SERVICE MANUAL

TACUMA

DAEWOO MOTOR CO., LTD.

SERVICE MANUAL

TACUMA

(Vol. 1 of 2)

FOREWORD

This manual includes procedure for maintenance, adjustment, service operation and removal and installation of components.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of manual approval.

The right is reserved to make changes at any time without notice.

DAEWOO MOTOR CO., LTD.

INCHON, KOREA

SECTION INDEX

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DAEWOO MOTOR CO., LTD.

INCHON, KOREA

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PERSONAL INJURY CAUTION

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all motor vehicles, as well as for the personal safety of the person doing the repair. There are many variations in procedures, techniques, tools and parts for servicing vehicles, as well as in the skills of the people doing the work. This manual cannot possibly anticipate all such variations and provide advice or precautions for each. Anyone who deviates from the instructions provided in this manual must ensure their own safety and preserve the safety and integrity of the vehicle. The following list contains general precautions that should always be followed while working on a vehicle.

- ***Safety stands are required whenever a procedure calls for underbody work.***
- ***Do not smoke when you work on a vehicle.***
- ***To prevent serious burns, do not touch any hot metal parts.***
- ***Set the parking brake when you work on the vehicle.***
- ***Turn the ignition switch OFF unless a procedure states otherwise.***
- ***The engine may operate only in a well-ventilated area.***
- ***Avoid moving parts when the engine is running.***
- ***Safety glasses must be worn for eye protection.***

TACUMA
Service Manual

FOREWORD

This manual includes procedures for maintenance, adjustment, service operations, and removal and installation of components for the TACUMA vehicle.

When reference is made in this manual to a brand name, number, or specific tool, an equivalent product may be used in place of the recommended item.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication approval. The right is reserved to make changes at any time without notice.

Daewoo Motor Company, Limited
Overseas Technical Service Department
409–7 Chong Chon- Dong, Pu Pyung-Gu,
Inchon, Korea
Tel: 82-32-509-7320 ~ 7326, 7350
Fax: 82-32-509-7205 / 7206
E-mail: m9310604@dwmc.co.kr
m8610452@dwmc.co.kr

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Overseas Technical Service Department
409–7 Chong Chon-Dong, Pu Pyung-Gu
Inchon, Korea

SECTION 0B

GENERAL INFORMATION

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DESCRIPTION AND OPERATION

GENERAL REPAIR INSTRUCTIONS

If a floor jack is used, the following precautions are recommended:

- Park the vehicle on level ground, "block" the front or rear wheels, set the jack against the frame, raise the vehicle and support it with chassis stands, and then perform the service operation.
- Before performing the service operation, disconnect the negative battery cable in order to reduce the chance of cable damage and burning due to short-circuiting.
- Use a cover on the body, the seats and the floor to protect them against damage and contamination.
- Handle brake fluid and antifreeze solution with care as they can cause paint damage.
- The use of proper tools, and the required special tools where specified, are important for efficient and reliable performance of the service repairs.
- Use genuine DAEWOO parts.
- Discard used cotter pins, gaskets, O-rings, oil seals, lock washers and self-locking nuts. Prepare new ones for installation. Normal functioning of the vehicle's components cannot be maintained if these fasteners and seals are reused.
- Keep the disassembled parts in order to assist in reassembly.
- Keep attaching bolts and nuts separated, as they vary in hardness and design depending on the position of the installation.
- Clean the parts before inspection or reassembly.
- Also clean the oil parts, etc. Use compressed air to make certain they are free of restrictions.
- Lubricate rotating and sliding faces of parts with oil or grease before installation.
- When necessary, use a sealer on gaskets to prevent leakage.
- Carefully observe all specifications for bolt and nut torques.

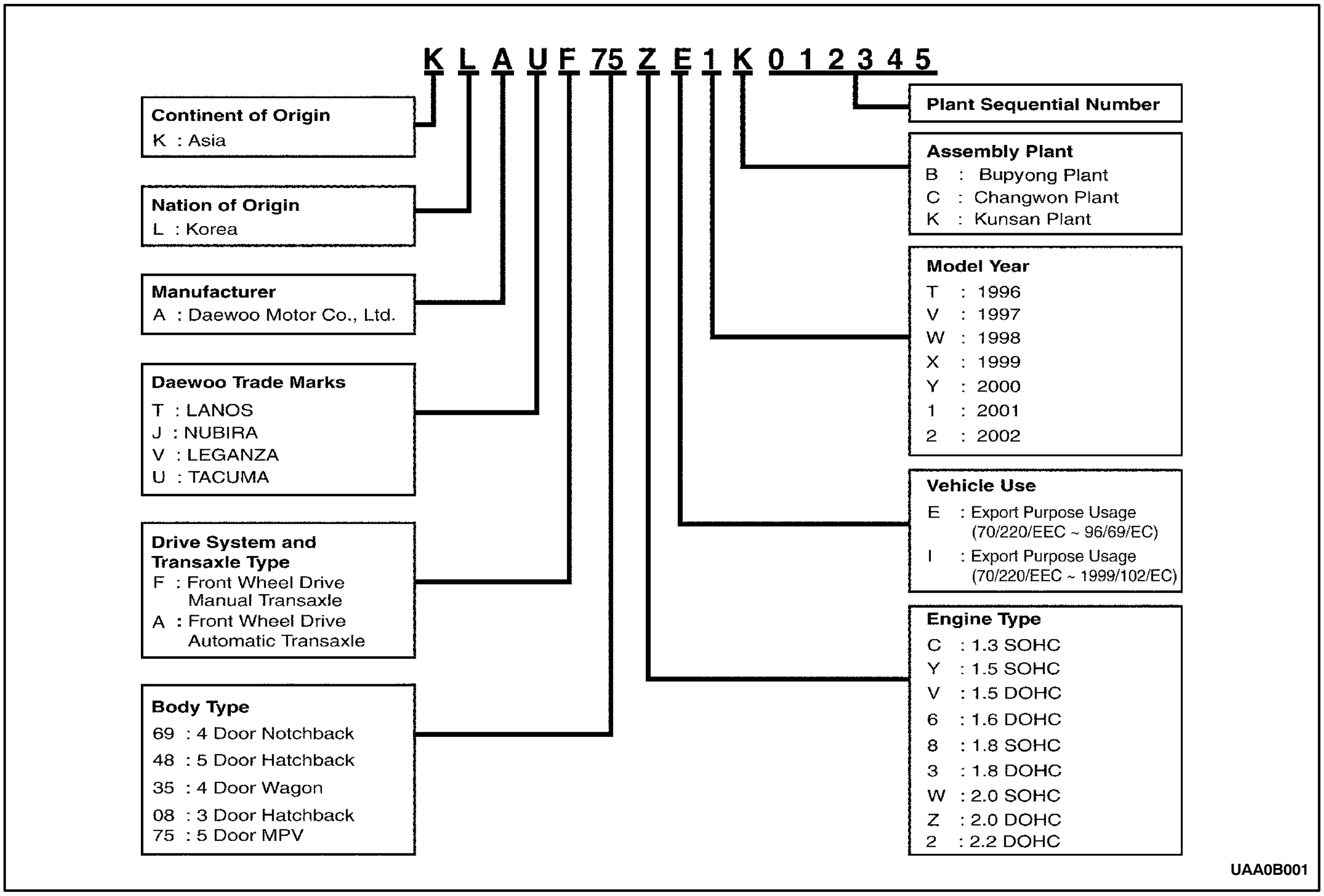
When service operation is complete, make a final check to be sure service was done properly and the problem was corrected.

GENERAL DESCRIPTION

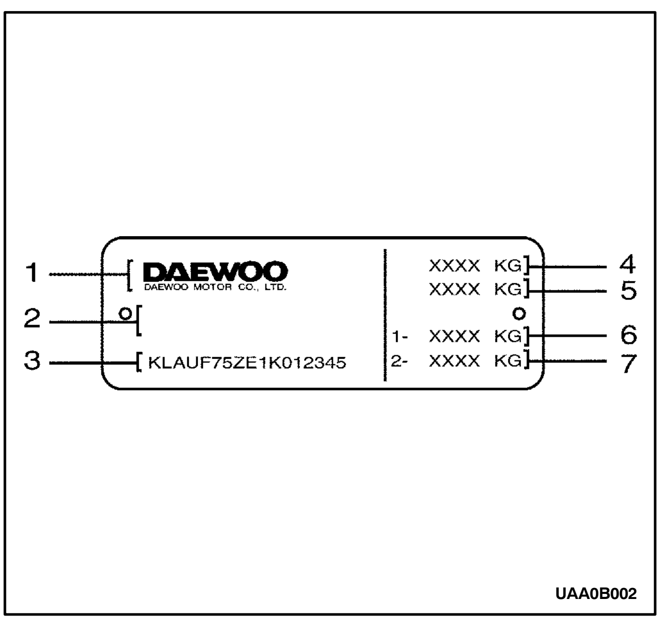
VEHICLE IDENTIFICATIONS

The vehicle identification number (VIN) plate is attached to the top right side of the front panel support. The VIN is also engraved in the top right side of the bulkhead.

Passenger Car VIN



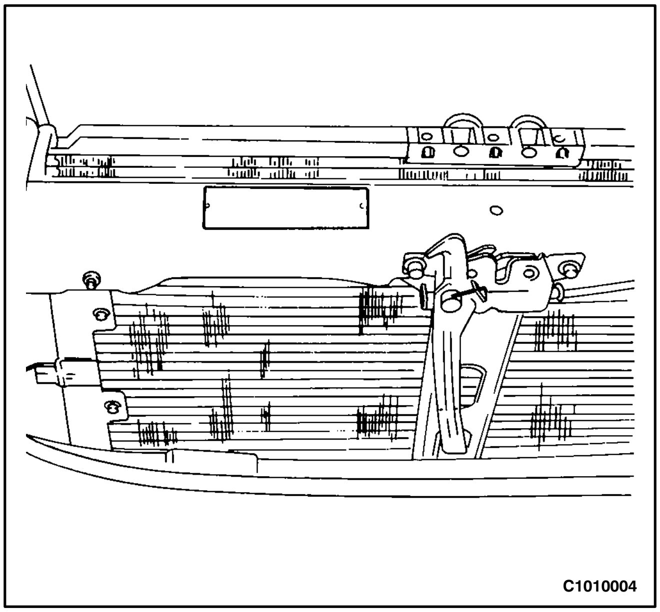
VIN Plate



1. Manufacturer's Name
2. NTA Number or WVTA Number
3. Vehicle Identification Number
4. Gross Vehicle Weight
5. Combination Weight
6. Front Axle Weight
7. Rear Axle Weight

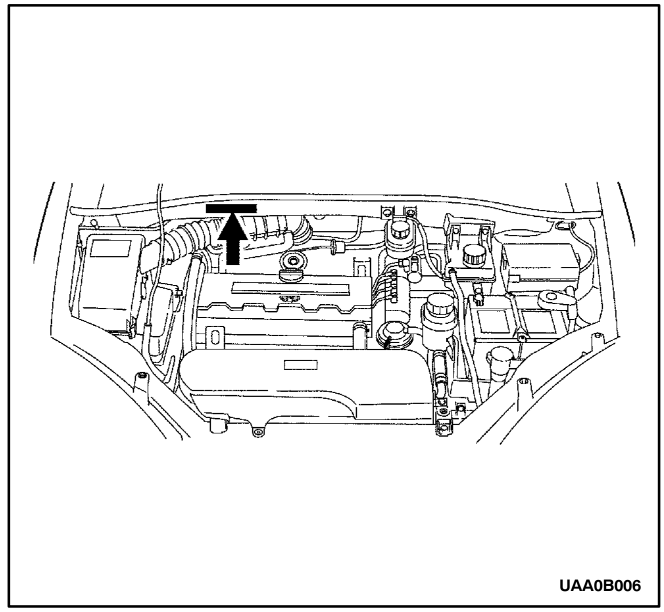
VIN Plate Location

The VIN plate is attached to the top right side of the front panel support.

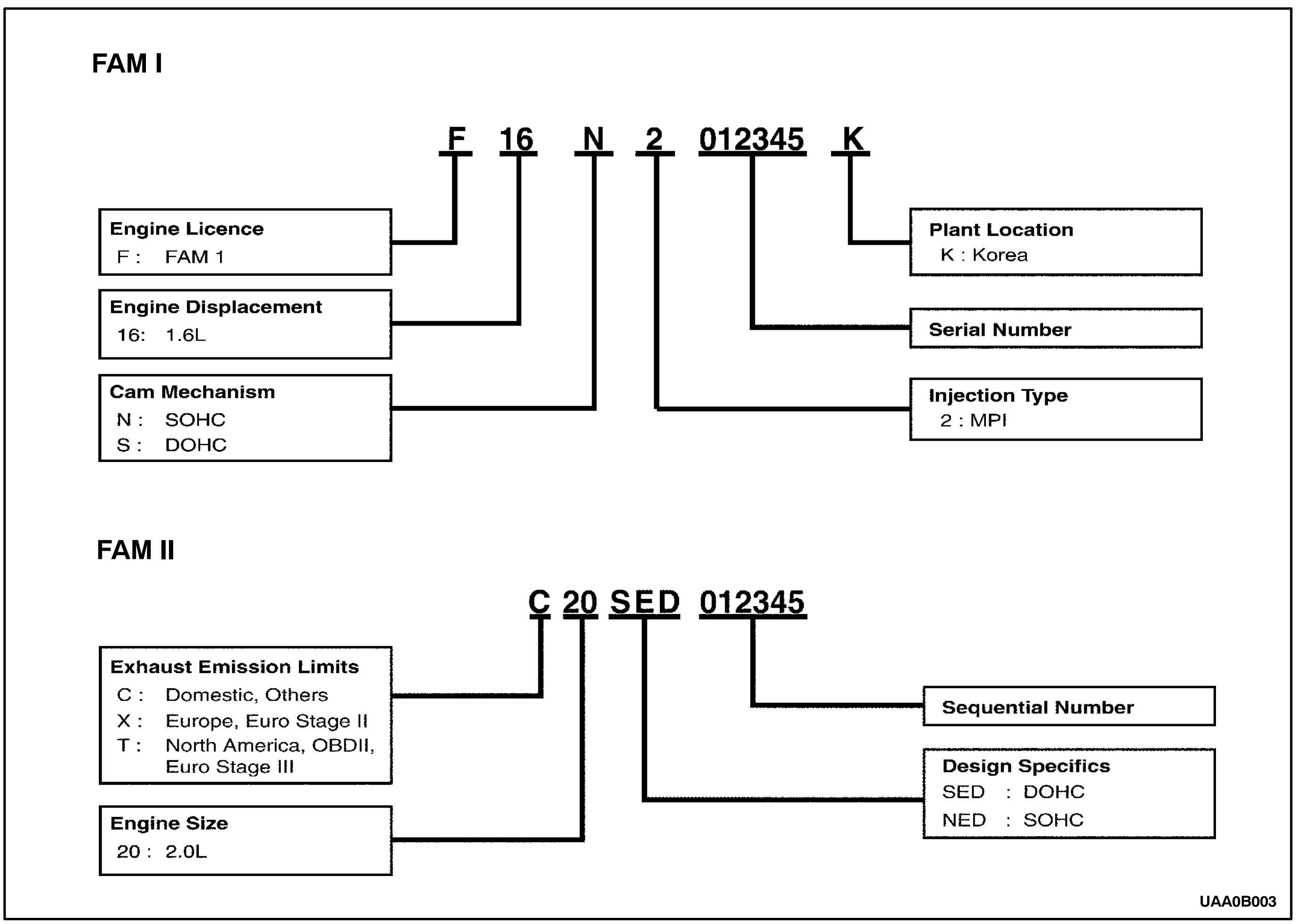


Engraved VIN Location

The engraved VIN is located on the top right side of the bulkhead.

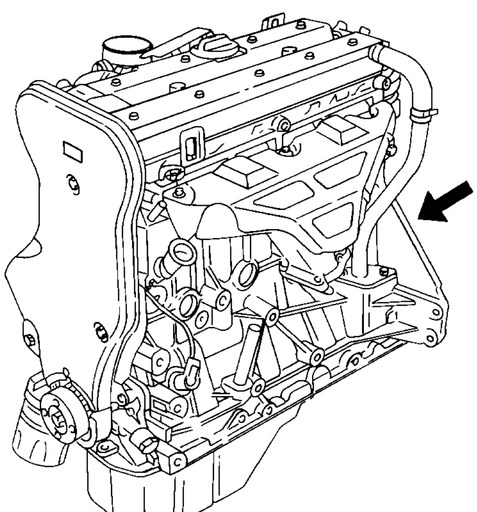


Engine Number



Engraved Engine Number Location

The engraved engine number is located on the engine block beneath the No. 4 exhaust manifold.



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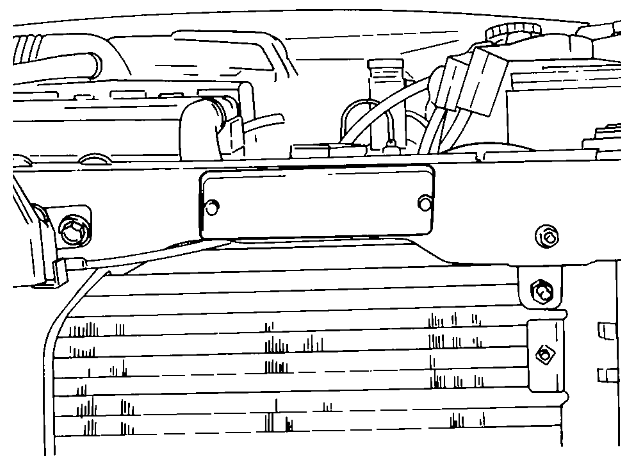
Body Identification Number Plate Location

The body identification number plate is attached to the top left side of the front panel support.



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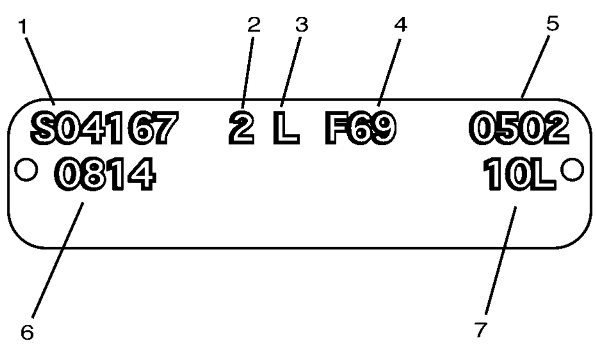
Body Identification Number Plate



C1010020

1 P/O Number
2 Check Digit
3 Drive
4 Body Type
5 P/O Date
6 Sequential Number
7 Exterior Color

Manual Transaxle Identification Number Plate

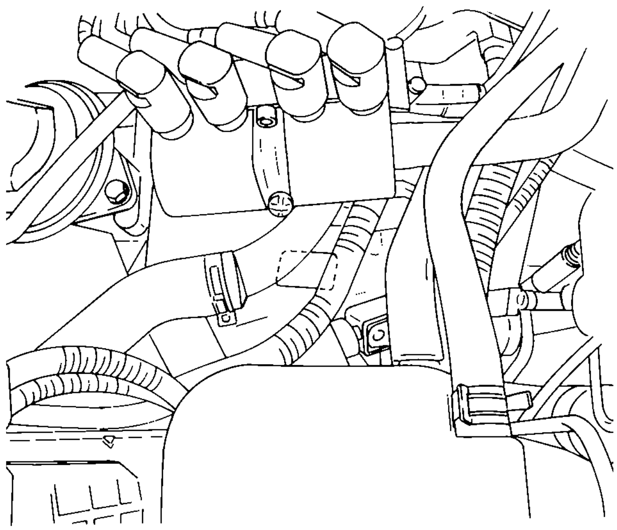
UAA0B005

1 Serial Number
2 Part Identification Code (P/Code)

Identification Code	Engine	Gear Ratio
VH	1.6L DOHC	3.944 C/R
FC	2.0L DOHC	3.722 C/R

Manual Transaxle Identification Number Plate Location

The manual transaxle identification number plate is attached to the top of the transaxle case near the engine.



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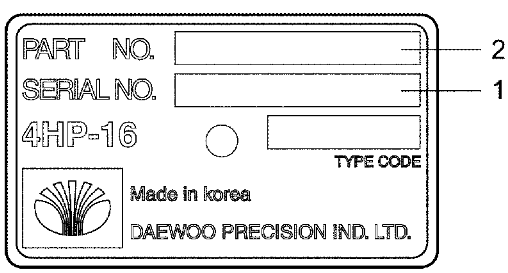
Automatic Transaxle Identification Number Plate (ZF 16 HP)



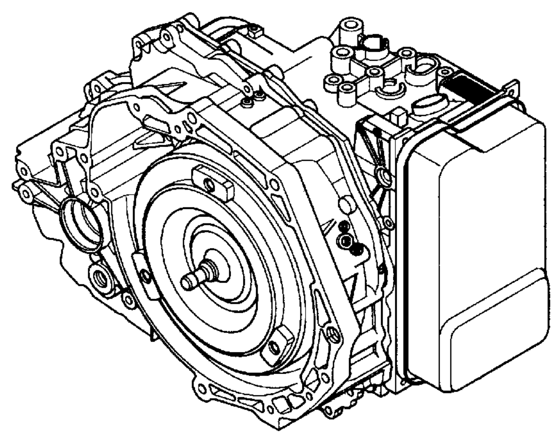
UAA5A190

1 Serial No.
2 Part Identification Code (P/Code)

Part Code	Engine
AW	2.0L DOHC

Automatic Transaxle Identification Number Plate Location (ZF 16 HP)

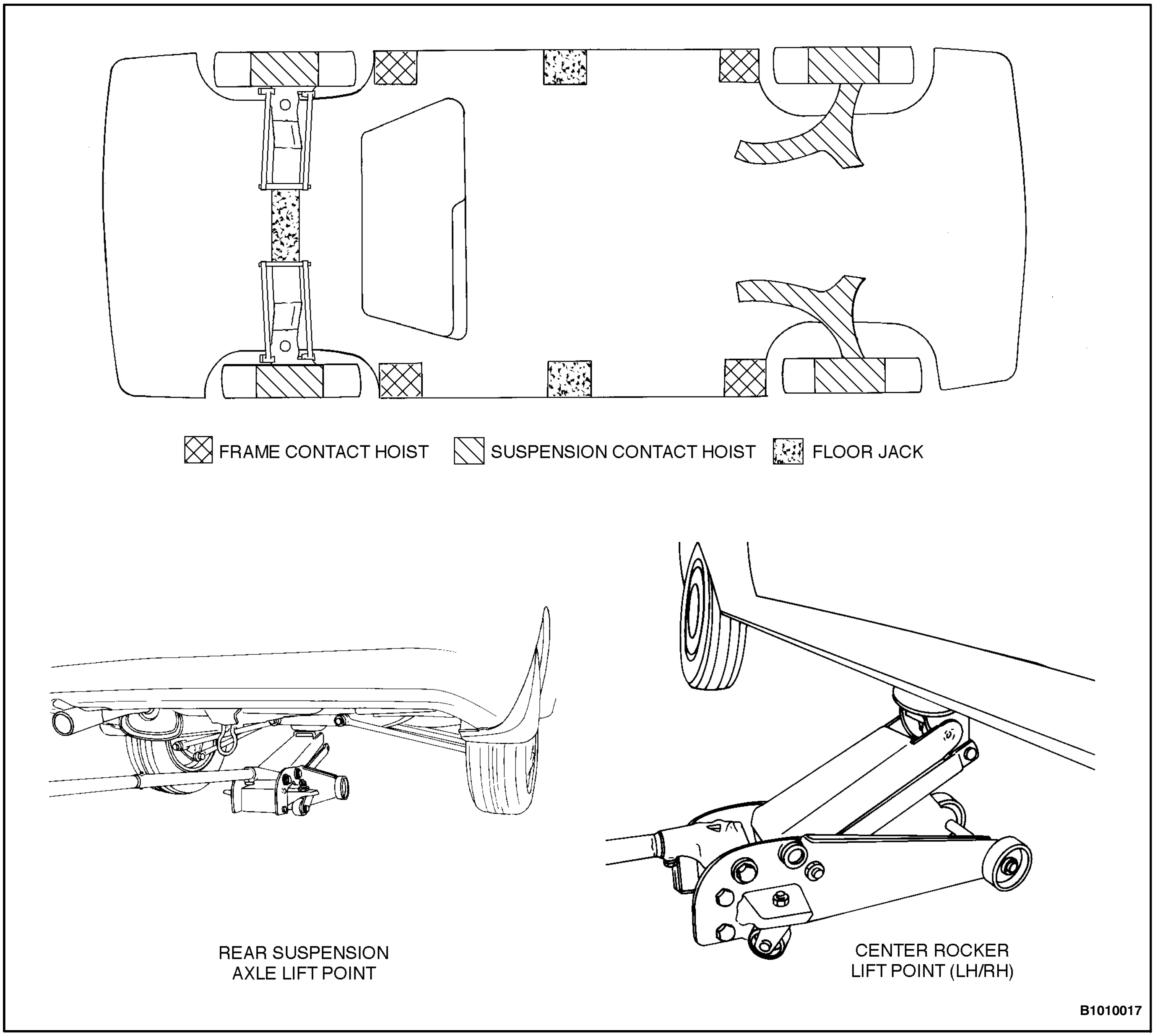
The automatic transaxle identification number plate is attached on the front top side of the transaxle case.



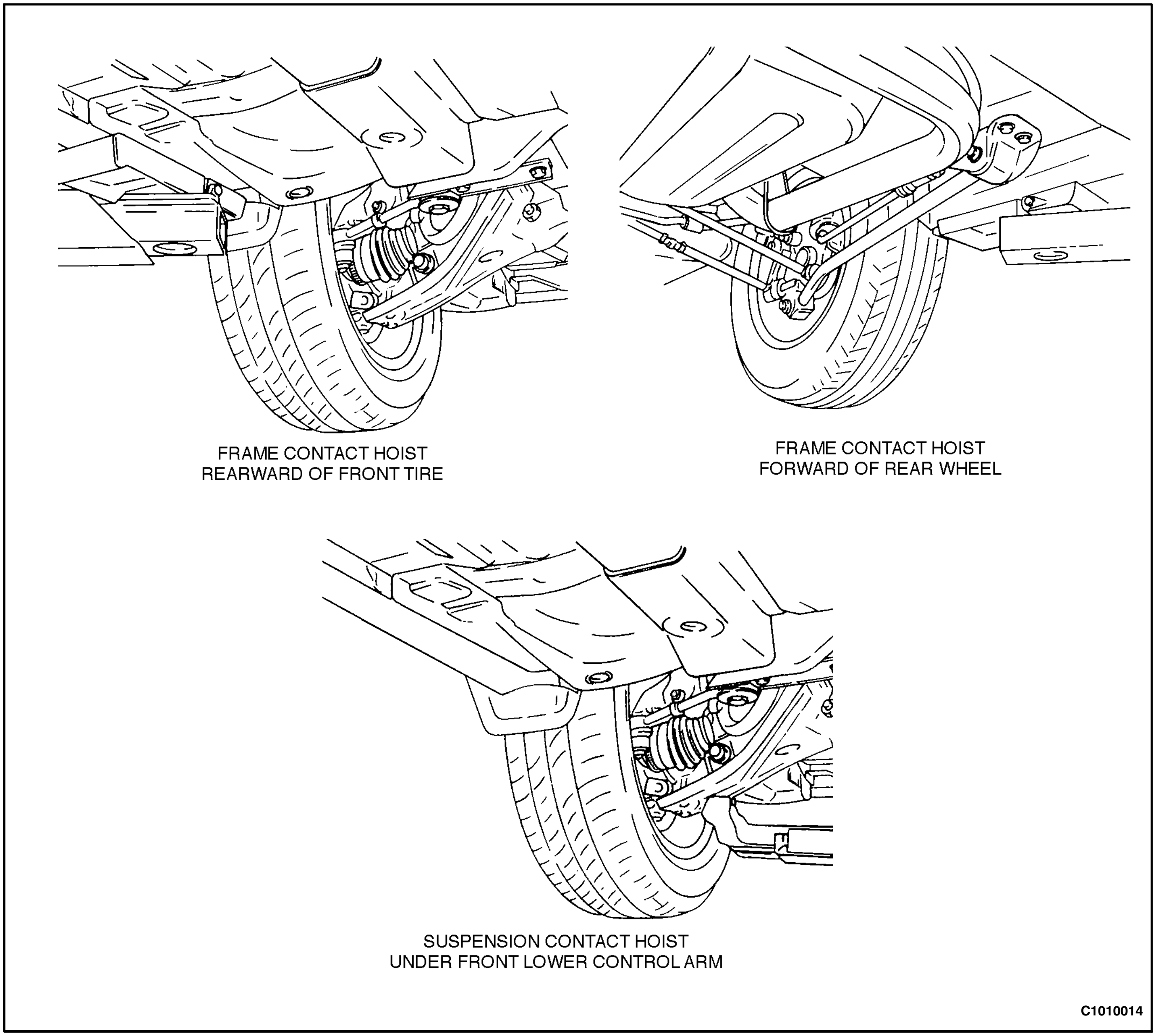
UAA0B007

VEHICLE LIFTING PROCEDURES

Notice: To raise the vehicle, place the lifting equipment only at the points indicated. Failure to use these precise positions may result in permanent body deformation. Many dealer service facilities and service stations are equipped with automotive hoists that bear upon some parts of the frame in order to lift the vehicle. If any other hoist method is used, use special care to avoid damaging the fuel tank, the filler neck, the exhaust system, or the underbody.



Vehicle Lifting Points



REPAIR INSTRUCTIONS

MAINTENANCE AND LUBRICATION

NORMAL VEHICLE USE

The maintenance instructions contained in the maintenance schedule are based on the assumption that the vehicle will be used for the following reasons:

- To carry passengers and cargo within the limitation indicated on the Tire Placard located on the edge of the driver's door.
- To be driven on reasonable road surfaces and within legal operating limits.

EXPLANATION OF SCHEDULED MAINTENANCE SERVICES

The services listed in the maintenance schedule are further explained below. When the following maintenance services are performed, make sure all the parts are replaced and all the necessary repairs are done before driving the vehicle. Always use the proper fluid and lubricants.

Drive Belt Inspection

When a separate belt drives the power steering pump, the air conditioning compressor and the generator, inspect it for cracks, fraying, wear, and proper tension. Adjust or replace the belt as needed.

Engine Oil and Oil Filter Change

Always use above the SJ grade engine oil. The SJ designation may be shown alone or in combination with other designations such as SJ/CC, etc.

Engine Oil Viscosity

Engine oil viscosity (thickness) has an effect on fuel economy and cold weather operation. Lower viscosity engine oils can provide better fuel economy and cold weather performance; however, higher temperature weather conditions require higher viscosity engine oils for satisfactory lubrication. Using oils of any viscosity other than those viscosities recommended could result in engine damage.

Cooling System Service

Drain, flush and refill the system with new coolant. Refer to "Recommended Fluids and Lubricants" in this section.

Fuel Micro-Filter Replacement

Replace the engine fuel filter every 45,000 km.

The engine fuel filter is located on the center dash panel near the brake booster.

Air Cleaner Element Replacement

Replace the air cleaner element every 45,000 km.

Replace the air cleaner more often under dusty conditions.

Throttle Body Mounting Bolt Torque

Check the torque of the throttle body mounting bolts.

Tighten the throttle body mounting nuts to 9 N•m (80 lb-in) (2.0 DOHC), 15 N•m (11 lb-ft) (1.6 DOHC), if necessary.

Spark Plug Replacement

Replace spark plugs with the same type.

	1.6 DOHC	2.0 DOHC
Maker	Woojin	Bosch
Type	BKR6E–11	FLR8LDCU
Gap	1.0~1.1 mm	1.0mm

Spark Plug Wire Replacement

Clean the wires and inspect them for burns, cracks, or other damage. Check the wire boot fit at the direct ignition system (DIS) module and at the spark plugs. Replace the wires as needed.

Brake System Service

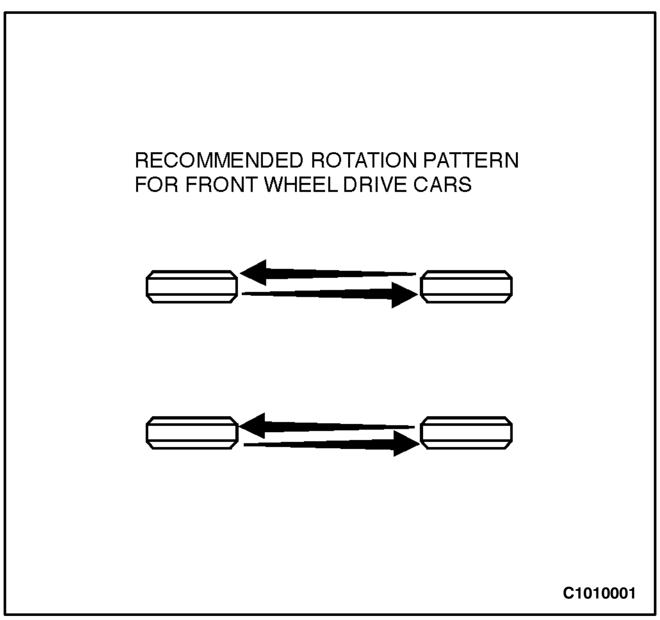
Check the disc brake pads every 15,000 km or 12 months. Check the pad and the lining thickness carefully. If the pads or the linings are not expected to last another 15,000 km, replace the pads or the linings. Check the breather hole in the brake fluid reservoir cap to be sure it is free from dirt and the passage is open.

Transaxle Service

The manual transaxle oil and automatic transaxle fluid do not require changing. The automatic transaxle fluid should be changed every 60,000 km under severe conditions.

Tire and Wheel Inspection and Rotation

Check the tires for abnormal wear or damage. To equalize wear and obtain maximum tire life, rotate the tires. If irregular or premature wear exists, check the wheel alignment and check for damaged wheels. While the tires and wheels are removed, inspect the brakes. Refer to “Each Time The Oil Is Changed” in this section.



SCHEDULED MAINTENANCE CHARTS

Engine Control System

Maintenance Item	Maintenance Interval											
	Kilometers (miles) or time in months, whichever comes first											
	x 1,000 km	1	10	20	30	40	50	60	70	80	90	100
	x 1,000 miles	0.6	6	12	18	24	30	36	42	48	54	60
	Months	-	6	12	18	24	30	36	42	48	54	60
Drive belts (alternator, power steering and A/C compressor*)					I			I			I	
Engine oil and oil filter[1, 3]		I	R	R	R	R	R	R	R	R	R	R
Cooling system hose & connections			I	I	I	I	I	I	I	I	I	I
Engine coolant[3]		I	I	I	I	R	I	I	I	R	I	I
Fuel filter						R				R		
Fuel line & connections				I		I		I		I		I
Air cleaner element[2]			I	I	I	R	I	I	I	R	I	I
Ignition timing				I		I		I		I	I	I
Spark plugs	1.6 DOHC			I	R		I	R		I	R	
	2.0 DOHC				I			R			I	
Spark plugs wires					I			I			R	
Evaporative emission canister & vapor lines						I				I		
PCV System					I			I			I	
Timing belt					I			I			R	

Chart Symbols:

I - Inspect these items and their related parts. If necessary, correct, clean, replenish, adjust or replace.

R - Replace or change:

[1] If the vehicle is operated under severe conditions: short distance driving, extensive idling or driving in dusty conditions, change the engine oil and the filter every 5 000 km (3 000 miles) or 6 months, whichever comes first.

[2] More frequently maintenance is required if under dusty driving conditions.

[3] Refer to “Recommended Fluids and Lubricants.”

Chassis and Body

Maintenance Item	Maintenance Interval											
	Kilometers (miles) or time in months, whichever comes first											
	x 1,000 km	1	10	20	30	40	50	60	70	80	90	100
	x 1,000 miles	0.6	6	12	18	24	30	36	42	48	54	60
	Months	-	6	12	18	24	30	36	42	48	54	60
Air filter (A/C)[2]			R	R	R	R	R	R	R	R	R	R
Exhaust pipe & mountings			I	I	I	I	I	I	I	I	I	I
Brake & clutch fluid[3, 4]		I	I	I	R	I	I	R	I	I	R	I
Front brake pads and discs[5]			I	I	I	I	I	I	I	I	I	I
Rear brake pads and discs or drum & linings[5]			I	I	I	I	I	I	I	I	I	I
Parking brake		I	I	I	I	I	I	I	I	I	I	I
Brake line & connections (including booster)			I	I	I	I	I	I	I	I	I	I
Rear hub bearing and clearance			I	I	I	I	I	I	I	I	I	I
Manual transaxle oil[3]			I	I	I	I	I	I	I	I	I	I
Clutch and brake pedal free play			I	I	I	I	I	I	I	I	I	I
Chassis and underbody bolts & nuts tight/secure			I	I	I	I	I	I	I	I	I	I
Automatic transaxle fluid[3, 6] (ZF 16HP)		I	I	I	I	I	I	I	I	I	I	I
Tire condition & inflation pressure		I	I	I	I	I	I	I	I	I	I	I
Wheel alignment[7]		Inspect when abnormal condition is noted										
Steering wheel and linkage			I	I	I	I	I	I	I	I	I	I
Power steering fluid and lines[3]		I	I	I	I	I	I	I	I	I	I	I
Drive shaft boots			I	I	I	I	I	I	I	I	I	I
Safety belts, buckles & anchorages			I	I	I	I	I	I	I	I	I	I
Lubricate locks, hinges & hood latch			I	I	I	I	I	I	I	I	I	I

Chart Symbols:

I - Inspect these items and their related parts. If necessary, correct, clean, replenish, adjust or replace.

R - Replace or change:

[2] More frequent maintenance is required if under dusty driving conditions.

[3] Refer to “Recommended Fluids And Lubricants.”

[4] Change the brake/clutch fluid every 15 000 km (9 000 miles) if the vehicle is mainly driven under severe conditions:

– Driving in hilly or mountainous terrain, or

– Towing a trailer frequenly.

[5] More frequently maintenance is required if under severe conditions: short distance driving, extensive idling, frequent low-speed operation in stop and go traffic or driving in dusty conditions.

[6] Change automatic transaxle fluid and filter every 60 000 km (36 000 miles) if the vehicle is mainly driven under severe conditions:

– In heavy city traffic where the outside temperature regularly reaches 32°C(90°F) or higher, or

– In hilly or mountaineous terrain, or

– When doing frequent trailer towing, or

– Uses such as found in taxi, police or delivery service.

[7] If necessary, rotate and balance wheels.

OWNER INSPECTIONS AND SERVICES

WHILE OPERATING THE VEHICLE

Horn Operation

Blow the horn occasionally to make sure it works. Check all the button locations.

Brake System Operation

Be alert for abnormal sounds, increased brake pedal travel, or repeated pulling to one side when braking. Also, if the brake warning light goes on or flashes, something may be wrong with part of the brake system.

Exhaust System Operation

Be alert to any changes in the sound of the system or the smell of the fumes. These are signs that the system may be leaking or overheating. Have the system inspected and repaired immediately.

Tires, Wheels and Alignment Operation

Be alert to any vibration of the steering wheel or the seats at normal highway speeds. This may mean a wheel needs to be balanced. Also, a pull right or left on a straight, level road may show the need for a tire pressure adjustment or a wheel alignment.

Steering System Operation

Be alert to changes in the steering action. An inspection is needed when the steering wheel is hard to turn or has too much free play, or if unusual sounds are noticed when turning or parking.

Headlamp Aim

Take note of the light pattern occasionally. Adjust the headlamps if the beams seem improperly aimed.

AT EACH FUEL FILL

A fluid loss in any (except windshield washer) system may indicate a problem. Have the system inspected and repaired immediately.

Engine Oil Level

Check the oil level and add oil if necessary. The best time to check the engine oil level is when the oil is warm.

1. After stopping the engine, wait a few minutes for the oil to drain back to the oil pan.
2. Pull out the oil level indicator (dipstick).
3. Wipe it clean, and push the oil level indicator back down all the way.
4. Pull out the oil level indicator and look at the oil level on it.
5. Add oil, if needed, to keep the oil level above the MIN line and within the area labeled “Operating Range.” Avoid overfilling the engine, since this may cause engine damage.

6. Push the indicator all the way back down into the engine after taking the reading.

If you check the oil level when the oil is cold, do not run the engine first. The cold oil will not drain back to the pan fast enough to give a true oil level reading.

Engine Coolant Level and Condition

Check the coolant level in the coolant reservoir tank and add coolant if necessary. Inspect the coolant. Replace dirty or rusty coolant.

Windshield Washer Fluid Level

Check the washer fluid level in the reservoir. Add fluid if necessary.

AT LEAST MONTHLY

Tire and Wheel Inspection and Pressure Check

Check the tires for abnormal wear or damage. Also check for damaged wheels. Check the tire pressure when the tires are cold (check the spare also, unless it is a stowaway). Maintain the recommended pressures that are on the tire placard that is on the driver's door.

Lamp Operation

Check the operation of the license plate lamp, the headlamps (including the high beams), the parking lamps, the fog lamps, the taillamp, the brake lamps, the turn signals, the backup lamps, and the hazard warning flasher.

Fluid Leak Check

Periodically inspect the surface beneath the vehicle for water, oil, fuel or other fluids, after the vehicle has been parked for a while. Water dripping from the air conditioning system after use is normal. If you notice fuel leaks or fumes, find the cause and correct it at once.

AT LEAST TWICE A YEAR

Power Steering System Reservoir Level

Check the power steering fluid level. Keep the power steering fluid at the proper level. Refer to *Section 6A, Power Steering System*.

Brake Master Cylinder Reservoir Level

Check the fluid and keep it at the proper level. Refer to *Section 4B, Master Cylinder*. A low fluid level can indicate worn disc brake pads may need to be serviced. Check the breather hole in the reservoir cover to be free from dirt and check for an open passage.

Clutch Pedal Free Travel

Check clutch pedal free travel and adjust as necessary every 15,000 km. Measure the distance from the center of the clutch pedal to the outer edge of the steering wheel with the clutch pedal not depressed. Then measure the distance from the center of the clutch pedal to the outer edge of the steering wheel with the clutch pedal fully depressed. The difference between the two values must be greater than 140 mm.

Weatherstrip Lubrication

Apply a thin film of silicone grease using a clean cloth.

EACH TIME THE OIL IS CHANGED

Automatic Transaxle Fluid

Refer to *Section 5A, ZF 4HP16 Automatic Transaxle.*

Manual Transaxle

Check the oil level and add oil as required. Refer to *Section 5B, Five-Speed Manual Transaxle*.

Brake System Inspection

This inspection should be done when the wheels are removed for rotation. Inspect the lines and the hoses for proper hookup, binding, leaks, cracks, chafing, etc. Inspect the disc brake pads for wear. Inspect the rotors for surface condition. Inspect other brake parts, including the parking brake, etc., at the same time. Check the parking brake adjustment. Inspect the brakes more often if habit or conditions result in frequent braking.

Steering, Suspension and Front Drive Axle Boot and Seal Inspection

Inspect the front and rear suspension and the steering system for damaged, loose, or missing parts; signs of wear; or lack of lubrication. Inspect the power steering lines and the hoses for proper hookup, binding, leaks, cracks and chafing, etc. Clean and inspect the drive axle boot and seals for damage, tears, or leakage. Replace the seals if necessary.

Exhaust System Inspection

Inspect the complete system (including the catalytic converter, if equipped). Inspect the body near the exhaust system. Look for broken, damaged, missing, or out-of-position parts, as well as open seams, holes, loose connections, or other conditions which could cause heat buildup in the floor pan or could let exhaust fumes seep into the trunk or passenger compartment.

Throttle Linkage Inspection

Inspect the throttle linkage for interference or binding, damaged, or missing parts. Lubricate all linkage joints and throttle cable joints, the intermediate throttle shaft bearing, the return spring at throttle valve assembly, and the accelerator pedal sliding face with suitable grease. Check the throttle cable for free movement.

Engine Drive Belts

Inspect all belts for cracks, fraying, wear, and proper tension. Adjust or replace the belts as needed.

Hood Latch Operation

When opening the hood, note the operation of the secondary latch. It should keep the hood from opening all the way when the primary latch is released. The hood must close firmly.

AT LEAST ANNUALLY

Lap and Shoulder Belt Condition and Operation

Inspect the belt system, including the webbing, the buckles, the latch plates, the retractor, the guide loops and the anchors.

Movable Head Restraint Operation

On vehicles with movable head restraints, the restraints must stay in the desired position.

Spare Tire and Jack Storage

Be alert to rattles in the rear of the vehicle. The spare tire, all the jacking equipment, and the tools must be securely stowed at all times. Oil the jack ratchet or the screw mechanism after each use.

Key Lock Service

Lubricate the key lock cylinder.

Body Lubrication Service

Lubricate all the body door hinges including the hood, the fuel door, the rear compartment hinges and the latches, the glove box and the console doors, and any folding seat hardware.

Transaxle Neutral Switch Operation on Automatic Transaxle

Caution: Take the following precautions because the vehicle could move without warning and possibly cause personal injury or property damage:

- ***Firmly apply the parking brake and the regular brakes.***
- ***Do not use the accelerator pedal.***
- ***Be ready to promptly turn off the ignition if the vehicle starts.***

On automatic transaxle vehicles, try to start the engine in each gear. The starter should crank only in P (PARK) and in N (NEUTRAL).

Parking Brake and Transaxle P (PARK) Mechanism Operation

Caution: In order to reduce the risk of personal injury or property damage, be prepared to apply the regular brakes promptly if the vehicle begins to move.

Park on a fairly steep hill with enough room for movement in the downhill direction. To check the parking brake, with the engine running and the transaxle in N (NEUTRAL), slowly remove foot pressure from the regular brake pedal (until only the parking brake is holding the vehicle).

To check the automatic transaxle P (PARK) mechanism's holding ability, release all brakes after shifting the transaxle to P (PARK).

Underbody Flushing

Flushing the underbody will remove any corrosive materials used for ice and snow removal and dust control. At least every spring, clean the underbody. First, loosen the sediment packed in closed areas of the vehicle. Then flush the underbody with plain water.

Engine Cooling System

Inspect the coolant and freeze protection fluid. If the fluid is dirty or rusty, drain, flush and refill the engine cooling system with new coolant. Keep the coolant at the proper mixture in order to ensure proper freeze protection, corrosion protection and engine operating temperature. Inspect the hoses. Replace the cracked, swollen, or deteriorated hoses. Tighten the clamps. Clean the outside of the radiator and the air conditioning condenser. Wash the filler cap and the neck. Pressure test the cooling system and the cap in order to help ensure proper operation.

RECOMMENDED FLUIDS AND LUBRICANTS

USAGE	CAPACITY	FLUID/LUBRICANT
Engine Oil	3.75L	1.6L DOHC - API SJ grade
	4.0L	2.0L DOHC - SAE 5W/30, API SJ
Engine Coolant	7.0L	Mixture of water and good quality silicate-base antifreeze (year-round coolant)
Brake and Clutch Fluid	0.5L	SSK-221 (DOT-3 or 4 Fluids)
Power Steering System Fluid	1.0L	DEXRON®-II or III
Automatic Transaxle Fluid (ZF 16HP)	6.9 ± 0.2L	ESSO LT 71141
Manual Transaxle Fluid	1.9L	SAE 80W
Manual Transaxle Shift Linkage	As needed	Grease (M-8122)
Key Lock Cylinders	As needed	Grease (M-8104)
Automatic Transaxle Shift Linkage	As needed	Grease
Clutch Linkage Pivot Points	As needed	Grease
Floor Shift Linkage Points	As needed	Grease
Hood Latch Assembly 1. Pivots and Spring Anchor	As needed	Grease (M-8105)
Hood and door hinges Fuel door hinge Rear compartment lid hinges	As needed	Spray Grease (M-8149) Oil (M-8030)
Weatherstrips	As needed	Wetting Agent (M-8128)

SPECIFICATIONS

TECHNICAL DATA

Performance - Manual Transaxle

Application	1.6L DOHC	2.0L DOHC
Maximum Speed (km/h)	167	188

Performance - Automatic Transaxle

Application	1.6L DOHC	2.0L DOHC
Maximum Speed (km/h)	–	168

Engine

Application	1.6L DOHC	2.0L DOHC
Engine Type	A16DMS	Dual Overhead Cam L-4
Bore (mm)	79 (3.1)	86.0
Stroke (mm)	81.5(3.21)	86.0
Total Displacement ($cm^{3)}$	1,598 (97.5)	1,998
Compression Ratio	$9.5 \pm 0.2:1$	9.6:1
Maximum Power (kw/rpm)	76.0/5,800	89/5,600
Maximum Torque (N•m/rpm)	104.8/3,400	176/4,000

Ignition System

Application	1.6L DOHC	2.0L DOHC
Ignition Type	Direct Ignition System	Direct Ignition System
Ignition Timing (° BTDC)	5°	5
Ignition Sequence	1-3-4-2	1-3-4-2
Spark Plug Gap (mm)	1.00-1.10 (0.039-0.043)	1.0
Spark Plug Maker	Woojin (NGK)	Bosch
Spark Plug Type	BKR6E–11	FLR8LDCU

Clutch - Manual Transaxle

Application	1.6L DOHC	2.0L DOHC
Type	Single Dry Plate	Single Dry Plate
Outside Diameter (mm)	200 (7.9)	225
Inside Diameter (mm)	134 (5.3)	150
Thickness (mm)	7.65 (0.301)	3.4
Fluid Capacity	Common Use; Brake Fluid	Common Use; Brake Fluid

Manual Transaxle

Application	1.6L DOHC	2.0L DOHC
Maker	DWMC	DWMC
Type or Model	D-16 (C/R)	D-20 (C/R)
Gear Ratio:	–	–
1st	3.545	3.545:1
2nd	2.158	2.158:1
3rd	1.478	1.478:1
4th	1.129	1.129:1
5th	0.886	0.886:1
Reverse	3.333	3.333:1
Final Drive Ratio	3.944	3.722:1
Oil Capacity (L)	1.9	1.9

Automatic Transaxle

Application	1.6L DOHC	2.0L DOHC
Maker	–	ZF
Type or Model	–	4HP16
Gear Ratio:	–	–
1st	–	2.719:1
2nd	–	1.487:1
3rd	–	1.000:1
4th	–	0.717:1
Reverse	–	2.529:1
Final Drive Ratio	–	3.945:1
Oil Capacity for Replacement (L)	–	6.9

Brake

Application	1.6L DOHC	2.0L DOHC
Booster Size:	–	–
Booster 1 (in.)	7	7
Booster 2 (in.)	8	8
Master Cylinder Diameter (mm)	23.81	23.81
Booster Ratio	5.0:1	5.0:1
Front Brake:	–	–
Disc Type	Ventilated	Ventilated
Rear Brake:	–	–
Drum Inside Diameter	230(9.06)	230(9.06)
Fluid Capacity (L)	0.5(0.53)	0.5(0.53)

Tire and Wheel

Application	1.6L DOHC	2.0L DOHC
Standard Tire Size	185/70R14 (195/60R15)	195/60R15
Standard Wheel Size	5.5JX14 (6.0JX15)	6.0JX15
Inflation Pressure at Full Load:	–	–
195/60R15:	–	–
Front	32	–
Rear	32	–

Steering System

Application	1.6L DOHC	2.0L DOHC
Gear Type	Power Rack and Pinion	Power Rack and Pinion
Wheel Alignment:	–	–
Front:	–	–
Toe-In at Each wheel (°/mm)	0° ±10′	0° ± 10′
Caster (°)	3°	3°
Camber (°)	–0°20′ ± 45′	–0°20′ ± 45′
Rear:	–	–
Toe-In at Each wheel (°/mm)	–0°5′ ± 30′	–0°5′ ± 30′
Camber (°)	–1°45′ ± 30′	–1°45′ ± 30′
Oil Capacity (L)	1.0L(1.1qt)	1.1L(1.1qt)

Suspension

Application	1.6L DOHC	2.0L DOHC
Front Type	MacPherson Strut	MacPherson Strut
Rear Type	Compound Link	Compound Link

Fuel System

Application	1.6L DOHC	2.0L DOHC
Fuel Delivery	MPFI	MPI
Fuel Pump Type	Electric Motor Pump	Electric Motor Pump
Fuel Filter Type	Cartridge	Cartridge
Fuel Capacity (L)	62(16.4)	60

Lubricating System

Application	1.6L DOHC	2.0L DOHC
Lubricating Type	Forced Feed	Forced Feed
Oil Pump Type	Duocentric Rotor	Duocentric Rotor
Oil Filter Type	Cartridge (Full Flow)	Cartridge (Full Flow)
Oil Pan Capacity Including Oil Filter (L)	3.75(4)	4.0

Cooling System

Application	1.6L DOHC	2.0L DOHC
Cooling Type	Forced Water Circulation	Forced Water Circulation
Radiator Type	Cross-flow	Down-flow
Water Pump Type	Turbo Centrifugal	Centrifugal
Thermostat Type	In–Line Wax Pellet Type	Pellet Type
Coolant Capacity (L)	7.0	8.4

Electric System

Application	1.6L DOHC	2.0L DOHC
Battery (Amps)	550 Cold Cranking	550 Cold Cranking 610 Cold Cranking
Alternator (Amps)	85	95
Starter (No-Load Test Current Draw):	–	–
1.4 kW (Amps/Volts)	Minimum 40 Maximum 90 (at 12.2 volts)	Minimum 80 Maximum 120 (at 10)

VEHICLE DIMENSIONS AND WEIGHTS

Vehicle Dimensions - Manual and Automatic

Application	1.6L DOHC	2.0L DOHC
Overall Length (mm)	4,305	4,305
Overall Width (mm)	1,755	1,755
Overall Height (mm)	1,580	1,580
Minimum Ground Clearance (mm)	167	167
Wheel Base (mm)	2,600	2,600
Tread:	–	–
Front (mm)	1,476	1,476
Rear (mm)	1,480	1,480

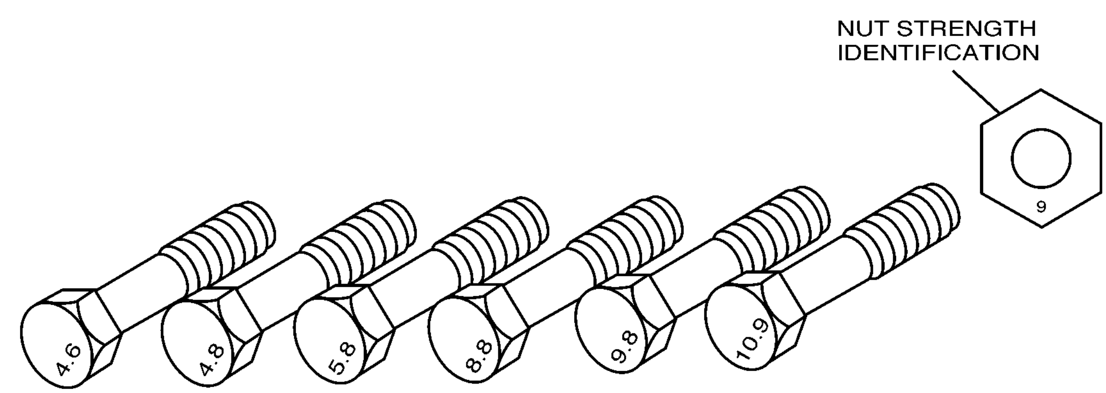
Vehicle Weights

Application	1.6L DOHC	2.0L DOHC
Manual:	–	–
Curb Weight (kg)	1,433	1,828
Gross Vehicle Weight (kg)	1,828	1,862
Automatic:	–	–
Curb Weight: (kg)	–	1,482
Gross Vehicle Weight (kg)	–	1,877
Passenger Capacity	5	5

STANDARD BOLT SPECIFICATIONS

Bolt*	4T - Low Carbon Steel	7T - High Carbon Steel	7T - Alloy Steel
M6 X 1.0	4.1-8.1 N•m (36-72 lb-in)	4.1-9.5 N•m (48-84 lb-in)	–
M8 X 1.25	8.1-17.6 N•m (72-156 lb-in)	12.2-23.0 N•m (108-204 lb-in)	16-30 N•m (12-22 lb-ft)
M10 X 1.25	20-34 N•m (15-25 lb-ft)	27-46 N•m (20-34 lb-ft)	37-62 N•m (27-46 lb-ft)
M10 X 1.5	19-34 N•m (14-25 lb-ft)	27-45 N•m (20-33 lb-ft)	37-60 N•m (27-44 lb-ft)
M12 X 1.25	49-73 N•m (36-54 lb-ft)	61-91 N•m (45-67 lb-ft)	76-114 N•m (56-84 lb-ft)
M12 X 1.75	45-69 N•m (33-51 lb-ft)	57-84 N•m (42-62 lb-ft)	72-107 N•m (53-79 lb-ft)
M14 X 1.5	76-115 N•m (56-85 lb-ft)	94-140 N•m (69-103 lb-ft)	114-171 N•m (84-126 lb-ft)
M14 X 2.0	72-107 N•m (53-79 lb-ft)	88-132 N•m (65-97 lb-ft)	107-160 N•m (79-118 lb-ft)
M16 X 1.5	104-157 N•m (77-116 lb-ft)	136-203 N•m (100-150 lb-ft)	160-240 N•m (118-177 lb-ft)
M16 X 2.0	100-149 N•m (74-110 lb-ft)	129-194 N•m (95-143 lb-ft)	153-229 N•m (113-169 lb-ft)
M18 X 1.5	151-225 N•m (111-166 lb-ft)	195-293 N•m (144-216 lb-ft)	229-346 N•m (169-255 lb-ft)
M20 X 1.5	206-311 N•m (152-229 lb-ft)	270-405 N•m (199-299 lb-ft)	317-476 N•m (234-351 lb-ft)
M22 X 1.5	251-414 N•m (185-305 lb-ft)	363-544 N•m (268-401 lb-ft)	424-636 N•m (313-469 lb-ft)
M24 X 2.0	359-540 N•m (265-398 lb-ft)	431-710 N•m (318-524 lb-ft)	555-831 N•m (409-613 lb-ft)

* Diameter X pitch in millimeters



METRIC BOLTS - IDENTIFICATION CLASS NUMBERS CORRESPOND TO BOLT STRENGTH - INCREASING NUMBERS REPRESENT INCREASING STRENGTH.

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SECTION 1A

GENERAL ENGINE INFORMATION

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

CLEANLINESS AND CARE

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the ten-thousandths of an inch. When any internal engine parts are serviced, care and cleanliness are important. A liberal coating of engine oil should be applied to friction areas during assembly, to protect and lubricate the surfaces on initial operation. Proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure. This is considered standard shop practice even if not specifically stated.

Whenever valve train components are removed for service, they should be kept in order. They should be installed in the same locations, and with the same mating surfaces, as when they were removed.

Battery cables should be disconnected before any major work is performed on the engine. Failure to disconnect cables may result in damage to wire harness or other electrical parts.

ON-ENGINE SERVICE

Caution: Disconnect the negative battery cable before removing or installing any electrical unit, or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

Notice: Any time the air cleaner is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material, which could follow the intake passage into the cylinder and cause extensive damage when the engine is started.

DIAGNOSTIC INFORMATION AND PROCEDURES

COMPRESSION TEST

Important: Disconnect the Crankshaft Position Sensor (CPS) connector to disable the fuel and the ignition systems.

Test the compression pressure for each cylinder. Low compression pressure may be the fault of the valves or the pistons. The following conditions should be considered when you check the cylinder compression:

- The engine should be at normal operating temperature.
- The throttle must be wide open.
- All the spark plugs should be removed.
- The battery must be at or near full charge.

1. Place approximately three squirts of oil from a plunger type oiler into each spark plug port.
2. Insert the engine compression gauge into each spark plug port.
3. Crank test each cylinder with four to five compression strokes using the starter motor.
4. The lowest reading should not be less than 70% of the highest reading. The compression gauge reading should not be less than 689 kPa (100 psi) for any of the cylinders.
5. Examine the gauge readings obtained after the four "puffs" per cylinder are obtained from cranking the starter motor. The readings are explained in the following descriptions:

- Normal Condition – Compression builds up quickly and evenly to specified compression on each cylinder.
- Piston Rings Faulty – Compression is low on the first stroke and tends to build up on following strokes, but the compression pressure does not reach normal. The compression pressure improves considerably with the addition of oil into the cylinder.
- Valves Faulty – Low compression pressure on the first stroke. The compression pressure does not tend to build up on the following strokes. The compression pressure does not improve much with the addition of oil into the cylinder.

OIL PRESSURE TEST

Step	Action	Value(s)	Yes	No
1	Is low or no oil pressure indicated?	–	Go to *Step 2*	System OK
2	Check the oil level in the crankcase. Is the level low?	–	Go to *Step 3*	Go to *Step 4*
3	Add oil so that the oil level is up to the full mark on the indicator. Is the repair complete?	–	Go to *Step 1*	–
4	Check the idle speed. Is the idle speed below the value specified?	850 rpm	Go to *Step 5*	Go to *Step 6*
5	Increase the idle speed. Is the speed increased?	–	Go to *Step 1*	–
6	Inspect the oil pressure switch. Is the oil pressure switch incorrect or malfunctioning?	–	Go to *Step 7*	Go to *Step 8*
7	Install a new oil pressure switch. Is the repair complete?	–	Go to *Step 1*	–
8	Inspect the oil pressure gauge on the cluster. Is the oil pressure gauge incorrect or malfunctioning?	–	Go to *Step 9*	Go to *Step 10*
9	Install a new oil pressure gauge. Is the repair complete?	–	Go to *Step 1*	–
10	Inspect the engine oil. Is the engine oil in the crankcase diluted or of the improper viscosity?	–	Go to *Step 11*	Go to *Step 12*
11	Install new engine oil of the proper viscosity for the expected temperatures. Is the repair complete?	–	Go to *Step 1*	–
12	Inspect the oil pump. Is the pump worn or dirty?	–	Go to *Step 13*	Go to *Step 14*
13	Replace the oil pump. Is the repair complete?	–	Go to *Step 1*	–
14	Inspect the oil filter. Is the oil filter plugged?	–	Go to *Step 15*	Go to *Step 16*
15	Install a new oil filter. Is the repair complete?	–	Go to *Step 1*	–
16	Inspect the oil pickup screen. Is the oil pickup screen loose or plugged?	–	Go to *Step 17*	Go to *Step 18*
17	Tighten or replace the oil pickup screen as necessary. Is the repair complete?	–	Go to *Step 1*	–
18	Inspect the oil pickup tube. Are there any holes in the oil pickup tube?	–	Go to *Step 19*	Go to *Step 20*
19	Replace the oil pickup tube. Is the repair complete?	–	Go to *Step 1*	–

OIL PRESSURE TEST (Cont'd)

Step	Action	Value(s)	Yes	No
20	Inspect the bearing clearances. Are the bearing clearances more than the values specified?	Crankshaft 0.026~0.042 mm (0.001~0.002 in.) Connecting Rod 0.019~0.071 mm (0.001~0.003 in.)	Go to *Step 21*	Go to *Step 22*
21	Replace the bearing if necessary. Is the repair complete?	–	Go to *Step 1*	–
22	Inspect the oil galleries. Are the oil galleries cracked, porous or plugged?	–	Go to *Step 23*	Go to *Step 24*
23	Repair or replace the engine block. Is the repair complete?	–	Go to *Step 1*	–
24	Inspect the gallery plugs. Are any of the gallery plugs missing or not installed properly?	–	Go to *Step 25*	Go to *Step 26*
25	Install plugs or repair as necessary. Is the repair complete?	–	Go to *Step 1*	–
26	Inspect the camshaft. Is the camshaft worn or is there evidence of poor machining?	–	Go to *Step 27*	System OK
27	Replace the camshaft. Is the repair complete?	–	Go to *Step 1*	–

OIL LEAK DIAGNOSIS

Most fluid oil leaks are easily located and repaired by visually finding the leak and replacing or repairing the necessary parts. On some occasions a fluid leak may be difficult to locate or repair. The following procedures may help you in locating and repairing most leaks.

Finding the Leak

1. Identify the fluid. Determine whether it is engine oil, automatic transmission fluid, power steering fluid, etc.
2. Identify where the fluid is leaking from.
   - 2.1. After running the vehicle at normal operating temperature, park the vehicle over a large sheet of paper.
   - 2.2. Wait a few minutes.
   - 2.3. You should be able to find the approximate location of the leak by the drippings on the paper.
3. Visually check around the suspected component. Check around all the gasket mating surfaces for leaks. A mirror is useful for finding leaks in areas that are hard to reach.
4. If the leak still cannot be found, it may be necessary to clean the suspected area with a degreaser, steam or spray solvent.
   - 4.1. Clean the area well.
   - 4.2. Dry the area.
   - 4.3. Operate the vehicle for several miles at normal operating temperature and varying speeds.
   - 4.4. After operating the vehicle, visually check the suspected component.
   - 4.5. If you still cannot locate the leak, try using the powder or black light and dye method.

Powder Method

1. Clean the suspected area.
2. Apply an aerosol-type powder (such as foot powder) to the suspected area.
3. Operate the vehicle under normal operating conditions.
4. Visually inspect the suspected component. You should be able to trace the leak path over the white powder surface to the source.

Black Light and Dye Method

A dye and light kit is available for finding leaks. Refer to the manufacturer's directions when using the kit.

1. Pour the specified amount of dye into the engine oil fill tube.
2. Operate the vehicle under normal operating conditions as directed in the kit.

3. Direct the light toward the suspected area. The dyed fluid will appear as a yellow path leading to the source.

Repairing the Leak

Once the origin of the leak has been pinpointed and traced back to its source, the cause of the leak must be determined in order for it to be repaired properly. If a gasket is replaced, but the sealing flange is bent, the new gasket will not repair the leak. The bent flange must be repaired also. Before attempting to repair a leak, check for the following conditions and correct them as they may cause a leak.

Gaskets

- The fluid level/pressure is too high.
- The crankcase ventilation system is malfunctioning.
- The fasteners are tightened improperly or the threads are dirty or damaged.
- The flanges or the sealing surface is warped.
- There are scratches, burrs or other damage to the sealing surface.
- The gasket is damaged or worn.
- There is cracking or porosity of the component.
- An improper seal was used (where applicable).

Seals

- The fluid level/pressure is too high.
- The crankcase ventilation system is malfunctioning.
- The seal bore is damaged (scratched, burred or nicked).
- The seal is damaged or worn.
- Improper installation is evident.
- There are cracks in the component.
- The shaft surface is scratched, nicked or damaged.
- A loose or worn bearing is causing excess seal wear.

KNOCK DIAGNOSIS

Definition for Knock

Engine knock refers to various types of engine noise. Heavy knock is usually very loud and the result of broken or excessively worn internal engine components. Light knock is a noticeable noise, but not as loud. Light knock can be caused by worn internal engine components. Loose or broken external engine components can also cause heavy or light knock.

Engine Knocks Cold and Continues for Two-Three Minutes and/or Knock Increases with Engine Torque

Step	Action	Value(s)	Yes	No
1	Does the engine knock when it is cold and continue for two to three minutes or does the knock increase with torque?	–	Go to *Step 2*	System OK
2	Inspect the flywheel. Is the flywheel contacting the splash shield?	–	Go to *Step 3*	Go to *Step 4*
3	Reposition the splash shield. Is the repair complete?	–	Go to *Step 1*	–
4	Inspect the balancer and the drive pulleys. Is either the balancer or the drive pulleys loose or broken?	–	Go to *Step 5*	Go to *Step 6*
5	Tighten or replace the balancer or the drive pulleys. Is the repair complete?	–	Go to *Step 1*	–
6	Inspect the piston-to-bore clearance. Is the clearance more than the value specified?	0.030 mm (0.001 in.)	Go to *Step 7*	Go to *Step 8*
7	1. Rebore the cylinder and hone to size. 2. Replace the piston. Is the repair complete?*	–	Go to *Step 1*	–
8	Inspect the connecting rod. Is the connecting rod bent?	–	Go to *Step 9*	System OK
9	Replace the connecting rod. Is the repair complete?	–	Go to *Step 1*	–
* Cold engine piston knock usually disappears when the cylinder is grounded out. Cold engine piston knock, which disappears in about 1.5 minutes, is considered acceptable.				

Heavy Knock Hot with Torque Applied

Step	Action	Value(s)	Yes	No
1	Is there a heavy knock when the engine is hot and torque is applied?	–	Go to *Step 2*	System OK
2	Inspect the balancer and pulley hub. Is the balancer or pulley hub broken?	–	Go to *Step 3*	Go to *Step 4*
3	Replace the broken balancer or pulley hub. Is the repair complete?	–	Go to *Step 1*	–
4	Inspect the torque converter bolts. Are the bolts tightened to value specified?	60 N•m (44 lb-ft)	Go to *Step 5*	Go to *Step 6*
5	Tighten the torque converter bolts. Is the repair complete?	–	Go to *Step 1*	–
6	Inspect the accessory belts. Are the belts too tight or nicked?	–	Go to *Step 7*	Go to *Step 8*
7	Replace and/or tension the belts to specifications as necessary. Is the repair complete?	–	Go to *Step 1*	–
8	Inspect the exhaust system. Is the system grounded?	–	Go to *Step 9*	Go to *Step 10*
9	Reposition the system as necessary. Is the repair complete?	–	Go to *Step 1*	–
10	Inspect the flywheel. Is the flywheel cracked?	–	Go to *Step 11*	Go to *Step 12*
11	Replace the flywheel. Is the repair complete?	–	Go to *Step 1*	–
12	Inspect the main bearing clearance. Is the clearance more than the value specified?	0.026~0.042 mm (0.001~0.002 in.)	Go to *Step 13*	Go to *Step 14*
13	Replace the main bearings as necessary. Is the repair complete?	–	Go to *Step 1*	–
14	Inspect the rod bearing clearance. Is the clearance more than the value specified?	1.8L:0.019~0.071mm (0.001~0.003 in.) 2.0L:0.041mm (0.002 in.)	Go to *Step 15*	System OK
15	Replace the rod bearings as necessary. Is the repair complete?	–	Go to *Step 1*	–

Light Knock Hot

Step	Action	Value(s)	Yes	No
1	Is there a light knock when the engine is hot?	–	Go to *Step 2*	System OK
2	Is detonation or spark knock evident?	–	Go to *Step 3*	Go to *Step 4*
3	Check the engine timing and the fuel quality. Was the problem found?	–	Go to *Step 1*	–
4	Inspect the torque converter bolts. Are the bolts loose?	–	Go to *Step 5*	Go to *Step 6*
5	Tighten the torque converter bolts. Is the repair complete?	–	Go to *Step 1*	–
6	Inspect the manifold. Is there an exhaust leak at the manifold?	–	Go to *Step 7*	Go to *Step 8*
7	Tighten the bolts or replace the gasket. Is the repair complete?	–	Go to *Step 1*	–
8	Check the rod bearing clearance. Is the clearance within the value specified?	1.8L:0.019~0.071mm (0.001~0.003 in.) 2.0L:0.013~0.041mm (0.001~0.002 in.)	Go to *Step 9*	System OK
9	Replace the rod bearings as necessary. Is the repair complete?	–	Go to *Step 1*	–

Knocks During Initial Start-Up But Lasts Only a Few Seconds

Step	Action	Value(s)	Yes	No
1	Does the engine knock during initial start-up but last only a few seconds?	–	Go to *Step 2*	System OK
2	Check the engine oil. Is the proper viscosity oil used in the crankcase?	–	Go to *Step 4*	Go to *Step 3*
3	Install oil of the proper viscosity for the expected seasonal temperatures. Is the repair complete?	–	Go to *Step 1*	–
4	Inspect the hydraulic lifters. Is there evidence of hydraulic lifter bleed-down?	–	Go to *Step 5*	Go to *Step 6*
5	Clean, test and replace the lifters as necessary. Is the repair complete?*	–	Go to *Step 1*	–
6	Inspect the crankshaft end clearance. Is the clearance more than value specified?	0.05~0.282 mm (0.002~0.011 in.)	Go to *Step 7*	Go to *Step 8*
7	Replace the crankshaft thrust bearing. Is the repair complete?	–	Go to *Step 1*	–
8	Inspect the front main bearing clearance. Is the clearance more than the value specified?	0.026~0.042 mm (0.001~0.002 in.)	Go to *Step 9*	System OK
9	Replace the worn parts of the front main bearing. Is the repair complete?	–	Go to *Step 1*	–

* When the engine is stopped, some valves will be open. Spring pressure against the lifters will tend to bleed lifter down. Attempts to repair this should be made only if the problem is consistent.
An engine that is operated for only short periods between start-ups may have lifter noise that lasts for a few minutes. This is a normal condition.

Knocks at Idle Hot

Step	Action	Value(s)	Yes	No
1	Does the engine knock at idle when hot?	–	Go to *Step 2*	System OK
2	Inspect the drive belts. Are the belts loose or worn?	–	Go to *Step 3*	Go to *Step 4*
3	Tension or replace the belts as necessary. Is the repair complete?	–	Go to *Step 1*	–
4	Inspect the A/C compressor and the generator. Is either the compressor or the generator faulty?	–	Go to *Step 5*	Go to *Step 6*
5	Replace the faulty A/C compressor or the generator. Is the repair complete?	–	Go to *Step 1*	–
6	Inspect the valve train. Are valve train components faulty?	–	Go to *Step 7*	Go to *Step 8*
7	Replace faulty valve train components. Is the repair complete?	–	Go to *Step 1*	–
8	Check the engine oil. Is the proper viscosity oil used in the crankcase?	–	Go to *Step 10*	Go to *Step 9*
9	Install oil of the proper viscosity for the expected seasonal temperatures. Is the repair complete?	–	Go to *Step 1*	–
10	Inspect the piston pin clearance. Is the clearance more than the value specified?	0.010~0.020 mm (0.0004~0.0008 in.)	Go to *Step 11*	Go to *Step 12*
11	Replace the piston and the pin. Is the repair complete?	–	Go to *Step 1*	–
12	Check the connecting rod alignment. Is the alignment faulty?	–	Go to *Step 13*	Go to *Step 14*
13	Check and replace rods as necessary. Is the repair complete?	–	Go to *Step 1*	–
14	Inspect the piston-to-bore clearance. Is the clearance within the value specified?	0.03 mm (0.0012 in.)	Go to *Step 16*	Go to *Step 15*
15	Hone the bore and fit a new piston. Is the repair complete?	–	Go to *Step 1*	–
16	Inspect the crankshaft balancer. Is the balancer loose?	–	Go to *Step 17*	Go to *Step 18*
17	Torque or replace worn parts. Is the repair complete?	–	Go to *Step 1*	–
18	Check the piston pin offset. Is the offset at the value specified?	0.5~0.7 mm (0.020~0.028 in.) Toward Thrust Side	Go to *Step 19*	System OK
19	Install the correct piston. Is the repair complete?	–	Go to *Step 1*	–

NOISE DIAGNOSIS

Main Bearing Noise

Step	Action	Value(s)	Yes	No
1	Are dull thuds or knocks heard with every engine revolution?	–	Go to *Step 2*	System OK
2	Check the oil pump pressure. Is the oil pump pressure low?	–	Go to *Oil Pressure Test*	Go to *Step 3*
3	Inspect the crankshaft end play. Is there excessive crankshaft end play?	0.05~0.282mm (0.002~0.011in.)	Go to *Crankshaft Replacement Procedure*	Go to *Step 4*
4	Inspect the crankshaft journals. Are the crankshaft journals out-of-round?	–	Go to *Crankshaft Replacement Procedure*	Go to *Step 5*
5	Inspect the belt tension. Is there excessive belt tension?	–	Go to *Timing Belt Replacement Procedure*	Go to *Step 6*
6	Inspect the crankshaft pulley. Is the crankshaft pulley loose?	–	Go to *Crankshaft Replacement Procedure*	System OK

Connecting Rod Bearing Noise Symptom

Step	Action	Value(s)	Yes	No
1	Is a knock noise heard under all engine speeds?	–	Go to *Step 2*	System OK
2	Inspect the crankshaft connecting rod journal. Is the crankshaft connecting rod journal worn?	–	Go to *Crankshaft Replacement Procedure*	Go to *Step 3*
3	Check the oil pump pressure. Is the oil pump pressure low?	–	Go to *Oil Pressure Test*	Go to *Step 4*
4	Inspect the crankshaft connecting rod journals. Are the journals out-of-round?	–	Go to *Crankshaft Replacement Procedure*	Go to *Step 5*
5	Inspect the connecting rods. Is there a misaligned connecting rod?	–	Go to *Pistons and Rods Replacement Procedure*	Go to *Step 6*
6	Inspect the connecting rod bolts. Are the connecting rod bolts torqued properly?	–	System OK	Go to *Pistons and Rods Replacement Procedure*

Piston Noises

Step	Action	Value(s)	Yes	No
1	Are any of the following noises heard: a sharp double knock when the engine is idling, a light ticking with no load on the engine or a “slapping” noise when the engine is cold?	–	Go to *Step 2*	System OK
2	Inspect the piston pin and bushing. Is the piston pin or the bushing worn or loose?	–	Go to *Pistons and Rods Replacement Procedure*	Go to *Step 3*
3	Inspect the piston. Is the piston broken or cracked?	–	Go to *Pistons and Rods Replacement Procedure*	Go to *Step 4*
4	Inspect the connecting rods. Is there a misaligned connecting rod?	–	Go to *Pistons and Rods Replacement Procedure*	Go to *Step 5*
5	Inspect the piston position. Is the piston 180° out of position?	–	Go to *Pistons and Rods Replacement Procedure*	System OK

Valve Mechanism or Valve Train Noises

Step	Action	Value(s)	Yes	No
1	Is a light tapping sound heard from the engine?	–	Go to *Step 2*	System OK
2	Inspect the valve springs. Are the springs weak or broken?	–	Go to *Cylinder Head and Valve Train Components Replacement Procedure*	Go to *Step 3*
3	Inspect the valves. Are the valves sticking or warped?	–	Go to *Cylinder Head and Valve Train Components Replacement Procedure*	Go to Step 4
4	Inspect the valve lifters. Are the valve lifters dirty, stuck or worn?	–	Go to *Cylinder Head and Valve Train Components Replacement Procedure*	Go to *Step 5*
5	Inspect the camshaft lobes. Are the camshaft lobes damaged or improperly machined?	–	Go to *Camshaft Replacement Procedure*	Go to *Step 6*
6	Check the oil supply to the valve train. Is the oil supply insufficient or poor?	–	Go to *Cylinder Head and Valve Train Components Replacement Procedure*	Go to *Step 7*
7	Inspect the valve guides. Are the valve guides worn?	–	Go to *Cylinder Head and Valve Train Components Replacement Procedure*	Go to *Step 8*
8	Inspect the valve spring seat. Is the valve spring seat incorrect?	–	Go to *Cylinder Head and Valve Train Components Replacement Procedure*	System OK

SECTION 1C1

1.6L DOHC ENGINE MECHANICAL

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

CYLINDER HEAD AND GASKET

The cylinder head is made of an aluminum alloy. The cylinder head uses cross-flow intake and exhaust ports. A spark plug is located in the center of each combustion chamber. The cylinder head houses the dual camshafts.

CRANKSHAFT

The crankshaft has eight integral weights which are cast with it for balancing. Oil holes run through the center of the crankshaft to supply oil to the connecting rods, the bearings, the pistons, and the other components. The end thrust load is taken by the thrust washers installed at the center journal.

TIMING BELT

The timing belt coordinates the crankshaft and the dual overhead camshafts and keeps them synchronized. The timing belt also turns the coolant pump. The timing belt and the pulleys are toothed so that there is no slippage between them. There are two idler pulleys. An automatic tensioner pulley maintains the timing belt's correct tension. The timing belt is made of a tough reinforced rubber similar to that used on the serpentine drive belt. The timing belt requires no lubrication.

OIL PUMP

The oil pump draws engine oil from the oil pan and feeds it under pressure to the various parts of the engine. An oil strainer is mounted before the inlet of the oil pump to remove impurities which could clog or damage the oil pump or other engine components. When the crankshaft rotates, the oil pump driven gear rotates. This causes the space between the gears to constantly open and narrow, pulling oil in from the oil pan when the space opens and pumping the oil out to the engine as it narrows.

At high engine speeds, the oil pump supplies a much higher amount of oil than required for lubrication of the engine. The oil pressure regulator prevents too much oil from entering the engine lubrication passages. During normal oil supply, a coil spring and valve keep the bypass closed, directing all of the oil pumped to the engine. When the amount of oil being pumped increases, the pressure becomes high enough to overcome the force of the spring. This opens the valve of the oil pressure regulator, allowing the excess oil to flow through the valve and drain back to the oil pan.

OIL PAN

The engine oil pan is mounted to the bottom of the cylinder block. The engine oil pan houses the crankcase and is made of cast aluminum.

Engine oil is pumped from the oil pan by the oil pump. After it passes through the oil filter, it is fed through two paths to lubricate the cylinder block and cylinder head. In one path, the oil is pumped through oil passages in the crankshaft to the connecting rods, then to the pistons and cylinders. It then drains back to the oil pan. In the second path, the oil is pumped through passages to the camshaft. The oil passes through the internal passageways in the camshafts to lubricate the valve assemblies before draining back to the oil pan.

EXHAUST MANIFOLD

A single four-port, rear-takedown manifold is used with this engine. The manifold is designed to direct escaping exhaust gases out of the combustion chambers with a minimum of back pressure. The oxygen sensor is mounted to the exhaust manifold.

INTAKE MANIFOLD

The intake manifold has four independent long ports and utilizes an inertial supercharging effect to improve engine torque at low and moderate speeds.

CAMSHAFTS

This engine is a dual overhead camshaft (DOHC) type, which means there are two camshafts. One camshaft operates the intake valves, and the other camshaft operates the exhaust valves. The camshafts sit in journals on the top of the engine (in the cylinder head) and are held in place by camshaft caps. The camshaft journals of the cylinder head are drilled for oil passages. Engine oil travels to the camshafts under pressure where it lubricates each camshaft journal. The oil returns to the oil pan through drain holes in the cylinder head. The camshaft lobes are machined into the solid camshaft to precisely open and close the intake and the exhaust valves the correct amount at the correct time. The camshaft lobes are oiled by splash action from pressurized oil escaping from the camshaft journals.

EXHAUST GAS RECIRCULATION VALVE

The exhaust gas recirculation (EGR) system is used to lower oxides of nitrogen (NOX) emission levels caused by high combustion temperature. The main element of the system is the EGR valve operated by

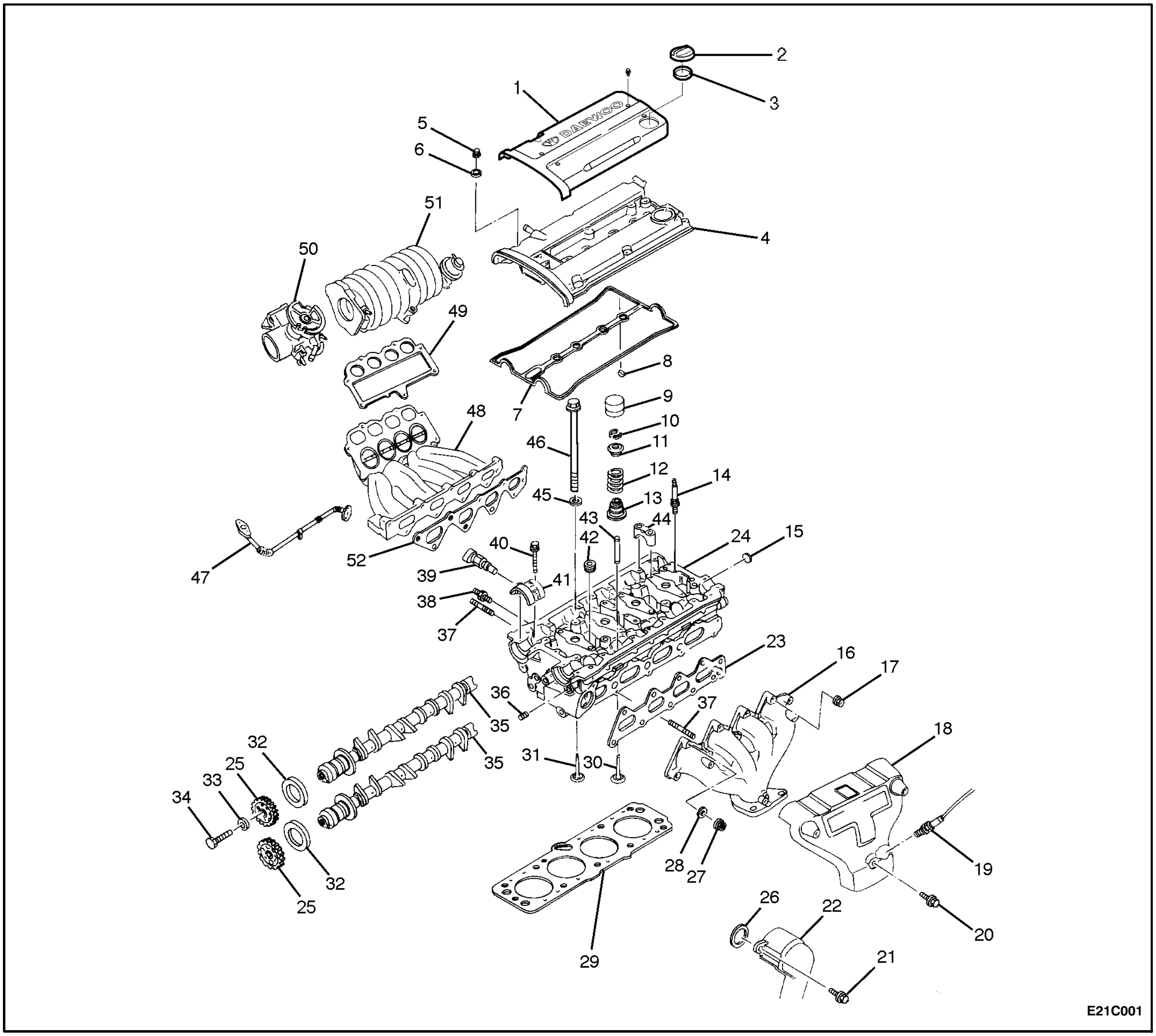
The EGR valve feeds small amounts of exhaust gas into the intake manifold to decrease combustion temperature. The amount of exhaust gas recirculated is controlled by variations in vacuum and exhaust back pressure. If too much exhaust gas enters, combustion will not take place. For this reason, very little exhaust gas is allowed to pass through the valve, especially at idle.

The EGR valve is usually open under the following conditions:

- Warm engine operation.
- Above idle speed.

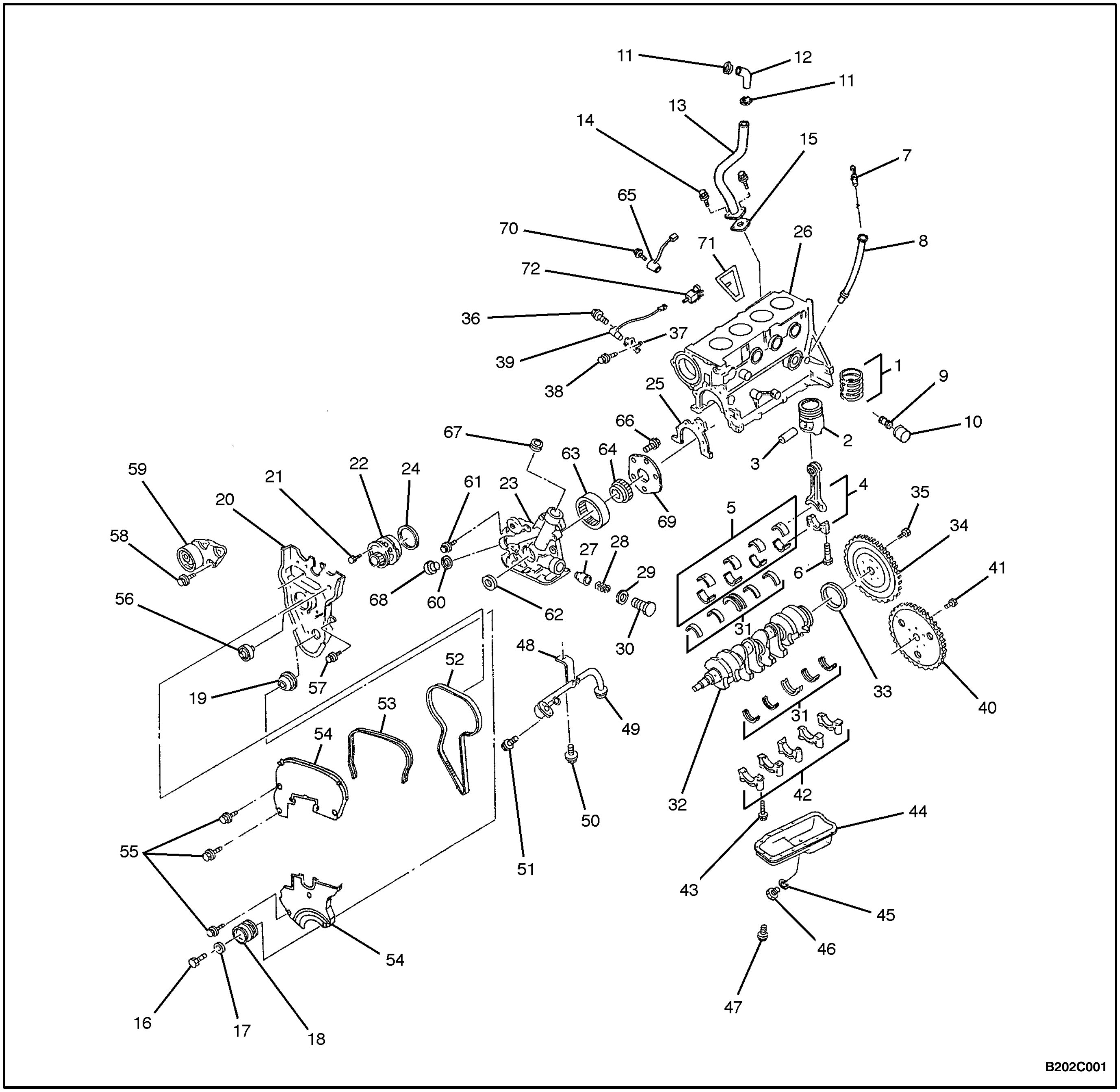
COMPONENT LOCATOR

UPPER END



1 Spark Plug Cover
2 Oil Filler Cap
3 Oil Filler Cap Seal
4 Camshaft Cover
5 Camshaft Cover Nut
6 Camshaft Cover Washer
7 Camshaft Cover Gasket
8 Seal
9 Hydraulic Tappet Adjuster
10 Valve Key
11 Valve Spring Cap
12 Valve Spring
13 Valve Stem Seal
14 Camshaft Cover Stud
15 Freeze Plug
16 Exhaust Manifold
17 Nut
18 Exhaust Manifold Heat Shield
19 Oxygen Sensor
20 Bolt
21 Bolt
22 Thermostat Housing
23 Exhaust Mainfold Gasket
24 Cylinder Head
25 Camshaft Gear
26 Thermostat Adapter Seal
27 Nut
28 Washer
29 Cylinder Head Gasket
30 Exhaust Valve
31 Intake Valve
32 Camshaft Seal
33 Washer
34 Camshaft Gear Bolt
35 Camshaft
36 Plug
37 Stud
38 Engine Coolant Temperature Sensor
39 Coolant Temperature Sensor
40 Bolt
41 Front Camshaft Cap
42 Plug
43 Valve Guide
44 Intermediate Camshaft Cap
45 Washer
46 Head Bolt
47 Exhaust Gas Recirculation Pipe
48 Intake Manifold
49 VGIS Manifold Gasket
50 Throttle Body
51 Intake VGIS Manifold
52 Intake Manifold Gasket

LOWER END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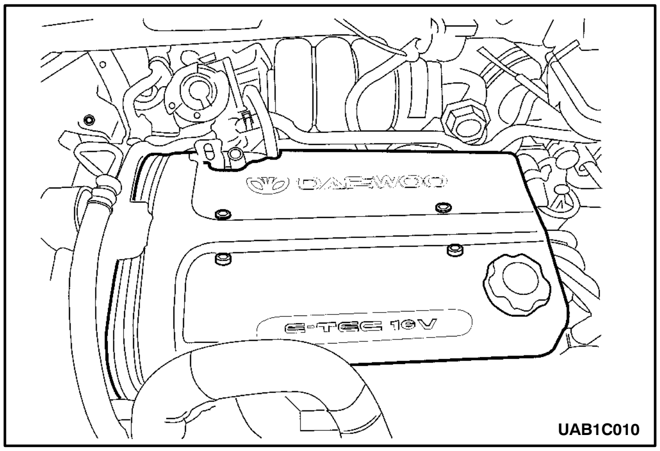
B202C001

1 Piston Ring Set
2 Piston
3 Piston Pin
4 Connecting Rod
5 Connecting Rod Bearing Set
6 Connecting Rod Bolt
7 Oil Level Gauge Stick
8 Gauge Stick Tube
9 Connecting Piece
10 Oil Filter
11 Hose Clamp
12 Engine Ventilation Hose
13 Engine Ventilation Pipe
14 Bolt
15 Oil Separator Gasket
16 Crankshaft Pulley Bolt
17 Washer
18 Crankshaft Pulley
19 Crankshaft Gear
20 Rear Timing Belt Cover
21 Bolt
22 Water Pump
23 Oil Pump
24 Seal Ring
25 Oil Pump Body Gasket
26 Engine Block
27 Pressure Relief Valve Plunger
28 Spring
29 Oil Pump Seal Ring
30 Bolt Plug
31 Crankshaft Bearing Set
32 Crankshaft
33 Shaft Seal Ring
34 Flywheel (Manual Transaxle)
35 Bolt (Manual Transaxle)
36 Bolt
37 Bracket
38 Bolt
39 Crankshaft Position Sensor
40 Flexible Plate (Automatic Transaxle)
41 Bolt (Automatic Transaxle)
42 Crankshaft Main Bearing Cap
43 Bolt
44 Oil Pan
45 Threaded Ring
46 Oil Pan Drain Plug
47 Bolt
48 Bracket
49 Oil Suction Pipe
50 Bolt
51 Bolt
52 Timing Belt
53 Cover Seal
54 Cover
55 Bolt
56 Idler Pulley
57 Rear Cover Bolt
58 Bolt
59 Auto Tensioner
60 Seal
61 Bolt
62 Seal
63 Ring Gear
64 Gear
65 Knock Sensor
66 Bolt
67 Plug
68 Oil Pressure Switch
69 Cover
70 Bolt
71 Intake Manifold-to-Engine Block Bracket
72 Exhaust Gas Recirculation Solenoid

REPAIR INSTRUCTION

ON–VEHICLE SERVICE



UAB1C010

VALVE COVER

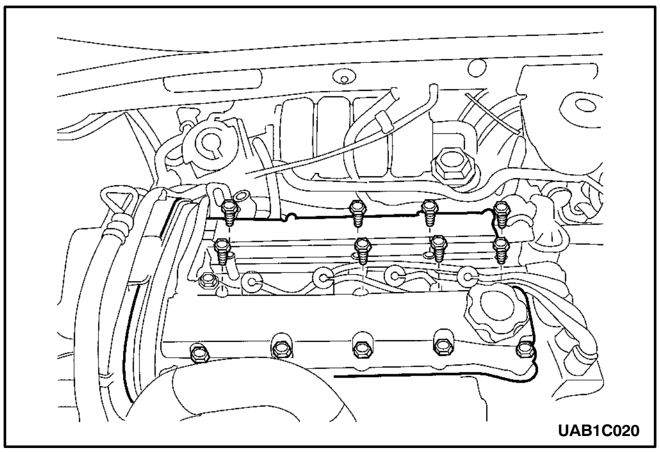
(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the intake air temperature (IAT) sensor connector.
3. Disconnect the breather hoses from the valve cover.
4. Disconnect the positive crankcase ventilation (PCV) hose from the valve cover.
5. Disconnect the clip at the valve cover.
6. Remove the spark plug cover bolts and cover.

Installation Notice

Tightening Torque	8 N·m (71 lb–in)



UAB1C020

7. Disconnect the ignition wires at the spark plugs.
8. Remove the valve cover bolts.

Installation Notice

Tightening Torque	8 N·m (71 lb–in)

9. Remove the valve cover.
10. Remove the valve cover gasket from the valve cover.
11. Installation should follow the removal procedure in the reverse order.

CYLINDER HEAD AND GASKET

(Left-Hand Drive Shown, Right-HandDrive Similar)

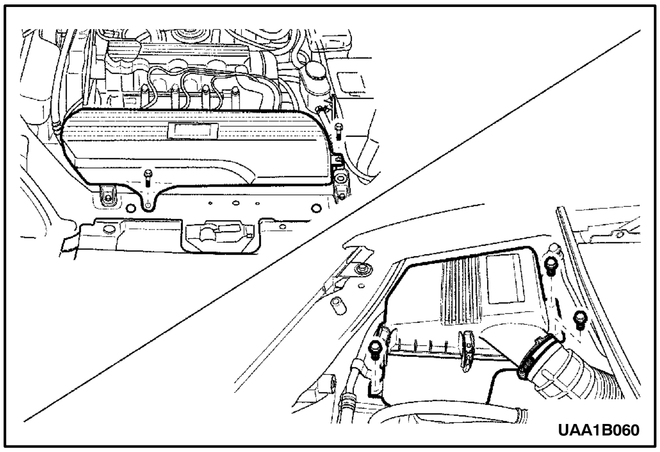
Tools Required

J–42472 Timing Belt Adjuster

KM–470–B Angular Torque Gauge

Removal and Installation Procedure

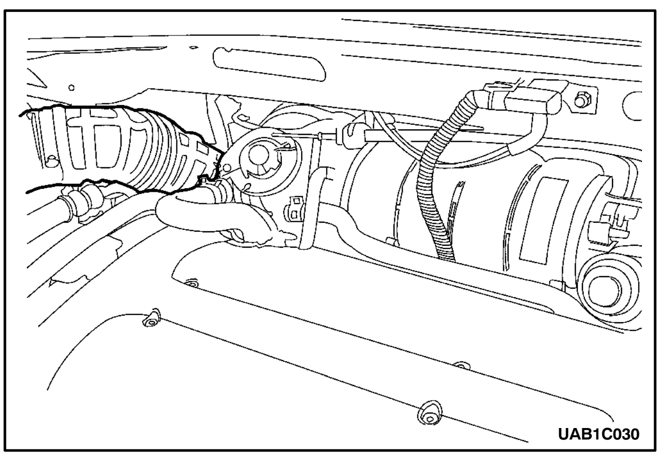
1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine after it stalls for 10 seconds to rid the fuel system of fuel pressure.



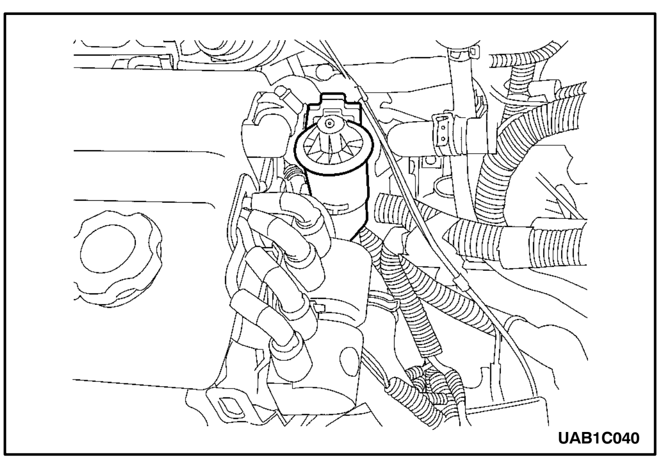
3. Drain the engine coolant. Refer to *Section 1D, Engine Cooling.*
4. Disconnect the negative battery cable
5. Remove the air filter housing bolts and the air filter housing assembly.
6. Remove the air inlet duct bolts and air inlet duct

Installation Notice

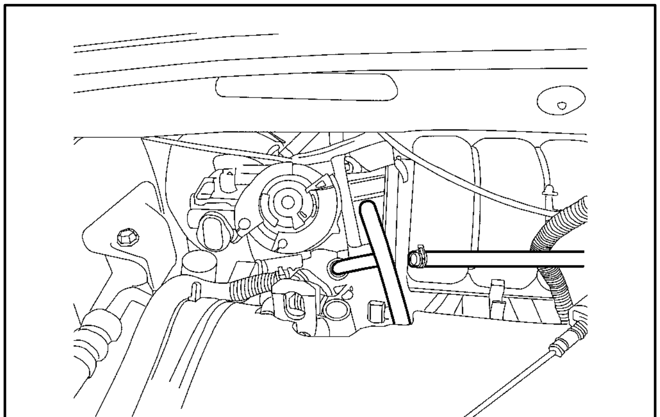
Tightening Torque	8 N·m (71 lb–in)



7. Disconnect the intake air temperature (IAT) sensor connector.
8. Disconnect the breather hose from the valve cover.
9. Remove the air intake tube from the throttle body.



10. Disconnect the camshaft position (CMP) sensor connector.
11. Disconnect the oxygen sensor connector.
12. Disconnect the engine coolant temperature (ECT) sensor connector.
13. Disconnect the coolant temperature gauge connector.
14. Disconnect the EGR valve connector.
15. Remove the electronic ignition (EI) system ignition coil. Refer to *Section 1F, Engine Controls.*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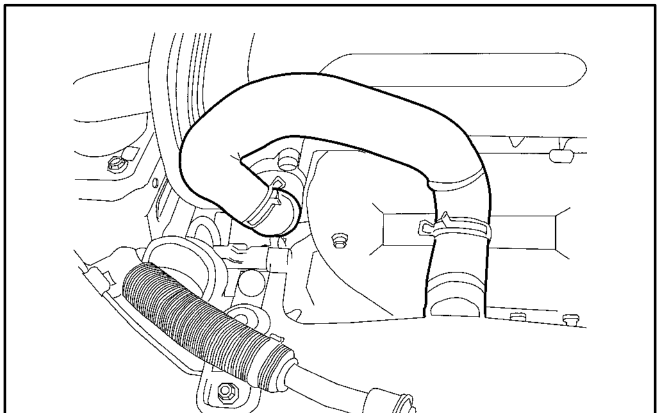
16. Disconnect the coolant hose from the throttle body.
17. Disconnect the coolant hose from the cylinder head.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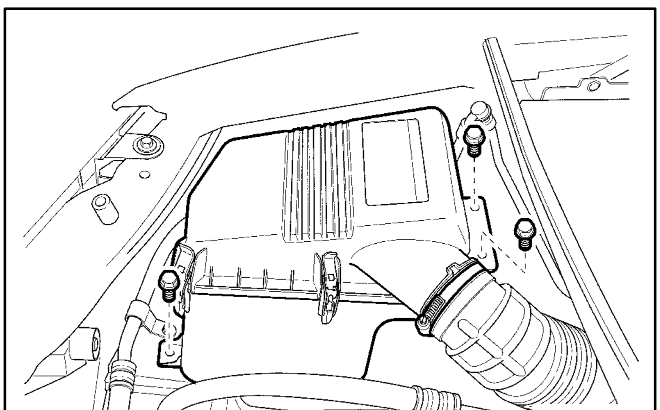
18. Disconnect the upper radiator hose at the thermostat housing.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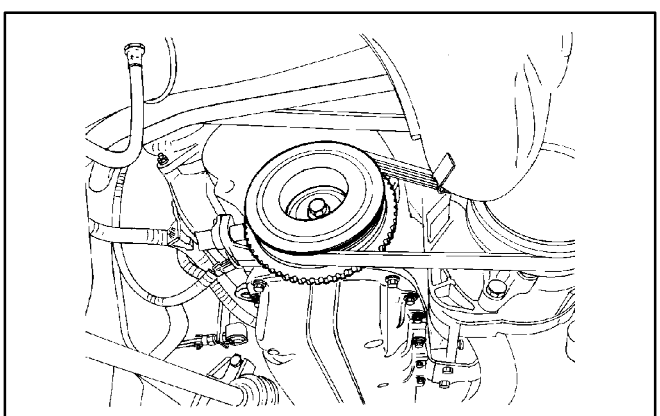
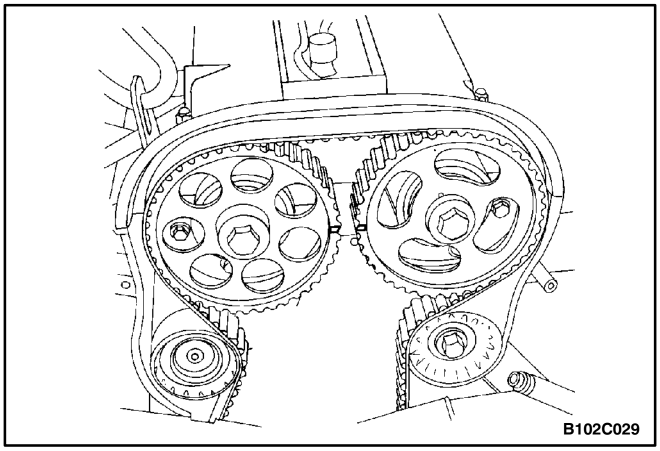
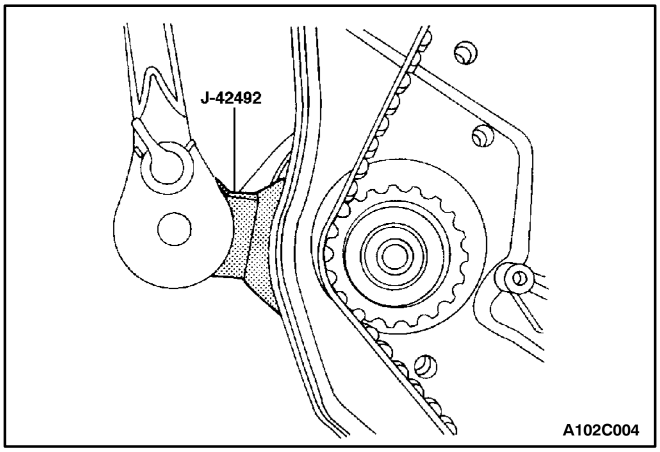
19. Remove the air cleaner housing bolts.
20. Remove the air cleaner housing.
21. Remove the right front wheel. Refer to *Section 2E, Tires and • heels*.
22. Remove the right front wheel well splash shield.


B102C023

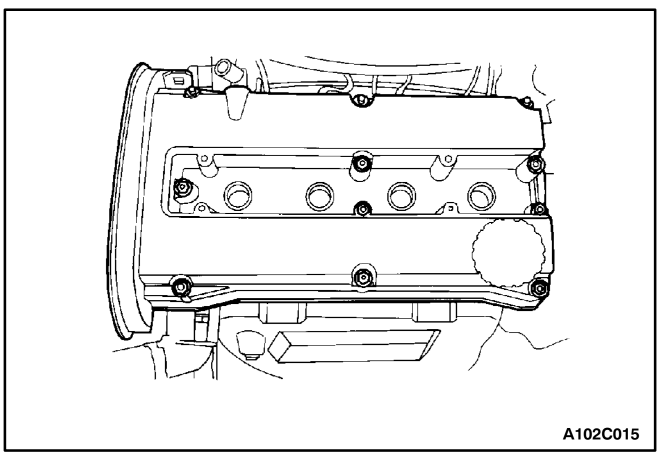
23. Disconnect the upper radiator hose at the thermostat housing.
24. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*.
25. Remove the crankshaft pulley bolt.
26. Remove the crankshaft pulley.



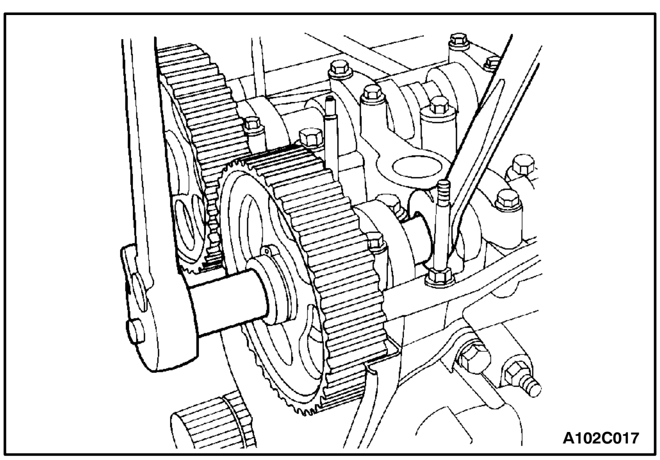
27. Remove the upper front timing belt cover bolts.
28. Remove the upper front timing belt cover.
29. Remove the lower front timing belt cover bolts.
30. Align the camshaft gear timing marks.
31. Remove the lower front timing belt cover.



32. Slightly loosen the water pump retaining bolts.
33. Rotate the water pump counterclockwise using the timing belt adjuster J-42492 to relieve the timing belt tension.
34. Remove the timing belt. Refer to "Timing Belt" in this section.

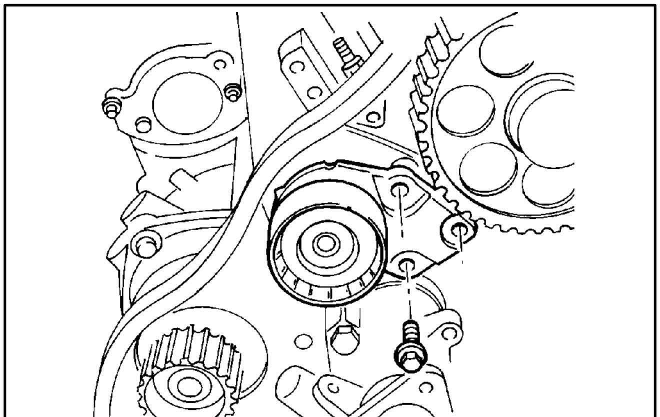


35. Disconnect the engine ventilation hose at the camshaft cover.
36. Remove the oil filler cap.
37. Remove the spark plug cover bolts.
38. Remove the spark plug cover.
39. Disconnect the ignition wires from the spark plugs.
40. Remove the camshaft cover nuts.
41. Remove the camshaft cover washers.
42. Remove the camshaft cover and the camshaft cover gasket.

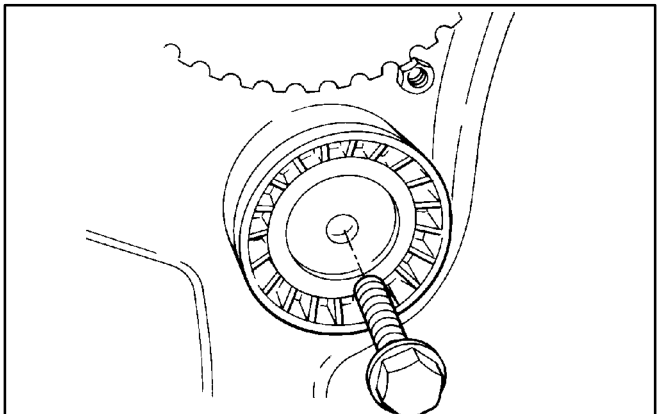


Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

43. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.
44. Remove the intake camshaft gear.
45. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.
46. Remove the exhaust camshaft gear.


A102C018

47. Remove the timing belt automatic tensioner bolts.
48. Remove the timing belt automatic tensioner.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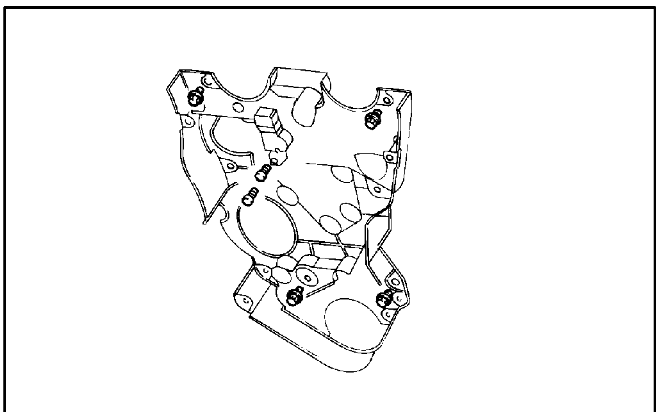
49. Remove the timing belt idler pulley bolt.
50. Remove the timing belt idler pulley.
51. Remove the right engine mount. Refer to “Engine Mount” in this section.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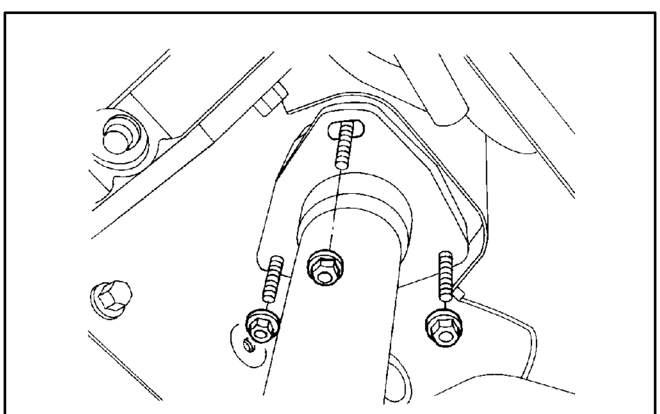
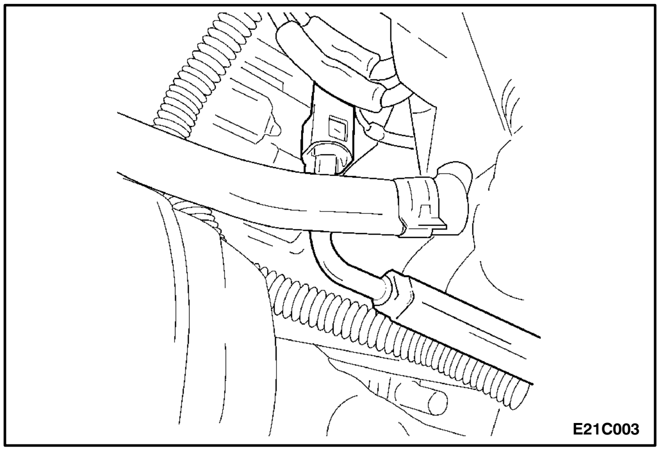
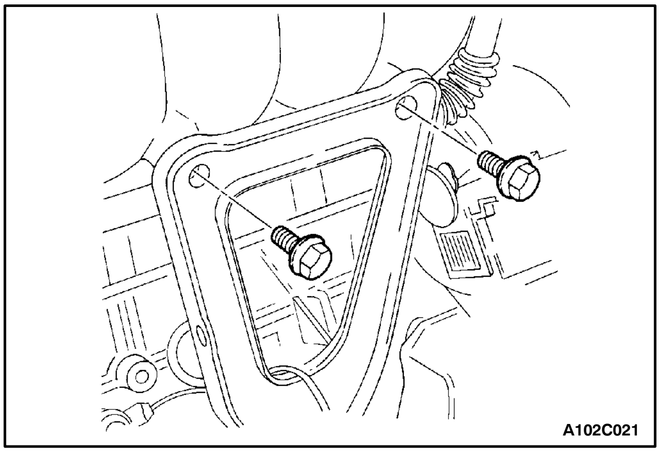
52. Remove the rear timing belt cover bolts.
53. Remove the rear timing belt cover.


C102B034

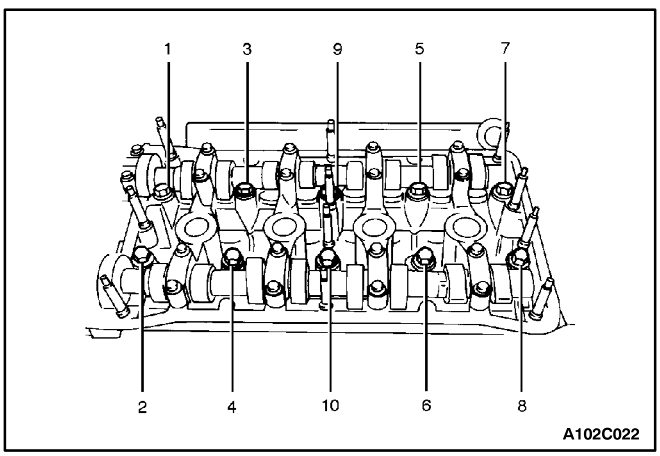
54. Remove the exhaust flex pipe retaining nuts at the exhaust manifold studs.
55. Disconnect all of the necessary vacuum hoses and the brake booster hose at the intake manifold.



56. Disconnect the fuel return line at the fuel pressure regulator.
57. Disconnect the fuel feed line at the fuel rail.
58. Remove the generator upper retaining bolt.
59. Disconnect the heater inlet hose at the cylinder head.
60. Disconnect the surge tank coolant hose at the throttle body.



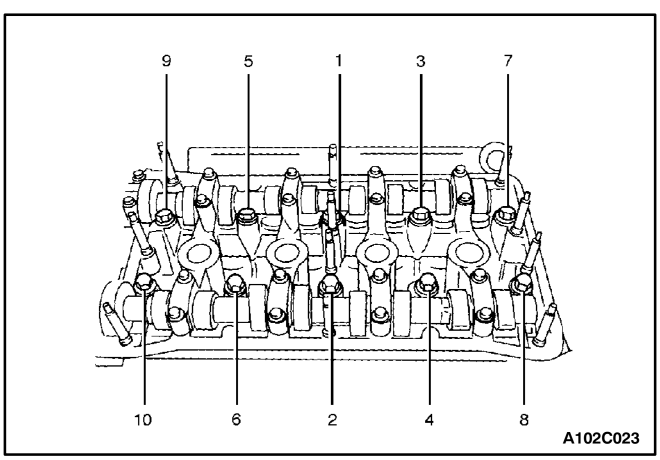
61. Remove the upper intake manifold support bracket bolts at the intake manifold.



62. Disconnect the throttle cable at the throttle body and the intake manifold.
63. Loosen all of the cylinder head bolts gradually and in the sequence shown.
64. Remove the cylinder head bolts.
65. Remove the cylinder head with the intake manifold and the exhaust manifold attached.

Notice: Prevent any engine oil or coolant from entering the cylinders when removing the cylinder head.

66. Remove the cylinder head gasket.
67. Installation should follow the removal procedure in the reverse order.



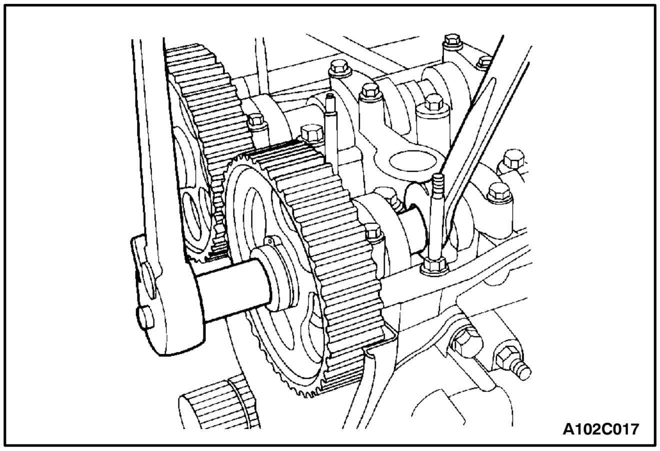
Cleaning Procedure

1. Clean the gasket surfaces of the cylinder head and the engine block.
2. Make sure the gasket surfaces of the cylinder head and the engine block are free of nicks and heavy scratches.
3. Clean the cylinder head bolts.
4. Inspect the cylinder head for warpage. Refer to “Cylinder Head and Valve Train Components” in this section.

CAMSHAFTS

(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal and Installation Procedure



1. Remove the timing belt. Refer to *“Timing Belt”* in this section.
2. Remove the valve cover. Refer to *“Valve Cover”* in this section.

Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

3. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.

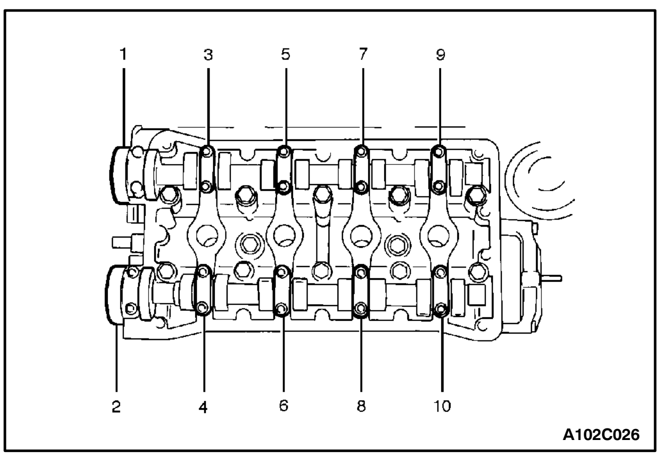
Installation Notice

Tightening Torque	67.5 N·m (49 lb–ft)

4. Remove the intake camshaft gear.
5. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.

Installation Notice

Tightening Torque	67.5 N·m (49 lb–ft)

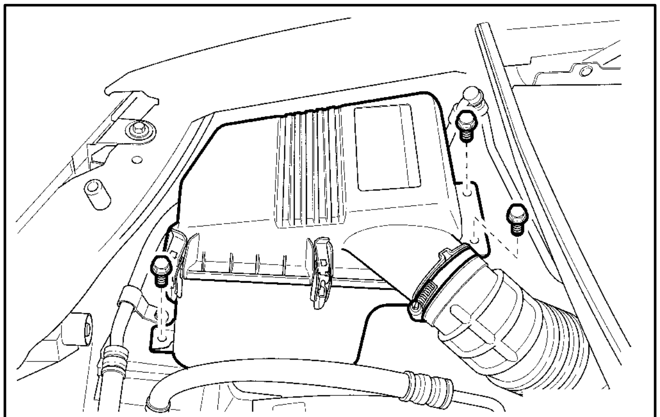


6. Remove the exhaust camshaft gear.
7. Remove the camshaft cap bolts gradually and in the sequence shown for each camshaft cap.

Installation Notice

Tightening Torque	16 N·m (12 lb–in)

8. Remove the intake/exhaust camshaft caps. Maintain the correct positions for installation.
9. Remove the intake/exhaust camshaft.
10. Installation should follow the removal procedure in the reverse order.



UAA1B110

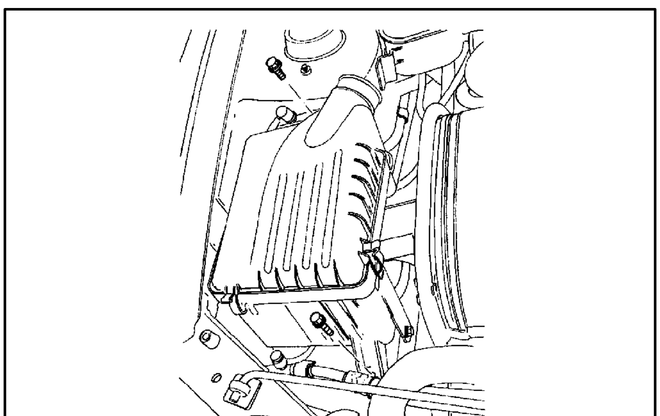
TIMING BELT CHECK AND ADJUST

(Left-Hand Drive Shown, Right-Hand Drive Similar)

Tools Required

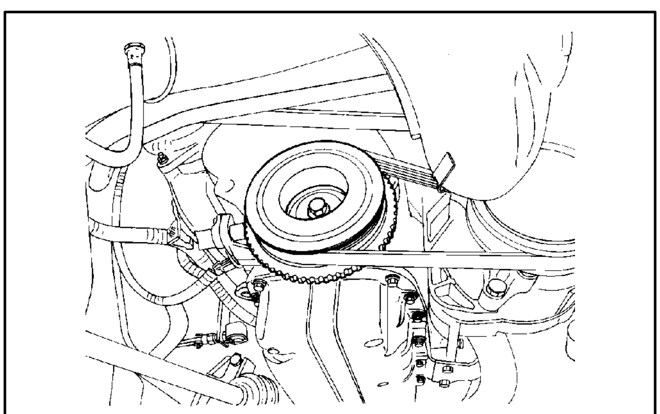
KM–470–B Angular Torque Gauge

1. Disconnect the negative battery cable.
2. Remove the air filter housing bolts.
3. Remove the air filter housing assembly.
4. Disconnect the manifold air temperature (MAT) sensor connector.
5. Remove the air cleaner outlet hose from the throttle body.
6. Remove the breather tube from the camshaft cover.



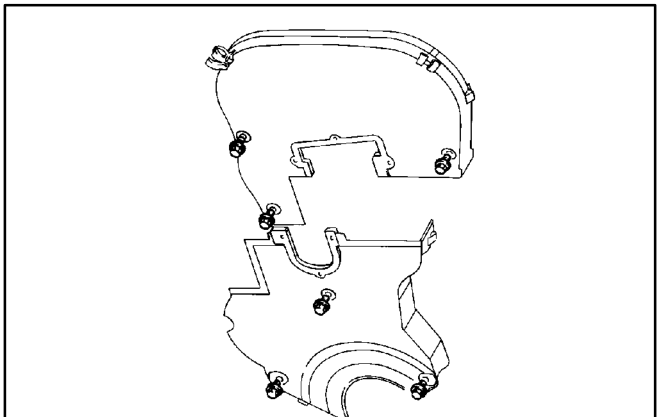
B102C024

7. Remove the air cleaner housing bolts.
8. Remove the air cleaner housing.
9. Remove the right front wheel. Refer to *Section 2E, Tires and • heels.*
10. Remove the right front wheel well splash shield.



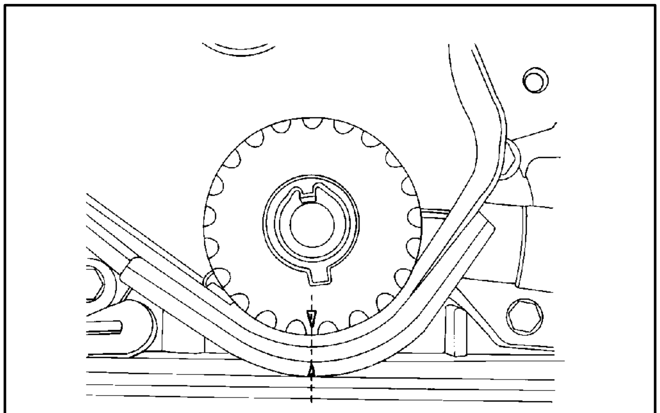
B102C023

11. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*.
12. Remove the crankshaft pulley bolt.
13. Remove the crankshaft pulley.



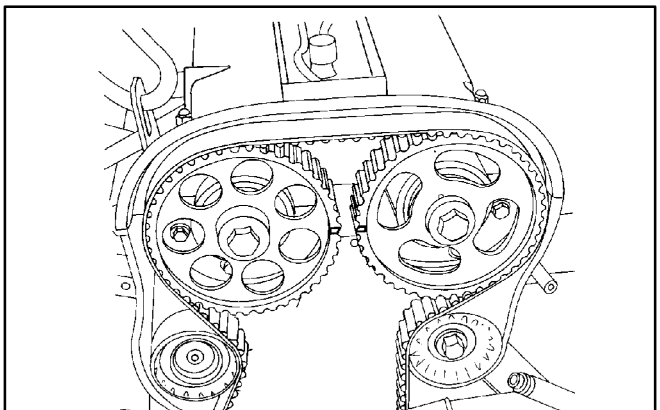
B102C014

14. Remove the upper front timing belt cover bolts.
15. Remove the upper front timing belt cover.
16. Remove the lower front timing belt cover bolts.
17. Remove the lower front timing belt cover.
18. Install the crankshaft pulley bolt.



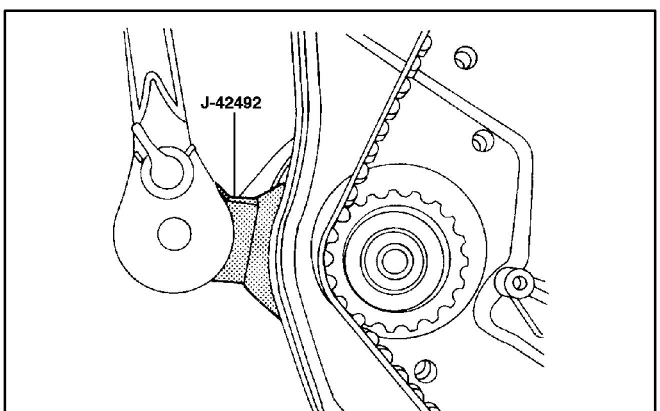
A102C008

19. Rotate the crankshaft at least one full turn clockwise using the crankshaft pulley bolt.
20. Align the mark on the crankshaft gear with the notch at the bottom of the rear timing belt cover.



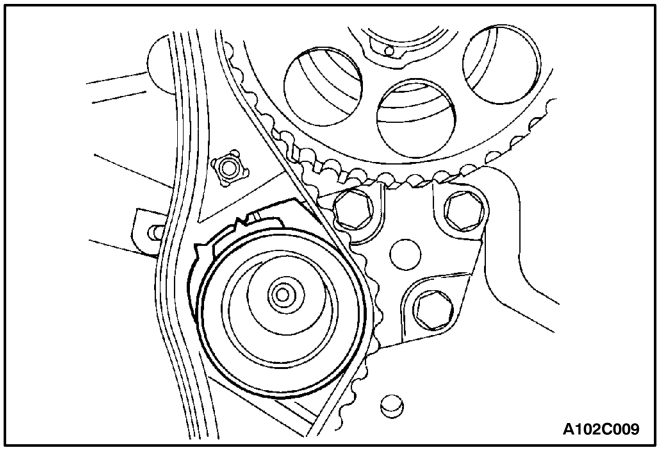
B102C029

21. Align the camshaft gear timing marks.

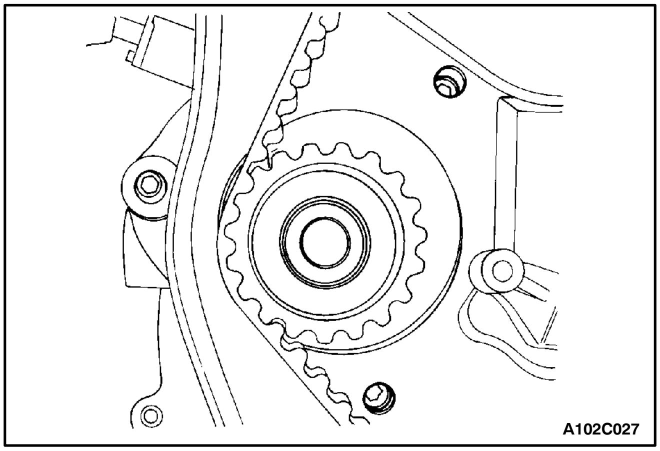


A102C004

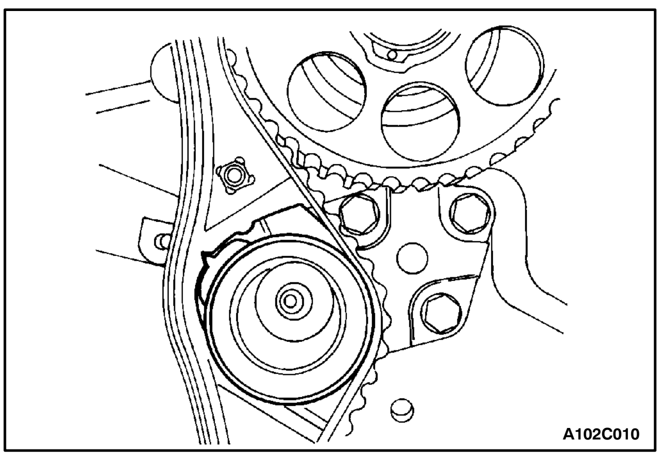
22. Slightly loosen the water pump retaining bolts.
23. Rotate the water pump clockwise using the timing belt adjuster J-42492.



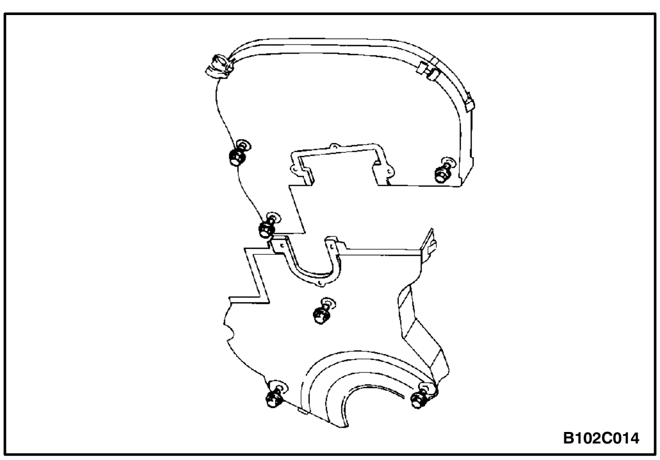
24. Rotate the water pump clockwise until the adjust arm pointer of the timing belt automatic tensioner is aligned with the notch in the timing belt automatic tensioner bracket.



25. Tighten the water pump retaining bolts.
26. Rotate the crankshaft two full turns clockwise using the crankshaft pulley.
27. Loosen the water pump retaining bolts.



28. Using the timing belt adjuster J-42492, rotate the water pump until the adjust arm pointer of the timing belt automatic tensioner is aligned with the pointer on the timing belt automatic tensioner bracket.



29. Tighten the water pump retaining bolts.

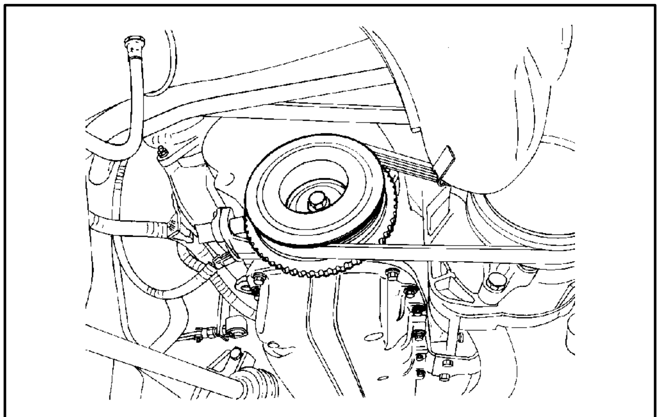
Tighten

Tighten the water pump retaining bolts to 10 N•m (89 lb-in).

30. Remove the crankshaft pulley bolt.
31. Install the upper and lower front timing belt covers.
32. Install the upper and lower front timing belt cover bolts.

Tighten

Tighten the front timing belt cover bolts to 10 N•m (89 lb-in).



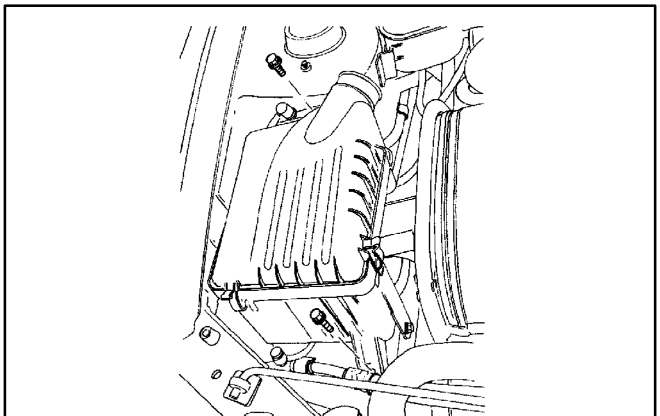
B102C023

33. Install the crankshaft pulley.
34. Install the crankshaft pulley bolt.

Tighten

Tighten the crankshaft pulley bolt to 20 N•m (15 lb-ft).

35. Install the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*.



B102C024

36. Install the right front wheel well splash shield.
37. Install the right front wheel. Refer to *Section 2E, Tires and • heels*.
38. Install the air cleaner housing.
39. Install the air cleaner housing bolts.

Tighten

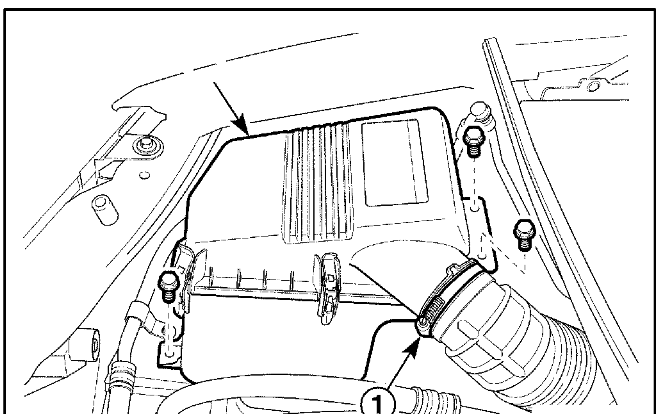
Tighten the air cleaner housing bolts to 10 N•m (89 lb-in).

TIMING BELT

(Left-Hand Drive Shown, Right-Hand Drive Similar)

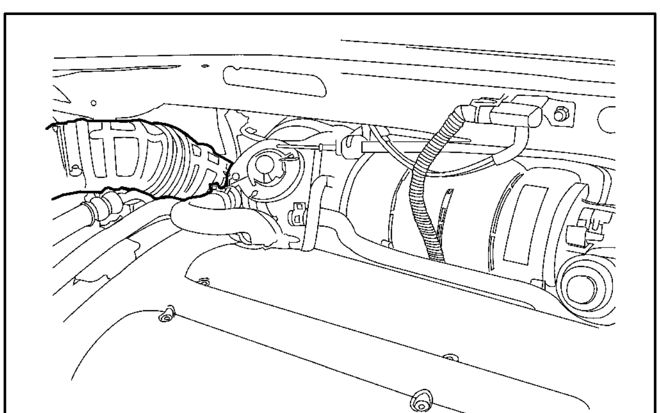
Tools Required

KM–470–B Angular Torque Gauge



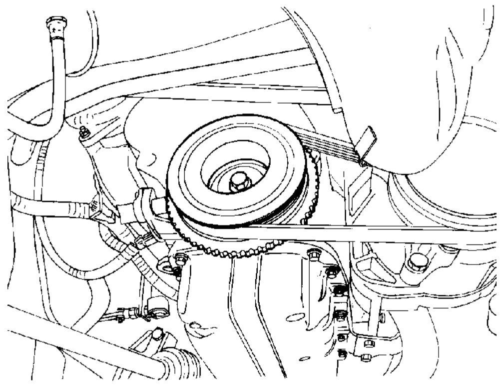
G102B501

1. Disconnect the negative battery cable.
2. Remove the air filter housing bolts.
3. Remove the air filter housing assembly.



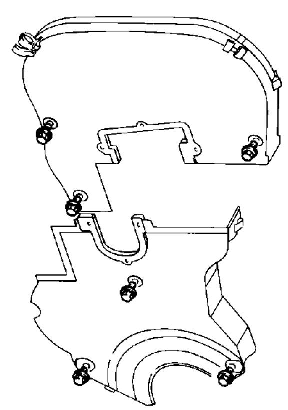
UAB1C030

4. Disconnect the intake air temperature (IAT) sensor connector.
5. Disconnect the breather hose from the valve cover.
6. Remove the air intake tube from the throttle body.



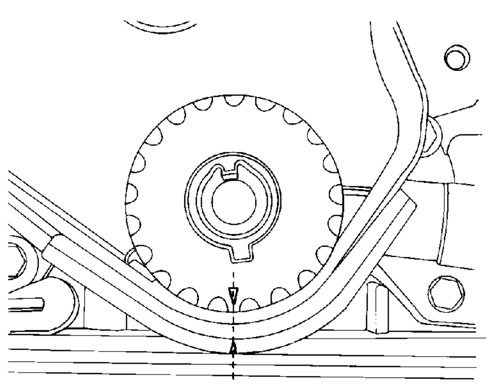
B102C023

7. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*.
8. Remove the crankshaft pulley bolt.
9. Remove the crankshaft pulley.



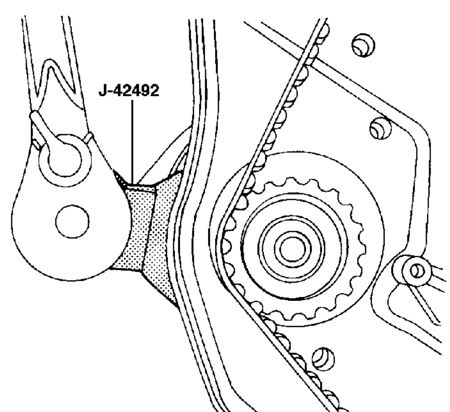
B102C014

10. Remove the upper front timing belt cover bolts.
11. Remove the upper front timing belt cover.
12. Remove the lower front timing belt cover bolts.
13. Remove the lower front timing belt cover.
14. Install the crankshaft pulley bolt.



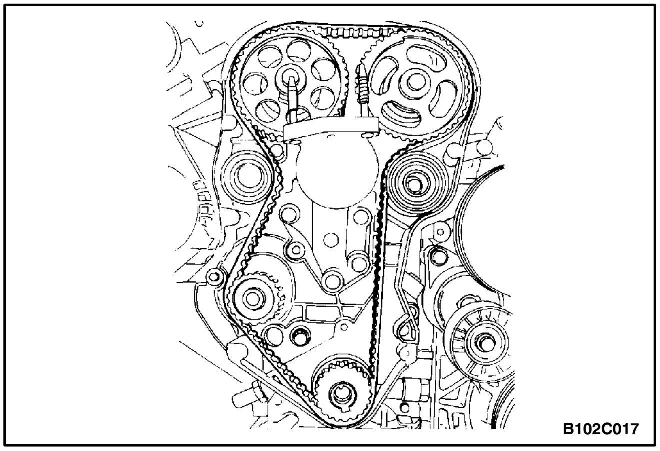
A102C008

15. Using the crankshaft pulley bolt, rotate the crankshaft clockwise until the timing mark on the crankshaft gear is aligned with the notch at the bottom of the rear timing belt cover.

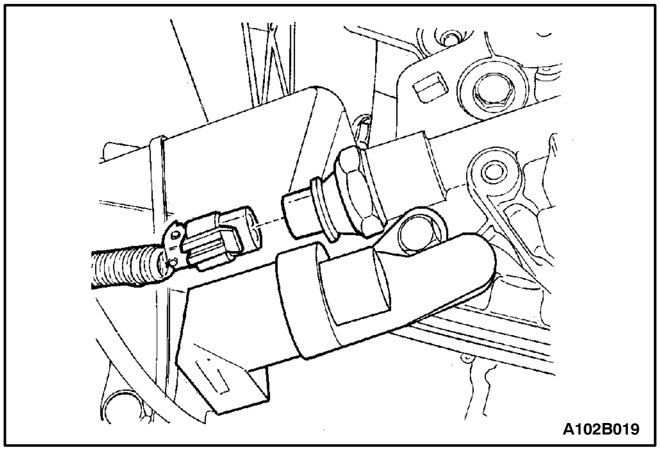


A102C004

16. Slightly loosen the water pump retaining bolts.
17. Using the timing belt adjuster J-42492, rotate the water pump counterclockwise to release the tension on the timing belt.
18. Remove the right engine mount bracket. Refer to “Engine Mount” in this section.


B102C017

19. Remove the timing belt.
20. Installation should follow the removal procedure in the reverse order.


A102B019

OIL PUMP

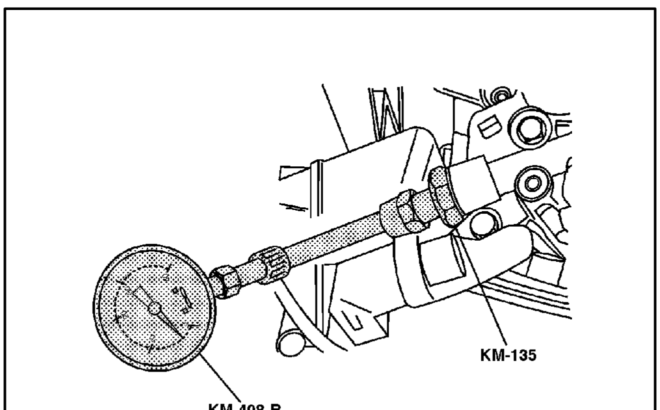
Tools Required

KM-498-B Pressure Gauge

KM-135 Adapter

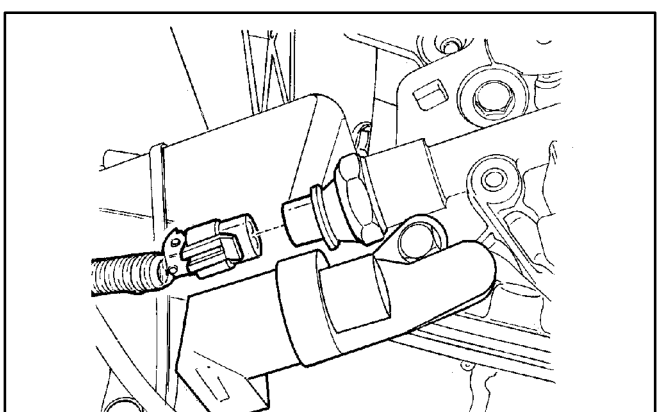
Engine Oil Pressure Inspection Procedure

1. Remove the right front wheel well splash shield.
2. Disconnect the oil pressure switch connector.



A202B003

3. Install the adapter KM-135 in place of the oil pressure switch.
4. Connect the pressure gauge KM-498-B to the adapter.
5. Start the engine and check the oil pressure at idle speed and engine temperature of 80°C (176°F). The minimum oil pressure should be 30 kPa (4.35 psi).
6. Stop the engine and remove the pressure gauge KM-498-B and the adapter KM-135.

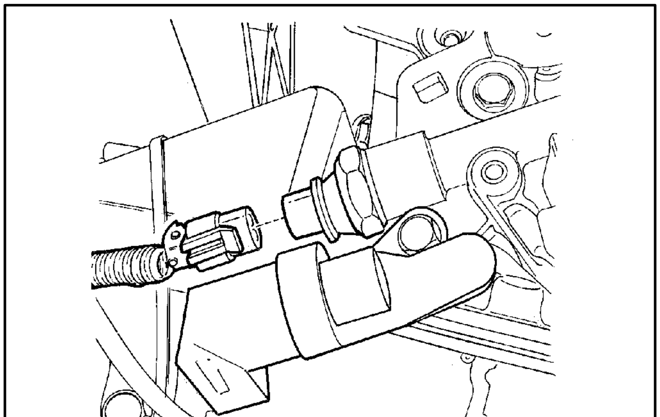

A102B019

7. Install the oil pressure switch.

Tighten

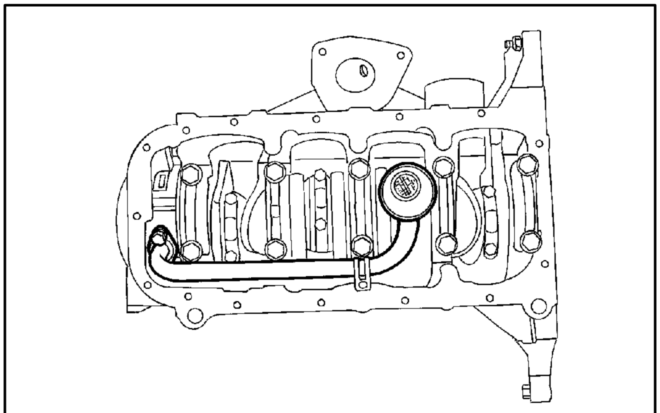
Tighten the oil pressure switch to 30 N•m (22 lb-ft).

8. Connect the oil pressure switch connector.
9. Install the right front wheel well splash shield.
10. Check the oil level. Pour oil until it reaches the full mark.

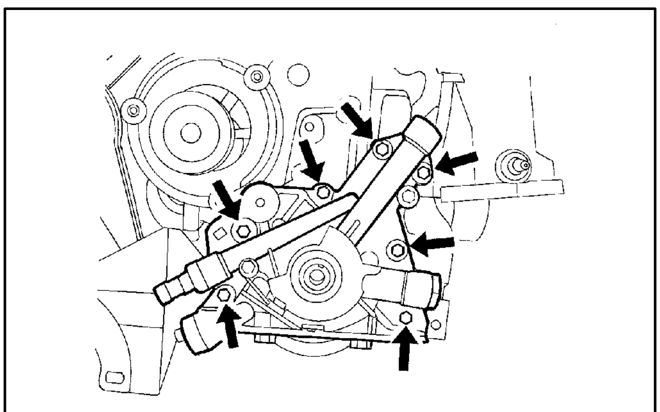

A102B019

Removal Procedure

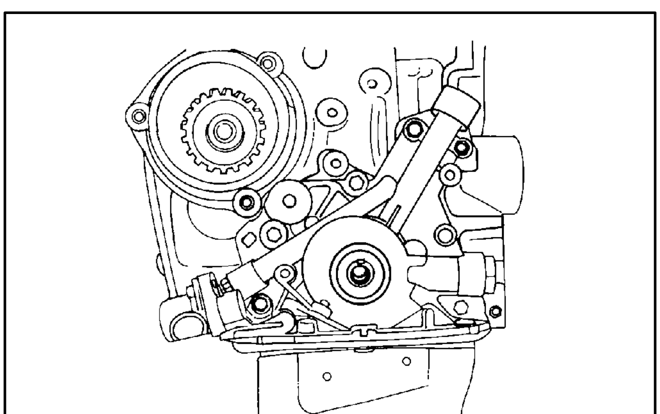
1. Disconnect the negative battery cable.
2. Remove the power steering pump, if equipped. Refer to *Section 6A, Power Steering System*.
3. Remove the timing belt. Refer to “Timing Belt” in this section.
4. Remove the rear timing belt cover. Refer to “Rear Timing Belt Cover” in this section.
5. Disconnect the oil pressure switch connector.


A102B064

6. Remove the crankshaft position sensor bolt.
7. Remove the crankshaft position sensor.
8. Remove the oil pan. Refer to “Oil Pan” in this section.
9. Remove the oil suction pipe and support bracket bolts.
10. Remove the oil suction pipe.

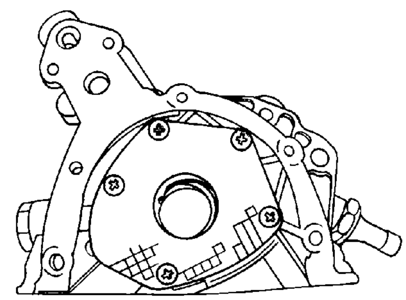

A102B065

11. Remove the oil pump retaining bolts.
12. Carefully separate the oil pump and gasket from the engine block and the oil pan.
13. Remove the oil pump.


A202B002

Inspection Procedure

1. Clean the oil pump and the engine block gasket mating surface areas.
2. Remove the safety relief valve bolt.
3. Remove the safety relief valve and the spring.
4. Remove the oil pump-to-crankshaft seal.

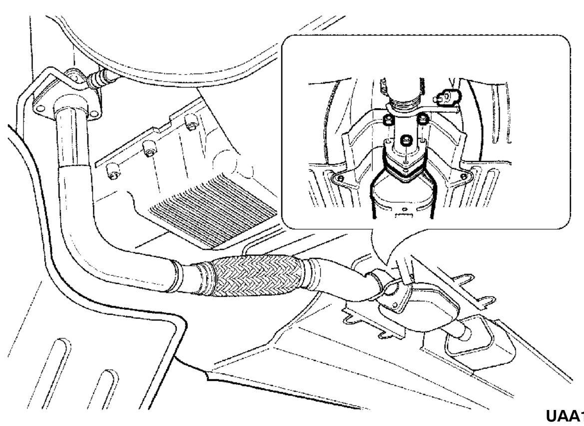


A202B001

5. Remove the oil pump rear cover bolts.
6. Remove the rear cover.

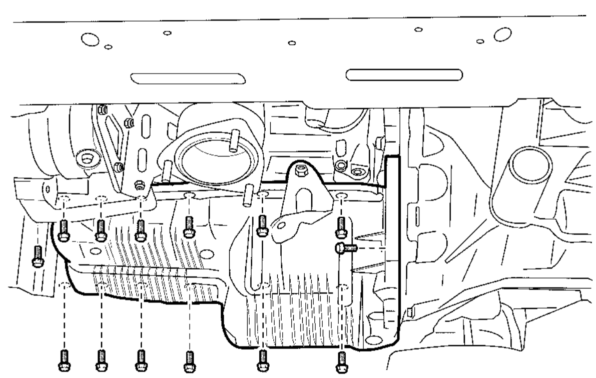
OIL PAN

Removal and Installation Procedure



UAA1G030

1. Disconnect the negative battery cable.
2. Remove the right front wheel. Refer to *Section 2E, Tires and • heels.*
3. Remove the right front wheel well splash shield.
4. Drain the engine oil from the engine crankcase.
5. Remove the exhaust front pipe. Refer to *Section 1G, Engine Exhaust.*



UAB1C070

6. Remove the reaction lower rod. Refer to *"Reaction Lower Rod"* in this section.
7. Remove the oil pan-to-transaxle housing retaining bolts.

Installation Notice

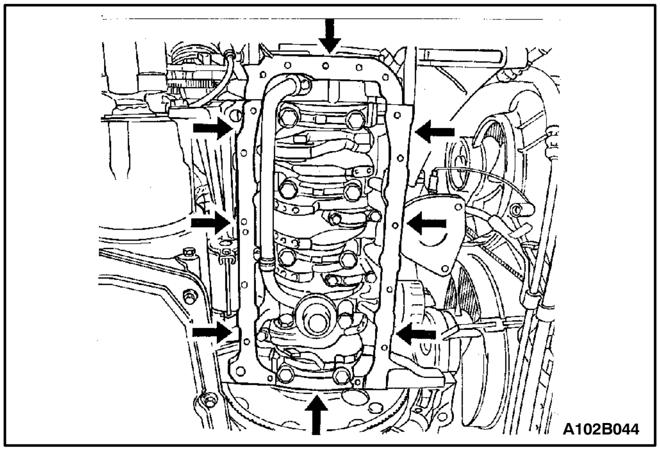
Tightening Torque	75 N·m (55 lb–ft)

8. Remove the oil pan retaining bolts.

Installation Notice

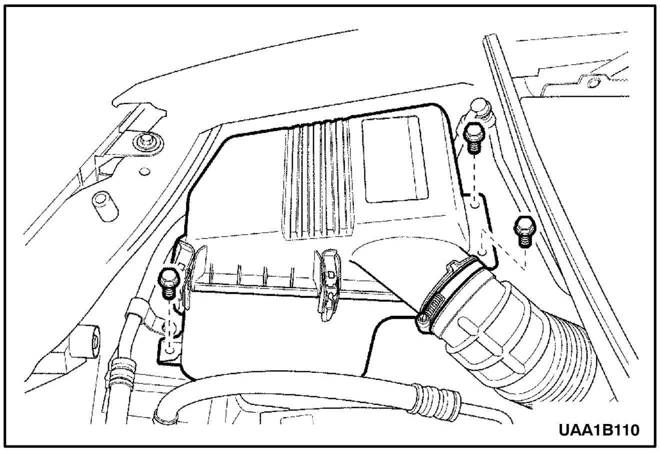
Tightening Torque	10 N·m (89 lb–in)

9. Remove the oil pan from the engine block.
10. Remove the oil pan gasket from the oil pan.
11. Installation should follow the removal procedure in the reverse order.



Cleaning Procedure

1. Clean the oil pan sealing surface.
2. Clean the engine block sealing surface.
3. Clean the oil pan retaining bolts.
4. Clean the oil pan attaching bolt holes in the engine block.



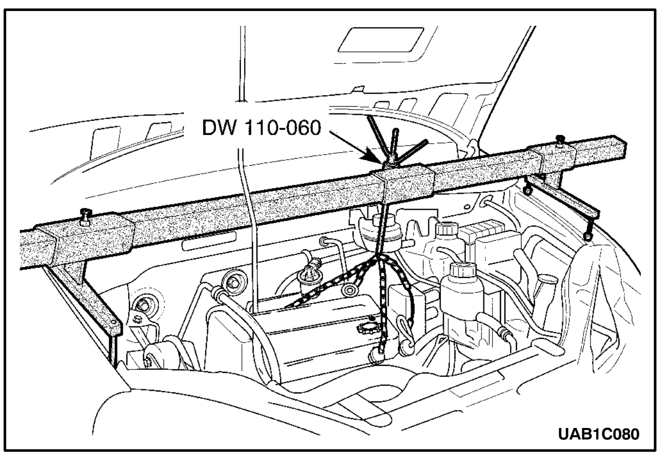
ENGINE MOUNT, RIGHT SIDE

Tools Required

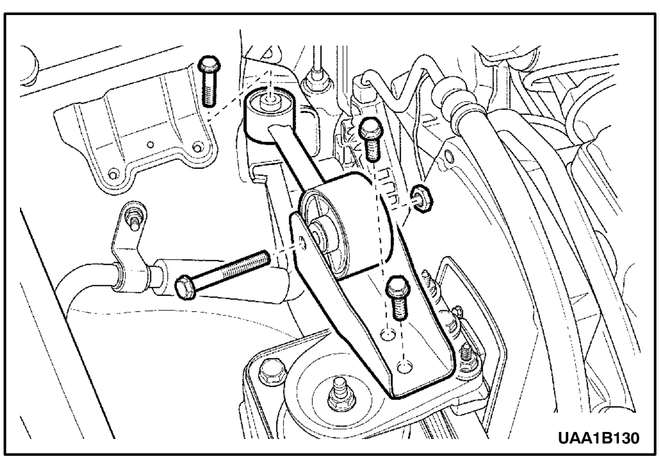
DW110–060 Engine Assembly Support Fixture

Removal and Installation Procedure

1. Remove the air filter housing bolts.
2. Remove the air filter housing assembly.



3. Support the engine assembly using the engine assembly support fixture DW110–160.

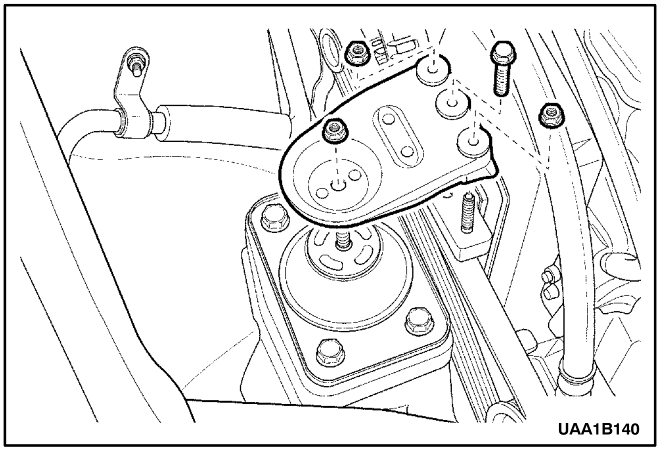


4. Remove the reaction upper rod and the reaction upper rod bracket bolts.

Installation Notice

Tightening Torque	75 N·m (55 lb–ft)

5. Remove the reaction upper rod and the reaction upper rod bracket.

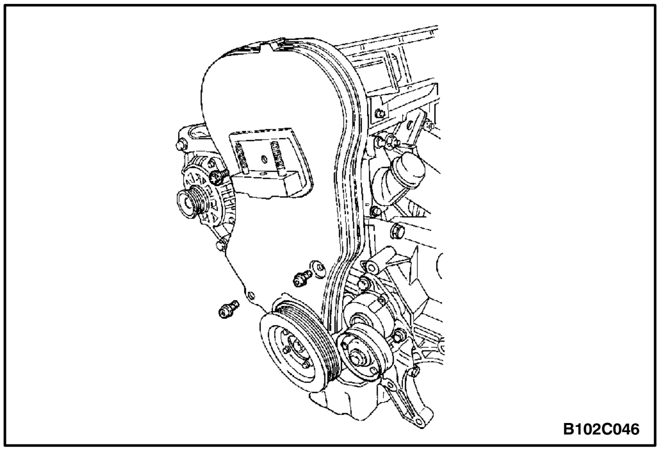


6. Remove the engine mount bracket retaining bolt/ nuts.

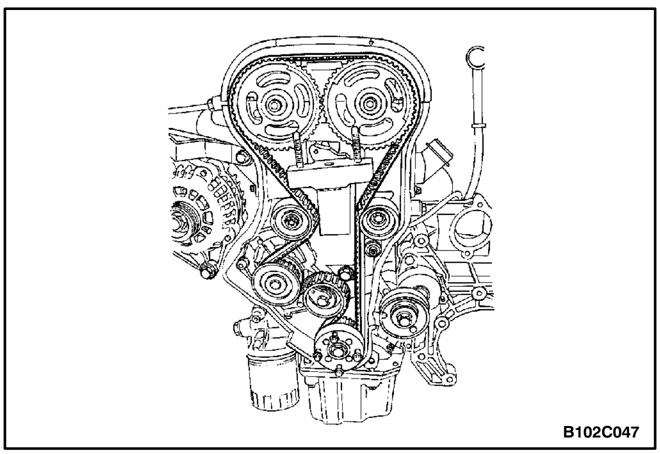
Installation Notice

Tightening Torque	60 N·m (44 lb–ft)

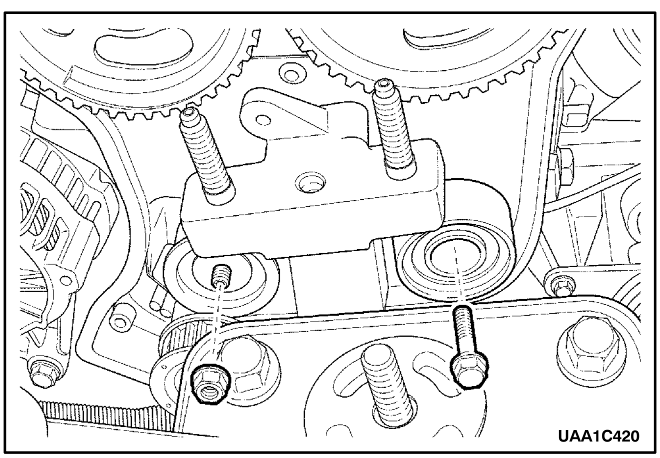
7. Remove the engine mount bracket.



8. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*
9. Remove the front timing belt cover bolts and the front timing belt cover.



10. Align the crankshaft pulley timing mark with the pointer, and the camshaft gears with the timing marks on the rear cover, by turning the crankshaft gear bolt.
11. Loosen the timing belt automatic tensioner bolt.
12. Turn the hex-key tab to relieve belt tension.
13. Remove the timing belt.

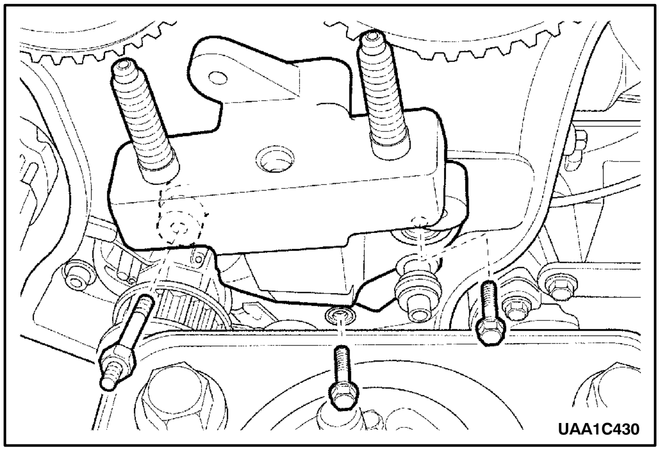


14. Remove the timing belt idler pulley bolt/nut.

Installation Notice

Tightening Torque	25 N·m (18 lb–ft)

15. Remove the timing belt idler pulleys.

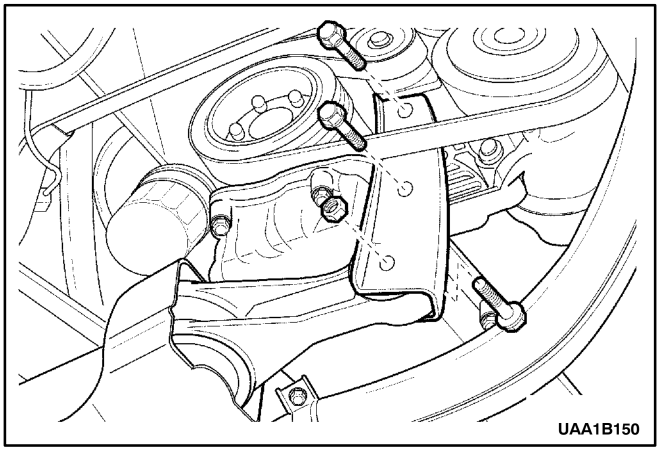


16. Remove the engine mount retaining bolts.
17. Remove the engine mount.

Installation Notice

Tightening Torque	55 N·m (44 lb–ft)

18. Installation should follow the removal procedure in the reverse order.



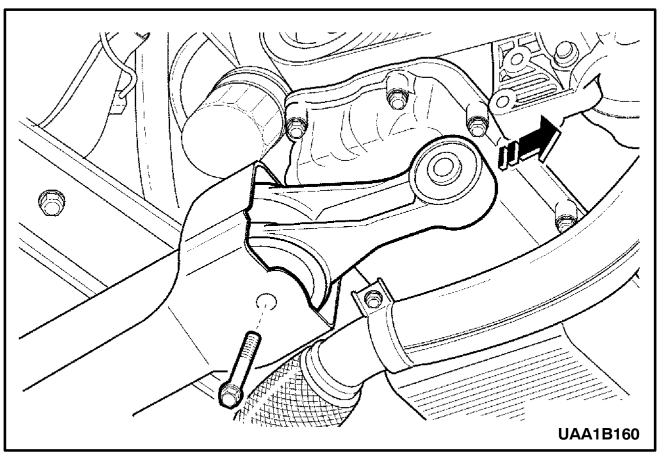
REACTION LOWER ROD

Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Remove the front fascia splash shield and engine under cover. Refer to *Section 9N, Frame and Under°ody.*
3. Remove the reaction lower rod bracket bolt/nut.
4. Remove the reaction lower rod bracket.

Installation Notice

Tightening Torque	69 N·m (49 lb–ft)

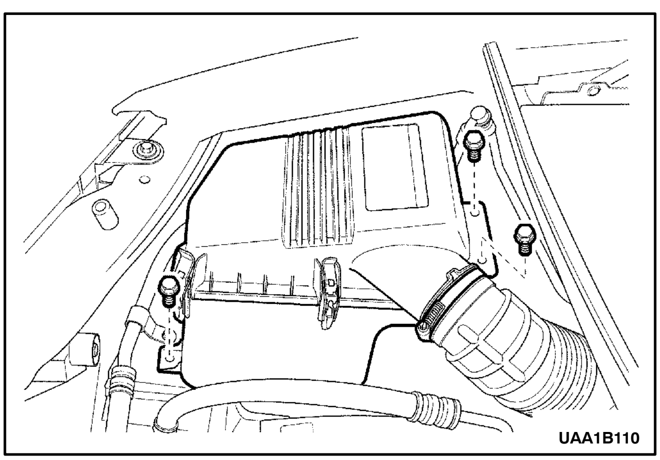


5. Remove the reaction lower rod mount bolt.
6. Remove the reaction lower rod mount.

Installation Notice

Tightening Torque	55 N·m (41 lb–ft)

7. Installation should follow the removal procedure in the reverse order.

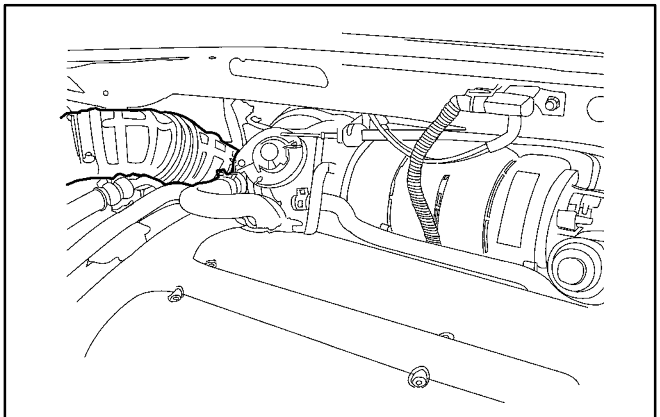


INTAKE MAINFOLD

(Left Hand Drive Shown, Right Hand Drive Similar)

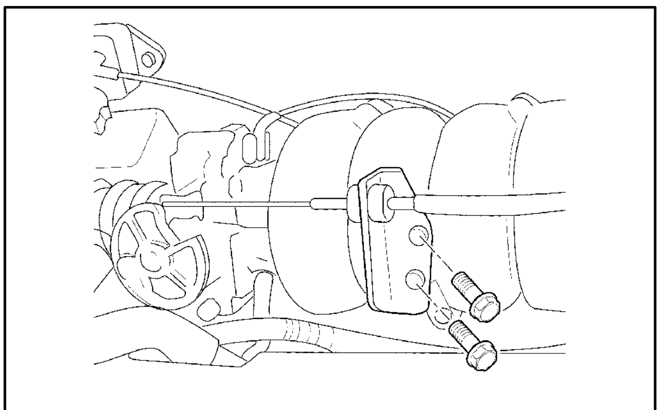
Removal and Installation Procedure

1. Remove the fuel pump fuse.
2. Start the engine. Crank the engine after it stalls for 10 seconds to rid the fuel system of fuel pressure.
3. Disconnect the negative battery cable.
4. Remove the air filter housing bolts.
5. Remove the air filter housing assembly.



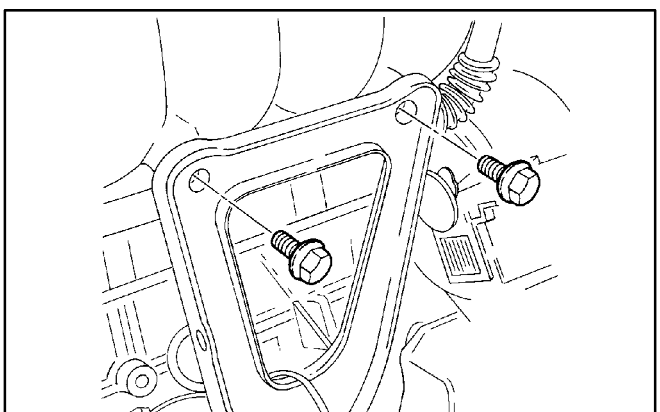
UAB1C030

6. Disconnect the manifold air temperature (MAT) sensor connector.
7. Disconnect the breather hose from the valve cover.
8. Remove the air intake tube from the throttle body.
9. Disconnect the idle air control (IAC) valve connector.
10. Disconnect the throttle position sensor (TPS) connector.
11. Disconnect the coolant temperature sensor (CTS) connector.
12. Disconnect the engine CTS connector.
13. Disconnect the heater inlet hose from the cylinder head.
14. Disconnect the surge tank coolant hose at the throttle body.



E21C011

15. Disconnect the throttle cable from the throttle body and the intake manifold.
16. Disconnect the vacuum hose at the fuel pressure regulator.



A102C021

17. Remove the fuel injector rail and fuel injectors as an assembly. Refer to *Section 1F, Engine Controls.*
18. Remove the intake manifold support bracket upper bolt.

Installation Notice

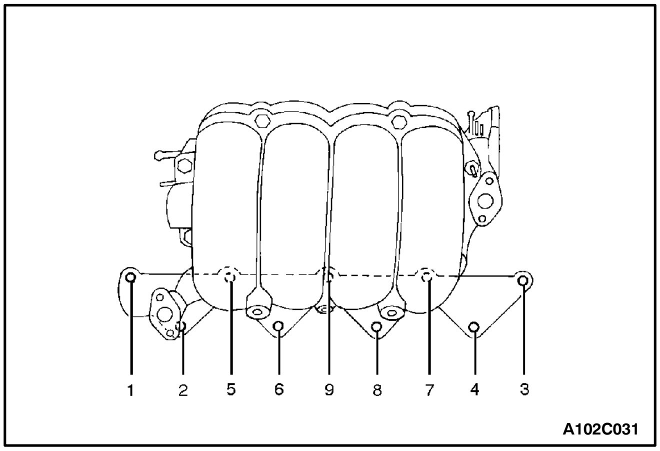
Tightening Torque	22 N·m (16 lb–ft)

19. Remove the intake manifold support bracket lower bolt.

Installation Notice

Tightening Torque	40 N·m (30 lb–ft)

20. Remove the evaporative (EAP) emission canister purge solenoid bracket bolt and reposition the canister purge solenoid clear of the repair area.

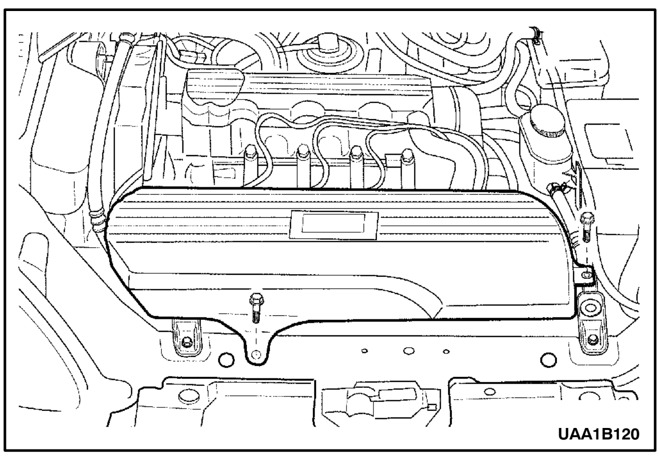


21. Remove the intake manifold retaining bolts/nuts in the sequence shown.
22. Remove the intake manifold.

Installation Notice

Tightening Torque	28 N·m (18 lb–ft)

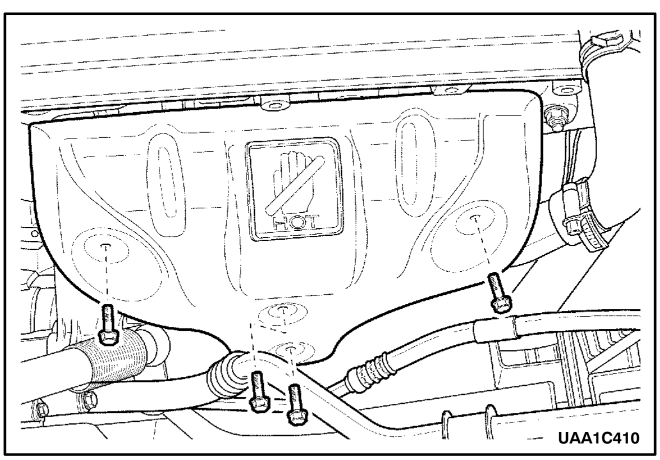
23. Remove the intake manifold gasket.
24. Clean the sealing surfaces of the intake manifold and the cylinder head.
25. Installation should follow the removal procedure in the reverse order.



EXHAUST MANIFOLD

Removal and Installation Procedure

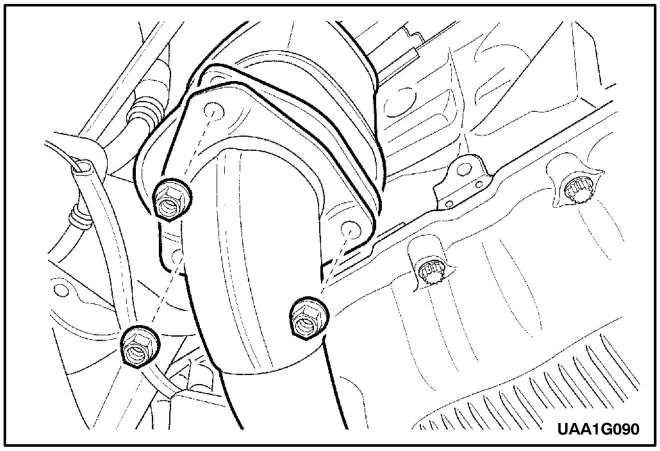
1. Disconnect the negative battery cable.
2. Remove the air inlet duct bolts.
3. Remove the air inlet duct assembly.



4. Disconnect the oxygen sensor connector.
5. Remove the exhaust manifold heat shield bolts.
6. Remove the exhaust manifold heat shield.

Installation Notice

Tightening Torque	15 N·m (11 lb–ft)

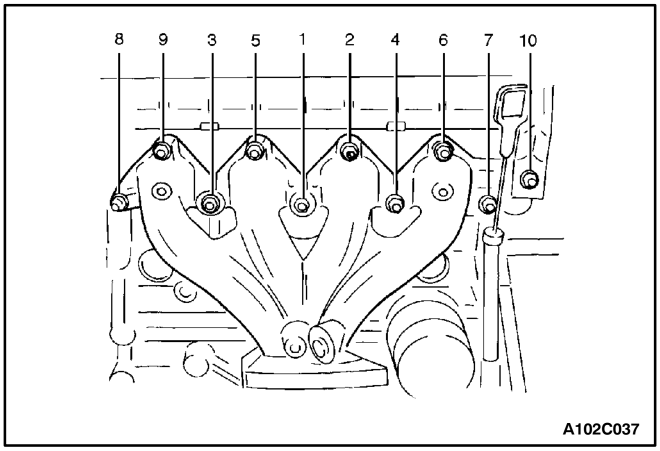


7. Remove the exhaust flex pipe retaining nuts from the exhaust manifold studs.

Installation Notice

Tightening Torque	35 N·m (26 lb–ft)

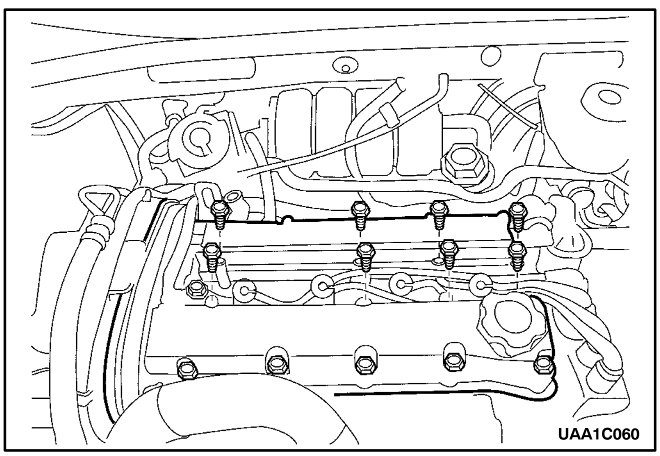
8. Remove the oxygen sensor.



9. Remove the exhaust manifold retaining nuts in the sequence shown.
10. Remove the exhaust manifold and exhaust manifold gasket
11. Clean the sealing surfaces of the exhaust manifold and the cylinder head.

Installation Notice

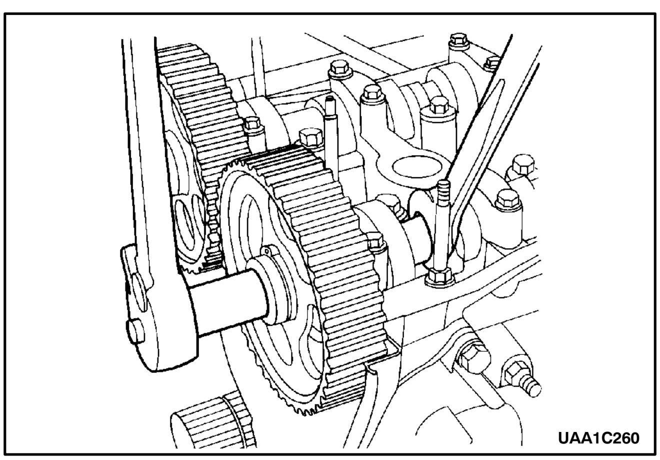
Tightening Torque	25 N·m



CAMSHAFT GEARS

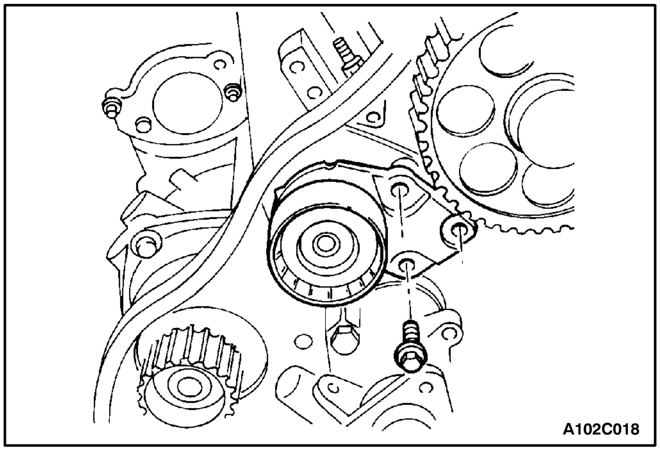
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to *“Timing Belt”* in this section.
3. Remove the valve cover. Refer to *“Valve Cover”* in this section.



Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

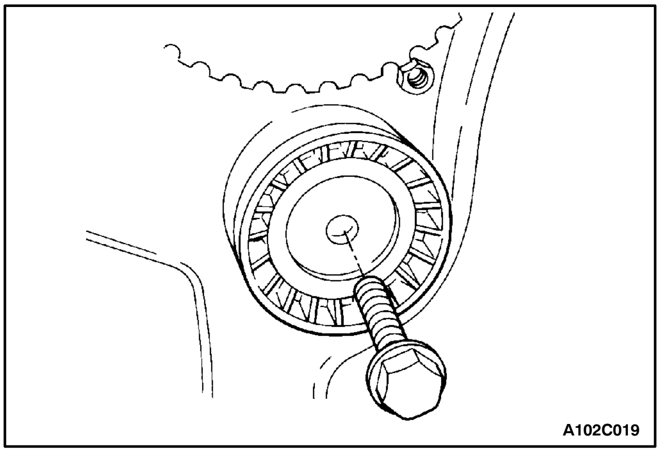
4. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.
5. Remove the intake camshaft gear.
6. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.
7. Remove the exhaust camshaft gear.



REAR TIMING BELT COVER

Removal and Installation Procedure

1. Remove the timing belt and the timing belt cover. Refer to “Timing Belt” in this section.
2. Remove the camshaft gears. Refer to “Camshaft Gears” in this section.
3. Remove the crankshaft gear.
4. Remove the timing belt automatic tensioner bolts.
5. Remove the timing belt automatic tensioner.

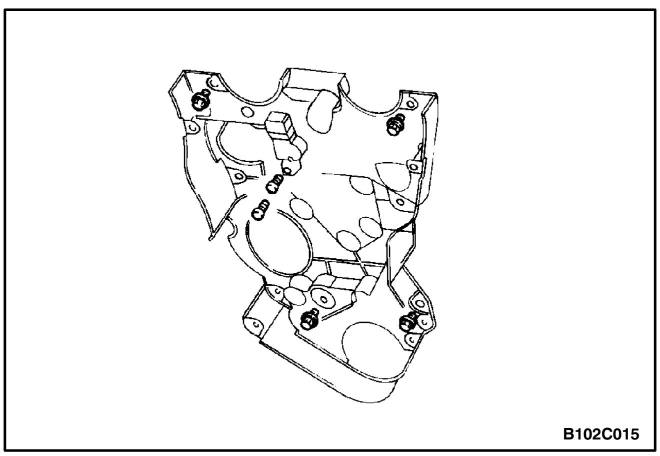


6. Remove the timing belt idler pulley bolt.

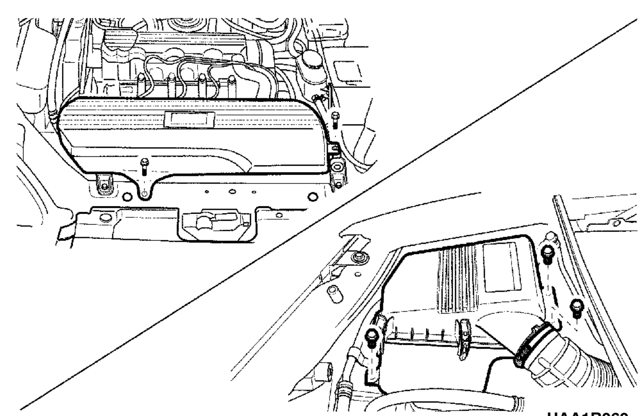
Installation Notice

Tightening Torque	40 N·m (30 lb–in)

7. Remove the timing belt idler pulley.



8. Remove the rear timing belt cover bolts.
9. Remove the rear timing belt cover.
10. Installation should follow the removal procedure in the reverse order.


UAA1B060

ENGINE

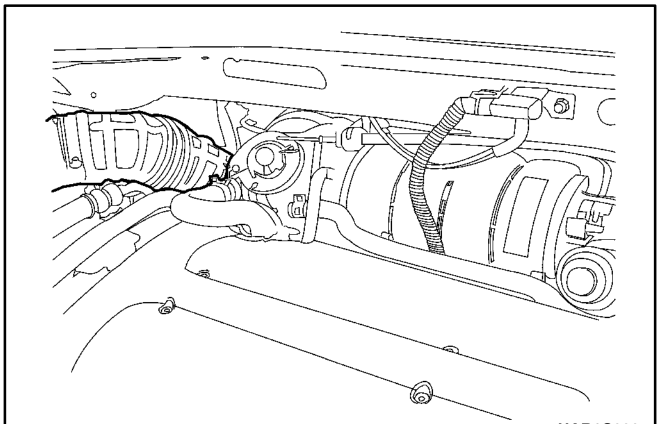
Tools Required

KM–470–B Angular Torque Gauge

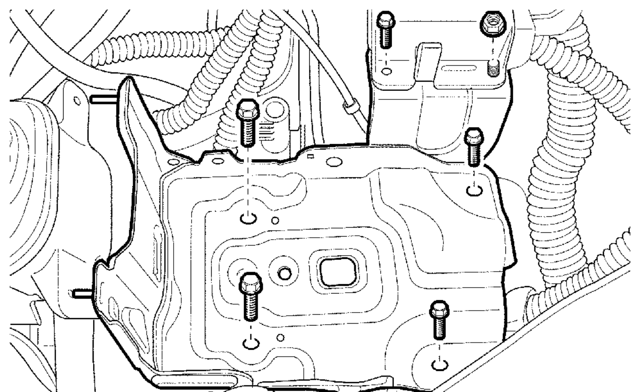
Removal and Installation Procedure

Important: On vehicles equipped with manual transaxle, the manual transaxle must be removed before the engine is removed. Refer to *Section 5B, Manual Transaxle.*

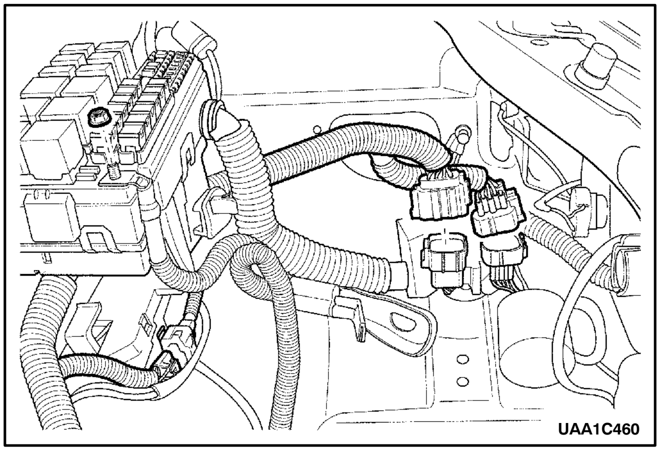
1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine after it stalls for 10 seconds to rid the fuel system of fuel pressure.
3. Remove the air filter bolts and the air filter assembly.
4. Remove the air inlet duct bolts the air inlet duct.


UAB1C030

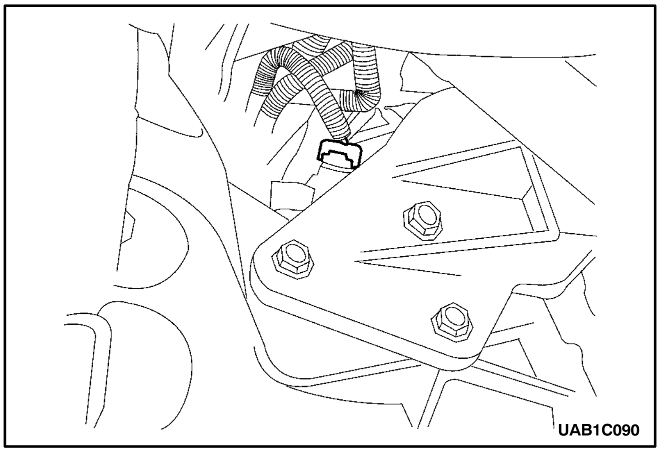
5. Disconnect the manifold intake temperature (IAT) sensor connector.
6. Disconnect the breather hose from the valve cover.
7. Disconnect the air intake tube from the throttle body.


UAA1E040

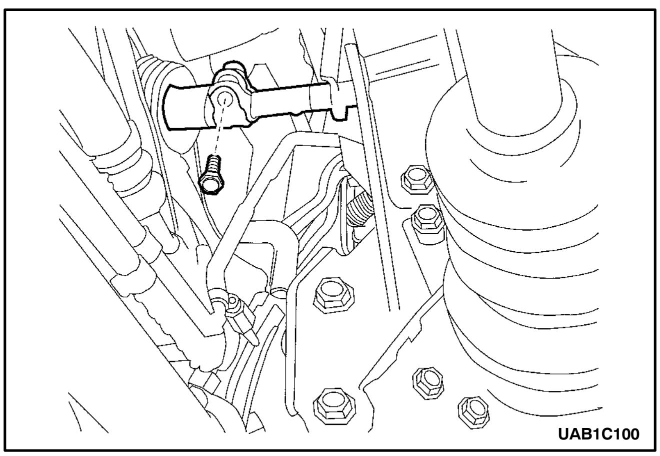
8. Drain the engine coolant. Refer to *Section 1D, Engine Cooling.*
9. Discharge the air conditioning system, if equipped. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System.*
10. Remove the battery and battery tray. Refer to *Section 1E, Battery and Battery Tray.*



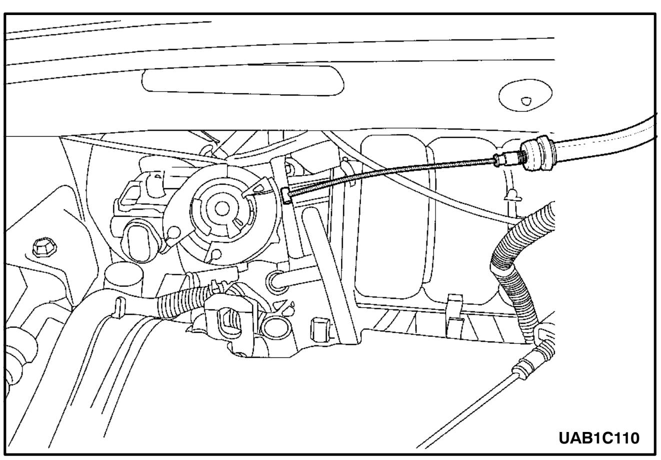
11. Remove the fuse box cover.
12. Remove the battery lead nut at the fuse box.
13. Disconnect the battery lead at the fuse box.
14. Disconnect the engine wiring harness connectors.



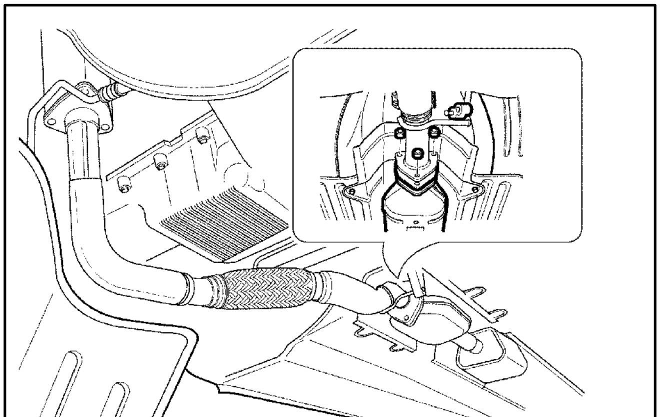
15. Remove the surge tank. Refer to *Section 1D, Engine Coolant.*
16. Disconnect the backup switch connector from the transaxle case.



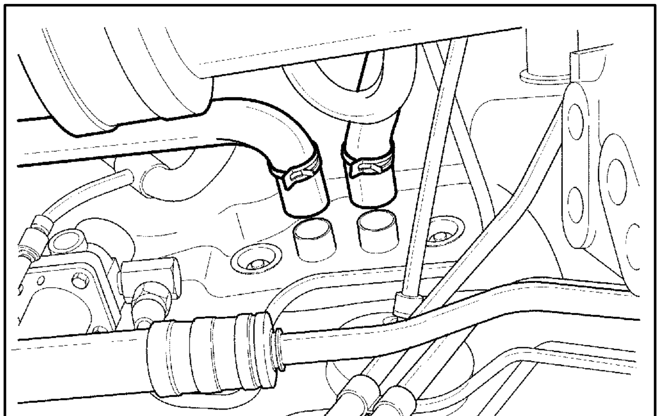
17. Disconnect the gear shift control guide with the bolt.



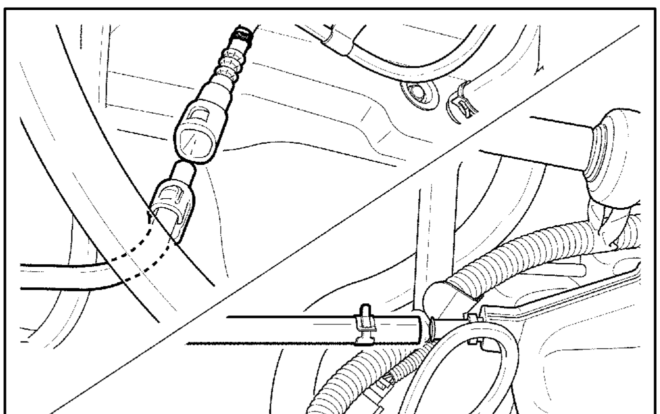
18. Disconnect the upper radiator hose at the thermostat housing.
19. Disconnect the power steering pressure hose and the power steering suction hose from the power steering pump. Refer to *Section 6A, "Power Steering System".*
20. Disconnect the A/C compressor hose assembly and the connector from the compressor. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System.*


UAA1G030

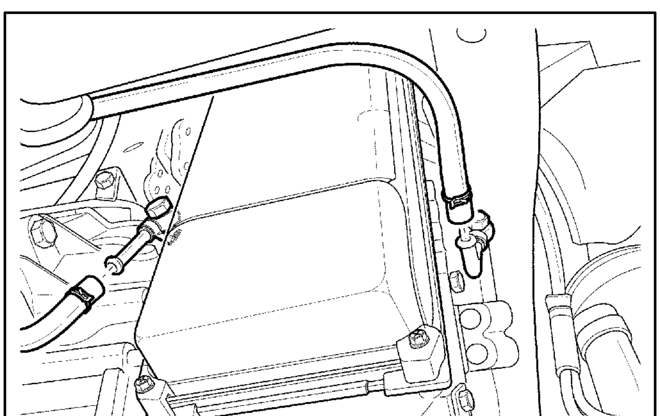
21. Remove the front wheel. Refer to *Section 2E, Tires and • heels.*
22. Remove the front wheel well splash shield. Refer to *Section 9R, Body Font End.*
23. Remove the front exhaust pipe. Refer to *Section 1G, Engine Exhaust.*


UAA1C040

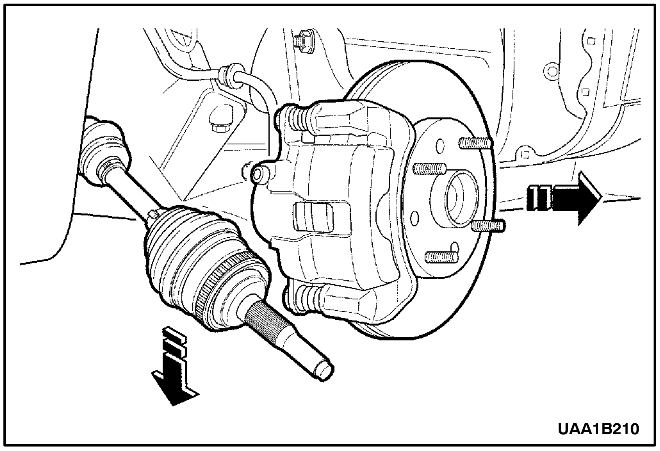
24. Disconnect the heater inlet hose at the heater core.
25. Disconnect the heater outer hose at the heater core.


UAA1C160

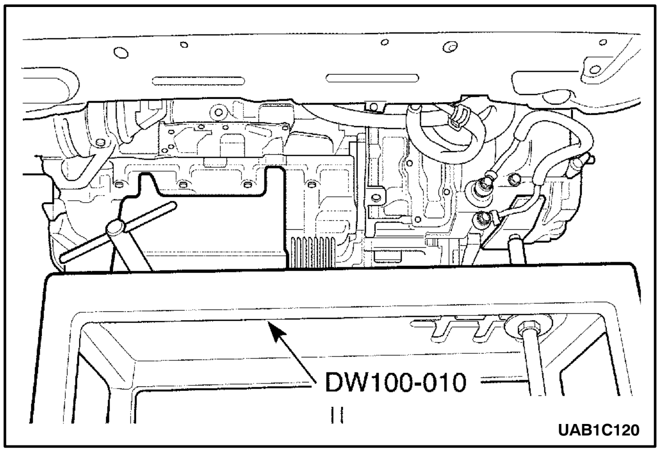
26. Disconnect the vacuum line from the charcoal canister purge solenoid.
27. Disconnect the brake vacuum hose at the intake manifold.


UAA1B550

28. Disconnect the A/C compressor connector at the A/C compressor coil.
29. Disconnect the lower radiator hose at the coolant pipe.
30. Disconnect the fluid cooler inlet hose from the transaxle.
31. Disconnect the fluid cooler outlet hose from the transaxle.



32. Remove the right side engine mount and forward engine mount. Refer to *“Forward Engine Mount”* in this section.
33. Remove the cross member. Refer to *Section 2C, Front Suspension.*
34. Disconnect the drive axle assembly from the transaxle.



35. Using the power pack stand DW110–010, support the engine and transaxle.
36. Remove the right side engine mount. Refer to *“Right Side Engine Mount”* in this section.
37. Remove the transaxle mount. Refer to *Section 5A, “Automatic Transaxle”.*
38. Slowly lift the vehicle.
39. Disconnect the engine assembly from the transaxle assembly. Refer to *Section 5A, “Automatic Transaxle”.*
40. Installation should follow the removal procedure in the reverse order.

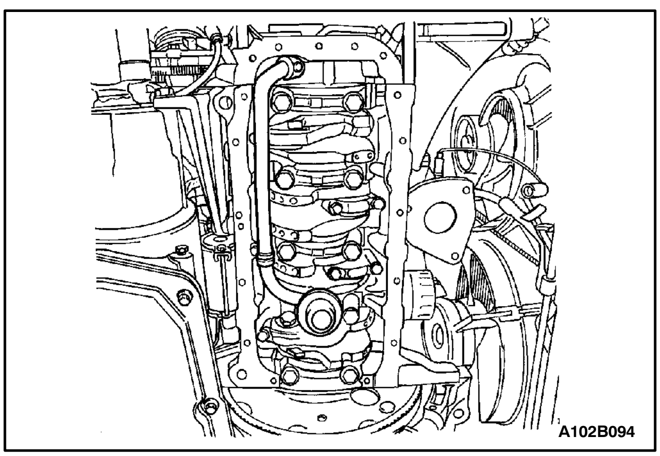
PISTONS AND RODS

Tools Required

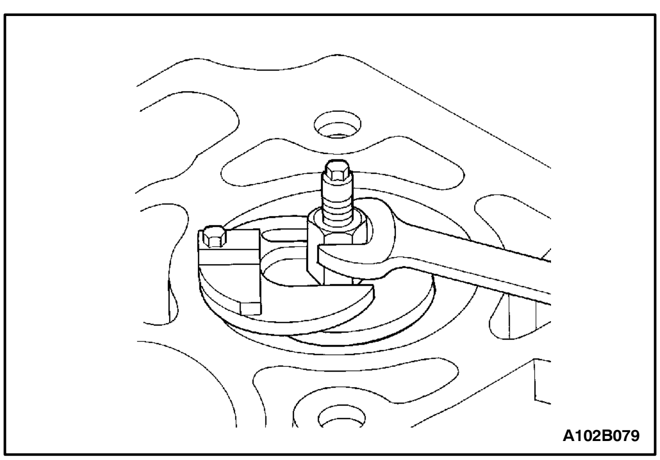
KM-427 Piston Pin Service Set

KM 470-B Angular Torque Gauge

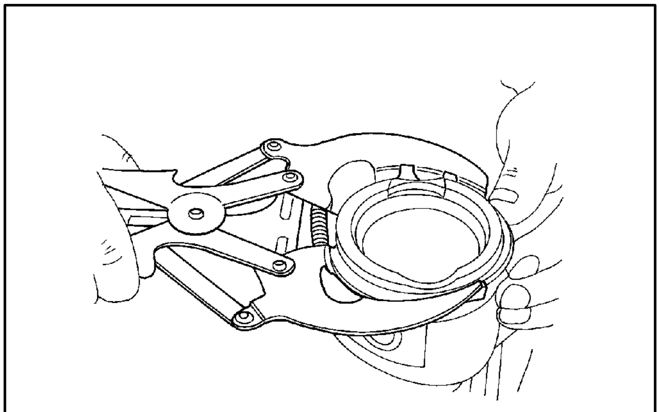
Removal Procedure



1. Remove the cylinder head with the intake manifold and the exhaust manifold attached. Refer to “Cylinder Head and Gasket” in this section.
2. Remove the oil pan. Refer to “Oil Pan” in this section.
3. Remove the oil suction pipe bolts.
4. Remove the oil suction pipe.

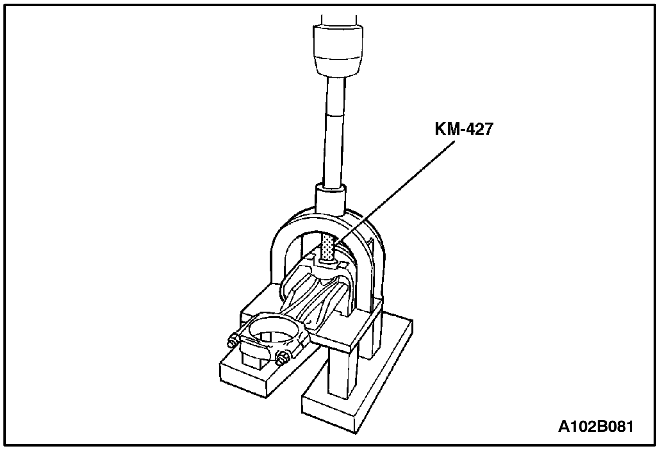


5. Move the piston to the bottom of the piston stroke.
6. Mark the connecting rod cap for position.
7. Remove the connecting rod cap bolts.
8. Remove the connecting rod cap and the lower connecting rod bearing.
9. Remove the upper piston connecting rod bearing.
10. Ridge ream the cylinder wall.


A102B080

Caution: Use care when handling the piston. Worn piston rings are sharp and may cause injury.

11. Remove the piston.
12. Use a piston ring expander tool to expand the piston rings.
13. Remove the piston rings.

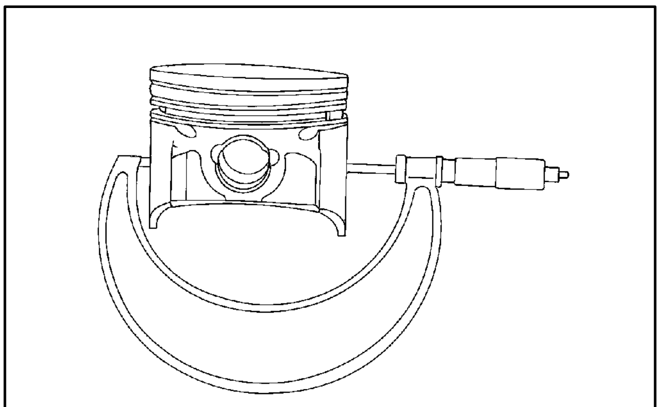


A102B081

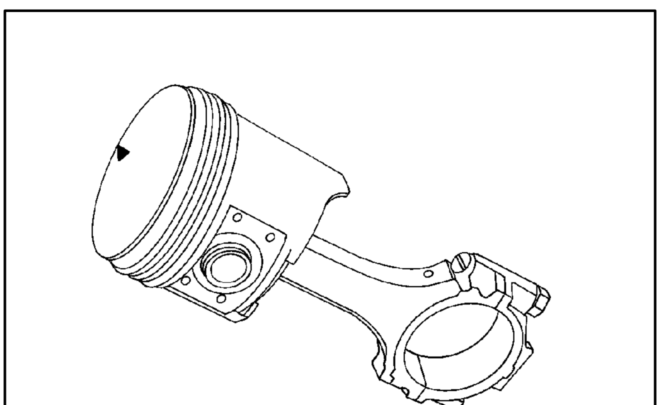
14. Remove the piston pin from the piston and connecting rod assembly using the piston pin service set KM-427.
15. Separate the piston from the connecting rod.

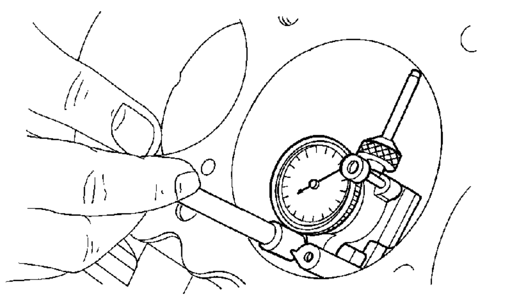
Inspection Procedure

1. Inspect the connecting rod for bending or twisting. If the connecting rod is bent or twisted, replace the connecting rod.
2. Inspect the connecting rod bearings.
3. Inspect the connecting rod lower end for wear.
4. Inspect the connecting rod upper end for scoring.
5. Inspect the crankshaft rod bearing journal for wear. Refer to “Engine Specifications” in this section.
6. Inspect the piston for scoring, cracks, and wear.
7. Inspect the piston for taper using a micrometer.


A102B087

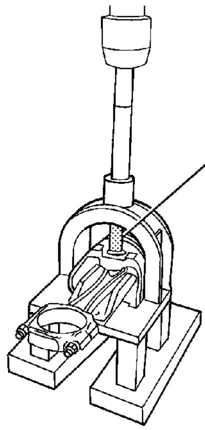
8. Inspect the piston for fit to the connecting rod.


A102B082



A102B083

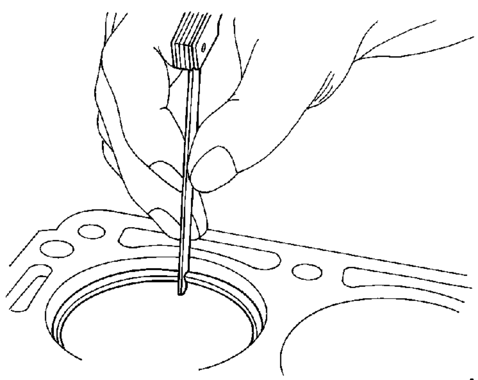
9. Inspect the engine block deck surface for flatness using a straight edge and a feeler gauge. Refer to “Engine Specifications” in this section.
10. Inspect the bearing bore for concentricity and alignment using a bore gauge. Refer to “Engine Specifications” in this section. If the bearing bore is beyond specifications, replace the engine block.
11. Inspect the engine block cylinder bore for wear, runout, ridging and taper using a bore gauge. Refer to “Engine Specifications” in this section.
12. Inspect the engine block cylinder bore for glazing. Lightly hone the cylinder bore as necessary.



A102B081

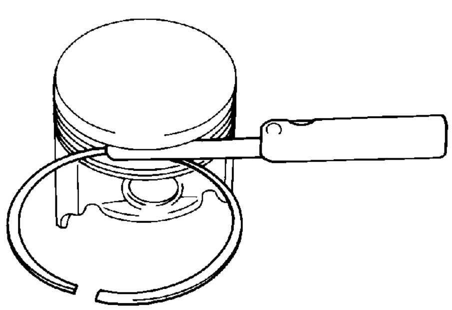
Installation Procedure

1. Align the notch on the piston and the connecting rod so that the proper sides will be facing the front of the engine.
2. Install the piston pin guide through the piston and the connecting rod.
3. Coat the piston pin with clean oil.
4. Install the piston pin into the opposite side of the piston.
5. Install the piston pin into the piston and connecting rod assembly using the piston pin service set KM-427.



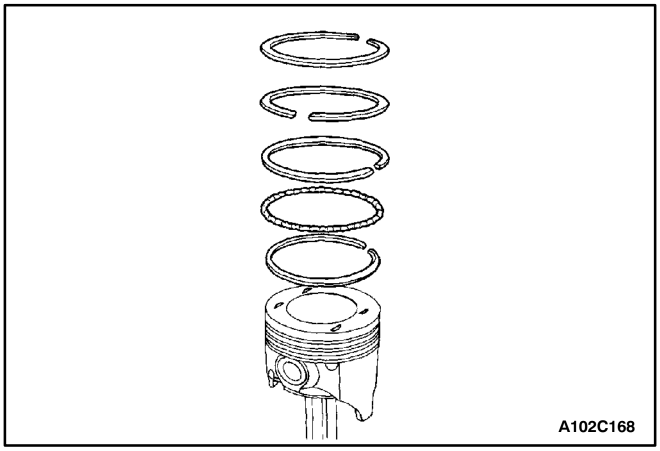
A102B084

6. Select a set of new piston rings.
7. Measure the piston ring gap using a feeler gauge. Refer to “Engine Specifications” in this section.
8. Increase the piston ring gap by carefully filing off excess material if the piston ring gap is below specifications.

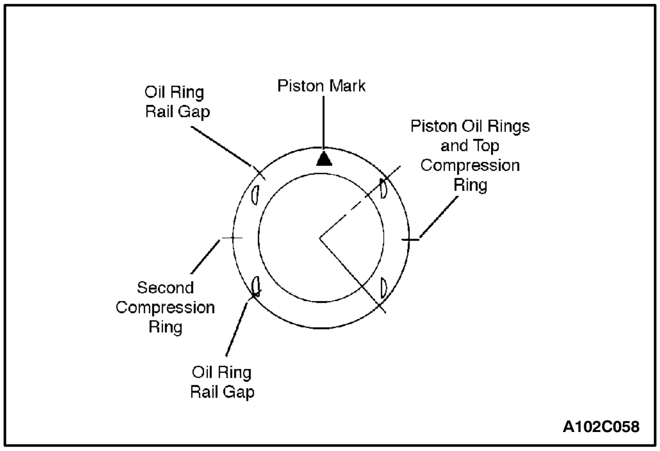


A102C055

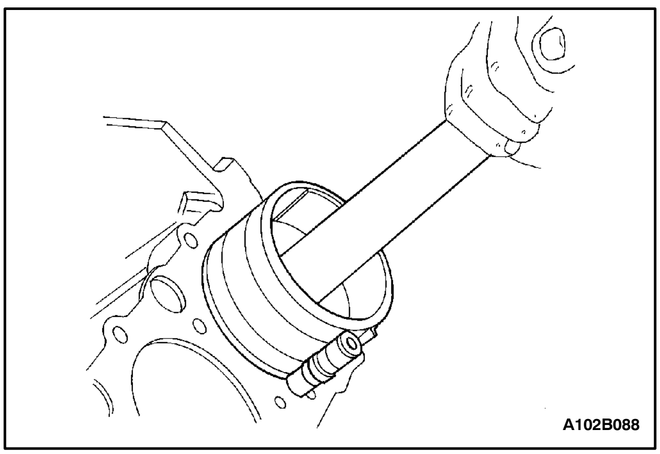
9. Measure the piston ring side clearance using a feeler gauge. Refer to “Engine Specifications” in this section.
10. If the piston ring is too thick, try another piston ring.
11. If no piston ring can be found that fits to specifications, the piston ring may be ground to size with emery paper placed on a sheet of glass.



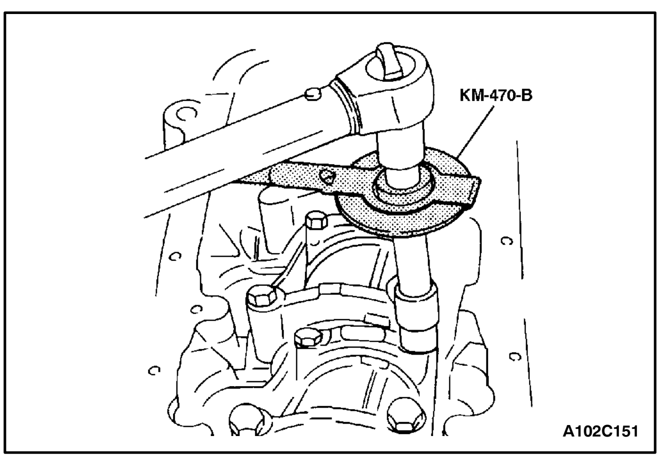
12. Install a piston oil ring, the expander, then the second piston oil ring to the bottom ring groove of the piston.
13. Install the second compression ring to the middle ring groove of the piston.
14. Install the top compression ring to the top ring groove of the piston.



15. Use a piston ring expander to install the piston rings. Do not expand the piston rings beyond the expansion necessary for installation.
16. Stagger the piston oil rings, the oil ring rail gaps, the second compression ring, and the top compression ring in relation to the notch on the top of the piston.



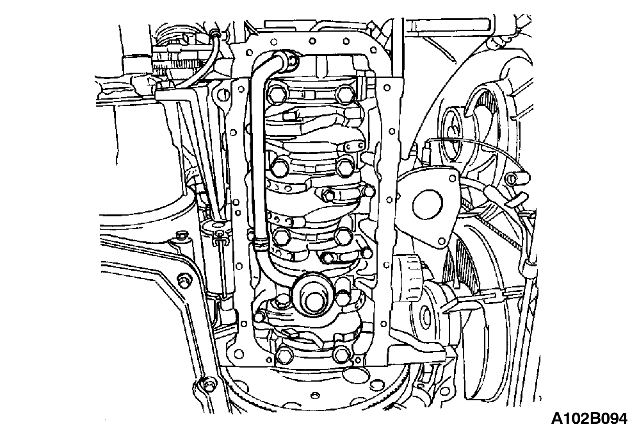
17. Lubricate the cylinder wall and the piston rings with clean engine oil.
18. Install the piston using a ring compressor and a wood handle. Guide the lower connecting rod end to prevent damaging the crankshaft journal.
19. Install the connecting rod cap and bearings. Refer to “Crankshaft Bearings and Connecting Rod Bearings – Gauging Plastic” in this section.



20. Install the connecting rod cap bolts.

Tighten

Tighten the connecting rod bearing cap bolts to 25 N•m (18 lb-ft). Using the angular torque gauge KM-470-B, tighten the bolts one turn of 30 degrees plus one turn of 15 degrees.



A102B094

21. Install the oil suction pipe.
22. Install the oil suction pipe bolts.

Tighten

Tighten the oil suction pipe bolts to 10 N•m (89 lb-in).

23. Install the oil pan. Refer to “Oil Pan” in this section.
24. Install the cylinder head with the intake manifold and the exhaust manifold attached. Refer to “Cylinder Head and Gasket” in this section.

UNIT REPAIR

CYLINDER HEAD AND VALVE TRAIN COMPONENTS

Tools Required

MKM–571–B Gauge

KM 340–0 Cutter Set

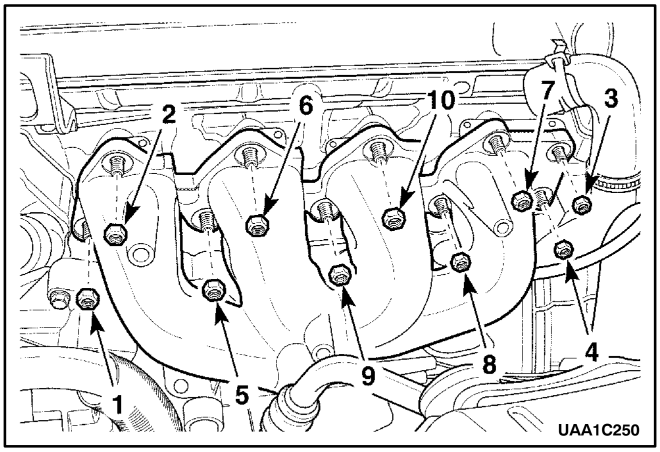
KM–340–7 Guide Drift

KM–340–13 Cutters

KM–340–26 Cutters

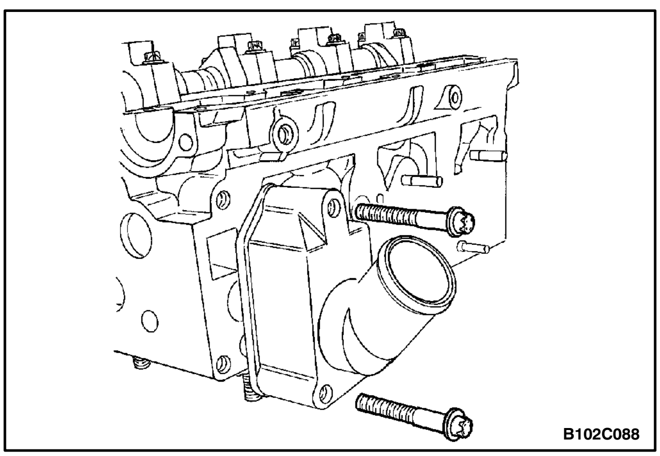
KM–348 Valve Spring Compressor

KM–653 Adapter

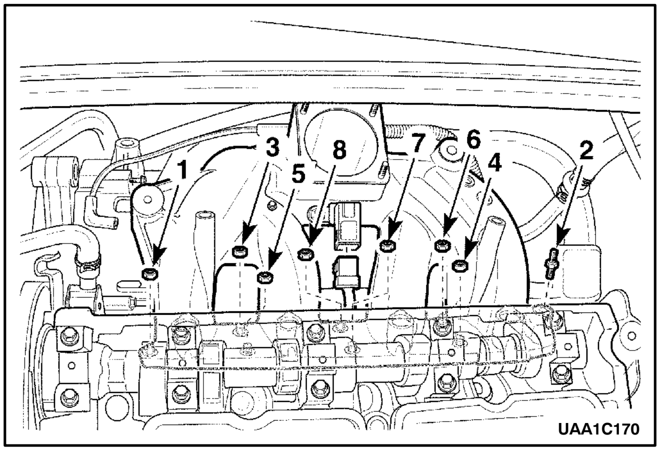


Disassembly Procedure

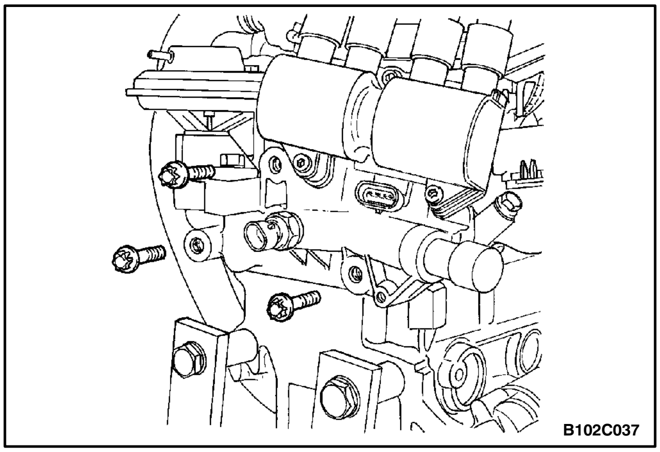
1. Remove the cylinder head with the intake manifold and the exhaust manifold attached. Refer to *"Cylinder Head and Gasket"* in this section.
2. Remove the engine coolant temperature (ECT) sensor.
3. Remove the exhaust manifold heat shield bolts.
4. Remove the exhaust manifold heat shield.
5. Remove the exhaust manifold retaining nuts in the sequence shown.
6. Remove the exhaust manifold.
7. Remove the exhaust manifold gasket.
8. Remove the exhaust manifold studs.



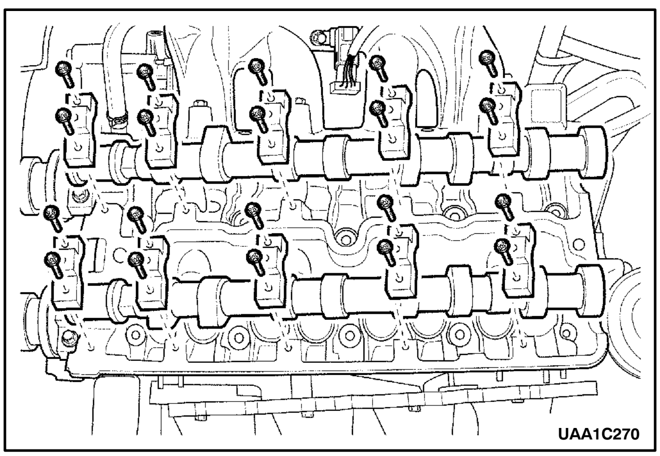
9. Remove the thermostat housing mounting bolts.
10. Remove the thermostat housing assembly.
11. Remove the fuel rail assembly. Refer to *Section 1F, Engine Controls.*
12. Remove the coolant bypass housing mounting bolts and the housing.



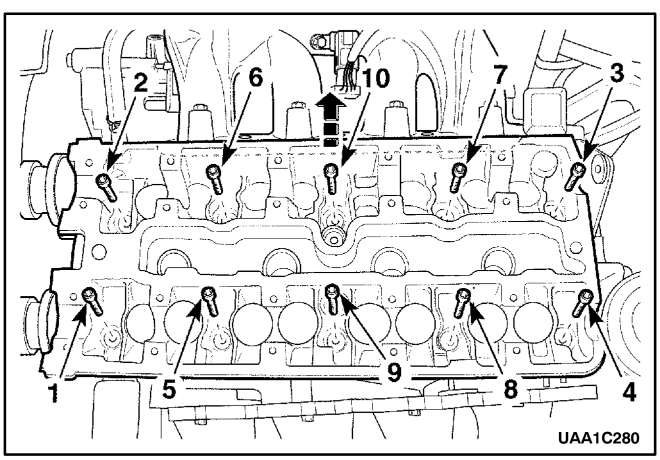
13. Remove the intake manifold retaining nuts and retaining bolt in the sequence shown.
14. Remove the intake manifold.
15. Remove the intake manifold gasket.



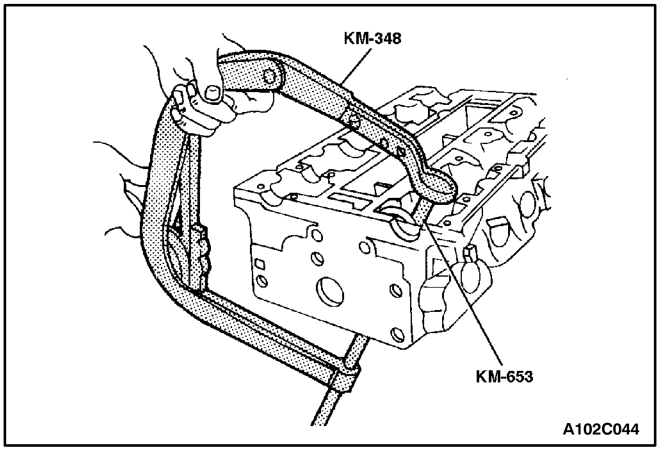
16. Remove the direct ignition system (DIS) coil and the exhaust gas recirculation (EGR) mounting bracket bolts.
17. Remove the DIS ignition coil and the EGR mounting bracket and ignition wires.
18. Remove the intake manifold studs.
19. Remove the spark plugs.



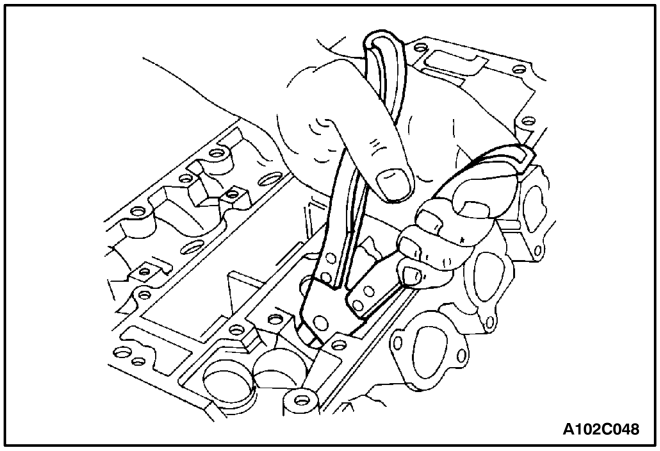
20. Remove the camshaft bearing cap bolts gradually and in the sequence shown for each camshaft cap.



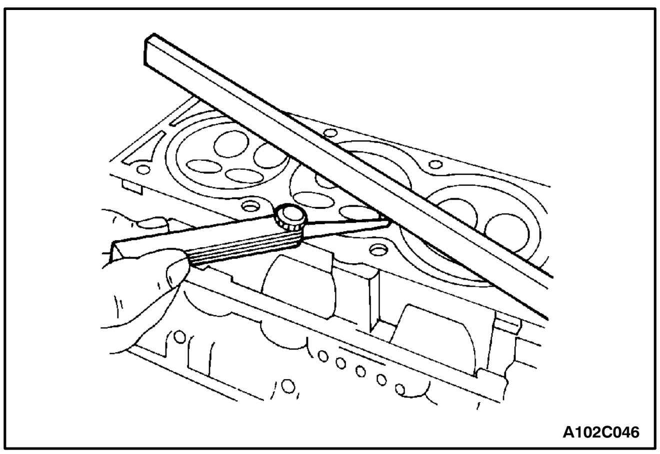
21. Remove the intake camshaft caps. Maintain the correct positions for installation.
22. Remove the intake camshaft.
23. Remove the intake valve tappet adjusters.
24. Remove the exhaust camshaft caps. Maintain the correct positions for installation.
25. Remove the exhaust camshaft.
26. Remove the exhaust valve tappet adjusters.



27. Compress the valve springs with the valve spring compressor KM–348 and the adapter KM–653.
28. Remove the valve retainers.
29. Remove the valve spring compressor KM–348 and the adapter KM–653.
30. Remove the valve spring caps.
31. Remove the valve springs. Maintain the original position of the valve springs for installation.

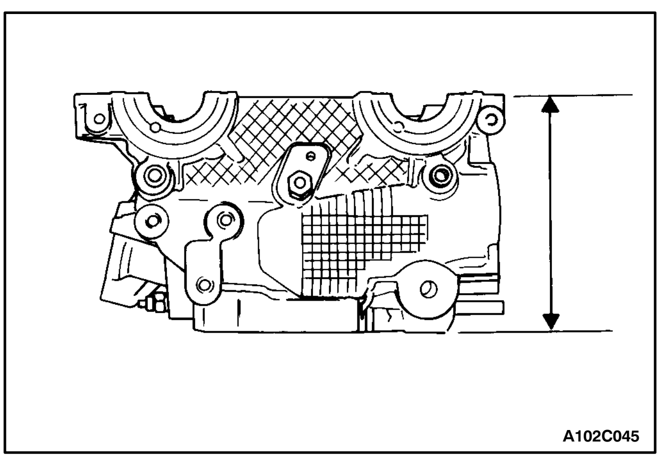


32. Remove the valves. Maintain the original position of the valves for installation.
33. Remove the valve stem seals.

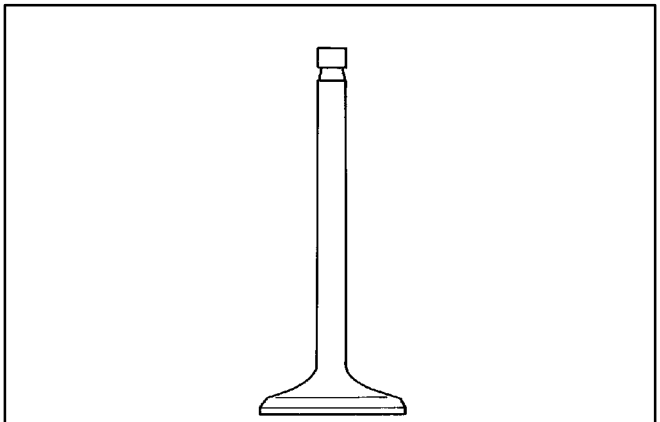


Cylinder Head Inspection

1. Clean the sealing surfaces.
2. Inspect the cylinder head gasket and mating surfaces for leaks, corrosion, and blow-by.
3. Inspect the cylinder head for cracks.
4. Inspect the length and the width of the cylinder head using a feeler gauge and a straight edge.
5. Check the sealing surfaces for deformation and warpage. The cylinder head sealing surfaces must be flat within 0.025mm (0.00linch) maximum.



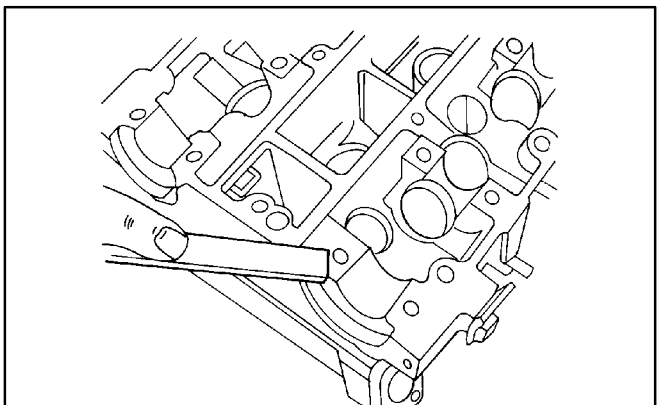
6. Measure the height of the cylinder head from sealing surface to sealing surface. The cylinder head height should be 133.975 to 134.025 mm (5.274 to 5.276 inches). If the cylinder head height is less than 133.9 mm (5.271 inches), replace the cylinder head.
7. Inspect all threaded holes for damage.
8. Inspect valve seats for excessive wear and burned spots.



A102B054

Valve Inspection

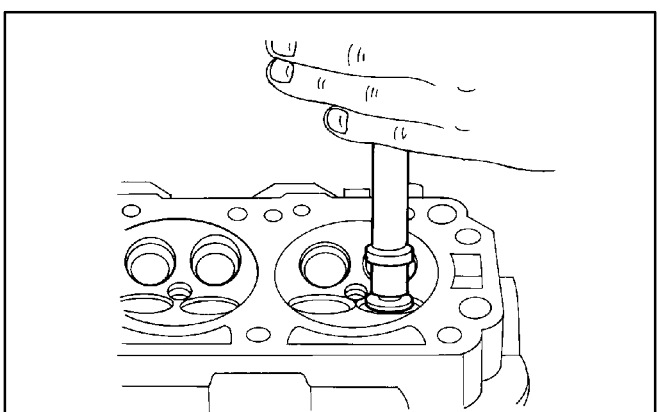
1. Inspect the valve stem tip for wear.
2. Inspect the valve key grooves and the oil seal grooves for chips and wear.
3. Inspect the valves for burns or cracks.
4. Inspect the valve stem for burrs and scratches.
5. Inspect the valve stem. The valve stem must be straight.
6. Inspect the valve face for grooving. If the groove is so deep that refacing the valve would result in a sharp edge, replace the valve.
7. Inspect the valve spring. If the valve spring ends are not parallel, replace the valve spring.
8. Inspect the valve spring seating surface of the valve rotators for wear or gouges. Replace as required.



A102C047

Cleaning Procedure

1. Clean the cylinder head.
2. Clean the valve guides.
3. Clean all of the threaded holes.
4. Clean the valves of carbon, oil, and varnish.

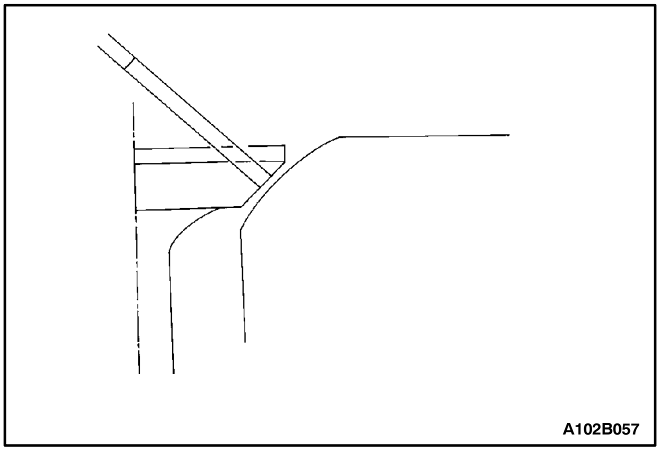


A102C049

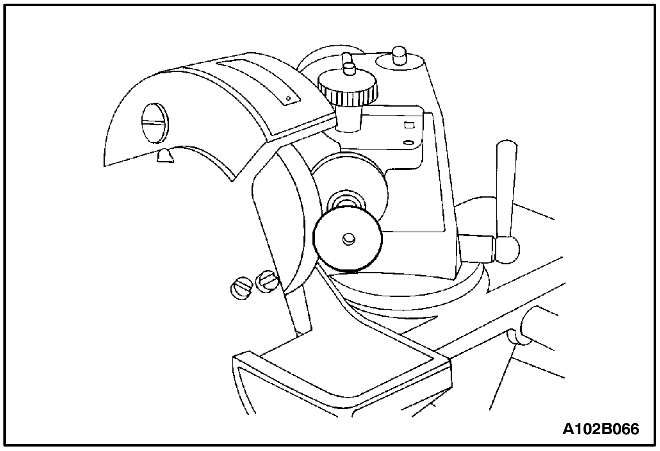
Cylinder Head Overhaul

Valve Grind-in

1. Lubricate the valve seat using a fine-grained paste.
2. Lift the valve rhythmically from the seat with a commercially available valve grinding tool in order to distribute the paste.

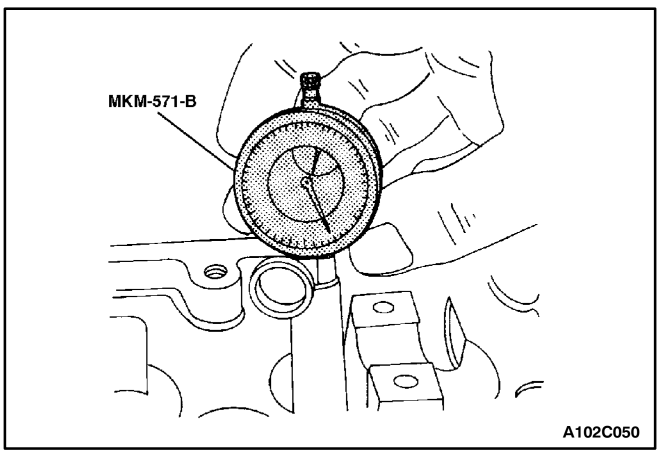

A102B057

3. Check the contact pattern on the valve head and in the cylinder head.
4. Clean the valves, the valve guides, and the cylinder head.


A102B066

Valve Grind

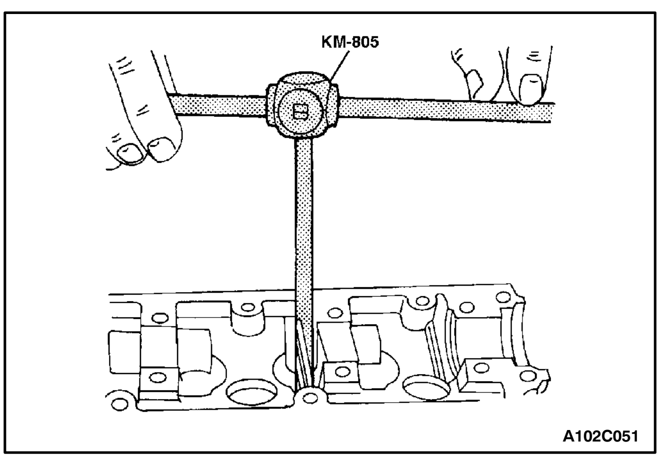
1. Ensure that there are no crater line burns on the valve cone.
2. The valve may be reground only two times. Do not grind the valve stem end.
3. Ensure that the angle at the valve face is 45 degrees.
4. Inspect the assembly height of the intake valves and the exhaust valves.



A102C050

Valve Guide – Ream

1. Measure the diameter of the valve guide using gauge MKM–571–B and a commercially available inside micrometer.



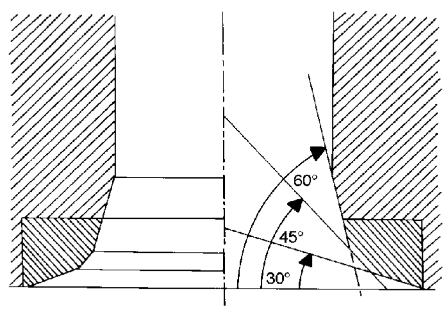
A102C051

Important: Valve oversizes may already have been fitted in production.

2. An oversize service code is on the valve guide and the valve stem end. The following table gives the correct size, reamer, and production code for each service.

Size	Reamer	Production Code	Service Code
Normal	—	—	K
0.075	KM-805	1	K1
0.150	—	2	K2

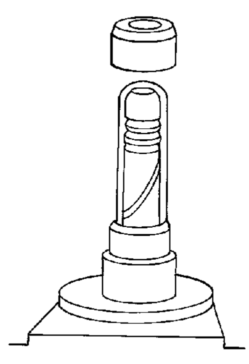
3. Ream the valve guide from the upper side of the cylinder head to the next oversize.
4. After reaming, cross out the code and emboss the valve guide with the new code.



A102B060

Valve Seat — Cut

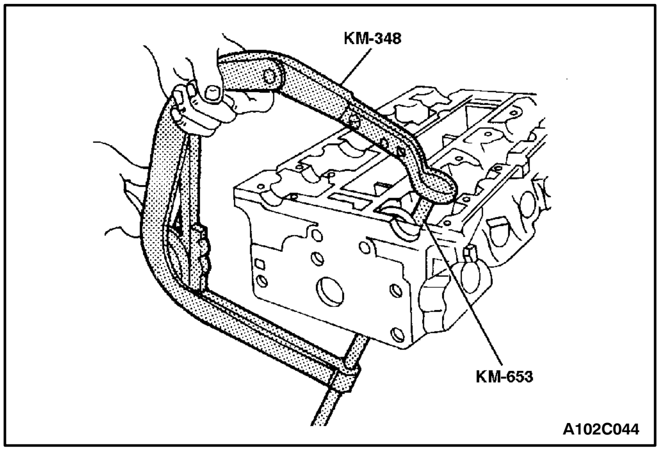
1. Place the cylinder head on wooden blocks.
2. Cut the intake and the exhaust valve seats using the guide drift KM–340–7 as follows:
   - Valve seat – A 45-degree surface using the cutter KM–340–13.
   - Upper correction angle – A 30-degree surface using the cutter KM–340–13.
   - Lower correction angle – A 60-degree surface using the cutter KM–340–26.
3. Clean the chipping from the cylinder head.
4. Inspect the dimension for the valve seat width.
   - Intake: 1.2 to 1.4 mm (0.047 to 0.055 inch).
   - Exhaust: 1.4 to 1.8 mm (0.055 to 0.070 inch).
5. Inspect the assembly height of the intake valves and the exhaust valves. If the dimension is exceeded, install new valves. Inspect the assembly height of the intake valves and the exhaust valves again. If the valve assembly height is still too large despite replacing the valves, replace the cylinder head.



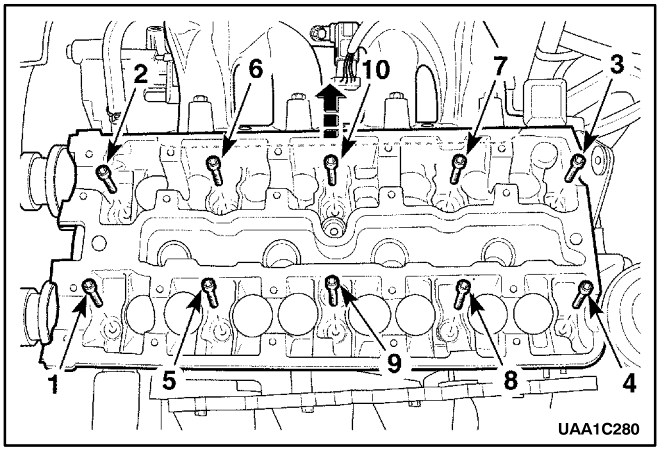
B102C040

Assembly Procedure

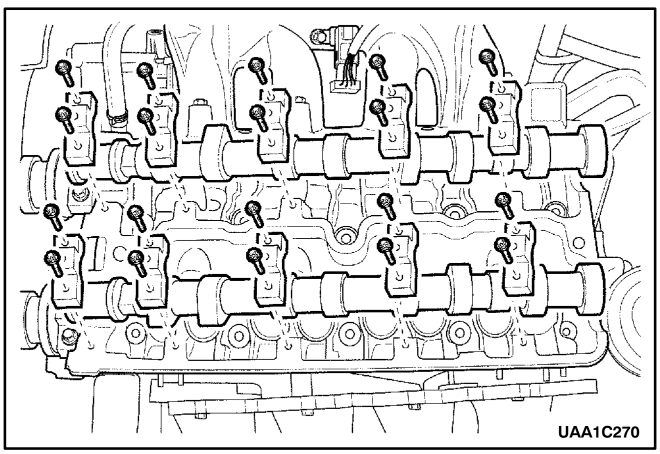
1. Coat the valve stems with engine oil.
2. Insert the valves in the cylinder head in their original positions.
3. Insert the valve spring seats.
4. Push the accompanying assembly sleeve onto the valve stem.
5. Insert the new valve stem seat.
6. Carefully drive the valve stem seal onto the stop with light taps.
7. Install the valve springs in their original positions.
8. Install the valve spring caps.



9. Compress the valve springs with the valve spring compressor KM–348 and adapter KM–653.
10. Install the valve keys.
11. Remove the valve spring compressor KM–348 and adapter KM–653.



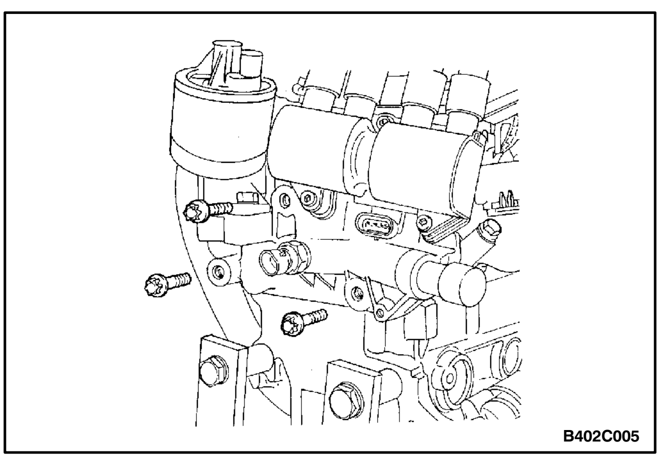
12. Lubricate the valve tappet adjusters with engine oil.
13. Install the valve lash adjusters.



14. Install the intake camshaft.
15. Install the intake camshaft bearing caps in their original positions.
16. Install the exhaust camshaft.
17. Install the exhaust camshaft bearing caps in their original positions.
18. Install the camshaft bearing cap bolts.
19. Tighten the camshaft bearing cap bolts gradually and in the sequence shown for each camshaft cap.

Installation Notice

Tightening Torque	8 N·m (71 lb–in)



20. Install the spark plugs.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

21. Install the EI system ignition coil and EGR mounting bracket and bolts.

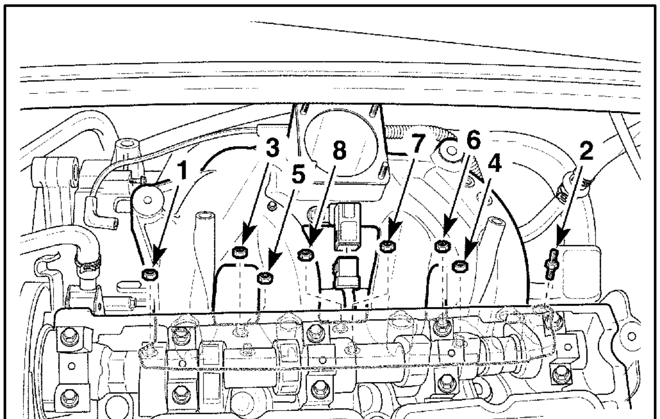
Installation Notice

Tightening Torque	Left Lower Side: 20 N·m (15 lb–ft) Others: 30 N·m (22 lb–ft)

22. Install the EI system ignition coil and EGR.

Installation Notice

Tightening Torque	8 N·m (71 lb–in)

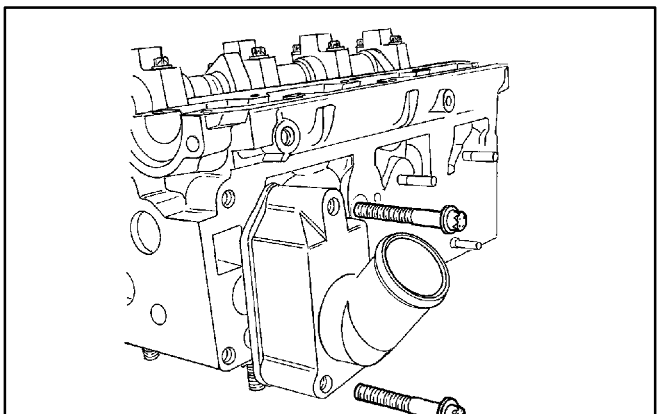


UAA1C170

23. Install the intake manifold studs.
24. Install the intake manifold gasket.
25. Install the intake manifold.
26. Install the intake manifold retaining nuts and retaining bolt in the sequence shown.

Installation Notice

Tightening Torque	22 N·m (16 lb–ft)


B102C088

27. Install the fuel rail assembly. Refer to *Section 1F, Engine Controls.*
28. Install the thermostat housing assembly.
29. Install the thermostat housing mounting bolts.

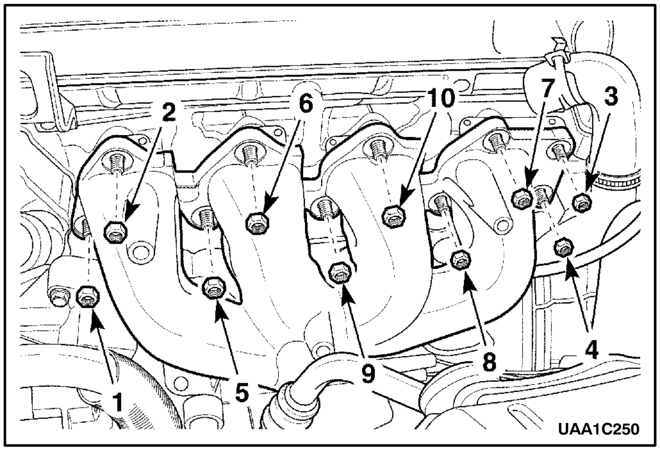
Installation Notice

Tightening Torque	15 N·m (11 lb–ft)

30. Install the coolant bypass housing and mounting bolts.

Installation Notice

Tightening Torque	15 N·m (11 lb–ft)



31. Install the exhaust manifold studs.
32. Install the exhaust manifold gasket.
33. Install the exhaust manifold.
34. Install the exhaust manifold retaining nuts in the sequence shown.

Installation Notice

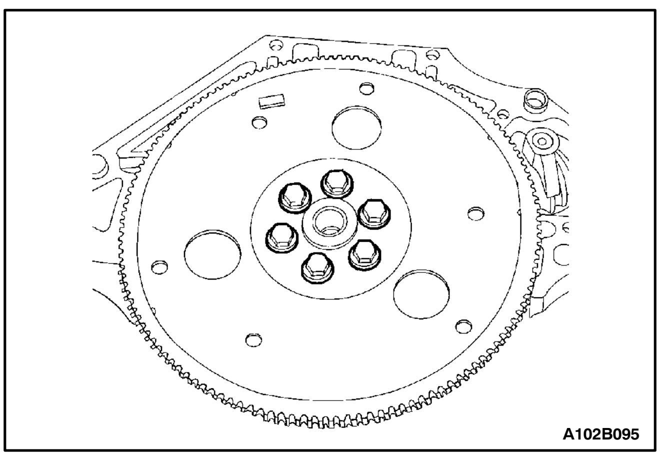
Tightening Torque	1st stage:	13 N·m (10 lb–ft): 9,10,6,5,8,7,2,1,3,4
	2st stage:	13 N·m (10 lb–ft): 9,10,6,5,8,7,2,1,3,4
	3rd stage:	15 N·m (11 lb–ft): 9,10,6,5,8,7,2,1,3,4
	4th stage:	15 N·m (11 lb–ft): 9,10,6,5,8,7,2,1,3,4,9,10,6

35. Install the exhaust manifold heat shield.
36. Install the exhaust manifold heat shield bolts.

Installation Notice

Tightening Torque	15 N·m (11 lb–ft)

37. Install the cylinder head with the intake manifold and the exhaust manifold attached. Refer to *"Cylinder Head and Gasket"* in this section.



CRANKSHAFT

Tools Required

KM–412 Engine Overhaul Stand

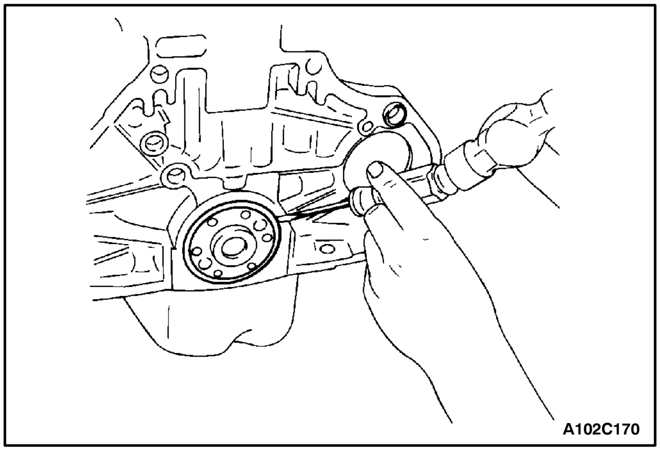
KM–470–B Angular Torque Gauge

J–36792 or KM–635 Crankshaft Rear Oil Seal Installer

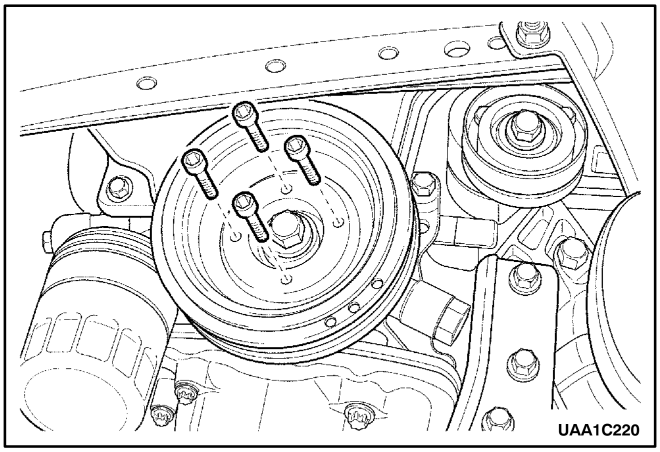
Notice: Take extreme care to prevent any scratches, nicks, or damage to the camshafts.

Disassembly Procedure

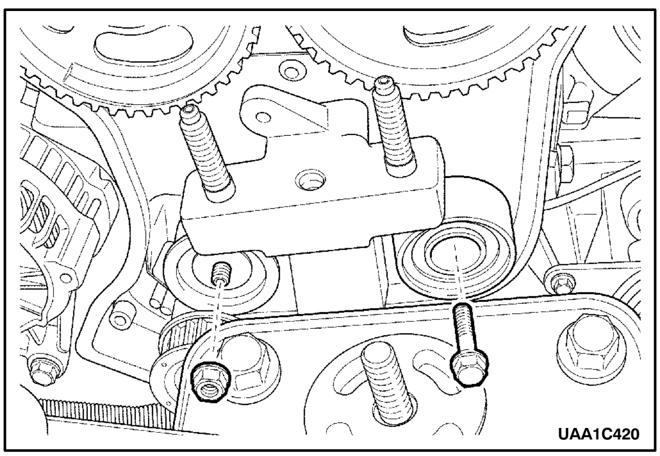
1. Remove the engine. Refer to *"Engine"* in this section.
2. Remove the flywheel or flexible plate bolts.
3. Remove the flywheel or the flexible plate.


A102C170

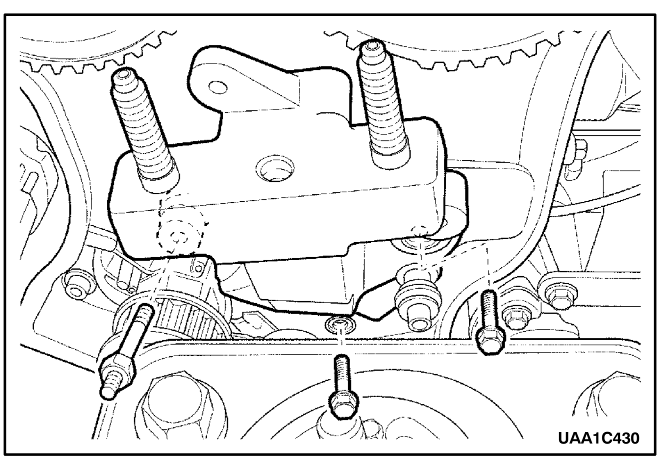
4. Remove the crankshaft rear oil seal.
5. Mounts the engine assembly on the engine overhaul stands KM–412.


UAA1C220

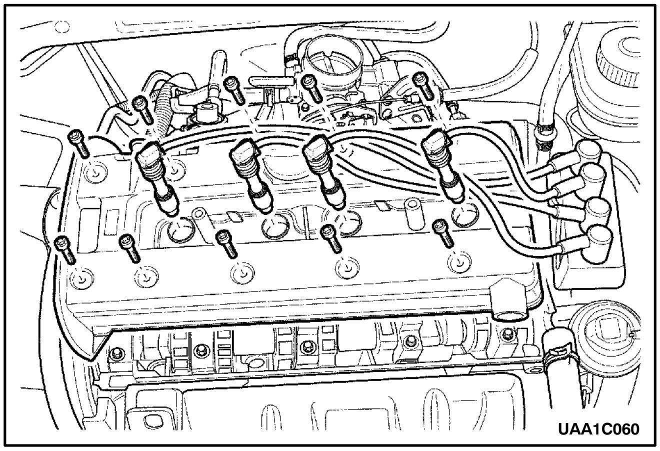
6. Remove the front timing belt cover bolts.
7. Remove the front timing belt cover.
8. Remove the crankshaft pulley bolts.
9. Remove the crankshaft pulley.


UAA1C420

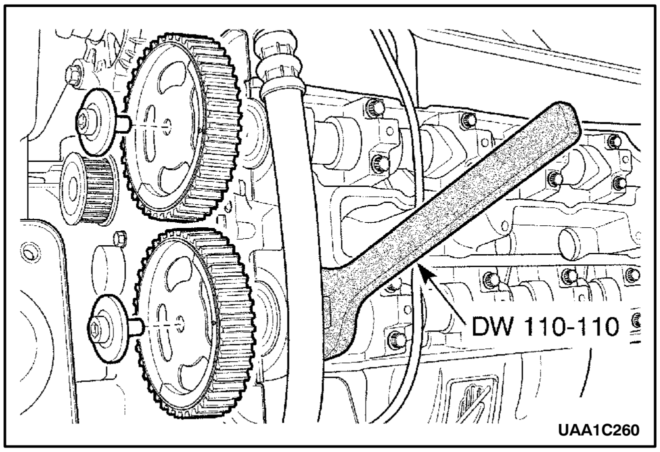
10. Loosen the timing belt automatic tensioner bolt.
11. Rotate the timing belt automatic tensioner hex-key clockwise to release the tension.
12. Remove the timing belt idler pulley bolt and nut.
13. Remove the timing belt idler pulleys.


UAA1C430

14. Remove the timing belt.
15. Remove the engine mount retaining bolts.
16. Remove the engine mount.

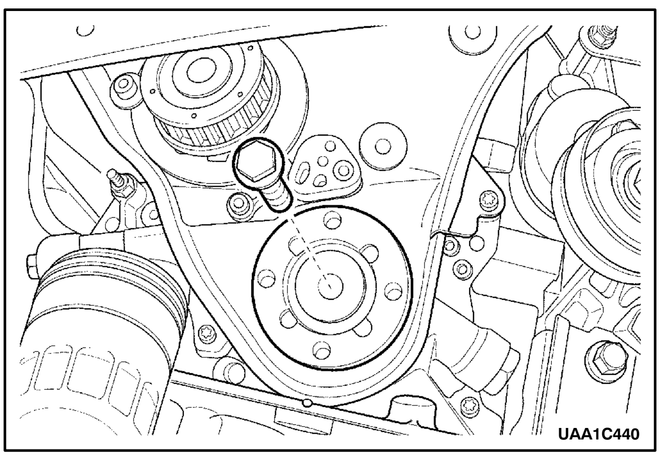


17. Disconnect the breather tubes from the valve cover.
18. Remove the spark plug cover bolts.
19. Remove the spark plug cover.
20. Disconnect the ignition wires from the spark plugs.
21. Remove the valve cover bolts.
22. Remove the valve cover washers.
23. Remove the valve cover and the valve cover gasket.

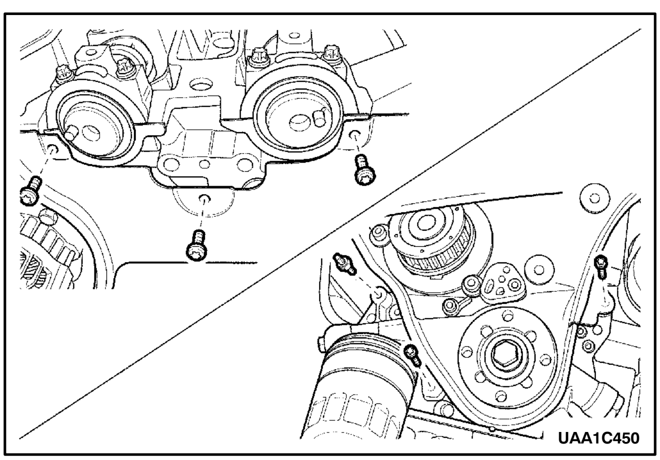


Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

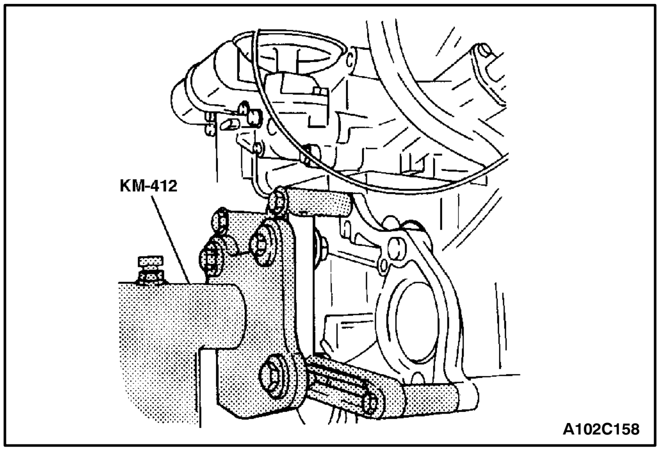
24. While holding the intake camshaft firmly in place, remove the intake camshaft bolt.
25. Remove the intake camshaft gear.
26. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft bolt.
27. Remove the exhaust camshaft gear.



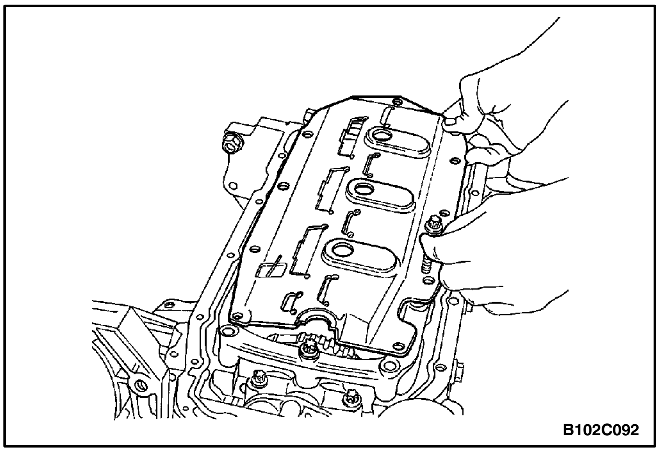
28. Remove the crankshaft timing belt gear bolt.
29. Remove the crankshaft timing belt gear.



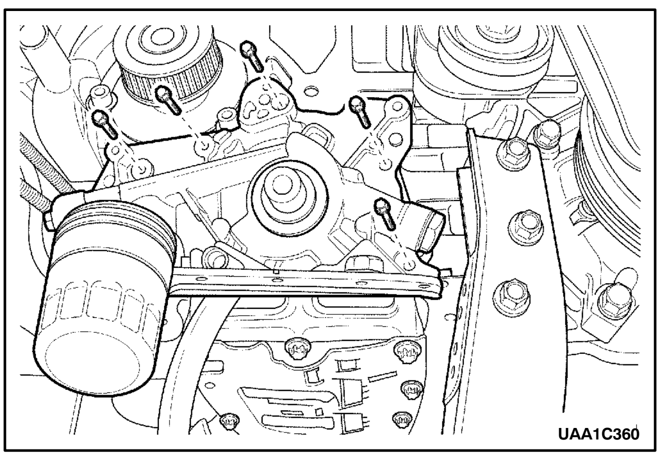
30. Remove the rear timing belt cover screws/bolt.
31. Remove the rear timing belt cover.



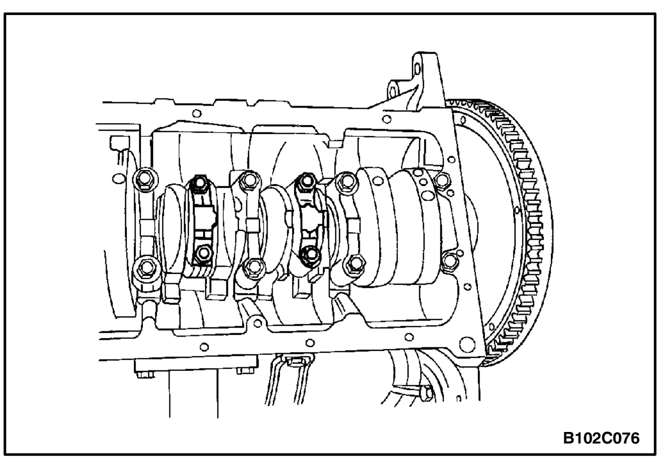
32. Rotate the engine on the engine overhaul stand KM–412.



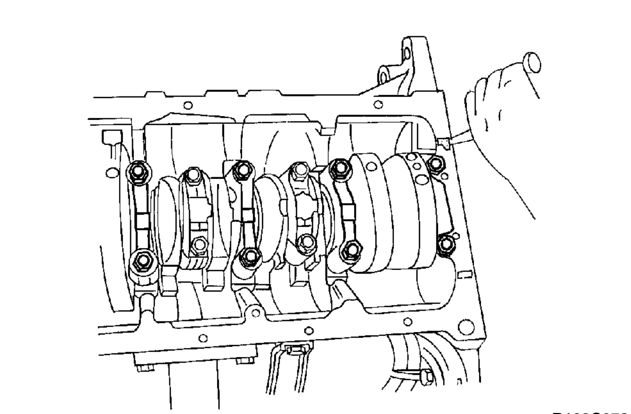
33. Remove the oil pan retaining bolts.
34. Remove the oil pan.
35. Remove the oil suction pipe and support bracket bolts.
36. Remove the oil suction pipe.
37. Remove the crankshaft bearing bridge and oil pan scraper bolts.
38. Remove the oil pan scraper.
39. Remove the crankshaft bearing bridge bolts.
40. Remove the crankshaft bearing bridge.



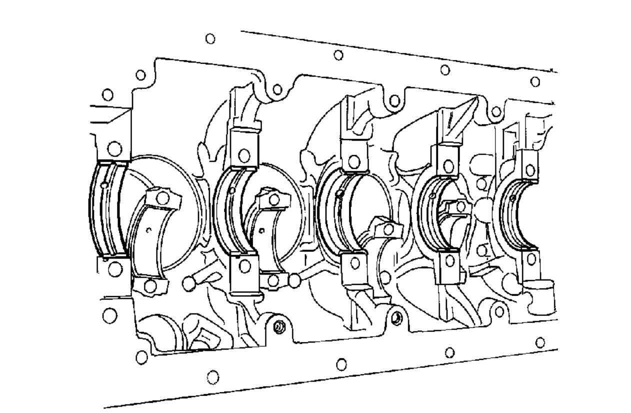
41. Remove the oil pump retaining bolts.
42. Remove the oil pump.



43. Mark the order of the connecting rod bearing caps.
44. Remove the connecting rod bearing cap bolts for all of the pistons.
45. Remove the connecting rod bearing caps and the lower connecting rod bearings.

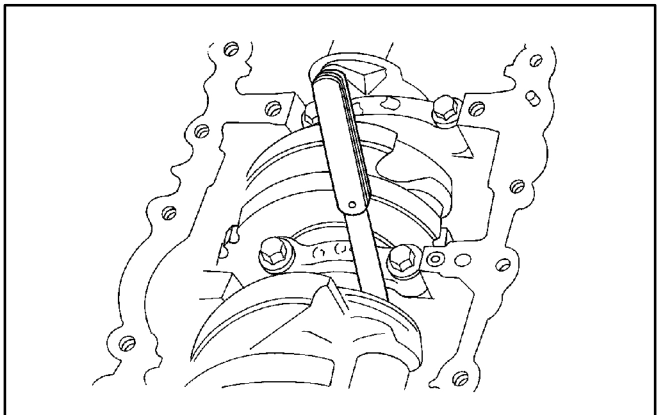

B102C078

46. Mark the order of the crankshaft bearing caps.
47. Remove the crankshaft bearing cap bolts.
48. Remove the crankshaft bearing caps and the lower crankshaft bearings.
49. Remove the crankshaft.
50. Clean the parts, as needed.

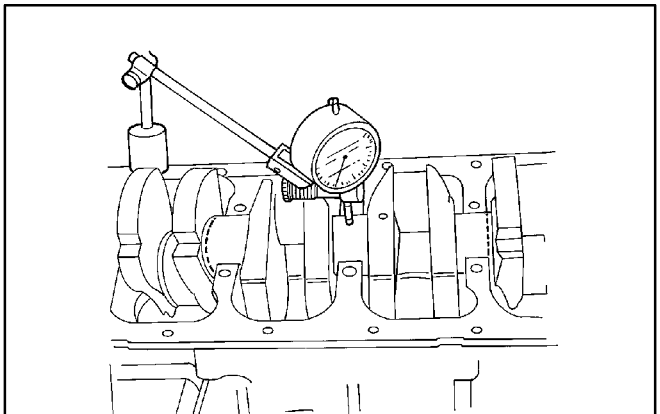

B102C077

Assembly Procedure

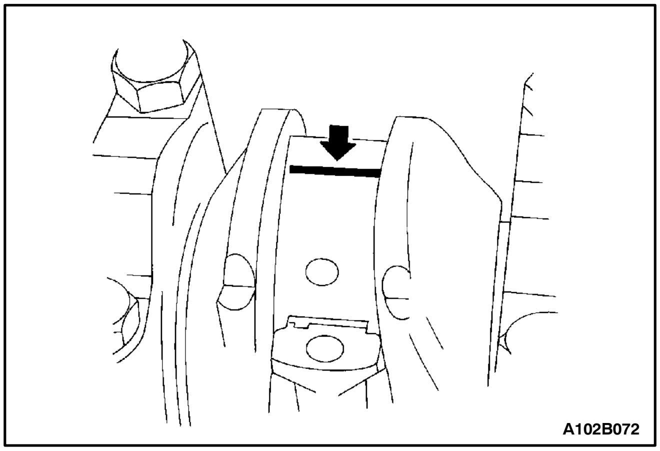
1. Coat the crankshaft bearings with engine oil.
2. If replacing the crankshaft, transfer the pulse pickup sensor disc to the new crankshaft.


A102B070

3. Install the crankshaft.
4. Install the lower crankshaft bearings in the bearing caps.
5. Inspect the crankshaft end play with the crankshaft bearings installed.
6. Check for permissible crankshaft end play. Refer to *"Engine Specifications"* in this section.


A102B071

7. With the crankshaft mounted on the front and rear crankshaft bearings, check the middle crankshaft journal for permissible out-of-round (runout). Refer to *"Engine Specifications"* in this section.

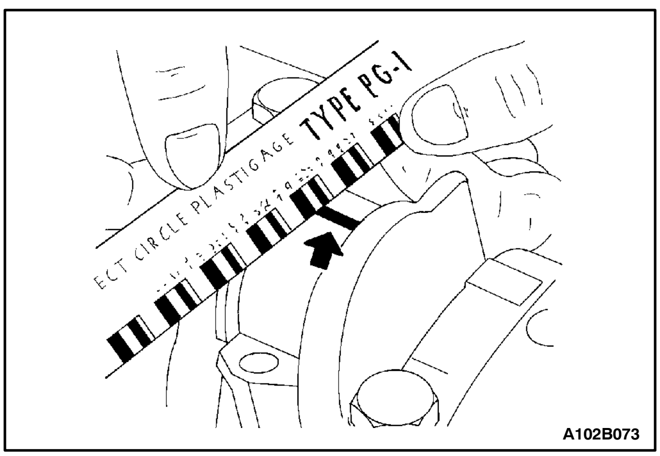


Important: Grease the crankshaft journals and lubricate the crankshaft bearings slightly so that the plastic gauging thread does not tear when the crankshaft bearing caps are removed.

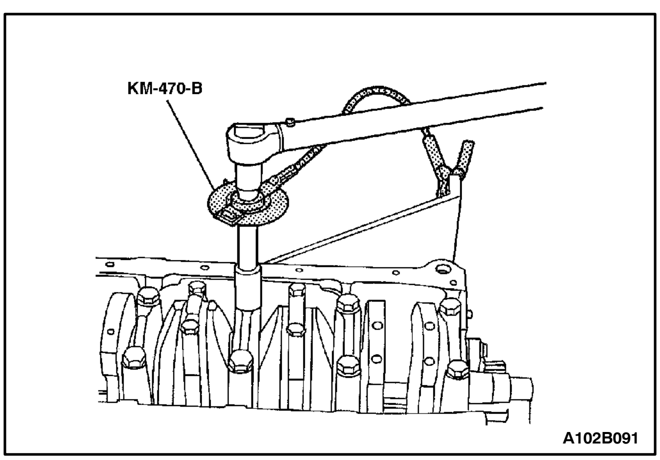
8. Inspect all of the crankshaft bearing clearances using a commercially available plastic gauging (ductile plastic threads).
9. Cut the plastic gauging threads to the length of the bearing width. Lay them axially between the crankshaft journals and the crankshaft bearings.
10. Install the crankshaft bearing caps and the bolts.

Installation Notice

Tightening Torque	50 N·m (37 lb–ft) +45°+15°



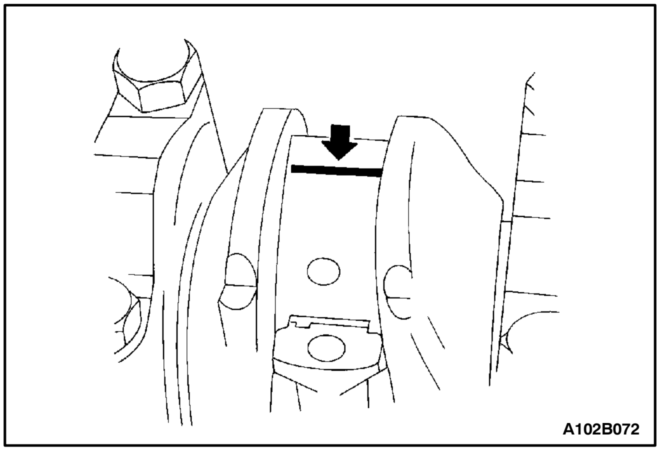
11. Remove the crankshaft bearing cap bolts and the caps.
12. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges)
13. Inspect the bearing clearance for permissible tolerance ranges. Refer to *"Engine Specifications"* in this section.



14. Apply a bead of adhesive sealing compound to the grooves of the crankshaft bearing caps.
15. Install the crankshaft bearing caps to the engine block.
16. Tighten the crankshaft bearing caps using new bolts.

Installation Notice

Tightening Torque	50 N·m (37 lb–ft) +45°+15°

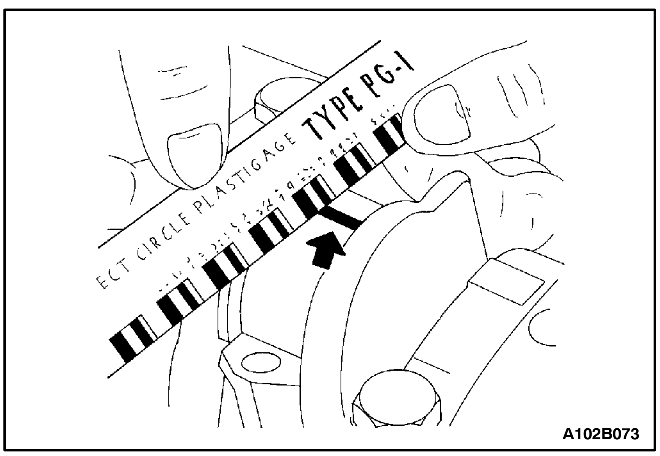


Important: Grease the connecting rod journals and lubricate the connecting rod bearings slightly so that the plastic gauging thread does not tear when the connecting rod bearing caps are removed.

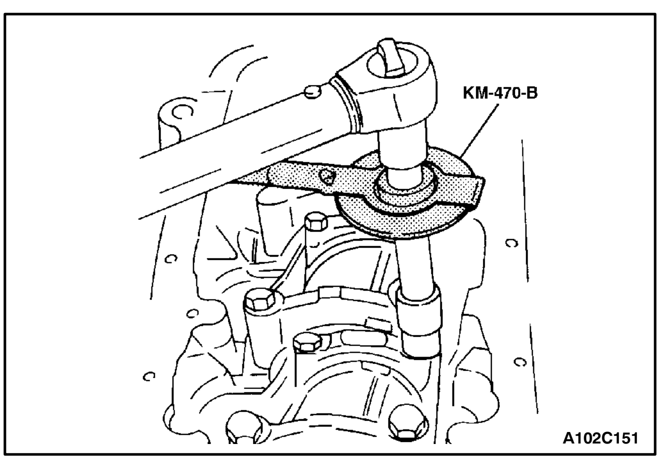
17. Inspect all of the connecting rod bearing clearances using a commercially available plastic gauging (ductile plastic threads).
18. Cut the plastic gauging threads to the length of the connecting rod bearing width. Lay them axially between the connecting rod journals and the connecting rod bearings.
19. Install the connecting rod bearing caps.

Installation Notice

Tightening Torque	35 N·m (26 lb–ft) +45°+15°



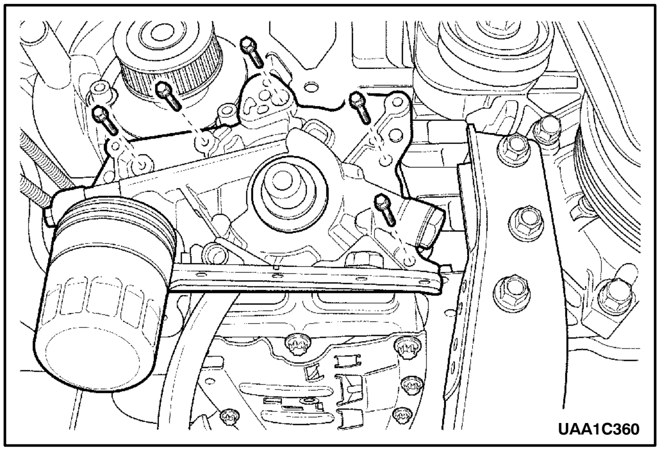
20. Remove the connecting rod bearing caps.
21. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges)
22. Inspect the bearing clearance for permissible tolerance ranges. Refer to *"Engine Specifications"* in this section.



23. Install the connecting rod bearing caps to the connecting rods.
24. Tighten the connecting rod bearing caps using new bolts.

Installation Notice

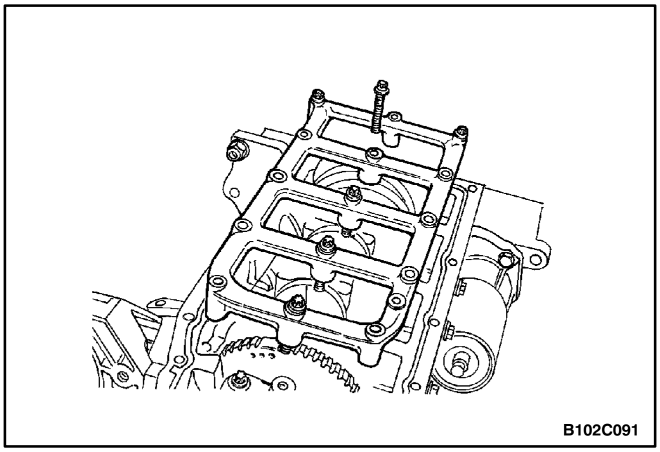
Tightening Torque	35 N·m (26 lb–ft) +45°+15°



25. Install the oil pump.
26. Install the oil pump retaining bolts.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)



27. Install the lower block support bracket and bolts.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft) +45°

28. Install the lower block support bracket splash shield and bolts.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft) +45°

29. Install the oil suction pipe.
30. Install the oil suction pipe on the oil pump bolts.

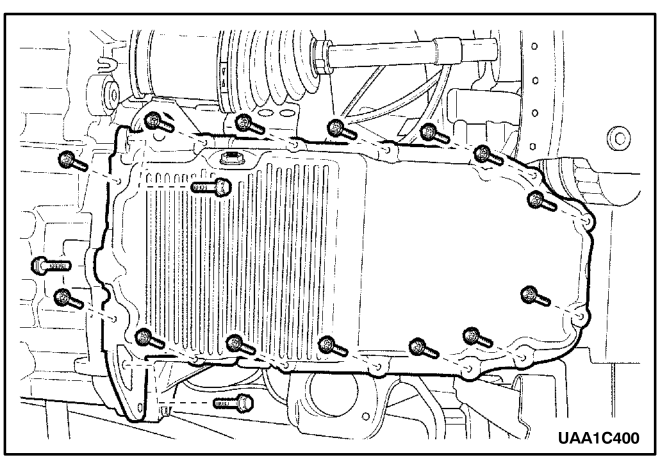
Installation Notice

Tightening Torque	8 N·m (71 lb–in)

31. Install the oil suction pipe support bracket bolts.

Installation Notice

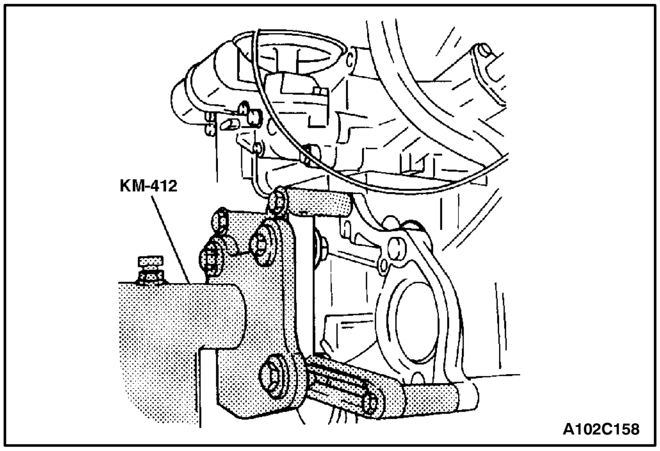
Tightening Torque	20 N·m (15 lb–ft) +45°



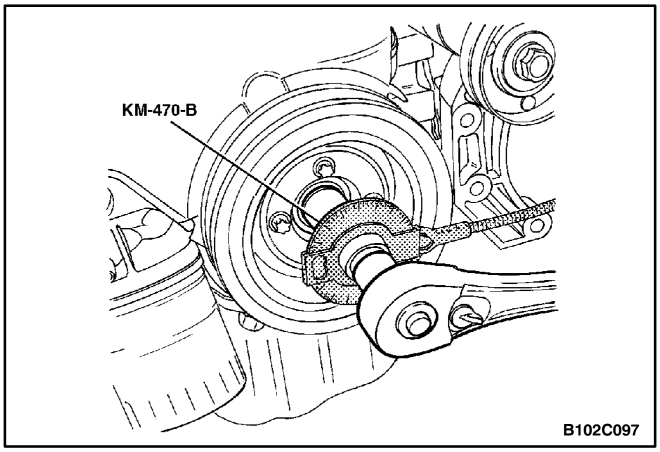
32. Coat the new oil pan gasket with sealant.
33. Install the oil pan gasket to the oil pan.
34. Install the oil pan.
35. Install the oil pan retaining bolts.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)



36. Rotate the engine on the engine overhaul stand KM–412.



37. Install the rear timing belt cover.
38. Install the rear timing belt cover bolts.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

39. Install the crankshaft gear and bolt.

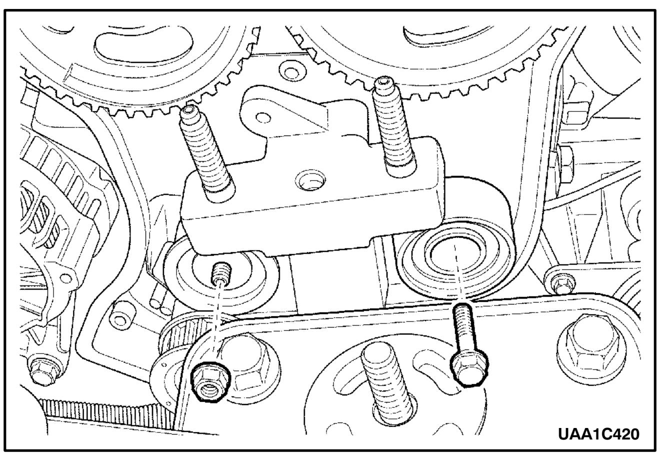
Installation Notice

Tightening Torque	130 N·m (96 lb–ft) +40°±5°

40. Install the engine mount and retaining bolts.

Installation Notice

Tightening Torque	60 N·m (44 lb–ft)



41. Install the timing belt automatic tensioner.
42. Install the timing belt automatic tensioner bolts.

Installation Notice

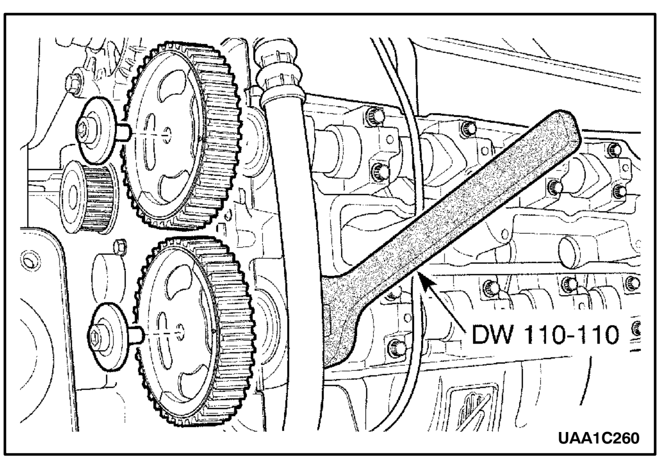
Tightening Torque	25 N·m (18 lb–ft)

43. Install the timing belt idler pulleys.
44. Install the timing belt idler pulley bolt and nut.

Installation Notice

Tightening Torque	25 N·m (18 lb–ft)

Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts.



45. Install the intake camshaft gear.
46. Install the intake camshaft gear bolt while holding the intake camshaft firmly in place.

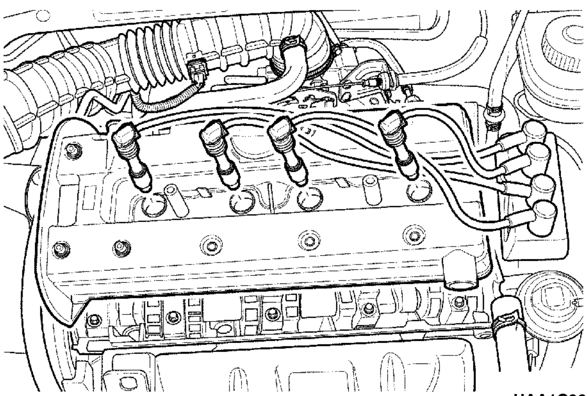
Installation Notice

Tightening Torque	50 N·m (37 lb–ft)+60°+15°

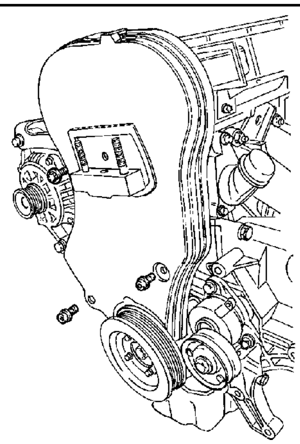
47. Install the exhaust camshaft gear.
48. Install the exhaust camshaft gear bolt while holding the exhaust camshaft firmly in place.

Installation Notice

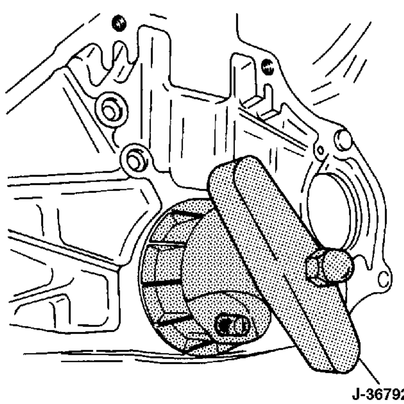
Tightening Torque	50 N·m (37 lb–ft) +60°+15°


UAA1C060

49. Install the timing belt. Refer to *"Timing Belt"* in this section.
50. Adjust the timing belt tension. Refer to *"Timing Belt Check and Adjust"* in this section.
51. Apply a small amount of gasket sealant to the corners of the front camshaft caps and to the top of the rear camshaft cover to cylinder head seal.
52. Install the valve cover and the valve cover gasket.
53. Install the valve cover bolts.
54. Connect the ignition wires to the spark plugs.
55. Install the spark plug cover and bolts.
56. Connect the breather tube to the camshaft cover.

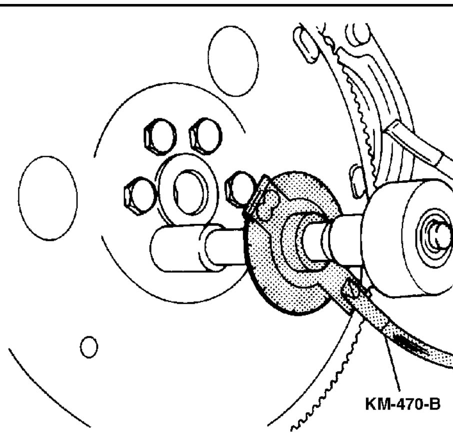

B102C046

57. Install the front timing belt cover.
58. Install the front timing belt cover bolts.
59. Install the engine lifting device.
60. Remove the engine from the engine overhaul stand KM–412.



A102C152

61. Install a new crankshaft rear oil seal using installer J–36792 or KM–635.



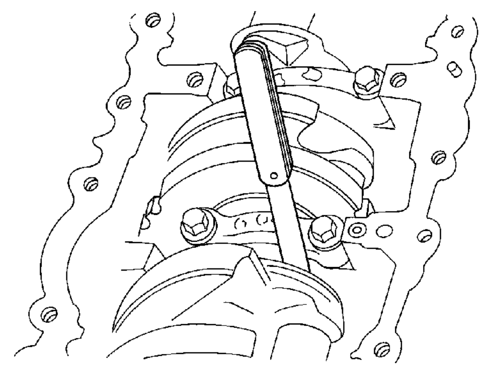
A102C159

62. Install the flywheel or flexible plate.
63. Install the flywheel or the flexible plate bolts.

Installation Notice

Tightening Torque (Flywheel Bolts)	60 N·m (48 lb–ft) +30°+15°
Tightening Torque (Flexible Plate Bolts)	65 N·m (48 lb–ft)

64. Install the engine. Refer to *"Engine"* in this section.



A102B070

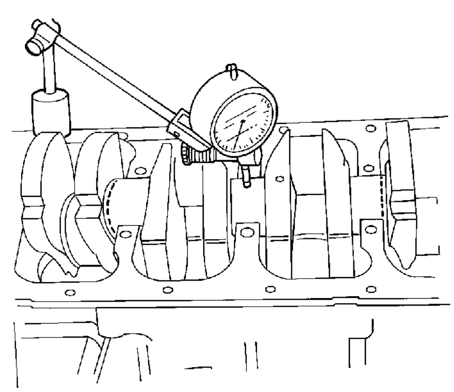
CRANKSHAFT BEARINGS AND CONNECTING ROD BEARINGS – GAUGING PLASTIC

Tools Required

KM–470–B Angular Torque Gauge

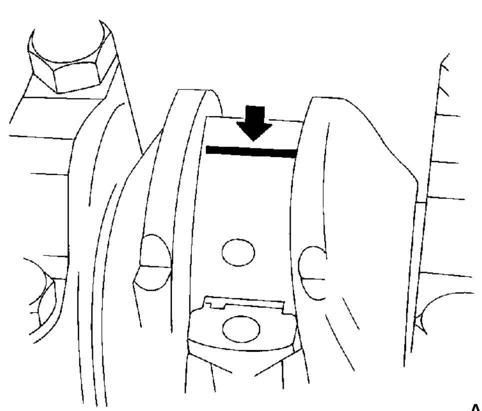
Inspection Procedure – Crankshaft

1. Coat the crankshaft bearings with engine oil.
2. Install the upper crankshaft bearings into the engine block crankshaft journals.
3. Install the lower crankshaft bearings into the crankshaft bearing caps.
4. Install the crankshaft.
5. Inspect the crankshaft end play with the crankshaft bearings installed.
6. Check for permissible crankshaft end play. Refer to *"Engine Specifications"* in this section.



A102B071

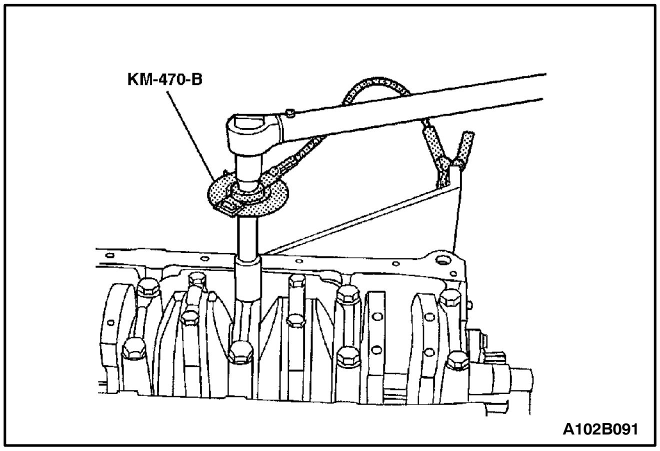
7. With the crankshaft mounted on the front and rear crankshaft bearings, check the middle crankshaft journal for permissible out-of-round (runout). Refer to *"Engine Specifications"* in this section.



A102B072

Important: Grease the crankshaft journals and lubricate the crankshaft bearings slightly so that the plastic gauging thread does not tear when the crankshaft bearing caps are removed.

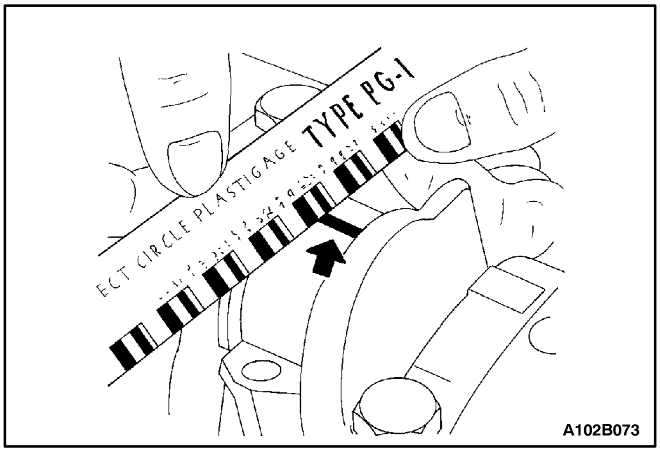
8. Inspect all of the crankshaft bearing clearances using a commercially available plastic gauging (ductile plastic threads).
9. Cut the plastic gauging threads to the length of the bearing width. Lay them axially between the crankshaft journals and the crankshaft bearings.



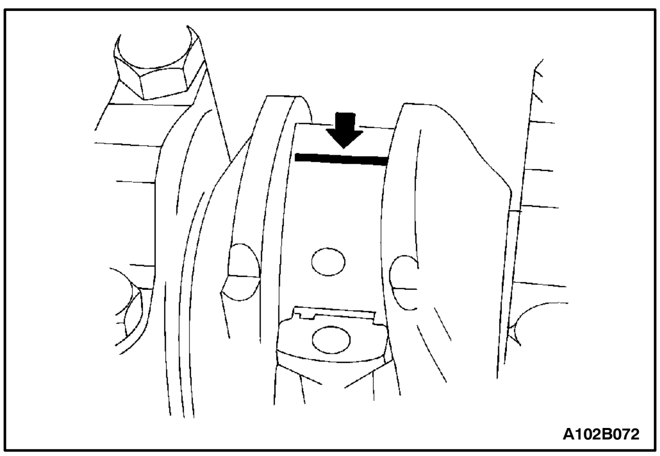
10. Install the crankshaft bearing caps.
11. Install the crankshaft bearing cap bolts.

Installation Notice

Tightening Torque	50 N·m (37 lb–ft) +45°+15°



12. Remove the crankshaft bearing caps.
13. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges.)
14. Inspect the bearing clearances for permissible tolerance ranges. Refer to *“Engine Specifications”* in this section.

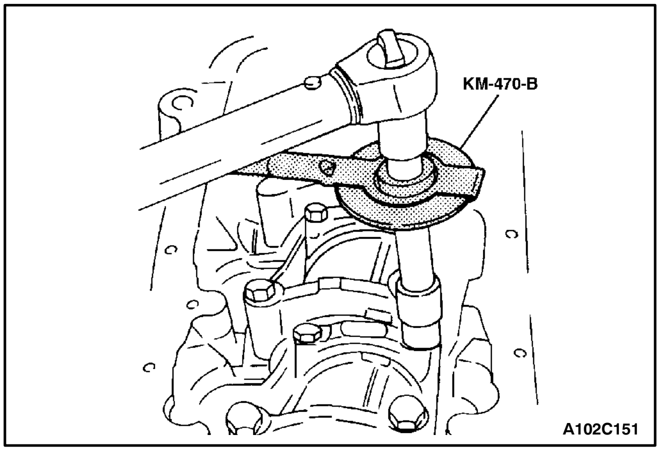


Inspection Procedure – Connecting Rods

1. Coat the connecting rod bearings with engine oil.
2. Install the upper connecting rod bearings into the connecting rod journals.
3. Install the lower connecting rod bearings into the connecting rod bearing caps.

Important: Grease the connecting rod journals and lubricate the connecting rod bearings slightly so that the plastic gauging thread does not tear when the connecting rod bearing caps are removed.

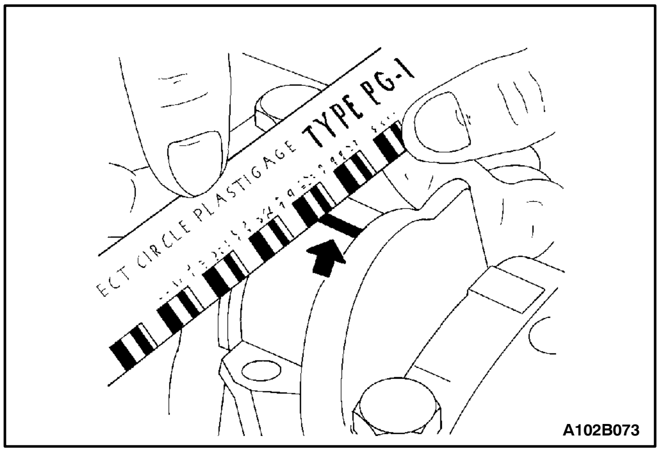
4. Inspect all of the connecting rod bearing clearances using a commercially available plastic gauging (ductile plastic threads).
5. Cut the plastic gauging threads to the length of the bearing width. Lay them axially between the connecting rod journals and the connecting rod bearings.



6. Install the connecting rod bearing caps.
7. Install the connecting rod bearing cap bolts.

Installation Notice

Tightening Torque	35 N·m (26 lb–ft) +45°+15°



8. Remove the connecting rod bearing caps.
9. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges.)
10. Inspect the bearing clearance for permissible tolerance ranges. Refer to *"Engine Specifications"* in this section.

SPECIFICATIONS

ENGINE SPECIFICATIONS

Application	Description (Manual and Automatic)
	1.6L DOHC
General Data:	
Engine Type	A15DMS
Displacement	1 498 cm^3 (91.4 in^3)
Bore Stroke	76.5 X 81.5mm (3.0in. X 3.21in.)
Compression Ratio	9.5 ± 0.2:1
Firing Order	1–3–4–2
Cylinder Bore:	
Diameter	76.5 mm (3.0 in.)
Out of Round (Maximum)	0.0065 mm (0.00025 in.)
Taper (Maximum)	0.0065 mm (0.00025 in.)
Piston:	
Diameter	76.470 mm (3.0 in.)
Clearance to Bore	0.030 mm (0.0012 in.)
Piston Rings:	
Ring, End Gap: Top Compression	0.5 mm (0.02 in.)
2nd Compression	0.5 mm (0.02 in.)
Groove Clearance:Top Compression	0.016 mm (0.0006 in.)
2nd Compression	0.066 mm (0.0026 in.)
Piston Pin:	
Diameter	18.00 mm (0.708 in.)
Pin Off-Set	0.6–0.8 mm (0.02–0.03 in.)
Camshaft:	
Lift Intake	8.75 mm (0.344 in.)
Lift Exhaust	8.75 mm (0.344 in.)
End Play	0.10–0.25mm (0.004–0.0089in.)
Journal OD : No. 1	30 mm (1.18 in.)
No. 2	27 mm (1.06 in.)
No. 3	27 mm (1.06 in.)
No. 4	27 mm (1.06 in.)
No. 5	27 mm (1.06 in.)
Camshaft Cap To Camshaft Journal Clearance (All)	0.021 mm (0.0008 in.)
Crankshaft:	
Main Journal:Diameter (All)	54.982–54.994mm(2.164–2.165in.)
Taper(Maximum)	0.005 mm (0.0001 in.)
Out of Round (Maximum)	0.004 mm (0.0001 in.)

ENGINE SPECIFICATIONS (Cont'd)

Application	Description (Manual and Automatic) 1.6L DOHC
Main Bearing Clearance(All)	0.010–0.026mm (0.0004–0.001 in.)
Crankshaft End Play	0.05–0.28 mm (0.002–0.011 in.)
Connecting Rod Journal: Diameter(All)	42.971–42.987mm (1.691–1.692in.)
Taper (Maximum)	0.005 mm (0.0001 in.)
Out of Round (Maximum)	0.004 mm (0.0001 in.)
Rod Bearing Clearance (All)	0.019–0.071mm (0.0007–0.0028in.)
Rod Side Clearance	0.070–0.242mm (0.0027–0.009in.)
Valve System:	
Valve Lash Compensators	Hydraulic
Face Angle (All)	90°
Seat Angle (All)	90°
Seat Runout (Maximum, All)	0.05 mm (0.002 in.)
Face Runout (Maximum, All)	0.03 mm (0.0012 in.)
Seat Width: Intake	1.17–1.57 mm (0.046–0.062 in.)
Exhaust	1.07–1.47 mm (0.042–0.058 in.)
Valve Guide Inside Diameter (All)	6.00–6.02 mm (0.236–0.237 in.)
Valve Stem Diameter (All)	6 mm (0.236 in.)
Valve Diameter (All): Intake	30.3 mm (1.19 in.)
Exhaust	26.0 mm (1.02 in.)
Valve Spring Loads: Valve Open	580–26N (428–19 lbs) @23.0mm(0.90in.)
Valve Closed	260"13N(192 " 9 lbs) @ 32.0mm(1.25 in.)
Valve Spring Free Length	40.95 mm (1.61 in.)
Oil Pump:	
Gap Between Oil Pump Body and Out Rotor	0.400~0.484 mm (0.0157~0.019 in.)
Out Rotor Side Clearance	0.45~0.100 mm (0.02~0.004 in.)
Inner Rotor Side Clearance	0.035~0.085 mm (0.001~0.003 in.)
Relief Valve Spring Free Length	81 mm (3.2 in.)
Sealants and Adhesives:	
Rear Main Bearing Cap	GE p/n RTV 159
Camshaft Carrier to Cylinder Head	HN 1581 (Loctite® 515)
Oil Pan Bolts	HN 1256 (Loctite® 242)
Oil Pump Bolts	HN 1256 (Loctite® 242)
Oil Pan Pickup Tube Bolts	HN 1256 (Loctite® 242)
Oil Gallery Plug	HN 1256 (Loctite® 242)
Coolant Jacket Caps and Plugs (Freeze Plugs)	HN 1756 (Loctite® 176)
Exhaust Manifold Studs/Nuts	Anti-seize Compound (HMC Spec HN1325)

FASTENER TIGHTENING SPECIFICATIONS

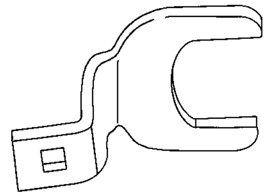
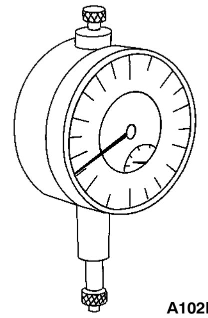
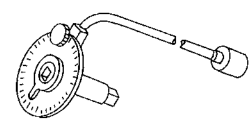
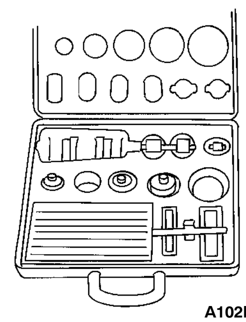
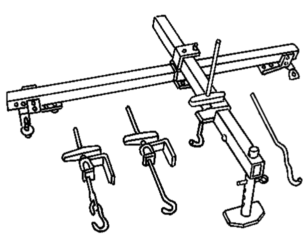
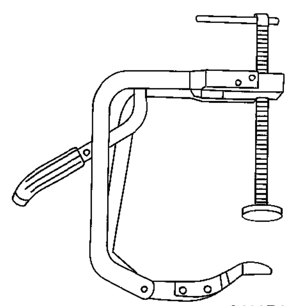
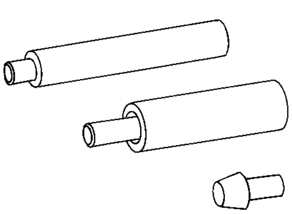
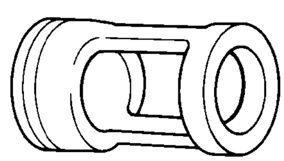
Application	N•m	Lb-Ft	Lb-In
Air Cleaner Housing Bolts	10	–	89
Camshaft Cap Bolts	16	12	–
Camshaft Cover Nuts	10	–	89
Connecting Rod Bearing Cap Bolts	25 + 30° + 15°	18 + 30° + 15°	–
Coolant Temperature Sensor	20	15	–
Crankshaft Bearing Cap Bolts	50 + 45° + 15°	37 + 45° + 15°	–
Crankshaft Cover Nuts	10	–	89
Crankshaft Position Sensor Retaining Bolt	10	–	89
Crankshaft Pulley Bolt	20	15	–
Cylinder Head Bolts (Cylinder Head Mounting Bolts)	25 + 70° + 70° + 50°	18 + 70° + 70° + 50°	–
Direct Ignition System Coil Mounting Bolts	10	–	89
Direct Ignition System Coil Mounting Bracket Bolts	10	–	89
Engine Mount Attaching Bolts	30	22	–
Engine Mount Bracket Attaching Bolts/Nuts	55	41	–
Exhaust Camshaft Gear Bolt	67.5	49	–
Exhaust Flex Pipe-to-Catalytic Converter or Connecting Pipe Retaining Nuts	35	26	–
Exhaust Flex Pipe-to-Exhaust Manifold Retaining Nuts	35	26	–
Exhaust Gas Recirculation Valve Adapter Bolts	25	18	–
Exhaust Manifold Heat Shield Bolts	13	10	–
Exhaust Manifold Retaining Nuts	25	18	–
Flexible Plate Bolts	45	33	–
Flexible Plate Inspection Cover Bolts	10	–	89
Flywheel Bolts	35 + 30° + 15°	25 + 30° + 15°	–
Flywheel Inspection Cover Bolts	12	–	106
Front Timing Belt Cover Bolts (Upper and Lower)	10	–	89
Fuel Rail Assembly Retaining Bolts	25	18	–
Fuel Rail Retaining Bolts	25	18	–
Generator Upper Retaining Bolt	20	15	–
Intake Camshaft Gear Bolt	67.5	49	–
Intake Manifold Retaining Bolts/Nuts	25	18	–
Intake Manifold Support Bracket Lower Bolt	40	30	–
Intake Manifold Support Bracket Upper Bolts	25	18	–
Lower Front Timing Belt Cover Bolts	10	–	89
Oil Pan Flange Bolts	75	55	–
Oil Pan Retaining Bolts	10	–	89
Oil Pan Drain Plug	55	40	–

FASTENER TIGHTENING SPECIFICATIONS (Cont'd)

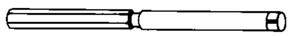
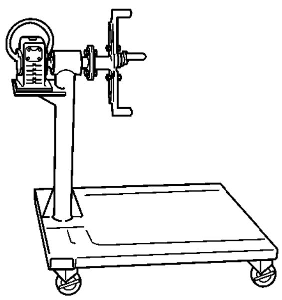
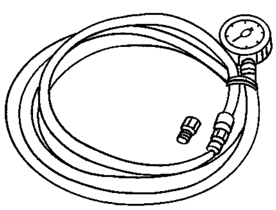
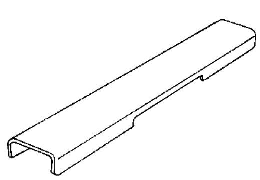
Application	N•m	Lb-Ft	Lb-In
OIl Pressure Switch	30	22	–
Oil Pump Bolts	10	–	89
Oil Pump Rear Cover Bolts	6	–	53
Oil Pump Retaining Bolts	10	–	89
Oil Suction Pipe or Support Bracket Bolts	10	–	89
Rear Timing Belt Cover Bolts	10	–	89
Safety Relief Valve Bolt	30	22	–
Spark Plug Cover Bolts	3	–	27
Spark Plugs	25	18	–
Thermostat Housing Mounting Bolts	20	15	–
Throttle Cable Bracket Bolts	8	–	71
Timing Belt Automatic Tensioner Bolts	25	18	–
Timing Belt Idler Pulley Bolt	40	30	–
Transaxle Bell Housing Bolts	75	55	–
Transaxle Torque Converter Bolts	45	33	–
Upper Front Timing Belt Cover Bolts	10	–	89
Water Pump Retaining Bolts	10	–	89

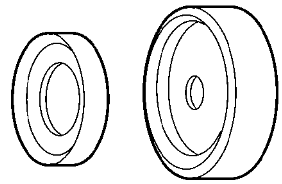
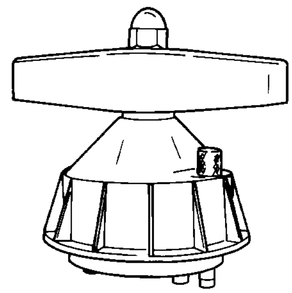
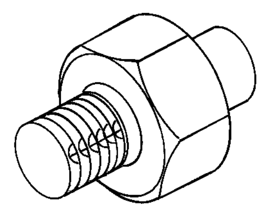
SPECIAL TOOLS

SPECIAL TOOLS TABLE

 A102B151	**J-42492** **Timing Belt** **Adjuster**	 A102B154	**MKM-571-B** **Gauge**
 A102B161	**KM-470-B** **Angular Torque** **Gauge**	 A102B156	**KM-340-0** **Cutter Set** **Includes: KM-340-7** **Guide Drift** **KM-340-13** **Cutters** **KM-340-26** **Cutters**
 A102B152	**J-28467-B** **Engine Assembly** **Support Fixture**	 A102B157	**KM-348** **Valve Spring** **Compressor**
 A102B153	**KM-427** **Piston Pin** **Service Set**	 A102C153	**KM-653** **Adapter**

SPECIAL TOOLS TABLE (Cont'd)

 A102C154	**KM-805 Valve Guide Reamer**
 A102B159	**KM-412 Engine Overhaul Stand**
 A202B005	**KM-498-B Pressure Gauge**
 B302C001	**X-28467-560 Engine Assembly Support Channel**

 A102B160	**KM-635 Crankshaft Rear Oil Seal Installer**
 A102C155	**J-36792 Crankshaft Rear Oil Seal Installer**
 B102C044	**KM-135 Adapter**

SECTION 1C2

2.0L DOHC ENGINE MECHANICAL

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

CYLINDER HEAD AND GASKET

The cylinder head is made of an aluminum alloy. The cylinder head uses cross-flow intake and exhaust ports. A spark plug is located in the center of each combustion chamber. The cylinder head houses the dual camshafts.

CRANKSHAFT

The crankshaft has eight integral weights which are cast with it for balancing. Oil holes run through the center of the crankshaft to supply oil to the connecting rods, the bearings, the pistons, and the other components. The end thrust load is taken by the thrust washers installed at the center journal.

TIMING BELT

The timing belt coordinates the crankshaft and the dual overhead camshafts and keeps them synchronized. The timing belt also turns the coolant pump. The timing belt and the pulleys are toothed so that there is no slippage between them. There are two idler pulleys. An automatic tensioner pulley maintains the timing belt's correct tension. The timing belt is made of a tough reinforced rubber similar to that used on the serpentine drive belt. The timing belt requires no lubrication.

OIL PUMP

The oil pump draws engine oil from the oil pan and feeds it under pressure to the various parts of the engine. An oil strainer is mounted before the inlet of the oil pump to remove impurities which could clog or damage the oil pump or other engine components. When the crankshaft rotates, the oil pump driven gear rotates. This causes the space between the gears to constantly open and narrow, pulling oil in from the oil pan when the space opens and pumping the oil out to the engine as it narrows.

At high engine speeds, the oil pump supplies a much higher amount of oil than required for lubrication of the engine. The oil pressure regulator prevents too much oil from entering the engine lubrication passages. During normal oil supply, a coil spring and valve keep the bypass closed, directing all of the oil pumped to the engine. When the amount of oil being pumped increases, the pressure becomes high enough to overcome the force of the spring. This opens the valve of the oil pressure regulator, allowing the excess oil to flow through the valve and drain back to the oil pan.

OIL PAN

The engine oil pan is mounted to the bottom of the cylinder block. The engine oil pan houses the crankcase and is made of cast aluminum.

Engine oil is pumped from the oil pan by the oil pump. After it passes through the oil filter, it is fed through two paths to lubricate the cylinder block and cylinder head. In one path, the oil is pumped through oil passages in the crankshaft to the connecting rods, then to the pistons and cylinders. It then drains back to the oil pan. In the second path, the oil is pumped through passages to the camshaft. The oil passes through the internal passageways in the camshafts to lubricate the valve assemblies before draining back to the oil pan.

EXHAUST MANIFOLD

A single four-port, rear-takedown manifold is used with this engine. The manifold is designed to direct escaping exhaust gases out of the combustion chambers with a minimum of back pressure. The oxygen sensor is mounted to the exhaust manifold.

INTAKE MANIFOLD

The intake manifold has four independent long ports and utilizes an inertial supercharging effect to improve engine torque at low and moderate speeds.

CAMSHAFTS

This engine is a dual overhead camshaft (DOHC) type, which means there are two camshafts. One camshaft operates the intake valves, and the other camshaft operates the exhaust valves. The camshafts sit in journals on the top of the engine (in the cylinder head) and are held in place by camshaft caps. The camshaft journals of the cylinder head are drilled for oil passages. Engine oil travels to the camshafts under pressure where it lubricates each camshaft journal. The oil returns to the oil pan through drain holes in the cylinder head. The camshaft lobes are machined into the solid camshaft to precisely open and close the intake and the exhaust valves the correct amount at the correct time. The camshaft lobes are oiled by splash action from pressurized oil escaping from the camshaft journals.

EXHAUST GAS RECIRCULATION VALVE

The exhaust gas recirculation (EGR) system is used to lower oxides of nitrogen (NOX) emission levels caused by high combustion temperature. The main element of the system is the EGR valve operated by

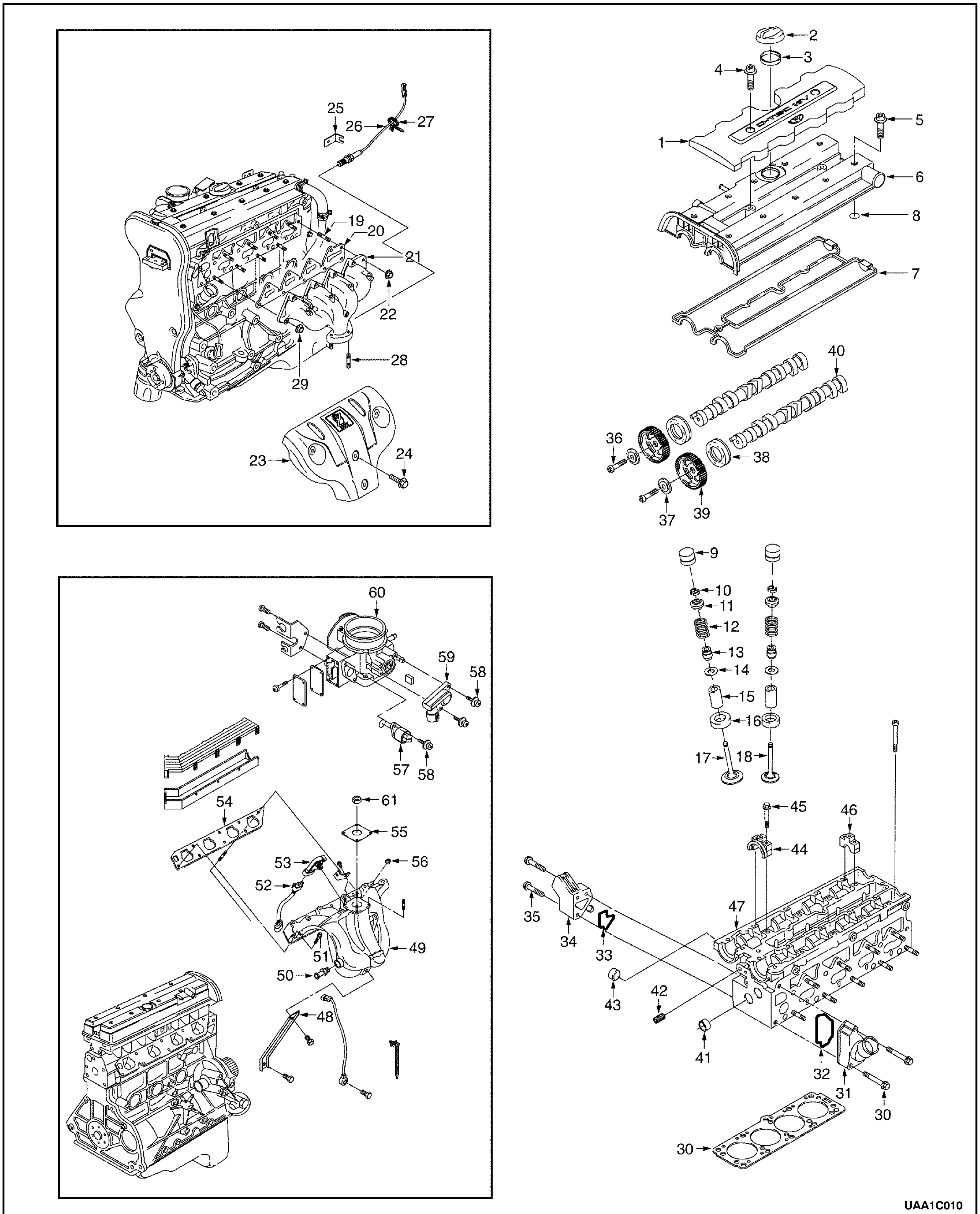
The EGR valve feeds small amounts of exhaust gas into the intake manifold to decrease combustion temperature. The amount of exhaust gas recirculated is controlled by variations in vacuum and exhaust back pressure. If too much exhaust gas enters, combustion will not take place. For this reason, very little exhaust gas is allowed to pass through the valve, especially at idle.

The EGR valve is usually open under the following conditions:

- Warm engine operation.
- Above idle speed.

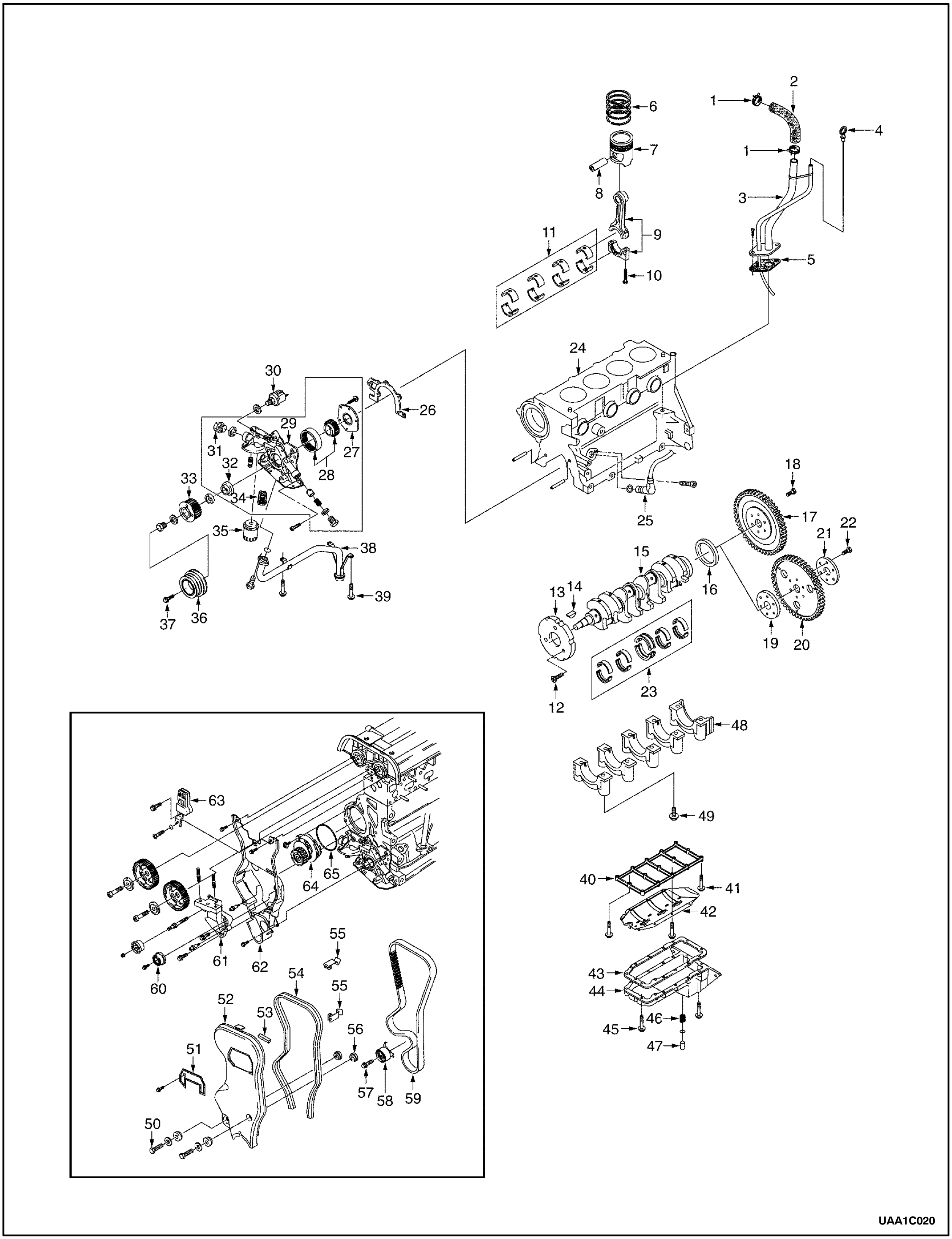
COMPONENT LOCATOR

UPPER END



1 Spark Plug Cover
2 Oil Cap
3 Oil Cap Seal
4 Bolt
5 Bolt
6 Valve Cover
7 Valve Cover Gasket
8 Seal
9 Hydraulic Valve Lash Adjuster
10 Valve Key
11 Valve Spring Retainer
12 Valve Spring
13 Valve Stem Seal
14 Valve Spring Seat
15 Valve Guide
16 Valve Spring Seat
17 Intake Valve
18 Exhaust Valve
19 Bolt-Stud
20 Exhaust Manifold Gasket
21 Exhaust Manifold
22 Nut
23 Exhaust Manifold Heat Shield
24 Bolt
25 Oxygen Sensor Bracket
26 Oxygen Sensor
27 Clamp
28 Bolt-Stud
29 Nut
30 Bolt
31 Thermostat Housing
32 Thermostat Housing Seal
33 Thermostat Adapter Seal
34 Thermostat Adapter
35 Bolt
36 Bolt
37 Washer
38 Camshaft Gear
39 Camshaft Seal
40 Camshaft
41 Plug
42 Plug
43 Plug
44 Front Camshaft Cap
45 Bolt
46 Intermediate Camshaft Cap
47 Cylinder Head
48 Intake Manifold Bracket
49 Intake Manifold
50 Vacuum Connector
51 Bolt
52 MAP Sensor Wiring Harness
53 MAP Sensor
54 Intake Manifold Gasket
55 Throttle Body Gasket
56 Nut
57 IACU Motor
58 Screw
59 TP Sensor
60 Throttle Body
61 Nut

LOWER END



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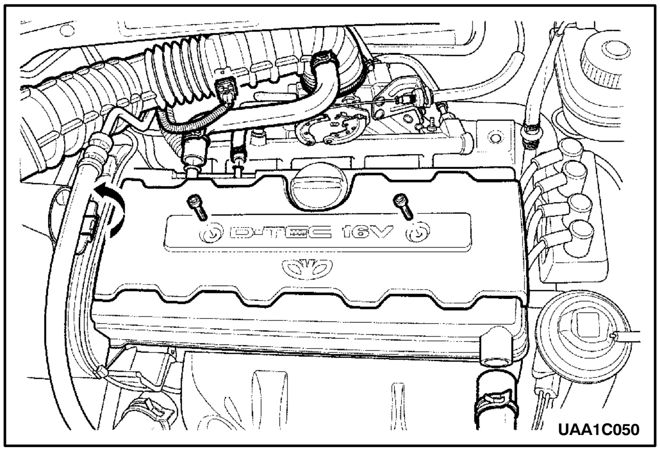
UAA1C020

1 Hose Clamp
2 Engine Ventilation Hose
3 Engine Ventilation Pipe
4 Oil Level Gauge Stick
5 Engine Ventilation Gasket
6 Piston Ring Set
7 Piston
8 Piston Pin
9 Connecting Rod
10 Bolt
11 Connecting Rod Bearing Set
12 Screw
13 Transmitter Disc
14 Woodruff Key
15 Crankshaft
16 Shaft Seal Ring
17 Flywheel (Manual Transaxle)
18 Bolt (Manual Transaxle)
19 Flexible Plate Spacer (Automatic Transaxle)
20 Flexible Plate (Automatic Transaxle)
21 Disc Reinforcing (Automatic Transaxle)
22 Bolt (Automatic Transaxle)
23 Crankshaft Bearing Set
24 Engine Block
25 CKP Sensor
26 Oil Pump Body Gasket
27 Cover
28 Gear
29 Oil Pump
30 Oil Pressure Switch
31 Plug
32 Crankshaft Front Seal
33 Crankshaft Gear
34 Bypass Valve
35 Oil Filter
36 Torsional Damper
37 Bolt
38 Oil Suction Pipe
39 Bolt
40 Bearing Bridge
41 Bolt
42 Oil Pan Scraper
43 Oil Pan Gasket
44 Oil Pan
45 Bolt
46 Oil Pan Plug Insert
47 Bolt
48 Crankshaft Main Bearing Cap
49 Bolt
50 Bolt
51 Torque Roll Axis Cover
52 Front Tooth Belt Hood
53 Seal
54 Front Tooth Belt Gasket
55 Clip
56 Damper Ring
57 Bolt
58 Timing Belt Tensioner
59 Timing Belt
60 Guide Roller
61 Torque Roll Axis Support
62 Rear Tooth Belt Hood
63 CMP Sensor
64 Coolant Pump
65 Seal Ring

REPAIR INSTRUCTION

ON–VEHICLE SERVICE



UAA1C050

VALVE COVER

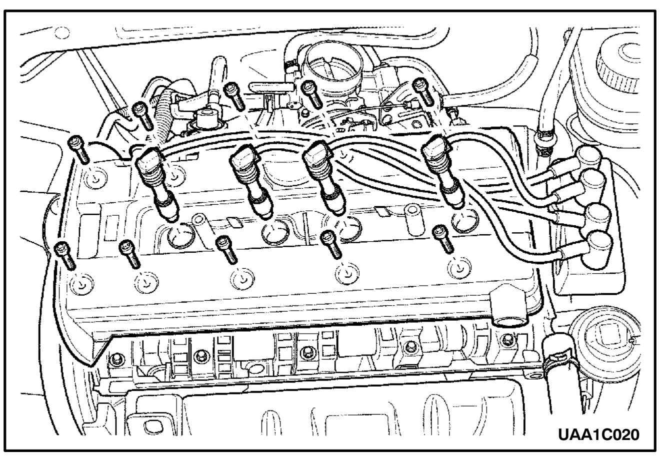
(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the intake air temperature (IAT) sensor connector.
3. Disconnect the breather hoses from the valve cover.
4. Disconnect the positive crankcase ventilation (PCV) hose from the valve cover.
5. Disconnect the clip at the valve cover.
6. Remove the spark plug cover bolts and cover.

Installation Notice

Tightening Torque	8 N·m (71 lb–in)



UAA1C020

7. Disconnect the ignition wires at the spark plugs.
8. Remove the valve cover bolts.

Installation Notice

Tightening Torque	8 N·m (71 lb–in)

9. Remove the valve cover.
10. Remove the valve cover gasket from the valve cover.
11. Installation should follow the removal procedure in the reverse order.

CYLINDER HEAD AND GASKET

(Left-Hand Drive Shown, Right-HandDrive Similar)

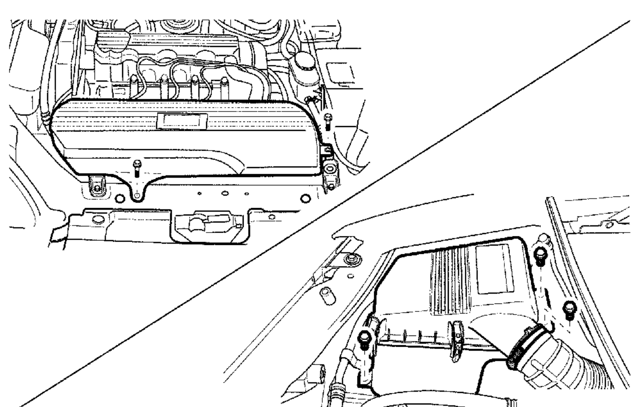
Tools Required

J–42472 Timing Belt Adjuster

KM–470–B Angular Torque Gauge

Removal and Installation Procedure

1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine after it stalls for 10 seconds to rid the fuel system of fuel pressure.

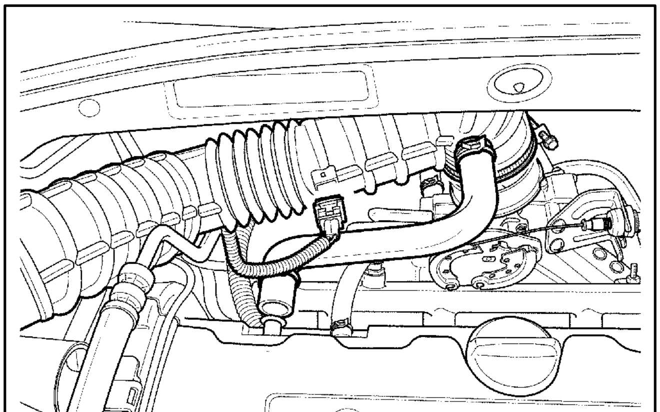


UAA1B060

3. Drain the engine coolant. Refer to *Section 1D, Engine Cooling.*
4. Disconnect the negative battery cable
5. Remove the air filter housing bolts and the air filter housing assembly.
6. Remove the air inlet duct bolts and air inlet duct

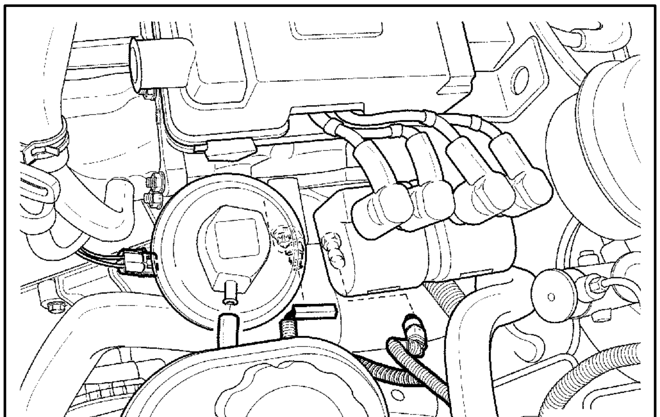
Installation Notice

Tightening Torque	8 N·m (71 lb–in)



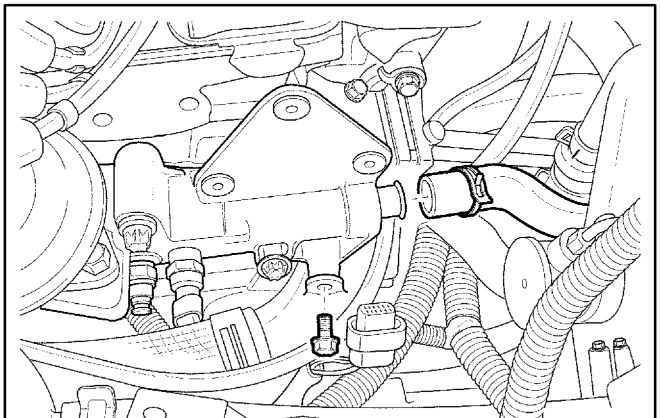
UAA1C070

7. Disconnect the intake air temperature (IAT) sensor connector.
8. Disconnect the breather hose from the valve cover.
9. Remove the air intake tube from the throttle body.

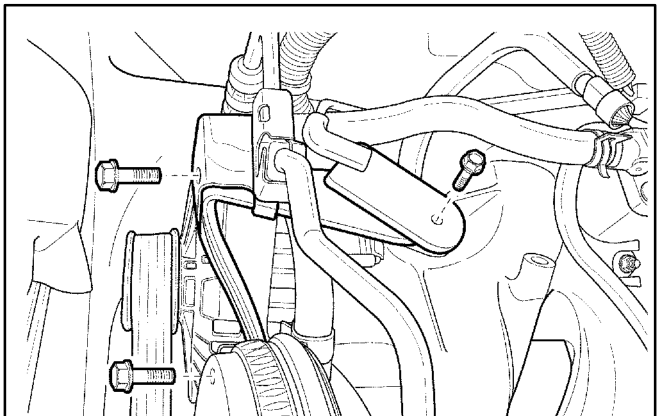


UAA1C180

10. Disconnect the camshaft position (CMP) sensor connector.
11. Disconnect the oxygen sensor connector.
12. Disconnect the engine coolant temperature (ECT) sensor connector.
13. Disconnect the coolant temperature gauge connector.
14. Disconnect the EGR valve connector.


UAA1C190

15. Remove the electronic ignition (EI) system ignition coil. Refer to *Section 1F, Engine Controls.*
16. Disconnect the heater inlet hose at the cylinder head.
17. Remove the coolant pipe bracket bolt.


UAA1C140

18. Remove the fuel injector rail and fuel injectors as an assembly. Refer to *Section 1F, Engine Controls.*
19. Remove the generator-to-intake manifold support bracket bolts upper bracket bolts and support bracket.

Installation Notice

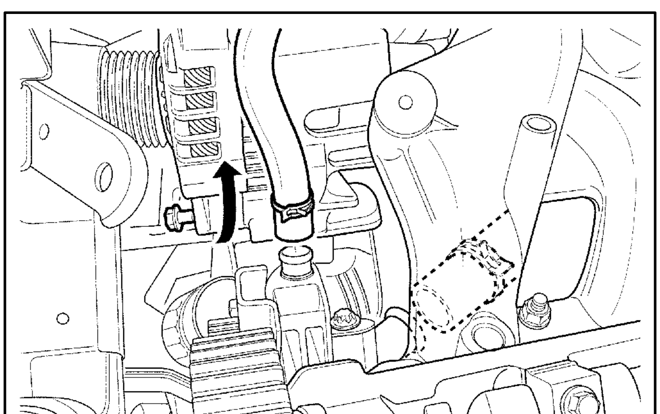
Tightening Torque	20 N·m (15 lb–ft)

20. Remove the intake manifold-to-generator strap bracket bolt and loosen the bolt on the generator.

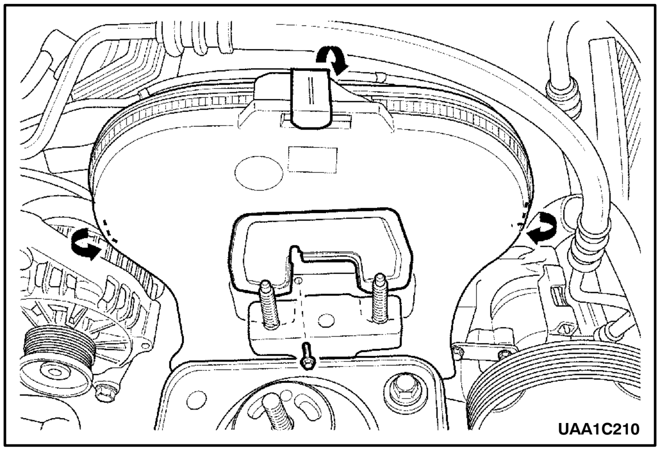
Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

21. Move the strap clear of the intake manifold.


UAA1C200

22. Loosen the generator lower bracket-to-generator bolt.
23. Put out the generator backward
24. Disconnect the coolant hose from the throttle body.
25. Disconnect the coolant hose from the cylinder head.
26. Disconnect the upper radiator hose at the thermostat housing.

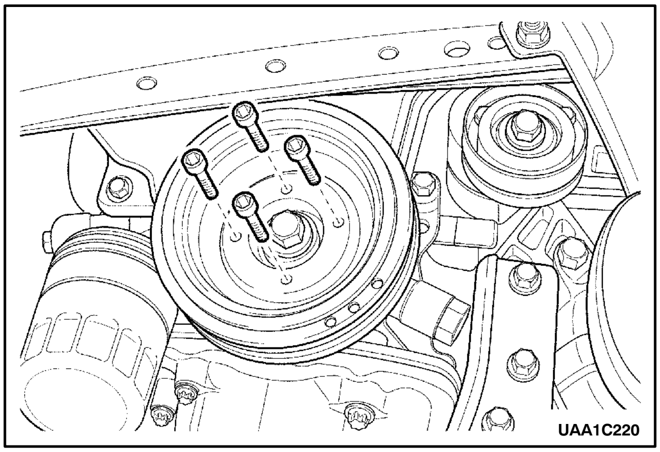


27. Remove the forward engine mount. Refer to *“Forward Engine Mount”* in this section.
28. Disconnect the clips at the upper front timing belt cover.
29. Remove the torque roll axis cover bolt.

Installation Notice

Tightening Torque	6 N·m (53 lb–in)

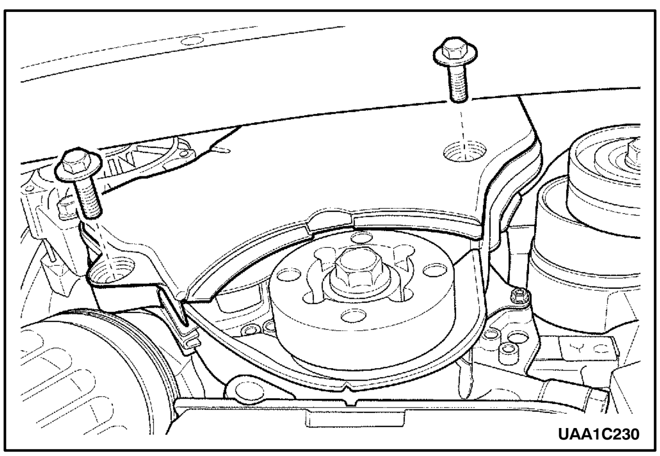
30. Remove the torque roll axis cover.



31. Remove the right front wheel. Refer to *Section 2E, Tires and Wheels.*
32. Remove the right front wheel well splash shield. Refer to *Section 9R, Body Front End.*
33. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump.*
34. Remove the crankshaft pulley bolts.
35. Remove the crankshaft pulley.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

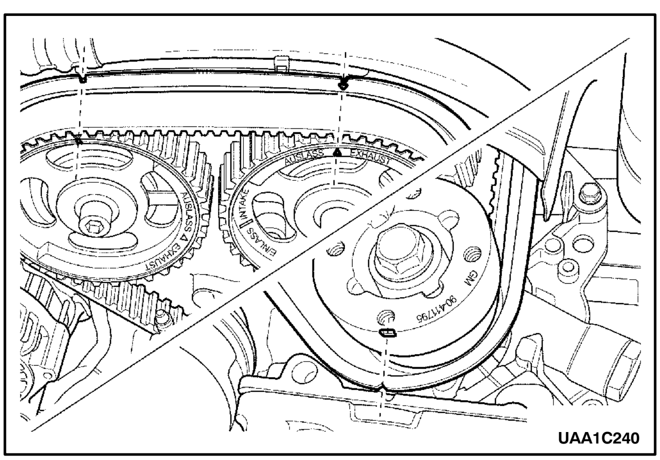


36. Remove front timing belt cover bolts.

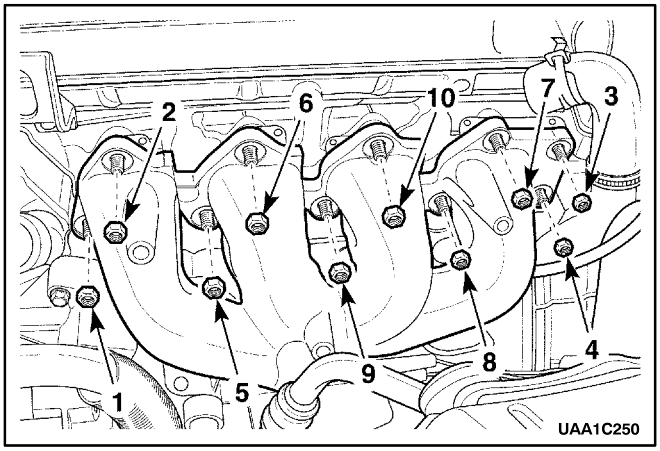
Installation Notice

Tightening Torque	6 N·m (53 lb–in)

37. Remove the front timing belt cover.



38. Using the crankshaft pulley bolt, rotate the crankshaft clockwise until the timing mark on the crankshaft gear is aligned with the notch at the bottom of the rear timing belt cover.
39. Remove the timing belt. Refer to *“Timing Belt”* in this section.



40. Remove the exhaust manifold heat shield bolts and the exhaust manifold heat shield.

Installation Notice

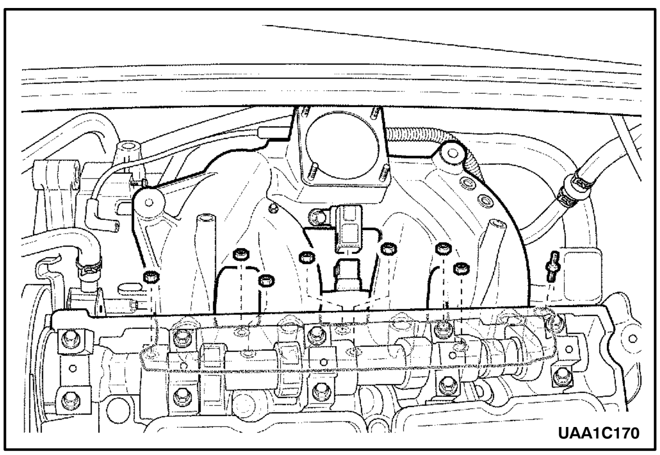
Tightening Torque	1st stage:	13 N·m (10 lb–ft): 9,10,6,5,8,7,2,1,3,4
	2st stage:	13 N·m (10 lb–ft): 9,10,6,5,8,7,2,1,3,4
	3rd stage:	15 N·m (11 lb–ft): 9,10,6,5,8,7,2,1,3,4
	4th stage:	15 N·m (11 lb–ft): 9,10,6,5,8,7,2,1,3,4,9,10,6

41. Remove the exhaust manifold retaining nuts.

Installation Notice

Tightening Torque	15 N·m (11 lb–ft)

42. Disconnect the exhaust manifold from the cylinder head.

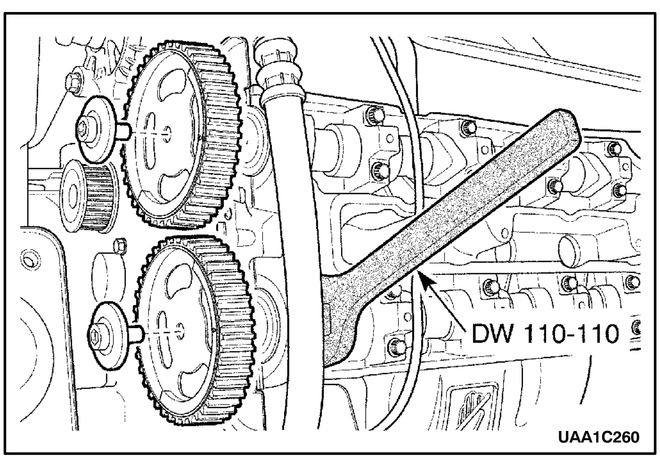


43. Remove the intake manifold retaining nuts/bolt.

Installation Notice

Tightening Torque	22 N·m (16 lb–ft)

44. Disconnect the intake manifold from the cylinder head.



45. Remove the valve cover. Refer to *"Valve Cover"* in this section.

Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

46. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.

Installation Notice

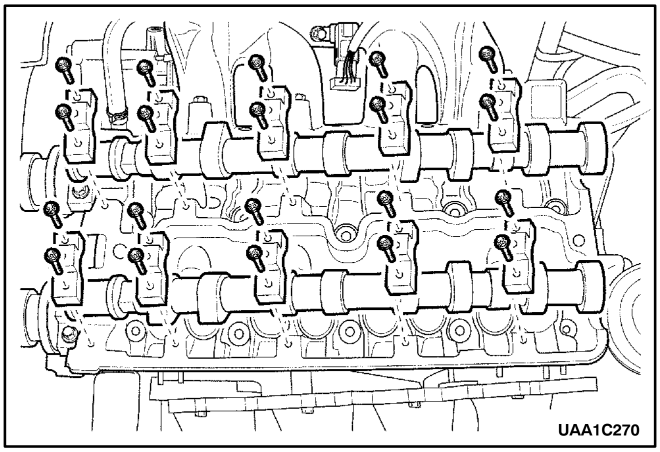
Tightening Torque	50 N·m (37 lb–ft) +60°+15°

47. Remove the intake camshaft gear.
48. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.

Installation Notice

Tightening Torque	50 N·m (37 lb–ft) +60°+15°

49. Remove the exhaust camshaft gear.

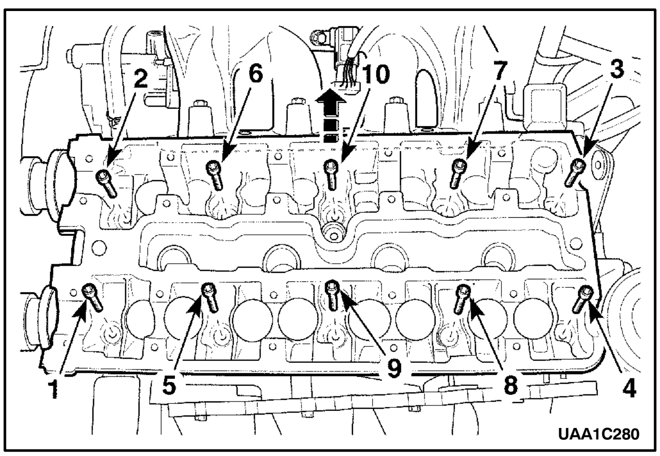


50. Remove the camshaft bearing cap bolts gradually and in the sequence shown for each camshaft bearing cap.

Installation Notice

Tightening Torque	8 N·m (71 lb–in)

51. Remove the intake/exhaust camshaft caps. Maintain the correct positions for installation.
52. Remove the intake/exhaust camshaft.



53. Loosen all of the cylinder head bolts gradually and in the sequence shown.
54. Remove the cylinder head bolts.
55. Remove the cylinder head and cylinder head gasket.

Notice: Prevent any engine oil or coolant from entering the cylinders when removing the cylinder heads.

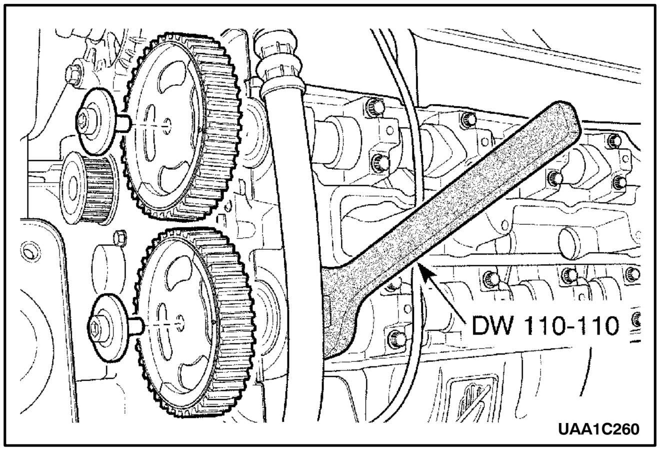
Installation Notice

Tightening Torque	25 N·m (18 lb–ft) +90°+90°+90°

56. Installation should follow the removal procedure in the reverse order.

Cleaning Procedure

1. Clean the gasket surfaces of the cylinder head and the engine block.
2. Make sure the gasket surfaces of the cylinder head and the engine block are free of nicks and heavy scratches.
3. Clean the cylinder head bolts.
4. Inspect the cylinder head for warpage. Refer to *“Cylinder Head and Valve Train Components”* in this section.



CAMSHAFTS

(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal and Installation Procedure

1. Remove the timing belt. Refer to *“Timing Belt”* in this section.
2. Remove the valve cover. Refer to *“Valve Cover”* in this section.

Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

3. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.

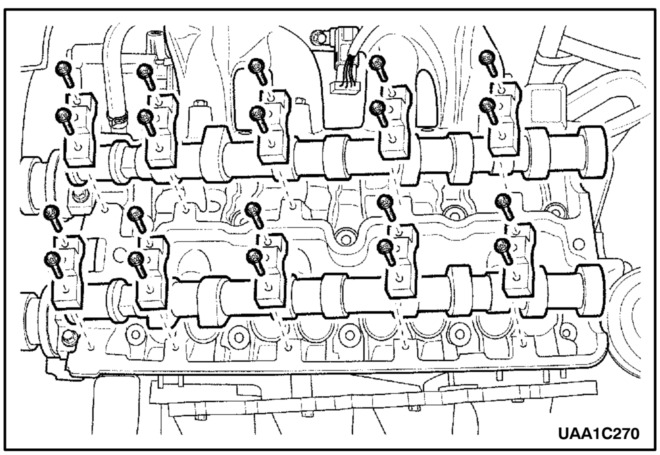
Installation Notice

Tightening Torque	50 N·m (37 lb–ft) +60°+15°

4. Remove the intake camshaft gear.
5. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.

Installation Notice

Tightening Torque	50 N·m (37 lb–ft) +60°+15°

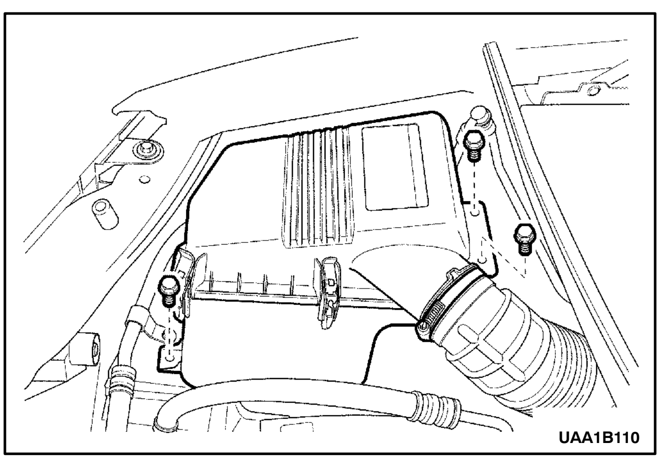


6. Remove the exhaust camshaft gear.
7. Remove the camshaft cap bolts gradually and in the sequence shown for each camshaft cap.

Installation Notice

Tightening Torque	8 N·m (71 lb–in)

8. Remove the intake/exhaust camshaft caps. Maintain the correct positions for installation.
9. Remove the intake/exhaust camshaft.
10. Installation should follow the removal procedure in the reverse order.



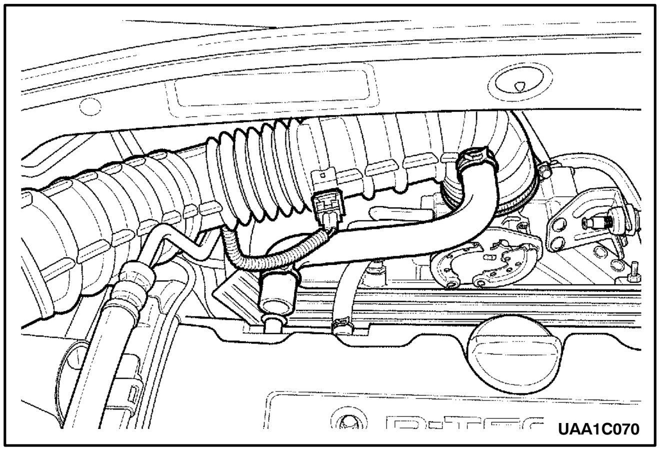
TIMING BELT CHECK AND ADJUST

(Left-Hand Drive Shown, Right-Hand Drive Similar)

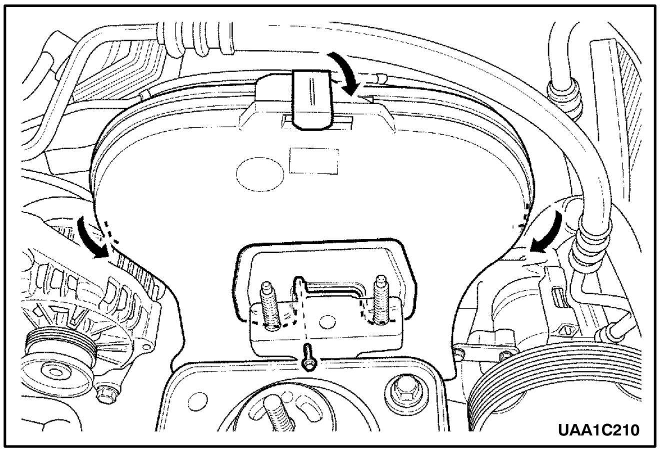
Tools Required

KM–470–B Angular Torque Gauge

1. Disconnect the negative battery cable.
2. Remove the air filter housing bolts.
3. Remove the air filter housing assembly.



4. Disconnect the intake air temperature (IAT) sensor connector.
5. Remove the breather tube from the valve cover.
6. Remove the air intake tube from the throttle body.

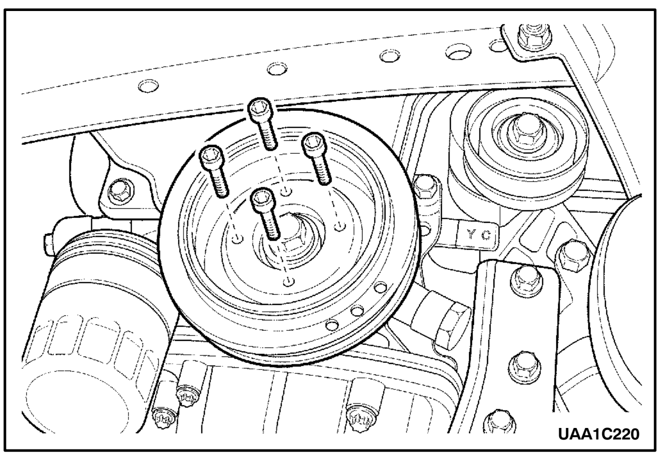


7. Remove the forward engine mount. Refer to *"Forward Engine Mount"* in this section.
8. Disconnect the clips at the upper front timing belt cover.
9. Remove the torque roll axis cover bolt.

Installation Notice

Tightening Torque	6 N·m (53 lb–in)

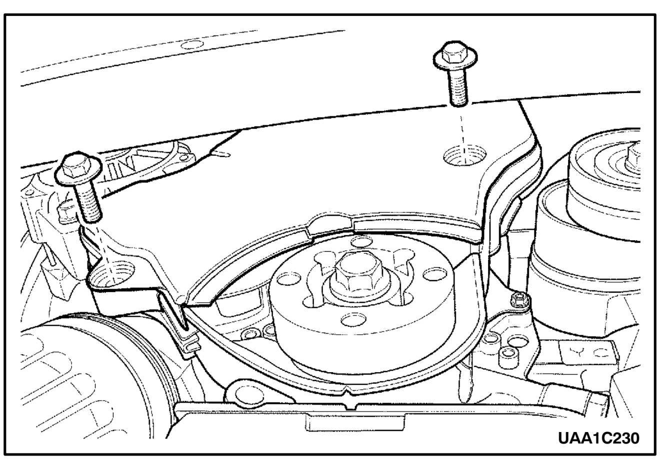
10. Remove the torque roll axis cover.



11. Remove the right front wheel. Refer to *Section 2E, Tires and Wheels.*
12. Remove the right front wheel splash shield. Refer to *Section 9R, Body Front End.*
13. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump.*
14. Remove the crankshaft pulley bolts.
15. Remove the crankshaft pulley.

Installation Notice

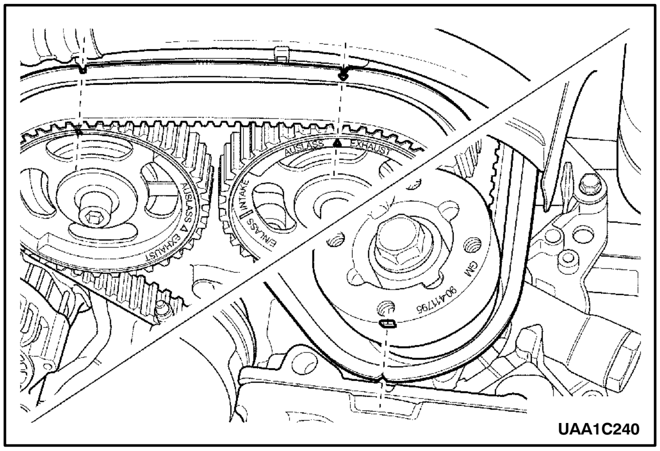
Tightening Torque	20 N·m (15 lb–ft)



16. Remove front timing belt cover bolts.
17. Remove the front timing belt cover.

Installation Notice

Tightening Torque	6 N·m (53 lb–in)



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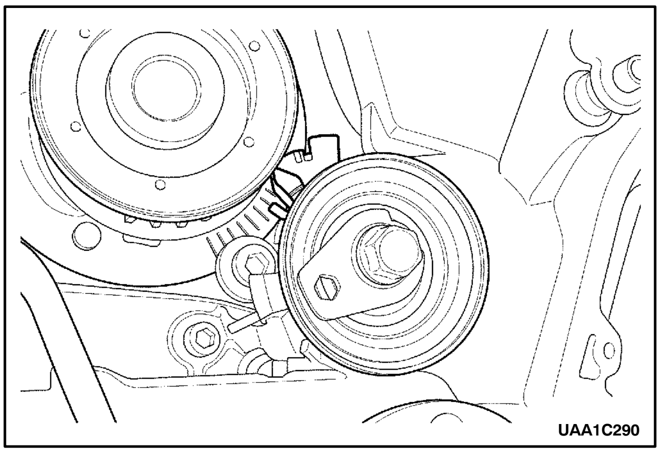
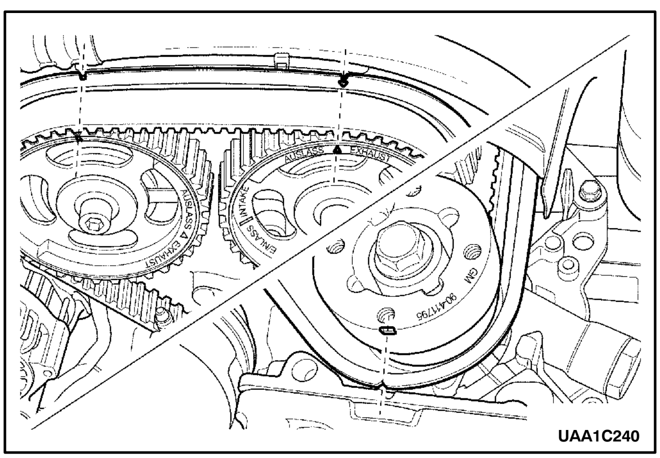
18. Rotate the crankshaft at least one full turn clockwise using the crankshaft gear bolt
19. Align the mark on the crankshaft gear with the notch at the bottom of the rear timing belt cover.
20. Align the camshaft gear timing marks. Use the exhaust gear mark for the exhaust gear and the intake gear mark for the intake gear, since the gears are interchangeable.



UAA1C290

21. Loosen the automatic tentioner bolt. To tighten the belt tension, turn the hex-key tab counterclockwise.
22. Rotate the automatic tensioner hex-key tab clockwise until the adjust arm pointer of the timing belt automatic tensioner is aligned to the notch in the timing belt automatic tensioner bracket.



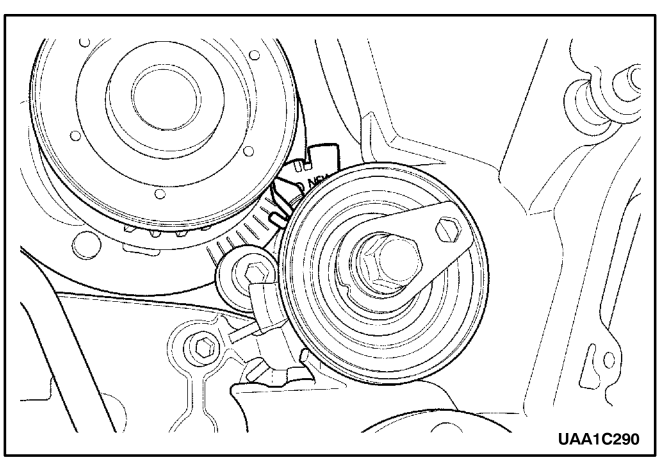
UAA1C240

23. Tighten the automatic tentioner bolt.

Installation Notice

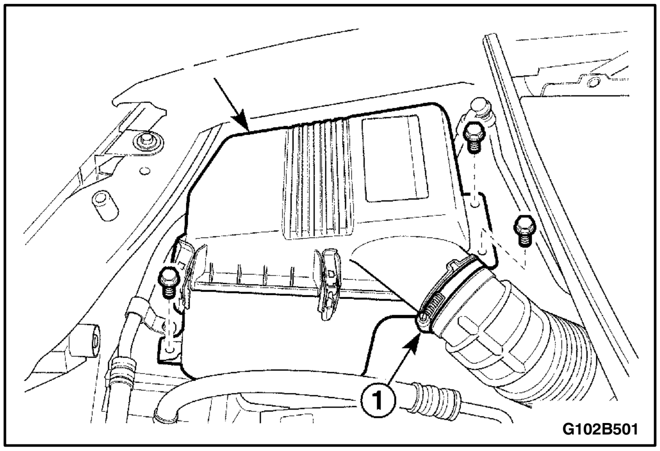
Tightening Torque	25 N·m (18 lb–ft)

24. Rotate the crankshaft two full turns clockwise using the crankshaft gear bolt.
25. Check the automatic tensioner pointer.



UAA1C290

26. When the adjust arm pointer of the timing belt automatic tensioner is aligned with the notch on the timing belt automatic tensioner bracket, the belt is tensioner correctly.
27. Installation should follow the removal procedure in the reverse order.



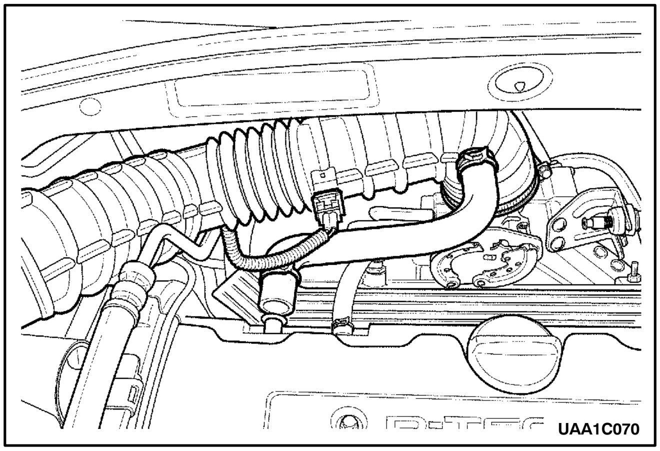
TIMING BELT

(Left-Hand Drive Shown, Right-Hand Drive Similar)

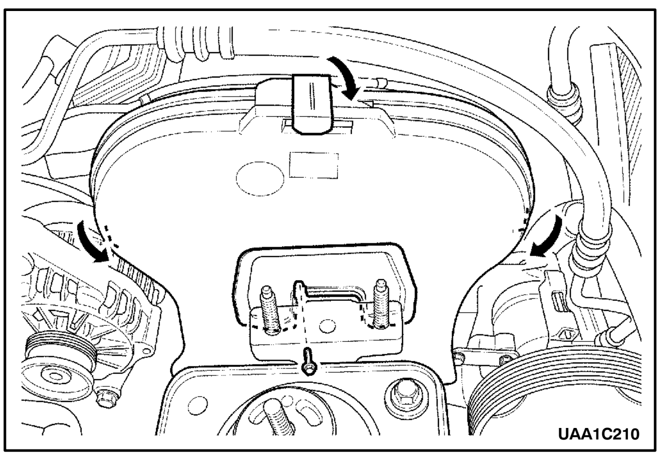
Tools Required

KM–470–B Angular Torque Gauge

1. Disconnect the negative battery cable.
2. Remove the air filter housing bolts.
3. Remove the air filter housing assembly.



4. Disconnect the intake air temperature (IAT) sensor connector.
5. Disconnect the breather hose from the valve cover.
6. Remove the air intake tube from the throttle body.

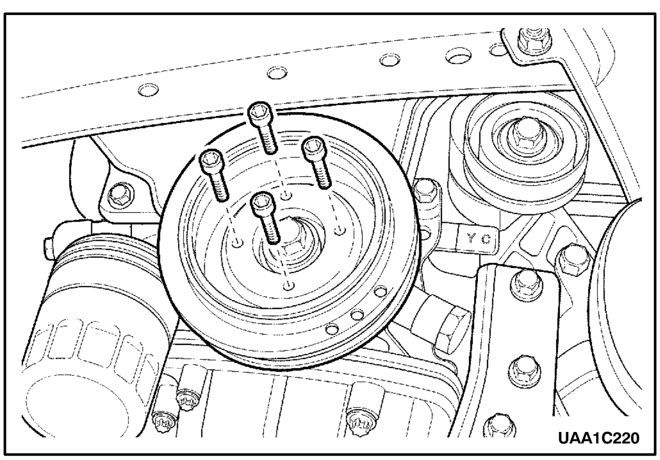


7. Remove the forward engine mount. Refer to *"Forward Engine Mount"* in this section.
8. Disconnect the clips at the upper front timing belt cover.
9. Remove the torque roll axis cover bolt.

Installation Notice

Tightening Torque	6 N·m (53 lb–in)

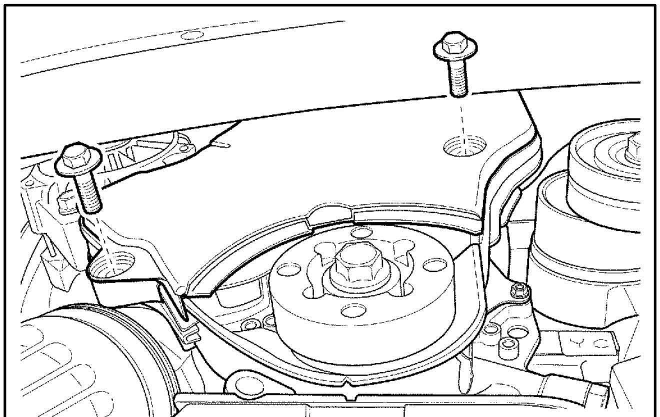
10. Remove the torque roll axis cover.



11. Remove the right front wheel. Refer to *Section 2E, Tires and Wheels.*
18. Remove the right front wheel splash shield. Refer to *Section 9R, Body Front End.*
12. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump.*
13. Remove the crankshaft pulley bolts.
14. Remove the crankshaft pulley.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

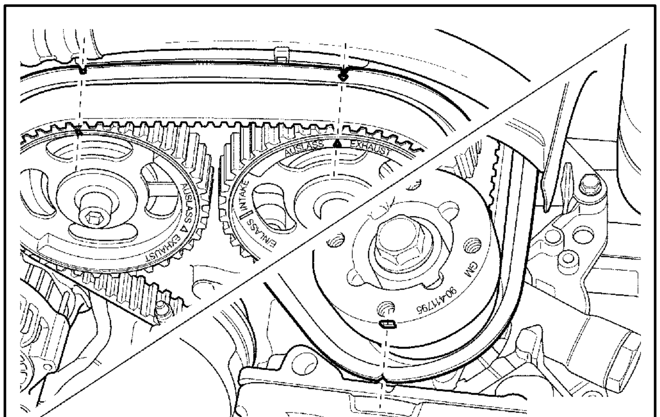


UAA1C230

15. Remove front timing belt cover bolts.
16. Remove the front timing belt cover.

Installation Notice

Tightening Torque	6 N·m (53 lb–in)



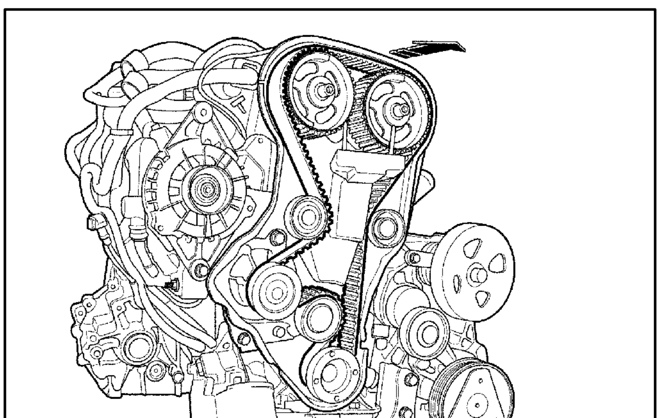
UAA1C240

17. Using the crankshaft pulley bolt, rotate the crankshaft clockwise until the timing mark on the crankshaft gear is aligned with the notch at the bottom of the rear timing belt cover.

Notice: The camshaft gears must align with the notch on the camshaft cover or damage to the engine could result.

18. Align the camshaft gears with the notch on the camshaft cover

Important: Use the intake gear mark for the intake camshaft gear and the exhaust gear mark for the exhaust camshaft gear since both gears are interchangeable.



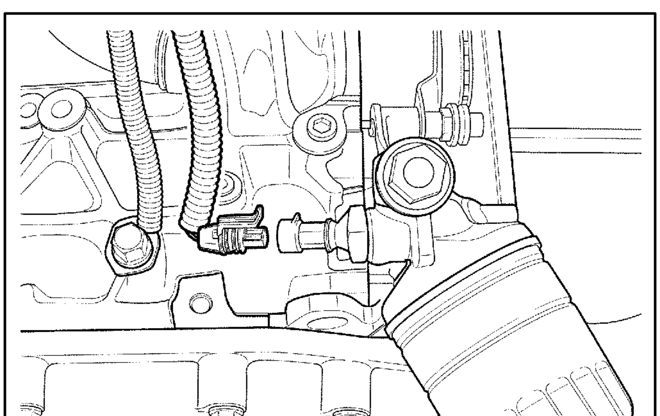
UAA1C310

19. Loosen the automatic tensioner bolt. Turn the hex-key tab to relieve belt tension.

Installation Notice

Tightening Torque	25 N·m (18 lb–ft)

20. Remove the timing belt.
21. Installation should follow the removal procedure in the reverse order.



UAA1C320

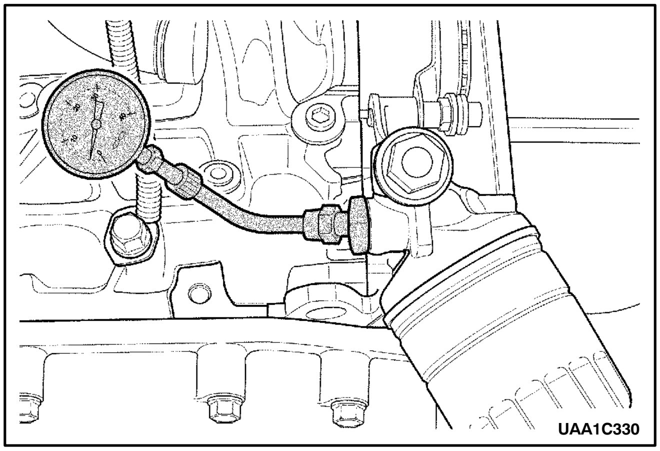
ENGINE OIL PRESSURE INSPECTION PROCEDURE

Tools Required

KM–498–B Pressure Gauge

KM–135 Adapter

1. Remove the front, right-hand wheel well splash shield.
2. Disconnect the oil pressure switch connector.

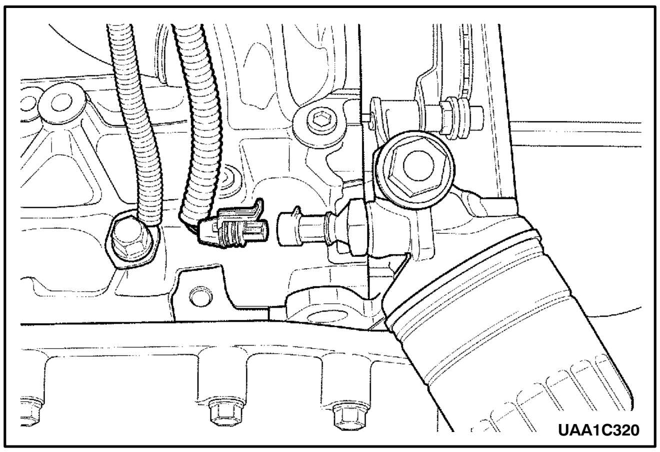


3. Install the adapter KM–135 in place of the oil pressure switch.

Installation Notice

Tightening Torque	40 N·m (30 lb–ft)

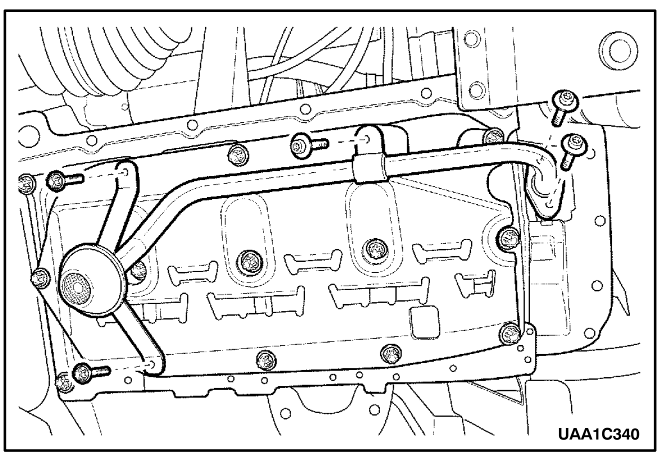
4. Connect the pressure gauge KM–498–B to the adapter
5. Start the engine and check the oil pressure at idle speed and engine temperature of 80°C(176°F). The minimum oil pressure should be 30 kPa (8.88 psi)
6. Turn the engine OFF and remove the oil pressure gauge and adapter.



OIL PUMP

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to *“Timing Belt”* in this section.
3. Remove the rear timing belt cover. Refer to *“Rear Timing Belt Cover”* in this section.
4. Disconnect the oil pressure switch connector.



5. Remove the oil pan. Refer to *“Oil Pan”* in this section.
6. Remove the oil suction pipe bolts on the oil pump.

Installation Notice

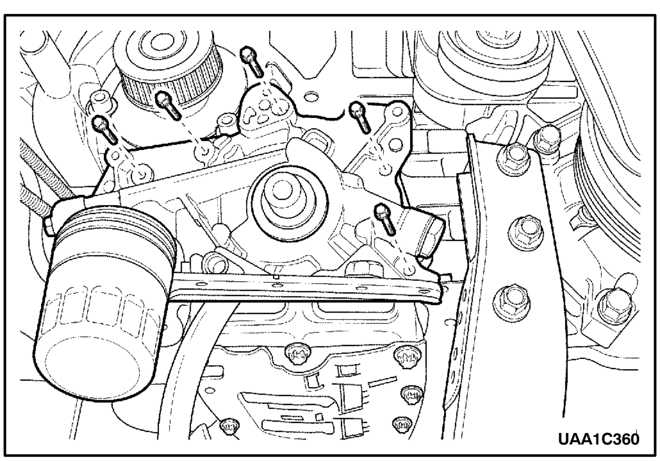
Tightening Torque	8 N·m (71 lb–in)

7. Remove the oil suction pipe support bracket bolts.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft) +45°

8. Remove the oil suction pipe.



9. Remove the oil pump retaining bolts.

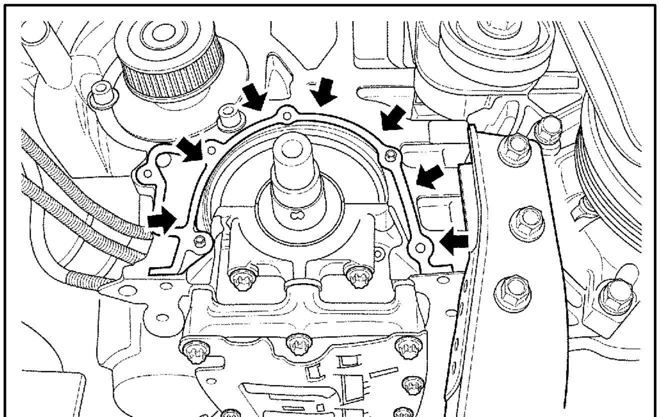
Installation Notice

Tightening Torque	10 N·m (89 lb–in)

10. Carefully separate the oil pump and gasket from the engine block and the oil pan.

Notice: Apply Loctite® 242 to the oil pump bolts and room temperature vulcanizing (RTV) sealant to the new oil pump gasket.

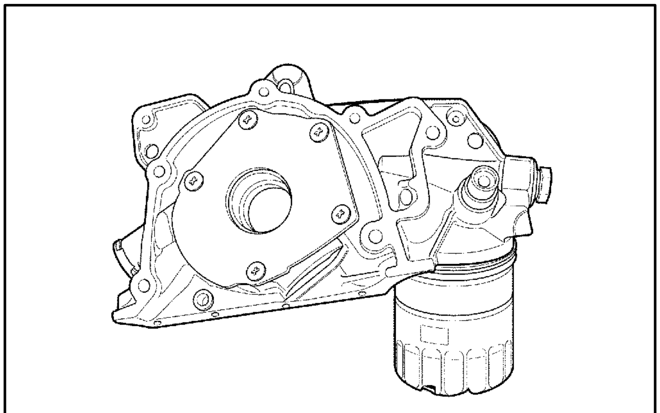
11. Remove the oil pump.



UAA1C370

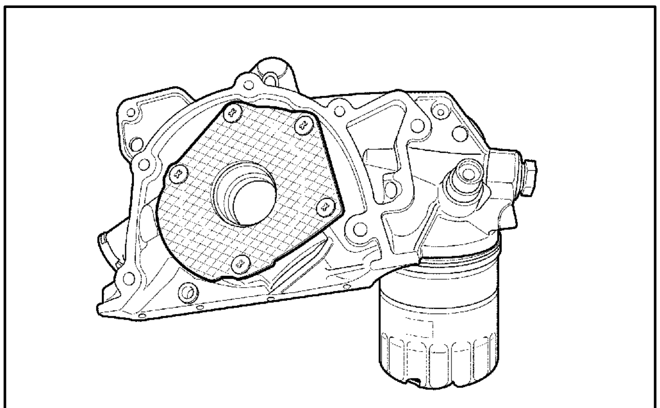
Inspection Procedure

1. Clean the oil pump and the engine block gasket mating surfaces.
2. Remove the safety relief valve bolt.
3. Remove the safety relief valve and the spring.
4. Remove the oil pump-to-crankshaft seal.



UAA1C380

5. Remove the oil pump rear cover screws.
6. Remove the rear cover.



UAA1C390

7. Clean the oil pump housing and all of the parts of the oil pump housing.
8. Inspect all of the parts for signs of wear. Refer to *"Engine Specifications"* in this section.
9. Coat all of the oil pump parts with clean engine and reinstall them.

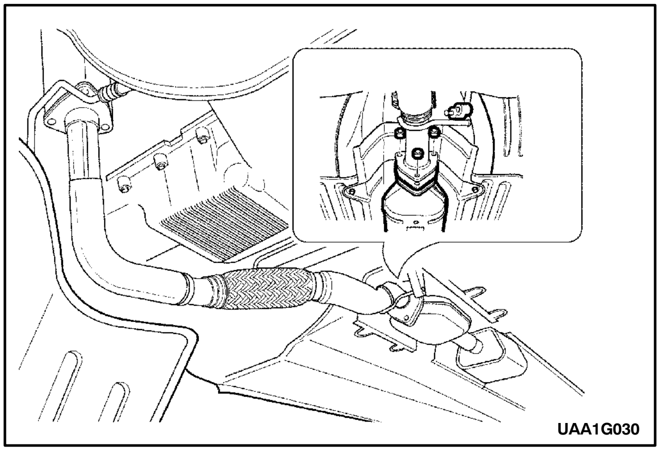
Notice: Pack the oil pump gear cavity with petroleum jelly to ensure an oil pump prime, or engine damage could result.

10. Apply Loctite® 242 to the rear cover bolts and install the rear oil pump cover with the bolts.
11. Install the safety relief valve, the spring, the washer, and the bolt.

Installation Notice

Tightening Torque	30 N·m (22 lb–ft)

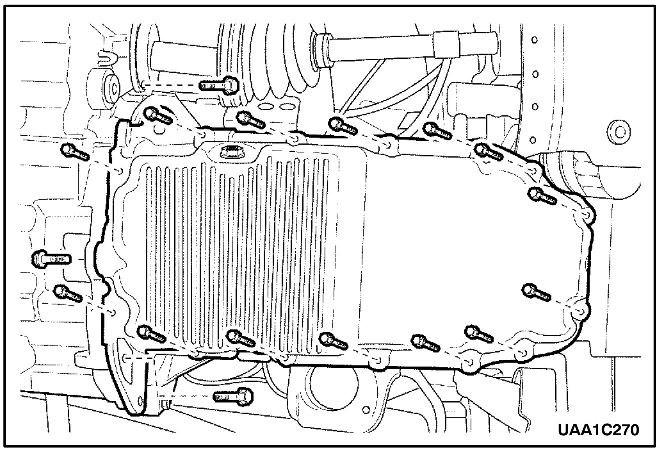
12. Installation should follow the removal procedure in the reverse order.



OIL PAN

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the right front wheel. Refer to *Section 2E, Tires and Wheels.*
3. Remove the right front wheel well splash shield.
4. Drain the engine oil from the engine crankcase.
5. Remove the exhaust front pipe. Refer to *Section 1G, Engine Exhaust.*



6. Remove the reaction lower rod. Refer to *“Reaction Lower Rod”* in this section.
7. Remove the oil pan-to-transaxle housing retaining bolts.

Installation Notice

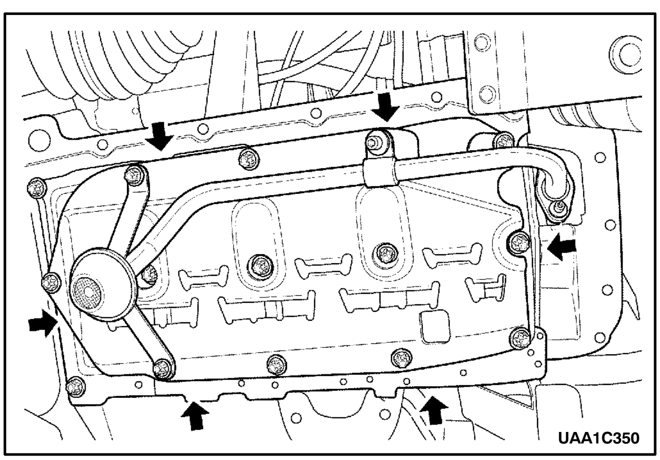
Tightening Torque	75 N·m (55 lb–ft)

8. Remove the oil pan retaining bolts.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

9. Remove the oil pan from the engine block.
10. Remove the oil pan gasket from the oil pan.
11. Installation should follow the removal procedure in the reverse order.



Cleaning Procedure

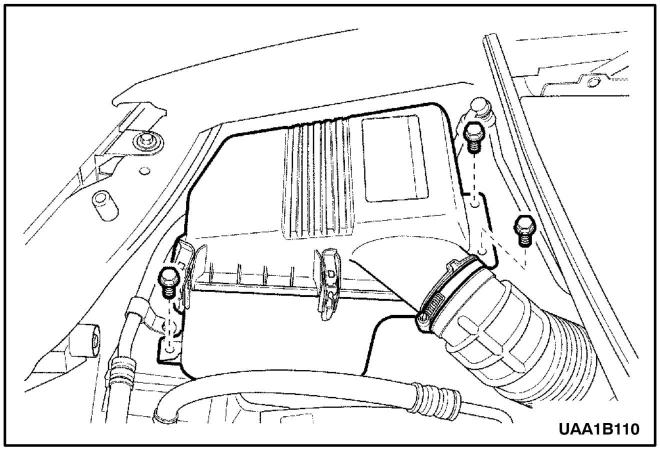
1. Clean the oil pan sealing surface.
2. Clean the engine block sealing surface.
3. Clean the oil pan retaining bolts.
4. Clean the oil pan attaching bolt holes in the engine block.

ENGINE MOUNT, RIGHT SIDE

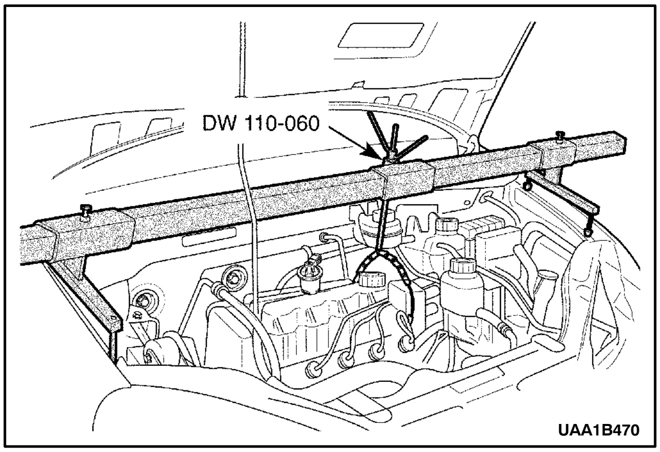
Tools Required

DW110–060 Engine Assembly Support Fixture

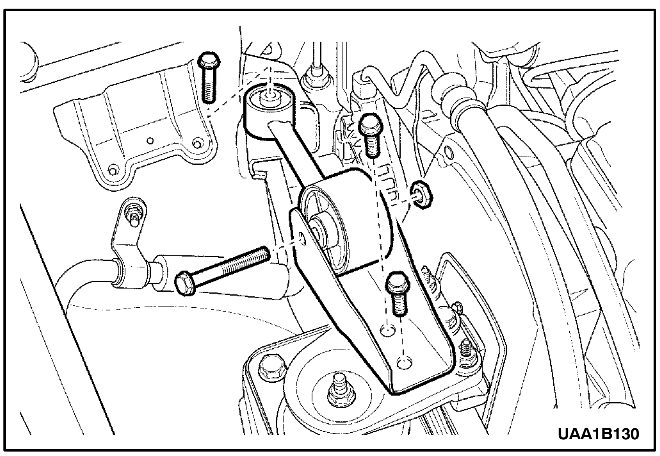
Removal and Installation Procedure



1. Remove the air filter housing bolts.
2. Remove the air filter housing assembly.



3. Support the engine assembly using the engine assembly support fixture DW110–160.

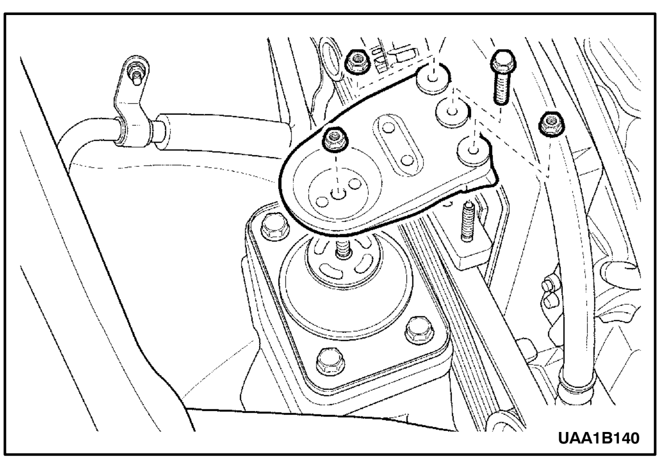


4. Remove the reaction upper rod and the reaction upper rod bracket bolts.

Installation Notice

Tightening Torque	75 N·m (55 lb–ft)

5. Remove the reaction upper rod and the reaction upper rod bracket.

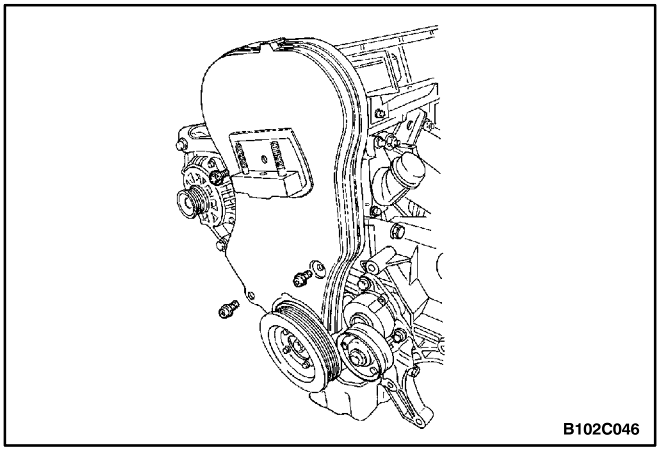


6. Remove the engine mount bracket retaining bolt/nuts.

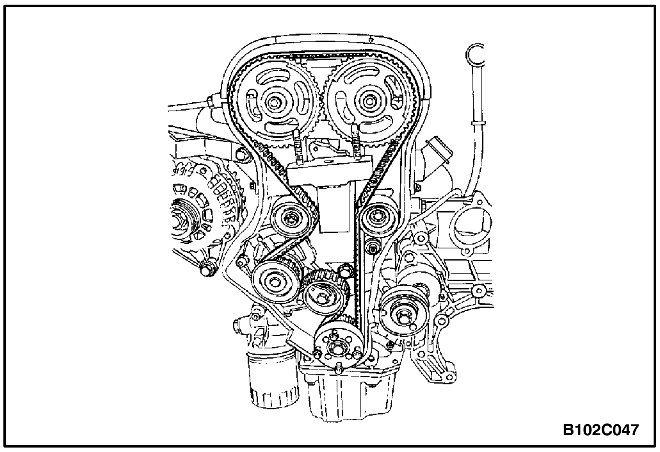
Installation Notice

Tightening Torque	60 N·m (44 lb–ft)

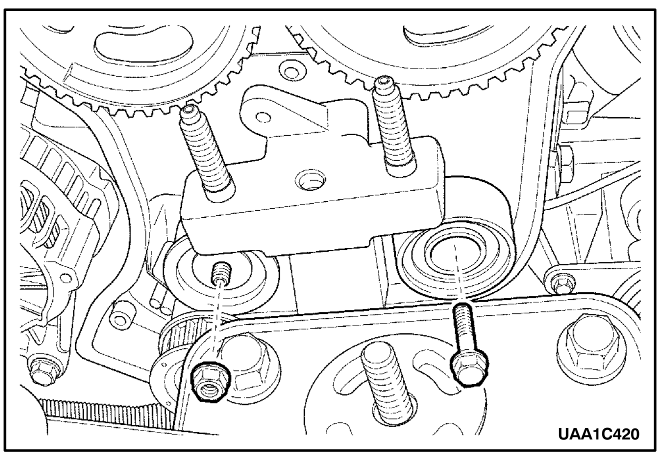
1. Remove the engine mount bracket.



2. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*
3. Remove the front timing belt cover bolts and the front timing belt cover.



4. Align the crankshaft pulley timing mark with the pointer, and the camshaft gears with the timing marks on the rear cover, by turning the crankshaft gear bolt.
5. Loosen the timing belt automatic tensioner bolt.
6. Turn the hex-key tab to relieve belt tension.
7. Remove the timing belt.

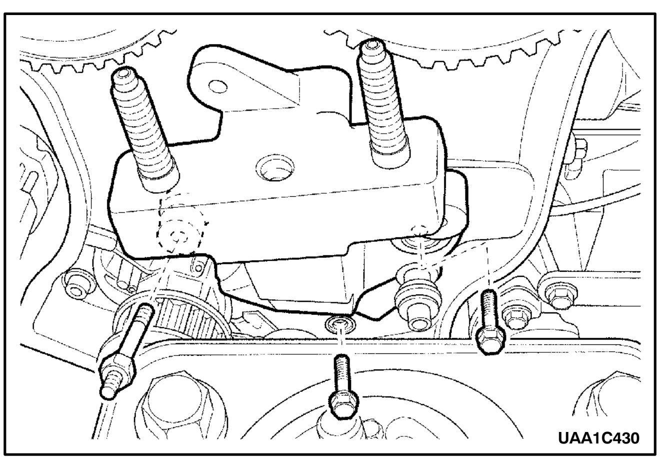


8. Remove the timing belt idler pulley bolt/nut.

Installation Notice

Tightening Torque	25 N·m (18 lb–ft)

9. Remove the timing belt idler pulleys.



10. Remove the engine mount retaining bolts.
11. Remove the engine mount.

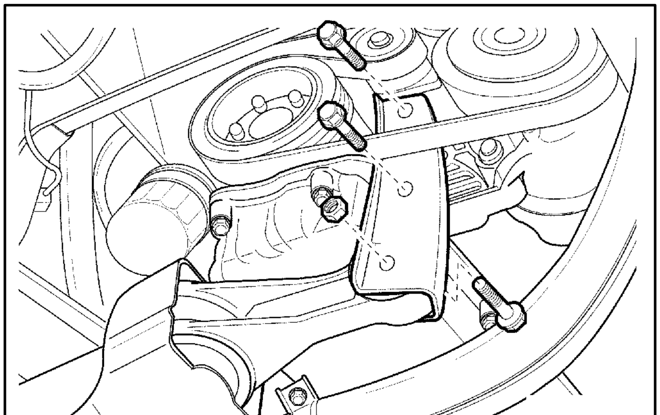
Installation Notice

Tightening Torque	55 N·m (44 lb–ft)

12. Installation should follow the removal procedure in the reverse order.

REACTION LOWER ROD

Removal and Installation Procedure

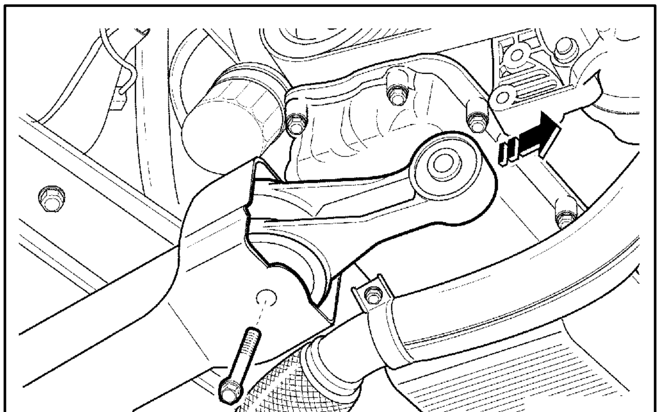


UAA1B150

1. Raise and suitably support the vehicle.
2. Remove the front fascia splash shield and engine under cover. Refer to *Section 9N, Frame and Underbody.*
3. Remove the reaction lower rod bracket bolt/nut.
4. Remove the reaction lower rod bracket.

Installation Notice

Tightening Torque	69 N·m (49 lb–ft)



UAA1B160

5. Remove the reaction lower rod mount bolt.
6. Remove the reaction lower rod mount.

Installation Notice

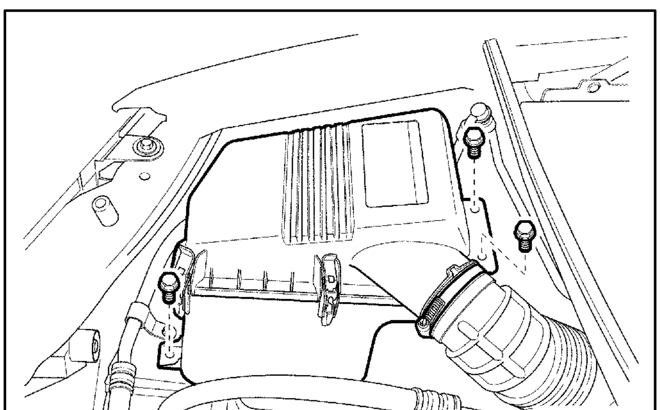
Tightening Torque	55 N·m (41 lb–ft)

7. Installation should follow the removal procedure in the reverse order.

INTAKE MAINFOLD

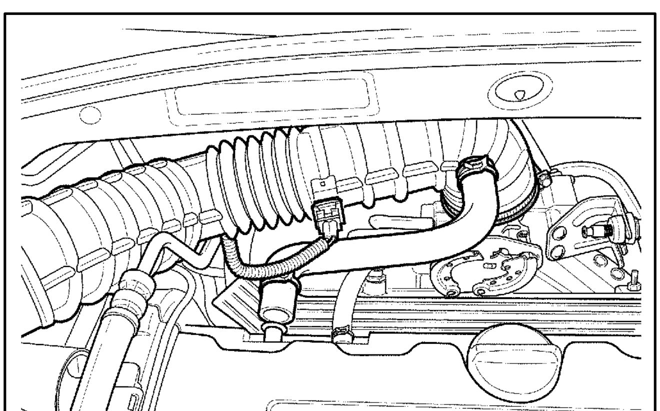
(Left Hand Drive Shown, Right Hand Drive Similar)

Removal and Installation Procedure



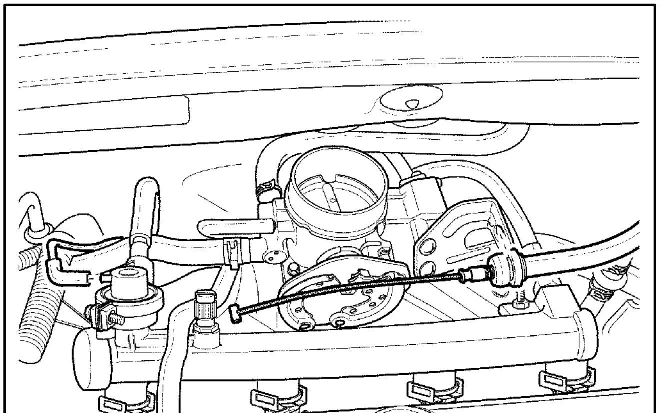
UAA1B110

1. Remove the fuel pump fuse.
2. Start the engine. Crank the engine after it stalls for 10 seconds to rid the fuel system of fuel pressure.
3. Disconnect the negative battery cable.
4. Remove the air filter housing bolts.
5. Remove the air filter housing assembly.

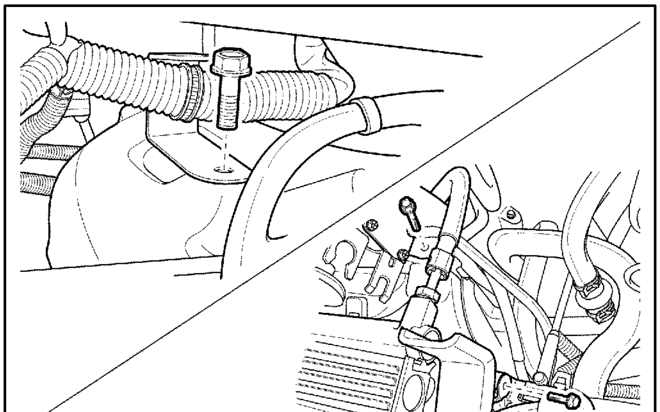


UAA1C070

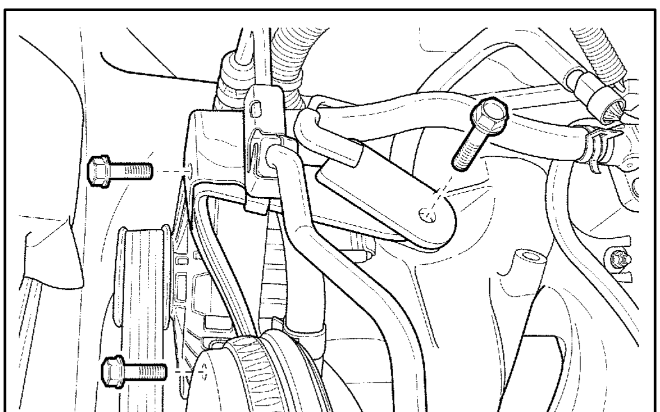
6. Disconnect the manifold air temperature (MAT) sensor connector.
7. Disconnect the breather hose from the valve cover.
8. Remove the air intake tube from the throttle body.


UAA1C100

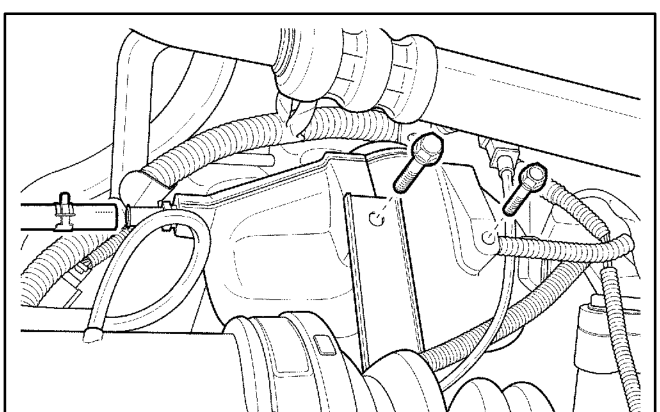
9. Disconnect the throttle cable from the throttle body and the intake manifold.
10. Disconnect the vacuum hose at the fuel pressure regulator.


UAA1C130

11. Remove the fuel injector rail and fuel injectors as an assembly. Refer to *Section 1F, Engine Controls.*
12. Remove the engine harness wire bracket bolts from the rear of the intake manifold.
13. Remove the evaporative (EAP) emission canister purge solenoid bracket bolt and reposition the canister purge solenoid clear of the repair area.


UAA1C140

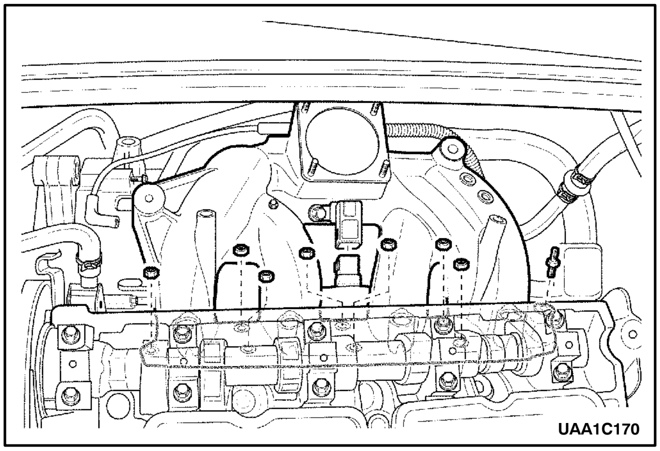
14. Remove the alternator upper bracket bolts.
15. Remove the alternator upper bracket.


UAA1C150

16. Disconnect the brake vacuum hose from the intake manifold.
17. Remove the ECM ground terminal bolt from the intake manifold.
18. Remove the intake manifold support bracket upper bolt to the intake manifold.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)



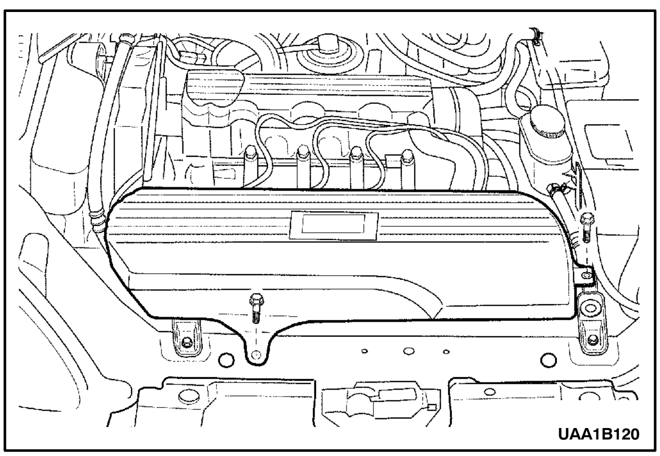
UAA1C170

19. Remove the throttle body assembly. Refer to Section 1F, Engine Controls.
20. Remove the valve cover. Refer to "*Valve Cover*" in this section.
21. Remove the intake manifold retaining bolt/nuts in the sequence shown.

Installation Notice

Tightening Torque	22 N·m (16 lb–ft)

22. Remove the intake manifold gasket.
23. Clean the sealing surfaces of the intake manifold and the cylinder head.
24. Installation should follow the removal procedure in the reverse order.

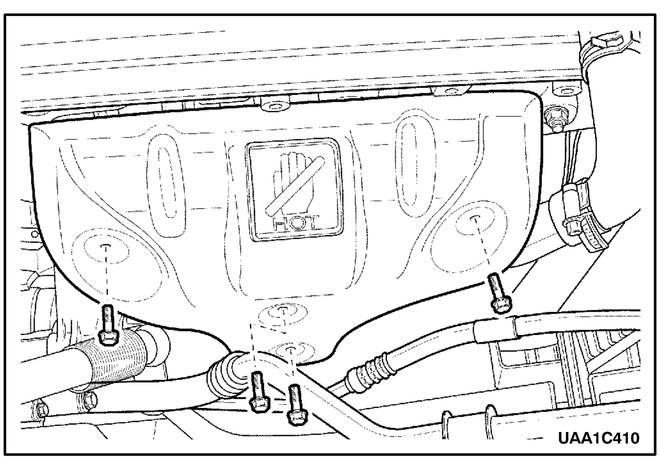


UAA1B120

EXHAUST MANIFOLD

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the air inlet duct bolts.
3. Remove the air inlet duct assembly.

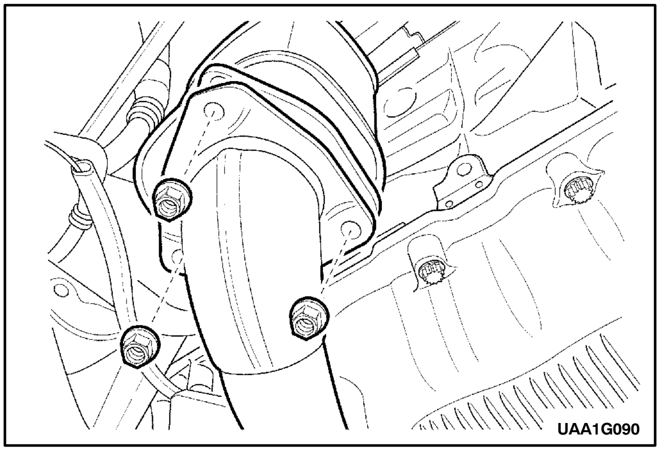


UAA1C410

4. Disconnect the oxygen sensor connector.
5. Remove the exhaust manifold heat shield bolts.
6. Remove the exhaust manifold heat shield.

Installation Notice

Tightening Torque	15 N·m (11 lb–ft)

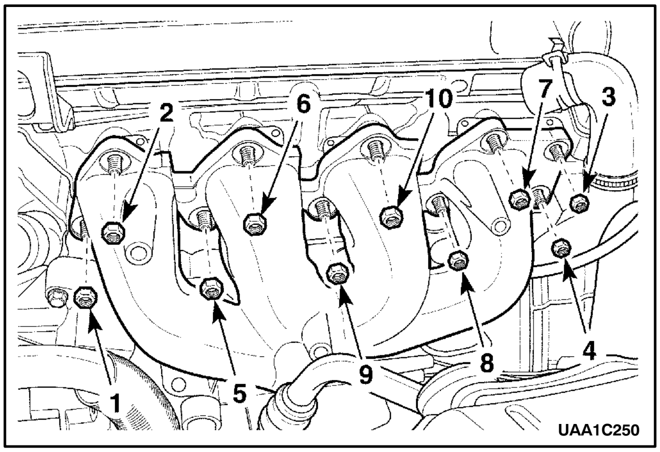


7. Remove the exhaust flex pipe retaining nuts from the exhaust manifold studs.

Installation Notice

Tightening Torque	35 N·m (26 lb–ft)

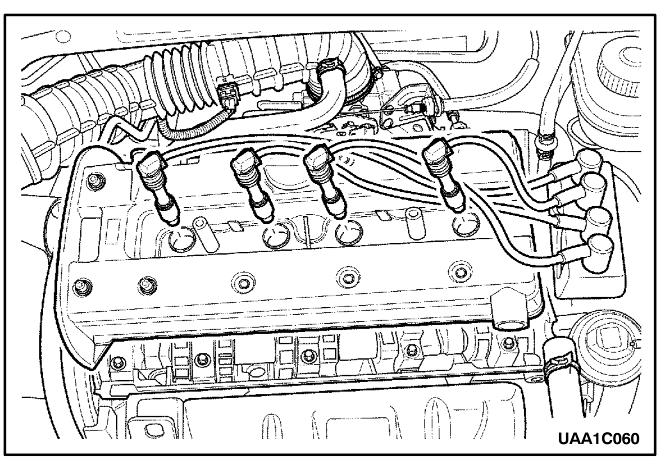
8. Remove the oxygen sensor.



9. Remove the exhaust manifold retaining nuts in the sequence shown.
10. Remove the exhaust manifold and exhaust manifold gasket
11. Clean the sealing surfaces of the exhaust manifold and the cylinder head.

Installation Notice

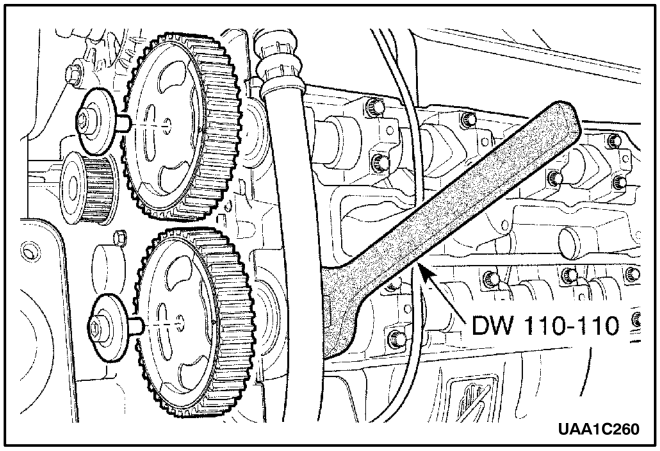
Tightening Torque	1st stage:	13 N·m (10 lb–ft): 9,10,6,5,8,7,2,1,3,4
	2st stage:	13 N·m (10 lb–ft): 9,10,6,5,8,7,2,1,3,4
	3rd stage:	15 N·m (11 lb–ft): 9,10,6,5,8,7,2,1,3,4
	4th stage:	15 N·m (11 lb–ft): 9,10,6,5,8,7,2,1,3,4,9,10,6



CAMSHAFT GEARS

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to *“Timing Belt”* in this section.
3. Remove the valve cover. Refer to *“Valve Cover”* in this section.



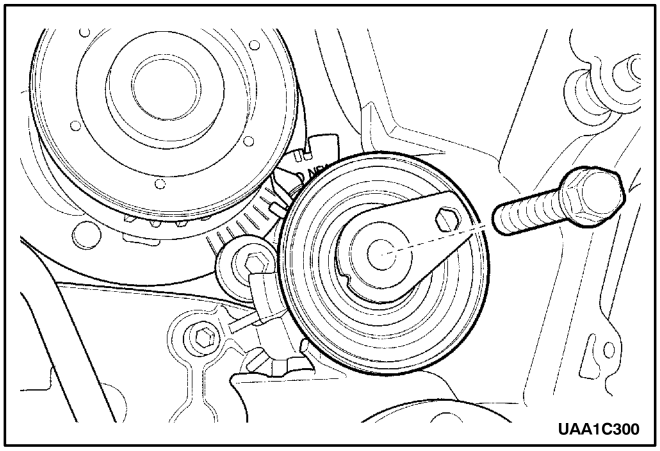
Notice: Take extreme care to prevent any scratches, nicks or damage to the camshaft. Such damage can cause premature engine wear.

4. While holding the camshaft firmly in place, remove the camshaft gear retaining bolt.

Installation Notice

Tightening Torque	50 N·m (37 lb–ft) +60°+15°

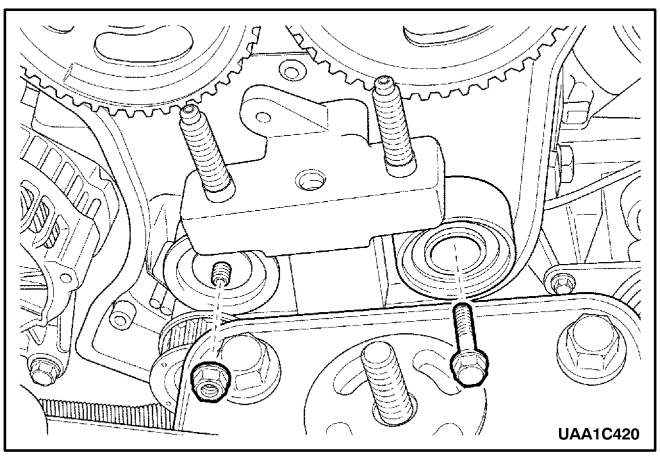
5. Remove the camshaft gear.
6. Installation should follow the removal procedure in the reverse order.



REAR TIMING BELT COVER

Removal and Installation Procedure

1. Remove the timing belt. Refer to *"Timing Belt"* in this section.
2. Remove the camshaft gear. Refer to *"Camshaft Gear"* in this section.
3. Remove the timing belt automatic tensioner bolt.
4. Remove the timing belt automatic tensioner.

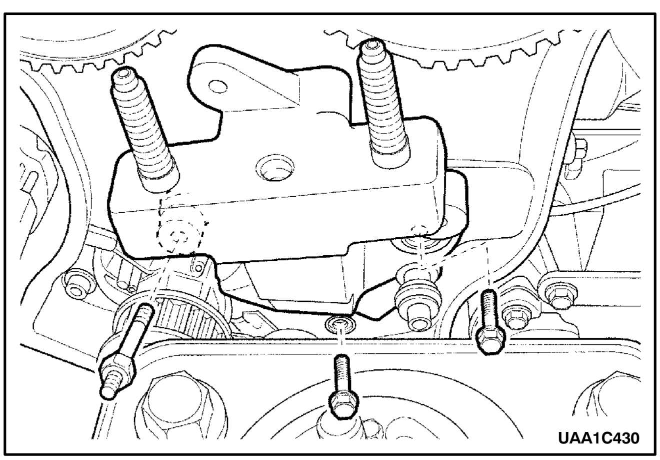


5. Remove the timing belt idler pulley bolt/nut.

Installation Notice

Tightening Torque	25 N·m (18 lb–ft)

6. Remove the timing belt idler pulleys.

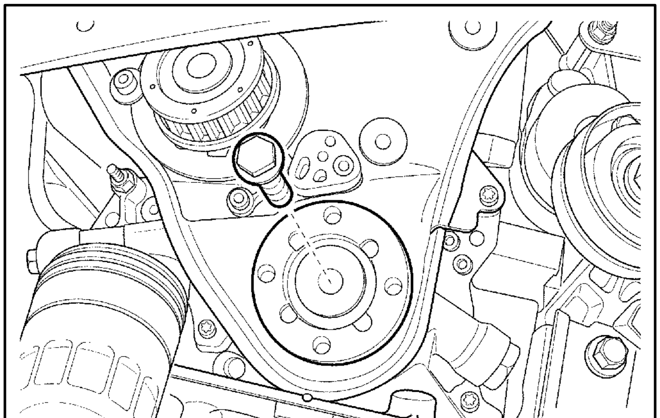


7. Remove the engine mount retaining bolts

Installation Notice

Tightening Torque	55 N·m (41 lb–ft)

8. Remove the engine mount.



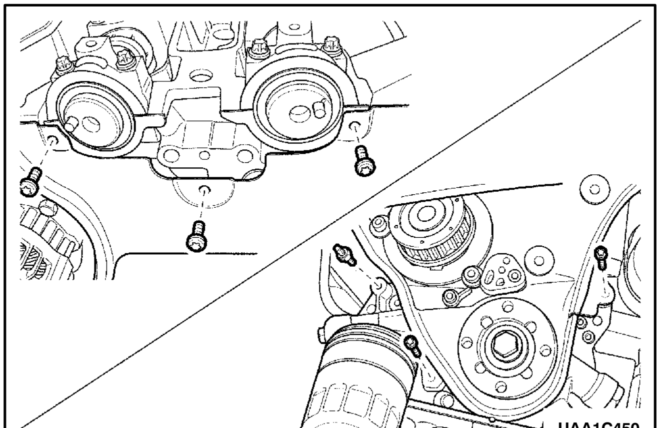
UAA1C440

9. Remove the crankshaft timing belt gear bolt.

Installation Notice

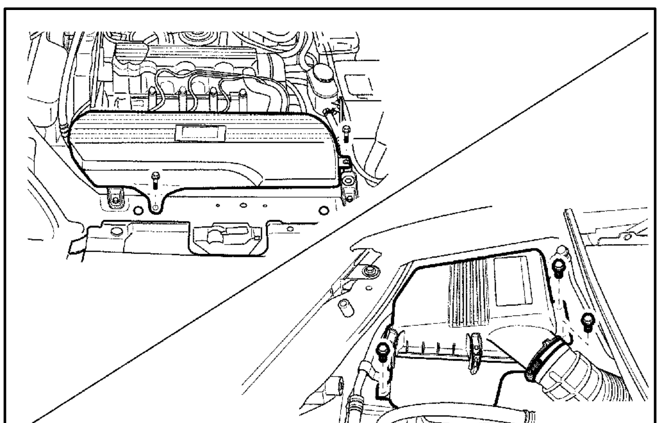
Tightening Torque	130 N·m (96 lb–ft) +45°+5°

10. Remove the crankshaft timing belt gear.



UAA1C450

11. Remove the rear timing belt cover screws/bolt.
12. Remove the rear timing belt cover.
13. Installation should follow the removal procedure in the reverse order.



UAA1B060

ENGINE

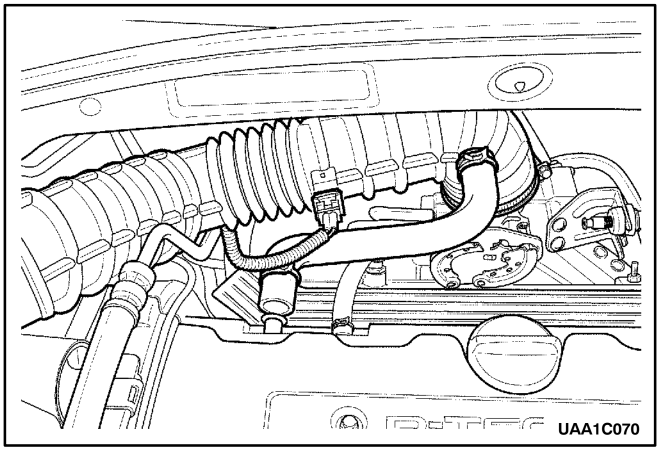
Tools Required

KM–470–B Angular Torque Gauge

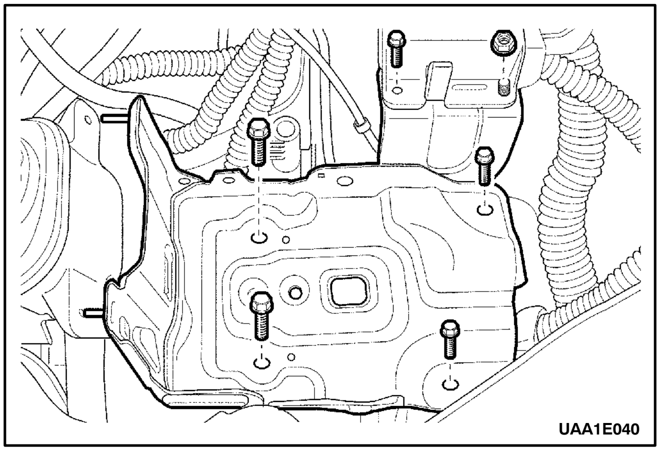
Removal and Installation Procedure

Important: On vehicles equipped with manual transaxle, the manual transaxle must be removed before the engine is removed. Refer to *Section 5B, Manual Transaxle.*

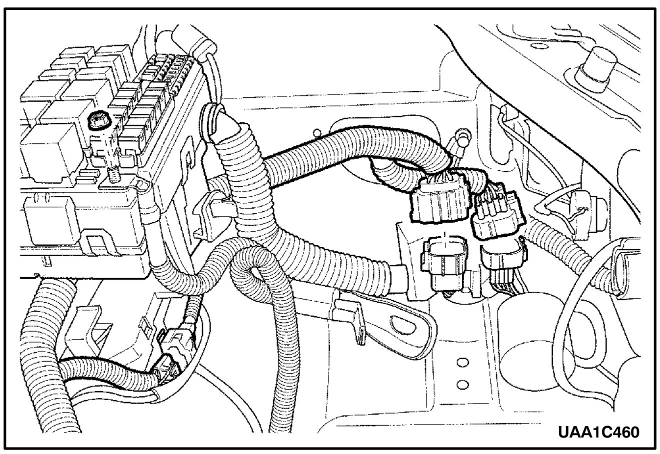
1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine after it stalls for 10 seconds to rid the fuel system of fuel pressure.
3. Remove the air filter bolts and the air filter assembly.
4. Remove the air inlet duct bolts the air inlet duct.



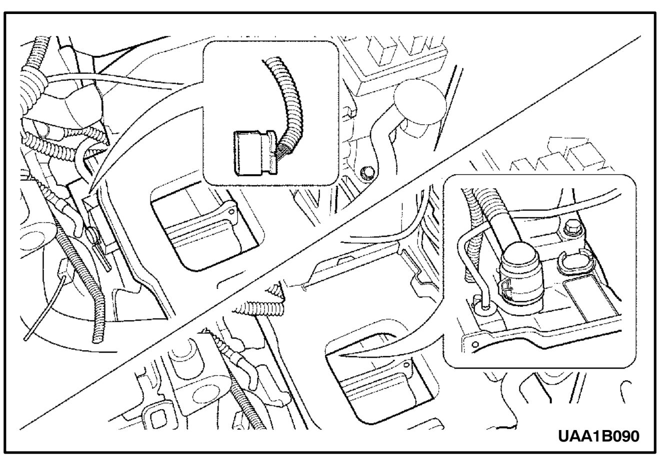
5. Disconnect the manifold intake temperature (IAT) sensor connector.
6. Disconnect the breather hose from the valve cover.
7. Disconnect the air intake tube from the throttle body.



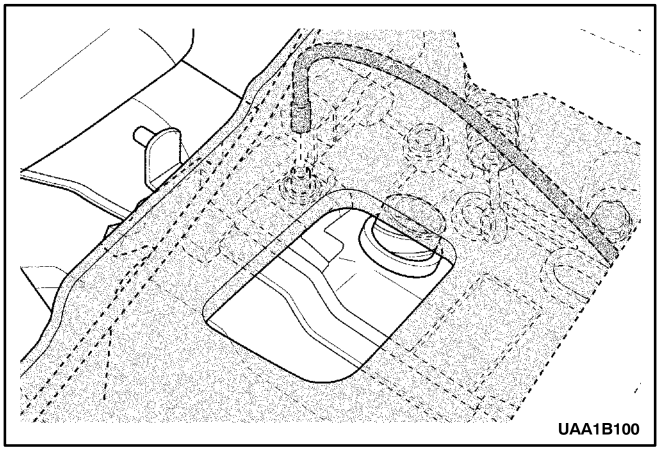
8. Drain the engine coolant. Refer to *Section 1D, Engine Cooling.*
9. Discharge the air conditioning system, if equipped. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System.*
10. Remove the battery and battery tray. Refer to *Section 1E, Battery and Battery Tray.*



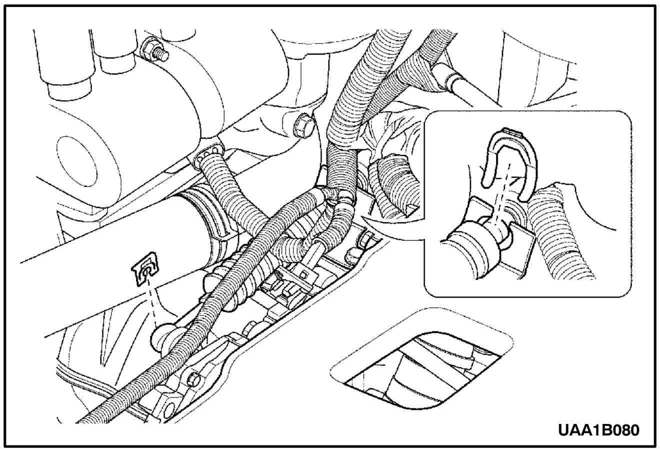
11. Remove the fuse box cover.
12. Remove the battery lead nut at the fuse box.
13. Disconnect the battery lead at the fuse box.
14. Disconnect the engine wiring harness connectors.



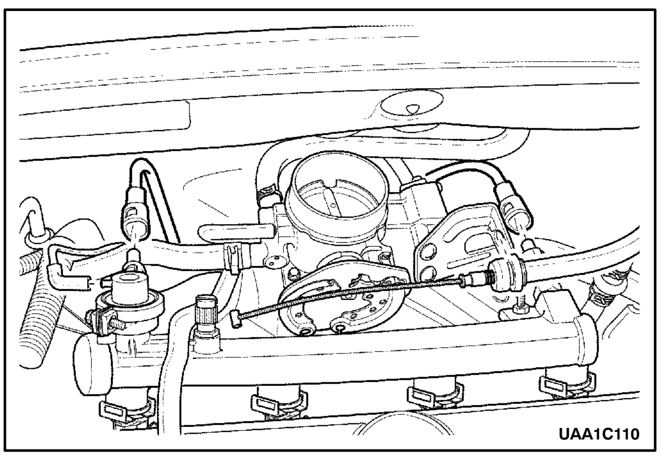
15. Remove the surge tank. Refer to *Section 1D, Engine Coolant.*
16. Disconnect the transaxle wiring harness connector from the transaxle case.
17. Disconnect the P/N switch connector from the transaxle case.



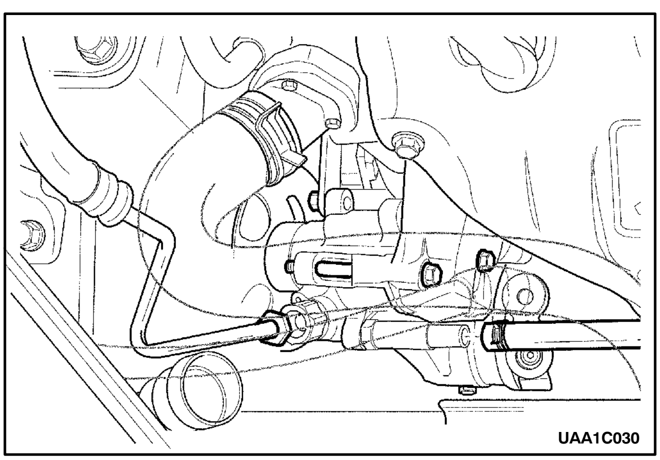
18. Disconnect the air breather hose from the transaxle case.



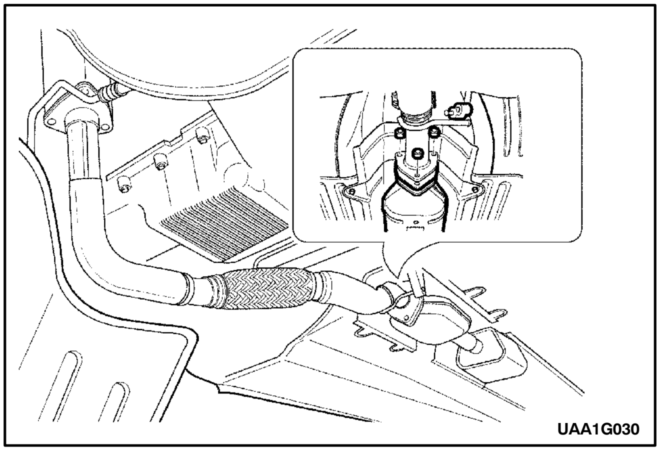
19. Remove the clip from the selector lever connection on the transaxle case and disconnect the shift control cable from the selector lever connection.
20. Remove the clip from the shift control cable at the transaxle mount connection.
21. Disconnect the shift control cable from the transaxle mount.



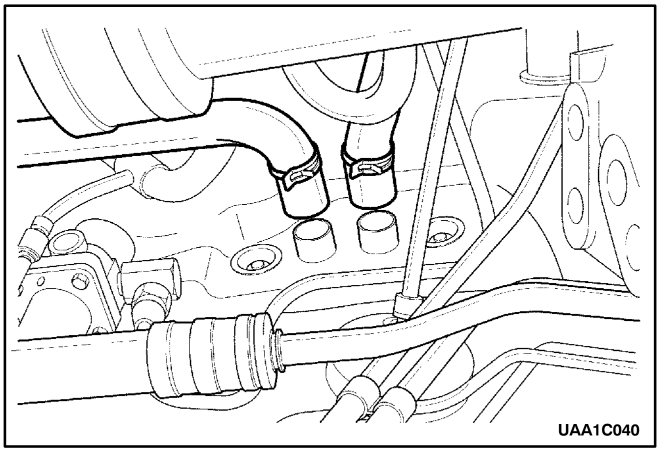
22. Disconnect the breather hose at the valve cover.
23. Disconnect the throttle cable at the throttle body and the intake manifold.
24. Disconnect the fuel feed line at the fuel rail.
25. Disconnect the fuel return line at the fuel pressure regulator.



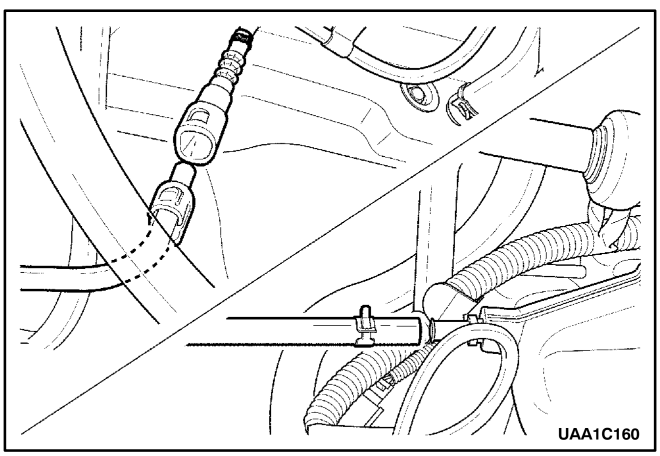
26. Disconnect the upper radiator hose at the thermostat housing.
27. Disconnect the power steering pressure hose and the power steering suction hose from the power steering pump. Refer to *Section 6A, "Power Steering System".*
28. Disconnect the A/C compressor hose assembly and the connector from the compressor. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System.*



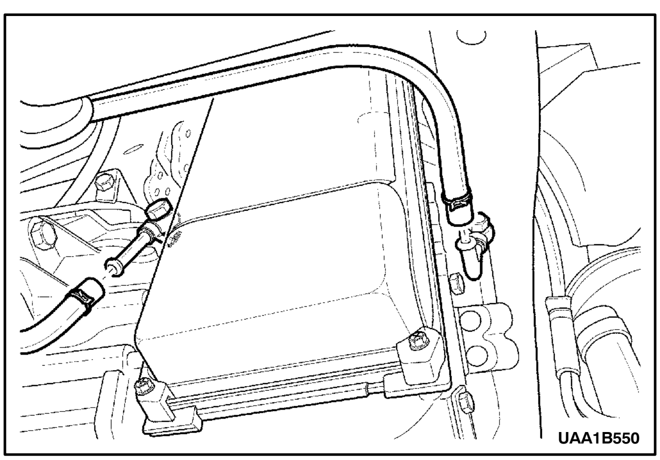
29. Remove the front wheel. Refer to *Section 2E, Tires and Wheels.*
30. Remove the front wheel well splash shield. Refer to *Section 9R, Body Font End.*
31. Remove the front exhaust pipe. Refer to *Section 1G, Engine Exhaust.*



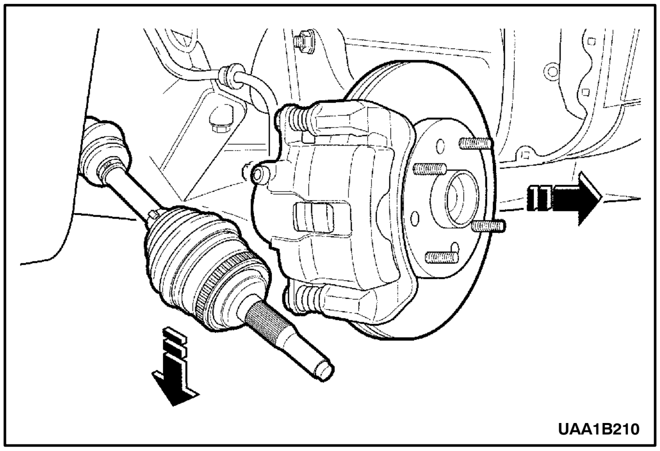
32. Disconnect the heater inlet hose at the heater core.
33. Disconnect the heater outer hose at the heater core.



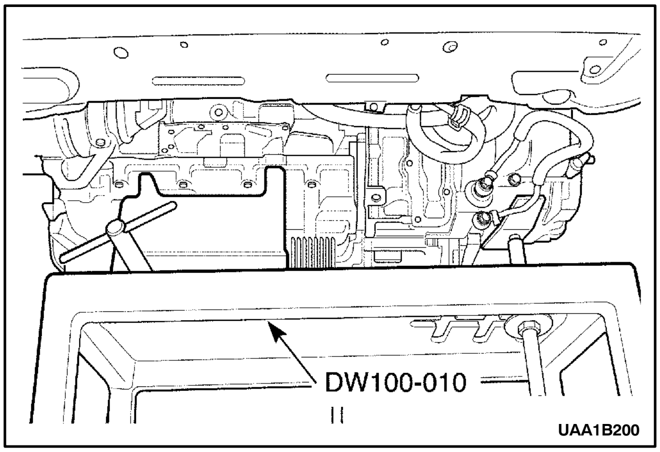
34. Disconnect the vacuum line from the charcoal canister purge solenoid.
35. Disconnect the brake vacuum hose at the intake manifold.



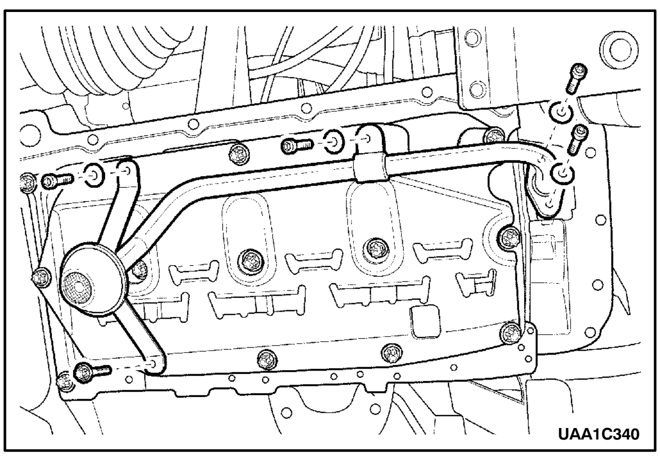
36. Disconnect the A/C compressor connector at the A/C compressor coil.
37. Disconnect the lower radiator hose at the coolant pipe.
38. Disconnect the fluid cooler inlet hose from the transaxle.
39. Disconnect the fluid cooler outlet hose from the transaxle.



40. Remove the right side engine mount and forward engine mount. Refer to *“Forward Engine Mount”* in this section.
41. Remove the cross member. Refer to *Section 2C, Front Suspension.*
42. Disconnect the drive axle assembly from the transaxle.



43. Using the power pack stand DW110–010, support the engine and transaxle.
44. Remove the right side engine mount. Refer to *“Right Side Engine Mount”* in this section.
45. Remove the transaxle mount. Refer to *Section 5A, “Automatic Transaxle”.*
46. Slowly lift the vehicle.
47. Disconnect the engine assembly from the transaxle assembly. Refer to *Section 5A, “Automatic Transaxle”.*
48. Installation should follow the removal procedure in the reverse order.



PISTONS AND CONNECTING RODS

Tools Required

J–8037 Universal Piston Ring Compressor

J–8087 Cylinder Bore Check Gauge

KM–427 Piston Pin Service Set

KM 470–B Angular Torque Gauge

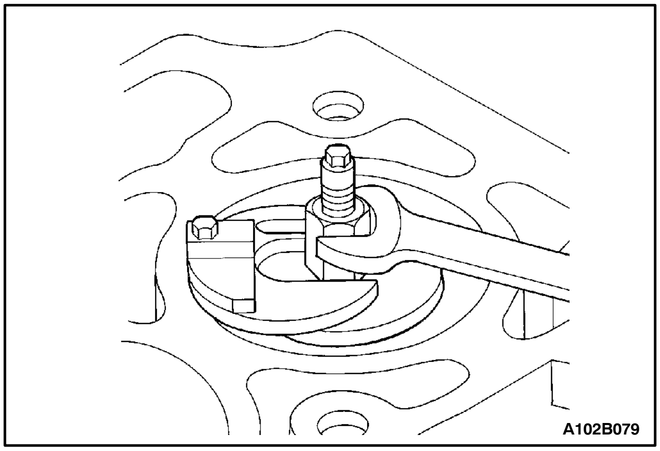
Removal and Installation Procedure

1. Remove the cylinder head with the intake manifold and exhaust manifold attached. Refer to *“Cylinder Head and Gasket”* in thins section.
2. Remove the oil pan. Refer to *“Oil Pan”* in this section.
3. Remove the oil suction pipe bolts and support bracket bolts.
4. Remove the oil suction pipe.
5. Remove the engine block lower support and the splash shield bolts.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

6. Remove the engine block lower support and the splash shield.

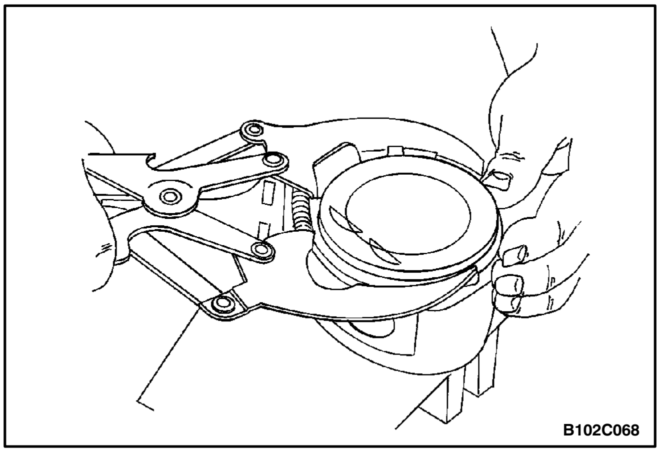


7. Move the piston to the bottom of the piston stroke.
8. Mark the connecting rod cap for position.
9. Remove the connecting rod cap bolts.

Installation Notice

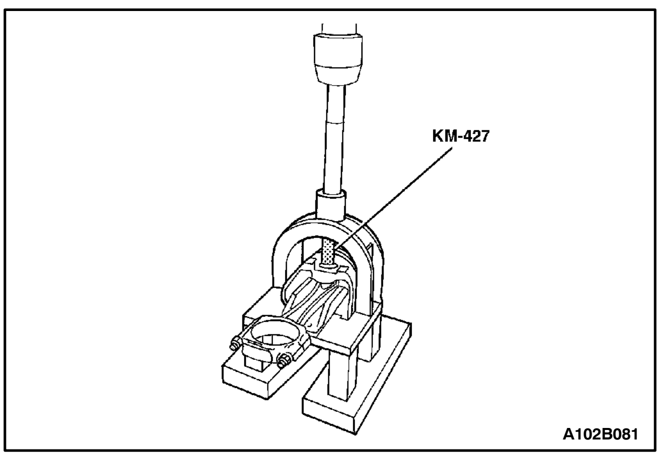
Tightening Torque	35 Nm (26 lb–ft) +45°+15°

10. Remove the connecting rod cap and lower connecting rod bearing.
11. Remove the upper piston connecting rod bearing.
12. Ridge ream the cylinder wall.

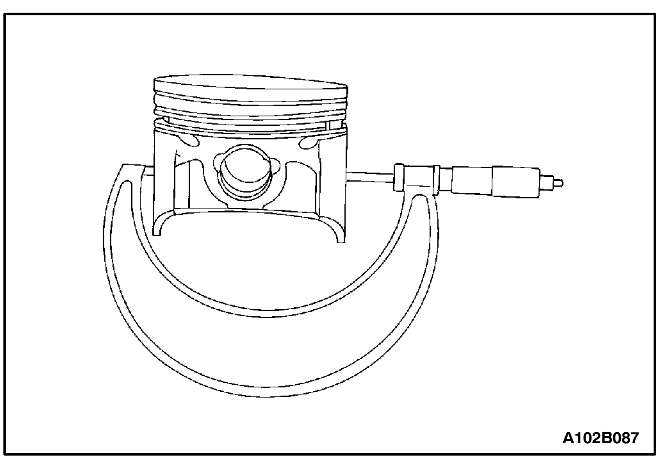


Caution : Use care when handling the piston. Worn piston rings are sharp and may cause injury.

13. Remove the piston.
14. Use a piston ring expander tool to expand the piston rings.
15. Remove the piston rings.

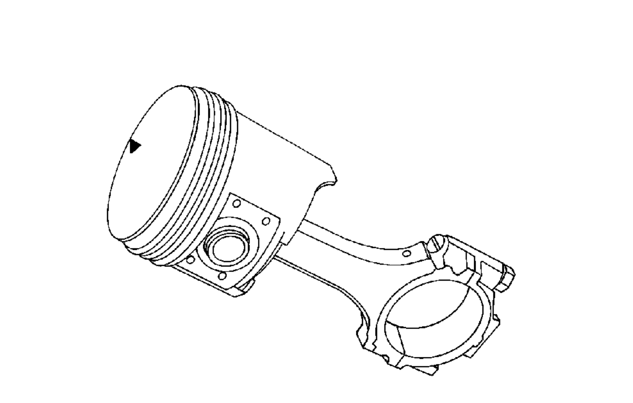


16. Remove the piston pin from the piston and connecting rod assembly using the piston pin service set KM–427.
17. Separate the piston from the connecting rod.

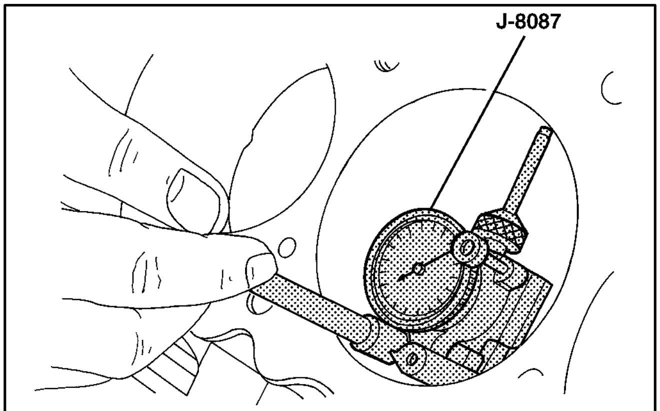


Inspection Procedure

1. Inspect the connecting rod for bending or twisting. If the connecting rod is bent or twisted, replace the connecting rod.
2. Inspect the connecting rod bearings.
3. Inspect the connecting rod lower end for wear.
4. Inspect the connecting rod upper end for scoring.
5. Inspect the crankshaft rod bearing journal for wear. Refer to *“Engine Specifications”* in this section.
6. Inspect the piston for scoring, cracks, and wear.
7. Inspect the piston for taper using a micrometer.

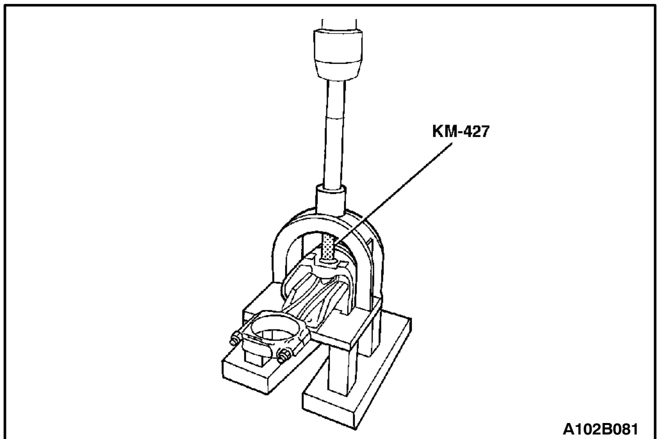

A102B082

8. Inspect the piston for fit to connecting rod.



C102B048

9. Inspect the engine block deck surface for flatness using a straight edge and a feeler gauge. Refer to *“Engine Specifications”* in this section.
10. Inspect the bearing bore for concentricity and alignment using a bore gauge. Refer to *“Engine Specifications”* in this section. If beyond specifications replace the engine block.
11. Inspect the engine block cylinder bore for wear, runout, ridging and taper using a bore gauge. Refer to *“Engine Specifications”* in this section.
12. Inspect the engine block cylinder bore for glazing Lightly hone the cylinder bore as necessary.

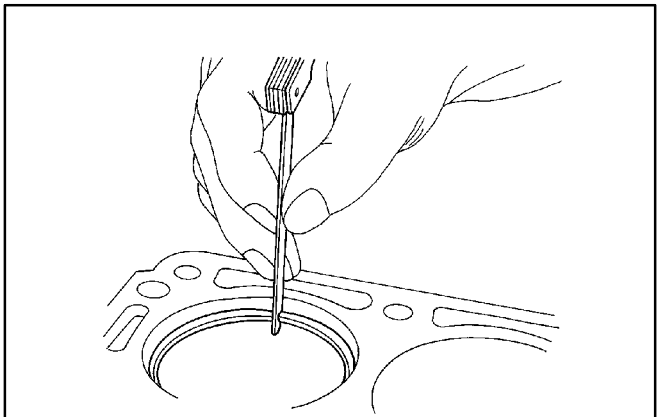


A102B081

Installation Procedure

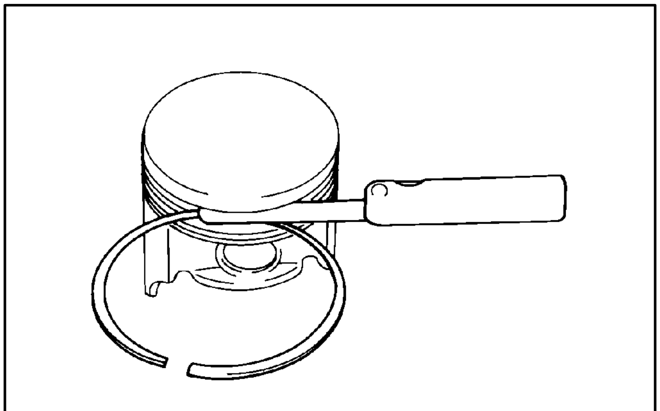
Important: For ease of installation of the piston pin, the connecting rod should be heated to 280°C. Heat the upper connecting rod only. Use commercial thermocolor material to determine the correct temperature. When the thermocolor material changes from black to green, the temperature is correct for installation.

1. Align the notch on the piston and connecting rod so that the proper sides will be facing the front of the engine.
2. Install the piston pin guide through the piston and the connecting rod.
3. Coat the piston pin with clean oil.
4. Install the piston pin into the opposite side of the piston.
5. Install the piston pin into the piston and connecting rod assembly using the piston pin service set KM–427.



A102B084

6. Select a set of new piston rings.
7. Measure the piston ring asp using a feeler gauge. Refer to *"Engine Specifications"* in this section.
8. Increase the piston ring gap by carefully filing off excess material if the piston ring gap is below specifications.



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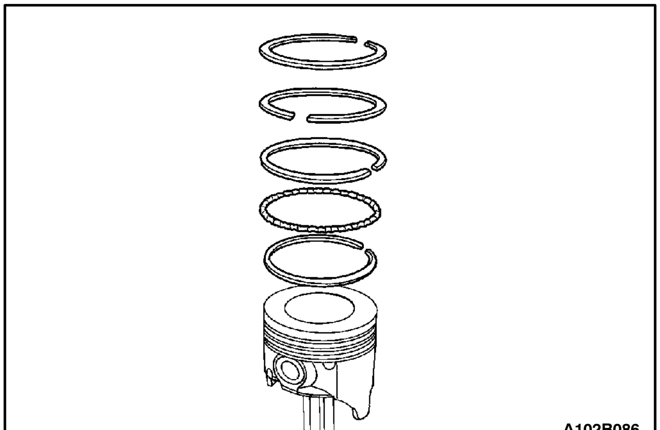
9. Measure the piston ring side clearance using a feeler gauge. Refer to *"Engine Specifications"* in this section.
10. If the piston ring is too thick, try another piston ring.
11. If no piston ring can be found that fits to specifications, the piston ring may be ground to size with emery paper placed on a sheet of glass.



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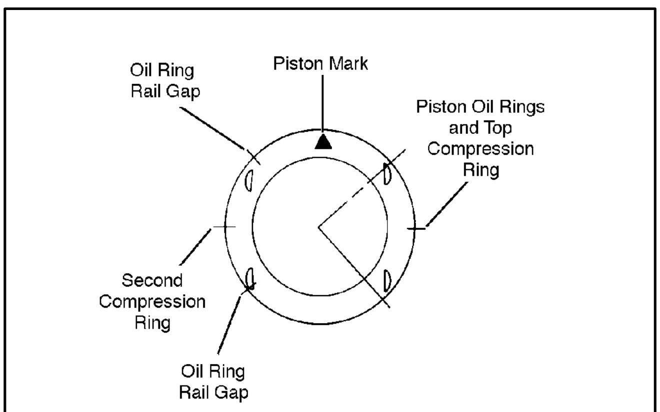
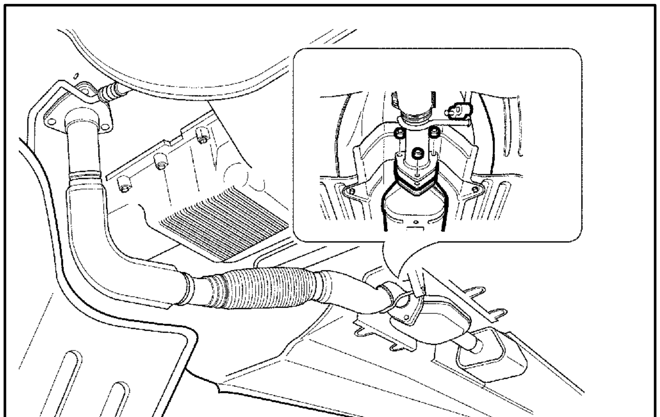
12. Install a piston oil ring, the expander, then the second piston oil ring to the bottom ring groove of the piston.
13. Install the second compression ring to the middle ring groove of the piston.
14. Install the top compression ring to the top ring groove of the piston.



A102C058

15. Use a piston ring expander to install the piston rings. Do not expand the piston rings beyond the expansion necessary for installation.
16. Stagger the piston oil rings, the oil ring rail gaps, the second compression ring, and the top compression ring in relation to the notch on the top of the piston.



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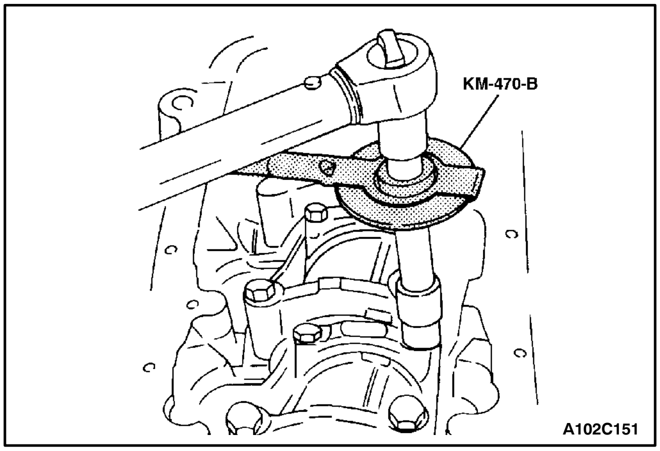
17. Lubricate the cylinder wall and the piston rings with clean engine oil.
18. Install the piston using a ring compressor and a wood handle, guide the lower connecting rod end to prevent damaging the crankshaft journal.
19. Install the connecting rod cap and the bearings. Refer to *"Crankshaft Bearings and Connecting Rod Bearings – Gauging Plastic"* in this section.



A102C151

20. Install the connecting rod bearing cap bolts.

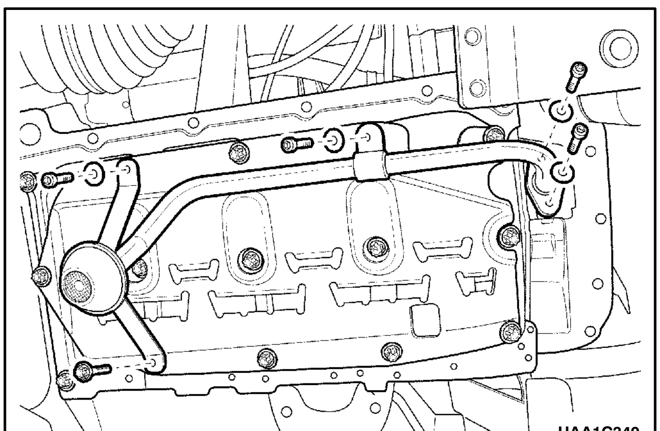
Installation Notice

Tightening Torque	35 N·m (26 lb–ft) +45°+15°

21. Install the engine block lower support bracket/ splash shield bolts.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft) +45°



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22. Install the oil suction pipe.
23. Install the oil suction pipe bolts.

Installation Notice

Tightening Torque	20 N·m (15 lb–in) +45°

24. Install the oil suction pipe support bracket.
25. Install the oil pan. Refer to *"Oil Pan"* in this section.
26. Install the cylinder head with the intake manifold and the exhaust manifold attached. Refer to *"Cylinder Head and Gasket"* in this section.

UNIT REPAIR

CYLINDER HEAD AND VALVE TRAIN COMPONENTS

Tools Required

MKM–571–B Gauge

KM 340–0 Cutter Set

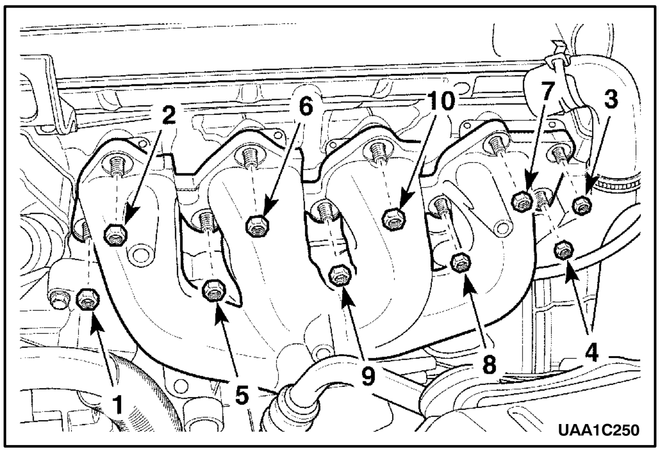
KM–340–7 Guide Drift

KM–340–13 Cutters

KM–340–26 Cutters

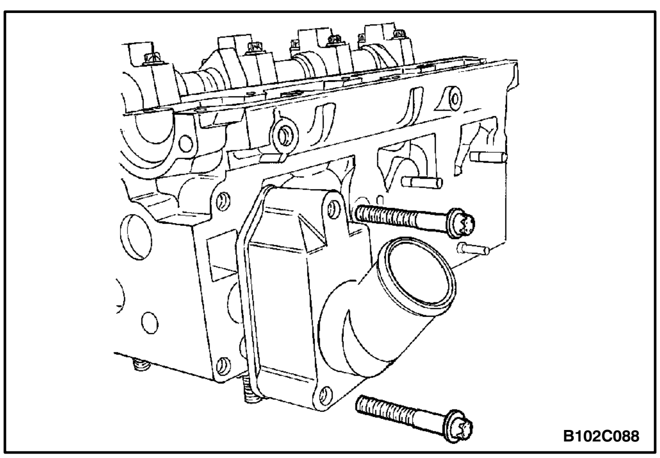
KM–348 Valve Spring Compressor

KM–653 Adapter

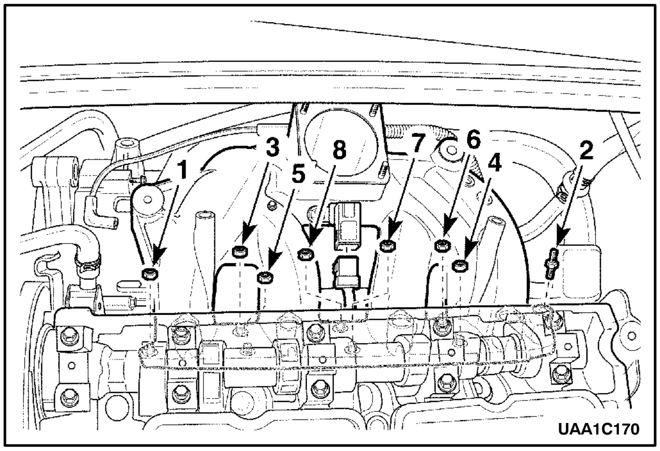


Disassembly Procedure

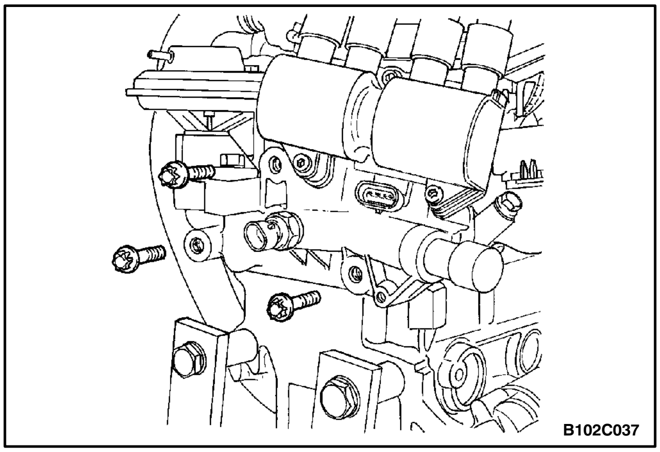
1. Remove the cylinder head with the intake manifold and the exhaust manifold attached. Refer to *“Cylinder Head and Gasket”* in this section.
2. Remove the engine coolant temperature (ECT) sensor.
3. Remove the exhaust manifold heat shield bolts.
4. Remove the exhaust manifold heat shield.
5. Remove the exhaust manifold retaining nuts in the sequence shown.
6. Remove the exhaust manifold.
7. Remove the exhaust manifold gasket.
8. Remove the exhaust manifold studs.



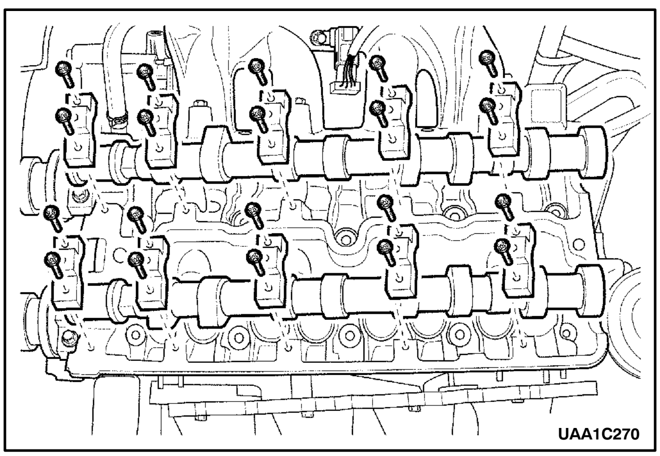
9. Remove the thermostat housing mounting bolts.
10. Remove the thermostat housing assembly.
11. Remove the fuel rail assembly. Refer to *Section 1F, Engine Controls.*
12. Remove the coolant bypass housing mounting bolts and the housing.



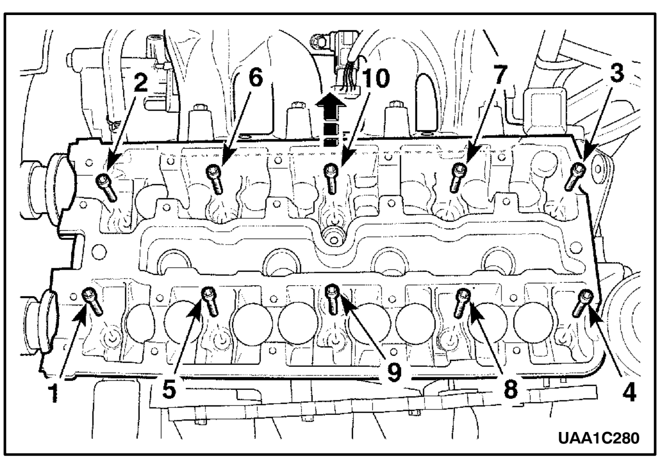
13. Remove the intake manifold retaining nuts and retaining bolt in the sequence shown.
14. Remove the intake manifold.
15. Remove the intake manifold gasket.



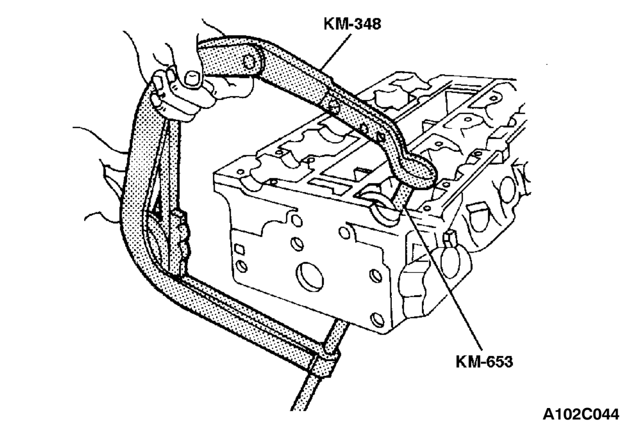
16. Remove the direct ignition system (DIS) coil and the exhaust gas recirculation (EGR) mounting bracket bolts.
17. Remove the DIS ignition coil and the EGR mounting bracket and ignition wires.
18. Remove the intake manifold studs.
19. Remove the spark plugs.



20. Remove the camshaft bearing cap bolts gradually and in the sequence shown for each camshaft cap.



21. Remove the intake camshaft caps. Maintain the correct positions for installation.
22. Remove the intake camshaft.
23. Remove the intake valve tappet adjusters.
24. Remove the exhaust camshaft caps. Maintain the correct positions for installation.
25. Remove the exhaust camshaft.
26. Remove the exhaust valve tappet adjusters.



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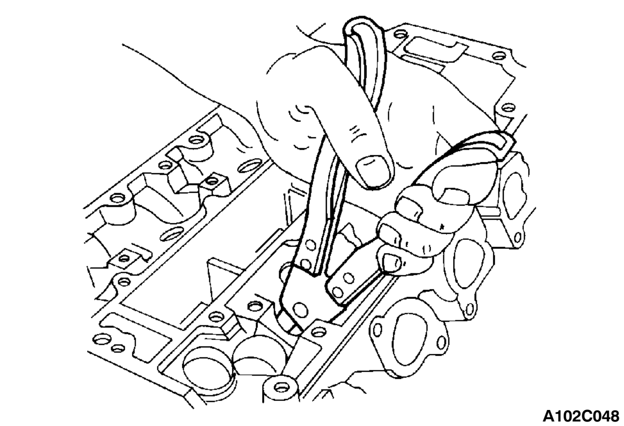
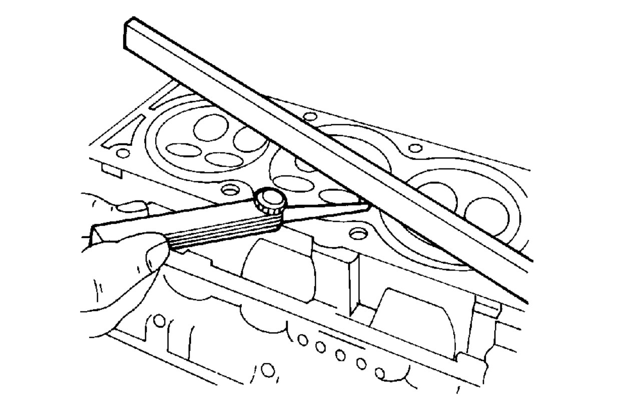
27. Compress the valve springs with the valve spring compressor KM–348 and the adapter KM–653.
28. Remove the valve retainers.
29. Remove the valve spring compressor KM–348 and the adapter KM–653.
30. Remove the valve spring caps.
31. Remove the valve springs. Maintain the original position of the valve springs for installation.

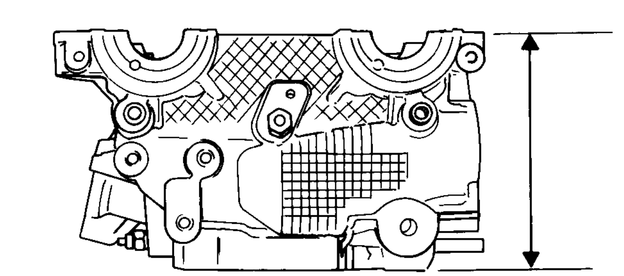

A102C048

32. Remove the valves. Maintain the original position of the valves for installation.
33. Remove the valve stem seals.


A102C046

Cylinder Head Inspection

1. Clean the sealing surfaces.
2. Inspect the cylinder head gasket and mating surfaces for leaks, corrosion, and blow-by.
3. Inspect the cylinder head for cracks.
4. Inspect the length and the width of the cylinder head using a feeler gauge and a straight edge.
5. Check the sealing surfaces for deformation and warpage. The cylinder head sealing surfaces must be flat within 0.025mm (0.00linch) maximum.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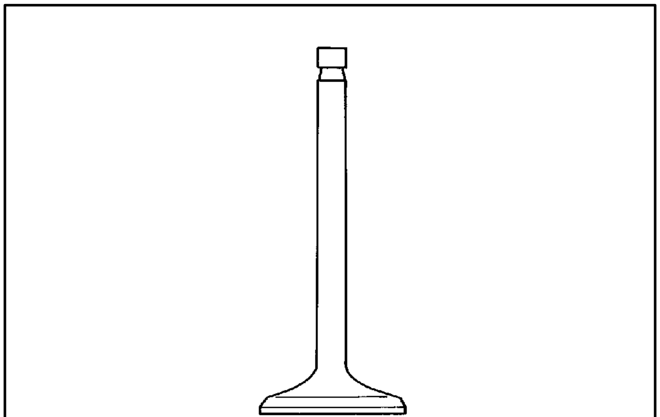
6. Measure the height of the cylinder head from sealing surface to sealing surface. The cylinder head height should be 133.975 to 134.025 mm (5.274 to 5.276 inches). If the cylinder head height is less than 133.9 mm (5.271 inches), replace the cylinder head.
7. Inspect all threaded holes for damage.
8. Inspect valve seats for excessive wear and burned spots.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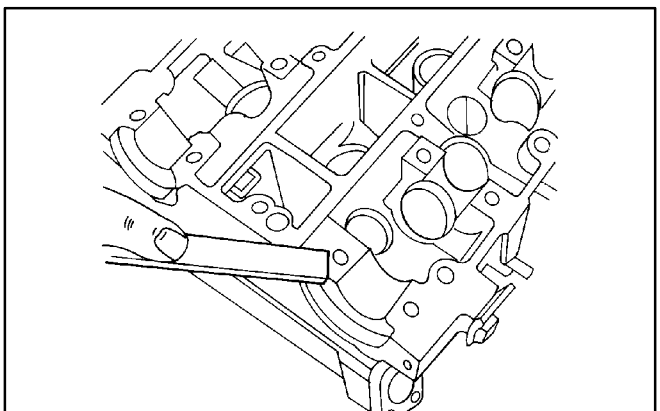
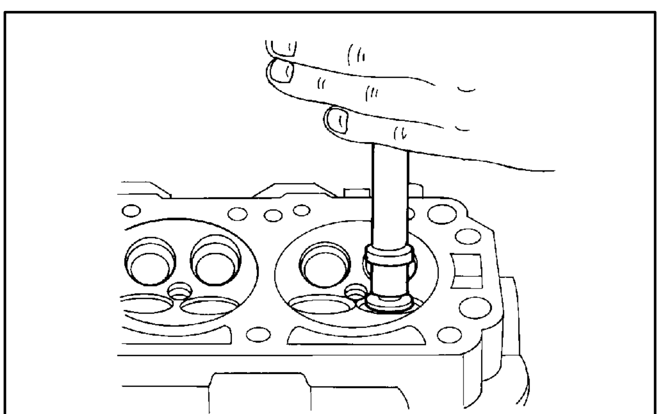
Valve Inspection

1. Inspect the valve stem tip for wear.
2. Inspect the valve key grooves and the oil seal grooves for chips and wear.
3. Inspect the valves for burns or cracks.
4. Inspect the valve stem for burrs and scratches.
5. Inspect the valve stem. The valve stem must be straight.
6. Inspect the valve face for grooving. If the groove is so deep that refacing the valve would result in a sharp edge, replace the valve.
7. Inspect the valve spring. If the valve spring ends are not parallel, replace the valve spring.
8. Inspect the valve spring seating surface of the valve rotators for wear or gouges. Replace as required.


A102C047

Cleaning Procedure

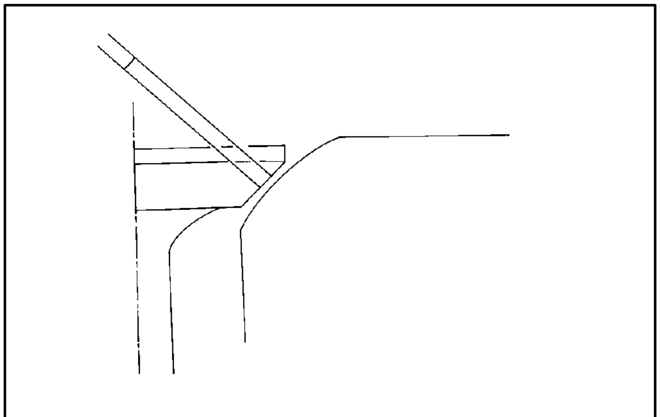
1. Clean the cylinder head.
2. Clean the valve guides.
3. Clean all of the threaded holes.
4. Clean the valves of carbon, oil, and varnish.


A102C049

Cylinder Head Overhaul

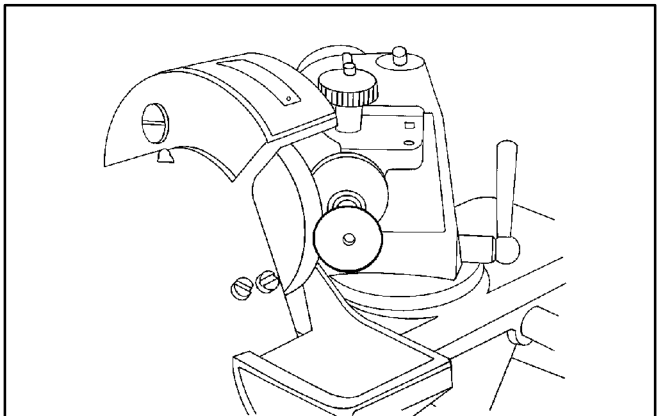
Valve Grind-in

1. Lubricate the valve seat using a fine-grained paste.
2. Lift the valve rhythmically from the seat with a commercially available valve grinding tool in order to distribute the paste.



A102B057

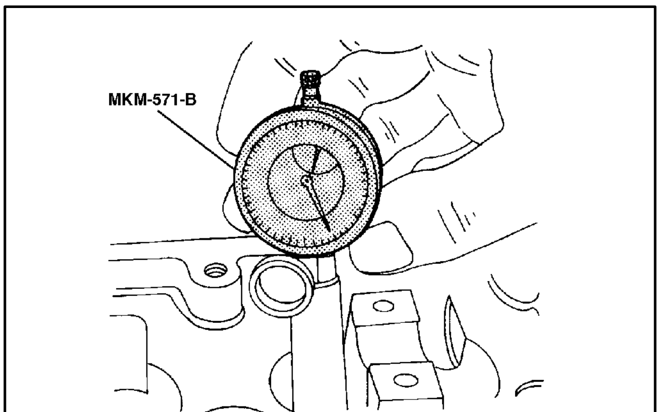
3. Check the contact pattern on the valve head and in the cylinder head.
4. Clean the valves, the valve guides, and the cylinder head.



A102B066

Valve Grind

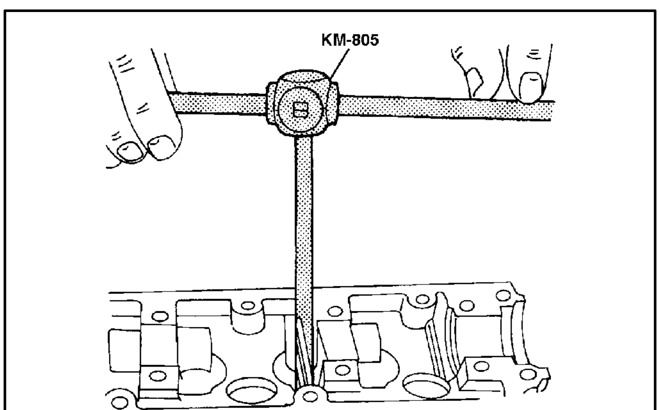
1. Ensure that there are no crater line burns on the valve cone.
2. The valve may be reground only two times. Do not grind the valve stem end.
3. Ensure that the angle at the valve face is 45 degrees.
4. Inspect the assembly height of the intake valves and the exhaust valves.



A102C050

Valve Guide – Ream

1. Measure the diameter of the valve guide using gauge MKM–571–B and a commercially available inside micrometer.



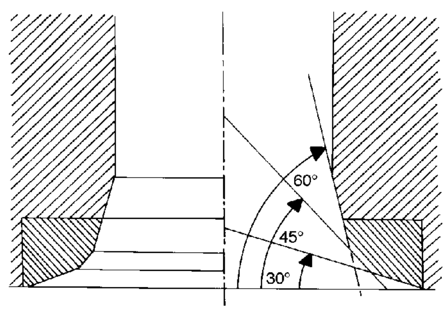
A102C051

Important: Valve oversizes may already have been fitted in production.

2. An oversize service code is on the valve guide and the valve stem end. The following table gives the correct size, reamer, and production code for each service.

Size	Reamer	Production Code	Service Code
Normal	—	—	K
0.075	KM-805	1	K1
0.150	—	2	K2

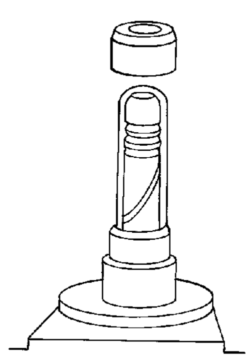
3. Ream the valve guide from the upper side of the cylinder head to the next oversize.
4. After reaming, cross out the code and emboss the valve guide with the new code.



A102B060

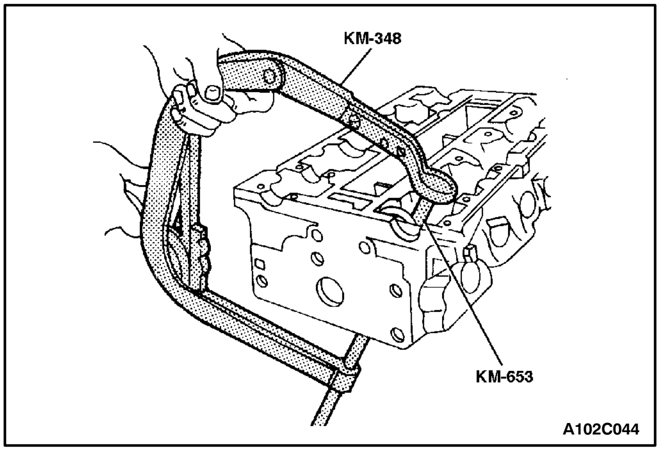
Valve Seat — Cut

1. Place the cylinder head on wooden blocks.
2. Cut the intake and the exhaust valve seats using the guide drift KM–340–7 as follows:
   - Valve seat – A 45-degree surface using the cutter KM–340–13.
   - Upper correction angle – A 30-degree surface using the cutter KM–340–13.
   - Lower correction angle – A 60-degree surface using the cutter KM–340–26.
3. Clean the chipping from the cylinder head.
4. Inspect the dimension for the valve seat width.
   - Intake: 1.2 to 1.4 mm (0.047 to 0.055 inch).
   - Exhaust: 1.4 to 1.8 mm (0.055 to 0.070 inch).
5. Inspect the assembly height of the intake valves and the exhaust valves. If the dimension is exceeded, install new valves. Inspect the assembly height of the intake valves and the exhaust valves again. If the valve assembly height is still too large despite replacing the valves, replace the cylinder head.

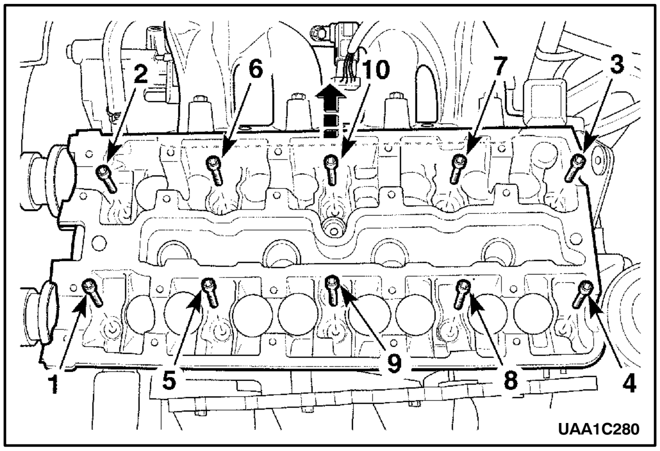

B102C040

Assembly Procedure

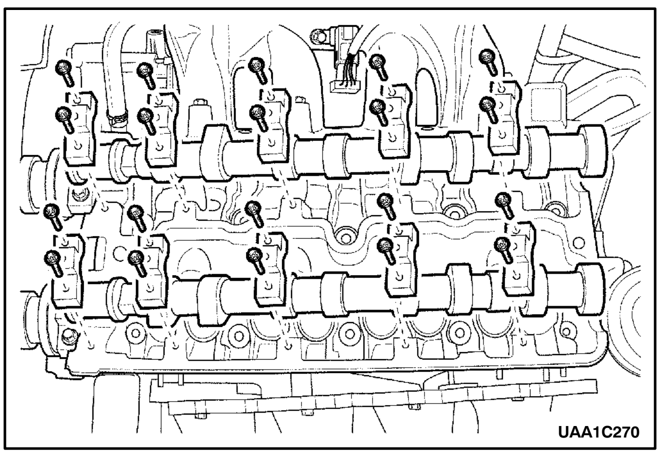
1. Coat the valve stems with engine oil.
2. Insert the valves in the cylinder head in their original positions.
3. Insert the valve spring seats.
4. Push the accompanying assembly sleeve onto the valve stem.
5. Insert the new valve stem seat.
6. Carefully drive the valve stem seal onto the stop with light taps.
7. Install the valve springs in their original positions.
8. Install the valve spring caps.



9. Compress the valve springs with the valve spring compressor KM–348 and adapter KM–653.
10. Install the valve keys.
11. Remove the valve spring compressor KM–348 and adapter KM–653.



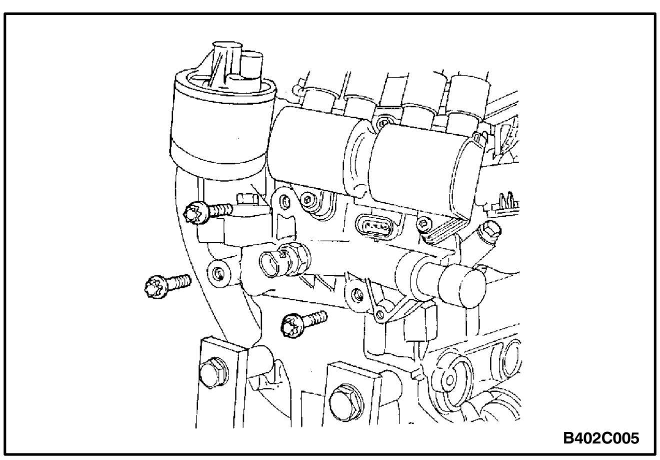
12. Lubricate the valve tappet adjusters with engine oil.
13. Install the valve lash adjusters.



14. Install the intake camshaft.
15. Install the intake camshaft bearing caps in their original positions.
16. Install the exhaust camshaft.
17. Install the exhaust camshaft bearing caps in their original positions.
18. Install the camshaft bearing cap bolts.
19. Tighten the camshaft bearing cap bolts gradually and in the sequence shown for each camshaft cap.

Installation Notice

Tightening Torque	8 N·m (71 lb–in)



20. Install the spark plugs.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

21. Install the EI system ignition coil and EGR mounting bracket and bolts.

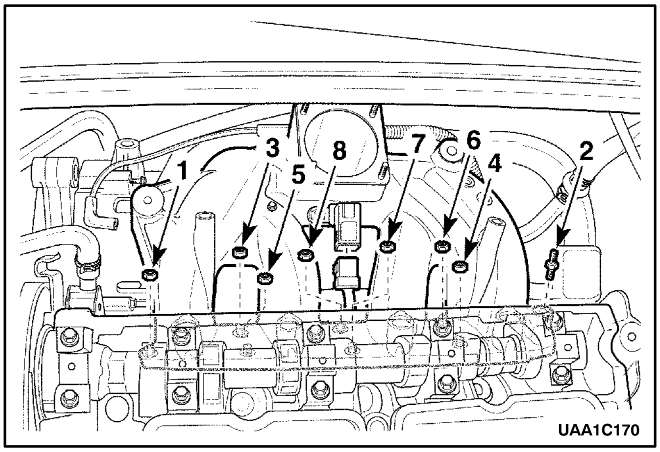
Installation Notice

Tightening Torque	Left Lower Side: 20 N·m (15 lb–ft) Others: 30 N·m (22 lb–ft)

22. Install the EI system ignition coil and EGR.

Installation Notice

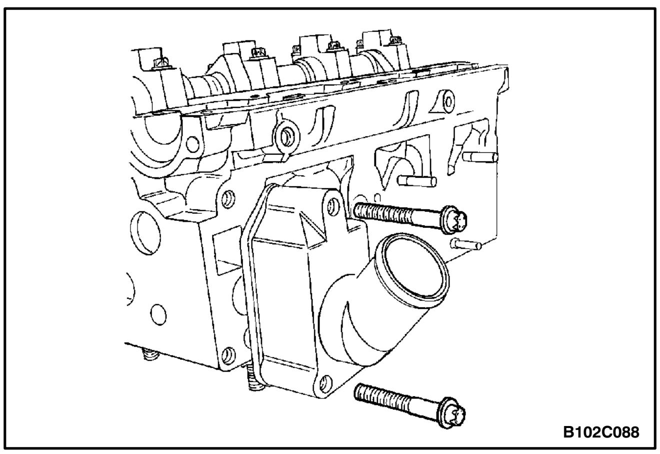
Tightening Torque	8 N·m (71 lb–in)



23. Install the intake manifold studs.
24. Install the intake manifold gasket.
25. Install the intake manifold.
26. Install the intake manifold retaining nuts and retaining bolt in the sequence shown.

Installation Notice

Tightening Torque	22 N·m (16 lb–ft)



27. Install the fuel rail assembly. Refer to *Section 1F, Engine Controls.*
28. Install the thermostat housing assembly.
29. Install the thermostat housing mounting bolts.

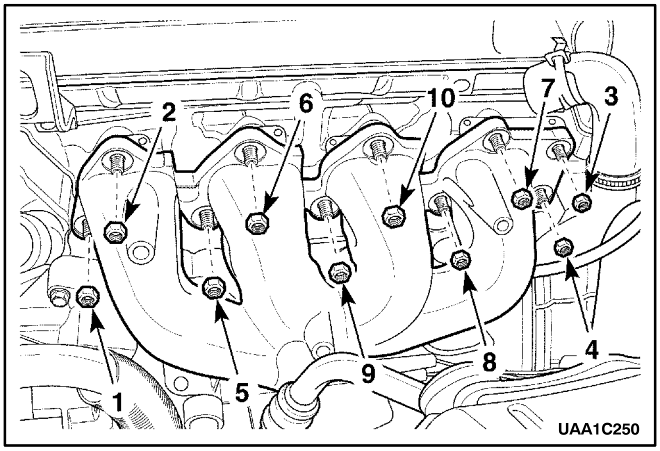
Installation Notice

Tightening Torque	15 N·m (11 lb–ft)

30. Install the coolant bypass housing and mounting bolts.

Installation Notice

Tightening Torque	15 N·m (11 lb–ft)



31. Install the exhaust manifold studs.
32. Install the exhaust manifold gasket.
33. Install the exhaust manifold.
34. Install the exhaust manifold retaining nuts in the sequence shown.

Installation Notice

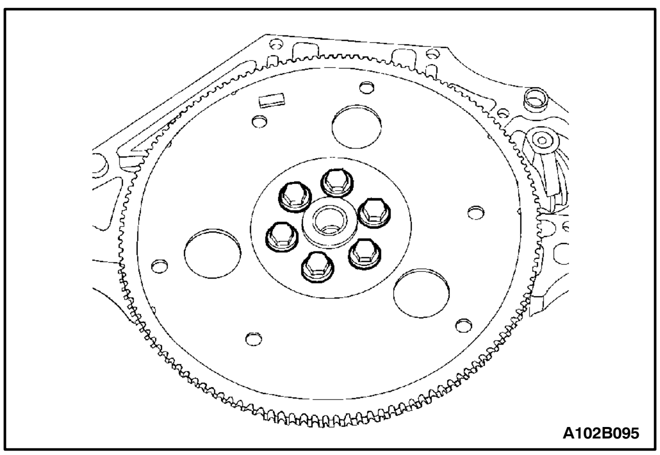
Tightening Torque	1st stage:	13 N·m (10 lb–ft): 9,10,6,5,8,7,2,1,3,4
	2st stage:	13 N·m (10 lb–ft): 9,10,6,5,8,7,2,1,3,4
	3rd stage:	15 N·m (11 lb–ft): 9,10,6,5,8,7,2,1,3,4
	4th stage:	15 N·m (11 lb–ft): 9,10,6,5,8,7,2,1,3,4,9,10,6

35. Install the exhaust manifold heat shield.
36. Install the exhaust manifold heat shield bolts.

Installation Notice

Tightening Torque	15 N·m (11 lb–ft)

37. Install the cylinder head with the intake manifold and the exhaust manifold attached. Refer to *"Cylinder Head and Gasket"* in this section.



CRANKSHAFT

Tools Required

KM–412 Engine Overhaul Stand

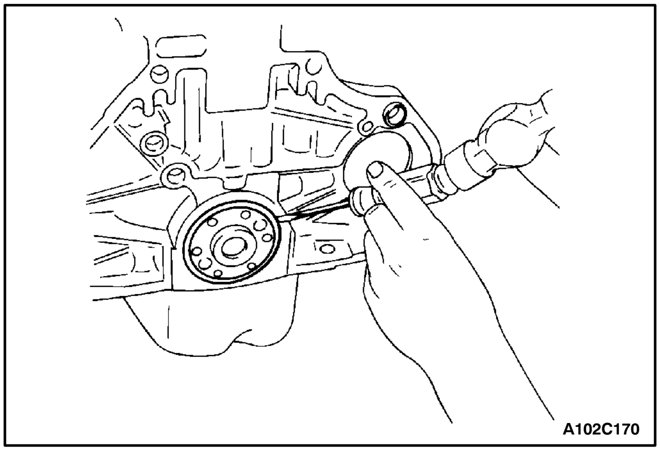
KM–470–B Angular Torque Gauge

J–36792 or KM–635 Crankshaft Rear Oil Seal Installer

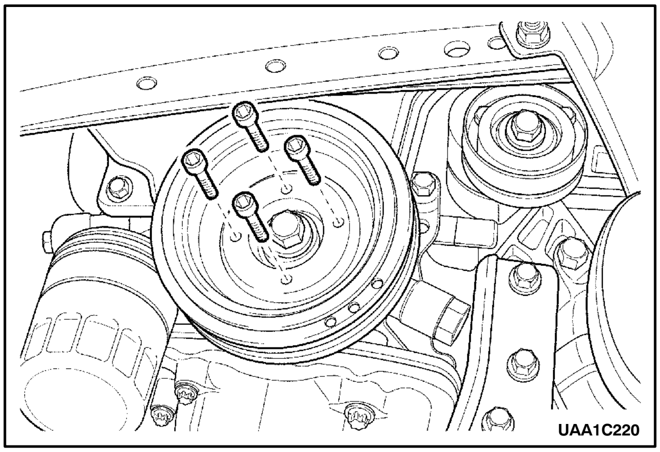
Notice: Take extreme care to prevent any scratches, nicks, or damage to the camshafts.

Disassembly Procedure

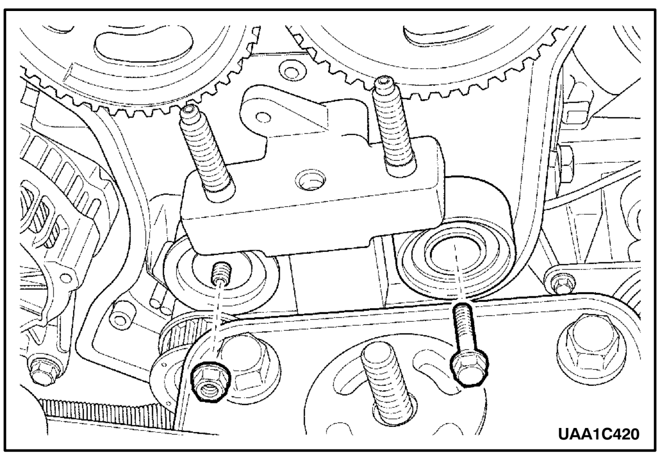
1. Remove the engine. Refer to *"Engine"* in this section.
2. Remove the flywheel or flexible plate bolts.
3. Remove the flywheel or the flexible plate.



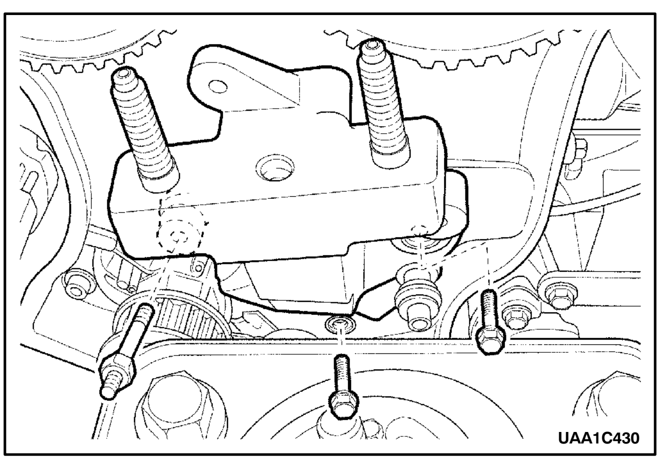
4. Remove the crankshaft rear oil seal.
5. Mounts the engine assembly on the engine overhaul stands KM–412.



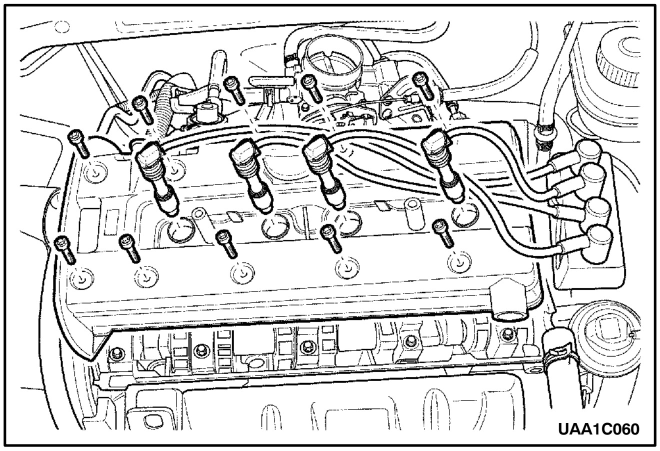
6. Remove the front timing belt cover bolts.
7. Remove the front timing belt cover.
8. Remove the crankshaft pulley bolts.
9. Remove the crankshaft pulley.



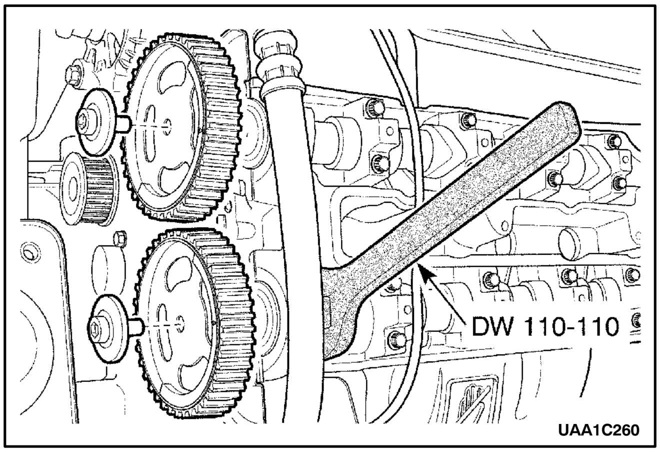
10. Loosen the timing belt automatic tensioner bolt.
11. Rotate the timing belt automatic tensioner hex-key clockwise to release the tension.
12. Remove the timing belt idler pulley bolt and nut.
13. Remove the timing belt idler pulleys.



14. Remove the timing belt.
15. Remove the engine mount retaining bolts.
16. Remove the engine mount.

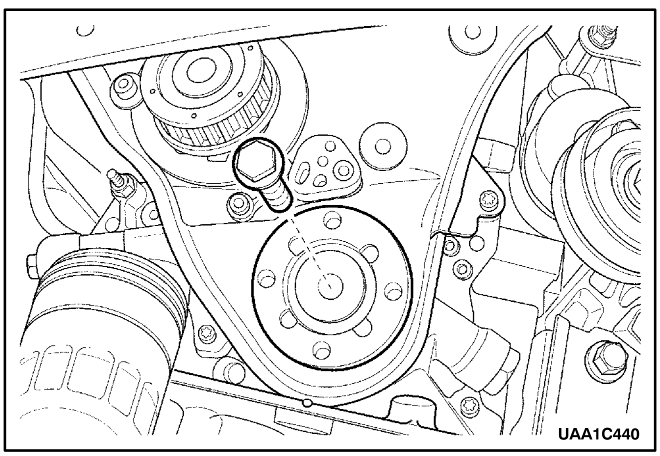


17. Disconnect the breather tubes from the valve cover.
18. Remove the spark plug cover bolts.
19. Remove the spark plug cover.
20. Disconnect the ignition wires from the spark plugs.
21. Remove the valve cover bolts.
22. Remove the valve cover washers.
23. Remove the valve cover and the valve cover gasket.

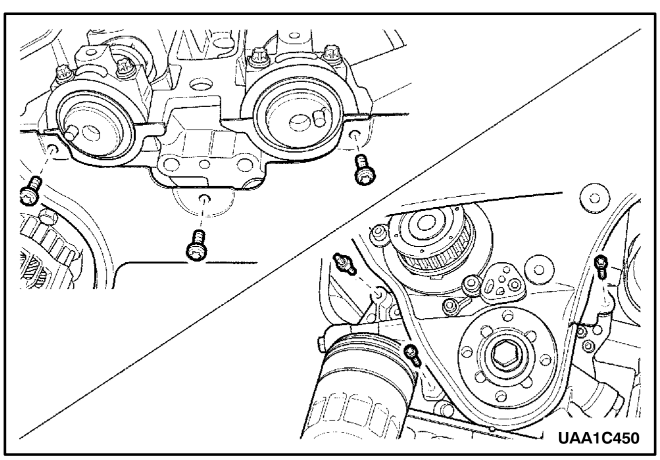


Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

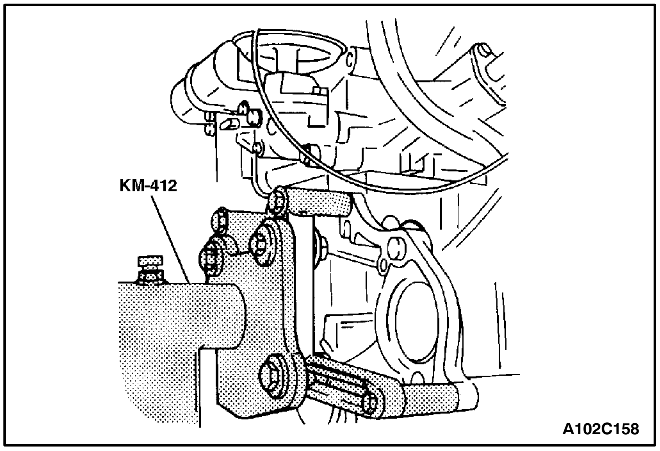
24. While holding the intake camshaft firmly in place, remove the intake camshaft bolt.
25. Remove the intake camshaft gear.
26. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft bolt.
27. Remove the exhaust camshaft gear.



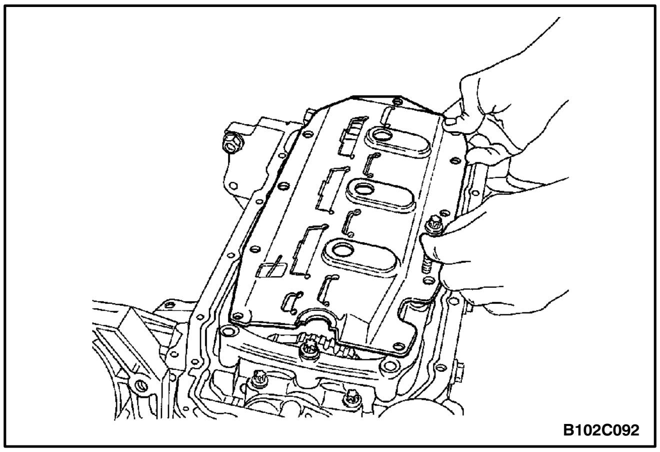
28. Remove the crankshaft timing belt gear bolt.
29. Remove the crankshaft timing belt gear.



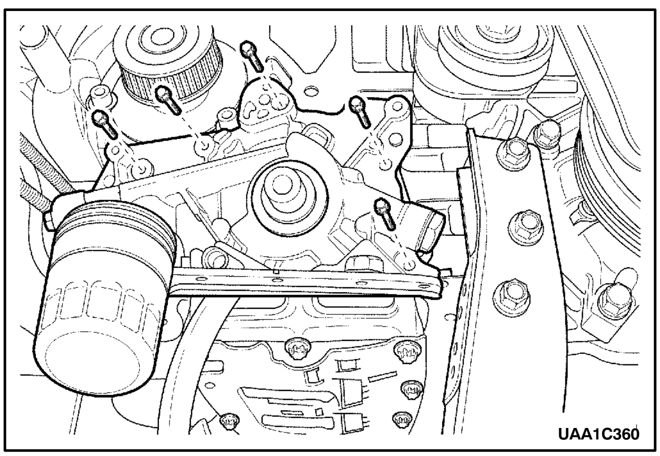
30. Remove the rear timing belt cover screws/bolt.
31. Remove the rear timing belt cover.



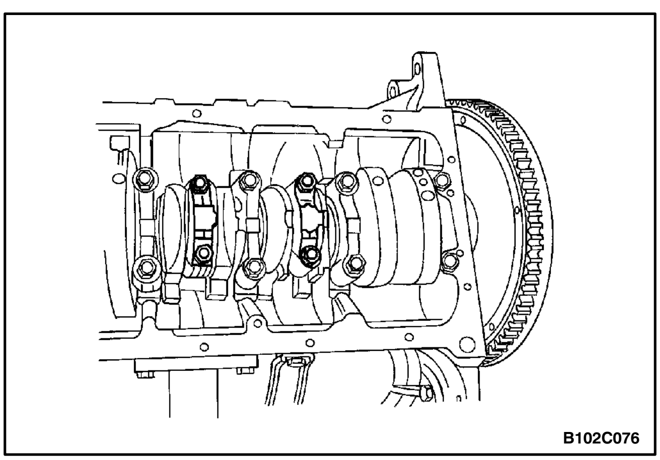
32. Rotate the engine on the engine overhaul stand KM–412.



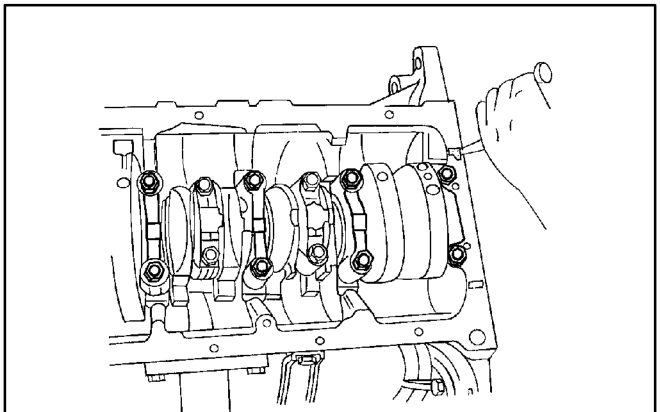
33. Remove the oil pan retaining bolts.
34. Remove the oil pan.
35. Remove the oil suction pipe and support bracket bolts.
36. Remove the oil suction pipe.
37. Remove the crankshaft bearing bridge and oil pan scraper bolts.
38. Remove the oil pan scraper.
39. Remove the crankshaft bearing bridge bolts.
40. Remove the crankshaft bearing bridge.



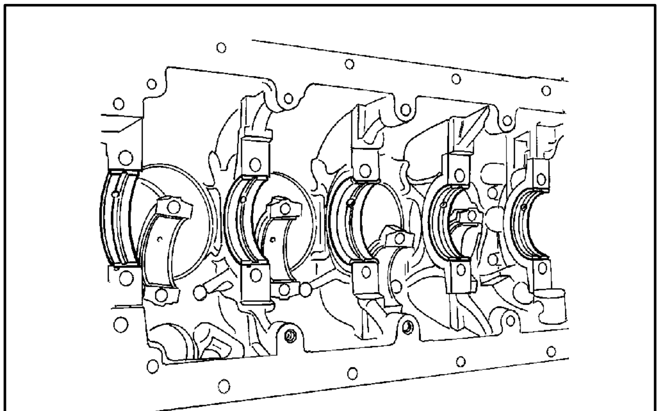
41. Remove the oil pump retaining bolts.
42. Remove the oil pump.



43. Mark the order of the connecting rod bearing caps.
44. Remove the connecting rod bearing cap bolts for all of the pistons.
45. Remove the connecting rod bearing caps and the lower connecting rod bearings.

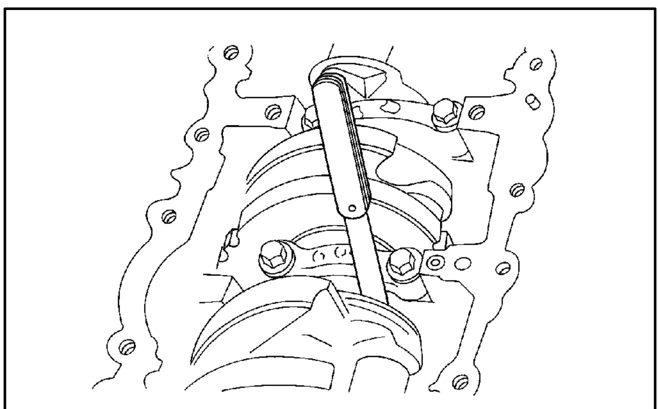

B102C078

46. Mark the order of the crankshaft bearing caps.
47. Remove the crankshaft bearing cap bolts.
48. Remove the crankshaft bearing caps and the lower crankshaft bearings.
49. Remove the crankshaft.
50. Clean the parts, as needed.

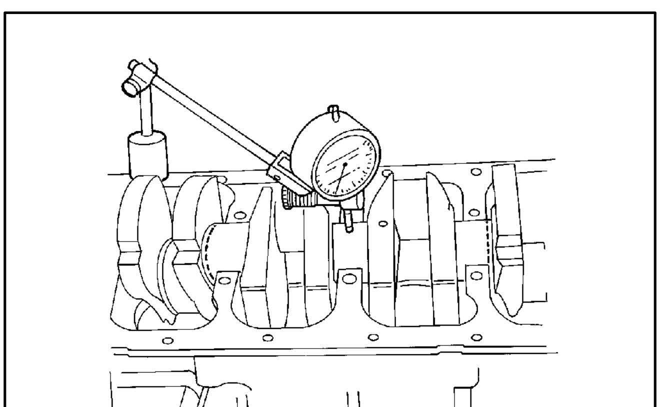

B102C077

Assembly Procedure

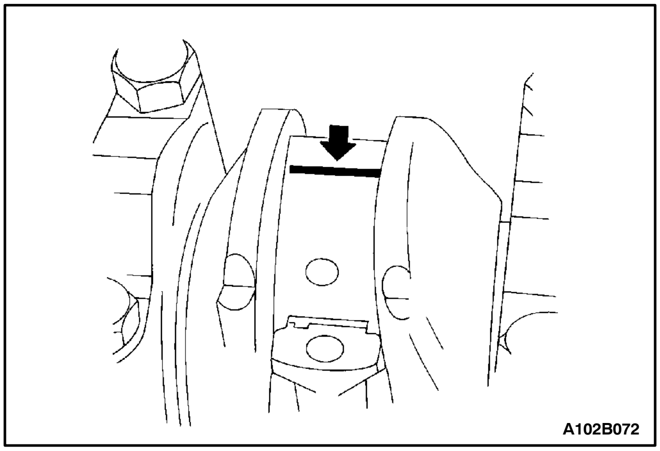
1. Coat the crankshaft bearings with engine oil.
2. If replacing the crankshaft, transfer the pulse pickup sensor disc to the new crankshaft.


A102B070

3. Install the crankshaft.
4. Install the lower crankshaft bearings in the bearing caps.
5. Inspect the crankshaft end play with the crankshaft bearings installed.
6. Check for permissible crankshaft end play. Refer to *"Engine Specifications"* in this section.


A102B071

7. With the crankshaft mounted on the front and rear crankshaft bearings, check the middle crankshaft journal for permissible out-of-round (runout). Refer to *"Engine Specifications"* in this section.

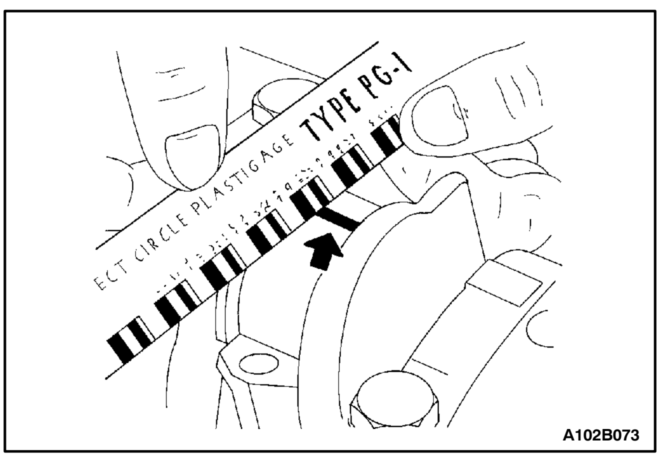


Important: Grease the crankshaft journals and lubricate the crankshaft bearings slightly so that the plastic gauging thread does not tear when the crankshaft bearing caps are removed.

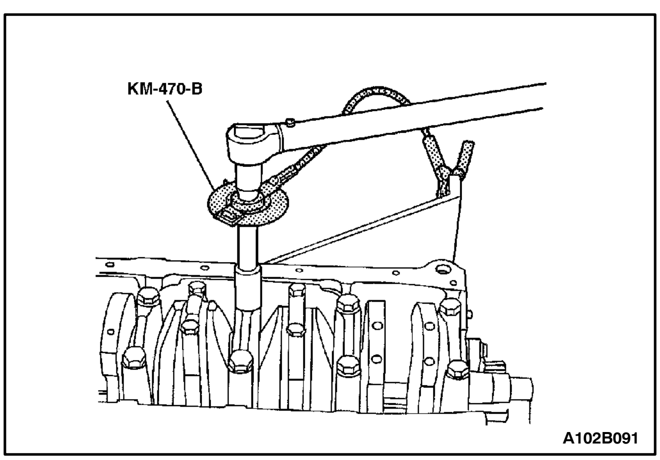
8. Inspect all of the crankshaft bearing clearances using a commercially available plastic gauging (ductile plastic threads).
9. Cut the plastic gauging threads to the length of the bearing width. Lay them axially between the crankshaft journals and the crankshaft bearings.
10. Install the crankshaft bearing caps and the bolts.

Installation Notice

Tightening Torque	50 N·m (37 lb–ft) +45°+15°



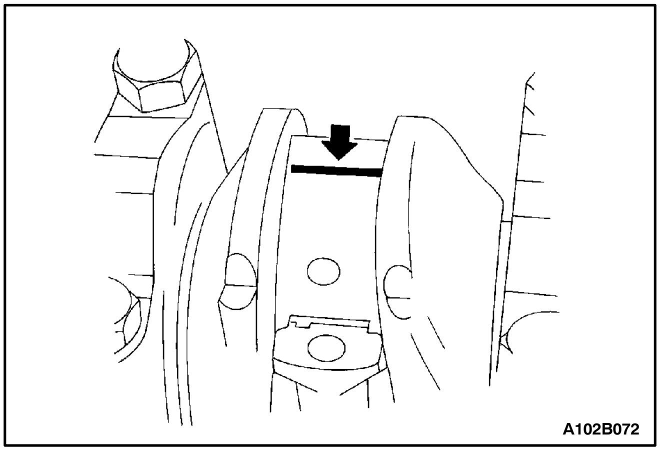
11. Remove the crankshaft bearing cap bolts and the caps.
12. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges)
13. Inspect the bearing clearance for permissible tolerance ranges. Refer to *"Engine Specifications"* in this section.



14. Apply a bead of adhesive sealing compound to the grooves of the crankshaft bearing caps.
15. Install the crankshaft bearing caps to the engine block.
16. Tighten the crankshaft bearing caps using new bolts.

Installation Notice

Tightening Torque	50 N·m (37 lb–ft) +45°+15°



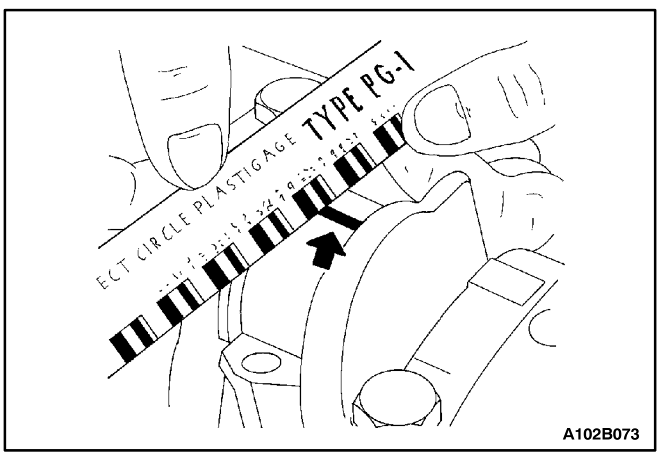
A102B072

Important: Grease the connecting rod journals and lubricate the connecting rod bearings slightly so that the plastic gauging thread does not tear when the connecting rod bearing caps are removed.

17. Inspect all of the connecting rod bearing clearances using a commercially available plastic gauging (ductile plastic threads).
18. Cut the plastic gauging threads to the length of the connecting rod bearing width. Lay them axially between the connecting rod journals and the connecting rod bearings.
19. Install the connecting rod bearing caps.

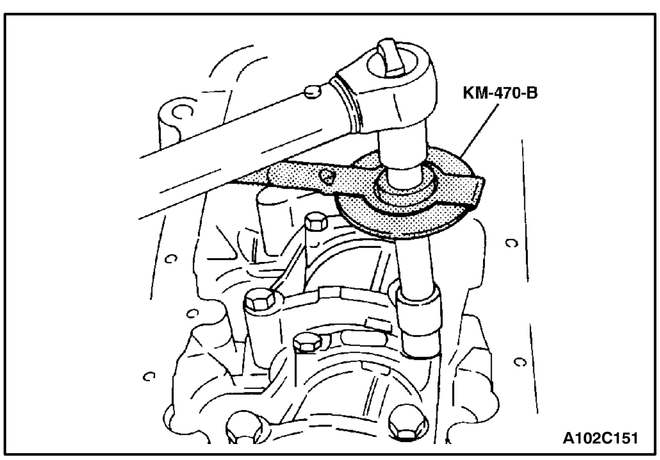
Installation Notice

Tightening Torque	35 N·m (26 lb–ft) +45°+15°



A102B073

20. Remove the connecting rod bearing caps.
21. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges)
22. Inspect the bearing clearance for permissible tolerance ranges. Refer to *“Engine Specifications”* in this section.

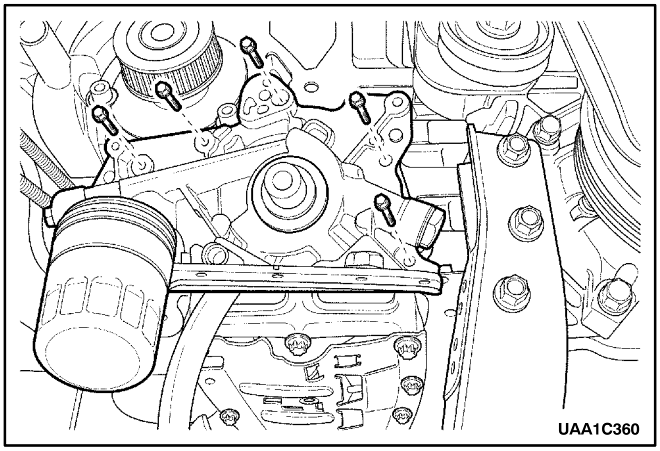


A102C151

23. Install the connecting rod bearing caps to the connecting rods.
24. Tighten the connecting rod bearing caps using new bolts.

Installation Notice

Tightening Torque	35 N·m (26 lb–ft) +45°+15°

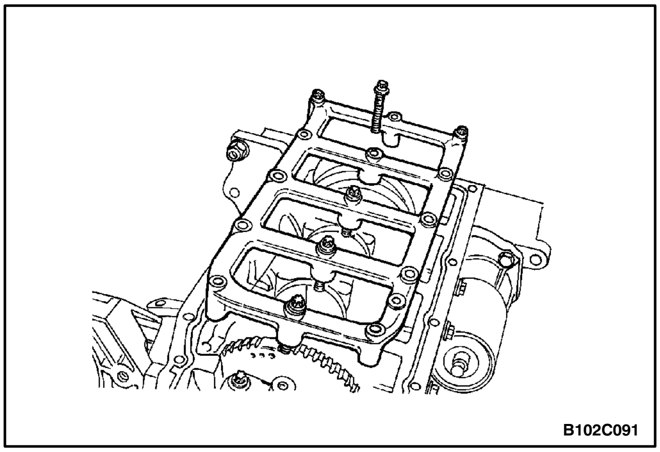


UAA1C360

25. Install the oil pump.
26. Install the oil pump retaining bolts.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)



B102C091

27. Install the lower block support bracket and bolts.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft) +45°

28. Install the lower block support bracket splash shield and bolts.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft) +45°

29. Install the oil suction pipe.
30. Install the oil suction pipe on the oil pump bolts.

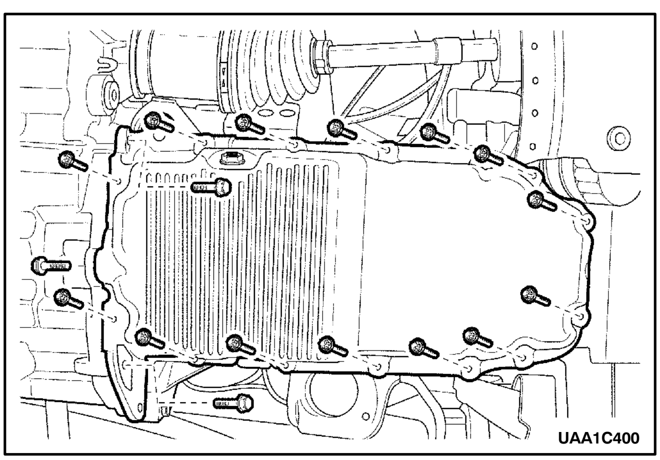
Installation Notice

Tightening Torque	8 N·m (71 lb–in)

31. Install the oil suction pipe support bracket bolts.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft) +45°

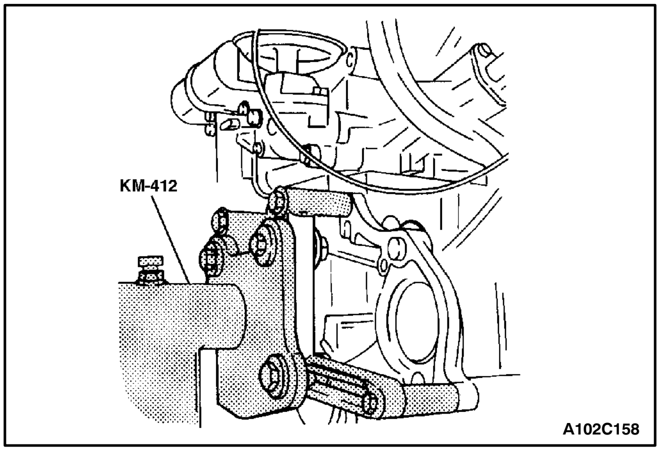


UAA1C400

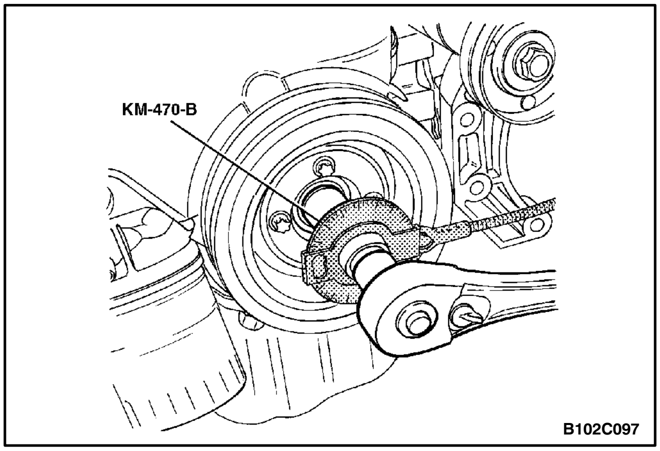
32. Coat the new oil pan gasket with sealant.
33. Install the oil pan gasket to the oil pan.
34. Install the oil pan.
35. Install the oil pan retaining bolts.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)



36. Rotate the engine on the engine overhaul stand KM–412.



37. Install the rear timing belt cover.
38. Install the rear timing belt cover bolts.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

39. Install the crankshaft gear and bolt.

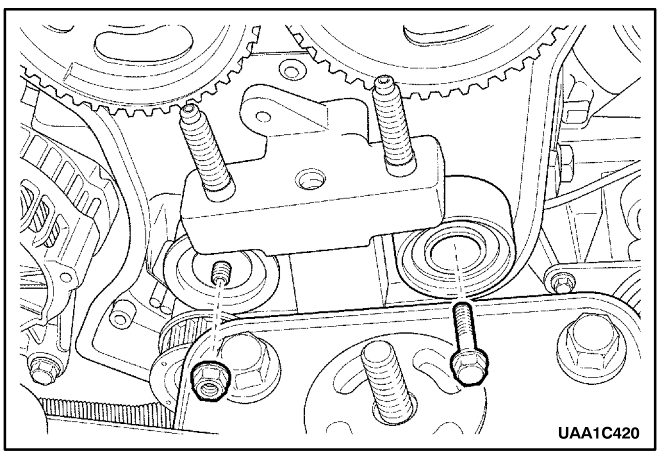
Installation Notice

Tightening Torque	130 N·m (96 lb–ft) +40°±5°

40. Install the engine mount and retaining bolts.

Installation Notice

Tightening Torque	60 N·m (44 lb–ft)



41. Install the timing belt automatic tensioner.
42. Install the timing belt automatic tensioner bolts.

Installation Notice

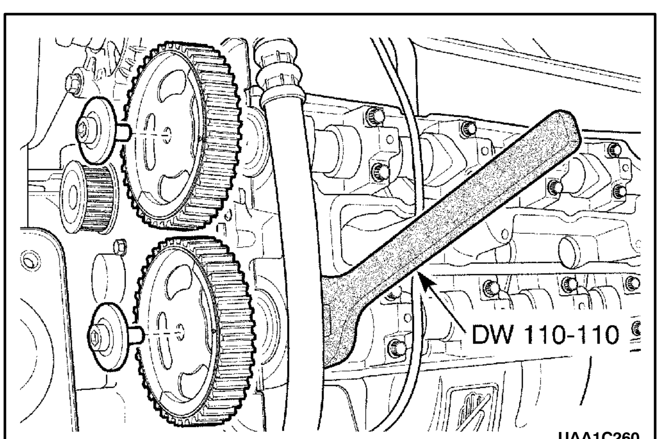
Tightening Torque	25 N·m (18 lb–ft)

43. Install the timing belt idler pulleys.
44. Install the timing belt idler pulley bolt and nut.

Installation Notice

Tightening Torque	25 N·m (18 lb–ft)

Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts.



45. Install the intake camshaft gear.
46. Install the intake camshaft gear bolt while holding the intake camshaft firmly in place.

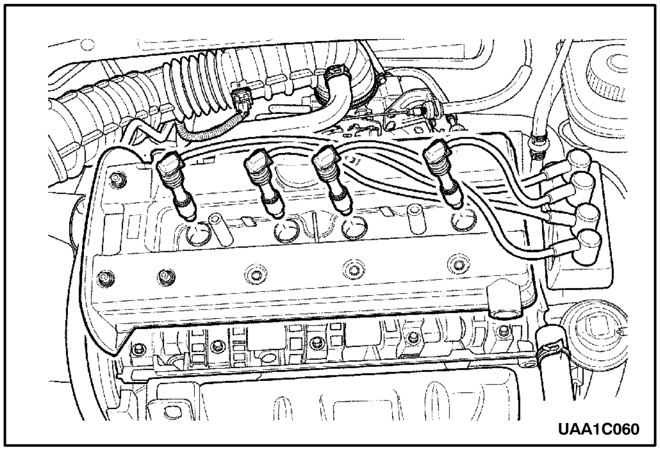
Installation Notice

Tightening Torque	50 N·m (37 lb–ft)+60°+15°

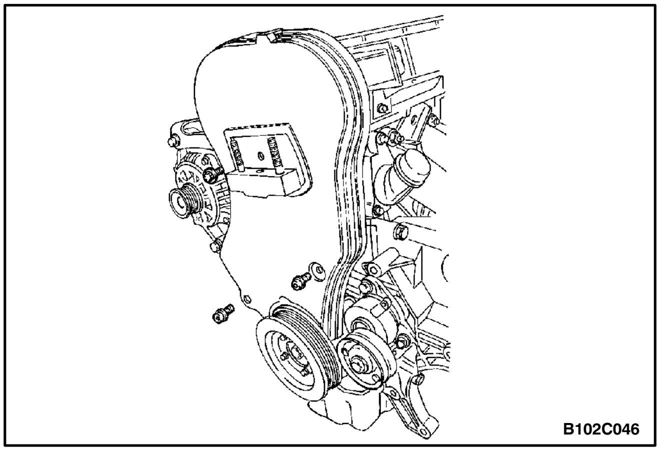
47. Install the exhaust camshaft gear.
48. Install the exhaust camshaft gear bolt while holding the exhaust camshaft firmly in place.

Installation Notice

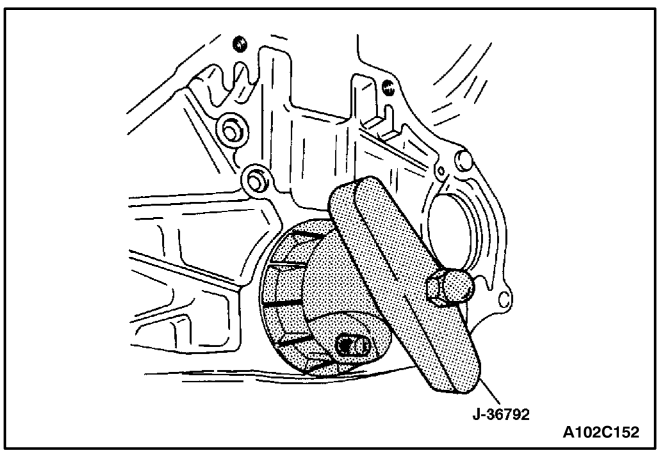
Tightening Torque	50 N·m (37 lb–ft) +60°+15°



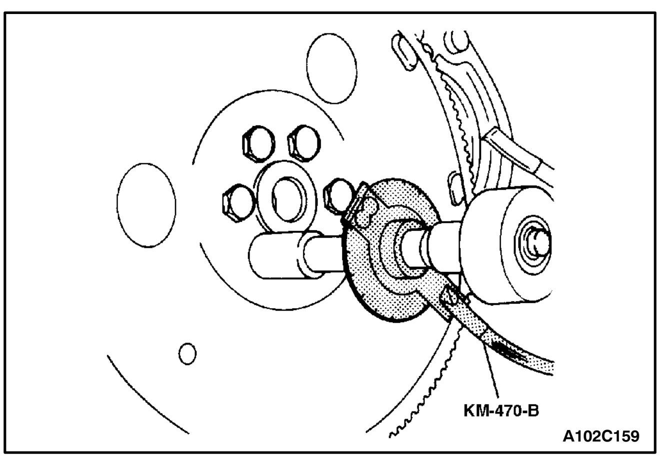
49. Install the timing belt. Refer to *“Timing Belt”* in this section.
50. Adjust the timing belt tension. Refer to *“Timing Belt Check and Adjust”* in this section.
51. Apply a small amount of gasket sealant to the corners of the front camshaft caps and to the top of the rear camshaft cover to cylinder head seal.
52. Install the valve cover and the valve cover gasket.
53. Install the valve cover bolts.
54. Connect the ignition wires to the spark plugs.
55. Install the spark plug cover and bolts.
56. Connect the breather tube to the camshaft cover.



57. Install the front timing belt cover.
58. Install the front timing belt cover bolts.
59. Install the engine lifting device.
60. Remove the engine from the engine overhaul stand KM–412.



61. Install a new crankshaft rear oil seal using installer J–36792 or KM–635.

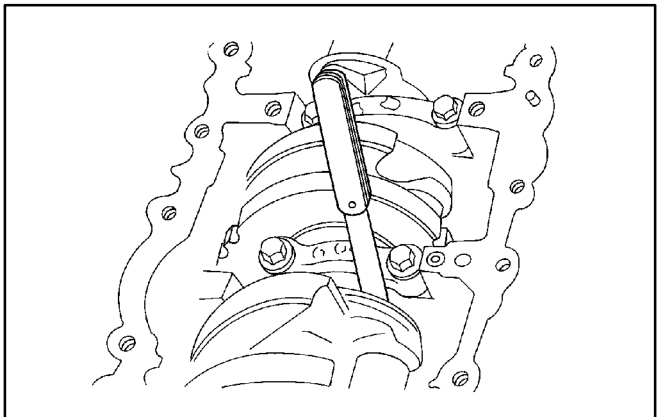


62. Install the flywheel or flexible plate.
63. Install the flywheel or the flexible plate bolts.

Installation Notice

Tightening Torque (Flywheel Bolts)	60 N·m (48 lb–ft) +30°+15°
Tightening Torque (Flexible Plate Bolts)	65 N·m (48 lb–ft)

64. Install the engine. Refer to *“Engine”* in this section.


A102B070

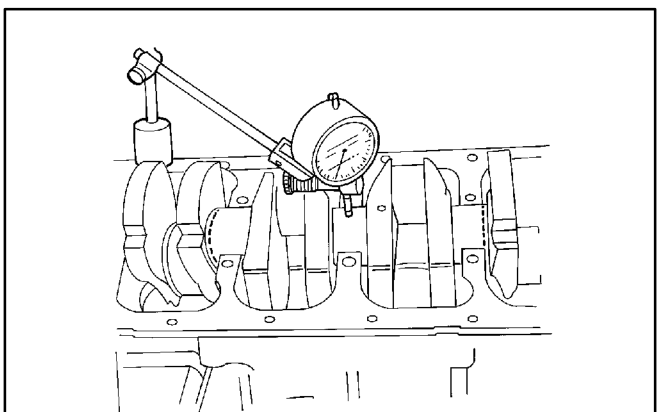
CRANKSHAFT BEARINGS AND CONNECTING ROD BEARINGS – GAUGING PLASTIC

Tools Required

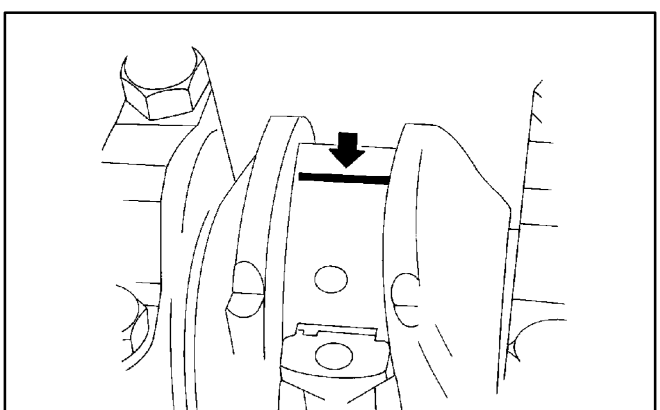
KM–470–B Angular Torque Gauge

Inspection Procedure – Crankshaft

1. Coat the crankshaft bearings with engine oil.
2. Install the upper crankshaft bearings into the engine block crankshaft journals.
3. Install the lower crankshaft bearings into the crankshaft bearing caps.
4. Install the crankshaft.
5. Inspect the crankshaft end play with the crankshaft bearings installed.
6. Check for permissible crankshaft end play. Refer to *"Engine Specifications"* in this section.

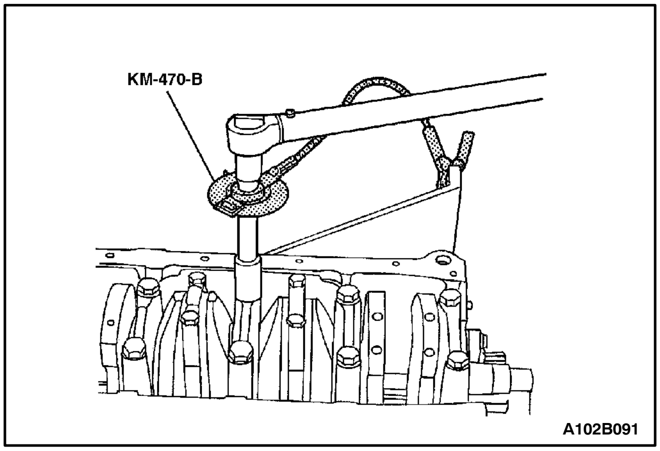

A102B071

7. With the crankshaft mounted on the front and rear crankshaft bearings, check the middle crankshaft journal for permissible out-of-round (runout). Refer to *"Engine Specifications"* in this section.


A102B072

Important: Grease the crankshaft journals and lubricate the crankshaft bearings slightly so that the plastic gauging thread does not tear when the crankshaft bearing caps are removed.

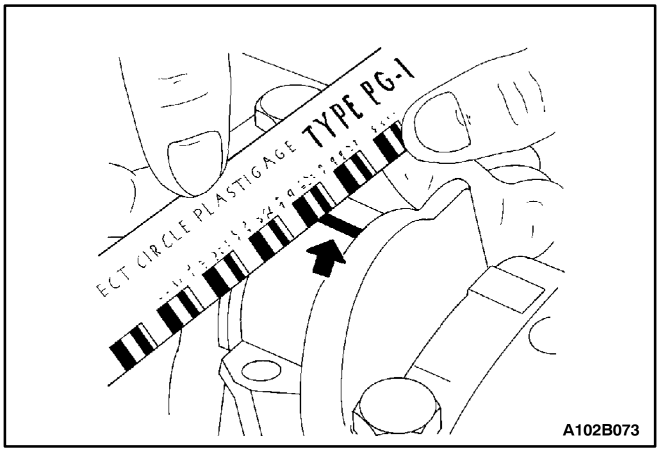
8. Inspect all of the crankshaft bearing clearances using a commercially available plastic gauging (ductile plastic threads).
9. Cut the plastic gauging threads to the length of the bearing width. Lay them axially between the crankshaft journals and the crankshaft bearings.



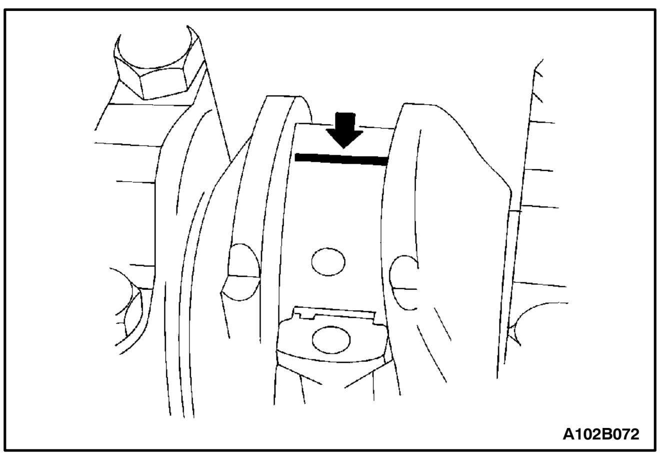
10. Install the crankshaft bearing caps.
11. Install the crankshaft bearing cap bolts.

Installation Notice

Tightening Torque	50 N·m (37 lb–ft) +45°+15°



12. Remove the crankshaft bearing caps.
13. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges.)
14. Inspect the bearing clearances for permissible tolerance ranges. Refer to *"Engine Specifications"* in this section.

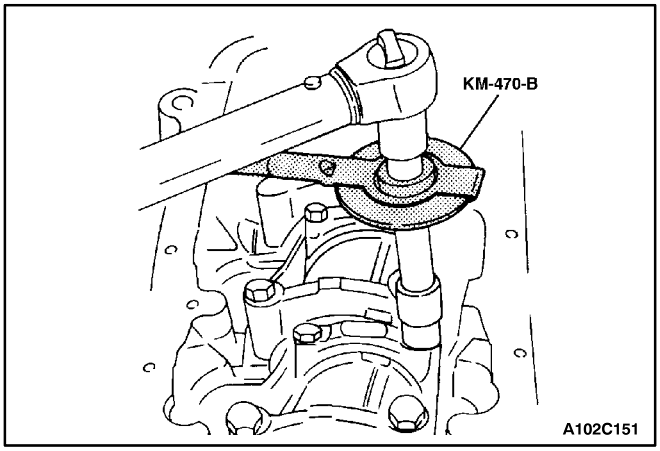


Inspection Procedure – Connecting Rods

1. Coat the connecting rod bearings with engine oil.
2. Install the upper connecting rod bearings into the connecting rod journals.
3. Install the lower connecting rod bearings into the connecting rod bearing caps.

Important: Grease the connecting rod journals and lubricate the connecting rod bearings slightly so that the plastic gauging thread does not tear when the connecting rod bearing caps are removed.

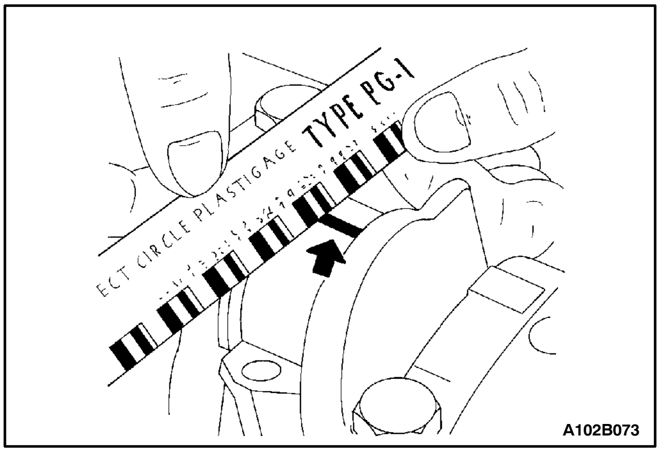
4. Inspect all of the connecting rod bearing clearances using a commercially available plastic gauging (ductile plastic threads).
5. Cut the plastic gauging threads to the length of the bearing width. Lay them axially between the connecting rod journals and the connecting rod bearings.



6. Install the connecting rod bearing caps.
7. Install the connecting rod bearing cap bolts.

Installation Notice

Tightening Torque	35 N·m (26 lb–ft) +45°+15°



8. Remove the connecting rod bearing caps.
9. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges.)
10. Inspect the bearing clearance for permissible tolerance ranges. Refer to *"Engine Specifications"* in this section.

SPECIFICATIONS

ENGINE SPECIFICATIONS

Application	2.0L DOHC
General Data:	
Engine Type	4 Cylinder (In-Line)
Displacement	1,998 cm^3 (121 in^3)
Bore Stroke	86 x 86 mm (3.38in x 3.38 in.)
Compression Ratio	9.6:1
Firing Order	1-3-4-2
Cylinder Bore:	
Diameter	85.975 ~ 86.025 mm (3.384 ~ 3.386 in.)
Out of Round (Maximum)	0.013 mm (0.0005 in.)
Cylinder Bore Taper (Maximum)	0.013 mm (0.0005 in.)
Piston Protusion	0.5 mm Max (0.019 in.)
Oversize (Measure Replacement Piston before Re-boring)	Available in 0.50 mm to suit bore (0.019 in.)
Service Replacement Standard Bore	4 Piston, Pin, and Ring Assemblies Available
Block Face Distortion	0.05 mm Max (0.00197 in.)
Piston:	
Diameter	85.955 ~ 86.485 mm (3.384 ~ 3.404 in.)
Clearance to Bore	0.030 ~ 0.050 mm (0.00118 ~ 0.0020 in.)
Piston Protrusion	0.5 mm Max (0.019 in.)
Piston Taper	0.013 mm (0.0005 in.)
Piston Rings:	
Ring, End Gap, Top Compression	0.3 ~ 0.5 mm (0.011 ~ 0.019 in.)
Ring, End Gap, Second Compression	0.3 ~ 0.5 mm (0.011 ~ 0.019 in.)
Oil	0.4 ~ 1.4 mm (0.0015 ~ 0.055 in.)
Piston Pin:	
Diameter	20.9970 ~ 20.9985 mm (0.82665 ~ 0.82671 in.)
Pin Offset	0.8 mm (0.03 in.) Toward Thrust Side

ENGINE SPECIFICATIONS (Cont'd)

Application	2.0L DOHC
Clearance: In Piston	0.0035 ~ 0.0140 mm (0.00013 ~ 0.00055 in.)
Clearance: In Rod	Interference Fit in Rod
Length	61.5 mm (2.42 in.)
Camshaft:	
Lift – Intake	10.0 mm (0.39 in.)
Lift – Exhaust	10.0 mm (0.39 in.)
Camshaft Cap to Bearing Journal Clearance	0.04 ~ 0.144 mm (0.0015 ~ 0.0056 in.)
Bearing Journal OD	42.455 ~ 43.470 mm (1.6714 ~ 1.7114 in.)
Crankshaft:	
Main Journal	–
Diameter (All)	57.974 ~ 57.995 mm (2.2824 ~ 2.2832 in.)
Radial Runout (Shaft Support on No. 1 and No. 5 Bearings Measured at No. 3 Journal)	0.03 ~ 0.061 mm (0.00118 ~ 0.00240 in.)
Main Bearing Clearance (All)	0.015 ~ 0.061 mm (0.00059 ~ 0.00240 in.)
End Play	0.070 ~ 0.302 mm (0.0027 ~ 0.0118 in.)
Service Oversize, Available in 2 sizes	0.25 and 0.5 mm (0.00098 and 0.019 in.)
Connecting Rod Journal:	
Diameter (All)	48.981 ~ 48.987 mm (1.9283 ~ 1.9286 in.)
Out of Round (Maximum)	0.004 mm (0.00015 in.)
Rod Bearing Play	0.006 ~ 0.031 mm (0.00023 ~ 0.00122 in.)
Rod Bearing Clearance	0.019 ~ 0.063 mm (0.0007 ~ 0.0024 in.) (Production 0.013 ~ 0.041 mm 0.0005 ~ 0.0016 in.)
Cylinder Head:	
Valve Stem Protrusion	39.8 mm Max (1.566 in.)
Valve Guide Height	13.7 ~ 14.0 mm (0.53 ~ 0.55 in.)
Overall Height	134.0 ± 0.025 mm (5.275 ~ 0.0009 in.)
Minimum Overall Height After Machining	133.9 mm (5.271 in.)

ENGINE SPECIFICATIONS (Cont'd)

Application	2.0L DOHC
Valve System:	
Valve Lash Compensators	Hydraulic
Seat Runout (Maximum, All)	0.03 mm (0.001 in.)
Face Runout (Maximum, All)	0.03 mm (0.001 in.)
Valve Stem Diameter Intake	5.970 ~ 5.955 mm (0.235 ~ 0.234 in.)
Exhaust	5.960 ~ 5.945 mm (0.23464 ~ 0.2360 in.)
Valve Diameter Intake	32 ± 0.1 mm (1.2598 ± 0.0039 in.)
Exhaust	29 ± 0.1 mm (1.1417 ± 0.0039 in.)
Valve Seat Width Intake	1.0 ~ 1.5 mm (0.039 ~ 0.059 in.)
Exhaust	1.7 ~ 2.2 mm (0.066 ~ 0.086 in.)
Valve Face Angle	44°
Valve Seat Angle	40°
Valve Guide Inside Diameter	6.000 ~ 6.012 mm (0.236 ~ 0.237 in.)
Oil Pump:	
Gear Lash	0.10 ~ 0.20 mm (0.0040 ~ 0.008 in.)
Outer Gear to Body	0.11 ~ 0.19 mm (0.0043 ~ 0.0074 in.)
Outer Gear to Crescent	0.11 ~ 0.24 mm (0.0043 ~ 0.009 in.)
Inner Gear to Crescent	0.18 ~ 0.26 mm (0.007 ~ 0.010 in.)
End Clearance	0.03 ~ 0.10 mm (0.001 ~ 0.004 in.)
Sealants and Adhesives:	
Rear Main Bearing Cap	GE p/n RTV 159
Camshaft Carrier-to-Cylinder head	HN 1581 (Loctite® 515)
Oil Pan Bolts	HN 1256 (Loctite® 542)
Oil Pump Bolts	HN 1256 (Loctite® 542)
Oil Pan Pickup Tube Bolts	HN 1256 (Loctite® 542)
Oil Gallery Plug	HN 1256 (Loctite® 542)
Coolant Jacket Caps and Plugs (Freeze Plugs)	HN 1756 (Loctite® 176)
Exhaust Manifold Studs/Nuts	Anti-seize Compound (HMC Spec HN1325)

FASTENER TIGHTENING SPECIFICATIONS

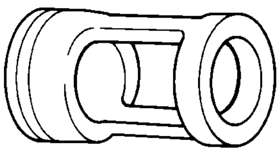
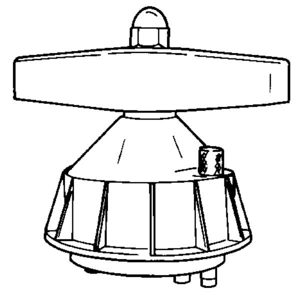
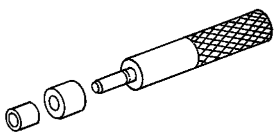
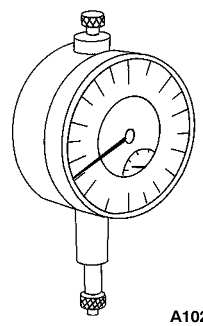
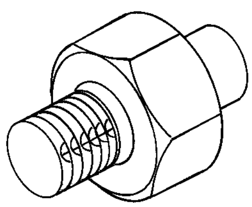
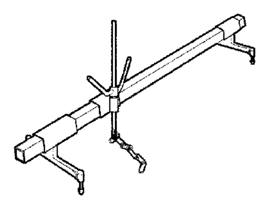
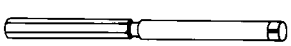
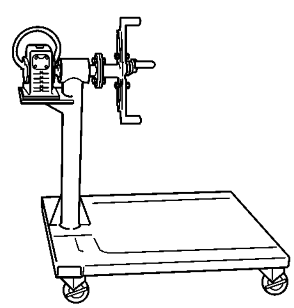
Application	N•m	Lb-Ft	Lb-In
A/C Compressor Hose Assembly Bolt	33	24	–
Air Filter Housing Bolts	8	–	71
Generator to Intake Manifold Strap Bracket Bolt	20	15	–
Generator-to-Intake Manifold Support Bracket Bolts	35	26	–
Automatic Tensioner Bolt	25	18	–
Camshaft Bearing Cap Bolts	8	–	71
Canister Purge Solenoid Bracket Bolt	5	–	44
Connecting Rod Cap Bearing Bolts	35 + 45° + 15°	26 + 45° + 15°	–
Coolant Bypass Housing Bolts	15	11	–
Coolant Pump Retaining Bolts	20	15	–
Coolant Temperature Sensor	25	18	–
Crankshaft Bearing Cap Bolts	50 +45° +15°	37 + 45°	–
Crankshaft Position Sensor Retaining Bolt	13	–	115
Crankshaft Pulley Bolts	20	15	–
Crankshaft Timing Belt Drive Gear Bolt	130 +40° +50°	96 + 40° + 50°	–
Cylinder Head Bolts	25 + 90°+ 90°+ 90°	18 + 90°+ 90°+ 90°	–
DIS Ignition Coil and EGR Mounting Bracket Bolts	25	18	–
Engine Block Lower Support Bracket/Splash Shield Bolts	35	26	–
Engine Mount Bolts	60	44	–
Engine Mount Bracket-to-Engine Mount Retaining Bolts	60	44	–
Engine Mount Bracket Retaining Bolts and Nut	60	44	–
Engine Mount Bracket-to-Engine Block Bolts	90	66	–
Engine Mount Bracket-to-Engine Block Nuts	90	66	–
Engine Mount Retaining Bolts	60	44	–
Engine to Intake Manifold Support Bracket	20	15	–
Exhaust Camshaft Gear Bolt	50 +60°+15°	37 +60°+15°	–
Exhaust Flex Pipe-to-Catalytic Converter Retaining Nuts	30	22	–
Exhaust Flex Pipe-to-Exhaust Manifold Retaining Nuts	22	16	–
Exhaust Flex Pipe Support Bracket Bolts	30	22	–
Exhaust Gas Recirculation Valve Bolts	20	15	–
Exhaust Manifold Heat Shield Bolts	15	11	–
Exhaust Manifold Retaining Nuts	15	11	–
Exhaust Support Bracket Bolts	30	22	
Flexible Plate Bolts	65	48	–

FASTENER TIGHTENING SPECIFICATIONS (Cont'd)

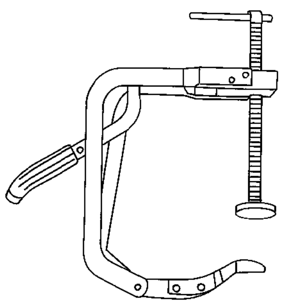
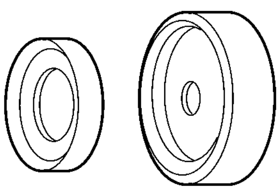
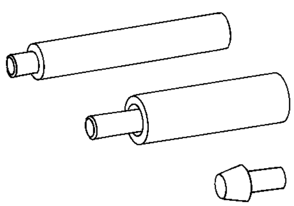
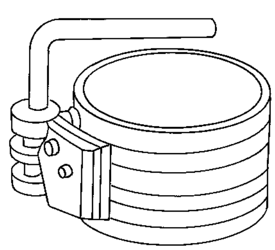
Application	Lb-Ft	N•m	Lb-In
Flywheel Bolts	48 + 30° + 15°	65 + 30° + 15°	–
Front Timing Belt Cover Bolts	–	6	53
Fuel Rail Retaining Bolts	18	25	–
Ignition Coil Mounting Bolts	–	10	89
Intake Camshaft Gear Bolt	37 +60°+15°	50 +60°+15°	–
Intake Manifold Retaining Nuts and Bolts	13	18	–
Intake Manifold Support Bracket Lower Bolts	15	20	–
Intake Manifold Support Bracket Upper Bolts	15	20	–
Oil Pan Drain Plug	26	35	–
Oil Pan Flange-to-Transaxle Bolts	30	40	–
Oil Pan Retaining Bolts	–	10	89
Oil Pump Retaining Bolts	–	10	89
Oil Pump Pickup Tube Bolts	–	8	71
Oil Pump Pickup Tube Support Bracket Bolt	–	10	89
Oil Pump Rear Cover Bolts	–	6	53
Power Steering Hose Clamp Bolt	–	8	71
Rear Timing Belt Cover Bolts	–	6	53
Resonator Retaining Bolts	–	8	71
Spark Plug Cover Bolts	–	3	27
Spark Plugs	15	20	–
Thermostat Housing Mounting Bolts	11	15	–
Throttle Cable Bracket Bolts	–	8	71
Timing Belt Automatic Tensioner Bolt	18	25	–
Timing Belt Idler Pulley Nuts	18	25	–
Transaxle Bell Housing Bolts	55	75	–
Transaxle Torque Converter Bolts	44	60	–
Valve Cover Bolts	–	8	71

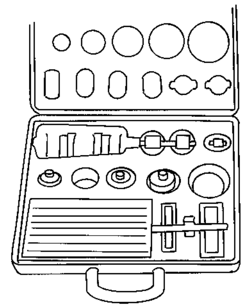
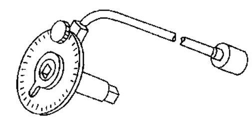
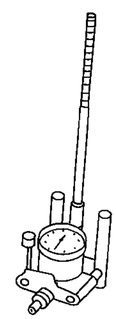
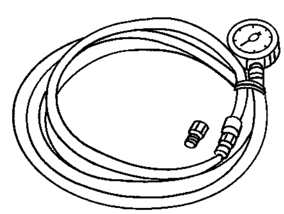
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 A102C153	**KM-653 Adapter**	 A102C155	**J-36972 Crankshaft Rear Oil Seal Installer**
 B102C045	**KM-535 Installer**	 A102B154	**MKM-571-B Gauge**
 B102C044	**KM-135 Adapter**	 A102B152	**DW110-060 Engine Support Fixture**
 A102C154	**KM-805 Valve Guide Reamer**	 A102B159	**KM-412 Engine Overhaul Stand**

SPECIAL TOOLS TABLE (Cont'd)

 A102B157	**KM-348 Spring Compressor**
 A102B160	**KM-635 Crankshaft Rear Oil Seal Installer**
 A102B153	**KM-427 Piston Pin Service Set**
 C102B004	**J-8037 Universal Piston Ring Compressor**

 A102B156	**KM-340-0 Cutter Set**
 A102B161	**KM-470-B Angular Torque Gauge**
 C102B005	**J-8087 Cylinder Bore Check Gauge**
 A202B005	**KM-498-B Pressure Gauge**

SECTION 1D

ENGINE COOLING

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION

The cooling system maintains the engine temperature at an efficient level during all engine operating conditions. When the engine is cold, the cooling system cools the engine slowly or not at all. This slow cooling of the engine allows the engine to warm up quickly.

The cooling system includes a radiator and recovery subsystem, cooling fans, a thermostat and housing, a coolant pump, and a coolant pump drive belt. The timing belt drives the coolant pump.

All components must function properly in order for the cooling system to operate. The coolant pump draws the coolant from the radiator. The coolant then circulates through water jackets in the engine block, the intake manifold, and the cylinder head. When the coolant reaches the operating temperature of the thermostat, the thermostat opens. The coolant then goes back to the radiator where it cools.

This system directs some coolant through the hoses to the heater core. This provides for heating and defrosting. The surge tank is connected to the radiator to recover the coolant displaced by expansion from the high temperatures. The surge tank maintains the correct coolant level.

The cooling system for this vehicle has no radiator cap or filler neck. The coolant is added to the cooling system through the surge tank.

RADIATOR

This vehicle has a lightweight tube-and-fin aluminum radiator. Plastic tanks are mounted on the upper and the lower sides of the radiator core.

On vehicles equipped with automatic transaxles, the transaxle fluid cooler lines run through the lower radiator tank. A radiator drain plug is on this radiator.

To drain the cooling system, open the drain plug.

SURGE TANK

The surge tank is a transparent plastic reservoir, similar to the windshield washer reservoir.

The surge tank is connected to the radiator by a hose and to the engine cooling system by another hose. As the vehicle is driven, the engine coolant heats and expands. The portion of the engine coolant displaced by this expansion flows from the radiator and the engine into the surge tank. The air trapped in the radiator and the engine is degassed into the surge tank.

When the engine stops, the engine coolant cools and contracts. The displaced engine coolant is then drawn back into the radiator and the engine. This keeps the radiator filled with the coolant to the desired level at all times and increases the cooling efficiency.

Maintain the coolant level between the MIN and the MAX marks on the surge tank when the system is cold.

COOLANT PUMP

The belt-driven centrifugal coolant pump consists of an impeller, a drive shaft, and a belt pulley. The coolant pump is mounted on the front of the transverse-mounted engine, and is driven by the timing belt.

The impeller is supported by a completely sealed bearing.

The coolant pump is serviced as an assembly and, therefore, cannot be disassembled.

THERMOSTAT

A wax pellet-type thermostat controls the flow of the engine coolant through the engine cooling system. The thermostat is mounted in the thermostat housing to the front of the cylinder head.

The thermostat stops the flow of the engine coolant from the engine to the radiator in order to provide faster warm-up, and to regulate the coolant temperature. The thermostat remains closed while the engine coolant is cold, preventing circulation of the engine coolant through the radiator. At this point, the engine coolant is allowed to circulate only throughout the heater core to warm it quickly and evenly.

As the engine warms, the thermostat opens. This allows the engine coolant to flow through the radiator where the heat is dissipated. This opening and closing of the thermostat permits enough engine coolant to enter the radiator to keep the engine within proper engine temperature operating limits.

The wax pellet in the thermostat is hermetically sealed in a metal case. The wax element of the thermostat expands when it is heated and contracts when it is cooled.

As the vehicle is driven and the engine warms, the engine coolant temperature increases. When the engine coolant reaches a specified temperature, the wax pellet element in the thermostat expands and exerts pressure against the metal case, forcing the valve open. This allows the engine coolant to flow through the engine cooling system and cool the engine.

As the wax pellet cools, the contraction allows a spring to close the valve.

The thermostat begins to open at 87°C (189°F) and is fully open at 102°C (226°F). The thermostat closes at 86°C (187°F).

ELECTRIC COOLING FAN

Caution: Keep hands, tools, and clothing away from the engine cooling fans to help prevent personal injury. This fan is electric and can turn on whether or not the engine is running.

Caution: If a fan blade is bent or damaged in any way, no attempt should be made to repair or reuse the damaged part. A bent or damaged fan assembly should always be replaced with a new one to prevent possible injury.

The cooling fans are mounted behind the radiator in the engine compartment. The electric cooling fans increase the flow of air across the radiator fins and across the condenser on air condition (A/C)-equipped vehicles. This helps to speed cooling when the vehicle is at idle or moving at low speeds.

All models with A/C system have two fans. The main fan is 340 mm (13.4 inches) in diameter with five blades to aid the air flow through the radiator and the condenser. An electric motor attached to the radiator support drives the fan. The auxiliary fan is 300 mm (11.8 inches) in diameter.

- The cooling fans are actuated by the electronic control module (ECM) using a low-speed cooling fan relay and a high-speed cooling fan relay and a series/parallel cooling fan relay.
- The ECM will turn the cooling fans on at low speed when the coolant temperature reaches 93°C (199°F) and at high speed when the coolant temperature reaches 97°C (207°F).
- The ECM will change the cooling fans from high speed to low speed at 94°C (201°F) and will turn the cooling fans off at 90°C (194°F).

ENGINE COOLANT TEMPERATURE SENSOR

The engine coolant temperature (ECT) sensor uses a thermistor to control the signal voltage to the electronic control module (ECM).

ENGINE COOLANT TEMPERATURE GAUGE

The engine coolant temperature gauge controls the instrument panel temperature indicator. The engine coolant temperature sensor is located on the intake manifold near the throttle body on an SOHC engine, and on the cylinder head under the intake manifold on a DOHC engine.

ENGINE BLOCK HEATER

The vehicle is designed to accept an engine block heater. The engine block heater helps warm the engine for improved cold weather starting. It can also help reduce fuel consumption when a cold engine is warming up.

The engine block heater utilizes an existing expansion plug for installation and is located under the intake manifold.

Contact your Daewoo dealer for further information or installation.

DIAGNOSTIC INFORMATION AND PROCEDURES

THERMOSTAT TEST

1. Remove the thermostat from the vehicle. Refer to "Thermostat" in this section.
2. Make sure the valve spring is tight when the thermostat is fully closed. If the spring is not tight, replace the thermostat.
3. Suspend the thermostat and a thermometer in a pan of 50/50 mixture of ethylene glycol and water. Do not let the thermostat or the thermometer rest on the bottom of the pan because the uneven concentration of heat on the bottom could result in inaccurate temperature measurements.
4. Heat the pan on a burner.
5. Use the thermometer to measure the temperature of the heated solution.
6. The thermostat should begin to open at 87°C (189°F) and it should be fully open at 102°C (226°F). If it does not open at these temperatures, replace the thermostat.

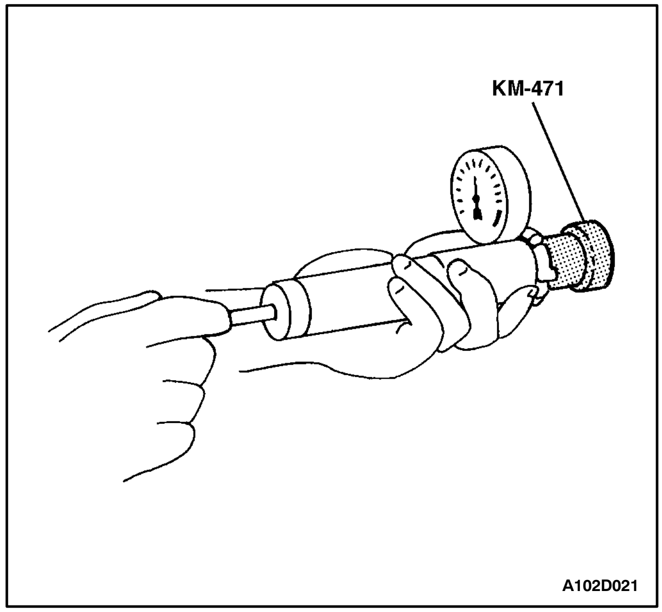
SURGE TANK CAP TEST

Tools Required

KM-471 Adapter

The surge tank cap maintains proper pressure, protects the system from high pressure by opening a pressure valve, and protects the coolant hoses from collapsing because of a vacuum.

1. Wash any sludge from the surge tank cap and the valve seat of the vacuum pressure valve for the surge tank cap.
2. Check for any damage or deformity to the vacuum pressure valve for the surge tank cap. If any damage or deformity is found, replace the cap.
3. Install a suitable cooling system pressure tester to the cap using the adapter KM-471.
4. Pull the vacuum pressure valve open. If the surge tank cap does not seal properly, replace the surge tank cap.
5. Pressurize the cap to 90 to 120 kPa (13 to 17 psi).
6. Wait 10 seconds and check the pressure held by the tank cap tester.



7. If the pressure held by the cooling system pressure tester falls below 80 kPa (11.6 psi), replace the surge tank cap.

COOLING SYSTEM DIAGNOSIS

Engine Overheats

Checks	Action
Check for a loss of the coolant.	Add the coolant.
Check for a weak coolant solution.	Confirm that the coolant solution is a 50/50 mixture of ethylene glycol and water.
Check the front of the radiator for any dirt, any leaves, or any insects.	Clean the front of the radiator.
Check for leakage from the hoses, the coolant pump, the heater, the thermostat housing, the radiator, the core plugs, or the head gasket.	Replace any damaged components.
Check for a faulty thermostat.	Replace a damaged thermostat.
Check for retarded ignition timing.	Perform an ECM code diagnosis. Confirm the integrity of the timing belt.
Check for an improperly operating electric cooling fan.	Replace the electric cooling fan.
Check for radiator hoses that are plugged or rotted.	Replace any damaged radiator hoses.
Check for a faulty water pump.	Replace a faulty water pump.
Check for a faulty surge tank cap.	Replace a faulty surge tank cap.
Check for a cylinder head or an engine block that is cracked or plugged.	Repair the damaged cylinder head or the damaged engine block.

Loss of Coolant

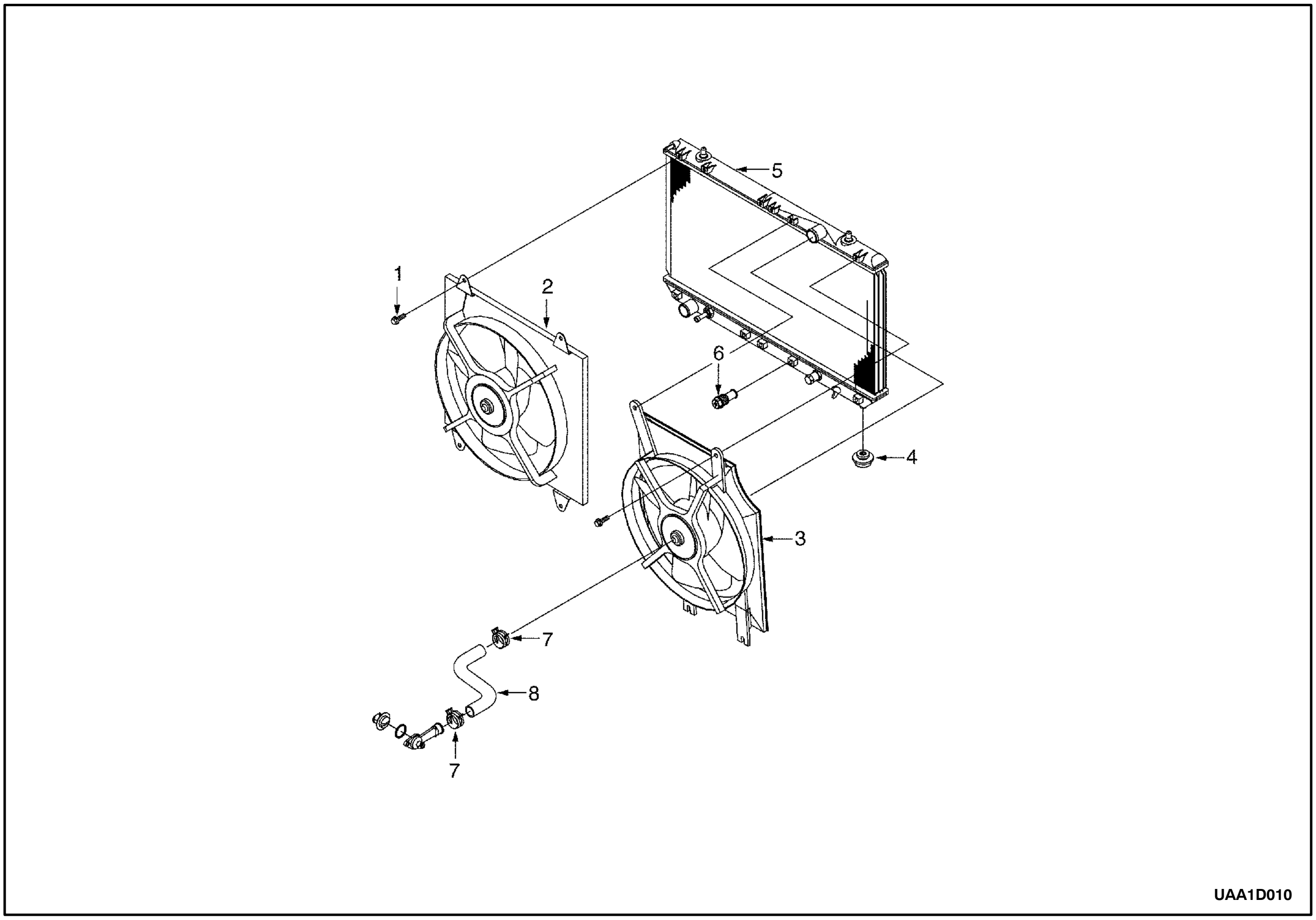
Checks	Action
Check for a leak in the radiator.	Replace a damaged radiator.
Check for a leak in the following locations: • Surge tank. • Hose.	Replace the following parts, as needed: • Surge tank. • Hose.
Check for loose or damaged radiator hoses, heater hoses, and connections.	Reseat the hoses. Replace the hoses or the clamps.
Check for leaks in the coolant pump seal.	Replace the coolant pump seal.
Check for leaks in the coolant pump gasket.	Replace the coolant pump gasket.
Check for an improper cylinder head torque.	Tighten the cylinder head bolts to specifications. Replace the cylinder head gasket, if needed.
Check for leaks in the following locations: • Intake manifold. • Cylinder head gasket. • Cylinder block plug. • Heater core. • Radiator drain plug.	Repair or replace any components, as needed, to correct the leak.

Engine Fails to Reach Normal Operating Temperature or Cool Air from the Heater

Checks	Action
Check to determine if the thermostat is stuck open or is the wrong type of thermostat.	Install a new thermostat of the correct type and heat range.
Check the coolant level to determine if it is below the MIN mark on the surge tank.	Add sufficient coolant to raise the fluid to the specified mark on the surge tank.

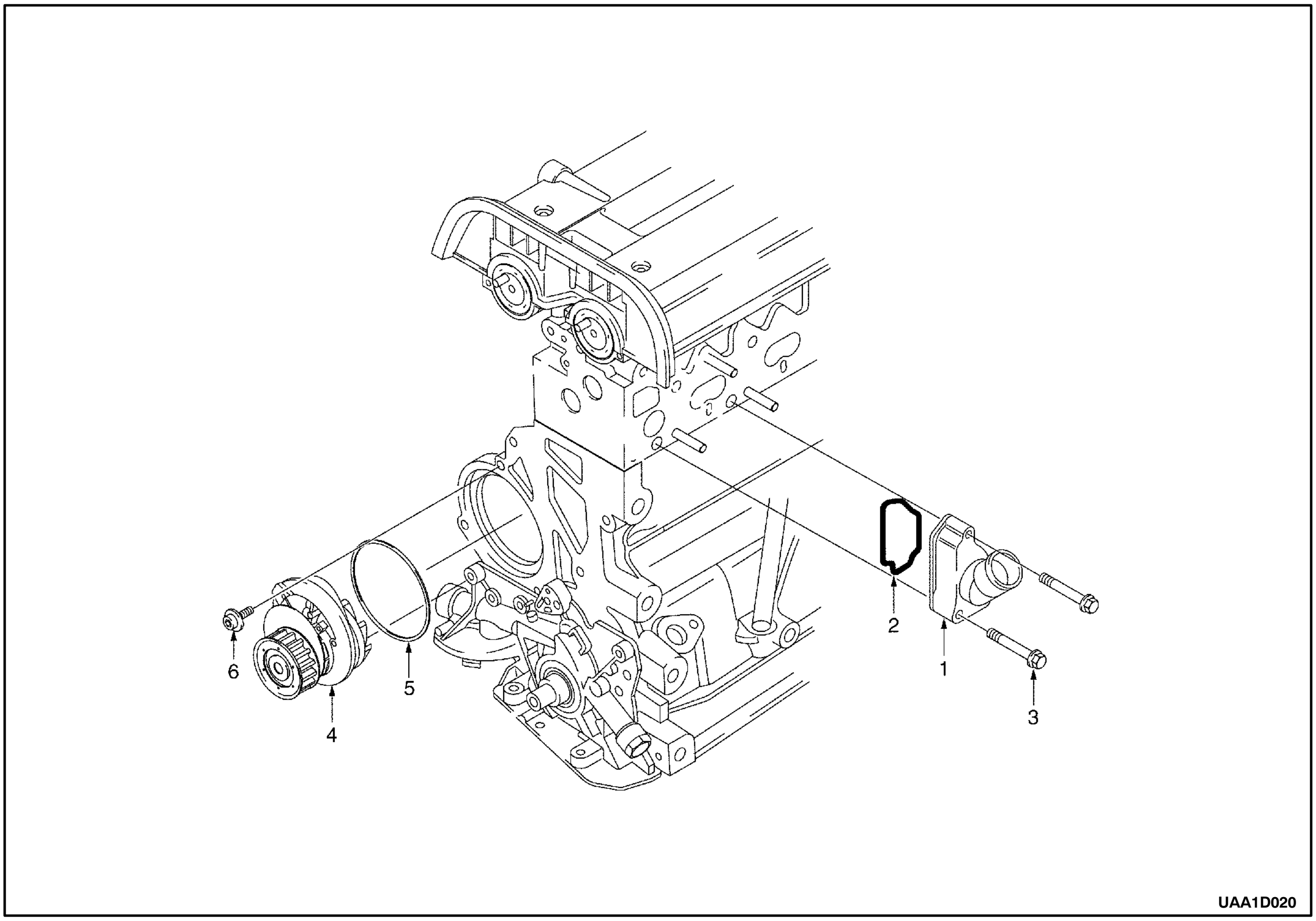
COMPONENT LOCATOR

RADIATOR/FAN



1 Bolt
2 Main Cooling Fan
3 Auxiliary Cooling Fan (Air Conditioning Only)
4 Radiator Lower Bumper
5 Radiator
6 Drain Cock
7 Spring Clamp
8 Upper Radiator Hose

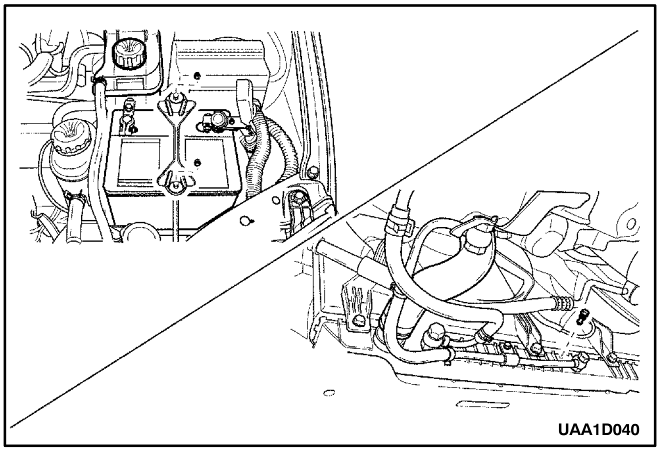
COOLANT PUMP/THERMOSTAT (DOHC)



1 Thermostat Housing
2 O-Ring Seal
3 Bolt
4 Coolant Pump
5 Ring Seal
6 Coolant Pump Mounting Bolt

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



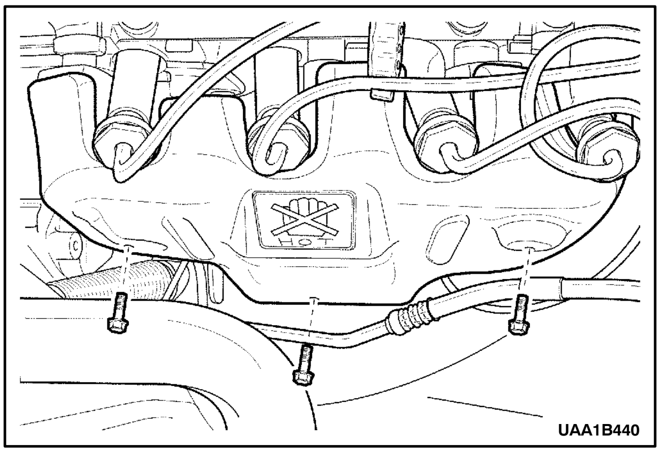
UAA1D040

DRAINING AND REFILLING THE COOLING SYSTIM

Removal and Installation Procedure

Caution : Do not remove the surge tank cap while the engine and the radiator are hot. Scalding fluid and steam may be blown out under pressure.

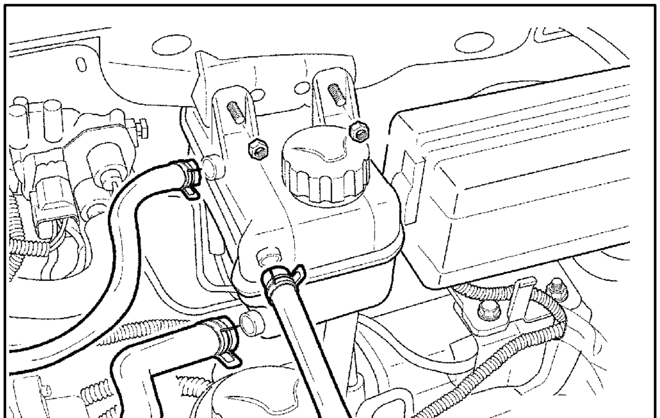
1. Place a pan below the vehicle to catch the draining coolant.
2. Remove the surge tank cap.
3. Unplug the drain cock.



UAA1B440

Caution : Dispose of the used coolant to a used coolant holding tank to be picked up with the used oil for disposal. Never pour the used coolant down the drain. Ethylene glycol antifreeze is an extremely toxic chemical. Disposing of it into the sewer system or the ground water can contaminate the local environment.

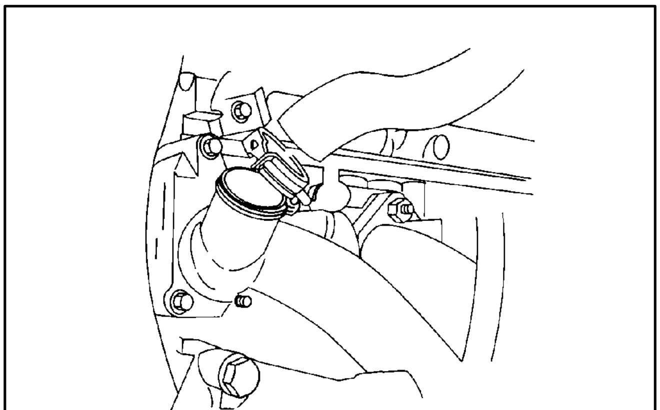
4. Catch the escaping fluid in a drain pan.
5. Remove all sludge and dirt from inside the surge tank. Refer to *"Surge Tank"* in thins section.
6. Plug the drain cock.
7. Add the clean water to the surge tank.
8. Fill the tank slowly so that the upper reservoir hose remains above the water line. This allows the air inside the cooling system to escape.
9. Start the engine.
10. Run the engine until the thermostat opens. You can tell the thermostat is open when both radiator hoses are hot to the touch.

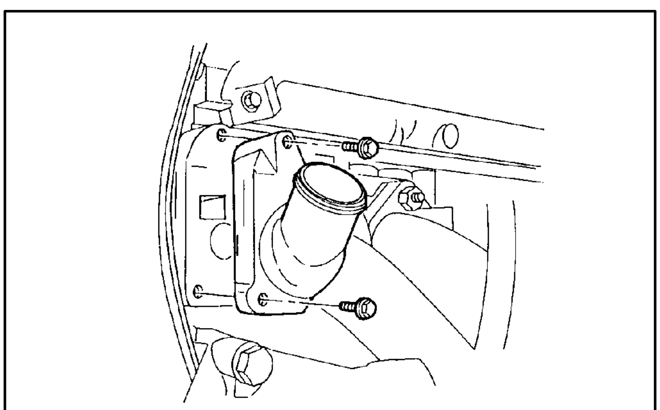

UAA1D050

11. Stop the engine.
12. Repeat steps 1 through 11 until the drained water is clear and free of coolant and rust.

Notice : Never use an antifreeze mixture more concentrated than 60 percent antifreeze to 40 percent water. The solution freezing point increases above this concentration.

13. Fill the cooling system through the surge thank with a mixture of ethylene glycol antifreeze and water. The mixture must be at least 44 percent antifreeze, but not more than 60 percent antifreeze.
14. Fill the surge tank to the specified MAX fill mark on the outside of the tank.
15. Installation should follow the removal procedure in the reverse order.


B102D005


B102D006

THERMOSTAT (2.0L DOHC Shown 1.6L DOHC Similar)

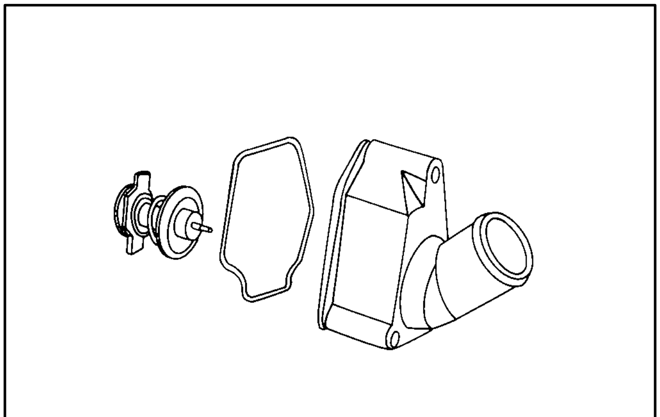
Removal and Installation Procedure

Caution : To prevent personal injury, do not remove the surge tank cap while the engine and the radiator are hot because the heat causes the system to remain under pressure. Scalding fluid and steam may be blown out under pressure.

1. Drain the coolant. Refer to *“Draining and Refilling th4e Cooling System”* in this section.
2. Disconnect the upper radiator hose from the thermostat housing.
3. Remove the mounting bolts that hold the thermostat housing to the cylinder head.
4. Remove the thermostat housing from the cylinder head.

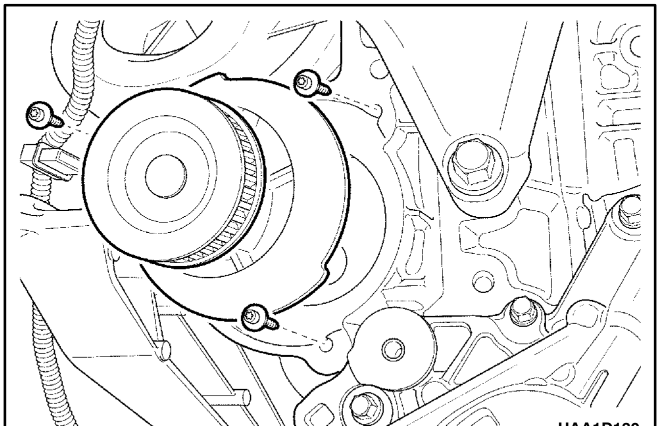
Installation Notice

Tightening Torque	15 N·m (11 lb–ft)



B102D007

5. Remove the seal from the thermostat housing.
6. Remove the thermostat from the thermostat housing by pressing the thermostat-mounting flange downward and then rotating the flange clockwise.
7. Inspect the valve seat for foreign matter that could prevent the valve from sealing properly.
8. Inspect the thermostat for proper operation. Refer to *“Thermostat Test”* in this section.
9. Clean the thermostat housing and the cylinder head mating surfaces.
10. Installation should follow the removal procedure in the reverse order.



UAA1D130

COOLANT PUMP (TYPICAL)

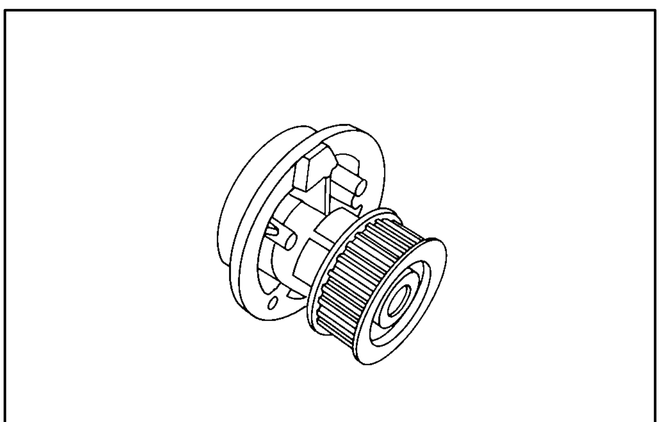
Removal and Installation Procedure

1. Drain the engine cooling system to a level below the thermostat housing. Refer to *“Draining and Refilling the Cooling System”* in this section.
2. Remove the timing belt. Refer to *Section 1B, SOHC Engine Mechanical*, or *Section 1C, DOHC Engine Mechanical*.
3. Remove the coolant pump mounting bolts.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

4. Remove the coolant pump from the cylinder block.
5. Remove the ring seal from coolant pump.
6. Installation should follow the removal procedure in the reverse order.



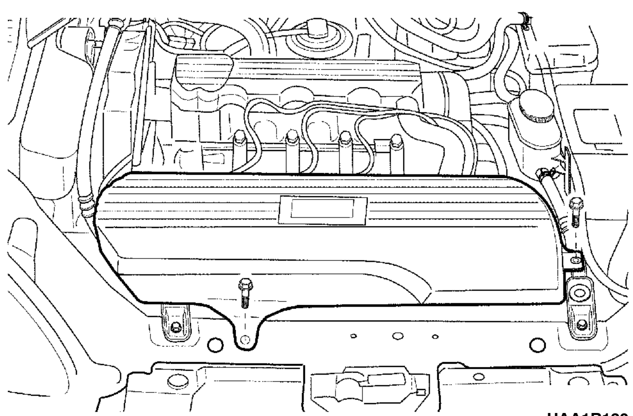
B102D020

Inspection and Cleaning Procedure

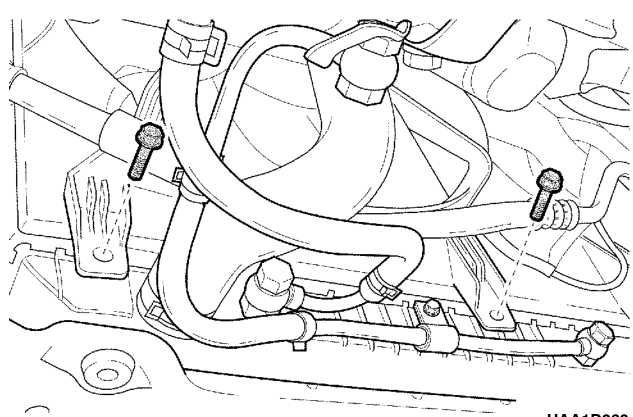
1. Inspect the coolant pump body for cracks and leaks.
2. Inspect the coolant pump bearing for play or abnormal noise.
3. Inspect the coolant pump pulley for excessive wear. If the coolant pump is defective, replace the coolant pump as a unit.
4. Clean the mating surfaces of the coolant pump and cylinder block.

ELECTRIC COOLING FAN – MAIN

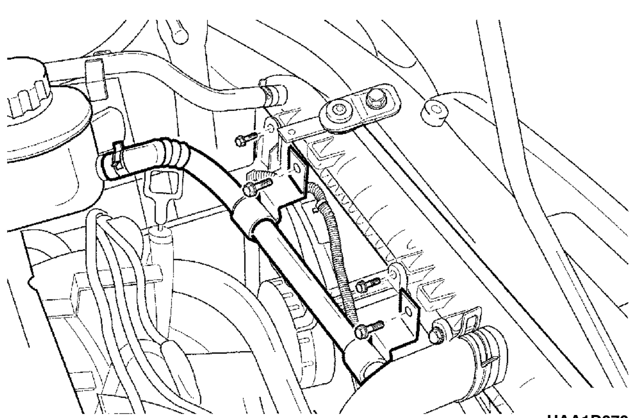
Removal and Installation Procedure


UAA1B120

1. Disconnect the negative battery cable.
2. Remove the snorkel bolts.
3. Remove the snorkel assembly.


UAA1D060

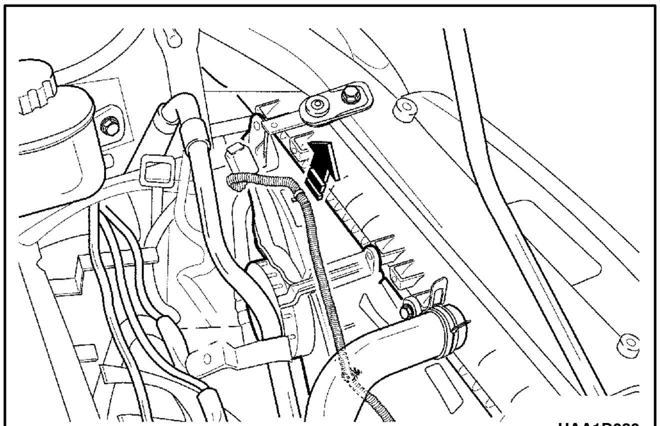
4. Remove the fan shroud lower mounting bolts.


UAA1D070

5. Remove the bolts at the power steering pipe hose bracket.
6. Remove the fan shroud upper mounting bolts.

Installation Notice

Tightening Torque	4 N·m (35 lb–in)

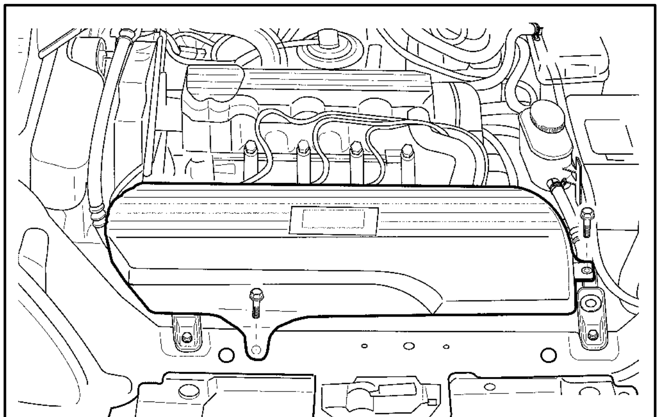

UAA1D080

7. Disconnect the cooling fan electrical connector.
8. Disconnect the clamps at the fan shroud
9. Lift the fan shroud assembly upward, and remove the fan shroud assembly from the vehicle.
10. Remove the fan motor retaining nuts.
11. Remove the fan motor from the shroud.

Installation Notice

Tightening Torque	3.2 N·m (28 lb–in)

12. Installation should follow the removal procedure in the reverse order.

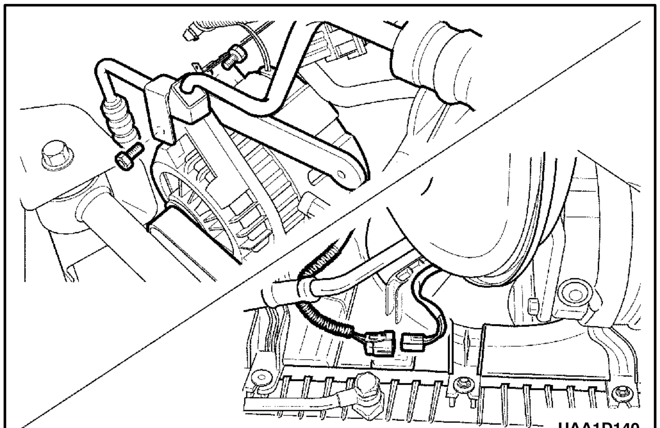


UAA1B120

ELECTRIC COOLING FAN – AUXILIARY

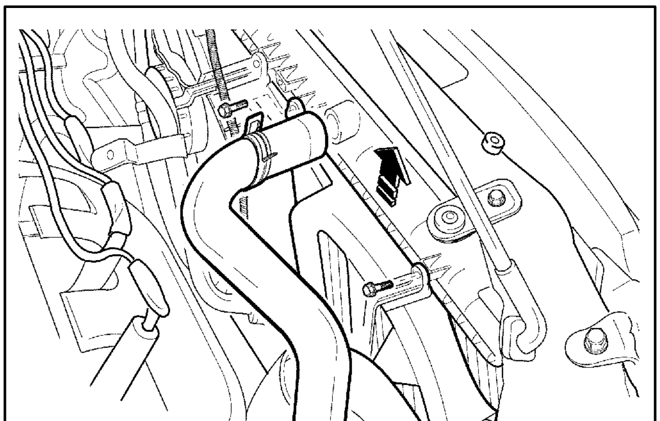
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the snorkel bolts.
3. Remove the snorkel assembly.



UAA1D140

4. Remove the bolts at the power steering pipe hose bracket.
5. Disconnect the cooling fan electrical connector.
6. Remove the fan shroud lower mounting bolts.



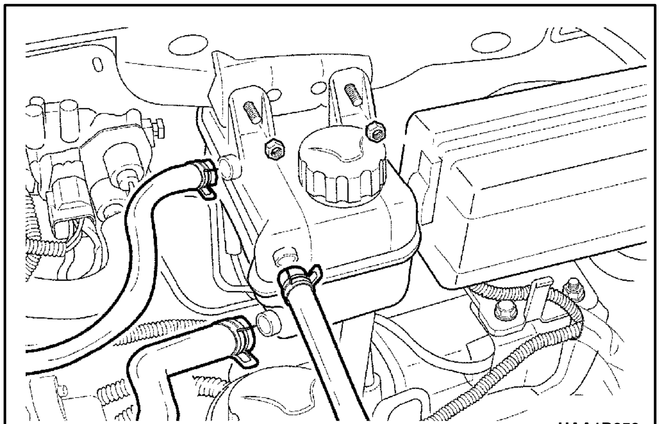
UAA1D090

7. Disconnect the upper radiator hose clamp.
8. Remove the fan shroud upper mounting bolts.

Installation Notice

Tightening Torque	4 N·m (35 lb–in)

9. Lift the fan shroud assembly upward, and remove the fan shroud assembly from the vehicle.
10. Installation should follow the removal procedure in the reverse order.



UAA1D050

SURGE TANK

Removal and Installation Procedure

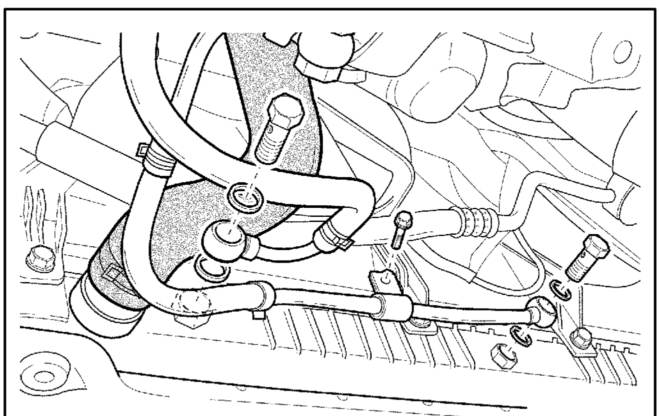
Caution : To prevent personal injury, do not remove the surge tank cap while the engine and the radiator are hot, because the heat causes the system to remain under pressure. Scalding fluid and steam may be blown out under pressure.

1. Drain the engine coolant to below the level of the surge tank.
2. Loosen the overflow hose clamps and disconnect the overflow hoses from the surge tank.
3. Remove the surge tank attaching nuts.

Installation Notice

Tightening Torque	4 N·m (35 lb–in)

4. Remove the surge tank from the vehicle.
5. Clean the inside and the outside of the surge tank and the surge tank cap with soap and water.
6. Rinse the surge tank and the cap thoroughly.
7. Installation should follow the removal procedure in the reverse order.



UAA1D100

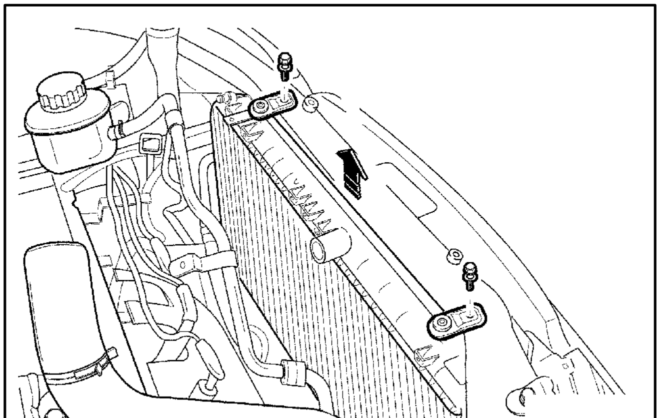
RADIATOR

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Drain the engine cooling system. Refer to *“Draining and Refilling the Cooling System”* in this section.
3. Remove the main cooling fan. Refer to *“Electric Cooling Fan – Main”* in this section.
4. Remove the auxiliary cooling fan. Refer to *“Electric Cooling Fan – Auxiliary”* in this section.
5. Disconnect the lower radiator hose from the radiator.
6. Remove the transmission cooler pipe union bolts and pipe bracket bolt at the lower radiator tank, if equipped.

Installation Notice

Tightening Torque	32 N·m (24 lb–ft)


UAA1D110

7. Remove the left/right upper radiator retaining bolt.

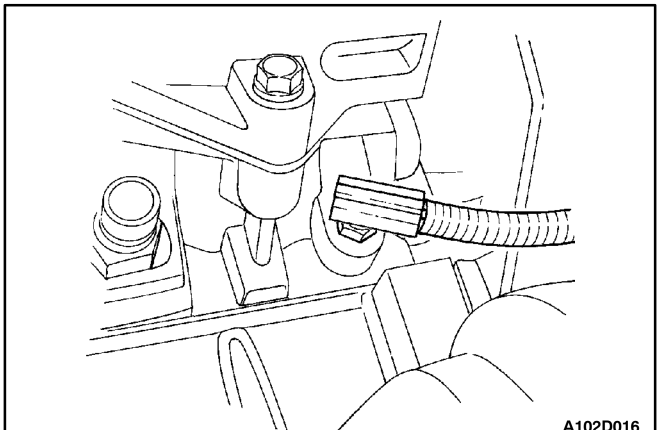
Installation Notice

Tightening Torque	8 N·m (71 lb–in)

8. Remove the left/right upper radiator retaining bracket.
9. Remove the radiator from the vehicle.

Important: The radiator still contains a substantial amount of coolant. Drain the remainder of the coolant from the radiator into a drain pan.

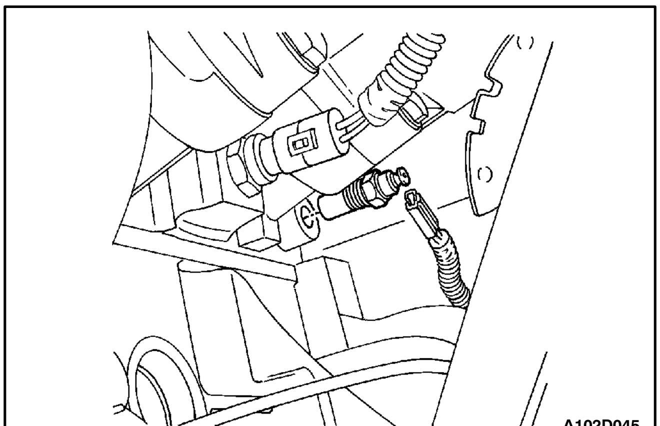
10. Installation should follow the removal procedure in the reverse order.


A102D016

ENGINE COOLANT TEMPERATURE GAUGE (1.6L DOHC)

Removal Procedure

1. Disconnect the negative battery cable.
2. Drain the coolant to a level below the engine coolant temperature sensor.
3. Disconnect the electrical connector from the engine coolant temperature sensor.
4. Remove the temperature sensor from the cylinder head.

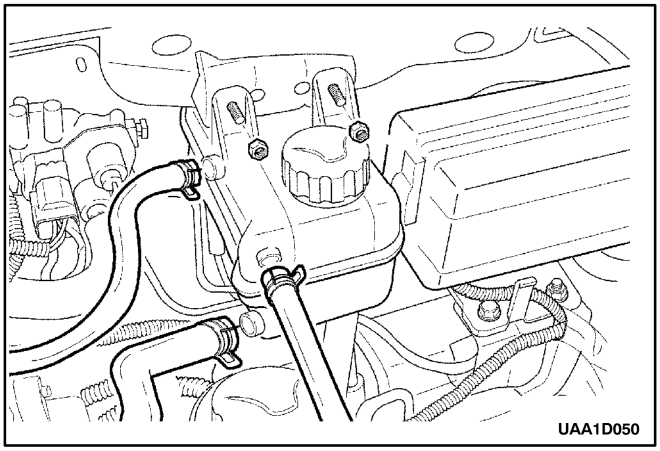

A102D045

Installation Procedure

1. Install the engine coolant temperature sensor into the threaded hole in the cylinder head.

   Tighten

   Tighten the engine coolant temperature sensor to 20 N•m (15 lb-ft).
2. Connect the electrical connector to the engine coolant temperature sensor.
3. Refill the engine cooling system. Refer to “Draining and Refilling the Cooling System” in this section.
4. Connect the negative battery cable.



ENGINE COOLANT TEMPERATURE GAUGE (2.0L DOHC)

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Drain the coolant below the engine coolant temperature level.
3. Disconnect the electrical connector from the engine coolant temperature gauge.
4. Remove the temperature gauge from the cylinder head.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

5. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

CAPACITY

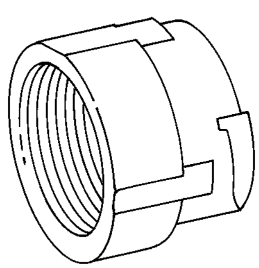
Application	Description
Coolant in the Cooling System (SOHC MPFI System)	7.5L (1.98 gal)
Coolant in the Cooling System (DOHC MPFI System)	8.4L (2.22 gal)

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Coolant Pump Mounting Bolts	20	15	–
Coolant Temperature Sensor	20	15	–
Fan Assembly Mounting Bolts	4	–	35
Fan Motor Nut	3.2	–	28
Fan Motor Retaining Screws	4	–	35
Radiator Retaining Bolts	8	–	71
Surge Tank Attaching Bolt	4	–	35
Thermostat Housing Mounting Bolt	15	11	–
Transaxle Fluid Cooler Pipe Bolt	20	15	–

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 A102D020	**KM-471 Adapter**

SECTION 1E

ENGINE ELECTRICAL

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

BATTERY

The sealed battery is standard on all cars. There are no vent plugs in the cover. The battery is completely sealed, except for two small vent holes in the sides. These vent holes allow the small amount of gas produced in the battery to escape. The battery has the following advantages over conventional batteries:

- No water addition for the life of the battery.
- Overcharge protection. If too much voltage is applied to the battery, it will not accept as much current as a conventional battery. In a conventional battery, the excess voltage will still try to charge the battery, leading to gassing, which causes liquid loss.
- Not as liable to self-discharge as a conventional battery. This is particularly important when a battery is left standing for long periods of time.
- More power available in a lighter, smaller case.

The battery has three major functions in the electrical system. First, the battery provides a source of energy for cranking the engine. Second, the battery acts as a voltage stabilizer for the electrical system. Finally, the battery can, for a limited time, provide energy when the electrical demand exceeds the output of the generator.

RATINGS

A battery has two ratings: (1) a reserve capacity rating designated at 27°C (80°F), which is the time a fully charged battery will provide 25 amperes of current flow at or above 10.5 volts; (2) a cold cranking amp rating determined under testing at -18°C (0°F), which indicates the cranking load capacity.

RESERVE CAPACITY

The reserve capacity (RC) is the maximum length of time it is possible to travel at night with the minimum electrical load and no generator output. Expressed in minutes, the RC rating is the time required for a fully charged battery, at a temperature of 27°C (80°F) and being discharged at a current of 25 amperes, to reach a terminal voltage of 10.5 volts.

COLD CRANKING AMPERAGE

The cold cranking amperage test is expressed at a battery temperature of -18°C (0°F). The current rating is the minimum amperage, which must be maintained by the battery for 30 seconds at the specified temperature, while meeting a minimum voltage requirement of 7.2 volts. This rating is a measure of cold cranking capacity.

The battery is not designed to last indefinitely. However, with proper care, the battery will provide many years of service.

If the battery tests well, but fails to perform satisfactorily in service for no apparent reason, the following factors may point to the cause of the trouble:

- Vehicle accessories are left on overnight.
- Slow average driving speeds are used for short periods.
- The vehicle's electrical load is more than the generator output, particularly with the addition of aftermarket equipment.
- Defects in the charging system, such as electrical shorts, a slipping generator belt, a faulty generator, or a faulty voltage regulator.
- Battery abuse, including failure to keep the battery cable terminals clean and tight, or a loose battery hold-down clamp.
- Mechanical problems in the electrical system, such as shorted or pinched wires.

BUILT-IN HYDROMETER

The sealed battery has a built-in, temperature-compensated hydrometer in the top of the battery. This hydrometer is to be used with the following diagnostic procedure:

1. When observing the hydrometer, make sure that the battery has a clean top.
2. Under normal operation, two indications can be observed:
   - GREEN DOT VISIBLE – Any green appearance is interpreted as a "green dot," meaning the battery is ready for testing.
   - DARK GREEN DOT IS NOT VISIBLE – If there is a cranking complaint, the battery should be tested. The charging and electrical systems should also be checked at this time.
3. Occasionally, a third condition may appear:
   - CLEAR OR BRIGHT YELLOW – This means the fluid level is below the bottom of the hydrometer. This may have been caused by excessive or prolonged charging, a broken case, excessive tipping, or normal battery wear. Finding a battery in this condition may indicate high charging by a faulty charging system. Therefore, the charging and the electrical systems may need to be checked if a cranking complaint exists. If the cranking complaint is caused by the battery, replace the battery.

CHARGING PROCEDURE

1. Batteries with the green dot showing do not require charging unless they have just been discharged, such as in cranking a vehicle.

2. When charging sealed-terminal batteries out of the vehicle, install the adapter kit. Make sure all the charger connections are clean and tight. For best results, batteries should be charged while the electrolyte and the plates are at room temperature. A battery that is extremely cold may not accept current for several hours after starting the charger.
3. Charge the battery until the green dot appears. The battery should be checked every half-hour while charging. Tipping or shaking the battery may be necessary to make the green dot appear.
4. After charging, the battery should be load tested. Refer to “Starter Motor” in this section.

CHARGING TIME REQUIRED

The time required to charge a battery will vary depending upon the following factors:

- **Size of Battery** – A completely discharged large heavy-duty battery requires more than twice the recharging time as a completely discharged small passenger car battery.
- **Temperature** – A longer time will be needed to charge any battery at -18°C (0°F) than at 27°C (80°F). When a fast charger is connected to a cold battery, the current accepted by the battery will be very low at first. The battery will accept a higher current rate as the battery warms.
- **Charger Capacity** – A charger which can supply only 5 amperes will require a much longer charging period than a charger that can supply 30 amperes or more.
- **State-of-Charge** – A completely discharged battery requires more than twice as much charge as a one-half charged battery. Because the electrolyte is nearly pure water and a poor conductor in a completely discharged battery, the current accepted by the battery is very low at first. Later, as the charging current causes the electrolyte acid content to increase, the charging current will likewise increase.

CHARGING A COMPLETELY DISCHARGED BATTERY (OFF THE VEHICLE)

Unless this procedure is properly followed, a perfectly good battery may be needlessly replaced.

The following procedure should be used to recharge a completely discharged battery:

1. Measure the voltage at the battery terminals with an accurate voltmeter. If the reading is below 10 volts, the charge current will be very low, and it could take some time before the battery accepts the current in excess of a few milliamperes. Refer to “Charging Time Required” in this section, which focuses on the factors affecting both the charging time required. Such low current may not be detectable on ammeters available in the field.
2. Set the battery charger on the high setting.

Important: Some chargers feature polarity protection circuitry, which prevents charging unless the charger leads are correctly connected to the battery terminals. A completely discharged battery may not have enough voltage to activate this circuitry, even though the leads are connected properly, making it appear that the battery will not accept charging current. Therefore, follow the specific charger manufacturer’s instruction for bypassing or overriding the circuitry so that the charger will turn on and charge a low-voltage battery.

3. Continue to charge the battery until the charge current is measurable. Battery chargers vary in the amount of voltage and current provided. The time required for the battery to accept a measurable charger current at various voltages may be as follows:

Voltage	Hours
16.0 or more	Up to 4 hours
14.0-15.9	Up to 8 hours
13.9 or less	Up to 16 hours

- If the charge current is not measurable at the end of the above charging times, the battery should be replaced.
- If the charge current is measurable during the charging time, the battery is good, and charging should be completed in the normal manner.

Important: It is important to remember that a completely discharged battery must be recharged for a sufficient number of ampere hours (AH) to restore the battery to a usable state. As a general rule, using the reserve capacity rating (RC) as the number of ampere hours of charge usually brings the green dot into view.

- If the charge current is still not measurable after using the charging time calculated by the above method, the battery should be replaced.

JUMP STARTING PROCEDURE

1. Position the vehicle with the charged battery so that the jumper cables will reach from the charged battery to the battery that requires charging.
2. Turn off the ignition, all the lights, and all the electrical loads in both vehicles.
3. Leave the hazard flasher on if jump starting where there may be other traffic and any other lights needed for the work area.
4. Apply the parking brake firmly in both vehicles.

Notice: In order to avoid damaging the vehicle make sure the cables are not on or near pulleys, fans, or other parts that will move when the engine starts.

5. Shift an automatic transmission to PARK, or a manual transmission to NEUTRAL.

Caution: In order to avoid injury, do not use cables that have loose or missing insulation.

6. Clamp one end of the first jumper cable to the positive terminal on the booster battery. Make sure it does not touch any other metal parts.
7. Clamp the other end of the same cable to the positive terminal on the discharged battery. Never connect the other end to the negative terminal of the discharged battery.

Caution: Do not attach the cable directly to the negative terminal of the discharged battery. Doing so could cause sparks and possible battery explosion.

8. Clamp one end of the second cable to the negative terminal of the booster battery.
9. Make the final connection to a solid engine ground, such as the engine lift bracket at least 450 millimeters (18 inches) from the discharged battery.
10. Start the engine of the vehicle with the good battery. Run the engine at a moderate speed for several minutes.
11. Then start the engine of the vehicle with the discharged battery.
12. Remove the jumper cables by reversing the above sequence exactly, removing the negative cable from the vehicle with the discharged battery first. While removing each clamp, take care that it does not touch any other metal while the other end remains attached.

GENERATOR

The Delco-Remy CS charging system has several models available, including the CS-128D. The number denotes the outer diameter in millimeters of the stator lamination.

CS generators are equipped with internal regulators.

Unlike three-wire generators, the CS-128D may be used with only two connections: battery positive and an “L” terminal to the charge indicator lamp.

As with other charging systems, the charge indicator lamp lights when the ignition switch is turned to RUN, and goes out when the engine is running. If the charge indicator is on with the engine running, a charging system defect is indicated. This indicator light will glow at full brilliance for several kinds of defects as well as when the system voltage is too high or too low.

The regulator voltage setting varies with temperature and limits the system voltage by controlling rotor field current. Achieve correct average field current for proper system voltage control by varying the on-off time. At high speeds, the on-time may be 10 percent and the off-time 90 percent. At low speeds, with high electrical loads, the on-time may be 90 percent and the off-time 10 percent.

CHARGING SYSTEM

CS generators use a new type of regulator that incorporates a diode trio. A Delta stator, a rectifier bridge, and a rotor with slip rings and brushes are electrically similar to earlier generators. A conventional pulley and fan are used. There is no test hole.

STARTER

Wound field starter motors have pole pieces, arranged around the armature, which are energized by wound field coils.

Enclosed shift lever cranking motors have the shift lever mechanism and the solenoid plunger enclosed in the drive housing, protecting them from exposure to dirt, icy conditions, and splashes.

In the basic circuit, solenoid windings are energized when the switch is closed. The resulting plunger and shift lever movement causes the pinion to engage the engine flywheel ring gear. The solenoid main contacts close. Cranking then takes place.

When the engine starts, pinion overrun protects the armature from excessive speed until the switch is opened, at which time the return spring causes the pinion to disengage. To prevent excessive overrun, the switch should be released immediately after the engine starts.

STARTING SYSTEM

The engine electrical system includes the battery, the ignition, the starter, the generator, and all the related wiring. Diagnostic tables will aid in troubleshooting system faults. When a fault is traced to a particular component, refer to that component section of the service manual.

The starting system circuit consists of the battery, the starter motor, the ignition switch, and all the related electrical wiring. All of these components are connected electrically.

DIAGNOSTIC INFORMATION AND PROCEDURES

NO CRANK

Step	Action	Value	Yes	No
1	1. Turn the headlamps ON. 2. Turn the dome lamps ON. 3. Turn the ignition to START. Did the lights dim or go out?	–	Go to *Step 2*	Go to *Step 8*
2	Check the battery state of charge. Is the green eye showing from the built-in hydrometer?	–	Go to *Step 3*	Go to “Charging Procedure”
3	1. Connect the voltmeter positive lead to the positive battery terminal. 2. Connect the voltmeter negative lead to the negative battery terminal. 3. Turn the ignition to START. Does the voltmeter indicate the value specified?	< 9.6 v	Go to “Charging Procedure”	Go to *Step 4*
4	1. Connect the voltmeter negative lead to the negative battery terminal. 2. Connect the positive voltmeter lead to the engine block. Does the voltmeter indicate the value specified?	> 0.5 v	Go to *Step 5*	Go to *Step 6*
5	Clean, tighten, or replace the negative battery cable. Is the repair complete?	–	System OK	–
6	1. Connect the voltmeter positive lead to the starter “B” terminal. 2. Connect the voltmeter negative lead to the negative battery terminal. Does the voltmeter indicate the value specified?	< 9 v	Go to *Step 7*	Go to *Step 13*
7	Clean, tighten, or replace the positive battery cable. Is the repair complete?	–	System OK	–
8	Inspect the engine fuse block fuse EF1. Is the fuse OK?	–	Go to *Step 10*	Go to *Step 9*
9	Replace the fuse EF1. Is the repair complete?	–	System OK	–
10	Check the connection at the starter “ST” terminal. Is the connection OK?	–	Go to *Step 12*	Go to *Step 11*
11	Clean or tighten the connection as needed. Is the repair complete?	–	System OK	–
12	1. Connect the voltmeter positive lead to the starter “ST” terminal. 2. Connect the voltmeter negative lead to the negative battery terminal. 3. Turn the ignition to START. Does the voltmeter indicate the value specified?	> 7 v	Go to *Step 13*	Go to *Step 14*
13	Repair or replace the starter as needed. Is the repair complete?	–	System OK	–
14	Determine the type of transaxle on the vehicle. Is the vehicle equipped with an automatic transmission?	–	Go to *Step 15*	Go to *Step 32*

NO CRANK (Continued)

Step	Action	Value	Yes	No
15	1. Disconnect the Park Neutral (P/N) position switch relay. 2. Connect the negative voltmeter lead to the P/N relay connector terminal 86. 3. Connect the positive voltmeter lead to battery positive. Does the voltmeter indicate the value specified?	11-14 v	Go to *Step 20*	Go to *Step 16*
16	1. Disconnect the P/N position switch. 2. Connect the negative voltmeter lead to the P/N position switch connector terminal 4. 3. Connect the positive voltmeter lead to battery positive. Does the voltmeter indicate the value specified?	11-14 v	Go to *Step 17*	Go to *Step 25*
17	1. Jumper the P/N position switch connector terminals 3 and 4. 2. Connect the negative voltmeter lead to the P/N relay connector terminal 86. 3. Connect the positive voltmeter lead to battery positive. Does the voltmeter indicate the value specified?	11-14 v	Go to *Step 18*	Go to *Step 19*
18	Replace the neutral safety backup switch. Is the repair complete?	–	System OK	–
19	Repair the open wire between the P/N position switch connector terminal 3 and the P/N back–up relay connector terminal 86. Is the repair complete?	–	System OK	–
20	1. Connect the positive voltmeter lead to the P/N back–up relay connector terminal 30. 2. Connect the voltmeter negative lead to ground. 3. Turn the ignition to START. Does the voltmeter indicate the value specified?	11-14 v	Go to *Step 21*	Go to *Step 27*
21	1. Connect the positive voltmeter lead to the park/neutral position relay connector terminal 85. 2. Connect the voltmeter negative lead to ground. 3. Turn the ignition to START. Does the voltmeter indicate the value specified?	11-14 v	Go to *Step 22*	Go to *Step 26*
22	1. Jumper connector terminals 30 and 87 of the P/N relay. 2. Turn the ignition to START. Does the starter crank?	–	Go to *Step 31*	Go to *Step 23*
23	Check for an open in the wire between the P/N relay connector terminal 87 and the starter “ST” terminal. Is the problem found?	–	Go to *Step 24*	Go to *Step 13*
24	Repair the wire as needed. Is the repair complete?	–	System OK	–
25	Repair the open wire between the P/N position switch connector terminal 4 and ground. Is the repair complete?	–	System OK	–

NO CRANK (Continued)

Step	Action	Value	Yes	No
26	Repair the open wire between the P/N relay connector terminal 85 and the ignition switch connector terminal 3. Is the repair complete?	–	System OK	–
27	1. Connect the voltmeter positive lead to the ignition switch connector terminal 5 by backprobing the connector. 2. Connect the voltmeter negative lead to ground. Does the voltmeter indicate the value specified?	11-14 v	Go to *Step 29*	Go to *Step 28*
28	Repair the open in the wiring between the engine block fuse EF1 and the ignition switch connector terminal 5. Is the repair complete?	–	System OK	–
29	1. Connect the voltmeter positive lead to the ignition switch connector terminal 3 by backprobing the connector. 2. Connect the voltmeter negative lead to ground. 3. Turn the ignition to START. Does the voltmeter indicate the value specified?	11-14 v	Go to *Step 30*	Go to *Step 35*
30	Repair the open in the wiring between the ignition switch connector terminal 3 and the P/N relay connector terminal 30. Is the repair complete?	–	System OK	–
31	Replace the P/N relay. Is the repair complete?	–	System OK	–
32	1. Connect the voltmeter positive lead to the ignition switch connector terminal 5 by backprobing the connector. 2. Connect the voltmeter negative lead to ground. Does the voltmeter indicate the value specified?	11-14 v	Go to *Step 34*	Go to *Step 33*
33	Repair the open in the wiring between the engine block fuse EF1 and the ignition switch connector terminal 5. Is the repair complete?	–	System OK	–
34	1. Connect the voltmeter positive lead to the ignition switch connector terminal 3 by backprobing the connector. 2. Connect the voltmeter negative lead to ground. 3. Turn the ignition to START. Does the voltmeter indicate the value specified?	11-14 v	–	Go to *Step 36*
35	Repair the open in the wiring between the ignition switch connector terminal 3 and the starter “ST” terminal. Is the repair complete?	–	System OK	–
36	Replace the ignition switch. Is the repair complete?	–	System OK	–

STARTER MOTOR NOISE

To correct starter motor noise during starting, use the following procedure:

Checks	Action
Check for a high-pitched whine during cranking before the engine fires. The engine cranks and fires properly.	The distance is too great between the starter pinion and the flywheel. Shimming the starter toward the flywheel is required.
Check for a high-pitched whine after the engine fires, as the key is being released. The engine cranks and fires properly. This intermittent complaint is often diagnosed as “starter hang-in” or “solenoid weak.”	The distance is too small between the starter pinion and the flywheel. Shimming the starter away from the flywheel is required.
Check for a loud “whoop” after the engine fires but while the starter is still held engaged. The sound is like a siren if the engine is revved while the starter is engaged.	The most probable cause is a defective clutch. A new clutch will often correct this problem.
Check for a “rumble,” a “growl,” or, in severe cases, a “knock” as the starter is coasting down to a stop after starting the engine.	The most probable cause is a bent or an unbalanced starter armature. A new armature will often correct this problem.

If the complaint is noise, correction can be achieved by proper shimming as follows:

1. Check for a bent or a worn flywheel.
2. Start the engine and carefully touch the outside diameter of the rotating flywheel ring gear with chalk or a crayon to show the high point of the tooth runout. Turn the engine OFF and rotate the flywheel so that the marked teeth are in the area of the starter pinion gear.
3. Disconnect the negative battery cable to prevent the cranking of the engine.
4. Check the pinion-to-flywheel clearance by using a wire gauge of 0.5 mm (0.02 inch) minimum thickness or diameter. Center a pinion tooth between two flywheel teeth and the gauge. Do not gauge in the corners where a misleading larger dimension may be observed. If the clearance is under this minimum, shim the starter away from the flywheel.
5. If the clearance approaches 1.5 mm (0.06 inch) or more, shim the starter toward the flywheel. This condition is generally the cause of broken flywheel teeth or the starter housing. Shim the starter toward the flywheel by shimming only the outboard starter mounting pad. A shim of 0.40 mm (0.016 inch) thickness at this location will decrease the clearance by approximately 0.30 mm (0.012 inch). If normal starter shims are not available, plain washers or other suitable material may be used as shims.

BATTERY LOAD TEST

1. Check the battery for obvious damage, such as a cracked or broken case or cover, which could permit the loss of electrolyte. If damage is obvious, replace the battery.

Caution: Do not charge the battery if the hydrometer is clear or light yellow. Instead, replace the battery. If the battery feels hot or if violent gassing or spewing of electrolyte through the vent hole occurs, discontinue charging or reduce the charging rate to avoid personal injury.

Important: The battery temperature must be estimated by touch, taking into consideration the ambient temperature to which the battery has been exposed for the preceding few hours.

2. Check the hydrometer. If the green dot is visible, go to the load test procedure. If the indicator is dark but green is not visible, charge the battery. For charging a battery removed from the vehicle, refer to “Charging a Completely Discharged Battery” in this section.
3. Connect a voltmeter and a battery load tester across the battery terminals.
4. Apply a 300-ampere load for 15 seconds to remove the surface charge from the battery.
5. Remove the load.
6. Wait 15 seconds to let the battery recover.
7. Apply a 270-ampere load.
8. If the voltage does not drop below the minimum listed, the battery is good and should be reinstalled. If the voltage is less than the minimum listed, replace the battery. Refer to “Battery Specifications” in this section.

GENERATOR OUTPUT TEST

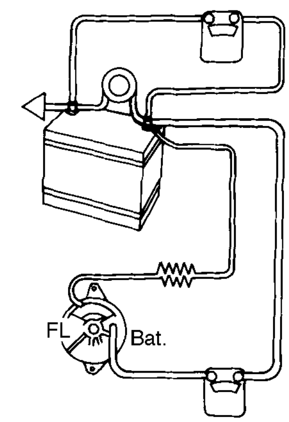
1. Perform the generator system test. Refer to "Generator System Check" in this section.
2. Replace the generator if it fails that test. Refer to "Generator" in the On-Vehicle Service portion of this section.
3. If the generator passes the test, perform the on-vehicle output test which follows.

Important: Always check the generator for output before assuming that a grounded "L" terminal circuit has damaged the regulator.

4. Attach a digital multimeter, an ammeter, and a carbon pile load to the vehicle.

Important: Be sure the vehicle battery is fully charged, and the carbon pile load is turned off.

5. With the ignition switch in the off position, check and record the battery voltage.
6. Remove the harness connector from the generator.
7. Turn the ignition switch to the RUN position with the engine not running.
8. Use a digital multimeter to check for voltage in the harness connector "L" terminal. The reading should be near the specified battery voltage of 12 volts.
9. If the voltage is too low, check the indicator "L" terminal circuits for open and grounded circuits causing voltage loss. Correct any open wires, terminal connections, etc., as necessary. Refer to "Charging System" in this section.
10. Attach the generator harness connector.
11. Run the engine at a moderate idle, and measure the voltage across the battery terminals. The reading should be above that recorded in step 15 but less than 16 volts. If the reading is over 16 volts or below the previous reading, replace the generator. Refer to "Generator" in the On-Vehicle Service portion of this section.
12. Run the engine at a moderate idle, and measure the generator amperage output.
13. Turn on the carbon pile, and adjust it to obtain the maximum amps while maintaining the battery voltage above 13 volts. If the reading is within 15 amps of the generator's rating listed on the generator, the generator is good. If not, replace the generator. Refer to "Generator" in the On-Vehicle Service portion of this section.
14. With the generator operating at the maximum output, measure the voltage between the generator housing and the battery negative terminal. The voltage drop should be 0.5 volt or less. If the voltage drop is more than 0.5 volt, check the ground path from the generator housing to the negative battery cable.
15. Check, clean, tighten, and recheck all of the ground connections.



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GENERATOR SYSTEM CHECK

When operating normally, the generator indicator lamp will come on when the ignition switch is in the RUN position and go out when the engine starts. If the lamp operates abnormally or if an undercharged or overcharged battery condition occurs, the following procedure may be used to diagnose the charging system. Remember that an undercharged battery is often caused by accessories being left on overnight or by a defective switch that allows a lamp, such as a trunk or a glove box lamp, to stay on.

Diagnose the generator with the following procedure:

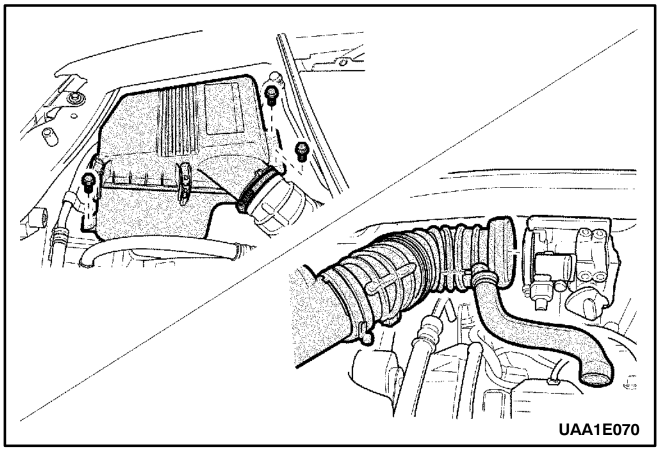
1. Visually check the belt and the wiring.
2. With the ignition switch in the RUN position and the engine stopped, the charge indicator lamp should be on. If not, detach the harness at the generator and ground the "L" terminal in the harness with a 5-ampere fused jumper lead.
   - If the lamp lights, replace the generator. Refer to "Generator" in the On-Vehicle Service portion of this section.
   - If the lamp does not light, locate the open circuit between the ignition switch and the harness connector. The indicator lamp bulb may be burned out.
3. With the ignition switch in the RUN position and the engine running at moderate speed, the charge indicator lamp should be off. If not, detach the wiring harness at the generator.
   - If the lamp goes off, replace the generator. Refer to "Generator" in the On-Vehicle Service portion of this section.

- If the lamp stays on, check for a short to ground in the harness between the connector and the indicator lamp.

Important: Always check the generator for output before assuming that a grounded “L” terminal circuit has damaged the regulator. Refer to “Generator” in the Unit Repair portion of this section.

MAINTENANCE AND REPAIR

ON–VEHICLE SERVICE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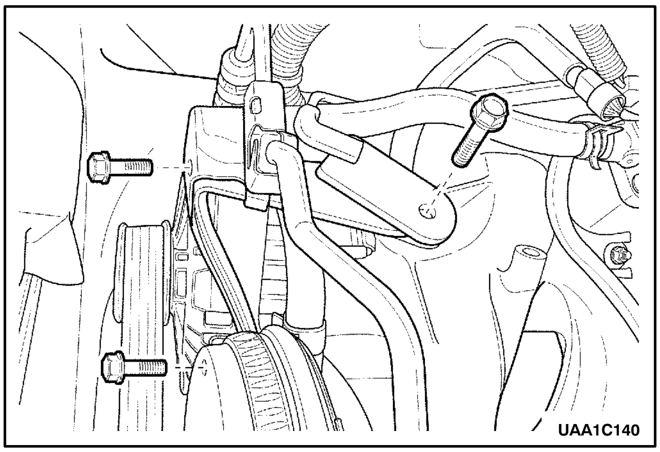
GENERATOR

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the air filter housing bolts and the air filter housing bolts.
3. Remove the air intake tube from the throttle body.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4. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump.*
5. Disconnect the harness connector from the back of the generator.
6. Remove the bracket bolt at the power steering oil pressure line.

Installation Notice

Tightening Torque	25 N·m (18 lb–ft)

7. Remove the support bracket bolt.

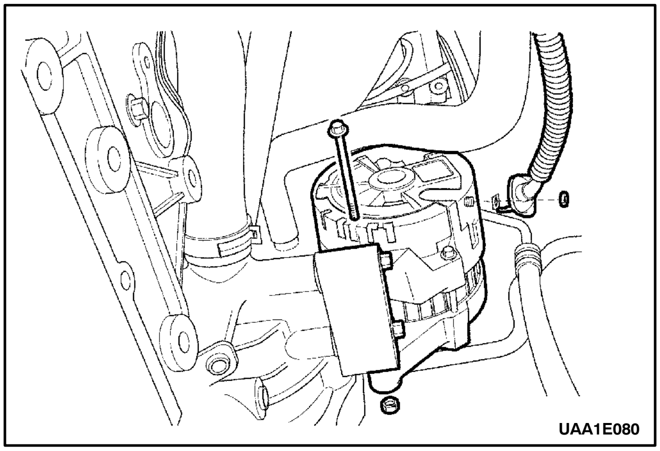
Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

8. Remove the air inlet duct bolts and the air inlet duct.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)



9. Remove the battery harness connector nut and washer from the generator.

Installation Notice

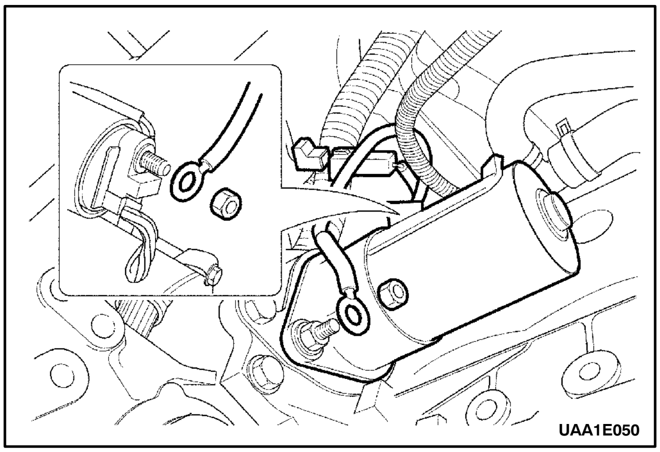
Tightening Torque	12 N·m (106 lb–in)

10. Remove the nut and the washers which hold the generator lower bracket-to-generator bolt.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

11. Carefully remove the generator.
12. Installation should follow the removal procedure in the reverse order.



STARTER

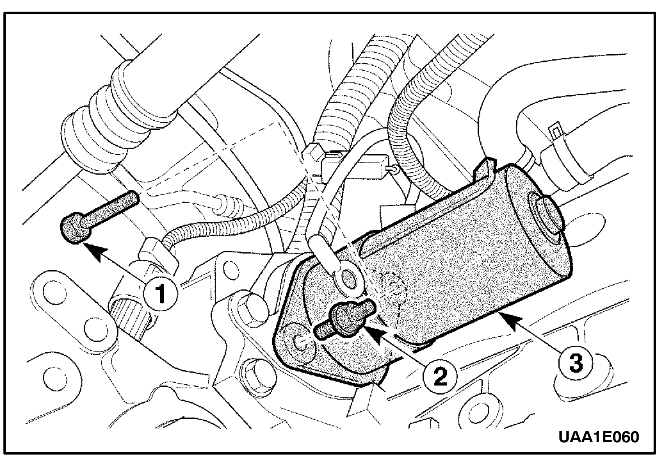
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the nut that secures the starter ground wire to the lower mounting stud.
3. Disconnect the ground wire.
4. Remove the starter solenoid nut.

Installation Notice

Tightening Torque	12 N·m (106 lb–in)

5. Disconnect the starter solenoid terminal-to-battery cable terminal.
6. Disconnect the ST-terminal connector from the starter solenoid.



7. Remove the starter-to-transmission mounting bolt.

Installation Notice

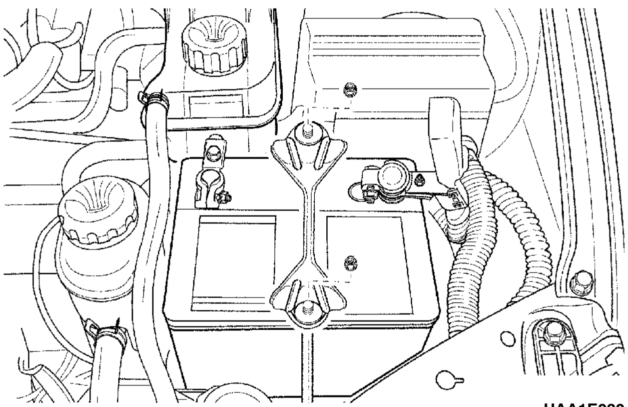
Tightening Torque	23 N·m (17 lb–ft)

8. Remove the starter-to-engine block mounting bolt.

Installation Notice

Tightening Torque	23 N·m (17 lb–ft)

9. Remove the starter assembly.
10. Installation should follow the removal procedure in the reverse order.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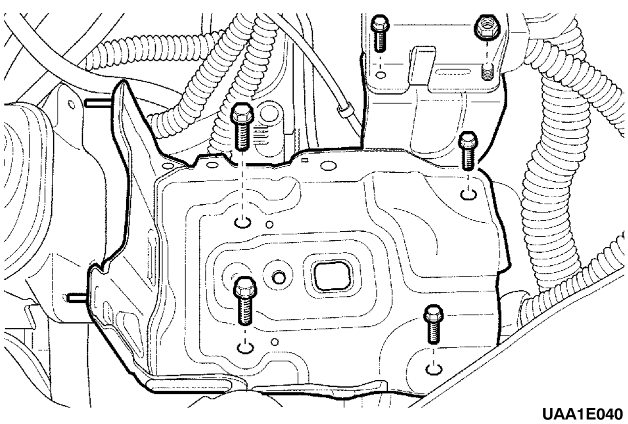
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BATTERY AND BATTERY TRAY

Remove Procedure

1. Remove the battery cable nuts.

Installation Notice

Tightening Torque	15 N·m (11 lb–ft)

2. Disconnect the negative battery cable and then disconnect the positive battery cable.
3. Remove the battery rods clamp nuts
4. Remove the battery rods and clamp
5. Remove the battery.
6. Remove the power steering fluid reservoir. Refer to *Section 6A, Power Steering System.*
7. Remove the EI system ignition coil. Refer to *Section 1F, Engine Controls.*
8. Remove the battery tray bolts/nut.

Installation Notice

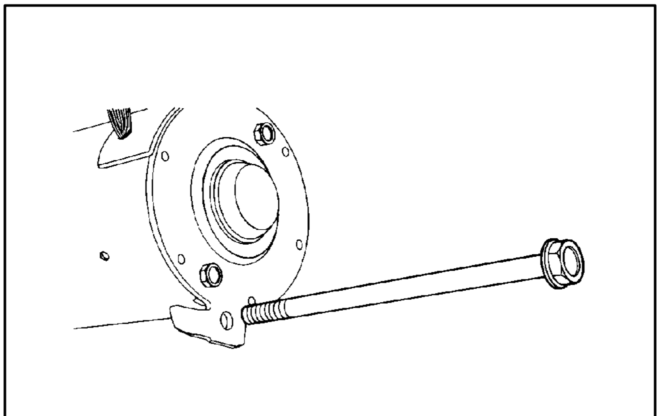
Tightening Torque	20 N·m (15 lb–ft)

9. Remove the battery tray.
10. Installation should follow the removal procedure in the reverse order.

UNIT REPAIR

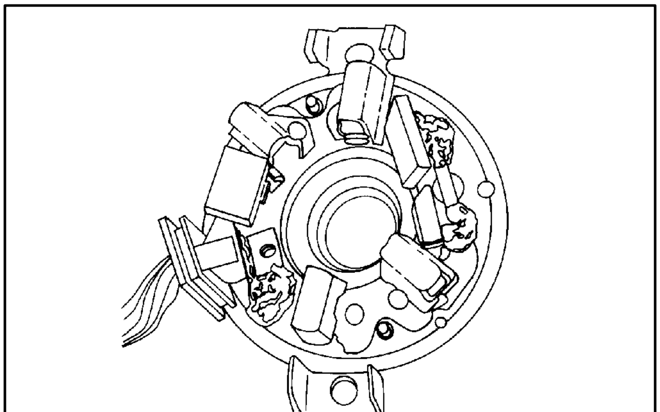
STARTER MOTOR

Disassembly Procedure



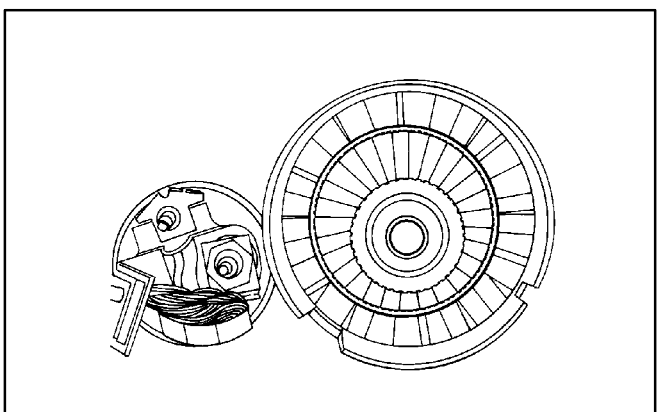
A102E239

1. Remove the starter. Refer to *"Starter"* in this section.
2. Remove the starter through-bolts.



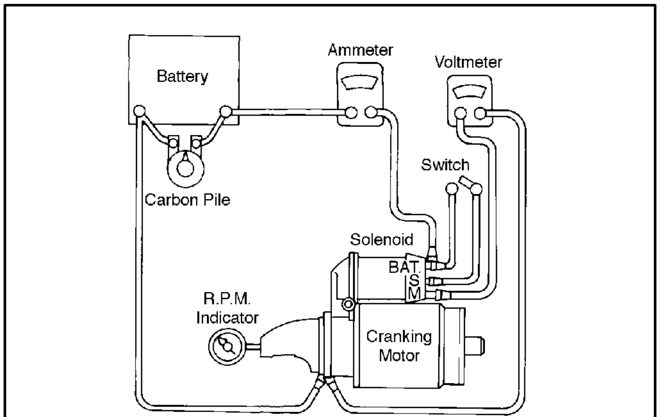
A102E215

3. Remove the commutator end frame/brush holder assembly.
4. Inspect the brushes, the pop-out springs, and the brush holders for wear and damage. Replace the assembly if necessary.



A102E218

5. Check the armature to see if it turns freely. If the armature does not turn freely, break down the assembly immediately, starting with Step 12. Otherwise, give the armature a no-load test.

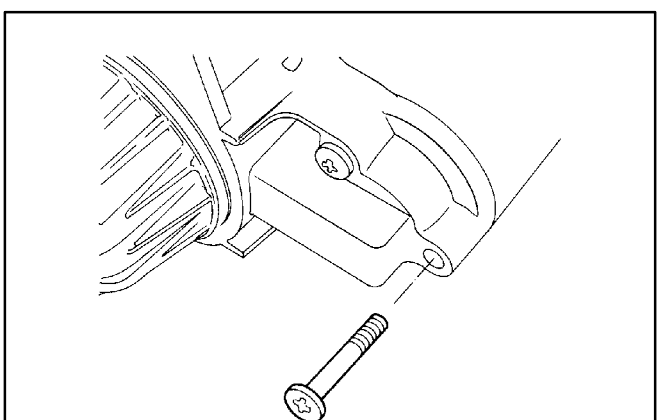


A102E219

Notice: Complete the testing in a minimum amount of time to prevent overheating of the solenoid.

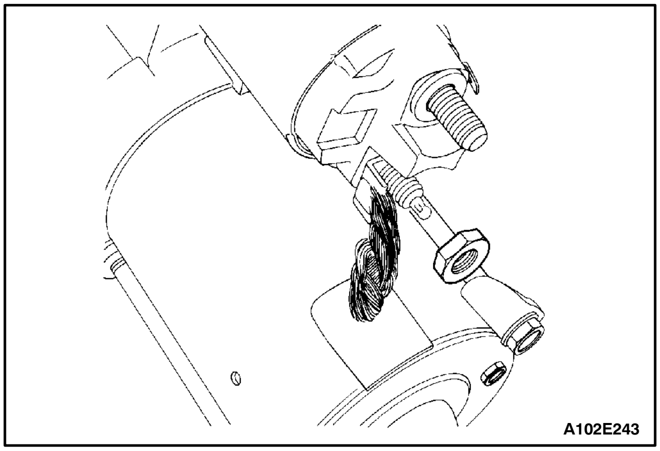
Important: If the specified current draw does not include the solenoid, deduct from the armature reading the specified current draw of the solenoid hold-in winding.

6. To begin the no-load test, close the switch and compare the rpm, the current, and the voltage readings with the specifications. Refer to *"Starter Specifications"* in this section. Make disconnection only with the switch open. Use the test results as follows.
   - 6.1 Rated current draw and no-load speed indicate a normal condition for the starter motor.
   - 6.2 Low free speed and high current draw indicate too much friction (tight, dirty or worn bearings or a bent armature shaft), a shorted armature, or a shorted armature or fields.
   - 6.3 Failure to operate with high current draw indicates a direct ground in the terminal or fields, or "frozen" bearings.
   - 6.4 Failure to operate with no current draw indicates an open field circuit, open armature coils, broken brush springs, worn brushes, high insulation between the commutator bars, or other causes which would prevent good contact between the brushes and the commutator.
   - 6.5 Low no-load speed and low current indicate high internal resistance and high current draw, which usually mean shorted fields.

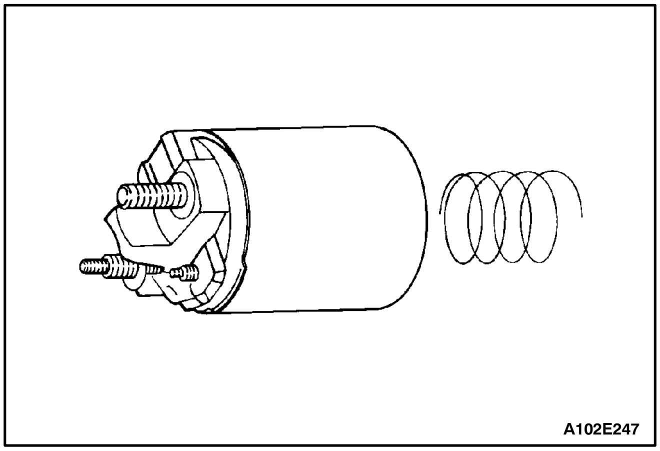


A102E226

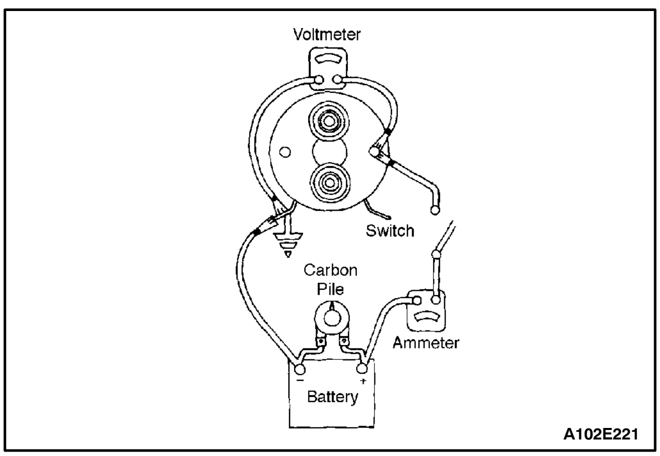
7. Remove the solenoid assembly screws.



8. Remove the field connector nut. Disconnect the field connector.



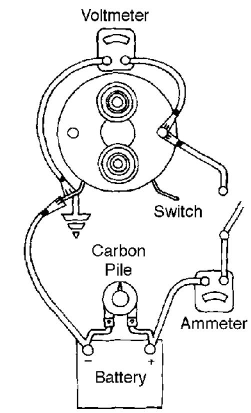
9. Rotate the solenoid 90 degrees and remove it along with the plunger return spring.



Important: If the solenoid is not removed from the starter motor, the connector strap terminal must be removed from the terminal on the solenoid before making these tests.

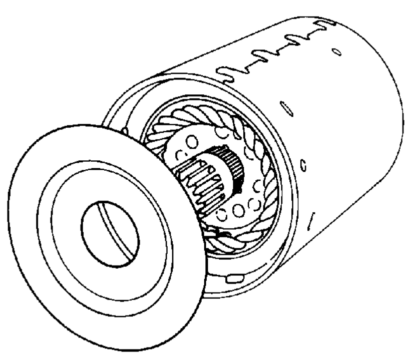
10. Test the solenoid windings by checking the current draw.
    - 10.1 Check the hold-in windings by connecting an ammeter in series with the 12-volt battery, the switch terminal, and to ground.
    - 10.2 Connect the carbon pile across the battery.
    - 10.3 Adjust the voltage to 12.2 volts. The ammeter reading should be 12 to 20 amperes.

Important: Current will decrease as the windings heat up. Current draw windings that are over specifications indicate shorted turns, or a ground in the windings of the solenoid. Both conditions require replacement of the solenoid. Current draw readings that are under specifications indicate excessive resistance. No reading indicates an open circuit.

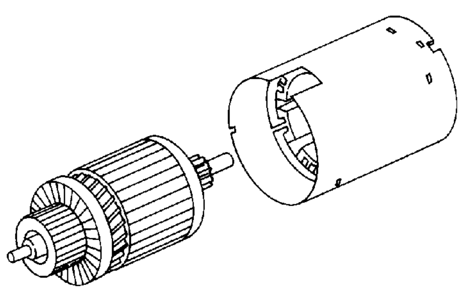


A102E221

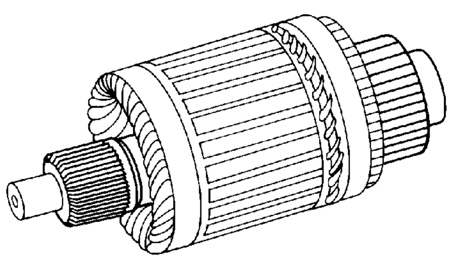
11. Check both windings, connecting them according to the preceding test.
    11.1 Ground the solenoid motor terminal.
    11.2 Adjust the voltage to 12.2 volts. The ammeter reading should b 60 to 90 amperes.
    11.3 Check the connections and replace the solenoid, if necessary.


A102E222

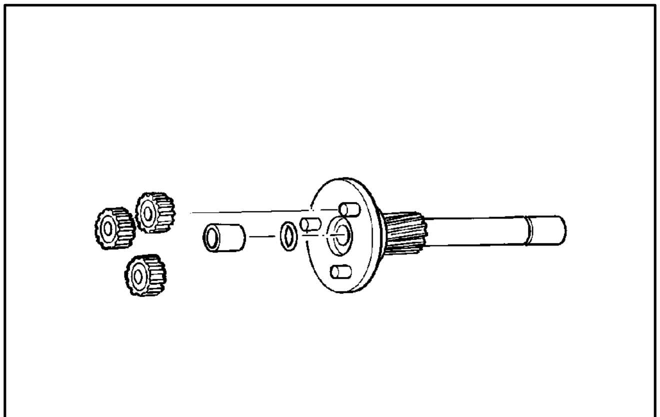
12. Slide the field frame with enclosed armature assembly away from the starter assembly.
13. Remove the shield.


A102E242

14. Separate the field frame from the armature.

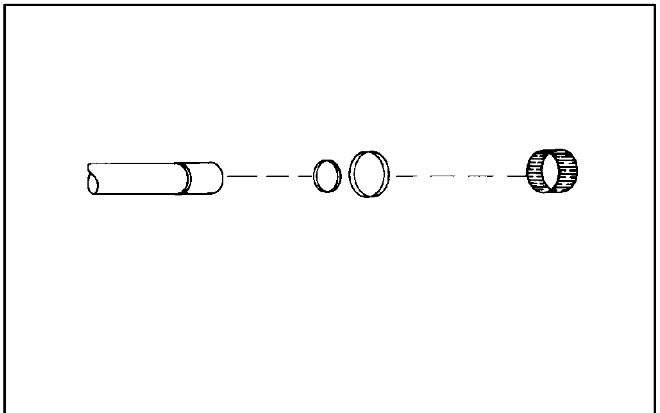

A102E223

15. Inspect the shaft, the bearing, and the pinion for discoloration, damage, or wear. Replace if necessary.
16. Inspect the points where the armature conductors join the commutator bars. Make sure they have a good connection. A burned commutator bar is usually evidence of a poor connection.
17. If test equipment is available, check the armature for short circuits by placing it on a growler, and holding back a saw blade over the armature core while the armature is rotated. If the saw blade vibrates, replace the armature.
18. Recheck after cleaning between the commutator bars. If the saw blade vibrates, replace the armature.



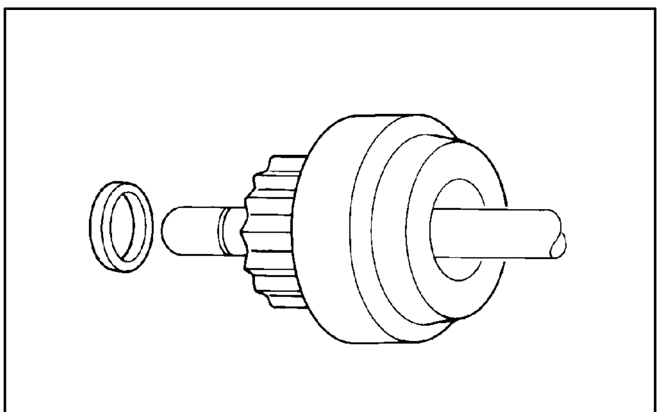
A202E006

19. Remove the gears, the bushing, and the washer.
20. Remove the cushion and driveshaft assembly from the starter housing.



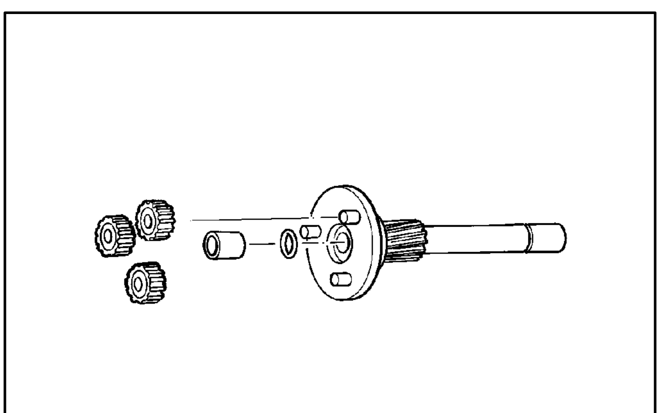
A102E220

21. Disassemble the driveshaft assembly by first separating the bushing from the driveshaft.
22. Remove the collar and the locking ring from the groove in the driveshaft.



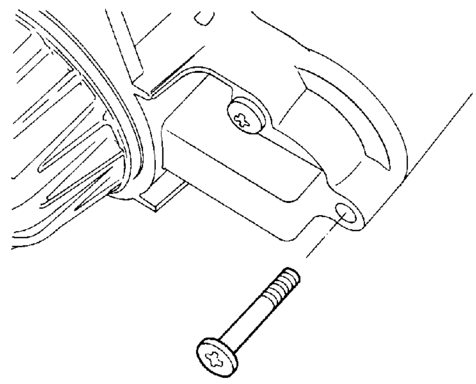
A102E248

23. Remove the pinion stop and the drive from the driveshaft.



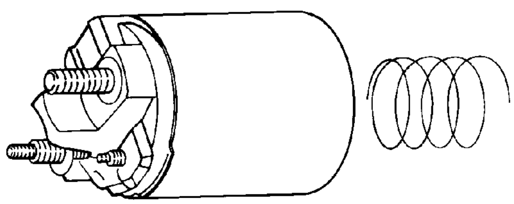
A202E006

24. Remove the gear support from the driveshaft.



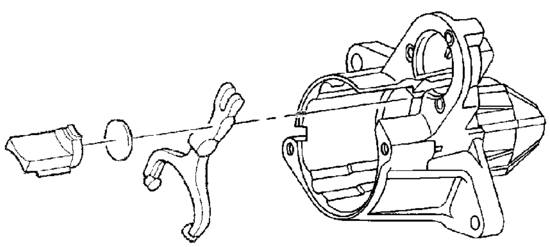
A102E226

25. If not done in the previous steps, remove the screws that hold the solenoid assembly into the housing, and remove the nut from the field coil connector.



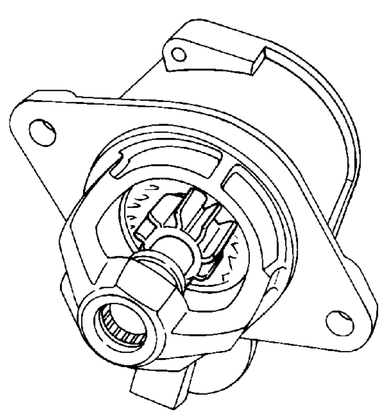
A102E247

26. Rotate the solenoid 90 degrees and remove it along with the return spring.



A302E007

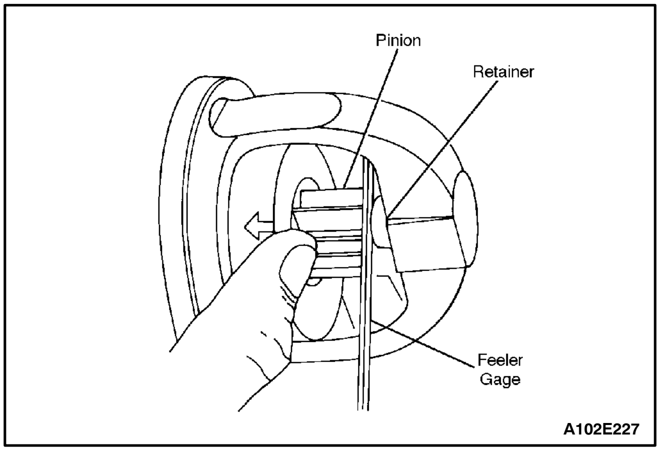
27. Remove the plunger with the boot and the shift lever assembly.



A102E237

Notice: The pinion clearance must be correct to prevent the buttons on the shift lever yoke from rubbing on the clutch collar during the cranking.

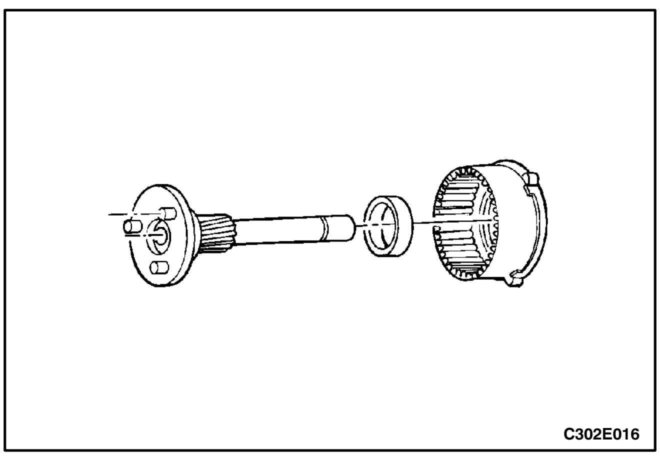
28. When the starter motor is disassembled and the solenoid is replaced, it is necessary to check the pinion clearance.



29. Disconnect the motor field coil connector from the solenoid motor terminal and carefully insulate the connector.
30. Connect one 12-volt battery lead to the solenoid switch terminal and the other to the starter frame.
31. Flash a jumper lead momentarily from the solenoid motor terminal to the starter frame, allowing shifting of the pinion in the cranking position, where it will remain until the battery is disconnected.

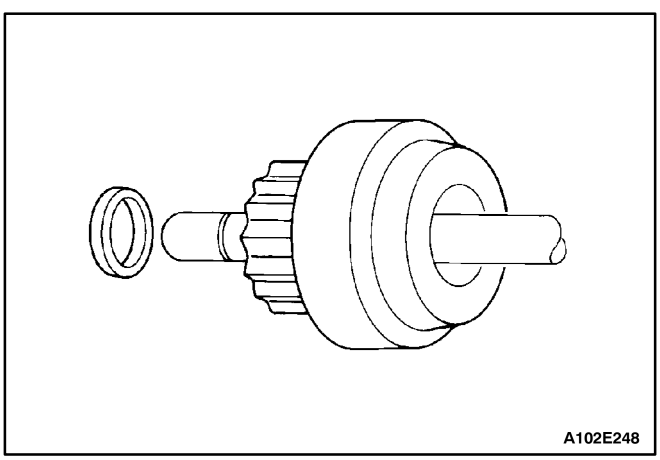
Important: A means for adjusting the pinion clearance is not provided on the starter motor. If the clearance does not fall within the limits, check for improper installation and replace all worn parts.

32. Push the pinion back as far as possible to take up any movement, and check the clearance with a feeler gauge. The clearance should be 0.25 to 3.56mm (0.01 to 0.14inch).

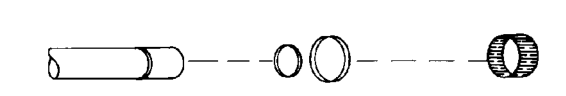


Assembly Procedure

1. Clean all of the starter motor parts, but do not use grease-dissolving solvents for cleaning the armature and the field coils.
2. Lubricate the gears with lubricant. (Begin at Step 7 if proceeding with just the reassembly of the solenoid.)
3. If full disassembly of the starter and the solenoid was performed, begin reassembly by placing the gear support and the collar on the driveshaft assembly.

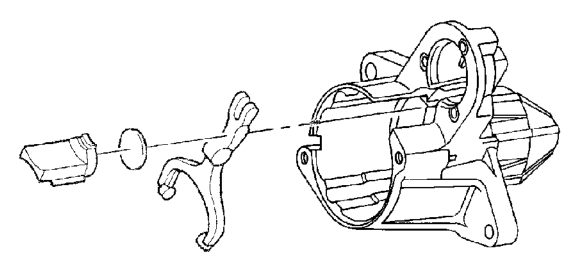


4. Install the drive and the pinion stop on the driveshaft.



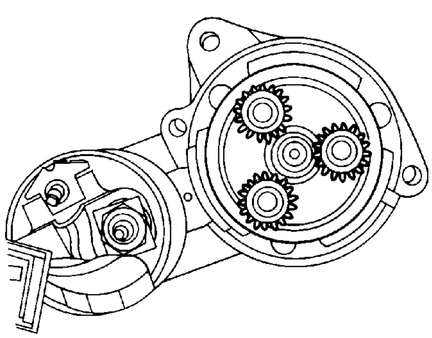
A102E220

5. Install the lock ring into the groove on the driveshaft and insert the collar.
6. Install the bushing.



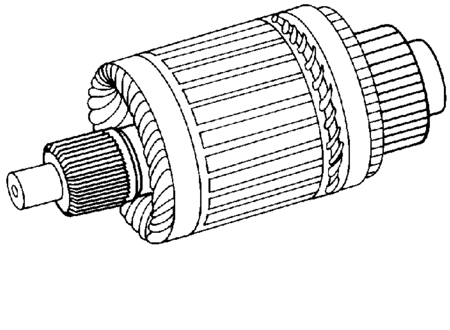
A302E007

7. Install the shift lever assembly with the plunger and the boot.



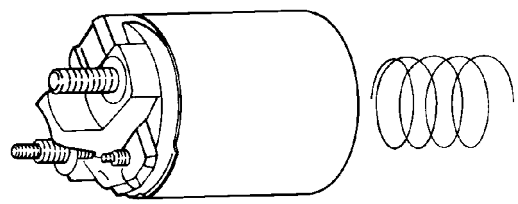
A102E224

8. Lubricate the gears with lubricant and install the driveshaft assembly with the bushing and the washer on the gear end.
9. Install the cushion and the gears.



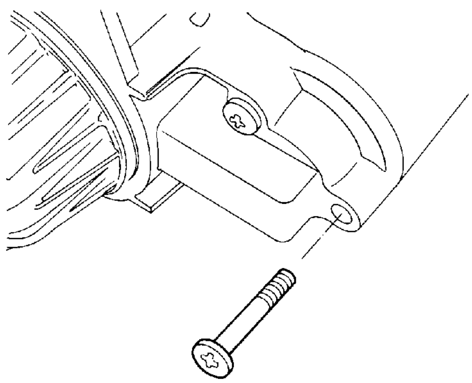
A102E223

10. Lubricate the drive end of the armature shaft with lubricant and install the new gear and the bearing, if necessary.



A102E247

11. Position the solenoid assembly and the return spring against the plunger, applying sealer to the solenoid flange.



A102E226

12. Fasten the solenoid assembly with the screws.

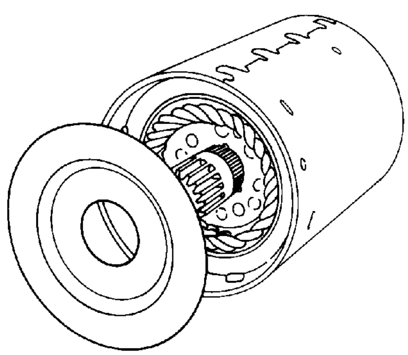
Installation Notice

Tightening Torque	8 N·m (71 lb–in)

13. Install the field coil connection to the starter terminal. Install the nut.

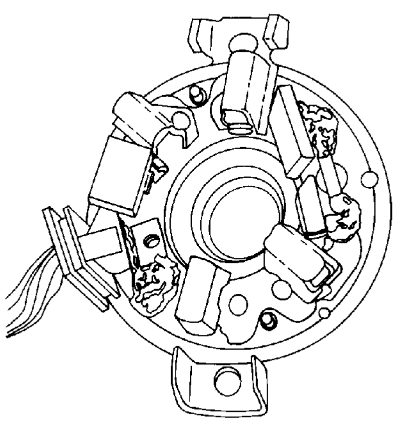
Installation Notice

Tightening Torque	8 N·m (71 lb–in)



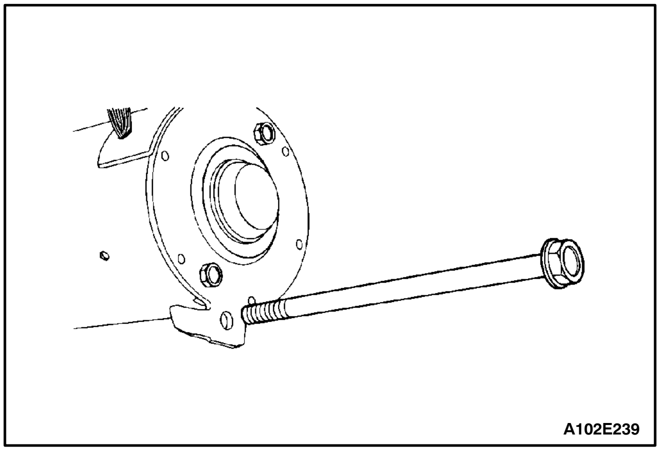
A102E222

14. Position the armature assembly into the field frame.
15. Place the shield on the armature and field frame assembly.
16. Install the armature and field frame assembly with the shield into the starter housing.



A102E215

17. Position the commutator end frame/brush holder assembly, lining up the end frame holes with the through-bolt holes in the housing.



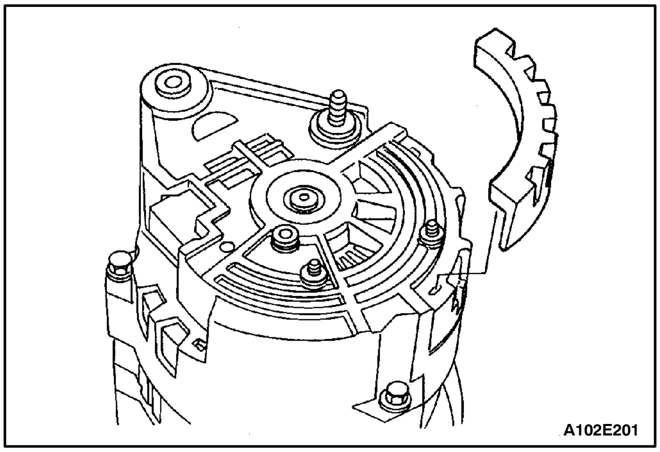
18. Install the starter through-bolts.
19. Install the starter. Refer to *"Starter"* in this section.

Installation Notice

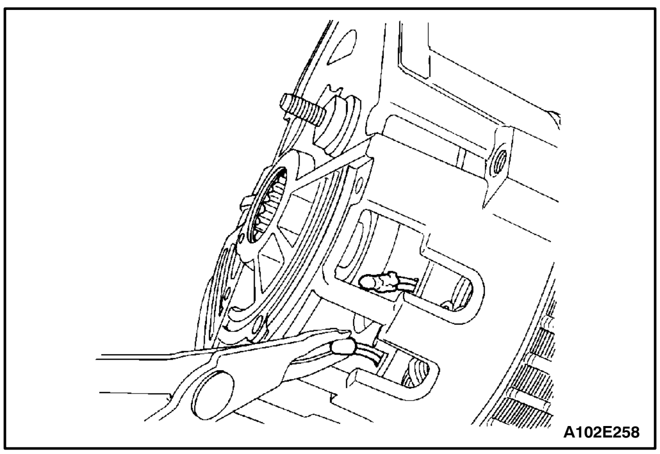
Tightening Torque	6 N·m (53 lb–in)

GENERATOR

Disassembly Procedure

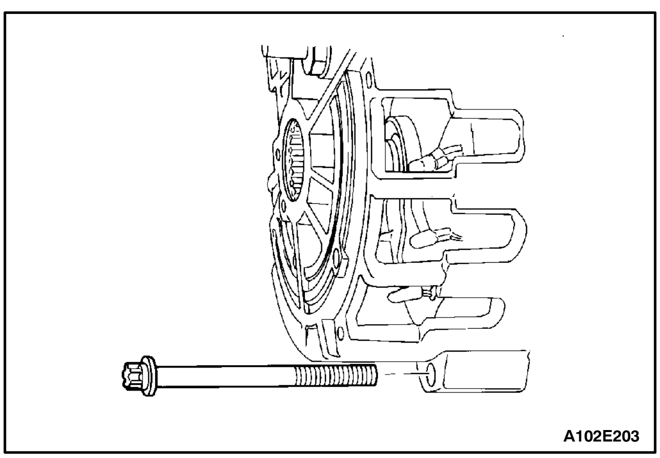


1. Remove the generator. Refer to *"Generator"* in the On-Vehicle Service section.
2. Mark a match line that cannot easily be removed on the end frame to make assembly easier.
3. Pry off the plastic cover to expose the stator connections.

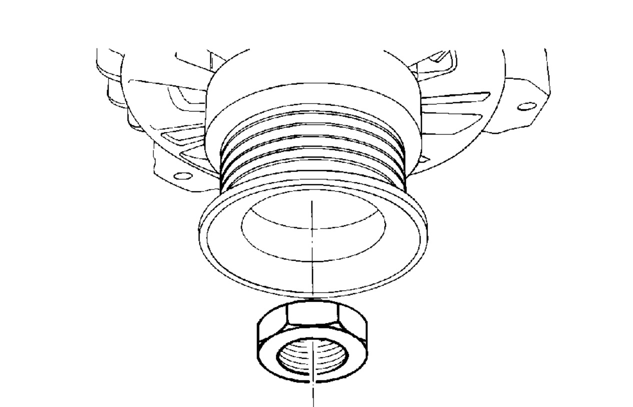


Notice: If the stator connections are not welded, melt the lead. Avoid excessive heating, as it can damage the diodes in the rectifier bridge.

4. Remove the stator connections from the rectifier bridge terminals by unsoldering or cutting the wires.



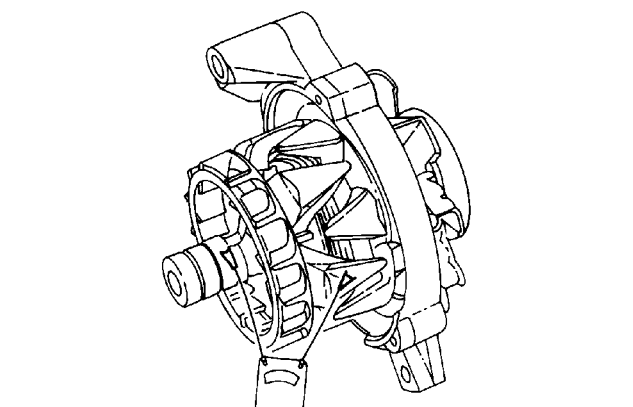
5. Remove the generator through-bolts.



A102E251

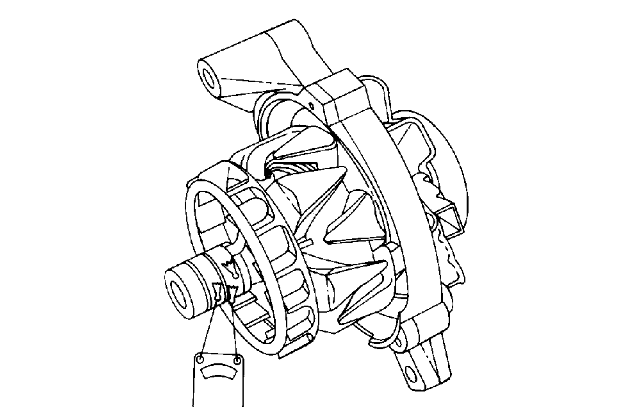
Important: The fastening torque of this nut is 81 N·m (60 lb–ft) and may not normally be unfastened using hand strength.

6. Move to the drive end of the generator and remove the drive end bearing nut.
7. Remove the pulley and the collars.



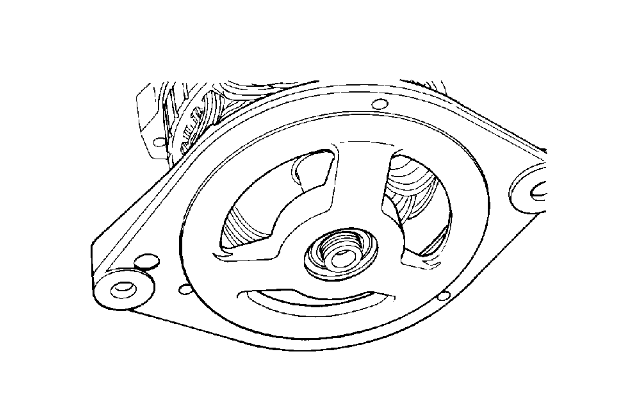
A102E252

8. Test the rotor for an open circuit by using the ohmmeter with the drive end frame assembled. The reading should be sufficiently high, or the rotor must be replaced.



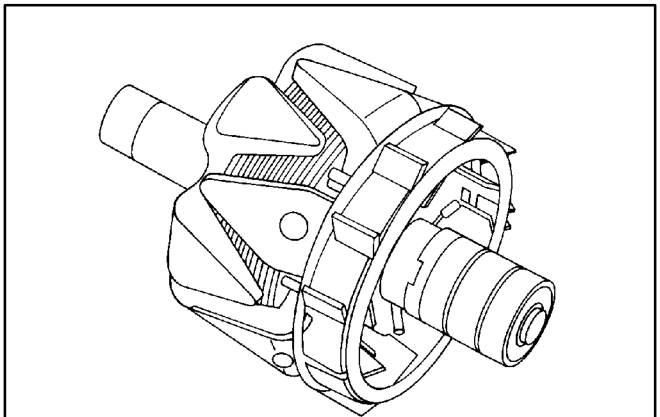
A102E205

9. Test the rotor for open and short circuits. The reading should be 1.7 to 2.3 ohms, or the rotor should be replaced.



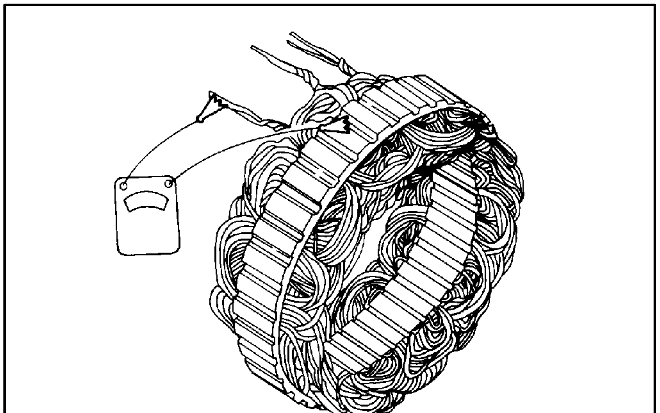
A102E206

10. Remove the drive end frame from the shaft.
11. For vehicles with an internal generator fan, remove the drive end frame and the fan.



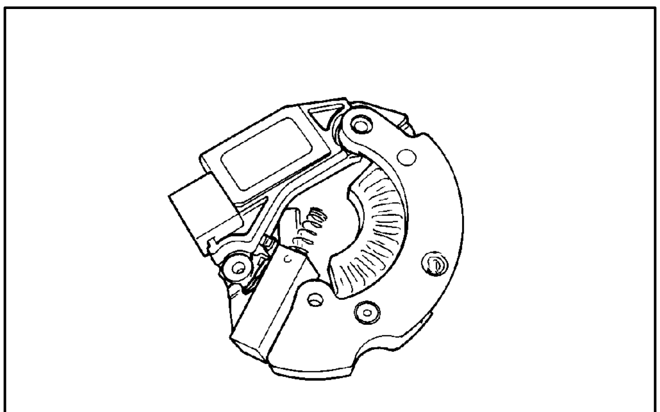
A102E207

12. Remove the rotor assembly.



A102E208

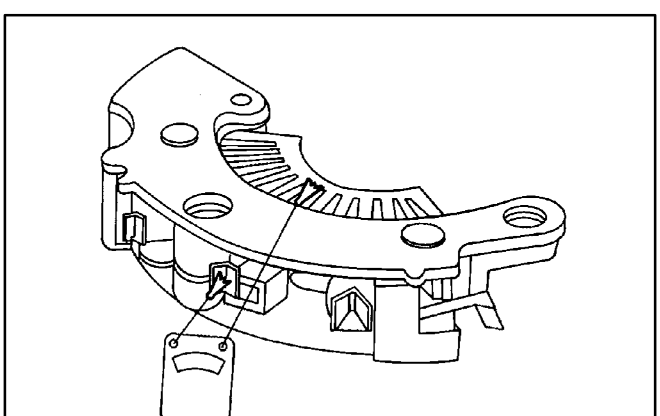
13. Remove the stator.
14. Test the stator for an open circuit using the ohmmeter.



A102E256

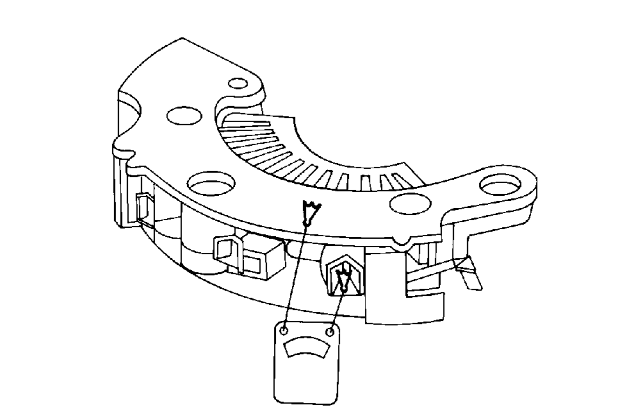
15. Pry off the baffle.
16. Remove the rectifier/regulator/brush holder assembly screws.
17. Remove the brush holder assembly and the regulator, cutting the terminal between the regulator and the rectifier bridge.

Important: If the brush can be reused, reassemble the brush to the holder with the retaining pin, after cleaning the brush with a soft, clean cloth.



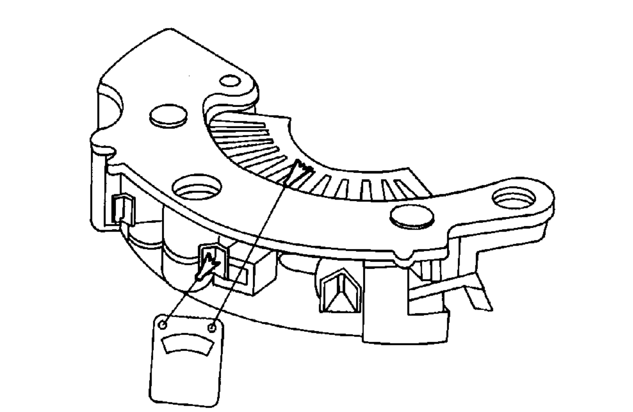
A102E211

18. Test the rectifier bridge by connecting the ohmmeter terminals to the bridge and the heat sink.



A102E204

19. Retest by connecting the ohmmeter terminals in reverse.

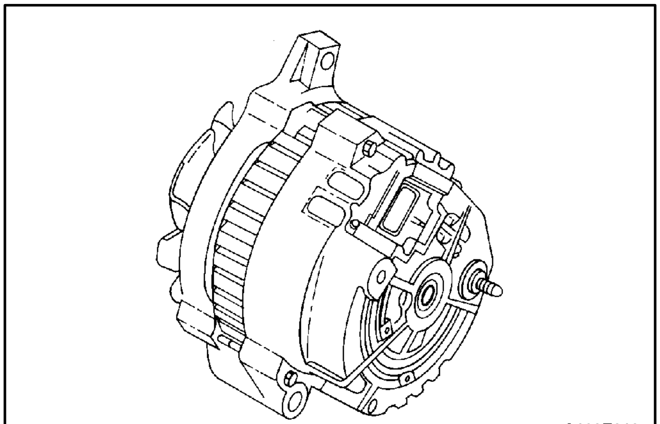


A102E211

20. Replace the rectifier bridge if each reading is the same.
21. Test the remaining two diodes after the above procedure.

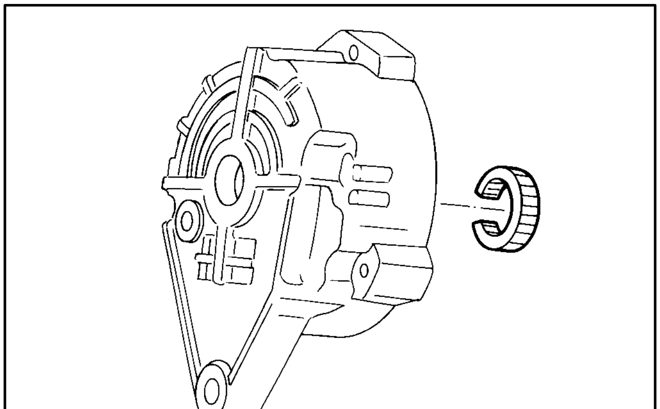
Notice: Some kinds of digital ohmmeters are not suited for the test of the bridge diode. In this case, consult the manufacturer regarding the test capacity.

22. Test the diodes by connecting the ohmmeter terminals to the bridge terminal and base plate. If the reading is the same, the rectifier bridge should be replaced.



A102E212

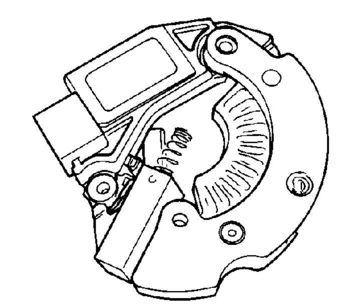
23. Remove the ring in the slip ring end frame.



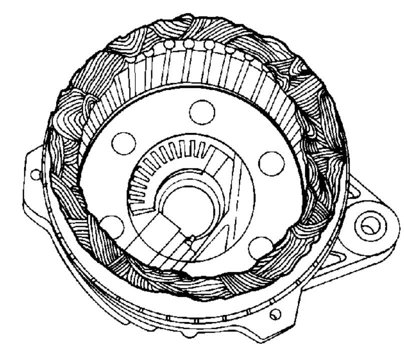
A102E257

Assembly Procedure

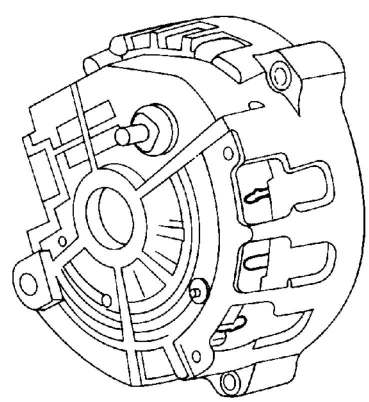
1. Install the new ring in the slip ring end frame.
2. Push the new bearing outer lace into the bottom of the end frame casting.


A102E256

3. Solder the brush holder terminal to the regulator terminal, if removed.
4. Fix the brush holder with the retainer pin, and solder the regulator/brush holder assembled terminal to the rectifier terminal.
5. Apply silicone grease between the bridge and the end frame for radiation purposes.
6. Fasten the screws holding the rectifier regulator/brush holder assembly to the end frame.
7. Punch the new baffle with the pin into the brush.

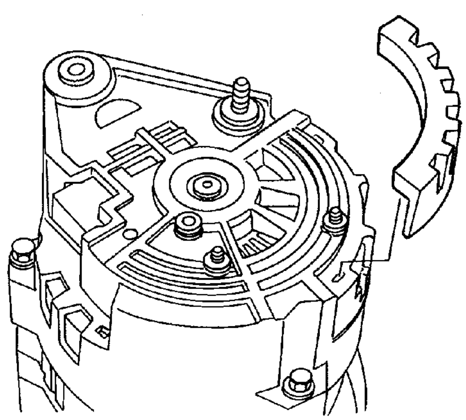

A102E213

8. Install the stator.

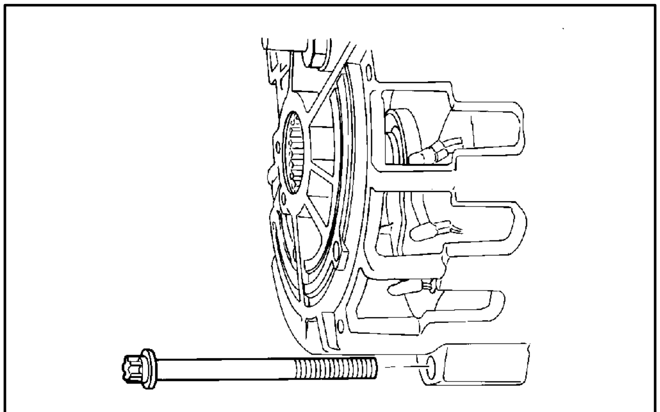

A102E202

Notice: Take care to protect the diode in the rectifier bridge from excessive heat while welding or soldering.

9. Solder or weld the connectors of the rectifier bridge.


A102E201

10. Install the outside cover.

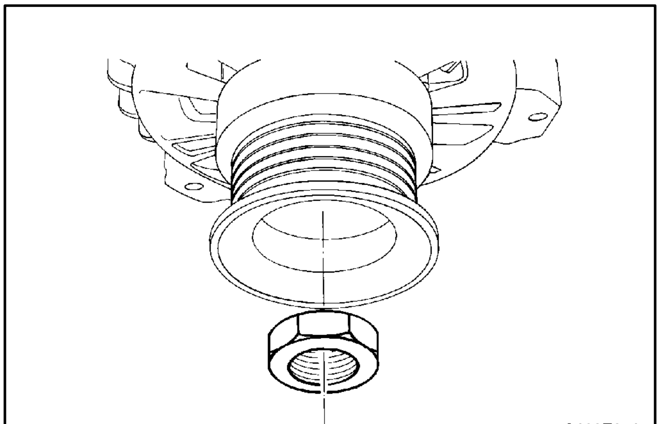


A102E203

11. Position the rotor assembly shaft with the drive end frame in the slip ring end assembly until the gap between the outer lace and the end frame casting is 1.9 mm (0.075 inch).
12. Install the generator through-bolts.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)



A102E251

13. Position the fan, the collars, and the pulley on the rotor shaft and secure with the nut.

Installation Notice

Tightening Torque	81 N·m (60 lb–ft)

14. Install the generator. Refer to *“Generator”* in the on-vehicle service section.

SPECIFICATIONS

STARTER SPECIFICATIONS

Application	Description
Starter	
No-Load Test @ 12.2 Volts	40-90 amps
Drive Pinion Speed	3,200-4,800 rpm
Solenoid	
Hold-in Windings @ 12.2 Volts	MAX 83 amps
Pull-in Windings @ 12.2 Volts	MAX 83 amps

GENERATOR SPECIFICATIONS

Application	Description
Type	CS-128D

BATTERY SPECIFICATIONS

Application	Description
Cold Cranking Amps	550 amps (Cold Area : 610 amps)
Reserve Capacity Minimum	110 minutes
Load Test	270 amps
Replacement	85B–60
Minimum Voltage:	Estimated Temperature:
9.6	21°C (69.8°F)
9.4	20°C (68°F)
9.1	0°C (32°F)
8.8	–10°C (14°F)
8.5	–18°C (0°F)
8.0	Below –18°C (Below 0°F)

FASTENER TIGHTENING SPECIFICATIONS

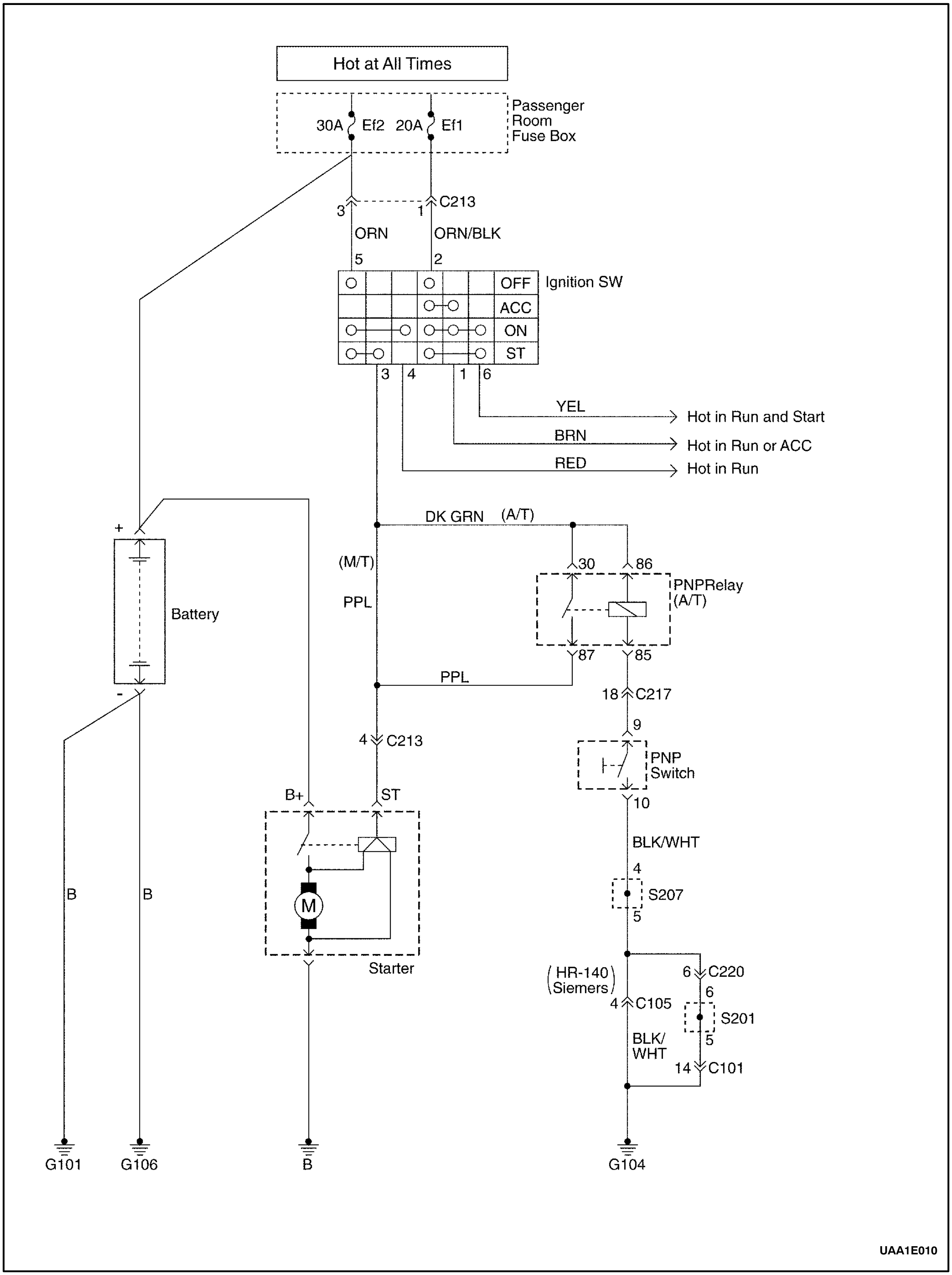
Application	N•m	Lb-Ft	Lb-In
Battery Cable Nuts	5	–	44
Battery Carrier Tray Lower Bolts	10	–	89
Battery Carrier Tray Upper Bolts	20	15	–
Battery Retainer Clamp-to-Battery Rod Nuts	4	–	35
Battery Terminal Bolt	20	15	–
Battery-to-Generator Lead Nut	12	–	106
Generator Driveshaft Nut	100	74	–
Generator Lower Bracket-to-Engine Block Bolts	30	22	–
Generator Lower Bracket-to-Generator Nut	20	15	–
Generator Through-Bolts	25	18	–
Generator-to-Cylinder Head Support Bracket Bolt	20	15	–

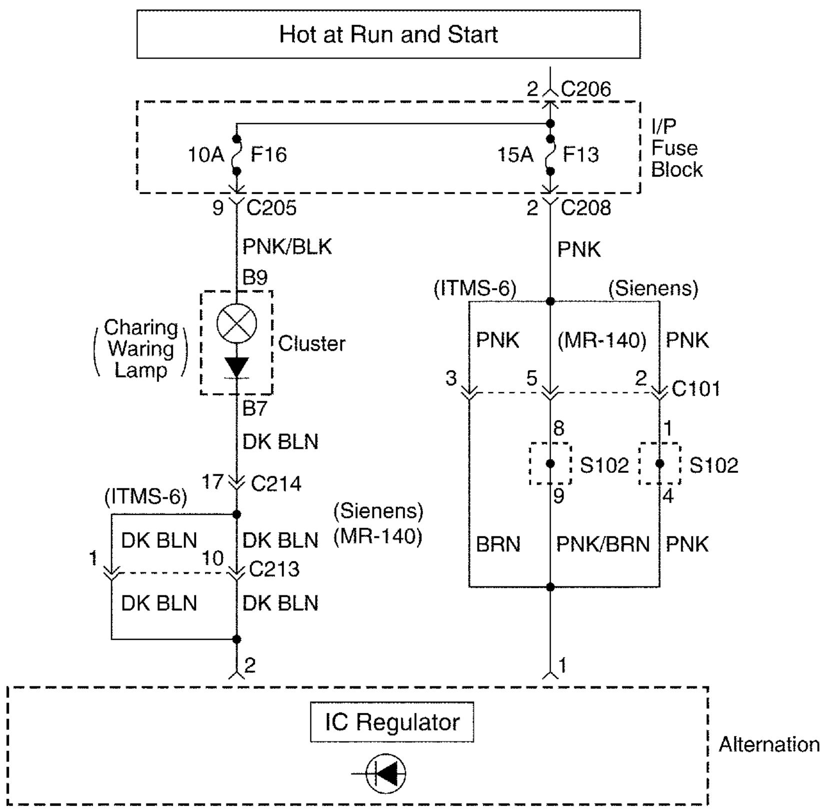
FASTENER TIGHTENING SPECIFICATIONS (Cont'd)

Application	N•m	Lb-Ft	Lb-In
Generator-to-Intake Manifold and Cylinder Head Support Bracket Bolts	35	26	–
Generator-to-Intake Manifold Strap Bracket Bolt	20	15	–
Intake Manifold-to-Engine Block Bracket Bolts (Over Starter)	20	15	–
Starter Field Connector Nut	6	–	53
Starter Solenoid Terminal-to-Battery Cable Terminal Nut	12	–	106
Starter Solenoid Terminal-to-Ignition Solenoid Terminal Nut	6	–	53
Starter Through-Bolts	6	–	53
Starter-to-Engine Block Mounting Bolt	50	37	–
Starter-to-Transmission Mounting Bolt	45	33	–

SCHEMATIC AND ROUTING DIAGRAMS

STARTING SYSTEM





Hot at Run and Start
2 C206
I/P
Fuse
Block
10A F16
15A F13
9 C205
2 C208
PNK/BLK
B9
PNK
(ITMS-6)
(Sienens)
Charing
Waring
Lamp
Cluster
PNK
(MR-140)
PNK
3
5
2
C101
B7
DK BLN
8
1
S102
S102
17 C214
9
4
(ITMS-6)
(Sienens)
(MR-140)
DK BLN
DK BLN
BRN
PNK/BRN
PNK
1
10 C213
DK BLN
DK BLN
2
1
IC Regulator
Alternation

UAA1E020

SECTION 1F

ENGINE CONTROLS

CAUTION: Disconnect the negative °attery ca°le °efore removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this ca°le will help prevent personal injury and damage to the vehicle. The ignition must also °e in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

IGNITION SYSTEM OPERATION

This ignition system does not use a conventional distributor and coil. It uses a crankshaft position sensor input to the Engine Control Module (ECM). The ECM then determines Electronic Spark Timing (EST) and triggers the electronic ignition system ignition coil.

This type of distributorless ignition system uses a "waste spark" method of spark distribution. Each cylinder is paired with the cylinder that is opposite it (1–4 or 2–3). The spark occurs simultaneously in the cylinder coming up on the compression stroke and in the cylinder coming up on the exhaust stroke. The cylinder on the exhaust stroke requires very little of the available energy to fire the spark plug. The remaining energy is available to the spark plug in the cylinder on the compression stroke.

These systems use the EST signal from the ECM to control the EST. The ECM uses the following information:

- Engine load (manifold pressure or vacuum).
- Atmospheric (barometric) pressure.
- Engine temperature.
- Intake air temperature.
- Crankshaft position.
- Engine speed (rpm).

ELECTRONIC IGNITION SYSTEM IGNITION COIL

The Electronic Ignition (EI) system ignition coil is mounted near the rear of the cylinder head. Each pair of terminals of the EI system ignition coil provides the spark for two spark plugs simultaneously. The EI system ignition coil is not serviceable and must be replaced as an assembly.

CRANKSHAFT POSITION SENSOR

This Electronic Ignition (EI) system uses a magnetic crankshaft position sensor. This sensor protrudes through its mount to within approximately 1.3 mm (0.05 inch) of the crankshaft reluctor. The reluctor is a special wheel attached to the crankshaft with 58 slots machined into it, 57 of which are equally spaced in 6-degree intervals. The last slot is wider and serves to generate a "sync pulse." As the crankshaft rotates, the slots in the reluctor change the magnetic field of the sensor, creating an induced voltage pulse. The longer pulse of the 58th slot identifies a specific orientation of the crankshaft and allows the Engine Control Module (ECM) to determine the crankshaft orientation at all times. The ECM uses this information to generate timed ignition and injection pulses that it sends to the ignition coils and to the fuel injectors.

CAMSHAFT POSITION SENSOR

The Camshaft Position (CMP) sensor sends a CMP signal to the Engine Control Module (ECM). The ECM uses this signal as a "sync pulse" to trigger the injectors in the proper sequence. The ECM uses the CMP signal to indicate the position of the #1 piston during its power stroke. This allows the ECM to calculate true sequential fuel injection mode of operation. If the ECM detects an incorrect CMP signal while the engine is running, Diagnostic Trouble Code (DTC) P0341 will set. If the CMP signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection mode based on the last fuel injection pulse, and the engine will continue to run. As long as the fault is present, the engine can be restarted. It will run in the calculated sequential mode with a 1-in-6 chance of the injector sequence being correct.

IDLE AIR SYSTEM OPERATION

The idle air system operation is controlled by the base idle setting of the throttle body of the Idle Air Control (IAC) valve and the Main Throttle Idle Actuator (MTIA).

The Engine Control Module (ECM) uses the IAC valve and MTC to set the idle speed dependent on conditions. The ECM uses information from various inputs, such as coolant temperature, manifold vacuum, etc., for the effective control of the idle speed.

FUEL CONTROL SYSTEM OPERATION

The function of the fuel metering system is to deliver the correct amount of fuel to the engine under all operating conditions. The fuel is delivered to the engine by the individual fuel injectors mounted into the intake manifold near each cylinder.

The main fuel control sensors are the Manifold Absolute Pressure (MAP) sensor, the oxygen sensor (O2S), and the heated oxygen sensor (HO2S).

The MAP sensor measures or senses the intake manifold vacuum. Under high fuel demands, the MAP sensor reads a low vacuum condition, such as wide open throttle. The Engine Control Module (ECM) uses this information to enrich the mixture, thus increasing the fuel injector on-time, to provide the correct amount of fuel. When decelerating, the vacuum increases. This vacuum change is sensed by the MAP sensor and read by the ECM, which then decreases the fuel injector on-time due to the low fuel demand conditions.

The O2S is located in the exhaust manifold. The HO2S is located in the exhaust pipe. The oxygen sensors indicate to the ECM the amount of oxygen in the exhaust gas, and the ECM changes the air/fuel ratio to the engine by controlling the fuel injectors. The best air/fuel ratio to minimize exhaust emissions is 14.7 to 1, which allows the catalytic converter to operate most efficiently. Because of the constant measuring and adjusting of the air/fuel ratio, the fuel injection system is called a "closed loop" system.

The ECM uses voltage inputs from several sensors to determine how much fuel to provide to the engine. The fuel is delivered under one of several conditions, called "modes."

Starting Mode

When the ignition is turned ON, the ECM turns the fuel pump relay on for 2 seconds. The fuel pump then builds fuel pressure. The ECM also checks the Engine Coolant Temperature (ECT) sensor and the Throttle Position (TP) sensor and determines the proper air/fuel ratio for starting the engine. This ranges from 1.5 to 1 at –38°C (–36.4°F) coolant temperature to 14.7 to 1 at 94°C (201°F) coolant temperature. The ECM controls the amount of fuel delivered in the starting mode by changing how long the fuel injector is turned on and off. This is done by "pulsing" the fuel injectors for very short times.

Clear Flood Mode (only 2.0L DOHC)

If the engine floods with excessive fuel, it may be cleared by pushing the accelerator pedal down all the way. The ECM will then completely turn off the fuel by eliminating any fuel injector signal. The ECM holds this injector rate as long as the throttle stays wide open and the engine is below approximately 400 rpm. If the throttle position becomes less than approximately 80 percent, the ECM returns to the starting mode.

Run Mode

The run mode has two conditions called "open loop" and "closed loop."

Open Loop

When the engine is first started and it is above 400 rpm, the system goes into "open loop" operation. In "open loop," the ECM ignores the signal from the O2S and calculates the air/fuel ratio based on inputs from the ECT sensor and the MAP sensor. The ECM stays in "open loop" until the following conditions are met:

- The O2S has a varying voltage output, showing that it is hot enough to operate properly.
- The ECT sensor is above a specified temperature.
- A specific amount of time has elapsed after starting the engine.

Closed Loop

The specific values for the above conditions vary with different engines and are stored in the Electronically Erasable Programmable Read-Only Memory (EEPROM). When these conditions are met, the system goes into "closed loop" operation. In "closed loop," the ECM calculates the air/fuel ratio (fuel injector on-time) based on the signals from the oxygen sensors. This allows the air/fuel ratio to stay very close to 14.7 to 1.

Acceleration Mode

The ECM responds to rapid changes in throttle position and airflow and provides extra fuel.

Deceleration Mode

The ECM responds to changes in throttle position and airflow and reduces the amount of fuel. When deceleration is very fast, the ECM can cut off fuel completely for short periods of time.

Battery Voltage Correction Mode

When battery voltage is low, the ECM can compensate for a weak spark delivered by the ignition module by using the following methods:

- Increasing the fuel injector pulse width.
- Increasing the idle speed rpm.
- Increasing the ignition dwell time.

Fuel Cut-Off Mode

No fuel is delivered by the fuel injectors when the ignition is off. This prevents dieseling or engine run-on. Also, the fuel is not delivered if there are no reference pulses received from the CKP sensor. This prevents flooding.

EVAPORATIVE EMISSION CONTROL SYSTEM OPERATION

The basic Evaporative Emission (EVAP) control system used is the charcoal canister storage method. This method transfers fuel vapor from the fuel tank to an activated carbon (charcoal) storage canister which holds the vapors when the vehicle is not operating. When the engine is running, the fuel vapor is purged from the carbon element by intake airflow and consumed in the normal combustion process.

Gasoline vapors from the fuel tank flow into the tube labeled TANK. These vapors are absorbed into the carbon. The canister is purged by Engine Control Module (ECM) when the engine has been running for a specified amount of time. Air is drawn into the canister and mixed with the vapor. This mixture is then drawn into the intake manifold.

The ECM supplies a ground to energize the controlled charcoal canister purge solenoid valve. This valve is Pulse Width Modulated (PWM) or turned on and off several times a second. The controlled charcoal canister purge PWM duty cycle varies according to operating conditions determined by mass airflow, fuel trim, and intake air temperature.

Poor idle, stalling, and poor driveability can be caused by the following conditions:

- An inoperative controlled canister purge valve.
- A damaged canister.

- Hoses that are split, cracked, or not connected to the proper tubes.

CONTROLLED CHARCOAL CANISTER

The controlled charcoal canister is an emission control device containing activated charcoal granules. The controlled charcoal canister is used to store fuel vapors from the fuel tank. Once certain conditions are met, the Engine Control Module (ECM) activates the controlled charcoal canister purge solenoid, allowing the fuel vapors to be drawn into the engine cylinders and burned.

VARIABLE GEOMETRY INDUCTION SYSTEM OPERATION (ONLY 1.6L DOHC)

The Variable Geometry Induction System (VGIS) is used to add more responsive acceleration to the dual overhead camshaft (DOHC) engines. Under certain conditions, the Engine Control Module (ECM) activates the VGIS solenoid, allowing the stored vacuum to actuate the secondary throttle control valve. The secondary throttle control valve then opens the secondary throttle plates, which are internal to the intake manifold and plenum assembly. This allows for increased airflow into the engine creating more responsive acceleration.

POSITIVE CRANKCASE VENTILATION CONTROL SYSTEM OPERATION

A Positive Crankcase Ventilation (PCV) control system is used to provide complete use of the crankcase vapors. Fresh air from the air cleaner is supplied to the crankcase. The fresh air is mixed with blowby gases which then pass through a vacuum hose into the intake manifold.

Periodically inspect the hoses and the clamps. Replace any crankcase ventilation components as required.

A restricted or plugged PCV hose may cause the following conditions:

- Rough idle
- Stalling or low idle speed
- Oil leaks
- Oil in the air cleaner
- Sludge in the engine

A leaking PCV hose may cause the following conditions:

- Rough idle
- Stalling
- High idle speed

ENGINE COOLANT TEMPERATURE SENSOR

The Engine Coolant Temperature (ECT) sensor is a thermistor (a resistor which changes value based on temperature) mounted in the engine coolant stream. Low coolant temperature produces a high resistance (100,000 ohms at –40°F [–40°C]) while high temperature causes low resistance (70 ohms at 130°F [266°C]).

The Engine Control Module (ECM) supplies 5 volts to the ECT sensor through a resistor in the ECM and measures the change in voltage. The voltage will be high when the engine is cold and low when the engine is hot. By measuring the change in voltage, the ECM can determine the coolant temperature. The engine coolant temperature affects most of the systems that the ECM controls. A failure in the ECT sensor circuit should set a Diagnostic Trouble Code (DTC) P0117 or P0118. Remember, these DTC indicate a failure in the ECT circuit, so proper use of the chart will lead either to repairing a wiring problem or to replacing the sensor to repair a problem properly.

THROTTLE POSITION SENSOR (ONLY 2.0L DOHC)

The Throttle Position (TP) sensor is a potentiometer connected to the throttle shaft of the throttle body. The TP sensor electrical circuit consists of a 5-volt supply line and a ground line, both provided by the Engine Control Module (ECM). The ECM calculates the throttle position by monitoring the voltage on this signal line. The TP sensor output changes as the accelerator pedal is moved, changing the throttle valve angle. At a closed throttle position, the output of the TP sensor is low, about 0.5 volt. As the throttle valve opens, the output increases so that, at Wide Open Throttle (WOT), the output voltage will be about 5 volts.

The ECM can determine fuel delivery based on throttle valve angle (driver demand). A broken or loose TP sensor can cause intermittent bursts of fuel from the injector and an unstable idle, because the ECM thinks the throttle is moving. A problem in any of the TP sensor circuits should set a Diagnostic Trouble Code (DTC) P0122 or P0123. Once the DTC is set, the ECM will substitute a default value for the TP sensor and some vehicle performance will return. A DTC P1121 will cause a high idle speed.

CATALYST MONITOR OXYGEN SENSORS

Three-way catalytic converters are used to control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx). The catalyst within the converters promotes a chemical reaction. This reaction oxidizes the HC and CO present in the exhaust gas and converts them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx by converting it to nitrogen. The ECM can monitor this process using the oxygen sensor (O2S) and heated oxygen sensor (HO2S). These sensors produce an output signal which indicates the amount of oxygen present in the exhaust gas entering and leaving the three-way converter. This indicates the catalyst's ability to efficiently convert exhaust gasses. If the catalyst is operating efficiently, the O2S signals will be more active than the signals produced by the HO2S. The catalyst monitor sensors operate the same way as the fuel control sensors. The sensors' main function is catalyst monitoring, but they also have a limited role in fuel control. If a sensor output indicates a voltage either above or below the 450 mV bias voltage for an extended period of time, the Engine Control Module (ECM) will make a slight adjustment to fuel trim to ensure that fuel delivery is correct for catalyst monitoring.

A problem with the O2S circuit will set DTC P0131, P0132, P0133 or P0134 depending on the special condition. A problem with the HO2S signal will set DTC P0137, P0138, P0140 or P0141 depending on the special condition.

A fault in the heated oxygen sensor (HO2S) heater element or its ignition feed or ground will result in lower oxygen sensor response. This may cause incorrect catalyst monitor diagnostic results.

MAIN THROTTLE IDLE ACTUATOR (ONLY 1.6L DOHC)

The aim of the MTIA (Main Throttle Idle Actuator) is to control the idle speed with the throttle body itself. The throttle is motorized for low opening angle (0°, 22.5°). The characteristics of the airflow are not the same for low and high opening angles. As a matter of fact, the gradient of the mass air flow function of TPS is lower for small angles that permits to be more precise during the idle speed control. Out of idle speed the throttle is actuated mechanically by a classical bowdencable.

The throttle position sensor (TPS) provides a voltage signal that changes in relation to the throttle plate angle. The signal voltage will vary from about nearly 5.0 V at idles to about 0.2V to 0.4 V at wide-open throttle. The TPS is one of the most important inputs used by the ECM for fuel control and other functions such as idle, wide open throttle, deceleration enleanment , and acceleration enrichment.

EXHAUST GAS RECIRCULATION VALVE

The Exhaust Gas Recirculation (EGR) system is used on engines equipped with an automatic transaxle to lower oxides of nitrogen (NOx) emission levels caused by high combustion temperature. The main element of the system is the EGR valve, controlled electrically by the Engine Control Module (ECM). The EGR valve feeds small amounts of exhaust gas into the intake manifold to decrease combustion temperature. The amount of exhaust gas recirculated is controlled by variations in vacuum and exhaust back pressure. If too much exhaust gas enters, combustion will not take place. For this reason, very little exhaust gas is allowed to pass through the valve, especially at idle.

The EGR valve is usually open under the following conditions:

- Warm engine operation.
- Above idle speed.

Results of Incorrect Operation

Too much EGR flow tends to weaken combustion, causing the engine to run roughly or to stop. With too much EGR flow at idle, cruise, or cold operation, any of the following conditions may occur:

- The engine stops after a cold start.
- The engine stops at idle after deceleration.
- The vehicle surges during cruise.
- Rough idle.

If the EGR valve stays open all the time, the engine may not idle. Too little or no EGR flow allows combustion temperatures to get too high during acceleration and load conditions. This could cause the following conditions:

- Spark knock (detonation)
- Engine overheating
- Emission test failure

INTAKE AIR TEMPERATURE SENSOR

The Intake Air Temperature (IAT) sensor is a thermistor, a resistor which changes value based on the temperature of the air entering the engine. Low temperature produces a high resistance (61,000 ohms at –40°F [–40°C]), while high temperature causes a low resistance (70 ohms at 266°C [130°C]).

The Engine Control Module (ECM) provides 5 volts to the IAT sensor through a resistor in the ECM and measures the change in voltage to determine the IAT. The voltage will be high when the manifold air is cold and low when the air is hot. The ECM knows the intake IAT by measuring the voltage.

The IAT sensor is also used to control spark timing when the manifold air is cold.

A failure in the IAT sensor circuit sets a diagnostic trouble code P0112 or P0113.

IDLE AIR CONTROL VALVE (ONLY 2.0L DOHC)

Notice: Do not attempt to remove the protective cap and readjust the stop screw. Misadjustment may result in damage to the Idle Air Control (IAC) valve or to the throttle body.

The IAC valve is mounted on the throttle body where it controls the engine idle speed under the command of the Engine Control Module (ECM). The ECM sends voltage pulses to the IAC valve motor windings, causing the IAC valve pintle to move in or out a given distance (a step or count) for each pulse. The pintle movement controls the airflow around the throttle valves which, in turn, control the engine idle speed.

The desired idle speeds for all engine operating conditions are programmed into the calibration of the ECM. These programmed engine speeds are based on the coolant temperature, the park/neutral position switch status, the vehicle speed, the battery voltage, and the A/C system pressure, if equipped.

The ECM "learns" the proper IAC valve positions to achieve warm, stabilized idle speeds (rpm) desired for the various conditions (park/neutral or drive, A/C on or off, if equipped). This information is stored in ECM "keep alive" memories (information is retained after the ignition is turned off). All other IAC valve positioning is calculated based on these memory values. As a result, engine variations due to wear and variations in the minimum throttle valve position (within limits) do not affect engine idle speeds. This system provides correct idle control under all conditions. This also means that disconnecting power to the ECM can result in incorrect idle control or the necessity to partially press the accelerator when starting until the ECM relearns idle control.

Engine idle speed is a function of total airflow into the engine based on the IAC valve pintle position, the throttle valve opening, and the calibrated vacuum loss through accessories. The minimum throttle valve position is set at the factory with a stop screw. This setting allows enough airflow by the throttle valve to cause the IAC valve pintle to be positioned a calibrated number of steps (counts) from the seat during "controlled" idle operation. The minimum throttle valve position setting on this engine should not be considered the "minimum idle speed," as on other fuel injected engines. The throttle stop screw is covered with a plug at the factory following adjustment.

If the IAC valve is suspected as being the cause of improper idle speed, refer to "Idle Air Control System Check" in this section.

MANIFOLD ABSOLUTE PRESSURE SENSOR

The Manifold Absolute Pressure (MAP) sensor measures the changes in the intake manifold pressure which result from engine load and speed changes and converts these to a voltage output.

A closed throttle on engine coast down produces a relatively low MAP output. MAP is the opposite of vacuum. When manifold pressure is high, vacuum is low. The MAP sensor is also used to measure barometric pressure. This is performed as part of MAP sensor calculations. With the ignition ON and the engine not running, the Engine Control Module (ECM) will read the manifold pressure as barometric pressure and adjust the air/fuel ratio accordingly. This compensation for altitude allows the system to maintain driving performance while holding emissions low. The barometric function will update periodically during steady driving or under a wide open throttle condition. In the case of a fault in the barometric portion of the MAP sensor, the ECM will set to the default value.

A failure in the MAP sensor circuit sets a diagnostic trouble codes P0107, P0108 or P0106.

ENGINE CONTROL MODULE

The Engine Control Module (ECM), located in engine room beside battery, is the control center of the fuel injection system. It constantly looks at the information from various sensors and controls the systems that affect the vehicle's performance. The ECM also performs the diagnostic functions of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL), and store diagnostic trouble code(s) which identify the problem areas to aid the technician in making repairs.

There are no serviceable parts in the ECM. The calibrations are stored in the ECM in the Programmable Read Only Memory (PROM).

The ECM supplies either 5 or 12 volts to power the sensors or switches. This is done through resistance in the ECM which are so high in value that a test light will not come on when connected to the circuit. In some cases, even an ordinary shop voltmeter will not give an accurate reading because its resistance is too low. You must use a digital voltmeter with a 10 megohm input impedance to get accurate voltage readings. The ECM controls output circuits such as the fuel injectors, the Idle Air Control (IAC valve, MTC), the A/C clutch relay, etc., by controlling the ground circuit through transistors or a device called a "quad-driver."

FUEL INJECTOR

The Multi-port Fuel Injection (MFI) assembly is a solenoid-operated device controlled by the Engine Control Module (ECM) that meters pressurized fuel to a single engine cylinder. The ECM energizes the fuel injector or solenoid to a normally closed ball or pintle valve. This allows fuel to flow into the top of the injector, past the ball or pintle valve, and through a recessed flow director plate at the injector outlet.

The director plate has six machined holes that control the fuel flow, generating a conical spray pattern of finely atomized fuel at the injector tip. Fuel from the tip is directed at the intake valve, causing it to become further atomized and vaporized before entering the combustion chamber. A fuel injector which is stuck partially open would cause a loss of fuel pressure after the engine is shut down. Also, an extended crank time would be noticed on some engines. Dieseling could also occur because some fuel could be delivered to the engine after the ignition is turned off.

KNOCK SENSOR

The knock sensor detects abnormal knocking in the engine. The sensor is mounted in the engine block near the cylinders. The sensor produces an AC output voltage which increases with the severity of the knock. This signal is sent to the Engine Control Module (ECM). The ECM then adjusts the ignition timing to reduce the spark knock.

GRAVITY SENSING ROUGH ROAD (G) SENSOR (ONLY 2.0L DOHC)

The Engine Control Module (ECM) receives rough road information from the rough road sensor located on right side front strut, for non-ABS vehicle. The ECM uses the rough road information to enable or disable the misfire diagnostic. The misfire diagnostic can be greatly affected by crankshaft speed variations caused by driving on rough road surfaces. The rough road sensor generates rough road information by producing a signal which is proportional to the movement of a small metal bar inside the sensor.

If a fault occurs which causes the ECM to not receive rough road information between 30 and 70 mph (50 and 113 km/h), Diagnostic Trouble Code (DTC) P1391 will set.

VARIABLE RELUCTANCE (VR) SENSOR (ONLY 1.6L DOHC)

The variable reluctance sensor is commonly refered to as an “inductive” sensor.

The VR wheel speed sensor consists of a sensing unit fixed to the left side front macpherson strut, for non-ABS vehicle.

The ECM uses the rough road information to enable or disable the misfire diagnostic. The misfire diagnostic can be greatly affected by crankshaft speed variations caused by driving on rough road surfaces. The VR sensor generates rough road information by producing a signal which is proportional to the movement of a small metal bar inside the sensor.

If a fault occurs which causes the ECM to not receive rough road information between 30 and 70 km/h (1.8 and 43.5 mph), Diagnostic Trouble Code (DTC) P1391 will set.

STRATEGY-BASED DIAGNOSTICS

Strategy-Based Diagnostics

The strategy-based diagnostic is a uniform approach to repair all Electrical/Electronic (E/E) systems. The diagnostic flow can always be used to resolve an E/E system problem and is a starting point when repairs are necessary. The following steps will instruct the technician on how to proceed with a diagnosis:

Verify the customer complaint. To verify the customer complaint, the technician should know the normal operation of the system.

- Perform preliminary checks as follows:
- Conduct a thorough visual inspection.
- Review the service history.
- Detect unusual sounds or odors.
- Gather Diagnostic Trouble Code (DTC) information to achieve an effective repair.
- Check bulletins and other service information. This includes videos, newsletters, etc.
- Refer to service information (manual) system check(s).
- Refer to service diagnostics.

No Trouble Found

This condition exists when the vehicle is found to operate normally. The condition described by the customer may be normal. Verify the customer complaint against another vehicle that is operating normally. The condition may be intermittent. Verify the complaint under the conditions described by the customer before releasing the vehicle.

Re-examine the complaints.

When the complaints cannot be successfully found or isolated, a re-evaluation is necessary. The complaint should be re-verified and could be intermittent as defined in “intermittents,” or could be normal.

After isolating the cause, the repairs should be made. Validate for proper operation and verify that the symptom has been corrected. This may involve road testing or other methods to verify that the complaint has resolved under following conditions:

- Conditions noted by the customer.
- If a DTC was diagnosed, verify the repair be duplicating conditions present when the DTC was set as noted in Failure Records or Freeze Frame data.

Verifying Vehicle Repair

Verification of the vehicle repair will be more comprehensive for vehicles with Euro On-Board Diagnostic (EOBD) system diagnostics. Following a repair, the technician should perform the following steps:

Important: Follow the steps below when you verify repairs on EOBD systems. Failure to follow these steps could result in unnecessary repairs.

- Review and record the Failure Records and the Freeze Frame data for the DTC which has been diagnosed (Freeze Fame data will only be stored for an A, B and E type diagnostic and only if the Malfunction Indicator Lamp has been requested).
- Clear the DTC(s).
- Operate the vehicle within conditions noted in the Failure Records and Freeze Frame data.
- Monitor the DTC status information for the specific DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

EOBD SERVICEABILITY ISSUES

Based on the knowledge gained from On-Board Diagnostic (OBD) experience in the 1994 and 1995 model years in United Status, this list of non-vehicle faults that could affect the performance of the Euro On-Board Diagnostic (EOBD) system has been compiled. These non-vehicle faults vary from environmental conditions to the quality of fuel used. With the introduction of EOBD across the entire passenger car, illumination of the Malfunction Indicator Lamp (MIL) due to a non-vehicle fault could lead to misdiagnosis of the vehicle, increased warranty expense and customer dissatisfaction. The following list of non-vehicle faults does not include every possible fault and may not apply equally to all product lines.

Fuel Quality

Fuel quality is not a new issue for the automotive industry, but its potential for turning on the MIL with EOBD systems is new.

Fuel additives such as “dry gas” and “octane enhancers” may affect the performance of the fuel. If this results in an incomplete combustion or a partial burn, it will set Diagnostic Trouble Code (DTC) P0300. The Reed Vapor Pressure of the fuel can also create problems in the fuel system, especially during the spring and fall months when severe ambient temperature swings occur. A high Reed Vapor Pressure could show up as a Fuel Trim DTC due to excessive canister loading.

Using fuel with the wrong octane rating for your vehicle may cause driveability problems. Many of the major fuel companies advertise that using “premium” gasoline will improve the performance of your vehicle. Most premium fuels use alcohol to increase the octane rating of the fuel. Although alcohol-enhanced fuels may raise the octane rating, the fuel’s ability to turn into vapor in cold temperatures deteriorates. This may affect the starting ability and cold driveability of the engine.

Low fuel levels can lead to fuel starvation, lean engine operation, and eventually engine misfire.

Non-OEM Parts

The EOBD system has been calibrated to run with Original Equipment Manufacturer (OEM) parts. Something as simple as a high performance-exhaust system that affects exhaust system back pressure could potentially interfere with the operation of the Exhaust Gas Recirculation (EGR) valve and thereby turn on the MIL. Small leaks in the exhaust system near the heated oxygen sensor (HO2S) can also cause the MIL to turn on.

Aftermarket electronics, such as cellular phones, stereos, and anti-theft devices, may radiate Electromagnetic Interference (EMI) into the control system if they are improperly installed. This may cause a false sensor reading and turn on the MIL.

Environment

Temporary environmental conditions, such as localized flooding, will have an effect on the vehicle ignition system. If the ignition system is rain-soaked, it can temporarily cause engine misfire and turn on the MIL.

Vehicle Marshaling

The transportation of new vehicles from the assembly plant to the dealership can involve as many as 60 key cycles within 2 to 3 miles of driving. This type of operation contributes to the fuel fouling of the spark plugs and will turn on the MIL with a set DTC P0300.

Poor Vehicle Maintenance

The sensitivity of the EOBD will cause the MIL to turn on if the vehicle is not maintained properly. Restricted air filters, fuel filters, and crankcase deposits due to lack of oil changes or improper oil viscosity can trigger actual vehicle faults that were not previously monitored prior to EOBD. Poor vehicle maintenance can not be classified as a “non-vehicle fault,” but with the sensitivity of the EOBD, vehicle maintenance schedules must be more closely followed.

Severe Vibration

The Misfire diagnostic measures small changes in the rotational speed of the crankshaft. Severe driveline vibrations in the vehicle, such as caused by an excessive amount of mud on the wheels, can have the same effect on crankshaft speed as misfire and, therefore, may set DTC P0300.

Related System Faults

Many of the EOBD system diagnostics will not run if the Engine Control Module (ECM) detects a fault on a related system or component. One example would be that if the ECM detected a Misfire fault, the diagnostics on the catalytic converter would be suspended until the Misfire fault was repaired. If the Misfire fault is severe enough, the catalytic converter can be damaged due to overheating and will never set a Catalyst DTC until the Misfire fault is repaired and the Catalyst diagnostic is allowed to run to completion. If this happens, the customer may have to make two trips to the dealership in order to repair the vehicle.

SERIAL DATA COMMUNICATIONS

Keyword 2000 Serial Data Communications

Government regulations require that all vehicle manufacturers establish a common communication system. This vehicle utilizes the “Keyword 2000” communication system. Each bit of information can have one of two lengths: long or short. This allows vehicle wiring to be reduced by transmitting and receiving multiple signals over a single wire. The messages carried on Keyword 2000 data streams are also prioritized. If two messages attempt to establish communications on the data line at the same time, only the message with higher priority will continue. The device with the lower priority message must wait. The most significant result of this regulation is that it provides scan tool manufacturers with the capability to access data from any make or model vehicle that is sold.

The data displayed on the other scan tool will appear the same, with some exceptions. Some scan tools will only be able to display certain vehicle parameters as values that are a coded representation of the true or actual value. On this vehicle, the scan tool displays the actual values for vehicle parameters. It will not be necessary to perform any conversions from coded values to actual values.

EURO ON-BOARD DIAGNOSTIC (EOBD)

Euro On-Board Diagnostic Tests

A diagnostic test is a series of steps, the result of which is a pass or fail reported to the diagnostic executive. When a diagnostic test reports a pass result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The diagnostic test has passed during the current ignition cycle.
- The fault identified by the diagnostic test is not currently active.

When a diagnostic test reports a fail result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The fault identified by the diagnostic test is currently active.
- The fault has been active during this ignition cycle.
- The operating conditions at the time of the failure.

Remember, a fuel trim Diagnostic Trouble Code (DTC) may be triggered by a list of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

COMPREHENSIVE COMPONENT MONITOR DIAGNOSTIC OPERATION

Comprehensive component monitoring diagnostics are required to monitor emissions-related input and output powertrain components.

Input Components

Input components are monitored for circuit continuity and out-of-range values. This includes rationality checking. Rationality checking refers to indicating a fault when the signal from a sensor does not seem reasonable, i.e. Throttle Position (TP) sensor that indicates high throttle position at low engine loads or Manifold Absolute Pressure (MAP) voltage. Input components may include, but are not limited to, the following sensors:

- Vehicle Speed Sensor (VSS).
- Crankshaft Position (CKP) sensor.
- Throttle Position (TP) sensor.
- Engine Coolant Temperature (ECT) sensor.
- Camshaft Position (CMP) sensor.
- MAP sensor.

In addition to the circuit continuity and rationality check, the ECT sensor is monitored for its ability to achieve a steady state temperature to enable closed loop fuel control.

Output Components

Output components are diagnosed for proper response to control module commands. Components where functional monitoring is not feasible will be monitored for circuit continuity and out-of-range values if applicable. Output components to be monitored include, but are not limited to the following circuit:

- Idle Air Control (IAC) Motor.
- Controlled Canister Purge Valve.
- A/C relays.
- Cooling fan relay.
- VSS output.
- Malfunction Indicator Lamp (MIL) control.

Refer to *"Engine Control Module"* and the sections on Sensors in General Descriptions.

Passive and Active Diagnostic Tests

A passive test is a diagnostic test which simply monitors a vehicle system or component. Conversely, an active test, actually takes some sort of action when performing diagnostic functions, often in response to a failed passive test. For example, the Exhaust Gas Recirculation (EGR) diagnostic active test will force the EGR valve open during closed throttle deceleration and/or force the EGR valve closed during a steady state. Either action should result in a change in manifold pressure.

Intrusive Diagnostic Tests

This is any Euro On-Board test run by the Diagnostic Management System which may have an effect on vehicle performance or emission levels.

Warm-Up Cycle

A warm-up cycle means that engine at temperature must reach a minimum of 70°C (160°F) and rise at least 22°C (40°F) over the course of a trip.

Freeze Frame

Freeze Frame is an element of the Diagnostic Management System which stores various vehicle information at the moment an emissions-related fault is stored in memory and when the MIL is commanded on. These data can help to identify the cause of a fault.

Failure Records

Failure Records data is an enhancement of the EOBD Freeze Frame feature. Failure Records store the same vehicle information as does Freeze Frame, but it will store that information for any fault which is stored in Euro On-Board memory, while Freeze Frame stores information only for emission-related faults that command the MIL on.

COMMON EOBD TERMS

Diagnostic

When used as a noun, the word diagnostic refers to any Euro On-Board test run by the vehicle's Diagnostic Management System. A diagnostic is simply a test run on a system or component to determine if the system or component is operating according to specification. There are many diagnostics, shown in the following list:

- Misfire.
- Oxygen sensors (O2S)
- Heated oxygen sensor (HO2S)
- Exhaust Gas Recirculation (EGR)
- Catalyst monitoring

Enable Criteria

The term "enable criteria" is engineering language for the conditions necessary for a given diagnostic test to run. Each diagnostic has a specific list of conditions which must be met before the diagnostic will run.

"Enable criteria" is another way of saying "conditions required."

The enable criteria for each diagnostic is listed on the first page of the Diagnostic Trouble Code (DTC) description under the heading "Conditions for Setting the DTC." Enable criteria varies with each diagnostic and typically includes, but is not limited to the following items:

- Engine speed.
- Vehicle speed
- Engine Coolant Temperature (ECT)
- Manifold Absolute Pressure (MAP)
- Barometric Pressure (BARO)
- Intake Air Temperature (IAT)
- Throttle Position (TP)
- Fuel trim
- A/C on

Trip

Technically, a trip is a key-on run key-off cycle in which all the enable criteria for a given diagnostic are met, allowing the diagnostic to run. Unfortunately, this concept is not quite that simple. A trip is official when all the enable criteria for a given diagnostic are met. But because the enable criteria vary from one diagnostic to another, the definition of trip varies as well. Some diagnostics are run when the vehicle is at operating temperature, some when the vehicle first starts up; some require that the vehicle cruise at a steady highway speed, some run only when the vehicle is at idle. Some run only immediately following a cold engine start-up.

A trip then, is defined as a key-on run-key off cycle in which the vehicle is operated in such a way as to satisfy the enable criteria for a given diagnostic, and this diagnostic will consider this cycle to be one trip. However, another diagnostic with a different set of enable criteria (which were not met) during this driving event, would not consider it a trip. No trip will occur for that particular diagnostic until the vehicle is driven in such a way as to meet all the enable criteria.

Diagnostic Information

The diagnostic charts and functional checks are designed to locate a faulty circuit or component through a process of logical decisions. The charts are prepared with the requirement that the vehicle functioned correctly at the time of assembly and that there are not multiple faults present.

There is a continuous self-diagnosis on certain control functions. This diagnostic capability is complimented by the diagnostic procedures contained in this manual. The language of communicating the source of the malfunction is a system of diagnostic trouble codes. When a malfunction is detected by the control module, a DTC is set, and the Malfunction Indicator Lamp (MIL) is illuminated.

Malfunction Indicator Lamp (MIL)

The Malfunction Indicator Lamp (MIL) is required by Euro On-Board Diagnostics (EOBD) to illuminate under a strict set of guidelines.

Basically, the MIL is turned on when the Engine Control Module (ECM) detects a DTC that will impact the vehicle emissions.

The MIL is under the control of the Diagnostic Executive. The MIL will be turned on if an emissions-related diagnostic test indicates a malfunction has occurred. It will stay on until the system or component passes the same test for three consecutive trips with no emissions related faults.

Extinguishing the MIL

When the MIL is on, the Diagnostic Executive will turn off the MIL after three consecutive trips that a "test passed" has been reported for the diagnostic test that originally caused the MIL to illuminate. Although the MIL has been turned off, the DTC will remain in the ECM memory (both Freeze Frame and Failure Records) until forty (40) warm-up cycles after no faults have been completed.

If the MIL was set by either a fuel trim or misfire-related DTC, additional requirements must be met. In addition to the requirements stated in the previous paragraph, these requirements are as follows:

- The diagnostic tests that are passed must occur with 375 rpm of the rpm data stored at the time the last test failed.
- Plus or minus ten percent of the engine load that was stored at the time the last test failed. Similar engine temperature conditions (warmed up or warming up) as those stored at the time the last test failed.

Meeting these requirements ensures that the fault which turned on the MIL has been corrected.

The MIL is on the instrument panel and has the following functions:

- It informs the driver that a fault affecting the vehicle's emission levels has occurred and that the vehicle should be taken for service as soon as possible.
- As a system check, the MIL will come on with the key ON and the engine not running. When the engine is started, the MIL will turn OFF.
- When the MIL remains ON while the engine is running, or when a malfunction is suspected due to a driveability or emissions problem, an EOBD System Check must be performed. The procedures for these checks are given in EOBD System Check. These checks will expose faults which may not be detected if other diagnostics are performed first.

Data Link Connector (DLC)

The provision for communicating with the control module is the Data Link Connector (DLC). The DLC is used to connect to a scan tool. Some common uses of the scan tool are listed below:

- Identifying stored DTCs.
- Clearing DTCs.
- Performing output control tests.
- Reading serial data.

DTC TYPES

Each Diagnostic Trouble Code (DTC) is directly related to a diagnostic test. The Diagnostic Management System sets DTCs based on the failure of the tests during a trip or trips. Certain tests must fail two consecutive trips before the DTC is set. The following are the three types of DTCs and the characteristics of those codes:

Type A

- Emissions related.
- Requests illumination of the Malfunction Indicator. Lamp (MIL) of the first trip with a fail.
- Stores a History DTC on the first trip with a fail.
- Stores a Freeze Frame (if empty).
- Stores a Fail Record.
- Updates the Fail Record each time the diagnostic test fails.

Type B

- Emissions related.
- "Armed" after one trip with a fail.
- "Disarmed" after one trip with a pass.
- Requests illumination of the MIL on the second consecutive trip with a fail.
- Stores a History DTC on the second consecutive trip with a fail (The DTC will be armed after the first fail).
- Stores a Freeze Frame on the second consecutive trip with a fail (if empty).

Type Cnl

- Non-Emissions related.
- Does not request illumination of any lamp.
- Stores a History DTC on the first trip with a fail .
- Does not store a Freeze Frame.
- Stores Fail Record when test fails.
- Updates the Fail Record each time the diagnostic test fails.

Type E

- Emissions related.
- "Armed" after two consecutive trip with a fail.

- "Disarmed" after one trip with a pass.
- Requests illumination of the MIL on the third consecutive trip with a fail.
- Stores a History DTC on the third consecutive trip with a fail (The DTC will be armed after the second fail).
- Stores a Freeze Frame on the third consecutive trip with a fail (if empty).

Important: For a 2.0 DOHC engine only four Fail Records and for 1.6 DOHC engine eight fail records can be stored. Each Fail Record is for a different DTC. It is possible that there will not be Fail Records for every DTC if multiple DTCs are set.

Special Cases of Type B Diagnostic Tests

Unique to the misfire diagnostic, the Diagnostic Executive has the capability of alerting the vehicle operator to potentially damaging levels of misfire. If a misfire condition exists that could potentially damage the catalytic converter as a result of high misfire levels, the Diagnostic Executive will command the MIL to "flash" as a rate of once per seconds during those the time that the catalyst damaging misfire condition is present.

Fuel trim and misfire are special cases of Type B diagnostics. Each time a fuel trim or misfire malfunction is detected, engine load, engine speed, and Engine Coolant Temperature (ECT) are recorded.

When the ignition is turned OFF, the last reported set of conditions remain stored. During subsequent ignition cycles, the stored conditions are used as a reference for similar conditions. If a malfunction occurs during two consecutive trips, the Diagnostic Executive treats the failure as a normal Type B diagnostic, and does not use the stored conditions. However, if a malfunction occurs on two non-consecutive trips, the stored conditions are compared with the current conditions. The MIL will then illuminate under the following conditions:

- When the engine load conditions are within 10% of the previous test that failed.
- Engine speed is within 375 rpm, of the previous test that failed.
- ECT is in the same range as the previous test that failed.

READING DIAGNOSTIC TROUBLE CODES

The procedure for reading Diagnostic Trouble Code(s) (DTC) is to use a diagnostic scan tool. When reading DTC(s), follow instructions supplied by tool manufacturer.

Clearing Diagnostic Trouble Codes

Important: Do not clear DTCs unless directed to do so by the service information provided for each diagnostic procedure. When DTCs are cleared, the Freeze Frame and Failure Record data which may help diagnose an intermittent fault will also be erased from memory. If the fault that caused the DTC to be stored into memory has been corrected, the Diagnostic Executive will begin to count the "warm-up" cycles with no further faults detected, the DTC will automatically be cleared from the Engine Control Module (ECM) memory.

To clear DTCs, use the diagnostic scan tool. When a scan tool is not available, DTCs can also be cleared by disconnecting one of the following sources for at least thirty (30) seconds:

In the 1.6L DOHC engine, it can't cleared DTCs without the diagnostic scan tool. So you must use the diagnostic scan tool.

Notice: To prevent system damage, the ignition key must be OFF when disconnecting or reconnecting battery power.

- The power source to the control module. Examples: fuse, pigtail at battery ECM connectors, etc.
- The negative battery cable. (Disconnecting the negative battery cable will result in the loss of other Euro On-Board memory data, such as preset radio tuning.)

DTC Modes

On Euro On-Board Diagnostic (EOBD) passenger cars there are five options available in the scan tool DTC mode to display the enhanced information available. A description of the new modes, DTC Info and Specific DTC, follows. After selecting DTC, the following menu appears:

- DTC Info.
- Specific DTC.
- Freeze Frame.
- Fail Records (not all applications).
- Clear Info.

The following is a brief description of each of the sub menus in DTC Info and Specific DTC. The order in which they appear here is alphabetical and not necessarily the way they will appear on the scan tool.

DTC Information Mode

Use the DTC info mode to search for a specific type of stored DTC information. There are seven choices. The service manual may instruct the technician to test for DTCs in a certain manner. Always follow published service procedures.

To get a complete description of any status, press the "Enter" key before pressing the desired F-key. For example, pressing "Enter" then an F-key will display a definition of the abbreviated scan tool status.

DTC Status

This selection will display any DTCs that have not run during the current ignition cycle or have reported a test failure during this ignition up to a maximum of 33 DTCs. DTC tests which run and pass will cause that DTC number to be removed from the scan tool screen.

Fail This Ign. (Fail This Ignition)

This selection will display all DTCs that have failed during the present ignition cycle.

History

This selection will display only DTCs that are stored in the ECM's history memory. It will not display Type B DTCs that have not requested the Malfunction Indicator Lamp (MIL). It will display all type A, B and E DTCs that have requested the MIL and have failed within the last 40 warm-up cycles. In addition, it will display all type C and type D DTCs that have failed within the last 40 warm-up cycles.

Last Test Fail

This selection will display only DTCs that have failed the last time the test ran. The last test may have run during a previous ignition cycle if a type A or type B DTC is displayed. For type C and type D DTCs, the last failure must have occurred during the current ignition cycle to appear as Last Test Fail.

MIL Request

This selection will display only DTCs that are requesting the MIL. Type C and type D DTCs cannot be displayed using this option. This selection will report type B and E DTCs only after the MIL has been requested.

Not Run SCC (Not Run Since Code Clear)

This option will display up to 33 DTCs that have not run since the DTCs were last cleared. Since the displayed DTCs have not run, their condition (passing or failing) is unknown.

Test Fail SCC (Test Failed Since Code Clear)

This selection will display all active and history DTCs that have reported a test failure since the last time DTCs were cleared. DTCs that last failed more than 40 warm-up cycles before this option is selected will not be displayed.

Specific DTC Mode

This mode is used to check the status of individual diagnostic tests by DTC number. This selection can be accessed if a DTC has passed, failed or both. Many EOBD DTC mode descriptions are possible because of the extensive amount of information that the diagnostic executive monitors regarding each test. Some of the many possible descriptions follow with a brief explanation.

The “F2” key is used, in this mode, to display a description of the DTC. The “Yes” and “No” keys may also be used to display more DTC status information. This selection will only allow entry of DTC numbers that are supported by the vehicle being tested. If an attempt is, made to enter DTC numbers for tests which the diagnostic executive does not recognize, the requested information will not be displayed correctly and the scan tool may display an error message. The same applies to using the DTC trigger option in the Snapshot mode. If an invalid DTC is entered, the scan tool will not trigger.

Failed Last Test

This message display indicates that the last diagnostic test failed for the selected DTC. For type A, B and E DTCs, this message will be displayed during subsequent ignition cycles until the test passes or DTCs are cleared. For type C and type D DTCs, this message will clear when the ignition is cycled.

Failed Since Clear

This message display indicates that the DTC has failed at least once within the last 40 warm-up cycles since the last time DTCs were cleared.

Failed This Ig. (Failed This Ignition)

This message display indicates that the diagnostic test has failed at least once during the current ignition cycle. This message will clear when DTCs are cleared or the ignition is cycled.

History DTC

This message display indicates that the DTC has been stored in memory as a valid fault. A DTC displayed as a History fault may not mean that the fault is no longer present. The history description means that all the conditions necessary for reporting a fault have been met (maybe even currently), and the information was stored in the control module memory.

MIL Requested

This message display indicates that the DTC is currently causing the MIL to be turned ON. Remember that only type A B and E DTCs can request the MIL. The MIL request cannot be used to determine if the DTC fault conditions are currently being experienced. This is because the diagnostic executive will require up to three trips during which the diagnostic test passes to turn OFF the MIL.

Not Run Since Cl (Not Run Since Cleared)

This message display indicates that the selected diagnostic test has not run since the last time DTCs were cleared. Therefore, the diagnostic test status (passing or failing) is unknown. After DTCs are cleared, this message will continue to be displayed until the diagnostic test runs.

Not Run This Ig. (Not Run This Ignition)

This message display indicates that the selected diagnostic test has not run during this ignition cycle.

Test Ran and Passed

This message display indicates that the selected diagnostic test has done the following:

- Passed the last test.

- Run and passed during this ignition cycle.
- Run and passed since DTCs were last cleared.

If the indicated status of the vehicle is “Test Ran and Passed” after a repair verification, the vehicle is ready to be released to the customer.

If the indicated status of the vehicle is “Failed This Ignition” after a repair verification, then the repair is incomplete and further diagnosis is required.

Prior to repairing a vehicle, status information can be used to evaluate the state of the diagnostic test, and to help identify an intermittent problem. The technician can conclude that although the MIL is illuminated, the fault condition that caused the code to set is not present. An intermittent condition must be the cause.

PRIMARY SYSTEM-BASED DIAGNOSTICS

There are primary system-based diagnostics which evaluate the system operation and its effect on vehicle emissions. The primary system-based diagnostics are listed below with a brief description of the diagnostic function:

Oxygen Sensor Diagnosis

The fuel control oxygen sensor (O2S) is diagnosed for the following conditions:

- Few switch count (rich to lean or lean to rich).
- Slow response (average transient time lean to rich or rich to lean).
- Response time ratio (ratio of average transient time rich(lean) to lean(rich)).
- Inactive signal (output steady at bias voltage approximately 450 mV).
- Signal fixed high.
- Signal fixed low.

The catalyst monitor heated oxygen sensor (HO2S) is diagnosed for the following conditions:

- Heater performance (current during IGN on).
- Signal fixed low during steady state conditions or power enrichment (hard acceleration when a rich mixture should be indicated).
- Signal fixed high during steady state conditions or deceleration mode (deceleration when a lean mixture should be indicated).
- Inactive sensor (output steady at approx. 438 mV).

If the O2S pigtail wiring, connector or terminal are damaged, the entire O2S assembly must be replaced. Do not attempt to repair the wiring, connector or terminals. In order for the sensor to function properly, it must have clean reference air provided to it. This clean air reference is obtained by way of the O2S wire(s). Any attempt to repair the wires, connector or terminals could result in the obstruction of the reference air and degrade the O2S performance.

Misfire Monitor Diagnostic Operation

The misfire monitor diagnostic is based on crankshaft rotational velocity (reference period) variations. The Engine Control Module (ECM) determines crankshaft rotational velocity using the Crankshaft Position (CKP) sensor and the Camshaft Position (CMP) sensor. When a cylinder misfires, the crankshaft slows down momentarily. By monitoring the CKP and CMP sensor signals, the ECM can calculate when a misfire occurs.

For a non-catalyst damaging misfire, the diagnostic will be required to monitor a misfire present for between 1000–3200 engine revolutions.

For catalyst-damaging misfire, the diagnostic will respond to misfire within 200 engine revolutions.

Rough roads may cause false misfire detection. A rough road will cause torque to be applied to the drive wheels and drive train. This torque can intermittently decrease the crankshaft rotational velocity. This may be falsely detected as a misfire.

A rough road sensor (VR sensor or G sensor) works together with the misfire detection system. The rough road sensor produces a voltage that varies along with the intensity of road vibrations. When the ECM detects a rough road, the misfire detection system is temporarily disabled.

Misfire Counters

Whenever a cylinder misfires, the misfire diagnostic counts the misfire and notes the crankshaft position at the time the misfire occurred. These “misfire counters” are basically a file on each engine cylinder. A current and a history misfire counter are maintained for each cylinder. The misfire current counters (Misfire Current #1–4) indicate the number of firing events out of the last 200 cylinder firing events which were misfires. The misfire current counter will display real time data without a misfire DTC stored. The misfire history counters (Misfire Histtory #1–4) indicate the total number of cylinder firing events which were misfires. The misfire history counters will display 0 until the misfire diagnostic has failed and a DTC P0300 is set. Once the misfire DTC P0300 is set, the misfire history counters will be updated every 200 cylinder firing events. A misfire counter is maintained for each cylinder.

If the misfire diagnostic reports a failure, the diagnostic executive reviews all of the misfire counters before reporting a DTC. This way, the diagnostic executive reports the most current information.

When crankshaft rotation is erratic, a misfire condition will be detected. Because of this erratic condition, the data that is collected by the diagnostic can sometimes incorrectly identify which cylinder is misfiring.

Use diagnostic equipment to monitor misfire counter data on EOBD compliant vehicles. Knowing which specific cylinder(s) misfired can lead to the root cause, even when dealing with a multiple cylinder misfire. Using the information in the misfire counters, identify which cylinders are misfiring. If the counters indicate cylinders numbers 1 and 4 misfired, look for a circuit or component common to both cylinders number 1 and 4.

The misfire diagnostic may indicate a fault due to a temporary fault not necessarily caused by a vehicle emission system malfunction. Examples include the following items:

- Contaminated fuel.
- Low fuel.
- Fuel-fouled spark plugs.
- Basic engine fault.

Fuel Trim System Monitor Diagnostic Operation

This system monitors the averages of short-term and long-term fuel trim values. If these fuel trim values stay at their limits for a calibrated period of time, a malfunction is indicated. The fuel trim diagnostic compares the averages of short-term fuel trim values and long-term fuel trim values to rich and lean thresholds. If either value is within the thresholds, a pass is recorded. If both values are outside their thresholds, a rich or lean DTC will be recorded.

The fuel trim system diagnostic also conducts an intrusive test. This test determines if a rich condition is being caused by excessive fuel vapor from the controlled charcoal canister. In order to meet EOBD requirements, the control module uses weighted fuel trim cells to determine the need to set a fuel trim DTC. A fuel trim DTC can only be set if fuel trim counts in the weighted fuel trim cells exceed specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e., engine idle high due to a small vacuum leak or rough idle due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Use a scan tool to observe fuel trim counts while the problem is occurring.

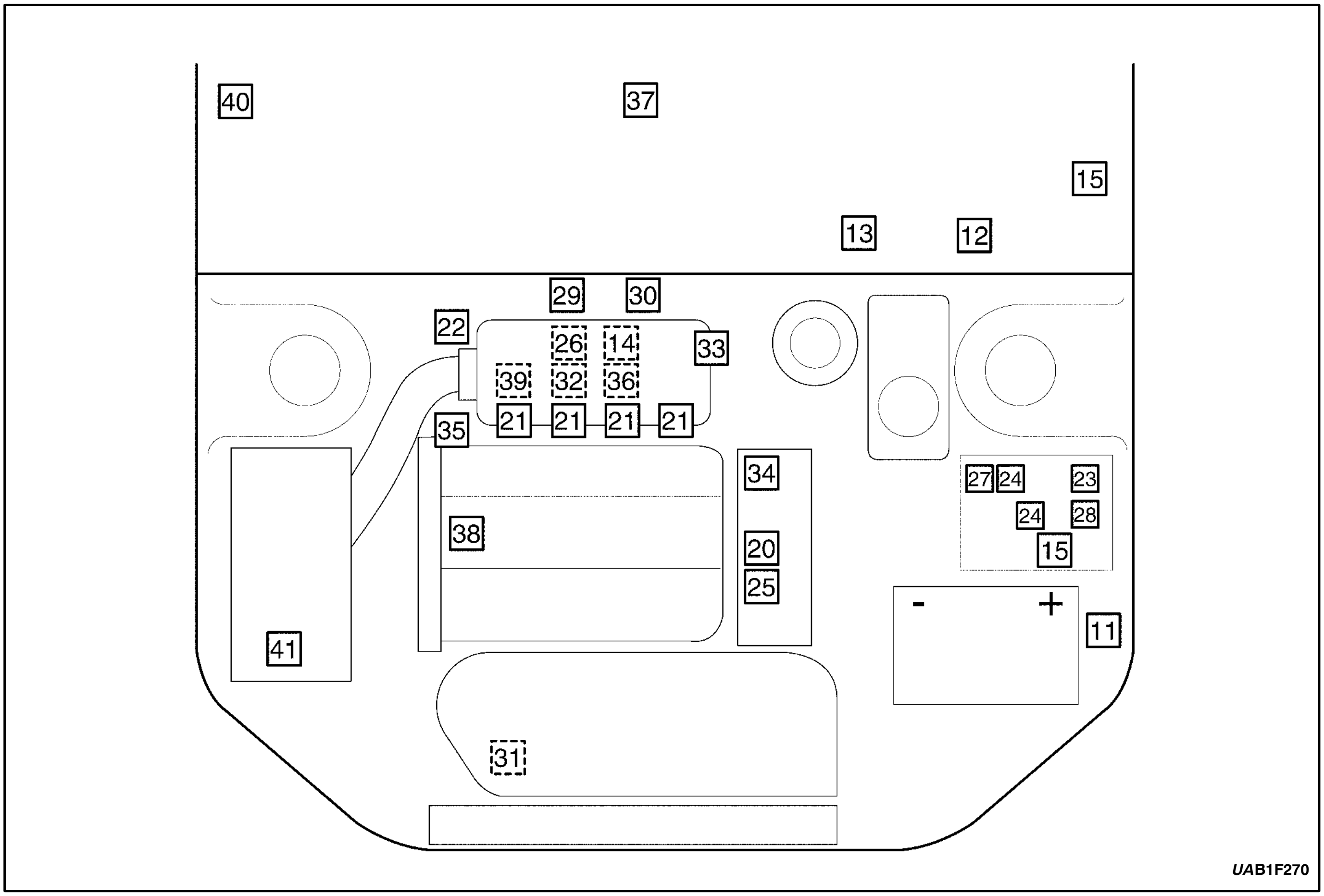
A fuel trim DTC may be triggered by a number of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

Fuel Trim Cell Diagnostic Weights

No fuel trim DTC will set regardless of the fuel trim counts in cell 0 unless the fuel trim counts in the weighted cells are also outside specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e. engine idle high due to a small vacuum leak or rough due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Use a scan tool to observe fuel trim counts while the problem is occurring.

COMPONENT LOCATOR

COMPONENT LOCATOR (1.6L DOHC)



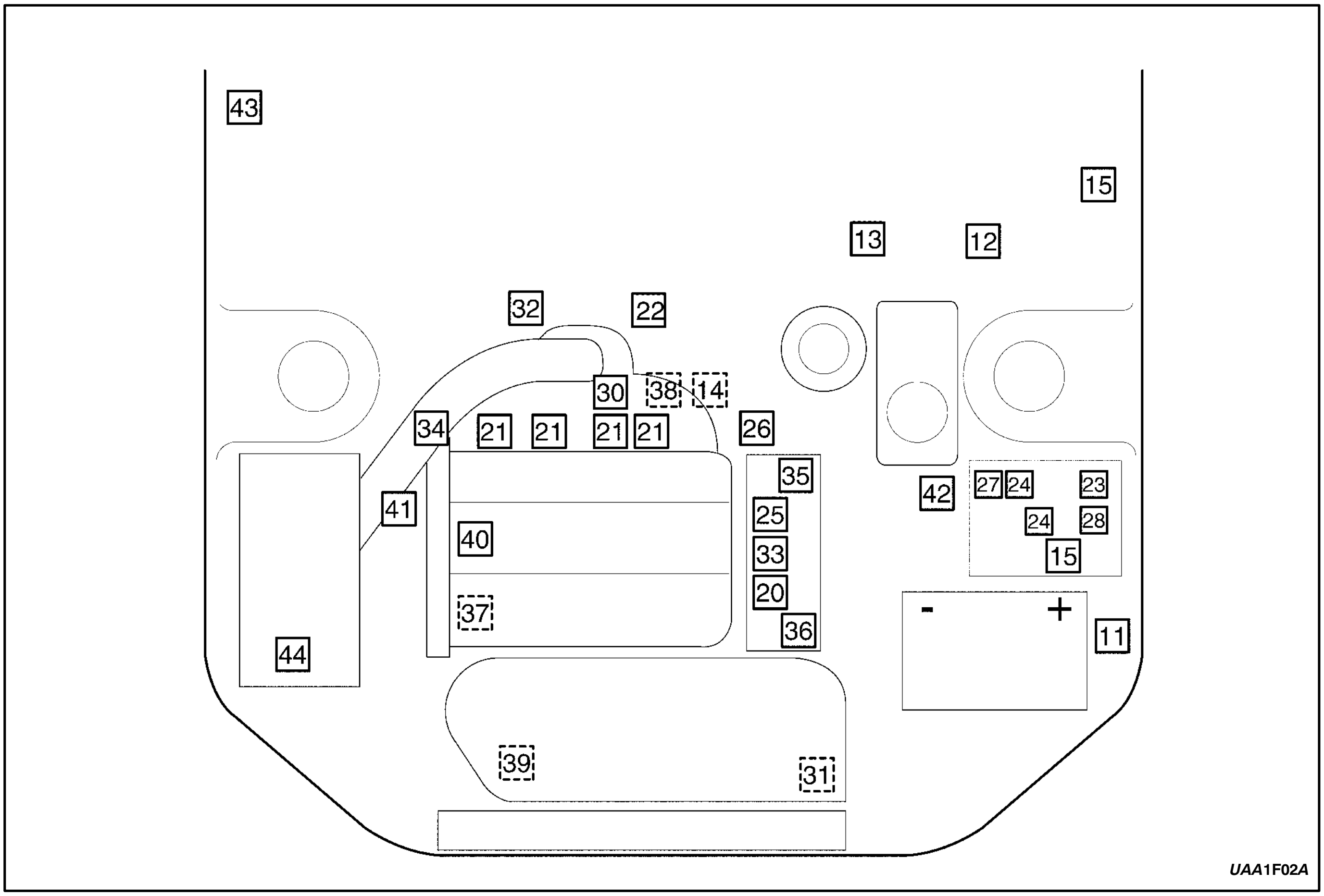
Components on ECM Harness
11 Engine Control Module(ECM)
12 Data Link Connector (DLC)
13 Malfunction Indicator Lamp
14 ECM Harness Ground
15 Fuse Block(2)

ECM Controlled Devices
20 Exhaust Gas Recirculation (EGR) Valve
21 Fuel Injector(4)
22 Main Throttle Idle Actuator (MTIA)
23 Fuel Pump Relay
24 Cooling Fan Relays
25 Electronic Ignition (EI) System Ignition Coil
26 Evaporative Emission (EVAP) Canister Purge Solenoid
27 Main Relay
28 A/C Compressor Relay
29 Variable Geometry Induction System (VGIS)

Information Sensors
30 Manifold Absolute Pressure (MAP) Sensor
31 Oxygen Sensor (O2S)
32 Engine Coolant Temperature (ECT) Sensor
33 Intake Air Temperature (IAT) Sensor
34 Vehicle Speed Sensor (VSS)
35 Cranskshaft Position (CKP) Sensor
36 Knock Sensor
37 Heated Oxygen Sensor (HO2S)
38 Camshaft Position (CMP) Sensor
39 Oil Pressure Switch

Not ECM Connected
40 Evapotative Emission Canister (Undervehicle, Between Under and Fuel Tankl)
41 Air Cleaner

COMPONENT LOCATOR (2.0L DOHC)



Components on* ECM H*arness

11 Engine Control Module (ECM)
12 Data Link Connector (DLC)
13 Malfunction Indicator Lamp
14 ECM Harness Ground
15 Fuse Block (2)

ECM *Controlled Devices*

20 Exhaust Gas Recirculation (EGR) Valve
21 Fuel Injector (4)
22 Idle Air Control (IAC) Valve
23 Fuel Pump Relay
24 Engine Fan Relays
25 Electronic Ignition (EI) System Ignition Coil
26 Evaporative Emission Canister Purge Solenoid
27 Main Relay
28 A/C Compressor Relay

Information Sensors

30 Manifold Absolute Pressure (MAP) Sensor
31 Oxygen Sensor (O2S)
32 Throttle Position (TP) Sensor
33 Engine Coolant Temperature (ECT) Sensor
34 Intake Air Temperature (IAT) Sensor
35 Vehicle Speed Sensor (VSS)
36 P/N Position Switch (Automatic Transaxle Only)
37 Cranskshaft Position (CKP) Sensor
38 Knock Sensor
39 Heated Oxygen Sensor (HO2S)
40 Camshaft Position (CMP) Sensor
41 Oil Pressure Switch
42 Rough Road (G) Sensor

Not* ECM *connected

43 Evapotative Emission Canister (Undervehicle, Between Under Body and Fuel Tank)
44 Air Cleaner

DIAGNOSTIC INFORMATION AND PROCEDURES

SYSTEM DIAGNOSIS

DIAGNOSTIC AIDS

If an intermittent problem is evident, follow the guidelines below.

Preliminary Checks

Before using this section you should have already performed the "Euro On-Board Diagnostic (EOBD) System Check."

Perform a thorough visual inspection. This inspection can often lead to correcting a problem without further checks and can save valuable time. Inspect for the following conditions:

- Engine Control Module (ECM) grounds for being clean, tight, and in their proper location.
- Vacuum hoses for splits, kinks, collapsing and proper connections as shown on the Vehicle Emission Control Information label. Inspect thoroughly for any type of leak or restriction.
- Air leaks at the throttle body mounting area and the intake manifold sealing surfaces.
- Ignition wires for cracks, hardness, proper routing, and carbon tracking.
- Wiring for proper connections.
- Wiring for pinches or cuts.

Diagnostic Trouble Code Tables

Do not use the Diagnostic Trouble Code (DTC) tables to try and correct an intermittent fault. The fault must be present to locate the problem.

Incorrect use of the DTC tables may result in the unnecessary replacement of parts.

Faulty Electrical Connections or Wiring

Most intermittent problems are caused by faulty electrical connections or wiring. Perform a careful inspection of suspect circuits for the following:

- Poor mating of the connector halves.
- Terminals not fully seated in the connector body.
- Improperly formed or damaged terminals. All connector terminals in a problem circuit should be carefully inspected, reformed, or replaced to insure contact tension.
- Poor terminal-to-wire connection. This requires removing the terminal from the connector body.

Road Test

If a visual inspection does not find the cause of the problem, the vehicle can be driven with a voltmeter or a scan tool connected to a suspected circuit. An abnormal voltage or scan tool reading will indicate that the problem is in that circuit.

If there are no wiring or connector problems found and a DTC was stored for a circuit having a sensor, except for DTC P0171 and DTC P0172, replace the sensor.

Intermittent Malfunction Indicator Lamp (MIL)

An intermittent Malfunction Indicator Lamp(MIL) with no DTC present may be caused by the following:

- Improper installation of electrical options such as lights, two way radios, sound, or security systems.
- MIL driver wire intermittently shorted to ground.

Fuel System

Some intermittent driveability problems can be attributed to poor fuel quality. If a vehicle is occasionally running rough, stalling, or otherwise performing badly, ask the customer about the following fuel buying habits:

- Do they always buy from the same source? If so, fuel quality problems can usually be discounted.
- Do they buy their fuel from whichever fuel station that is advertising the lowest price? If so, check the fuel tank for signs of debris, water, or other contamination.

IDLE LEARN PROCEDURE (1.6L DOHC)

Whenever the battery cables, the Engine Control Module (ECM), or the fuse is disconnected or replaced, the following idle learn procedure must be performed:

1. Turn the ignition ON for 5 seconds.
2. Turn the ignition OFF for 10 seconds.
3. Turn the ignition ON for 5 seconds.
4. Start the engine in park/neutral.
5. Allow the engine to run until the engine coolant is above 85°C (185°F).
6. Turn the A/C ON for 10 seconds, if equipped.

7 Turn the A/C OFF for 10 seconds, if equipped.

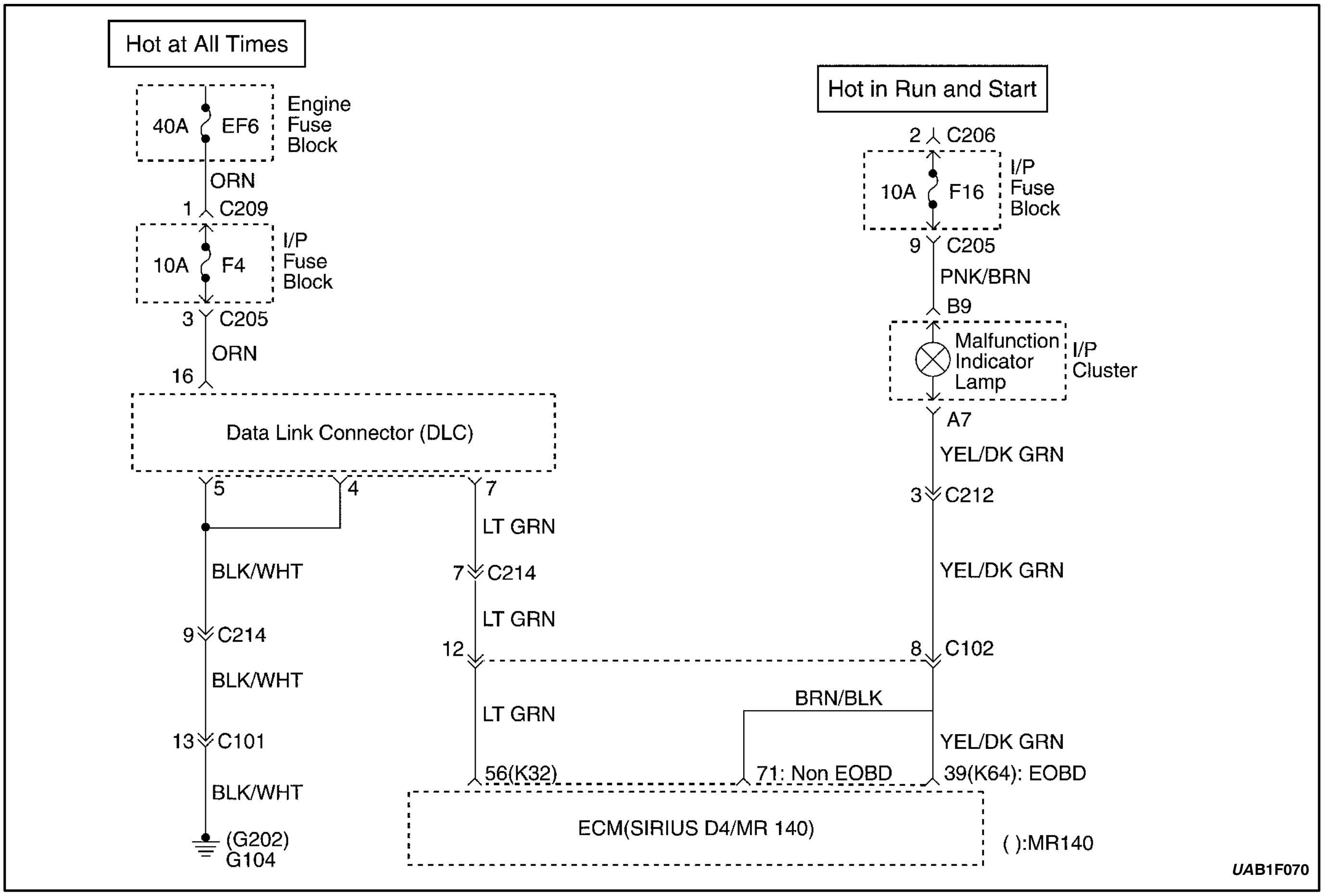
8 Turn the ignition OFF. The idle learn procedure is complete.

IDLE LEARN PROCEDURE (2.0L DOHC)

Whenever the battery cables, the Engine Control Module (ECM), or the fuse is disconnected or replaced, the following idle learn procedure must be performed:

1. Turn the ignition ON for 5 seconds.
2. Turn the ignition OFF for 10 seconds.
3. Turn the ignition ON for 5 seconds.

4. Start the engine in park/neutral.
5. Allow the engine to run until the engine coolant is above 85°C (185°F).
6. Turn the A/C ON for 10 seconds, if equipped.
7. Turn the A/C OFF for 10 seconds, if equipped.
8. If the vehicle is equipped with an automatic transaxle, apply the parking brake. While pressing the brake pedal, place the transaxle in D (drive).
9. Turn the A/C ON for 10 seconds, if equipped.
10. Turn the A/C OFF for 10 seconds, if equipped.
11. Turn the ignition OFF. The idle learn procedure is complete.



EURO ON-BOARD DIAGNOSTIC (EOBD) SYSTEM CHECK

Circuit Description

The Euro On-Board Diagnostic (EOBD) System Check is the starting point for any driveability complaint diagnosis. Before using this procedure, perform a careful visual/physical check of the Engine Control Module (ECM) and the engine grounds for cleanliness and tightness.

The EOBD system check is an organized approach to identifying a problem created by an electronic engine control system malfunction.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for poor connections or a damaged harness. Inspect the ECM harness and connections for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connections, and damaged harness.

Euro On-Board Diagnostic (EOBD) *System Check*

Step	*Action*	*Value(s)*	*Yes*	*No*
1	1. Turn the ignition ON with the engine OFF. 2. Observe the Malfunction Indicator Lamp (MIL). Is the MIL on?	–	Go to *Step 2*	Go to "No Malfunction Indicator Lamp"
2	1. Turn the ignition OFF. 2. Install the scan tool. 3. Turn the ignition ON. 4. Attempt to display the Engine Control Module (ECM) engine data with the scan tool. Does the scan tool display the ECM engine data?	–	Go to *Step 3*	Go to *Step 8*
3	1. Using the scan tool output test function, select the MIL lamp control and command the MIL off. 2. Observe the MIL. Does the MIL turn off?	–	Go to *Step 4*	Go to "Malfunction Indicator Lamp on Steady"
4	Attempt to start the engine. Does the engine start and continue to run?	–	Go to *Step 5*	Go to "Engine Cranks But Will Not Run"
5	Select DISPLAY DTC with the scan tool. Are any Diagnostic Trouble Codes stored?	–	Go to *Step 6*	Go to *Step 7*
6	Check the display for DTCs P0107, P0108, P0113, P0118, P0122, P0123, P0172, P1392. Are two or more of the following DTCs stored?	–	Go to "Multiple ECM Information Sensor DTCs Set"	Go to applicable DTC table
7	Compare the ECM data values displayed on the scan tool to the typical engine scan data values. Are the displayed values normal or close to the typical values?	–	Go to "ECM Output Diagnosis"	Go to indicated component system check
8	1. Turn the ignition OFF and disconnect the ECM. 2. Turn the ignition ON with the engine OFF. 3. Check the serial data circuit for an open, short to ground, or short to voltage. Also check the Data Link Connector (DLC) ignition feed circuit for an open or short to ground, and check the DLC ground circuits for an open. Is a problem found?	–	Go to *Step 9*	Go to *Step 10*
9	Repair the open, short to ground, or short to voltage in the serial data circuit or the DLC ignition feed circuit. Is the repair complete?	–	System OK	–
10	1. Attempt to reprogram the ECM. 2. Attempt to display the ECM data with the scan tool. Does the scan tool display ECM engine data?	–	Go to *Step 2*	Go to *Step 11*
11	Replace the ECM. Is the repair complete?	–	System OK	–

ECM OUTPUT DIAGNOSIS

Circuit Description

The Engine Control Module (ECM) controls most components with electronic switches which complete a ground circuit when turned on. These switches are arranged in groups of 4 and 7, and they are called either a Surface Mounted Quad Driver Module, which can independently control up to 4 output terminals or an Output Driver Module (ODM), which can independently control up to 7 outputs. Not all of the outputs are always used.

Drivers are fault protected. If a relay or solenoid is shorted, having very low or zero resistance, or if the control side of the circuit is shorted to voltage, it would allow too much current flow into the ECM. The driver senses this and the output is either turned OFF or its internal resistance increases to limit current flow and protect the ECM and driver. The result is high output terminal voltage when it should be low. If the circuit from B+ to the component or the component is open, or the control side of the circuit is shorted to ground, terminal voltage will be low. Either of these conditions is considered to be a driver fault.

Drivers also have a fault line to indicate the presence of a current fault to the ECM's central processor. A scan tool displays the status of the driver fault lines as 0=OK and 1=Fault.

Diagnostic Aids

The scan tool has the ability to command certain components and functions ON and OFF. If a component or function does not have this capability, operate the vehicle during its normal function criteria to check for an open or shorted circuit.

An open or short to ground will appear in the open positions on the scan tool only when it is not commanded by the ECM or the scan tool, while a short to voltage will appear in the short positions on the scan tool only while the component is being commanded by the ECM or scan tool.

ECM *Output Diagnosis*

Step	*Action*	*Value(s)*	*Yes*	*No*
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check complete.	–	Go to *Step 2*	Go to "Euro On-Board Diagnostic System Check"
2	Install the scan tool. Is there a number 1 (=fault) below any of the numbered positions in the OUTPUT DRIVERS?	–	Go to *Step 3*	Go to *Step 4*
3	Check for an open or shorted circuit in any corresponding position (circuit) that contained a number 1 and repair as necessary. Is a repair necessary?	–	Go to *Step 9*	Go to *Step 7*
4	Command the output being checked with a scan tool while watching the corresponding position for each circuit. Do any of the position changed to a 1?	–	Go to *Step 6*	Go to *Step 5*
5	Command the output being checked with a scan tool while watching the corresponding position for each circuit. Does the component or function operate when commanded?	–	Go to *Step 9*	Go to the appropriate component table for repair
6	Repair the short to voltage in the corresponding circuit for position (circuit) that displayed at a 1. Is the repair complete?	–	Go to *Step 9*	–
7	Disconnect the electrical connector to the component connected to the fault circuit. Is a 1 still displayed in the corresponding OUTPUT DRIVER position?	–	Go to *Step 8*	Go to the appropriate component table for repair
8	Replace the Engine control Module (ECM). Is the repair complete?	–	Go to *Step 9*	–
9	Operate the vehicle within the conditions under which the original symptom was noted. Does the system now operate properly?	–	System OK	Go to *Step 2*

MULTIPLE ECM INFORMATION SENSOR DTCS SET

Circuit Description

The Engine Control Module (ECM) monitors various sensors to determine engine operating conditions. The ECM controls fuel delivery, spark advance, transaxle operation, and emission control device operation based on the sensor inputs.

The ECM provides a sensor ground to all of the sensors. The ECM applies 5 volts through a pull-up resistor and monitors the voltage present between the sensor and the resistor to determine the status of the Engine Coolant Temperature (ECT) sensor, the Intake Air Temperature (IAT) sensor. The ECM provides the Exhaust Gas Recirculation (EGR) Pintle Position Sensor, the Throttle Position (TP) sensor, the Manifold Absolute Pressure (MAP) sensor, and the Fuel Tank Pressure Sensor with a 5 volt reference and a sensor ground signal. The ECM monitors the separate feedback signals from these sensors to determine their operating status.

Diagnostic Aids

Be sure to inspect the ECM and the engine grounds for being secure and clean.

A short to voltage in one of the sensor circuits can cause one or more of the following DTCs to be set: P0108, P0113, P0118, P0123, P1106, P1111, P1115, P1121.

If a sensor input circuit has been shorted to voltage, ensure that the sensor is not damaged. A damaged sensor will continue to indicate a high or low voltage after the affected circuit has been repaired. If the sensor has been damaged, replace it.

An open in the sensor ground circuit between the ECM and the splice will cause one or more of the following DTCs to be set: P0108, P0113, P0118, P0123, P1106, P1111, P1115, P1121.

A short to ground in the 5 volt reference circuit or an open in the 5 volt reference circuit between the ECM and the splice will cause one or more of the following DTCs to be set: P0107, P0112, P0117, P0122, P1107, P1112, P1114, P1122.

Check for the following conditions:

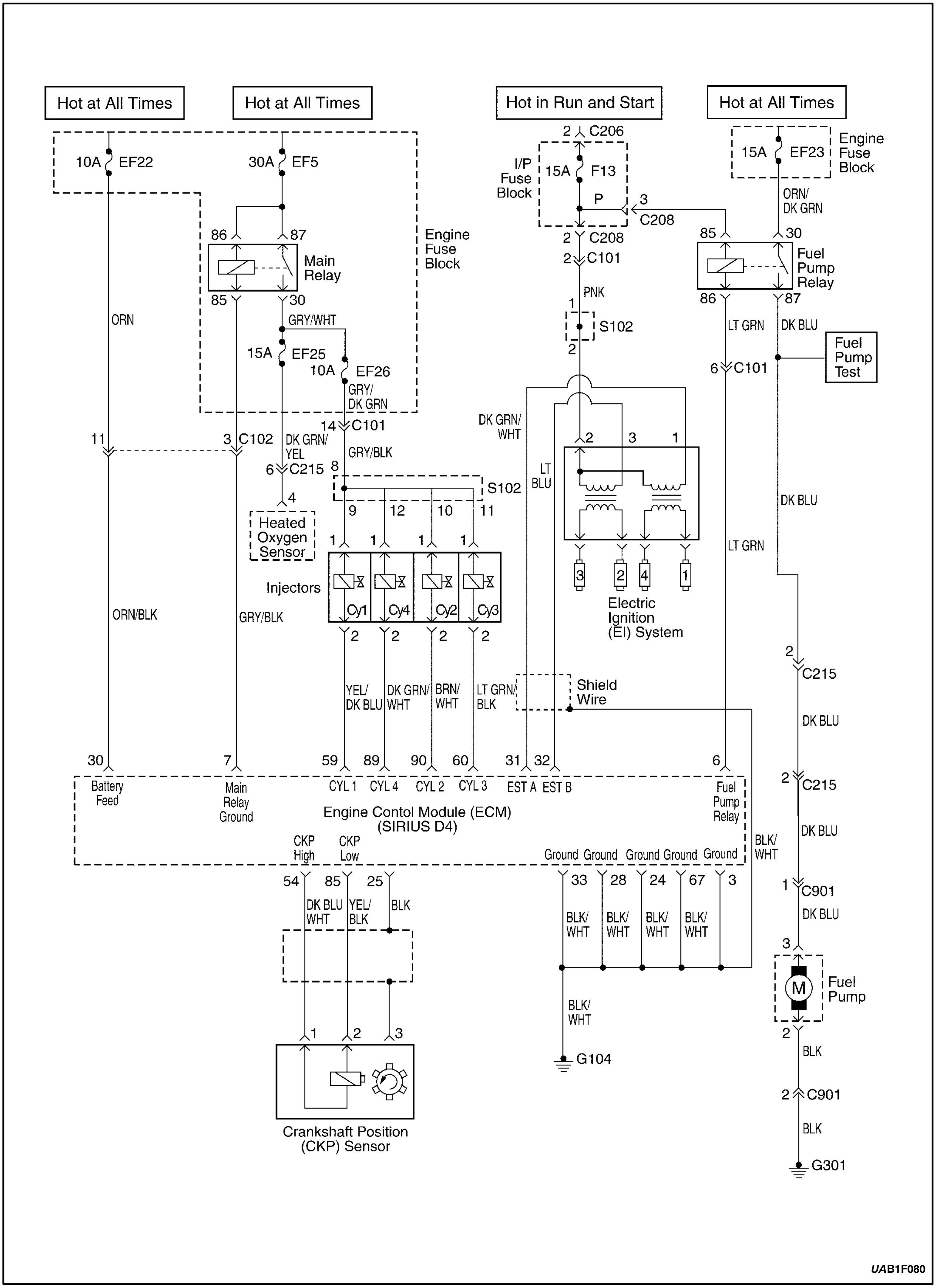
- Inspect for a poor connection at the ECM. Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Inspect the wiring harness for damage. If the harness appears to be OK, observe an affected sensor's displayed value on the scan tool with the ignition ON and the engine OFF while moving connectors and wiring harnesses related to the affected sensors. A change in the affected sensor's displayed value will indicate the location of the fault.

***Multiple* ECM *Information* Sensor *DTCs* Set**

Step	*Action*	*Value(s)*	*Yes*	*No*
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check complete.	–	Go to *Step 2*	Go to "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition OFF and disconnect the Engine Control Module (ECM). 2. Turn the ignition ON and check the 5 volt reference circuit for the following conditions: ● Poor connection at the ECM. ● Open between the ECM connector affected sensors shorted to ground or voltage. 3. If a problem is found, locate and repair the open or short circuit as necessary. Is a problem found?	–	Go to *Step 19*	Go to *Step 3*
3	1. Check the sensor ground circuit for the following conditions: ● Poor connection at the ECM or affected sensors. ● Open between the ECM connector and the affected sensors. 2. If a problem is found, repair it as necessary. Is a problem found?	–	Go to *Step 19*	Go to *Step 4*
4	Measure the voltage of the Exhaust Gas Recirculation (EGR) Pintle Position Sensor signal circuit between ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 5*	Go to *Step 9*
5	Measure the voltage of the Manifold Absolute Pressure (MAP) sensor signal circuit between the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 6*	Go to *Step 11*
6	Measure the voltage of the Throttle Position (TP) sensor signal circuit between the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 7*	Go to *Step 12*
7	Measure the voltage of the Intake Air Temperature (IAT) sensor signal circuit between the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 8*	Go to *Step 13*
8	Measure the voltage of the Engine Coolant Temperature (ECT) sensor signal circuit between the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 16*	Go to *Step 14*
9	1. Disconnect the EGR valve. 2. Measure the voltage of the EGR Pintle Position sensor signal circuit between the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 10*	Go to *Step 15*
10	Replace the EGR valve. Is the repair complete?	–	Go to *Step 19*	–
11	Locate and repair the short to voltage in the MAP sensor signal circuit. Is the repair complete?	–	Go to *Step 19*	–

***Multiple* ECM *Information* Sensor *DTCs* Set (*Cont'd*)**

Step	*Action*	*Value(s)*	*Yes*	*No*
12	Locate and repair the short to voltage in the TP sensor signal circuit. Is the repair complete?	–	Go to *Step 19*	–
13	Locate and repair the short to voltage in the IAT sensor signal circuit. Is the repair complete?	–	Go to *Step 19*	–
14	Locate and repair the short to voltage in the ECT sensor signal circuit. Is the repair complete?	–	Go to *Step 19*	–
15	Locate and repair the short to voltage in the EGR Pintle Position sensor circuit. Is the repair complete?	–	Go to *Step 19*	–
16	Measure the voltage of the Fuel Tank Pressure sensor signal circuit between the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 18*	Go to *Step 17*
17	Locate and repair the short to voltage in the Fuel Tank Pressure sensor signal circuit. Is the repair complete?	–	Go to *Step 19*	–
18	Replace the ECM. Is the repair complete?	–	Go to *Step 19*	–
19	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTCs as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 20*	Go to *Step 2*
20	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK


Hot at All Times
Hot at All Times
Hot in Run and Start
Hot at All Times
10A EF22
30A EF5
Engine Fuse Block
Main Relay
86 87 85 30
ORN
GRY/WHT
15A EF25
10A EF26
GRY/ DK GRN
14 C101
11
3 C102
DK GRN/ YEL
6 C215
4
Heated Oxygen Sensor
GRY/BLK
8
S102
9 12 10 11
Injectors
Cy1 Cy4 Cy2 Cy3
ORN/BLK
GRY/BLK
YEL/ DK BLU
DK GRN/ WHT
BRN/ WHT
LT GRN/ BLK
2 C206
I/P Fuse Block
15A F13
P
3 C208
2 C208
2 C101
PNK
S102
DK GRN/ WHT
LT BLU
Electric Ignition (EI) System
Shield Wire
15A EF23
Engine Fuse Block
ORN/ DK GRN
Fuel Pump Relay
85 30 86 87
LT GRN
DK BLU
Fuel Pump Test
6 C101
2 C215
DK BLU
1 C901
Fuel Pump
BLK
2 C901
G301
30 7 59 89 90 60 31 32 6
Battery Feed
Main Relay Ground
CYL 1 CYL 4 CYL 2 CYL 3 EST A EST B
Fuel Pump Relay
Engine Contol Module (ECM)
(SIRIUS D4)
CKP High
CKP Low
Ground Ground Ground Ground Ground
BLK/ WHT
54 85 25
DK BLU WHT
YEL/ BLK
BLK
33 28 24 67 3
G104
Crankshaft Position (CKP) Sensor
UAB1F080

ENGINE CRANKS BUT WILL NOT RUN(1.6L DOHC)

Caution: Use only electrically insulated pliers when handling ignition wires with the engine running to prevent an electrical shock.

Caution: Do not pinch or restrict nylon fuel lines. Damage to the lines could cause a fuel leak, resulting in possi° le fire or personal injury.

Important: If a no start condition exists, ensure the fuel cutoff switch has not been tripped prior to further diagnosis.

Engine Cranks But Will Not Run(1.6L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check complete.	–	Go to *Step 2*	Go to "Euro On-Board Diagnostic System Check"
2	Crank the engine. Does the engine start and continue to run?	–	System OK	Go to *Step 3*
3	Perform a cylinder compression test. Is the cylinder compression for all of the cylinders at or above the value specified?	689 kPa (100 psi)	Go to *Step 7*	Go to *Step 4*
4	Inspect the timing belt alignment. Is the timing belt in alignment?	–	Go to *Step 6*	Go to *Step 5*
5	Align or replace the timing belt as needed. Is the repair complete?	–	Go to *Step 2*	–
6	Repair internal engine damage as needed. Is the repair complete?	–	Go to *Step 2*	–
7	Inspect the fuel pump fuse. Is the problem found?	–	Go to *Step 8*	Go to *Step 9*
8	Replace the fuse. Is the repair complete?	–	Go to *Step 2*	–
9	Check for the presence of spark from all of the ignition wires while cranking the engine. Is spark present from all of the ignition wires?	–	Go to *Step 23*	Go to *Step 10*
10	1. Measure the resistance of the ignition wires. 2. Replace any of the ignition wire(s) with a resistance above the value specified. 3. Check for the presence of spark from all of the ignition wire. Is spark present from all of the ignition wires?	30000 Ω	Go to *Step 2*	Go to *Step 11*
11	1. Turn the ignition OFF. 2. Disconnect the crankshaft position (CKP) sensor connector. 3. Turn the ignition ON. 4. Measure the voltage between following terminals: • Terminal 1 and 3 of the CKP sensor connector. • Terminal 2 and 3 of the CKP sensor connector. • Terminal 1 of the CKP sensor connector and ground. • Terminal 2 of the CKP sensor connector and ground. Are the voltage measure within the value specified?	≈ 1.4 V	Go to *Step 13*	Go to *Step 12*

Engine Cranks But Will Not Run(1.6L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check for an open or short in the wires between CKP sensor connector and ECM connector and repair as need. Is the repair complete?	–	Go to *Step 2*	–
13	1. Disconnect electronic Ignition (EI) system ignition coil connector to prevent the vehicle from starting. 2. Measure the voltage at ECM connector terminal 85 and 54 by backprobing the ECM connector. Are the voltage readings near the value specified?	1.4 V with ignition ON, 1.6 V during cranking	Go to *Step 15*	Go to *Step 14*
14	Replace the CKP sensor. Is the repair complete?	–	Go to *Step 2*	–
15	1. Turn the ignition OFF. 2. Disconnect the electrical connector at EI system ignition coil. 3. Connect a test light between terminal 2 of the EI system ignition coil connector and ground. 4. Turn the ignition ON. Is the test light on?	–	Go to *Step 17*	Go to *Step 16*
16	Check for open in wire between the battery and EI system ignition coil connector terminal 2 and repair as needed. Is the repair complete?	–	Go to *Step 2*	–
17	1. Turn the ignition OFF. 2. Disconnect ECM connect and EI system ignition coil connector. 3. Measure the resistance between following terminals: ● Terminal 1 of ignition coil and terminal 31 of ECM connector. ● Terminal 3 of ignition coil and terminal 32 of ECM connector. Are the resistance within the value specified?	0 Ω	Go to *Step 19*	Go to *Step 18*
18	Check for open circuit and repair as needed. Is the repair complete?	–	Go to *Step 2*	–
19	1. Measure the resistance between following terminals: ● Terminal 1 and 2 of ignition coil. ● Terminal 2 and 3 of ignition coil. Are the resistance within the value specified. 2. Remove the high tension cable. 3. Measure the resistance between second coil. ● Between 1 and 4 ● Between 2 and 3 Are the resistance within the value specified.	0.9Ω 5.3 kΩ	Go to *Step 21*	Go to *Step 20*
20	Replace the EI system ignition coil. Is the repair complete?	–	Go to *Step 2*	–

Engine Cranks But Will Not Run(1.6L DOHC) (Cont'd)

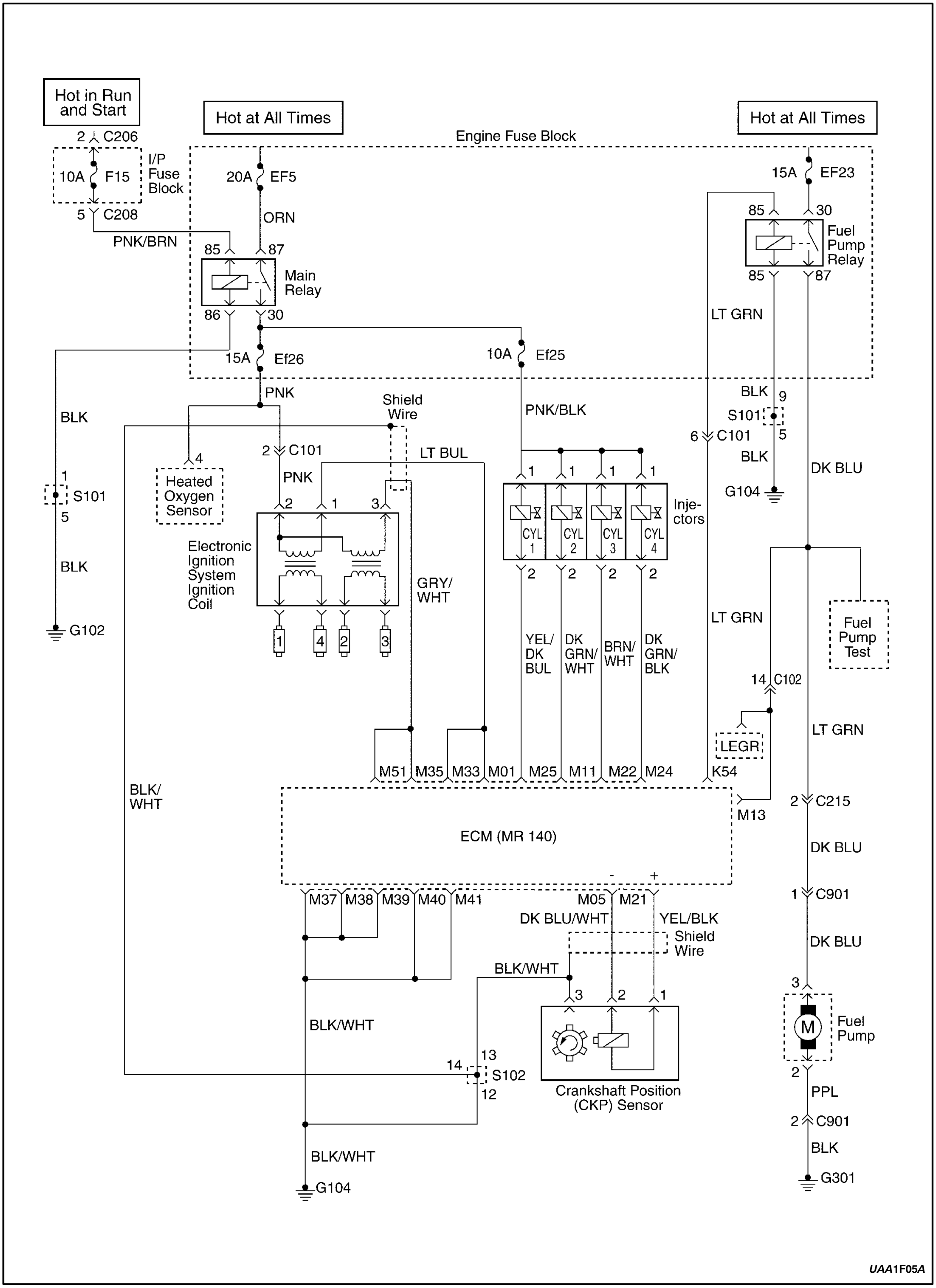
Step	Action	Value(s)	Yes	No
21	1. Check for any damages or poor connection in ignition wires and repair as needed. 2. Connect the Ei system ignition coil connector and ECM connector. 3. Check for the presence of spark from all of the ignition wires. Is the spark present from all of the ignition wires?	–	Go to *Step 2*	Go to *Step 22*
22	Replace ECM Is the repair complete?	–	Go to *Step 2*	–
23	1. Turn the ignition OFF. 2. Connect a fuel pressure gauge. 3. Crank the engine. Is any fuel pressure present?	–	Go to *Step 26*	Go to *Step 24*
24	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the fuel pump. 3. Connect a test light between the fuel pump terminals 2 and 3. 4. Turn the ignition ON. 5. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec.	Go to *Step 25*	Go to *Step 34*
25	Replace the fuel pump. Is the repair complete?	–	Go to *Step 2*	–
26	Is the fuel pressure within the value specified?	283 – 324 kPa (41 – 47 psi)	Go to *Step 27*	Go to *Step 29*
27	Check the fuel for contamination. Is the fuel contaminated?	–	Go to *Step 28*	Go to *Step 41*
28	1. Remove the contaminated fuel from the fuel tank. 2. Clean the fuel tank as needed. Is the repair complete?	–	Go to *Step 2*	–
29	1. Check the fuel filter for restriction. 2. Inspect the fuel lines for kinks and restrictions. 3. Repair or replace as needed. 4. Measure the fuel pressure. Is the fuel pressure within the value specified?	283 – 324 kPa (41 – 47 psi)	Go to *Step 2*	Go to *Step 30*
30	1. Disconnect vacuum line from the fuel pressure regulator. 2. Inspect the vacuum line for the presence of fuel. 3. Inspect the fuel pressure regulator vacuum port for the presence of fuel. Is any fuel present?	–	Go to *Step 31*	Go to *Step 32*
31	Replace the fuel pressure regulator. Is the repair complete?	–	Go to *Step 2*	–
32	1. Remove the fuel pump assembly from the fuel tank. 2. Inspect the fuel pump sender and the fuel coupling hoses for a restriction. 3. Inspect the in-tank fuel filter for restriction. Is the problem found?	–	Go to *Step 33*	Go to *Step 25*

Engine Cranks But Will Not Run(1.6L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
33	Replace the fuel pump sender, the in-tank fuel filter, and/or the fuel coupling hoses as needed. Is the repair complete?	–	Go to *Step 2*	–
34	1. Turn the ignition OFF. 2. Disconnect the electric connector at the fuel pump. 3. Connect a test light between fuel pump connector terminal 3 and ground. 4. Turn the ignition ON. 5. With the ignition ON, the test light should illuminate for the time specified. Is the test light on?	2 sec	Go to *Step 35*	Go to *Step 36*
35	Repair the open circuit between the fuel pump connector terminal 2 and ground. Is the repair complete?	–	Go to *Step 2*	–
36	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Turn the ignition ON. 4. Measure the voltage at terminal 30 and 85 of fuel pump relay. Is the voltage within the value specified?	11 – 14 V	Go to *Step 38*	Go to *Step 37*
37	Repair open or short circuit for power supply. Is the repair complete?	–	Go to *Step 2*	–
38	1. Turn the ignition OFF. 2. Disconnect ECM connector. 3. Using an ohmmeter, measure the resistance between following terminals. • Terminal 6 of ECM and terminal 86 of fuel pump relay. • Terminal 87 of fuel pump relay and terminal 3 of fuel pump. Does the resistance within the value specified?	0 Ω	Go to *Step 40*	Go to *Step 39*
39	Repair the open or short circuit the following terminals. • Terminal 6 of ECM and terminal 86 of fuel pump relay. • Terminal 87 of fuel pump relay and terminal 3 of fuel pump. Is the repair complete?	–	Go to *Step 2*	–
40	Replace the fuel pump relay. Is the repair complete?	–	Go to *Step 2*	–
41	1. Turn the ignition OFF. 2. Disconnect the fuel inject harness connectors from all of the fuel injectors. 3. Turn the ignition ON. 4. Connect test light between fuel injector harness connector 1 and ground. 5. Repeat step 4 for each of the remaining fuel injectors. Does the test light on at all of the fuel injectors?	–	Go to *Step 42*	Go to *Step 45*

Engine Cranks But *Will Not* Run(1.6*L DO*HC) (*Cont'd*)

Step	*Action*	*Value(s)*	*Yes*	*No*
42	1. Turn the ignition OFF. 2. Connect test light between fuel injector harness connector 2 and battery positive. 3. Crank the engine. 4. Repeat step 2 and 3 for each of the remaining fuel injectors. Does the test light flash for all of the fuel injectors?	–	Go to *Step 43*	Go to *Step 46*
43	Measure the resistance of each fuel injectors. Is the resistance within the value specified. ***Note:*** the resistance will increase slightly at higher temperature.	11.6 –12.4 Ω	System OK	Go to *Step 44*
44	Replace any of the fuel injectors with a resistance out of specification. Is the repair complete?	–	Go to *Step 2*	–
45	1. Inspect the fuse EF26 in engine fuse block. 2. Check for an open between the circuit from terminal 1 of the four fuel injectors and terminal 30 of main relay. Is the problem found?	–	Go to *Step 48*	Go to "Main Relay Circuit Check"
46	Measure the resistance between following terminals. • Terminal 2 of injector 1 connector and terminal 59 of ECM connector. • Terminal 2 of injector 2 connector and terminal 90 of ECM connector. • Terminal 2 of injector 3 connector and terminal 60 of ECM connector. • Terminal 2 of injector 4 connector and terminal 89 of ECM connector. Does the resistance within the specified value?	0 Ω	Go to *Step 49*	Go to *Step 47*
47	Repair the open fuel injector harness wire(s). Is the repair complete?	–	Go to *Step 2*	–
48	Replace the fuse or repair the wiring as needed. Is the repair complete?	–	Go to *Step 2*	–
49	Replace the ECM. Is the repair complete?	–	Go to *Step 2*	–



Hot in Run and Start
Hot at All Times
Hot at All Times
Engine Fuse Block
2 C206
10A F15
I/P Fuse Block
5 C208
PNK/BRN
20A EF5
ORN
85 87
Main Relay
86 30
15A Ef26
10A Ef25
15A EF23
85 30
Fuel Pump Relay
85 87
LT GRN
BLK
PNK
Shield Wire
PNK/BLK
BLK 9
S101
5
6 C101
BLK
G104
DK BLU
1
S101
5
BLK
G102
4
Heated Oxygen Sensor
2 C101
LT BUL
PNK
2 1 3
Electronic Ignition System Ignition Coil
1 4 2 3
GRY/ WHT
1 1 1 1
CYL 1
CYL 2
CYL 3
CYL 4
Inje- ctors
2 2 2 2
YEL/ DK BUL
DK GRN/ WHT
BRN/ WHT
DK GRN/ BLK
LT GRN
Fuel Pump Test
14 C102
LEGR
LT GRN
M51 M35 M33 M01 M25 M11 M22 M24 K54
BLK/ WHT
M13
2 C215
ECM (MR 140)
DK BLU
- +
1 C901
M37 M38 M39 M40 M41 M05 M21
DK BLU/WHT
YEL/BLK
Shield Wire
DK BLU
BLK/WHT
3 2 1
3
M
Fuel Pump
BLK/WHT
13
14 S102
12
Crankshaft Position (CKP) Sensor
2
PPL
2 C901
BLK
BLK/WHT
G104
G301
UAA1F05A

ENGINE CRANKS BUT WILL NOT RUN(2.0L DOHC)

Caution: Use only electrically insulated pliers when handling ignition wires with the engine running to prevent an electrical shock.

Caution: Do not pinch or restrict nylon fuel lines. Damage to the lines could cause a fuel leak, resulting in possi° le fire or personal injury.

Important: If a no start condition exists, ensure the fuel cutoff switch has not been tripped prior to further diagnosis.

Engine Cranks But Will Not Run(2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check complete.	–	Go to *Step 2*	Go to "Euro On-Board Diagnostic System Check"
2	Crank the engine. Does the engine start and continue to run?	–	System Ok	Go to *Step 3*
3	Perform a cylinder compression test. Is the cylinder compression for all of the cylinders at or above the value specified?	689 kPa (100 psi)	Go to *Step 7*	Go to *Step 4*
4	Inspect the timing belt alignment. Is the timing belt in alignment?	–	Go to *Step 6*	Go to *Step 5*
5	Align or replace the timing belt as needed. Is the repair complete?	–	Go to *Step 2*	–
6	Repair internal engine damage as needed. Is the repair complete?	–	Go to *Step 2*	–
7	Inspect the fuel pump fuse. Is the problem found?	–	Go to *Step 8*	Go to *Step 9*
8	Replace the fuse. Is the repair complete?	–	Go to *Step 2*	–
9	Check for the presence of spark from all of the ignition wires while cranking the engine. Is spark present from all of the ignition wires?	–	Go to *Step 23*	Go to *Step 10*
10	1. Measure the resistance of the ignition wires. 2. Replace any of the ignition wire(s) with a resistance above the value specified. 3. Check for the presence of spark from all of the ignition wire. Is spark present from all of the ignition wires?	30000 Ω	Go to *Step 2*	Go to *Step 11*
11	1. Turn the ignition OFF. 2. Disconnect the crankshaft position (CKP) sensor connector. 3. Turn the ignition ON. 4. Measure the voltage between following terminals: • Terminal 1 and 3 of the CKP sensor connector. • Terminal 2 and 3 of the CKP sensor connector. • Terminal 1 of the CKP sensor connector and ground. • Terminal 2 of the CKP sensor connector and ground. Are the voltage measure within the value specified?	≈ 1.4 V	Go to *Step 13*	Go to *Step 12*

Engine Cranks But Will Not Run(2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check for an open or short in the wires between CKP sensor connector and ECM connector and repair as need. Is the repair complete?	–	Go to *Step 2*	–
13	1. Disconnect electronic Ignition (EI) system ignition coil connector to prevent the vehicle from starting. 2. Measure the voltage at ECM connector terminal M05 and M21 by backprobing the ECM connector. Are the voltage readings near the value specified?	1.4 V with ignition ON, 1.6 V during cranking	Go to *Step 15*	Go to *Step 14*
14	Replace the CKP sensor. Is the repair complete?	–	Go to *Step 2*	–
15	1. Turn the ignition OFF. 2. Disconnect the electrical connector at EI system ignition coil. 3. Connect a test light between terminal 2 of the EI system ignition coil connector and ground. 4. Turn the ignition ON. Is the test light on?	–	Go to *Step 17*	Go to *Step 16*
16	Check for open in wire between the battery and EI system ignition coil connector terminal 2 and repair as needed. Is the repair complete?	–	Go to *Step 2*	–
17	1. Turn the ignition OFF. 2. Disconnect ECM connect and EI system ignition coil connector. 3. Measure the resistance between following terminals: • Terminal 1 of ignition coil and terminal M33/M01 of ECM connector. • Terminal 3 of ignition coil and terminal M51/M35 of ECM connector. Are the resistance within the value specified?	0 Ω	Go to *Step 19*	Go to *Step 18*
18	Check for open circuit and repair as needed. Is the repair complete?	–	Go to *Step 2*	–
19	1. Measure the resistance between following terminals: • Terminal 1 and 2 of ignition coil. • Terminal 2 and 3 of ignition coil. Are the resistance within the value specified. 2. Remove the high tension cable. 3. Measure the resistance between second coil. • Between 1 and 4 • Between 2 and 3 Are the resistance within the value specified.	0.9Ω 5.3 kΩ	Go to *Step 21*	Go to *Step 20*
20	Replace the EI system ignition coil. Is the repair complete?	–	Go to *Step 2*	–

Engine Cranks But Will Not Run(2.0L DOHC) (Cont'd)

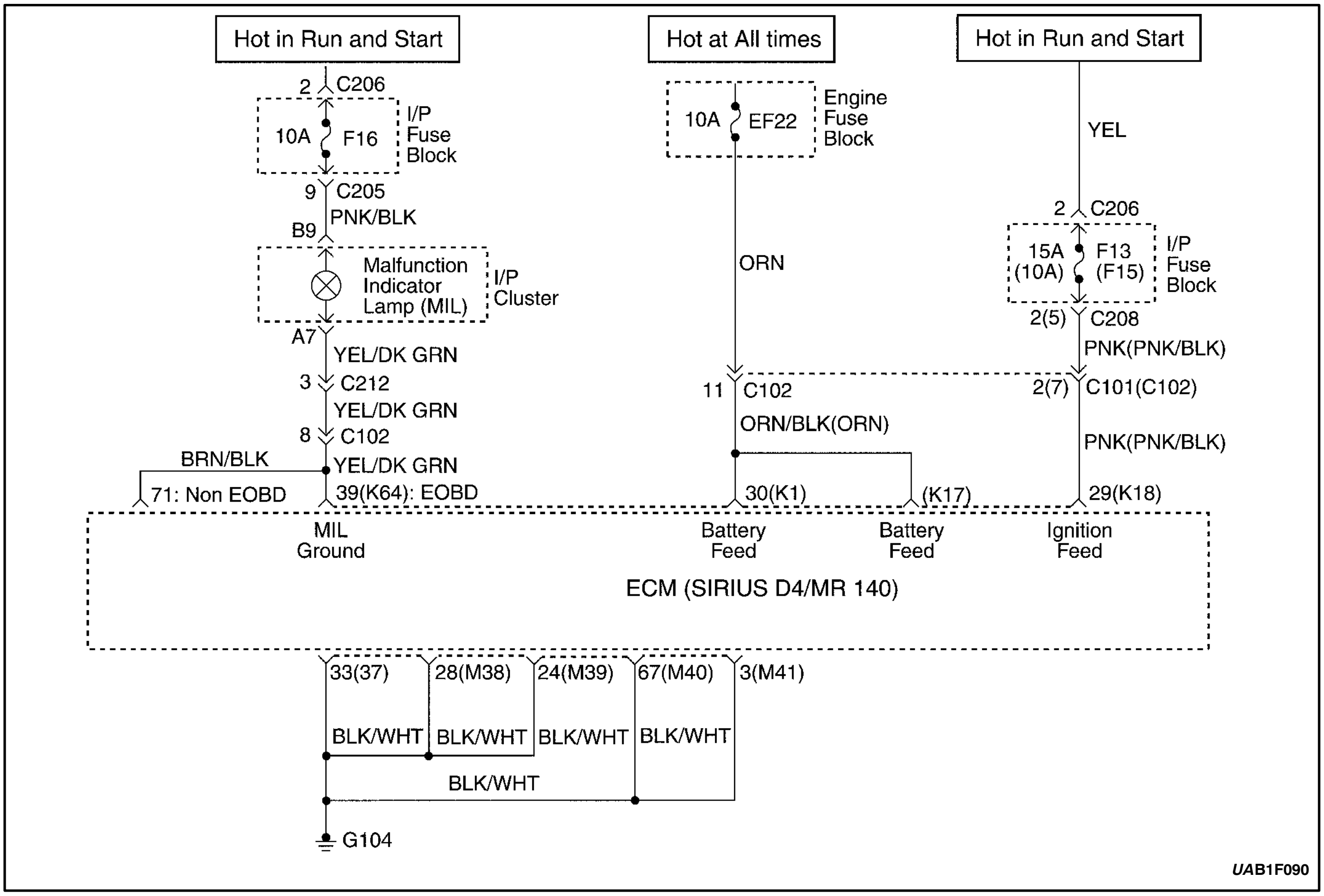
Step	Action	Value(s)	Yes	No
21	1. Check for any damages or poor connection in ignition wires and repair as needed. 2. Connect the EI system ignition coil connector and ECM connector. 3. Check for the presence of spark from all of the ignition wires. Is the spark present from all of the ignition wires?	–	Go to *Step 2*	Go to *Step 22*
22	Replace ECM Is the repair complete?	–	Go to *Step 2*	–
23	1. Turn the ignition OFF. 2. Connect a fuel pressure gauge. 3. Crank the engine. Is any fuel pressure present?	–	Go to *Step 26*	Go to *Step 24*
24	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the fuel pump. 3. Connect a test light between the fuel pump terminals 2 and 3. 4. Turn the ignition ON. 5. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec.	Go to *Step 25*	Go to *Step 32*
25	Replace the fuel pump. Is the repair complete?	–	Go to *Step 2*	–
26	Is the fuel pressure within the value specified?	283 – 324 kPa (41 – 47 psi)	Go to *Step 27*	Go to *Step 29*
27	Check the fuel for contamination. Is the fuel contaminated?	–	Go to *Step 28*	Go to *Step 41*
28	1. Remove the contaminated fuel from the fuel tank. 2. Clean the fuel tank as needed. Is the repair complete?	–	Go to *Step 2*	–
29	1. Check the fuel filter for restriction. 2. Inspect the fuel lines for kinks and restrictions. 3. Repair or replace as needed. 4. Measure the fuel pressure. Is the fuel pressure within the value specified?	283 – 324 kPa (41 – 47 psi)	Go to *Step 2*	Go to *Step 30*
30	1. Disconnect vacuum line from the fuel pressure regulator. 2. Inspect the vacuum line for the presence of fuel. 3. Inspect the fuel pressure regulator vacuum port for the presence of fuel. Is any fuel present?	–	Go to *Step 31*	Go to *Step 32*
31	Replace the fuel pressure regulator. Is the repair complete?	–	Go to *Step 2*	–
32	1. Remove the fuel pump assembly from the fuel tank. 2. Inspect the fuel pump sender and the fuel coupling hoses for a restriction. 3. Inspect the in-tank fuel filter for restriction. Is the problem found?	–	Go to *Step 33*	Go to *Step 25*

Engine Cranks But Will Not Run(2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
33	Replace the fuel pump sender, the in-tank fuel filter, and/or the fuel coupling hoses as needed. Is the repair complete?	–	Go to *Step 2*	–
34	1. Turn the ignition OFF. 2. Disconnect the electric connector at the fuel pump. 3. Connect a test light between fuel pump connector terminal 3 and ground. 4. Turn the ignition ON. 5. With the ignition ON, the test light should illuminate for the time specified. Is the test light on?	2 sec	Go to *Step 35*	Go to *Step 36*
35	Repair the open circuit between the fuel pump connector terminal 2 and ground. Is the repair complete?	–	Go to *Step 2*	–
36	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Turn the ignition ON. 4. Measure the voltage at terminal 30 and 86 of fuel pump relay. Is the voltage within the value specified?	11 – 14 V	Go to *Step 38*	Go to *Step 37*
37	Repair open or short circuit for power supply. Is the repair complete?	–	Go to *Step 2*	–
38	1. Turn the ignition OFF. 2. Disconnect ECM connector. 3. Using an ohmmeter, measure the resistance between following terminals. • Terminal K54 of ECM and terminal 86 of fuel pump relay. • Terminal M3 of ECM and terminal 87 of fuel pump relay. • Terminal 87 of fuel pump relay and terminal 3 of fuel pump. Does the resistance within the value specified?	0 Ω	Go to *Step 40*	Go to *Step 39*
39	1. Check for open circuit and fuel cut–off switch. 2. Reset fuel cut–off switch or repair open circuit as needed. Is the repair complete?	–	Go to *Step 2*	–
40	Replace the fuel pump relay. Is the repair complete?	–	Go to *Step 2*	–
41	1. Turn the ignition OFF. 2. Disconnect the fuel inject harness connectors from all of the fuel injectors. 3. Turn the ignition ON. 4. Connect test light between fuel injector harness connector 1 and ground. 5. Repeat step 4 for each of the remaining fuel injectors. Does the test light on at all of the fuel injectors?	–	Go to *Step 42*	Go to *Step 45*

Engine Cranks But Will Not Run(2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
42	1. Turn the ignition OFF. 2. Connect test light between fuel injector harness connector 2 and battery positive. 3. Crank the engine. 4. Repeat step 2 and 3 for each of the remaining fuel injectors. Does the test light flash for all of the fuel injectors?	–	Go to *Step 43*	Go to *Step 46*
43	Measure the resistance of each fuel injectors. Is the resistance within the value specified. ***Note:*** the resistance will increase slightly at higher temperature.	11.6 –12.4 Ω	System OK	Go to *Step 44*
44	Replace any of the fuel injectors with a resistance out of specification. Is the repair complete?	–	Go to *Step 2*	–
45	1. Inspect the fuse EF25 in engine fuse block. 2. Check for an open between the circuit from terminal 1 of the four fuel injectors and terminal 30 of main relay. Is the problem found?	–	Go to *Step 48*	Go to "Main Relay Circuit Check"
46	Measure the resistance between following terminals. • Terminal 2 of injector 1 connector and terminal M25 of ECM connector. • Terminal 2 of injector 2 connector and terminal M22 of ECM connector. • Terminal 2 of injector 3 connector and terminal M24 of ECM connector. • Terminal 2 of injector 4 connector and terminal M11 of ECM connector. Does the resistance within the specified value?	0 Ω	Go to *Step 49*	Go to *Step 47*
47	Repair the open fuel injector harness wire(s). Is the repair complete?	–	Go to *Step 2*	–
48	Replace the fuse or repair the wiring as needed. Is the repair complete?	–	Go to *Step 2*	–
49	Replace the ECM. Is the repair complete?	–	Go to *Step 2*	–



NO MALFUNCTION INDICATOR LAMP

Circuit Description

When the ignition is turned ON, the Malfunction Indicator Lamp (MIL) will be turned ON and remain ON until the engine is running, if no Diagnostic Trouble Codes (DTCs) are stored. Battery voltage is supplied through the ignition switch directly to the MIL telltale. The Engine Control Module (ECM) controls the MIL by providing a ground path through the MIL control circuit to turn ON the MIL.

Diagnostic Aids

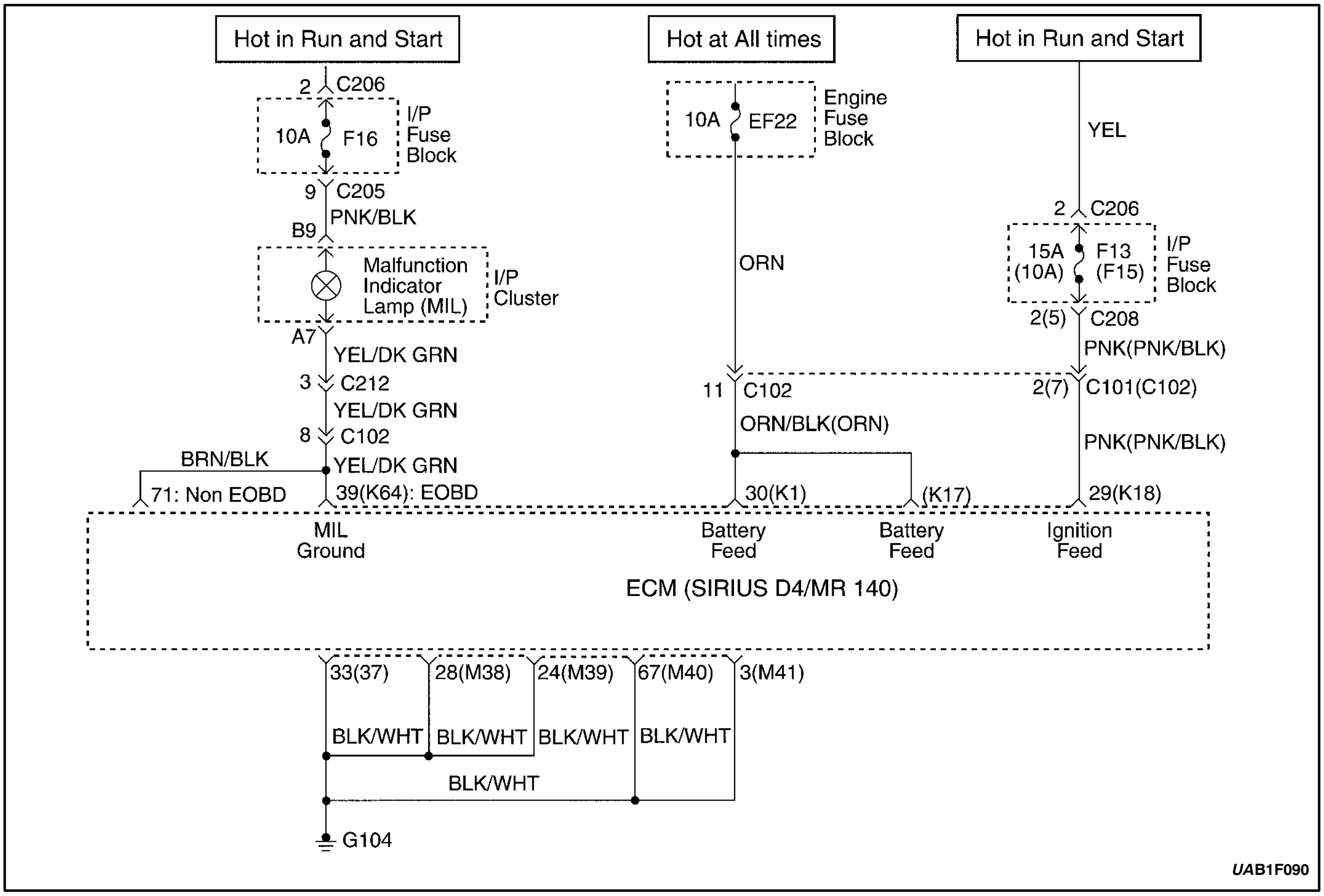
An open ignition F16 fuse will cause the entire cluster to be inoperative.

Check the battery and ignition feed circuits for poor connections if the MIL is intermittent.

Any circuitry, that is suspected as causing an intermittent complaint, should be thoroughly checked for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections or physical damage to the wiring harness.

No Malfunction Indicator Lamp

Step	***Action***	***Value(s)***	***Yes***	***No***
1	Attempt to start the engine. Does the engine start?	–	Go to *Step 2*	Go to "Engine Cranks But Will Not Run"
2	1. Turn the ignition OFF. 2. Disconnect the engine control module (ECM) connector. 3. Turn the ignition ON. 4. Connect a test light between terminal 39(K64) of ECM connector and ground. Is the test light on?	–	Go to *Step 3*	Go to *Step 6*
3	Check terminals for damage or poor connection. Does any problem found?	–	Go to *Step 5*	Go to *Step 4*
4	Replace ECM Is the repair complete?	–	Go to "On Board Diagnostic System Check"	–
5	Repair any damaged terminals or poor connection. Is the repair complete?	–	Go to "On Board Diagnostic System Check"	–
6	Check the fuse F16. Is the fuse blown?	–	Go to *Step 7*	Go to *Step 8*
7	1. Check for a short to ground in the circuit and repair as needed. 2. Replace the blown fuse. Is the repair complete?	–	Go to "On Board Diagnostic System Check"	–
8	1. Check for an open circuit between fuse F16 and terminal 39(K64) of ECM connector and repair as needed. 2. Check the MIL bulb and replace if blown. Is the repair complete?	–	Go to "On Board Diagnostic System Check"	–



MALFUNCTION INDICATOR LAMP ON STEADY

Circuit Description

When the ignition is turned ON, the Malfunction Indicator Lamp (MIL) will be turned ON and remain ON until the engine is running, if no Diagnostic Trouble Codes (DTCs) are stored. Battery voltage is supplied through the ignition switch directly to the MIL telltale. The Engine Control Module (ECM) controls the MIL by providing a ground path through the MIL control circuit to turn ON the MIL.

Malfunction Indicator Lamp On Steady

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check complete.	–	Go to *Step 2*	Go to "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition OFF. 2. Install the scan tool. 3. Command the Malfunction Indicator Lamp (MIL) on and off. Does the MIL turn on and off when commanded?	–	Go to *Step 7*	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the engine control module (ECM) connector. 3. Turn the ignition ON. Is the MIL off?	–	Go to *Step 6*	Go to *Step 4*
4	Check the MIL control circuit for a short to ground and repair as needed. Is a repair necessary?	–	Go to *Step 7*	Go to *Step 5*
5	Replace the instrument panel cluster. Refer to *Section 9E, Instrumentation/Driver Information.* Is the repair complete?	–	Go to *Step 7*	–
6	Replace the ECM. Is the repair complete?	–	Go to *Step 7*	–
7	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs). 2. Attempt to start the engine. Does the engine start and continue to run?	–	Go to *Step 8*	Go to *Step 1*
8	Allow the engine to idle until normal operating temperature is reached. Check if any DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

FUEL SYSTEM DIAGNOSIS

Circuit Description

The fuel pump is an in-tank type mounted to a fuel sender assembly. The fuel pump will remain on as long as the engine is cranking or running and the Engine Control Module (ECM) is receiving reference pulses from the crankshaft position (CKP) sensor. If there are no reference pulses, the ECM will turn off the fuel pump two seconds after the ignition switch is turned ON or two seconds after the engine stops running. The fuel pump delivers fuel to the fuel rail and the fuel injectors, where the fuel system pressure is controlled from 284 to 325 kPa (41 to 47 psi) by the fuel pressure regulator. The excess fuel is returned to the fuel tank.

Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

Caution: Do not pinch or restrict nylon fuel lines. Damage to the lines could cause a fuel leak, resulting in possible fire or personal injury.

Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump fuse EF23 from the engine fuse box.
3. Start the engine and allow the engine to stall.
4. Crank the engine for an additional 10 seconds.

Fuel System Diagnosis

Step	Action	Value(s)	Yes	No
1	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284–325 kPa (41–47psi)	Go to *Step 2*	Go to *Step 5*
2	1. Disconnect the fuel pressure regulator vacuum hose. 2. Start the engine. 3. Allow the engine to idle. 4. Connect the fuel pressure regulator vacuum hose. Did the fuel pressure decrease?	–	System OK	Go to *Step 3*
3	1. Allow the engine to idle. 2. Disconnect the vacuum hose from the fuel pressure regulator. 3. Connect a vacuum pump with a gauge to the fuel pressure regulator vacuum port. 4. Apply 41–47 kPa (12–14 in. Hg) of vacuum to the fuel pressure regulator. Did the fuel pressure decrease?	–	Go to *Step 4*	Go to *Step 16*
4	1. Locate and correct the cause of the vacuum restriction to the fuel pressure regulator. 2. Confirm the operation of the fuel pressure regulator. Is the repair complete?	–	System OK	–
5	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified but not holding steady?	284–325kPa (41–47psi)	Go to *Step 6*	Go to *Step 17*
6	Inspect the fuel lines for a leak. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*

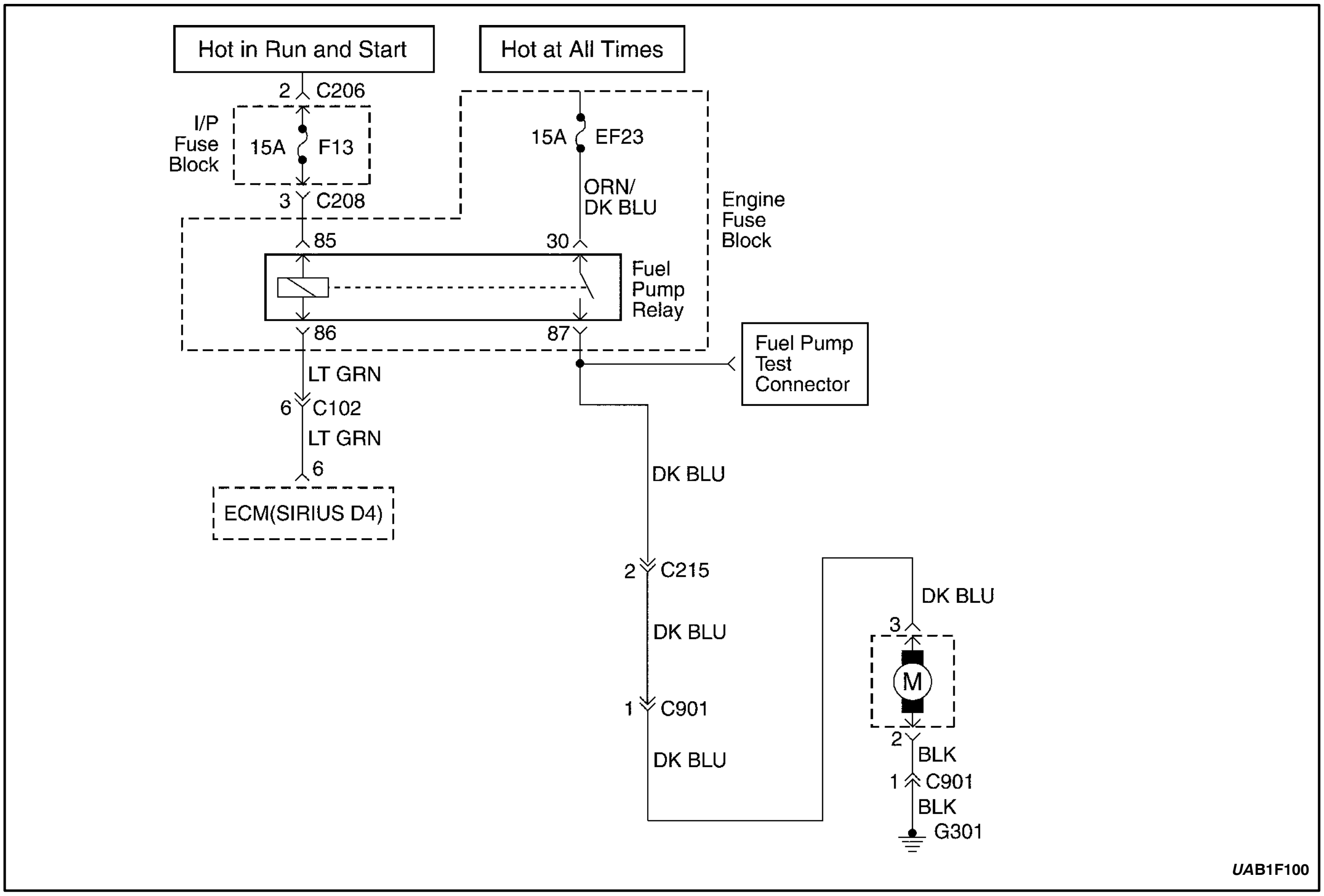
Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Replace the fuel line(s) as needed. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284–325kPa (41–47psi)	System OK	–
8	1. Remove the fuel pump assembly. 2. With the fuel pump under pressure, inspect the fuel pump coupling hoses for leaking. Is the problem found?	–	Go to *Step 9*	Go to *Step 10*
9	1. Tighten or replace the fuel pump coupling hoses as needed. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284–325kPa (41–47psi)	System OK	–
10	With the fuel system under pressure, inspect the fuel return outlet for leaking. Is the problem found?	–	Go to *Step 11*	Go to *Step 12*
11	1. Replace the fuel pressure regulator. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284–325kPa (41–47psi)	System Ok	–
12	With the fuel system under pressure, inspect the fuel inlet for leaking. Is the problem found?	–	Go to *Step 13*	Go to *Step 14*
13	1. Replace the fuel pump assembly. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284–325kPa (41–47psi)	System OK	–
14	1. Remove the fuel rail and the fuel injectors as an assembly. 2. With the fuel system under pressure, inspect all of the fuel injectors for leaking. Is the problem found?	–	Go to *Step 15*	–
15	1. Replace the leaking fuel injector(s). 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284–325kPa (41–47psi)	System OK	–
16	1. Replace the fuel pressure regulator. 2. Disconnect the fuel pressure regulator vacuum hose. 3. Start the engine. 4. Allow the engine to idle. 5. Connect the fuel pressure regulator vacuum hose. Did the fuel pressure decrease?	–	System OK	–

Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
17	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel system pressure below the values specified and holding steady?	284–325kPa (41–47psi)	Go to *Step 13*	Go to *Step 18*
18	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel system pressure below the values specified and not holding steady?	284–325kPa (41–47psi)	Go to *Step 18*	–
19	Inspect the fuel lines for leaks. Is the problem found?	–	Go to *Step 7*	Go to *Step 20*
20	1. Remove the fuel pump assembly. 2. With the fuel pump under pressure, inspect the fuel pump coupling hoses for leaking. Is the problem found?	–	Go to *Step 9*	Go to *Step 21*
21	1. Remove the fuel pump assembly. 2. With the fuel system under pressure, inspect the fuel return outlet for leaking. Is the problem found?	–	Go to *Step 11*	Go to *Step 22*
22	1. Remove the fuel pump assembly. 2. With the fuel system under pressure, inspect the fuel inlet for leaking. Is the problem found?	–	Go to *Step 13*	Go to *Step 23*
23	1. Remove the fuel rail and the fuel injectors as an assembly. 2. With the fuel system under pressure, inspect all of the fuel injectors for leaking. Is the problem found?	–	Go to *Step 15*	Go to *Step 13*

B*LANK*



FUEL PUMP RELAY CIRCUIT CHECK(1.6L DOHC)

Circuit Description

When the ignition switch is turned ON, the Engine Control Module (ECM) will supply battery voltage to activate the fuel pump relay and run the in-tank fuel pump. The fuel pump will operate as long as the engine is cranking or running and the ECM is receiving ignition reference pulses.

If there are no reference pulses, the ECM will shut off the fuel pump within 2 seconds after the ignition switch is turned ON.

Diagnostic Aids

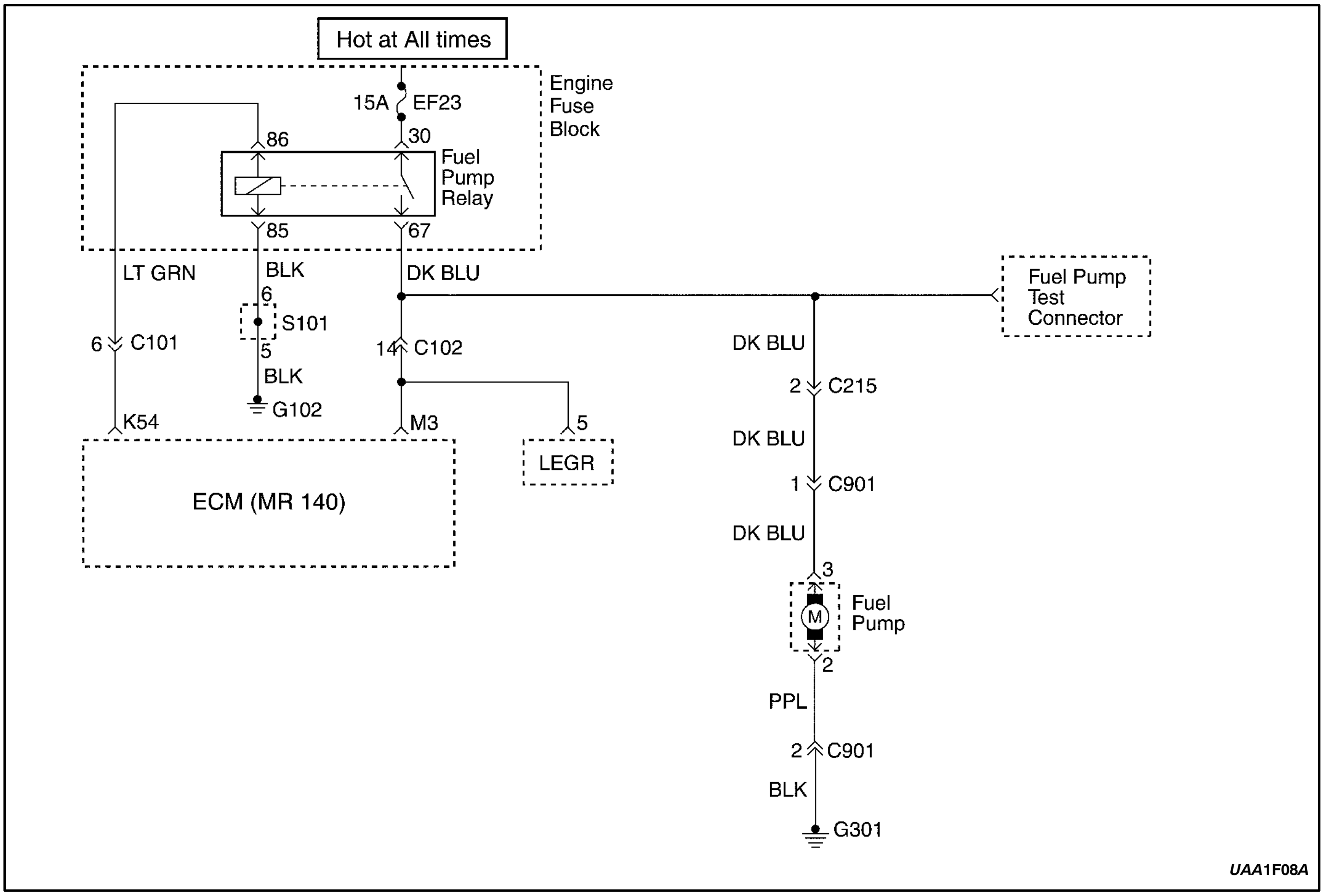
An intermittent problem may be caused by a poor connection, rubbed through wire insulation, or a broken wire inside the insulation.

Fuel Pump Relay Circuit Check(1.6L DOHC)

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF for 10 seconds. 2. Turn the ignition ON. 3. Listen for in-tank fuel pump operation. Does the fuel pump operate for the time specified?	2 sec	System OK	Go to *Step 2*
2	1. Turn the ignition OFF. 2. Connect battery positive to fuel pump test connect. 3. Listen for in-tank fuel pump operation. Does the fuel pump operate?	–	Go to *Step 4*	Go to *Step 3*

Fuel Pump Relay Circuit Check(1.6L DOHC) (Cont'd)

Step	***Action***	***Value(s)***	***Yes***	***No***
3	1. Check for an open circuit between fuel pump test connector and ground G301, and repair as needed. 2. Check for the fuel cut-off switch and reset or replace the fuel cut off switch. Is the repair complete?	–	System OK	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 85 and battery positive. 4. Turn the ignition ON. Is the test light on?	–	Go to *Step 6*	Go to *Step 5*
5	Check for an open circuit between terminal 85 of fuel pump relay and battery positive and repair as needed. Is the repair complete?	–	System OK	–
6	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 86 and ground. 3. Turn the ignition ON. Is the test light on?	2 sec	Go to *Step 8*	Go to *Step 7*
7	Check for an open circuit between terminal 86 of fuel pump relay and terminal 6 of ECM, and repair as needed. Is the repair complete?	–	System OK	–
8	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 30 and ground. Is the test light on?	–	Go to *Step 10*	Go to *Step 9*
9	1. Check the fuse EF23, if blown, repair short circuit between fuel pump relay 30 terminal. 2. Replace the fuse as needed. 3. Repair an open circuit as needed. Is the repair complete?	–	System OK	–
10	1. Turn the ignition OFF. 2. Measure the resistance between following terminals: ● Terminal 87 of fuel pump relay and terminal 1 of the fuel cut-off switch(or terminal 2 of connector C215). Does the resistance within the value specified.	0 Ω	Go to *Step 12*	Go to *Step 11*
11	Repair an open circuit as needed. Is the repair complete?	–	System OK	–
12	Replace the fuel pump relay. Is the repair complete?	–	System OK	Go to *Step 13*
13	Replace the ECM. Is the repair complete?	–	System OK	–



FUEL PUMP RELAY CIRCUIT CHECK(2.0L DOHC)

Circuit Description

When the ignition switch is turned ON, the Engine Control Module (ECM) will supply battery voltage to activate the fuel pump relay and run the in-tank fuel pump. The fuel pump will operate as long as the engine is cranking or running and the ECM is receiving ignition reference pulses.

If there are no reference pulses, the ECM will shut off the fuel pump within 2 seconds after the ignition switch is turned ON.

Diagnostic Aids

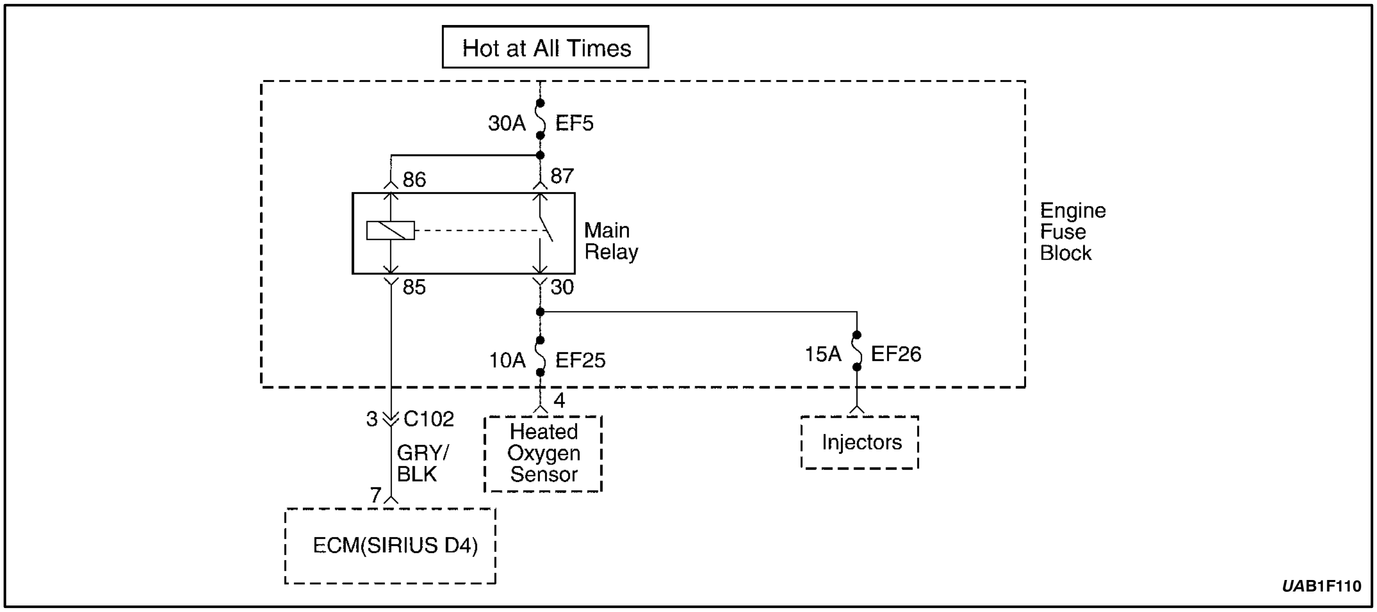
An intermittent problem may be caused by a poor connection, rubbed through wire insulation, or a broken wire inside the insulation.

Fuel Pump Relay Circuit Check(2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF for 10 seconds. 2. Turn the ignition ON. 3. Listen for in-tank fuel pump operation. Does the fuel pump operate for the time specified?	2 sec	System OK	Go to *Step 2*
2	1. Turn the ignition OFF. 2. Connect battery positive to fuel pump test connect. 3. Listen for in-tank fuel pump operation. Does the fuel pump operate?	–	Go to *Step 4*	Go to *Step 3*

Fuel Pump Relay Circuit Check(2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
3	1. Check for an open circuit between fuel pump test connector and ground G301, and repair as needed. 2. Check for the fuel cut-off switch and reset or replace the fuel cut off switch. Is the repair complete?	–	System OK	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 85 and battery positive. 4. Turn the ignition ON. Is the test light on?	–	Go to *Step 6*	Go to *Step 5*
5	Check for an open circuit between terminal 85 of fuel pump relay and ground G102 and repair as needed. Is the repair complete?	–	System OK	–
6	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 86 and ground. 3. Turn the ignition ON. Is the test light on?	2 sec	Go to *Step 8*	Go to *Step 7*
7	Check for an open circuit between terminal 86 of fuel pump relay and terminal K54 of ECM, and repair as needed. Is the repair complete?	–	System OK	–
8	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 30 and ground. Is the test light on?	–	Go to *Step 10*	Go to *Step 9*
9	1. Check the fuse EF23, if blown, repair short circuit between fuel pump relay 30 terminal. 2. Replace the fuse as needed. 3. Repair an open circuit as needed. Is the repair complete?	–	System OK	–
10	1. Turn the ignition OFF. 2. Measure the resistance between following terminals: • Terminal 87 of fuel pump relay and terminal M3 of the ECM. • Terminal 87 of fuel pump relay and terminal 1 of the fuel cut-off switch(or terminal 2 of connector C215). Does the resistance within the value specified.	0 Ω	Go to *Step 12*	Go to *Step 11*
11	Repair an open circuit as needed. Is the repair complete?	–	System OK	–
12	Replace the fuel pump relay. Is the repair complete?	–	System OK	Go to *Step 13*
13	Replace the ECM. Is the repair complete?	–	System OK	–



MAIN RELAY CIRCUIT CHECK(1.6L DOHC)

Circuit Description

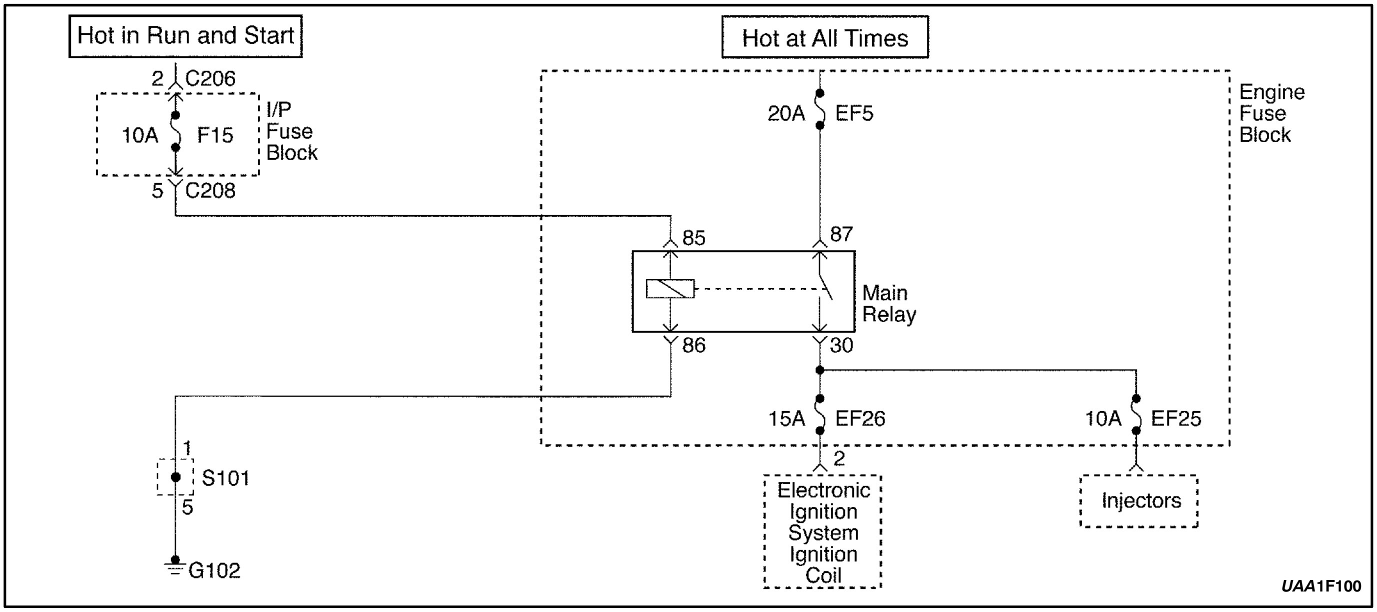
When the ignition is turned On or to the START position, the main relay is energized. The main relay then supply voltage to the engine fuse block fuse EF25 and EF26. The Electronic Ignition (EI) system ignition coil is supplied voltage through the engine fuse block fuse EF26. The fuel injectors are supplied voltage through the engine fuse block fuse EF25.

Diagnostic Aids

- An intermittent problem may be caused by a poor connection, rubbed through wire insulation, or a broken wire inside the insulation.
- A fault main relay will cause a no start condition. There will be no voltage supplied to the EI system ignition coil, or the fuel injectors. Without voltage supplied to these components, they will not operate.

Main Relay Circuit Check(1.6*L DO*HC)

Step	*Action*	*Value(s)*	*Yes*	*No*
1	1. Turn the ignition OFF. 2. Disconnect the engine fuse block fuse EF26. 3. Turn the ignition ON. 4. With a test light connected to the ground, probe the fuse terminals nearest the main relay for fuse EF26 and EF25. Is the light on at both terminal?	–	System OK	Go to *Step 2*
2	Is the light on at only one terminal?	–	Go to *Step 3*	Go to *Step 4*
3	Repair the open in the wiring between the main relay connector terminal 30 and the fuse EF25 or EF26 as needed. Is the repair complete?	–	System OK	–
4	1. Turn the ignition OFF. 2. Remove the main relay. 3. Turn the ignition ON. 4. With a test light connected to the ground, probe the main relay terminals 85 and 87. Is the light on at both terminals.	–	Go to *Step 8*	Go to *Step 5*
5	1. Turn the ignition OFF. 2. Check engine fuse block fuse EF5. Is the fuse blown?	–	Go to *Step 6*	Go to *Step 7*
6	1. Repair short circuit between terminal 87 of main relay and fuse EF5.. 2. Replace fuse EF5. Is the repair complete?	–	System OK	–
7	Repair open circuit between terminal 87 of main relay and fuse EF5. Is the repair complete?	–	System OK	Go to *Step 8*
8	1. Turn the ignition OFF. 2. Measure the resistance between following terminals. ● Terminal 86 of main relay and ground. ● Terminal 30 of main relay and fuse EF26 Is the resistance within the specified value	0 Ω	Go to *Step 10*	Go to *Step 9*
9	Repair open circuit. Is the repair complete?	–	System OK	–
10	Replace the main relay. Is the repair complete?	–	System OK	–



MAIN RELAY CIRCUIT CHECK(2.0L DOHC)

Circuit Description

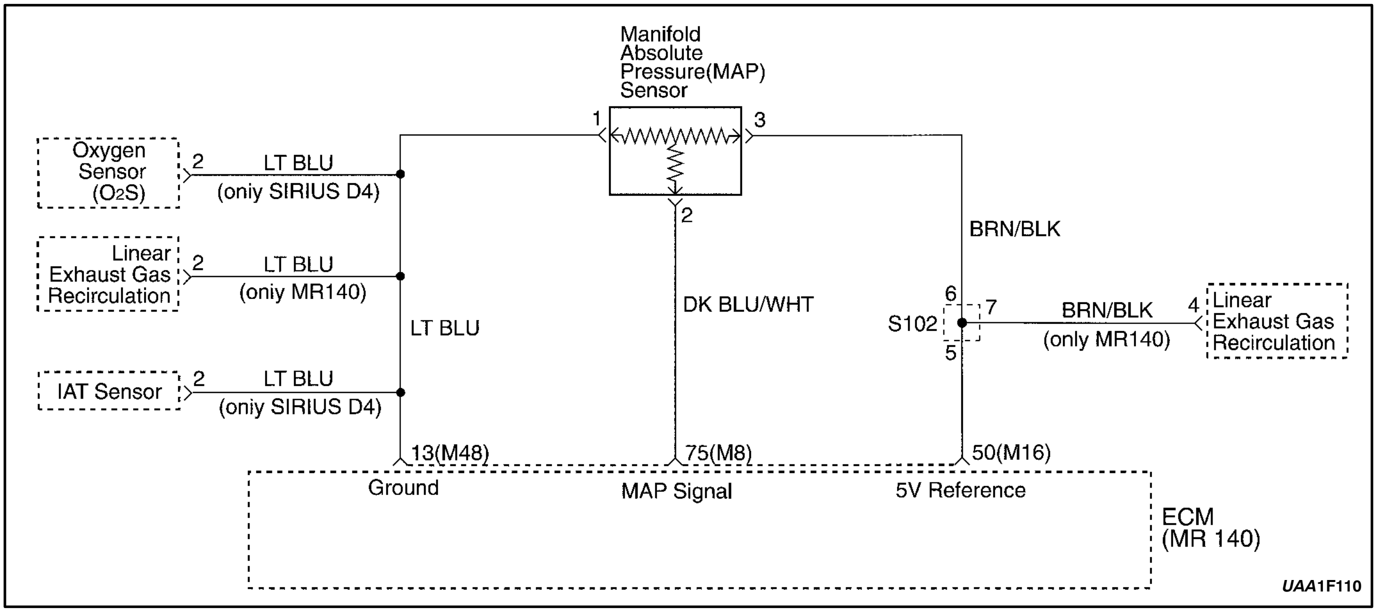
When the ignition is turned On or to the START position, the main relay is energized. The main relay then supply voltage to the engine fuse block fuse EF25 and EF26. The Electronic Ignition (EI) system ignition coil is supplied voltage through the engine fuse block fuse EF26. The fuel injectors are supplied voltage through the engine fuse block fuse EF25.

Diagnostic Aids

- An intermittent problem may be caused by a poor connection, rubbed through wire insulation, or a broken wire inside the insulation.
- A fault main relay will cause a no start condition. There will be no voltage supplied to the EI system ignition coil, or the fuel injectors. Without voltage supplied to these components, they will not operate.

Main Relay Circuit Check(2.0L DOHC)

Step	***Action***	***Value(s)***	***Yes***	***No***
1	1. Turn the ignition OFF. 2. Disconnect the engine fuse block fuse EF25 and EF26. 3. Turn the ignition ON. 4. With a test light connected to the ground, probe the fuse terminals nearest the main relay for fuse EF25 and EF26. Is the light on at both terminal?	–	System OK	Go to *Step 2*
2	Is the light on at only one terminal?	–	Go to *Step 3*	Go to *Step 4*
3	Repair the open in the wiring between the main relay connector terminal 30 and the fuse EF25 or EF26 as needed. Is the repair complete?	–	System OK	–
4	1. Turn the ignition OFF. 2. Remove the main relay. 3. Turn the ignition ON. 4. With a test light connected to the ground, probe the main relay terminals 85 and 87. Is the light on at both terminals.	–	Go to *Step 8*	Go to *Step 5*
5	1. Turn the ignition OFF. 2. Check instrument fuse block fuse F15 or engine fuse block fuse EF5. Is one or both fuse blown?	–	Go to *Step 6*	Go to *Step 7*
6	1. Repair short circuit between terminal 85 of main relay and fuse F15 or terminal 87 of main relay and fuse EF5. 2. Replace fuse F15 or fuse EF5. Is the repair complete?	–	System OK	–
7	Repair open circuit between terminal 85 of main relay and fuse F15 or terminal 87 of main relay and fuse EF5. Is the repair complete?	–	System OK	Go to *Step 8*
8	1. Turn the ignition OFF. 2. Measure the resistance between following terminals. • Terminal 86 of main relay and ground. • Terminal 30 of main relay and fuse EF25 or EF26 Is the resistance within the specified value	0 Ω	Go to *Step 10*	Go to *Step 9*
9	Repair open circuit. Is the repair complete?	–	System OK	–
10	Replace the main relay. Is the repair complete?	–	System OK	–



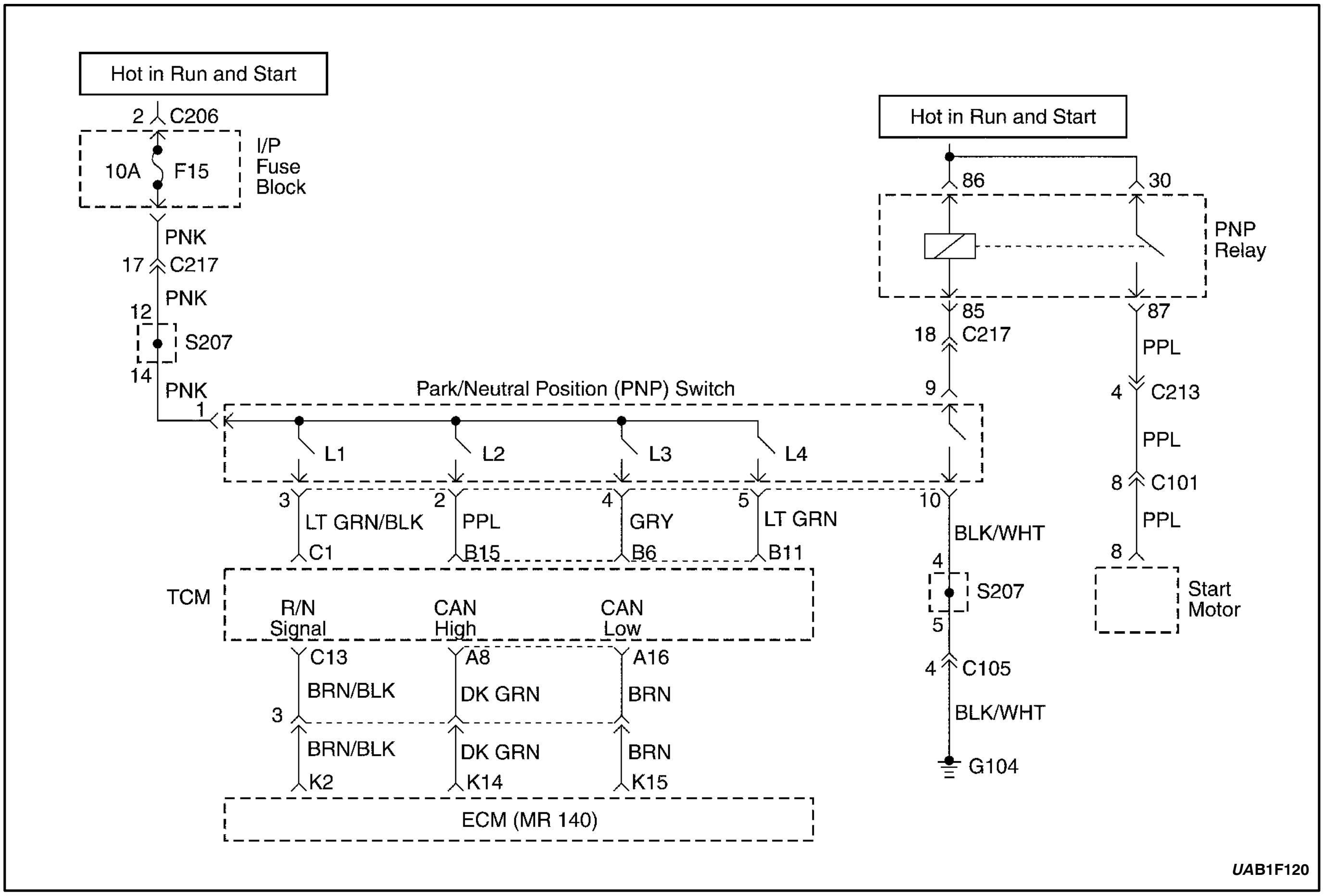
MANIFOLD ABSOLUTE PRESSURE CHECK

Circuit Description

The Manifold Absolute Pressure (MAP) sensor measure the changes in the intake manifold pressure which result from engine load (intake manifold vacuum) and rpm changes. The MAP sensor converts these changes into voltage output. The Engine Control Module (ECM) send a 5-volt reference voltage to the MAP sensor. As the intake manifold pressure changes, the output voltage of MAP sensor also changes. A low voltage (high vacuum) output of 1 to 2 volts is present at idle. A high voltage (low vacuum) output of 4.0 to 4.8 volts is present at wide open throttle. The MAP sensor is also used under certain conditions to measure barometric attitude changes. The ECM uses the Map sensor for the delivery and ignition timing changes.

Manifold Absolute Pressure Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF. 2. Connect a scan tool to the Data Link Connector (DLC). 3. Turn the ignition ON. 4. Compare the Manifold Absolute Pressure (MAP) sensor voltage reading from scanner with that from known good vehicle. Is the difference in the two voltage reading less than the value specified?	0.4 V	Go to *Step 2*	Go to *Step 5*
2	1. Turn the ignition OFF. 2. Connect a scan tool to the DLC. 3. Disconnect the MAP sensor vacuum line. 4. Connect a hand vacuum pump to the Map sensor. 5. Turn the ignition ON. 6. Note the MAP sensor voltage. 7. Apply 34kPa (10 in. Hg) of vacuum to the Map sensor and note the voltage change. Is the difference in voltage readings more than the value specified?	1.5 V	System OK	Go to *Step 3*
3	Inspect the MAP sensor connector terminals. Is the problem found.	–	Go to *Step 4*	Go to *Step 5*
4	Repair the MAP sensor connector terminals as needed. Is the repair complete?	–	System OK	–
5	Replace the MAP sensor. Is the repair complete?	–	System OK	–



PARK/NEUTRAL POSITION SWITCH(2.0L DOHC)

Circuit Description

The Park/Neutral Position (PNP) Switch is located on the automatic transaxle. The Transaxle Control Module (TCM) receives the signal of combined switch in PNP switch and send PNP signal to Engine Control Module (ECM). The ECM uses the PNP signal as one of the inputs to control idle air and spark timing.

Park/Neutral Position Switch(2.0L DOHC)

Step	*Action*	*Value(s)*	*Yes*	*No*
1	1. Connect a scan tool to the data link connector (DLC). 2. Place the transaxle selector lever in P (Park). 3. Turn the ignition ON. Does the scan tool indicate park or neutral?	–	Go to *Step 2*	Go to *Step 3*
2	Place the selector lever in D (Drive) Does the scan tool indicate drive?	–	System OK	–
3	1. Disconnect the Park/Neutral Position (PNP) switch connector. 2. Jumper the PNP switch connector terminals 1 and 4. 3. Turn the ignition ON. Does the scan tool indicate park?	–	Go to *Step 4*	Go to *Step 5*

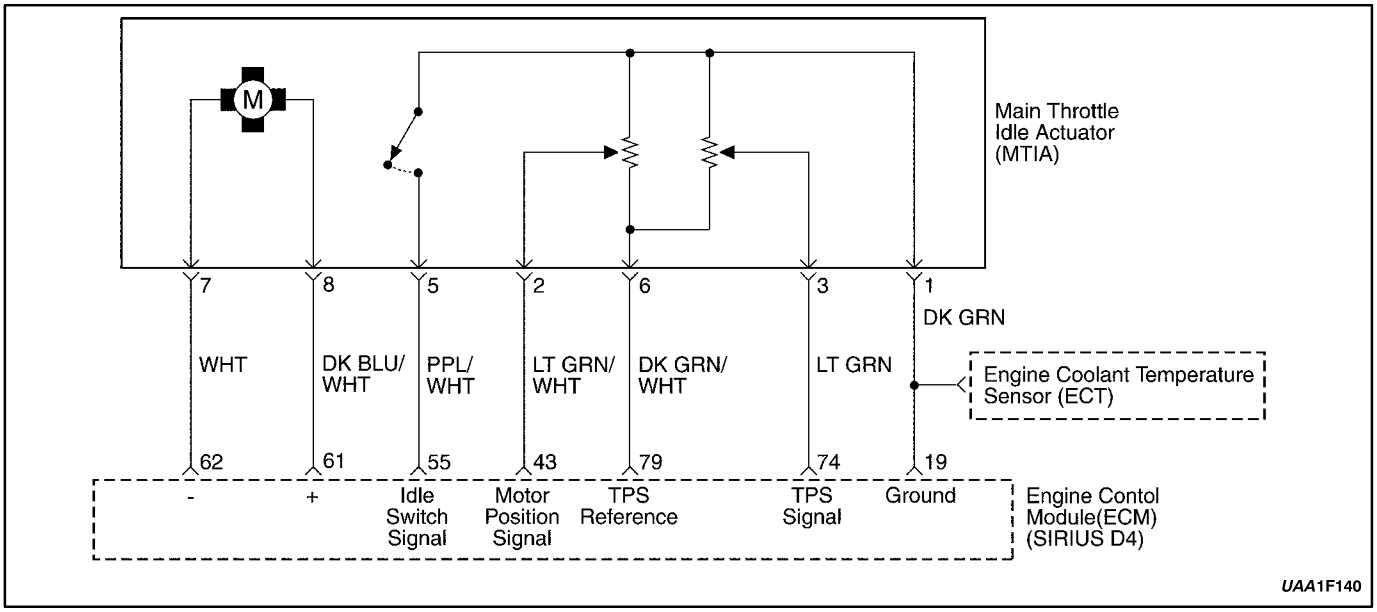
Park/Neutral Position Switch(2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
4	Check the PNP switch adjustment using "Park/ Neutral Position Switch Combination Chart" in this section and repair or replace the PNP switch as needed. Is the repair complete?	–	System OK	–
5	1. Turn the ignition ON. 2. Connect a test light between terminal 1 of the PNP switch and ground. Does the test light turn on?	–	Go to *Step 7*	Go to *Step 6*
6	Check for an open circuit between terminal 1 of the PNP switch and fuse F15 and repair as needed. Is the repair complete?	–	System OK	–
7	Check for an open or short to ground in the wire between following PNP and Transaxle Control Module (TCM) terminals: ● Terminal 3 (PNP switch) and C1 (TCM). ● Terminal 2 (PNP switch) and B15 (TCM). ● Terminal 4 (PNP switch) and B6 (TCM). ● Terminal 5 (PNP switch) and B11 (TCM) Is the problem found?	–	Go to *Step 8*	Go to *Step 9*
8	Repair the open or short to ground in the wire. Is the repair complete?	–	System OK	–
9	Check the TCM using a scan tool. Does the scan tool show any TCM Diagnostic Trouble Code (DTC)	–	Go to proper TCM Diagnostic Chart	Go to *Step 10*
10	Measure the resistance between terminal C13 of the TCM and terminal K2 of the ECM. Is the resistance between the specified value?	≈ 0 Ω	Go to *Step 12*	Go to *Step 11*
11	Repair the wire as needed. Is the repair complete?	–	System OK	–
12	Replace the ECM. Is the repair complete?	–	System OK	–

Park /Neutral Position Switch Combination Chart

The Park/Neutral Switch has internal 4 switches that changes On and Off by the select lever position, and the Transaxle Control Module (TCM) receives these combined switch signals and controls the transaxle in drive range. The TCM send PNP signal to the Engine Control Module (ECM).

	P	R	N	D	3	2	1
L1 (Terminal 3)	X	X	X	O	O	O	X
L2 (Terminal 2)	X	X	X	O	O	X	O
L3 (Terminal 4)	O	O	X	O	X	O	O
L4 (Terminal 5)	X	X	O	X	O	O	O



IDLE AIR CONTROL SYSTEM CHECK(1.6L DOHC)

Circuit Description

The aim of the MTIA (Main Throttle Idle Actuator) is to control the idle speed with the throttle body itself. The throttle is motorized for low opening angle (0°, 19°). The characteristics of the airflow are not the same for low and high opening angles. As a matter of fact, the gradient of the mass air flow function of TPS is lower for small angles that permits to be more precise during the idle speed control. Out of idle speed the throttle is actuated mechanically by a classical bowdencable.

The throttle position sensor (TPS) provides a voltage signal that changes in relation to the throttle plate angle. The signal voltage will vary from about nearly 5.0 V at idles to about 0.2V to 0.4 V at wide-open throttle. The TPS is one of the most important inputs used by the ECM for fuel control and other functions such as idle, wide open throttle, deceleration enleanment, and acceleration enrichment.

Diagnostic Aids

If the idle is too high, stop the engine. Fully extend the Idle Air Control (IAC) valve with a IAC driver. Start the engine. If the idle speed is above 800 rpm, locate and repair the vacuum leak. Also, check for a binding throttle plate or throttle linkage or an incorrect base idle setting.

Idle Air Control **Valve Reset** *Procedure*

Whenever the battery cable or the Engine Control Module (ECM) connector or the ECM fuse EF6 is disconnected or replaced, the following idle learn procedure must be performed:

1. Turn the ignition ON for 5 seconds.
2. Turn the ignition OFF for 10 seconds.
3. Turn the ignition ON for 5 seconds.
4. Start the engine in park/neutral.
5. Allow the engine to run until the engine coolant is above 85°C (185°F).
6. Turn the A/C ON for 10 seconds, if equipped.
7. Turn the A/C OFF for 10 seconds, if equipped.
8. Turn the ignition OFF. The idle learn procedure is complete.

Idle Air Control System Check(1.6*L DO*HC)

Step	**Action**	**Value(s)**	**Yes**	**No**
1	Perform an On-Board Diagnostic (EOBD II) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	Turn the ignition switch to ON. Is the Malfunction Indicator Lamp (MIL) on steady?	–	Go to *Step 4*	Go to *Step 3*
3	Turn the ignition switch to LOCK. Connect the scan tool to the DLC. Turn the Turn the ignition switch to ON. Are any diagnostic trouble codes (DTCs) displayed?	–	Go to *Step 4*	Try with another scan tool
4	Refer to the applicable DTC table. Is only one DTC identified as valid trouble code P0122?	–	Go to *Step 5*	Go to applicable DTC table And Go To “Multiple DTC”
5	1. Connect the scan tool to the DLC. 2. Turn the ignition switch to ON. 3. Press the accelerator pedal while watching TPS for smooth changes in the voltage Does the scan tool show the TPS voltage change smoothly within the value specified?	0.3V ~ 4.8V	Go to “Diagnostic Aids”	Go to *Step 6*
6	1. Turn the ignition switch to lock. 2. Disconnect the MTIA connector. 3. Measure the voltage between terminal 4 and 7. Does the voltage measure within the value specified?	4.8V ~ 5.0V	Go to *Step 7*	Go to *Step 8*
7	Connect a fused jumper between the MTIA connector terminal 4 and terminal 5. Does the scan tool show the TPS voltage above value specified?	4.8V ~ 5.0V	Go to *Step 13*	Go to *Step 11*
8	Measure the voltage between the MTIA connector 4 and ground. Does the voltage measure within the value specified?	< 5.0V	Go to *Step 9*	Go to *Step 10*
9	1. Turn the ignition switch to lock. 2. Check for an open or low voltage in the wire between the MTIA connector 7 and ECM connector 19. Is the problem found?	–	Go to *Step 12*	Go to *Step 14*
10	1. Turn the ignition switch to LOCK. 2. Check for an open or low voltage in the wire between the MTIA connector 4 and ECM connector 79. Is the problem found?	–	Go to *Step 12*	Go to *Step 14*
11	1. Turn the ignition switch to LOCK. 2. Check for an open or low voltage in the wire between the MTIA connector 5 and ECM connector 74. Is the problem found?	–	Go to *Step 12*	Go to *Step 14*

Idle Air Control **System** *Check* (1.6L *DO*HC)

Step	*Action*	*Value(s)*	*Yes*	*No*
12	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
13	1. Replace the throttle body assembly. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
14	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to step 15	–
15	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

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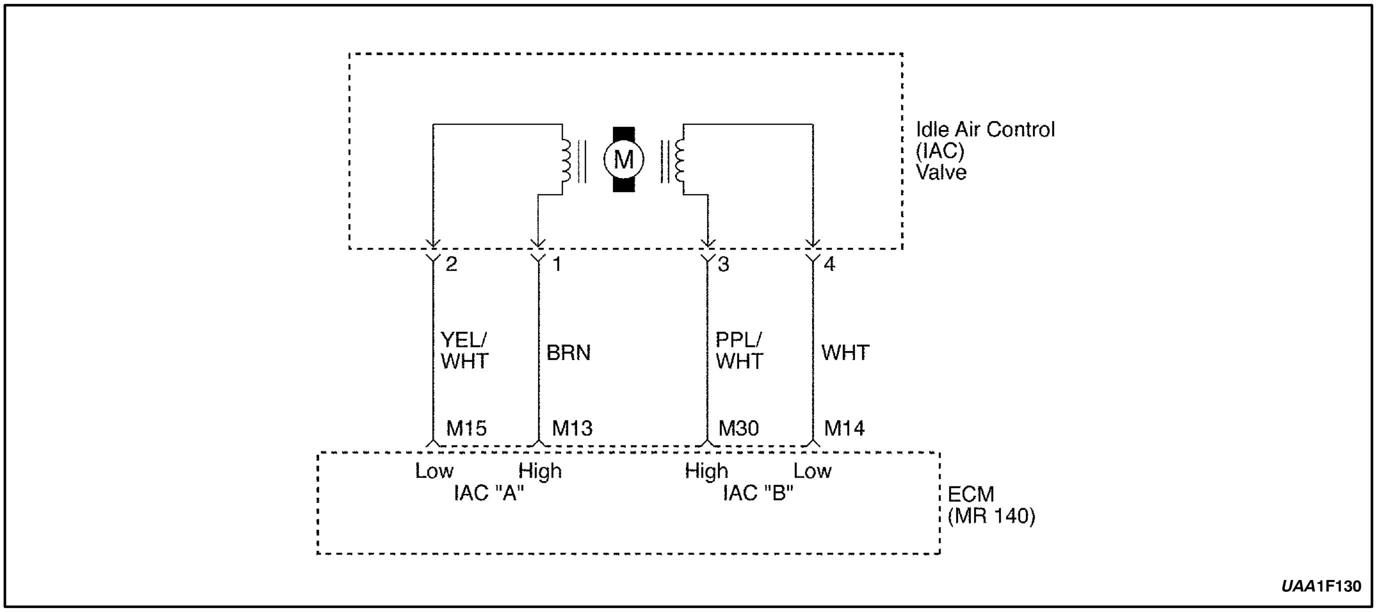


IDLE AIR CONTROL SYSTEM CHECK(2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) controls the engine idle speed with the Idle Air Control (IAC) valve. To increase the idle speed, the ECM pulls the IAC pintle away from its seat, allowing more air to pass by the throttle body. To decrease the idle speed, it extends the IAC valve pintle toward its seat, reducing bypass air flow. A scan tool will read the ECM commands to the IAC valve in counts. The higher counts indicate more air bypass (higher idle). The lower counts indicate less air is allowed to bypass (lower idle).

Diagnostic Aids

If the idle is too high, stop the engine. Fully extend the Idle Air Control (IAC) valve with a IAC driver. Start the engine. If the idle speed is above 800 rpm, locate and repair the vacuum leak. Also, check for a binding throttle plate or throttle linkage or an incorrect base idle setting.

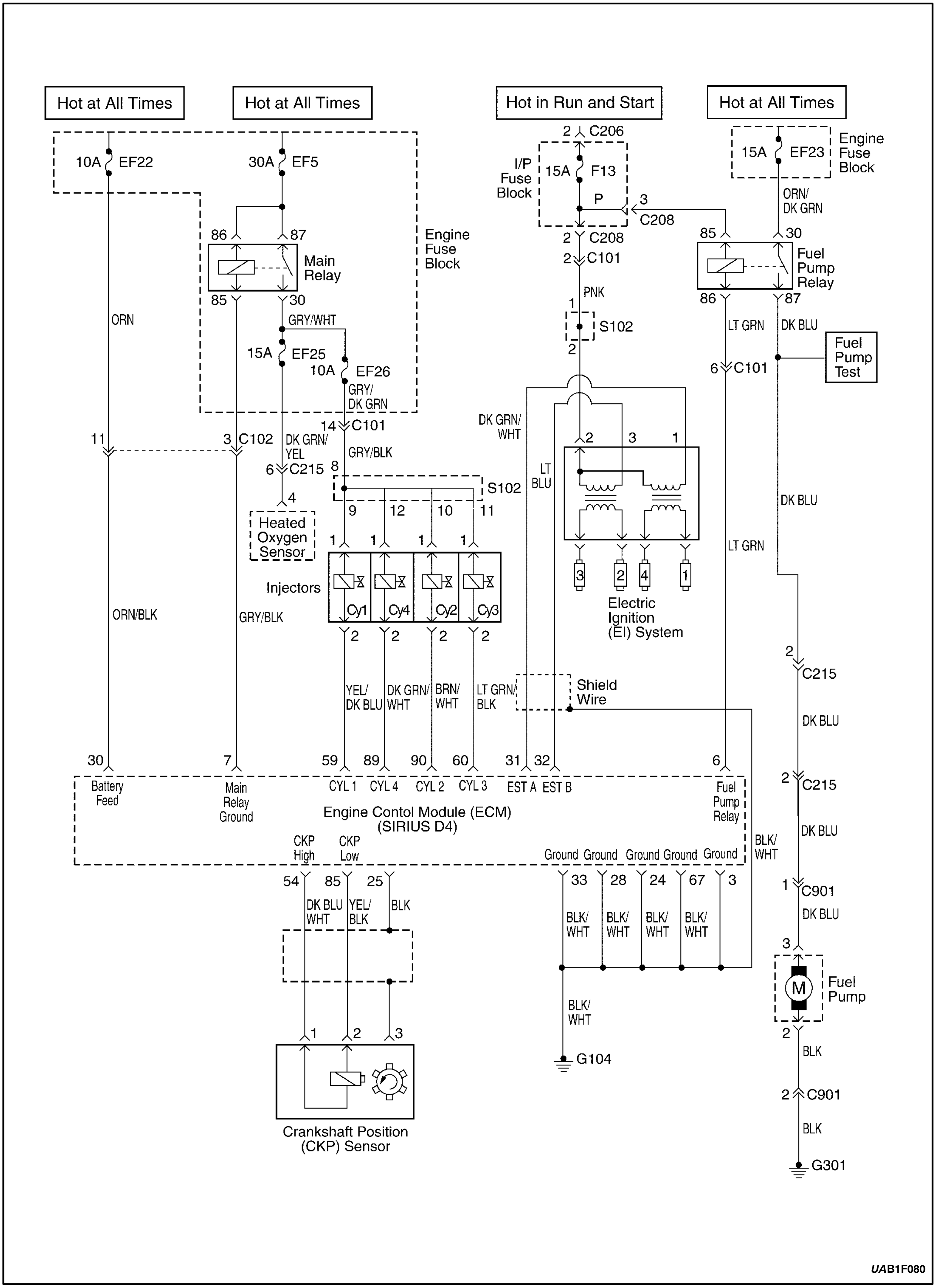
Idle Air Control Valve Reset Procedure

Whenever the battery cable or the Engine Control Module (ECM) connector or the ECM fuse EF6 is disconnected or replaced, the following idle learn procedure must be performed:

1. Turn the ignition ON for 5 seconds.
2. Turn the ignition OFF for 10 seconds.
3. Turn the ignition ON for 5 seconds.
4. Start the engine in park/neutral.
5. Allow the engine to run until the engine coolant is above 85°C (185°F).
6. Turn the A/C ON for 10 seconds, if equipped.
7. Turn the A/C OFF for 10 seconds, if equipped.
8. If the vehicle is equipped with an automatic transaxle, apply the parking brake. While pressing the brake pedal, place the transaxle in D (drive).
9. Turn the A/C ON for 10 seconds, if equipped.
10. Turn the A/C OFF for 10 seconds, if equipped.
11. Turn the ignition OFF. The idle learn procedure is complete.

Idle Air Control System *Check*(2.0*L DO*HC)

Step	*Action*	*Value(s)*	*Yes*	*No*
1	Perform an Euro On-Board Diagnostic (EOBD) system check. Was the check performed?	–	Go to *Step 2*	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Remove Idle Air Control (IAC) valve. 3. Inspect the IAC passages for restrictions. Is the problem found?	–	Go to *Step 3*	Go to *Step 4*
3	Clean the IAC passages. Is the repair complete?	–	System OK	–
4	Measure the resistance between following terminals of IAC valve. ● Terminal 1 and 2 ● Terminal 3 and 4 Does the resistance equal to the value specified?	40–80 Ω	Go to *Step 6*	Go to *Step 5*
5	Replace the IAC valve. Is the repair complete?	–	System OK	–
6	1. Disconnect the Engine control Module (ECM) connector. 2. Check for an open or short in the wires between following terminals. ● Terminal 1 of IAC valve connector and terminal M13 of ECM connector ● Terminal 2 of IAC valve connector and terminal M15 of ECM connector ● Terminal 3 of IAC valve connector and terminal M30 of ECM connector ● Terminal 4 of IAC valve connector and terminal M14 of ECM connector Is the problem found?	–	Go to *Step 8*	Go to *Step 7*
7	Repair an open or short circuit as needed. Is the repair complete?	–	System OK	–
8	Inspect the IAC connector terminals and the ECM connector terminals. Is the problem found?	–	Go to *Step 9*	Go to *Step 10*
9	Repair or replace the throttle body assembly and/or ECM connector terminals as needed. Is the repair complete?	–	System OK	–
10	Replace the ECM. Is the repair complete?	–	System OK	–



Hot at All Times
Hot at All Times
Hot in Run and Start
Hot at All Times
10A EF22
30A EF5
Engine Fuse Block
86 87
Main Relay
85 30
ORN
GRY/WHT
15A EF25
10A EF26
GRY/ DK GRN
14 C101
11
3 C102
DK GRN/ YEL
6 C215
4
Heated Oxygen Sensor
GRY/BLK
8
S102
9 12 10 11
1 1 1 1
Injectors
Cy1 Cy4 Cy2 Cy3
2 2 2 2
ORN/BLK
GRY/BLK
YEL/ DK BLU
DK GRN/ WHT
BRN/ WHT
LT GRN/ BLK
2 C206
I/P Fuse Block
15A F13
P
3 C208
2 C208
2 C101
PNK
1 S102 2
DK GRN/ WHT
LT BLU
2 3 1
3 2 4 1
Electric Ignition (EI) System
Shield Wire
15A EF23
Engine Fuse Block
ORN/ DK GRN
85 30
Fuel Pump Relay
86 87
LT GRN
DK BLU
Fuel Pump Test
6 C101
DK BLU
LT GRN
2 C215
DK BLU
2 C215
DK BLU
1 C901
DK BLU
3
Fuel Pump
M
2
BLK
2 C901
BLK
G301
30 7 59 89 90 60 31 32 6
Battery Feed
Main Relay Ground
CYL 1 CYL 4 CYL 2 CYL 3 EST A EST B
Fuel Pump Relay
Engine Contol Module (ECM) (SIRIUS D4)
CKP High
CKP Low
Ground Ground Ground Ground Ground
BLK/ WHT
54 85 25
DK BLU WHT
YEL/ BLK
BLK
33 28 24 67 3
BLK/ WHT
BLK/ WHT
BLK/ WHT
BLK/ WHT
BLK/ WHT
G104
1 2 3
Crankshaft Position (CKP) Sensor
UAB1F080

IGNITION SYSTEM *CHECK*(1.6*L DO*HC)

Circuit Description

The Electronic Ignition (EI) system uses a waste spark method of spark distribution. In this type of EI system, the Crankshaft Position (CKP) sensor is mounted to the oil pump near a slotted wheel that is a part of the crankshaft pulley. The CKP sensor sends reference pulses to the Engine Control Module (ECM). The ECM then triggers the EI system ignition coil. Once the ECM triggers the EI system ignition coil, both of the connected spark plugs fire at the same time. One cylinder is on its compression stroke at the same time that the other is on the exhaust stroke, resulting in lower energy needed to fire the spark plug in the cylinder on its exhaust stroke.

This leaves the remainder of the high voltage to be used to fire the spark plug in the cylinder on its compression stroke. Since the CKP sensor is in a fixed position, timing adjustments are not possible or needed.

Ignition System *Check*(1.6*L DO*HC)

Caution: Use only electrically insulated pliers when handling ignition wires with the engine running to prevent an electrical shock.

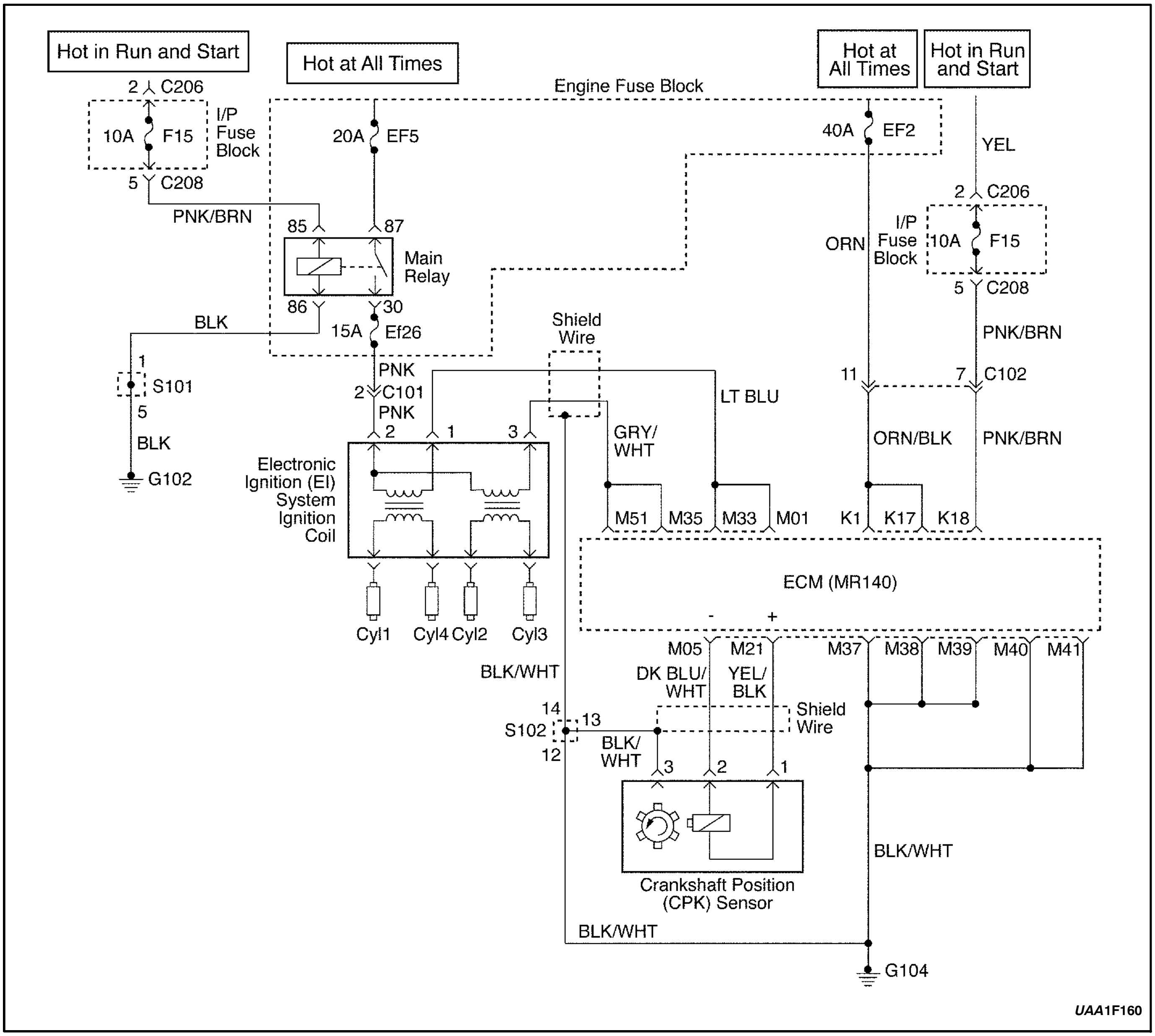
Step	Action	Value(s)	Yes	No
1	1. Remove the spark plugs. 2. Inspect for wet spark plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. 3. Replace the spark plugs as needed. Is the repair complete?	–	System OK	Go to *Step 2*
2	Check for the presence of spark from all of the ignition wires while cranking the engine. Is spark present from all of the ignition wires?	–	System OK	Go to *Step 3*
3	1. Measure the resistance of the ignition wires. 2. Replace any ignition wire(s) with a resistance above the value specified. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	30000 Ω	System OK	Go to *Step 4*
4	Is spark present from at least one of the ignition wires, but not all of the ignition wires?		Go to Step 5	Go to Step 12
5	1. Turn the ignition OFF. 2. Disconnect the Electronic Ignition (EI) system ignition coil connector. 3. While cranking the engine, measure the voltage at the EI system ignition coil connector terminal 1. Does the voltage fluctuate within the values specified?	0.2–2.0 V	Go to *Step 8*	Go to *Step 6*
6	Check for an open in the wire from EI system ignition coil connector terminal 1 to the Engine Control Module (ECM) connector terminal 31. Is the problem found?	–	Go to *Step 7*	Go to *Step 11*
7	1. Repair the wiring as needed. 2. Connect the EI system ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	–	System OK	–
8	While cranking the engine, measure the voltage at the EI system ignition coil connector terminal 3. Does the voltage fluctuate within the values specified?	0.2–2.0 V	Go to *Step 10*	Go to *Step 9*

Ignition **System** *Check* (1.6*L DO*HC) (*Cont'd*)

Step	*Action*	*Value(s)*	*Yes*	*No*
9	Check for an open in the wire from EI system ignition coil connector terminal 3 to the Engine Control Module (ECM) connector terminal 32. Is the problem found?	–	Go to *Step 7*	Go to *Step 11*
10	1. Replace the EI system ignition coil. 2. Connect the EI system ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	–	System OK	–
11	1. Replace the ECM. 2. Connect the EI system ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	–	System OK	–
12	1. Turn the ignition OFF. 2. Disconnect the crankshaft position (CKP) sensor connector. 3. Measure the resistance between the CKP sensor terminals 1 and 2. Is the resistance within the value specified? 4. Measure the resistance between following terminals. ● Terminals 1 and 3 of CKP sensor. ● Terminals 2 and 3 of CKP sensor. Is the resistance within the value specified?	400–600 Ω ∞	Go to *Step 14*	Go to *Step 13*
13	Replace the crankshaft position sensor. Is the repair complete?	–	System OK	–
14	1. Turn the ignition ON. 2. Measure the voltage between the CKP sensor connector terminals 1 and 3. Is the voltage within the value specified?	0.95–1.10 V	Go to *Step 20*	Go to *Step 15*
15	Measure the voltage between the CKP sensor connector terminal 1 and ground. Is the voltage within the value specified?	0.95–1.10 V	Go to *Step 18*	Go to *Step 16*
16	Check the wire between the CKP sensor connector terminal 1 and the ECM connector terminal 54 for an open or short. Is the problem found?	–	Go to *Step 17*	Go to *Step 10*
17	Repair the wire between the CKP sensor connector terminal 1 and the ECM connector terminal 54. Is the repair complete?	–	System OK	–
18	Check the wire between the CKP sensor connector terminal 3 and ground for an open or short. Is the problem found?	–	Go to *Step 19*	Go to *Step 11*
19	Repair the wire between the CKP sensor connector terminal 3 and ground. Is the repair complete?	–	System OK	–
20	1. Turn the ignition ON. 2. Measure the voltage between the CKP sensor connector terminals 2 and 3. Is the voltage within the value specified?	0.95–1.10 V	Go to *Step 24*	Go to *Step 21*

Ignition System *Check*(1.6*L DO*HC) (*Cont'd*)

Step	Action	Value(s)	Yes	No
21	Measure the voltage between the CKP sensor connector terminal 2 and ground. Is the voltage within the value specified?	0.95–1.10 V	Go to *Step 18*	Go to *Step 22*
22	Check the wire between the CKP sensor connector terminal 2 and the ECM connector terminal 85 for an open or short. Is the problem found?	–	Go to *Step 23*	Go to *Step 11*
23	Repair the wire between the CKP sensor connector terminal 2 and the ECM connector terminal 85. Is the repair complete?	–	System OK	–
24	1. Turn the ignition OFF. 2. Connect a test light between the EI system ignition coil connector terminal 2 and ground. 3. Turn the ignition ON. Is the test light on?	–	Go to *Step 27*	Go to *Step 25*
25	Check for an open in the wiring between the EI system ignition coil connector, terminal 2 and the I/P fuse block fuse F13. Is the problem found?	–	Go to *Step 26*	–
26	Repair the open in the wiring between the EI system ignition coil connector terminal 2 and the I/P fuse block fuse F13. Is the repair complete?	–	System OK	–
27	Check for a damage in the terminal of the EI system ignition coil connector and repair as needed. Is the repair complete?	–	System OK	–



IGNITION SYSTEM CHECK(2.0L DOHC)

Circuit Description

The Electronic Ignition (EI) system uses a waste spark method of spark distribution. In this type of EI system, the Crankshaft Position (CKP) sensor is mounted to the oil pump near a slotted wheel that is a part of the crankshaft pulley. The CKP sensor sends reference pulses to the Engine Control Module (ECM). The ECM then triggers the EI system ignition coil. Once the ECM triggers the EI system ignition coil, both of the connected spark plugs fire at the same time. One cylinder is on its compression stroke at the same time that the other is on the exhaust stroke, resulting in lower energy needed to fire the spark plug in the cylinder on its exhaust stroke.

This leaves the remainder of the high voltage to be used to fire the spark plug in the cylinder on its compression stroke. Since the CKP sensor is in a fixed position, timing adjustments are not possible or needed.

Ignition System Check (2.0L DOHC)

Caution: Use only electrically insulated pliers when handling ignition wires with the engine running to prevent an electrical shock.

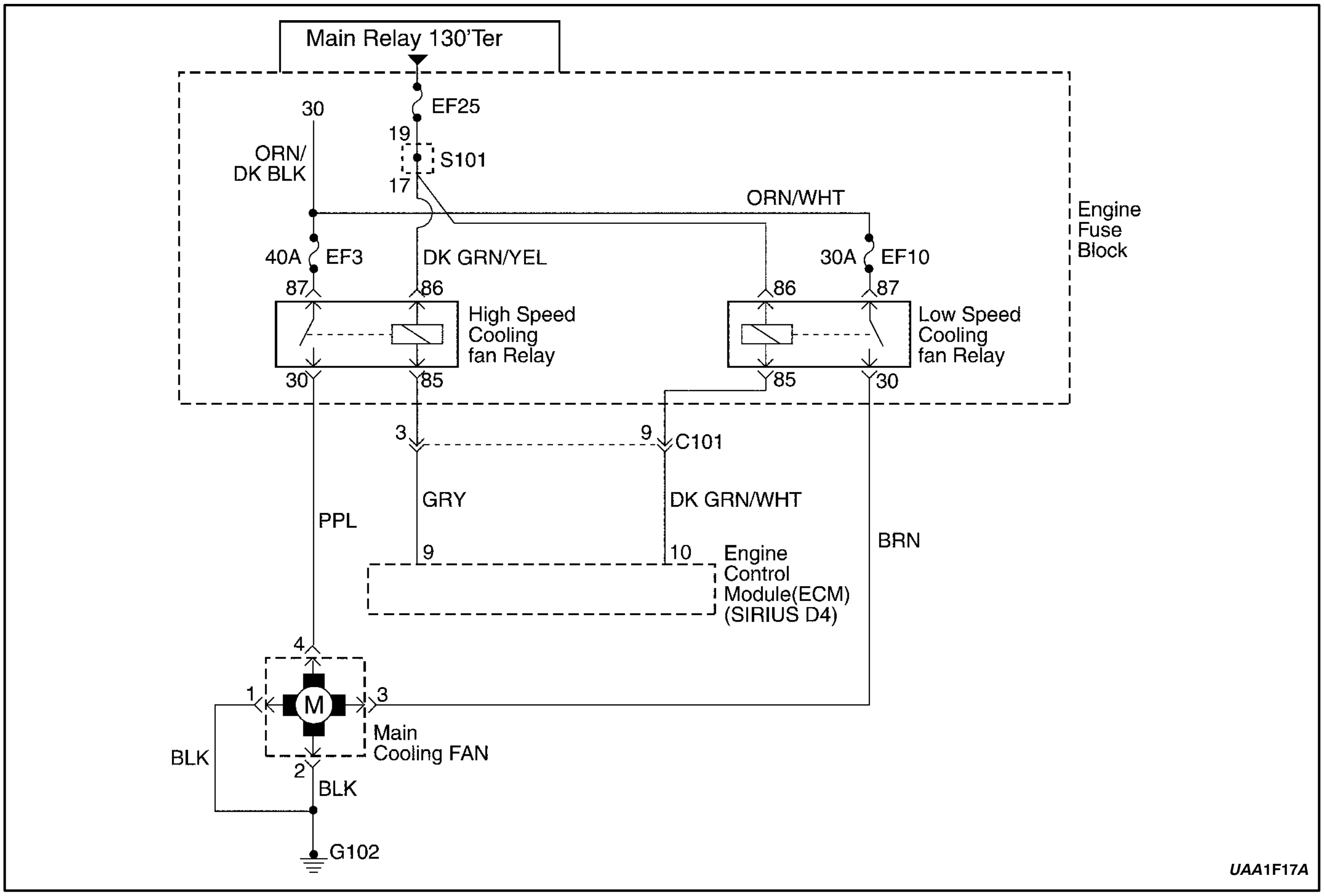
Step	Action	Value(s)	Yes	No
1	1. Remove the spark plugs. 2. Inspect for wet spark plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. 3. Replace the spark plugs as needed. Is the repair complete?	–	System OK	Go to *Step 2*
2	Check for the presence of spark from all of the ignition wires while cranking the engine. Is spark present from all of the ignition wires?	–	System OK	Go to *Step 3*
3	1. Measure the resistance of the ignition wires. 2. Replace any ignition wire(s) with a resistance above the value specified. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	30000 Ω	System OK	Go to *Step 4*
4	Is spark present from at least one of the ignition wires, but not all of the ignition wires?	–	Go to *Step 5*	Go to *Step 12*
5	1. Turn the ignition OFF. 2. Disconnect the Electronic Ignition (EI) system ignition coil connector. 3. While cranking the engine, measure the voltage at the EI system ignition coil connector terminal 1. Does the voltage fluctuate within the values specified?	0.2–2.0 V	Go to *Step 8*	Go to *Step 6*
6	Check for an open in the wire from EI system ignition coil connector terminal 1 to the Engine Control Module (ECM) connector terminal M33/M1. Is the problem found?	–	Go to *Step 7*	Go to *Step 11*
7	1. Repair the wiring as needed. 2. Connect the EI system ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	–	System OK	–
8	While cranking the engine, measure the voltage at the EI system ignition coil connector terminal 2. Does the voltage fluctuate within the values specified?	0.2–2.0 V	Go to *Step 10*	Go to *Step 9*
9	Check for an open in the wire from EI system ignition coil connector terminal 2 to the Engine Control Module (ECM) connector terminal M51/M35. Is the problem found?	–	Go to *Step 7*	Go to *Step 11*
10	1. Replace the EI system ignition coil. 2. Connect the EI system ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	–	System OK	–

Ignition System Check(2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Replace the ECM. 2. Connect the EI system ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	–	System OK	–
12	1. Turn the ignition OFF. 2. Disconnect the crankshaft position (CKP) sensor connector. 3. Measure the resistance between the CKP sensor terminals 1 and 2. Is the resistance within the value specified? 4. Measure the resistance between following terminals. • Terminals 1 and 3 of CKP sensor. • Terminals 2 and 3 of CKP sensor. Is the resistance within the value specified?	400–600 Ω ∞	Go to *Step 14*	Go to *Step 13*
13	Replace the crankshaft position sensor. Is the repair complete?	–	System OK	–
14	1. Turn the ignition ON. 2. Measure the voltage between the CKP sensor connector terminals 1 and 3. Is the voltage within the value specified?	0.95–1.10 V	Go to *Step 20*	Go to *Step 15*
15	Measure the voltage between the CKP sensor connector terminal 1 and ground. Is the voltage within the value specified?	0.95–1.10 V	Go to *Step 18*	Go to *Step 16*
16	Check the wire between the CKP sensor connector terminal 1 and the ECM connector terminal M21 for an open or short. Is the problem found?	–	Go to *Step 17*	Go to *Step 10*
17	Repair the wire between the CKP sensor connector terminal 1 and the ECM connector terminal M21. Is the repair complete?	–	System OK	–
18	Check the wire between the CKP sensor connector terminal 3 and ground for an open or short. Is the problem found?	–	Go to *Step 19*	Go to *Step 11*
19	Repair the wire between the CKP sensor connector terminal 3 and ground. Is the repair complete?	–	System OK	–
20	1. Turn the ignition ON. 2. Measure the voltage between the CKP sensor connector terminals 2 and 3. Is the voltage within the value specified?	0.95–1.10 V	Go to *Step 24*	Go to *Step 21*
21	Measure the voltage between the CKP sensor connector terminal 2 and ground. Is the voltage within the value specified?	0.95–1.10 V	Go to *Step 18*	Go to *Step 22*
22	Check the wire between the CKP sensor connector terminal 2 and the ECM connector terminal M5 for an open or short. Is the problem found?	–	Go to *Step 23*	Go to *Step 11*

Ignition System *Check*(2.0*L DO*HC) (*Cont'd*)

Step	*Action*	*Value(s)*	*Yes*	*No*
23	Repair the wire between the CKP sensor connector terminal 2 and the ECM connector terminal M5. Is the repair complete?	–	System OK	–
24	1. Turn the ignition OFF. 2. Connect a test light between the EI system ignition coil connector terminal 2 and ground. 3. Turn the ignition ON. Is the test light on?	–	Go to *Step 27*	Go to *Step 25*
25	Check for an open in the wiring between the EI system ignition coil connector, terminal 2 and the main relay connector terminal 30. Is the problem found?	–	Go to *Step 26*	Go to "Main Relay Circuit Check"
26	Repair the open in the wiring between the EI system ignition coil connector terminal 2 and the main relay connector terminal 30. Is the repair complete?	–	System OK	–
27	Check for a damage in the terminal of the EI system ignition coil connector and repair as needed. Is the repair complete?	–	System OK	–



ENGINE COOLING FAN CIRCUIT CHECK(1.6L DOHC)

Circuit Description

The engine cooling fan circuit operates only the main cooling fan. The cooling fans are controlled by the Engine Control Module (ECM) based on inputs from the Engine Coolant Temperature (ECT) sensor and the Air Conditioning Pressure (ACP) sensor. The ECM controls the low speed cooling fan operation by internally grounding the ECM connector terminal K28. This energizes the low speed cooling fan relay and operates the main cooling fan at low speed as the cooling fans. The ECM controls the high speed cooling fan operation by internally grounding the ECM connector terminal K12. This energizes the high speed cooling fan relay resulting in high speed fan operation as the cooling fans are now connected in a parallel circuit.

Diagnostic Aids

- If the owner complained of an overheating problem, it must be determined if the complaint was due to an actual boil over, or the engine coolant temperature gauge indicated overheating. If the engine is overheating and the cooling fans are on, the cooling system should be checked.
- If the engine fuse block fuses EF3 or EF10 become open (blown) immediately after installation, inspect for a short to ground in the wiring of the appropriate circuit. If the fuses become open (blown) when the cooling fans are to be turned on by the Engine Control Module (ECM), suspect a faulty cooling fan motor.
- The ECM will turn the cooling fans on at low speed when the coolant temperature is 97°C (207°F). The ECM will turn the cooling fans off when the coolant temperature is 94°C (201°F).
- The ECM will turn the cooling fans on at high speed when the coolant temperature is 101°C (214°F). The ECM will change the cooling fans from high speed to low speed when the coolant temperature is 97°C (207°F).
- The ECM will turn the cooling fans on at low speed when the A/C system is on. The ECM will change the cooling fans from low speed to high speed when the high side A/C pressure is 1,860 kPa (270 psi) then return to low speed when the high side A/C pressure is 1,447 kPa (210 psi).
- The cooling fan circuit can be checked quickly by disconnecting the ECM connector and grounding the connector terminal K28. This should create low speed cooling fan operation with the ignition ON. By grounding the ECM connector terminals K12 and turning the ignition ON, high speed cooling fan operation should be achieved.

E*ngine Cooling* Fan *Circuit Check*(1.6*L DO*HC)

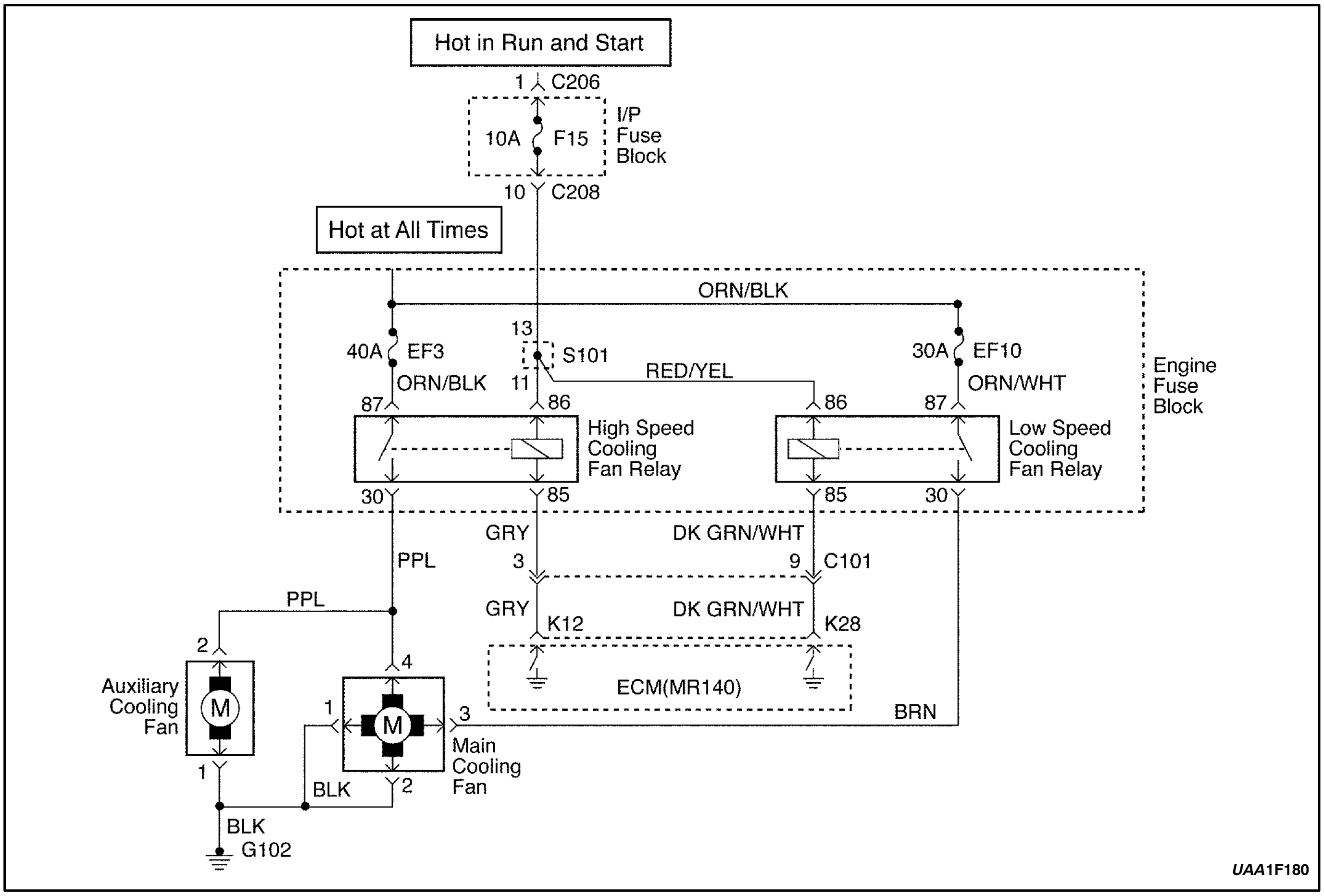
Step	*Action*	*Value(s)*	*Yes*	*No*
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "Euro On-Board Diagnostic System Check.
2	1. Check the fuses EF3 and EF10 in engine fuse block. 2. Replace the fuse(s) as needed. Is the fuse(s) OK?	–	Go to *Step 3*	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Turn the A/C switch OFF. If equipped. 3. Connect a scan tool to the Data Link Connector (DLC). 4. Start the engine. 5. The main cooling fan should run at low speed when the coolant temperature reaches 96°C (205°F). Does the cooling fan run at low speed?	–	Go to *Step 4*	Go to *Step 8*
4	The cooling fans should run at high speed when the coolant temperature reaches 100°C (212°F). Do the cooling fans run at high speed?	–	Go to *Step 5*	Go to *Step 19*
5	1. Turn the ignition OFF. 2. Start the engine. 3. Turn the A/C switch ON. Does the cooling fan runs at low speed?	–	Go to *Step 7*	Go to *Step 6*
6	1. Diagnose the A/C compressor clutch circuit. 2. Repair the A/C compressor clutch circuit as needed. Is the repair complete?	–	System OK	–
7	1. Turn the ignition OFF. 2. Connect the A/C pressure gauge. 3. Start the engine. 4. Turn the A/C switch ON and raise the rpm. 5. The cooling fan should run at high speed when the high side A/C pressure reaches 2068 kPa (300 psi). Do the cooling fans run at high speed?	–	System OK	–
8	1. Turn the ignition OFF. 2. Disconnect the main cooling fan connector. 3. Turn the ignition ON. 4. Connect a test light between terminal 3 of main cooling fan connector and ground. Is the test light on?	–	Go to *Step 9*	Go to *Step 12*
9	Connect a test light between terminal 1 of main cooling fan connector and battery positive. Is the test light on?	–	Go to *Step 11*	Go to *Step 10*
10	Repair open circuit between terminal 1 of main cooling fan connector and ground. Is the repair complete?	–	System OK	–
11	Check for a damaged terminals in main cooling fan connector and repair it or replace the main cooling fan. Is the repair complete?	–	System OK	–

Engine Cooling Fan *Circuit Check*(1.6*L DO*HC) (*Cont'd*)

Step	*Action*	*Value(s)*	*Yes*	*No*
12	1. Turn the ignition ON. 2. Connect a test light between terminals 86 and 87 of low speed cooling fan relay and ground. Does the test light on for both case?	–	Go to *Step 14*	Go to *Step 13*
13	Repair power supply circuit. ● Fuse F17 and terminal 86 of low speed cooling fan relay. ● Fuse EF10 and terminal 87 of low speed cooling fan relay. Is the repair complete?	–	System OK	Go to *Step 14*
14	1. Turn the ignition OFF. 2. Disconnect Engine Control Module (ECM) connectors. 3. Turn the ignition ON. 4. Connect a jump wire between terminal 10 and ground. Does the cooling fan run at low speed?	–	Go to *Step 15*	Go to *Step 16*
15	Replace the ECM. Is the repair complete?	–	System OK	–
16	1. Turn the ignition OFF. 2. Measure the resistance between following terminals: ● Terminal 85 of low speed cooling fan relay and terminal 10 of ECM connector. ● Terminal 30 of low speed cooling fan relay and terminal 3 of main cooling fan. Are the resistance within the value specified?	0 Ω	Go to *Step 18*	Go to *Step 17*
17	Repair open circuit. Is the repair complete?	–	System OK	–
18	Replace the low speed cooling fan relay. Is the repair complete?	–	System OK	–
19	1. Turn the ignition OFF. 2. Connect a test light between terminal 2 of main cooling fan connector and ground. Is the test light on?	–	Go to *Step 20*	Go to *Step 21*
20	Repair an open circuit between following terminals: ● Terminal 4 of main cooling fan connector and terminal 30 of high speed cooling fan relay. ● Terminal 2 of main cooling fan connector and ground. Is the repair complete?	–	System OK	Go to *Step 11*
21	1. Turn the ignition ON. 2. Connect a test light between terminals 86 and 87 of high speed cooling fan relay and ground. Does the test light on for both case?	–	Go to *Step 23*	Go to *Step 22*
22	Repair open power supply circuit: ● From fuse EF3 to terminal 87 of high speed cooling fan relay. ● From splice pack S101 to terminal 87 of high speed cooling fan relay. Is the repair complete?	–	System OK	Go to *Step 23*

Engine Cooling Fan Circuit Check(1.6L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
23	1. Turn the ignition OFF. 2. Disconnect Engine Control Module (ECM) connectors. 3. Turn the ignition ON. 4. Connect a jump wire between terminal 9 and ground. Does the cooling fans run at high speed?	–	Go to *Step 15*	Go to *Step 24*
24	1. Turn the ignition OFF. 2. Measure the resistance between following terminals: • Terminal 85 of high speed cooling fan relay and terminal 9 of ECM connector. • Terminal 30 of high speed cooling fan relay and terminal 4 of main cooling fan. • Terminal 30 of high speed cooling fan relay and terminal 2 of auxiliary cooling fan. Are the resistance within the value specified?	0 Ω	Go to *Step 26*	Go to *Step 25*
25	Repair open circuit between specific circuit wiring. Is the repair complete?	–	System OK	–
26	Replace the high speed cooling fan relay. Is the repair complete?	–	System OK	Go to *Step 15*



ENGINE COOLING FAN CIRCUIT CHECK(2.0L DOHC)

Circuit Description

The engine cooling fan circuit operates the main cooling fan and the auxiliary cooling fan. The cooling fans are controlled by the Engine Control Module (ECM) based on inputs from the Engine Coolant Temperature (ECT) sensor and the Air Conditioning Pressure (ACP) sensor. The ECM controls the low speed cooling fan operation by internally grounding the ECM connector terminal K28. This energizes the low speed cooling fan relay and operates the main cooling fan at low speed as the cooling fans. The ECM controls the high speed cooling fan operation by internally grounding the ECM connector terminal K12. This energizes the high speed cooling fan relay resulting in high speed fan operation as the cooling fans are now connected in a parallel circuit.

Diagnostic Aids

- If the owner complained of an overheating problem, it must be determined if the complaint was due to an actual boil over, or the engine coolant temperature gauge indicated overheating. If the engine is overheating and the cooling fans are on, the cooling system should be checked.
- If the engine fuse block fuses EF3 or EF10 become open (blown) immediately after installation, inspect for a short to ground in the wiring of the appropriate circuit. If the fuses become open (blown) when the cooling fans are to be turned on by the Engine Control Module (ECM), suspect a faulty cooling fan motor.
- The ECM will turn the cooling fans on at low speed when the coolant temperature is 96°C (205°F). The ECM will turn the cooling fans off when the coolant temperature is 90°C (194°F).
- The ECM will turn the cooling fans on at high speed when the coolant temperature is 100°C (212°F). The ECM will change the cooling fans from high speed to low speed when the coolant temperature is 94°C (201°F).
- The ECM will turn the cooling fans on at low speed when the A/C system is on. The ECM will change the cooling fans from low speed to high speed when the high side A/C pressure is 1,859 kPa (269 psi) then return to low speed when the high side A/C pressure is 1,449 kPa (210 psi).
- The cooling fan circuit can be checked quickly by disconnecting the ECM connector and grounding the connector terminal K28. This should create low speed cooling fan operation with the ignition ON. By grounding the ECM connector terminals K12 and turning the ignition ON, high speed cooling fan operation should be achieved.

Engine Cooling Fan Circuit Check(2.0L DOHC)

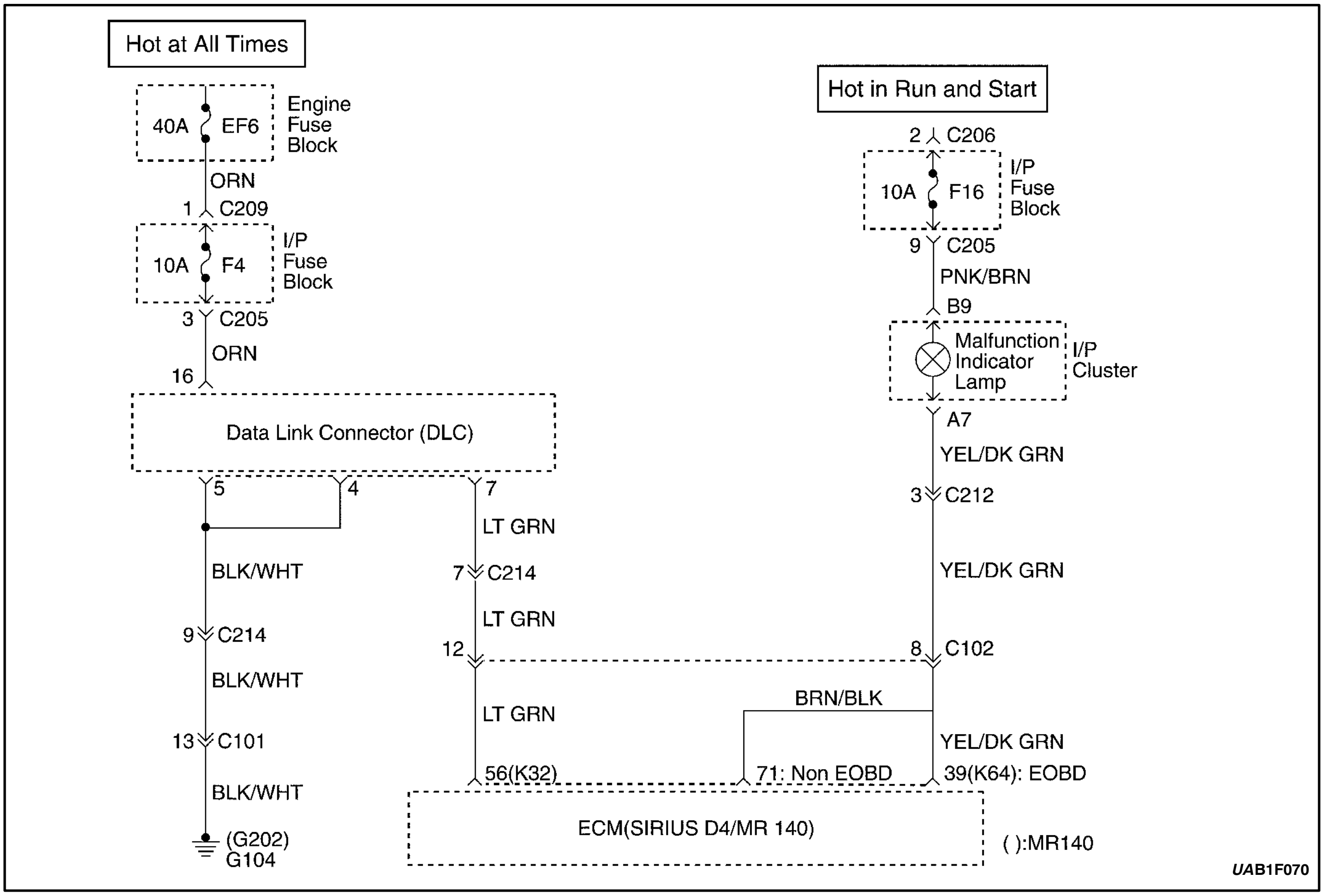
Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to Step 2	Go to "Euro On-Board Diagnostic System Check.
2	1. Check the fuses EF3 and EF10 in engine fuse block. 2. Replace the fuse(s) as needed. Is the fuse(s) OK?	–	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Turn the A/C switch OFF. If equipped. 3. Connect a scan tool to the Data Link Connector (DLC). 4. Start the engine. 5. The main cooling fan should run at low speed when the coolant temperature reaches 96°C (205°F). Does the cooling fan run at low speed?	–	Go to Step 4	Go to Step 8
4	The cooling fans should run at high speed when the coolant temperature reaches 100°C (212°F). Do the cooling fans run at high speed?	–	Go to Step 5	Go to Step 19
5	1. Turn the ignition OFF. 2. Start the engine. 3. Turn the A/C switch ON. Does the cooling fan runs at low speed?	–	Go to Step 7	Go to Step 6
6	1. Diagnose the A/C compressor clutch circuit. 2. Repair the A/C compressor clutch circuit as needed. Is the repair complete?	–	System OK	
7	1. Turn the ignition OFF. 2. Connect the A/C pressure gauge. 3. Start the engine. 4. Turn the A/C switch ON and raise the rpm. 5. The cooling fan should run at high speed when the high side A/C pressure reaches 2068 kPa (300 psi). Do the cooling fans run at high speed?	–	System OK	
8	1. Turn the ignition OFF. 2. Disconnect the main cooling fan connector. 3. Turn the ignition ON. 4. Connect a test light between terminal 3 of main cooling fan connector and ground. Is the test light on?	–	Go to Step 9	Go to Step 12
9	Connect a test light between terminal 1 of main cooling fan connector and battery positive. Is the test light on?	–	Go to Step 11	Go to Step 10
10	Repair open circuit between terminal 1 of main cooling fan connector and ground. Is the repair complete?	–	System OK	
11	Check for a damaged terminals in main cooling fan connector and repair it or replace the main cooling fan. Is the repair complete?	–	System OK	

*E**ngine Cooling*** **Fan** ***Circuit Check*****(2.0*****L DO*****HC)** **(*****Cont'd*****)**

Step	Action	Value(s)	Yes	No
12	1. Turn the ignition ON. 2. Connect a test light between terminals 86 and 87 of low speed cooling fan relay and ground. Does the test light on for both case?	–	Go to *Step 14*	Go to *Step 13*
13	Repair power supply circuit. • Fuse F17 and terminal 86 of low speed cooling fan relay. • Fuse EF10 and terminal 87 of low speed cooling fan relay. Is the repair complete?	–	System OK	Go to *Step 14*
14	1. Turn the ignition OFF. 2. Disconnect Engine Control Module (ECM) connectors. 3. Turn the ignition ON. 4. Connect a jump wire between terminal K28 and ground. Does the cooling fan run at low speed?	–	Go to *Step 15*	Go to *Step 16*
15	Replace the ECM. Is the repair complete?	–	System OK	–
16	1. Turn the ignition OFF. 2. Measure the resistance between following terminals: • Terminal 85 of low speed cooling fan relay and terminal K28 of ECM connector. • Terminal 30 of low speed cooling fan relay and terminal 3 of main cooling fan. Are the resistance within the value specified?	0 Ω	Go to *Step 18*	Go to *Step 17*
17	Repair open circuit. Is the repair complete?	–	System OK	–
18	Replace the low speed cooling fan relay. Is the repair complete?	–	System OK	–
19	1. Turn the ignition OFF. 2. Disconnect the auxiliary cooling fan connector. 3. Turn the ignition ON. 4. Connect a test light between terminal 2 of main cooling fan connector and ground. Is the test light on?	–	Go to *Step 20*	Go to *Step 24*
20	Connect a test light between terminal 1 of auxiliary cooling fan connector and battery positive. Is the test light on?	–	Go to *Step 21*	Go to *Step 23*
21	Replace the auxiliary cooling fan. Is the repair complete?	–	System OK	Go to *Step 22*
22	Repair an open circuit between following terminals: • Terminal 4 of main cooling fan connector and terminal 30 of high speed cooling fan relay. • Terminal 2 of main cooling fan connector and ground. Is the repair complete?	–	System OK	Go to *Step 11*
23	Repair an open circuit between terminal 1 of auxiliary cooling fan connector and ground. Is the repair complete?	–	System OK	–

E**ngine Cooling* **F**an Circuit Check(**2.0L DO***HC**) (*Cont'd*)

Step	*Action*	*Value(s)*	*Yes*	*No*
24	1. Turn the ignition ON. 2. Connect a test light between terminals 86 and 87 of high speed cooling fan relay and ground. Does the test light on for both case?	–	Go to *Step 26*	Go to *Step 25*
25	Repair open power supply circuit: ● From fuse EF3 to terminal 87 of high speed cooling fan relay. ● From splice pack S101 to terminal 87 of high speed cooling fan relay. Is the repair complete?	–	System OK	Go to *Step 26*
26	1. Turn the ignition OFF. 2. Disconnect Engine Control Module (ECM) connectors. 3. Turn the ignition ON. 4. Connect a jump wire between terminal K12 and ground. Does the cooling fans run at high speed?	–	Go to *Step 15*	Go to *Step 27*
27	1. Turn the ignition OFF. 2. Measure the resistance between following terminals: ● Terminal 85 of high speed cooling fan relay and terminal K12 of ECM connector. ● Terminal 30 of high speed cooling fan relay and terminal 4 of main cooling fan. ● Terminal 30 of high speed cooling fan relay and terminal 2 of auxiliary cooling fan. Are the resistance within the value specified?	0 Ω	Go to *Step 29*	Go to *Step 28*
28	Repair open circuit between specific circuit wiring. Is the repair complete?	–	System OK	–
29	Replace the high speed cooling fan relay. Is the repair complete?	–	System OK	Go to *Step 15*



DATA LINK CONNECTOR DIAGNOSIS

Circuit Description

The provision for communicating with the Engine Control Module (ECM) is the Data Link Connector (DLC). It is located under the instrument panel. The DLC is used to connect the scan tool. Battery power and ground is supplied for the scan tool through the DLC. The Keyword 2000 serial data circuit to the DLC allows the ECM to communicate with the scan tool. A Universal Asynchronous Receiver Transmitter (UART) serial data line is used to communicate with the other modules such as the Electronic Brake Control Module (EBCM), the Supplemental Inflatable Restraint (SIR) system. and the Instrument Panel Cluster.

Diagnostic Aids

Ensure that the correct application (model line, car year, etc.) has been selected on the scan tool. If communication still cannot be established, try the scan tool on another vehicle to ensure that the scan tool or cables are not the cause of the condition.

An intermittent may be caused by a poor connection, rubbed through wire insulation, or a broken wire inside the insulation.

Any circuitry that is suspected of causing an intermittent complaint should be thoroughly checked for the following conditions:

- Backed-out terminals.
- Improper mating of terminals.
- Broken locks.
- Improperly formed or damaged terminals.
- Poor terminal-to-wiring connection.
- Physical damage to the wiring harness.
- Corrosion.

Data Link Connector Diagnosis

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "Euro On-Board Diagnostic System Check.
2	With a test light connected to the ground, probe the Data Link Connector (DLC) battery feed terminal 16. Is the test light on?	–	Go to *Step 4*	Go to *Step 3*
3	Repair an open or short to ground in the DLC battery feed circuit . Is the repair complete?	–	Go to *Step 4*	–
4	With a test light connected to the battery, probe the Data Link Connector (DLC) ground terminal 4 and 5. Is the test light on?	–	Go to *Step 6*	Go to *Step 5*
5	Repair an open circuit . Is the repair complete?	–	Go to *Step 6*	–
6	1. Turn the ignition OFF. 2. Connect a scan tool to the Data Link Connector (DLC). 3. Turn the ignition ON. Does the scan tool power up?	–	Go to *Step 8*	Go to *Step 7*
7	Check for damages in the terminal of DLC and scan tool, and repair as needed. Is the repair complete?	–	Go to *Step 8*	–
8	Using a scan tool, request engine data of Engine Control Module (ECM). Does the scan tool display any data?	–	Go to *Step 12*	Go to *Step 9*
9	Install the scan tool on another vehicle and check for proper operation. Does the scan tool work properly on a different vehicle.	–	Go to *Step 11*	Go to *Step 10*
10	The scan tool is malfunctioning. Refer to the scan tool's manual for repair. Is the repair complete?	–	Go to *Step 12*	–
11	Repair communication circuit between ECM and DLC. Is the repair complete?	–	Go to *Step 12*	–
12	1. Using a scan tool, clear the Diagnostic Trouble Codes(DTCs). 2. Attempt to start the engine. Does the engine and continue to run?	–	Go to *Step 13*	Go to *Step 1*
13	1. Allow the engine to idle until normal operation temperature reached. 2. Check if any DTCs are set? Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

FUEL INJECTOR BALANCE TEST

A fuel injector tester is used to energize the injector for a precise amount of time, thus spraying a measured amount of fuel into the intake manifold. This causes a drop in the fuel rail pressure that can be recorded and used to compare each of the fuel injectors. All of the fuel injectors should have the same pressure drop.

Fuel Injector Balance Test Example

Cylinder	**1**	**2**	**3**	**4**
First Reading	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)
Second Reading	131 kPa (19 psi)	117 kPa (17 psi)	124 kPa (18 psi)	145 kPa (21 psi)
Amount Of Drop	165 kPa (24 psi)	179 kPa (26 psi)	172 kPa (25 psi)	151 kPa (22 psi)
Average Range: 156-176 kPa (22.5-25.5 psi)	Injector OK	Faulty Injector – Too Much Pressure Drop	Injector OK	Faulty Injector – Too Little Pressure Drop

Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

Caution: Do not pinch or restrict nylon fuel lines. Damage to the lines could cause a fuel leak, resulting in possible fire or personal injury.

Notice: In order to prevent flooding of the engine, do not perform the Injector Balance Test more than once (including any retest on faulty fuel injectors) without running the engine.

Test

1. Turn the ignition ON in order to get the fuel pressure to its maximum level.
2. Allow the fuel pressure to stabilize and then record this initial pressure reading. Wait until there is no movement of the needle on the fuel pressure gauge.
3. Follow the manufacturer's instructions for the use of the adapter harness. Energize the fuel injector tester once and note the fuel pressure drop at its lowest point. Record this second reading. Subtract it from the first reading to determine the amount of the fuel pressure drop.
4. Disconnect the fuel injector tester from the fuel injector.
5. After turning the ignition ON, in order to obtain maximum pressure once again, make a connection at the next fuel injector. Energize the fuel injector tester and record the fuel pressure reading. Repeat this procedure for all the injectors.
6. Retest any of the fuel injectors that the pressure drop exceeds the 10 kPa (1.5 psi) of the average pressure drop value.
7. Replace any of the fuel injectors that fail the retest.
8. If the pressure drop of all of the fuel injectors is within 10 kPa (1.5 psi) of the average pressure drop value, then the fuel injectors are flowing normally and no replacement should be necessary.
9. Reconnect the fuel injector harness and review the symptom diagnostic tables.
10. An engine cool down period of 10 minutes is necessary in order to avoid irregular readings due to hot soak fuel boiling.
11. Connect the fuel pressure gauge carefully to avoid any fuel spillage.
12. The fuel pump should run about 2 seconds after the ignition is turned to the ON position.
13. Insert a clear tube attached to the vent valve of the fuel pressure gauge into a suitable container.
14. Bleed the air from the fuel pressure gauge and hose until all of the air is bled from the fuel pressure gauge.
15. The ignition switch must be in the OFF position at least 10 seconds in order to complete the Engine Control Module (ECM) shutdown cycle.

DIAGNOSTIC TROUBLE CODE DIAGNOSIS (1.6L DOHC)

CLEARING TROUBLE CODES

Notice: To prevent Engine Control Module (ECM) damage, the key must be OFF when disconnecting or reconnecting the power to the ECM (for example battery cable, ECM pigtail connector, ECM fuse, jumper cables, etc.).When the ECM sets a Diagnostic Trouble Code (DTC), the Malfunction Indicator Lamp (MIL) lamp will be turned on only for type A, B and E but a DTC will be stored in the ECM's memory for all types of DTC. If the problem is intermittent, the MIL will go out after 10 seconds if the fault is no longer present. The DTC will stay in the ECM's memory until cleared by scan tool. Removing battery voltage for 10 seconds will clear some stored DTCs.

DTCs should be cleared after repairs have been completed. Some diagnostic tables will tell you to clear the codes before using the chart. This allows the ECM to set the DTC while going through the chart, which will help to find the cause of the problem more quickly.

DIAGNOSTIC TROUBLE CODES

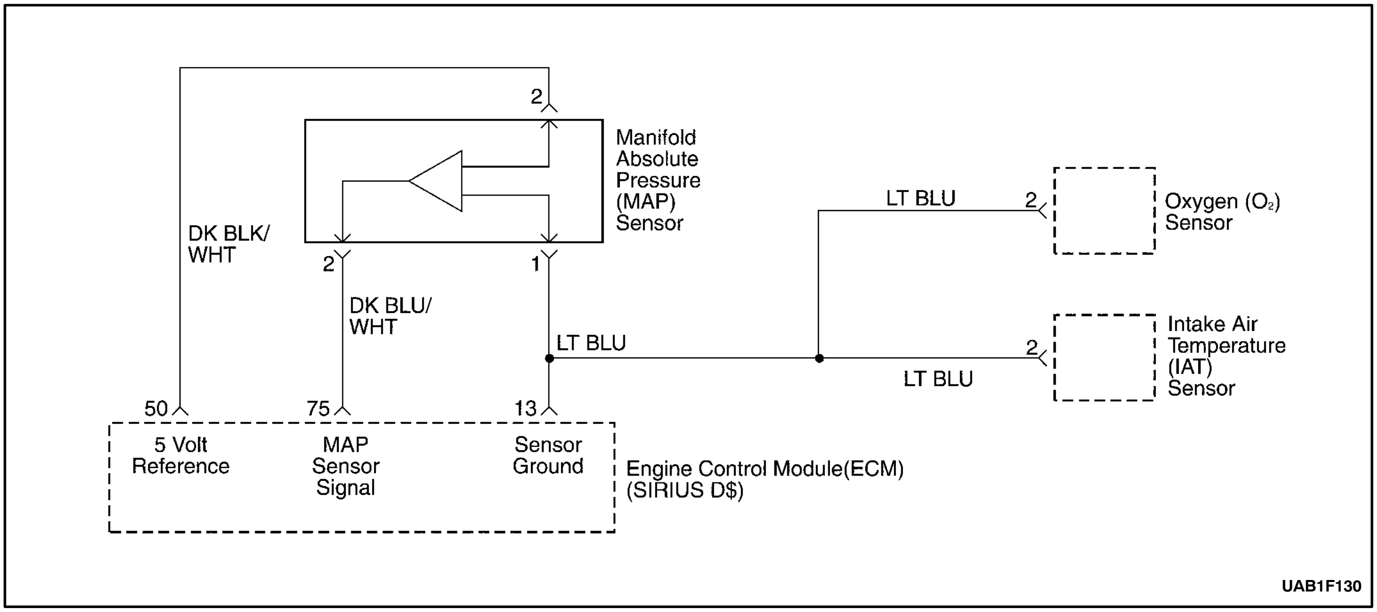
DTC	Function	Error Type	Illuminate MIL
P0107	Manifold Absolute Pressure Sensor Low Voltage	A	YES
P0108	Manifold Absolute Pressure Sensor High voltage	A	YES
P0112	Intake Air Temperature Sensor Low Voltage	E	YES
P0113	Intake Air Temperature Sensor High voltage	E	YES
P0117	Engine Coolant Temperature Sensor Low Voltage	A	YES
P0118	Engine Coolant Temperature Sensor High voltage	A	YES
P0122	Throttle Position Sensor Low Voltage	A	YES
P0123	Throttle Position Sensor Hig voltage	A	YES
P0131	Oxygen Sensor Low Voltage	A	YES
P0132	Oxygen Sensor High Voltage	A	YES
P0133	Oxygen Sensor No Activity	E	YES
P0137	Heated Oxygen Sensor Low Voltage	E	YES
P0138	Heated Oxygen Sensor high voltage	E	YES
P0140	Heated Oxygen Sensor No Activity	E	YES
P0141	Heated Oxygen Sensor Heater Malfuction	E	YES
P0171	Fuel Trim System Too Lean	E	YES
P0172	Fuel Trim System Too Rich	E	YES
P1181	Variable Geometry Induction System Solenoid Low Voltage	A	YES
P1182	Variable Geometry Induction System Solenoid High Voltage	A	YES
P0222	Main Throttle Idle Actuactor (MTIA) Low Voltage	A	YES
P0223	Main Throttle Idle Actuactor (MTIA) High voltage	A	YES
P1230	Fuel Pump Relay Low Voltage	A	YES
P1231	Fuel Pump Relay High Voltage	A	YES
P0261	Injector 1 Low Voltage	A	YES
P0262	Injector 1 high voltage	A	YES
P0264	Injector 2 Low Voltage	A	YES
P0265	Injector 2 high voltage	A	YES
P0267	Injector 3 Low Voltage	A	YES
P0268	Injector 3 high voltage	A	YES
P0270	Injector 4 Low Voltage	A	YES

Diagnostic Trouble Codes (Cont'd)

DTC	Function	Error Type	Illuminate MIL
P0271	Injector 4 high voltage	A	YES
P0300	Multiple Cylinder Misfire (Catalyst Damage)	A	BLINKING
P0300	Multiple Cylinder Misfire (Increase Emission)	E	YES
P1320	Crankshatft Segment Period Segment Adaptation At Limit	E	YES
P1321	Crankshatft Segment Period Tooth Error	E	YES
P0327	Knock Sensor Circuit Fault	E	YES
P0335	Magnetic Crankshaft Position Sensor Electrical Error	E	YES
P0336	58X Crankshaft Position Sensor Extra/missing Pulse	E	YES
P0337	58X Crankshaft Sensor No Signal	E	YES
P0341	Camshaft Position Sensor Rationality	E	YES
P0342	Camshaft Position Sensor No Signal	E	YES
P0351	Ignition Signal Coil A Fault	A	YES
P0352	Ignition Signal Coil B Fault	A	YES
P1382	Rough Road Data Invalid (Non ABS)	Cnl	NO
P1382	Rrough Road Data Invalid (ABS)	Cnl	NO
P1385	Rough Road Sensor Circuit Fault (Non ABS)	Cnl	NO
P1385	Rough Road Sensor Circuit Fault (ABS)	Cnl	NO
P0400	Exhaust Gas Recirculation Out of Limit	E	YES
P1402	Exhaust Gas Recirculation Blocked	E	YES
P1403	Exhaust Gas Recirculation Valve Failure	E	YES
P0404	Exhaust Gas Recirculation (EGR) Ppend	E	YES
P1404	Exhaust Gas Recirculation (EGR) Closed	E	YES
P0405	EGR Pintle Position Sensor Low Voltage	E	YES
P0406	EGR Pintle Position Sensor High voltage	E	YES
P0420	Catalyst Low Efficiency	E	YES
P0444	EVAP Purge Control Circuit No Signal	E	YES
P0445	EVAP Purge Control Circuit Fault	E	YES
P0462	Fuel Level Sensor Low Voltage	Cnl	NO
P0463	Fuel Level Sensor High voltage	Cnl	NO
P0480	Low Speed Cooling Fan Relay Circuit Fault (Without A/C)	Cnl	NO
P0480	Low Speed Cooling Fan Relay Circuit Fault (With A/C)	Cnl	NO
P0481	High Speed Cooling Fan Relay High Voltage (Without A/C)	Cnl	NO
P0481	High Speed Cooling Fan Relay High Voltage (With A/C)	Cnl	NO
P0501	Vehicle Speed No Signal (M/T Only)	A	YES
P0510	Throttle Positon Switch Circuit Fault	A	YES
P1511	Idle Charge Actuactor Circuit Fault	E	YES
P1512	Idle Charge Actuactor Mechanical Error	E	YES
P1513	Idle Charge Actuactor Functionnal Error	Cnl	NO
P0532	A/C Pressure Sensor Low Voltage	Cnl	NO
P0533	A/C Pressure Sensor High voltage	Cnl	NO
P1537	A/C Compressor Relay High Voltage	Cnl	NO
P1538	A/C Compressor Relay Low Voltage	Cnl	NO
P0562	System Voltage (Engine Side) Too Low	Cnl	NO

Diagnostic Trouble Codes (Cont'd)

DTC	Function	Error Type	Illuminate MIL
P0563	System Voltage (Engine Side) Too High	Cnl	NO
P0601	Engine Control Module Checksum Error	E	YES
P0604	Engine Control Module RAM Error	E	YES
P0605	Engine Control Module INMVY Write Error	E	YES
P1610	Main Relay High Voltage	A	YES
P1611	Main Relay Low Voltage	A	YES
P1628	Immobilizer No Successful Communication	Cnl	NO
P1629	Immobilizer Wrong Computation	Cnl	NO
P0654	Engine Speedometer Circuit Fault	Cnl	NO
P0656	Fuel Level Gauge High Circuit Fault	Cnl	NO
P1660	Malfunction Indicator Lamp(MIL) High Voltage	E	YES
P1661	Malfunction Indicator Lamp(MIL) Low Voltage	E	YES



DIAGNOSTIC TROUBLE CODE (DTC) – P0107 MANIFOLD ABSOLUTE PRESSURE SENSOR LOW VOLTAGE

Circuit Description

The engine control module (ECM) uses the Manifold Absolute Pressure (MAP) sensor to control the fuel delivery and the ignition timing. The MAP sensor measures the changes in the intake manifold pressure, which results from engine load (intake manifold vacuum) and the rpm changes; and converts these into voltage outputs. The ECM sends a 5 volt-reference voltage to the MAP sensor. As the manifold pressure changes, the output voltage of the MAP sensor also changes. By monitoring the MAP sensor output voltage, the ECM knows the manifold pressure. A low-pressure (low voltage) output voltage will be about 1.0 to 1.5 volts at idle, while higher pressure (high voltage) output voltage will be about 4.5 to 4.8 at wide open throttle (WOT). The MAP sensor is metric pressure, allowing the ECM to make adjustments for different altitudes.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.

(Case A)

- When the engine idling.
- No throttle position(TP) sensor MTIA fail conditions present.
- Engine speed(rpm) is less than 2,500rpm.
- The MAP is less than 12.0kPA.

(Case A)

- When the engine part load.
- The engine revolution speed is less than 4,000rpm.
- No Throttle Position (TP) Sensor fails conditions present.
- The Throttle Position (TP) angle greather than 30.0°
- The MAP is less than 11.5 kPA.
- An open or low voltage condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The coolant fan turns ON.
- The ECM will substitutes a fixed MAP value and use TP to control the fuel delivery (the scan tool will not show defaulted)

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

With the ignition ON and the engine stopped, the manifold pressure is equal to atmosphere pressure and the signal voltage will be high.

The ECM as an indication of vehicle altitude uses this information. Comparison of this reading with a known good vehicle with the same sensor is a good way to check the accuracy of a suspect sensor. Readings should be the same ±0.4volt.

If a DTC P 0107 is intermittent, refer to *"Manifold Absolute Pressure Check"* in this Section for further diagnosis.

If the connections are OK monitor the manifold absolute pressure (MAP) sensor signal voltage while moving related connectors and the wiring harness. If the failure is induced, the display on the scan tool will change. This may help to isolate the location of an intermittent malfunction.

DTC P0107 – Manifold Absolute Pressure Sensor Low voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Connect the scan tool to the data link connector (DLC). 2. Turn the ignition switch to ON. Does the scan tool show the manifold absolute pressure (MAP) sensor voltage above the value specified?	4V	Go to *Step 3*	Go to *Step 4*
3	1. Disconnect the vacuum line from the MAP sensor. 2. Apply 88kPA (20in.of Hg) of vacuum to the MAP sensor. Does the scan tool show the MAP sensor voltage within the value specified?	1.0–1.5V	Go to "Diagnostic Aids"	Go to *Step 4*
4	1. Turn the ignition switch to LOCK. 2. Disconnect the MAP sensor connector. 3. Turn the ignition switch to ON. 4. Measure the voltage between the MAP sensor connector terminals 1 and 3. Does the voltage measure within the value specified?	4.5–5.5V	Go to *Step 5*	Go to *Step 6*
5	Connect a fused jumper between the MAP sensor connector terminals 2 and 3. Does the scan tool show the MAP sensor voltage above the value specified?	4V	Go to *Step 11*	Go to *Step 9*
6	Measure the voltage between the MAP sensor connector terminal 1 and ground. Does the voltage measure within the value specified?	4.5–5.5V	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition switch to LOCK. 2. Check for open wires between the MAP sensor connector terminal 1 and the ECM connector terminal 13. Is the problem found?	–	Go to *Step 10*	Go to *Step 12*
8	1. Turn the ignition switch to LOCK. 2. Check for an open or short to ground in the wire between the MAP sensor connector terminal 3 and the ECM connector terminal 50. Is the problem found ?	–	Go to *Step 10*	Go to *Step 12*
9	1. Turn the ignition switch to LOCK. 2. Check for an open or short to ground in the wire between the MAP sensor connector terminal 2 and the ECM connector terminal 75. Is the problem found ?	–	Go to *Step 10*	Go to *Step 12*

DTC P0107 – Manifold Absolute Pressure Sensor Low voltage (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
11	1. Replace the manifold absolute pressure sensor. 2. Clear any DTCs from the ECM. 3. Perform the diagnostic system check. Is the replacement complete?	–	System OK	–
12	Replace the ECM. Is the replacement complete?	–	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

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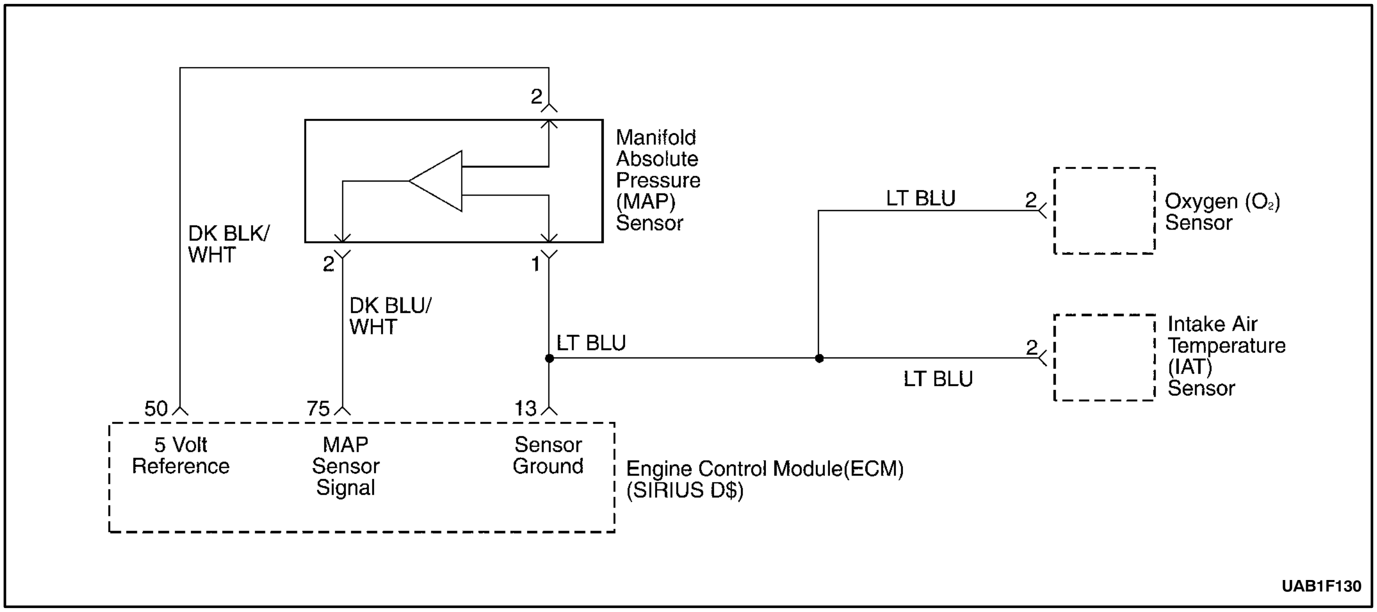

DIAGNOSTIC TROUBLE CODE (DTC) – P0108 MANIFOLD ABSOLUTE PRESSURE SENSOR HIGH VOLTAGE

Circuit Description

The engine control module (ECM) uses the Manifold Absolute Pressure (MAP) sensor to control the fuel delivery and the ignition timing. The MAP sensor measures the changes in the intake manifold pressure, which results from engine load (intake manifold vacuum) and the rpm changes; and converts these into voltage outputs. The ECM sends a 5 volt-reference voltage to the MAP sensor. As the manifold pressure changes, the output voltage of the MAP sensor also changes. By monitoring the MAP sensor output voltage, the ECM knows the manifold pressure. A low-pressure (low voltage) output voltage will be about 1.0 to 1.5 volts at idle, while higher pressure (high voltage) output voltage will be about 4.5 to 4.8 at wide open throttle (WOT). The MAP sensor is metric pressure, allowing the ECM to make adjustments for different altitudes.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- When the engine idling.
- Engine speed is greater than 700rpm.
- No throttle position sensor (TPS) fail conditions present.
- The MAP is greater than 95kPA.
- A high voltage condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The ECM will substitutes a fixed MAP value and use TP to control the fuel delivery (the scan tool will not show defaulted)

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

With the ignition ON and the engine stopped, the manifold pressure is equal to atmosphere pressure and the signal voltage will be high.

The ECM as an indication of vehicle altitude uses this information. Comparison of this reading with a known good vehicle with the same sensor is a good way to check the accuracy of a suspect sensor. Readings should be the same ±0.4volt.

If a DTC P 0108 is intermittent, refer to *“manifold absolute pressure check”* in this Section for further diagnosis.

If the connections are OK monitor the manifold absolute pressure(MAP) sensor signal voltage while moving related connectors and the wiring harness. If the failure is induced, the display on the scan tool will change. This may help to isolate the location of an intermittent malfunction.

DTC P0108 – Manifold Absolute Pressure Sensor High voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Connect the scan tool to the data link connector (DLC). 2. Turn the ignition switch to ON. Does the scan tool show the manifold absolute pressure (MAP) sensor voltage above the value specified?	4V	Go to *Step 3*	Go to *Step 4*
3	1. Disconnect the vacuum line from the MAP sensor. 2. Apply 66kPA (20in.of Hg) of vacuum to the MAP sensor. Does the scan tool show the MAP sensor voltage within the value specified?	1.0–1.5V	Go to “Diagnostic Aids”	Go to *Step 4*
4	1. Turn the ignition switch to LOCK. 2. Disconnect the MAP sensor connector. 3. Turn the ignition switch to ON. 4. Measure the voltage between the MAP sensor connector terminals 1 and 3. Does the voltage measure within the value specified?	4.5–5.5V	Go to *Step 5*	Go to *Step 6*
5	Connect a fused jumper between the MAP sensor connector terminals 2 and 3. Does the scan tool show the MAP sensor voltage above the value specified?	4V	Go to *Step 11*	Go to *Step 9*
6	Measure the voltage between the MAP sensor connector terminal 1 and ground. Does the voltage measure within the value specified?	4.5–5.5V	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition switch to LOCK. 2. Check for open wires between the MAP sensor connector terminal 1 and the ECM connector terminal 13. Is the problem found?	–	Go to *Step 10*	Go to *Step 12*
8	1. Turn the ignition switch to LOCK. 2. Check for an open or short to ground in the wire between the MAP sensor connector terminal 3 and the ECM connector terminal 50. Is the problem found ?	–	Go to *Step 10*	Go to *Step 12*
9	1. Turn the ignition switch to LOCK. 2. Check for an open or short to ground in the wire between the MAP sensor connector terminal 2 and the ECM connector terminal 75. Is the problem found ?	–	Go to *Step 10*	Go to *Step 12*
10	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–

DTC P0108 – Manifold Absolute Pressure Sensor High voltage (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Replace the manifold absolute pressure sensor. 2. Clear any DTCs from the ECM. 3. Perform the diagnostic system check. Is the replacement complete?	–	System OK	–
12	Replace the ECM. Is the replacement complete?	–	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

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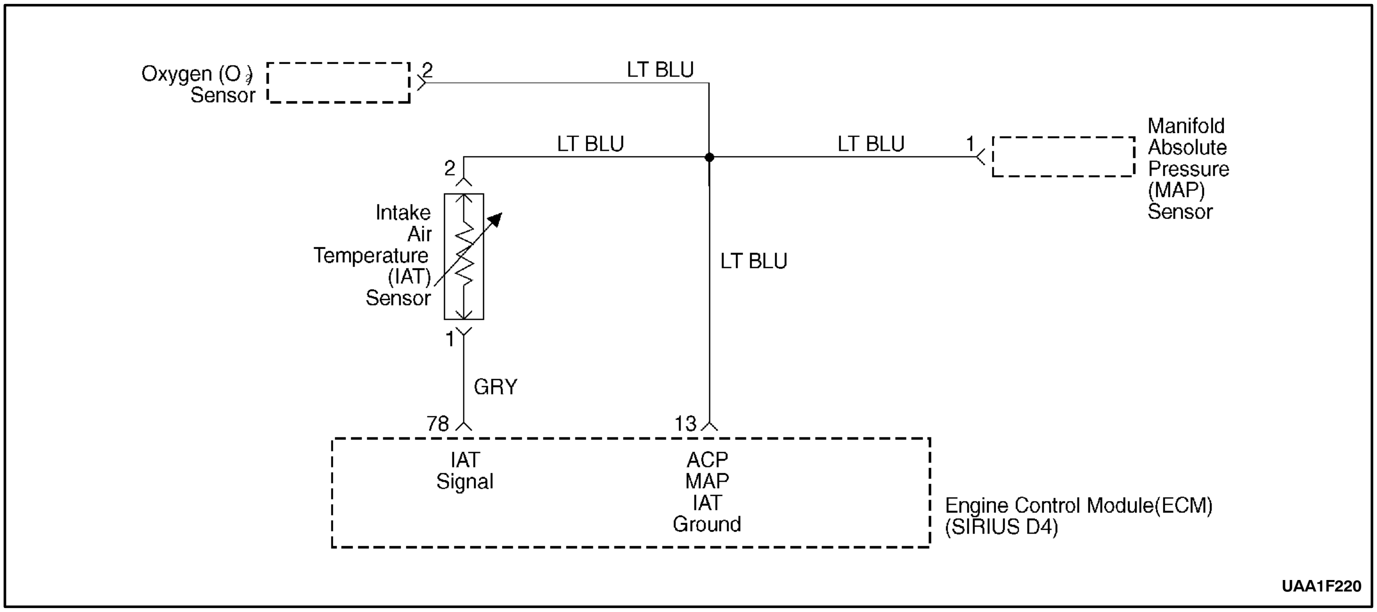


DIAGNOSTIC TROUBLE CODE (DTC) – P0112 INTAKE AIR TEMPERATURE SENSOR LOW VOLTAGE

Circuit Description

The Intake Air Temperature (IAT) Sensor uses a thermistor to control the signal voltage to the engine control module (ECM). The ECM supplies a 5 volt reference voltage and a ground to the sensor. When the air is cold, the resistance is high ; therefore IAT sensor signal voltage will be high. If the intake air is warm, resistance is low ; therefore the IAT sensor signal voltage will be low.

Conditions for Setting the DTC

- IAT voltage is less than 0.01V

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The ECM will default to 60°C(140°F) for intake air temperature. The scan tool will not show the defaulted value.

Conditions for Clearing the MIL/DTC

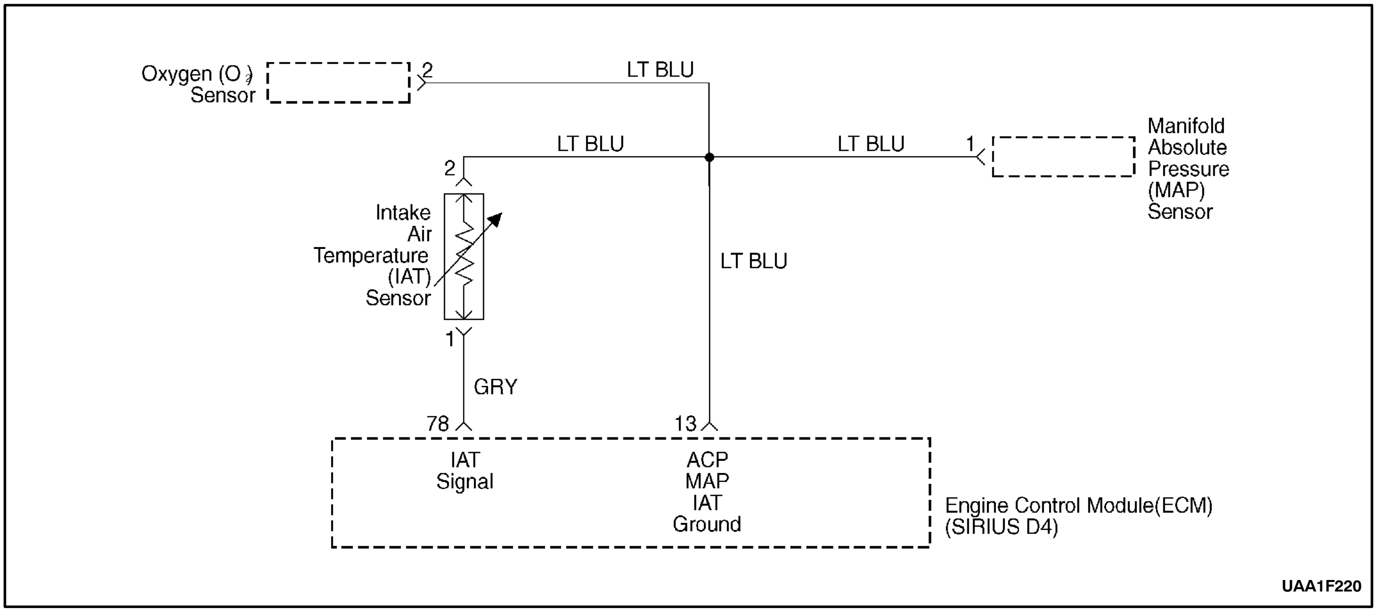
- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic aids

If the vehicle is at ambient temperature, compare the IAT sensor to the engine coolant temperature(ECT) sensor. The IAT sensor and the ECT sensor should be relatively close to each other. Use the temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to *"Temperature vs. Resistance"* in this Section.

DTC P0112 – Intake Air Temperature Sensor Low voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Connect the scan tool to the data link connector(DLC). 2. Run the engine until it reaches operating temperature. Does the scan tool show the IAT sensor reading within the value specified?	15–80°C	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the IAT sensor connector. 3. Turn the ignition switch to ON. Does the scan tool show the IAT sensor reading within the value specified?	≤ -30°C	Go to *Step 4*	Go to *Step 5*
4	Check for a faulty connector or terminals at the IAT sensor connector. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
5	Check for wire for a short to ground between the IAT connector terminal 1 and the ECM connector terminal 78. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
6	Check for wire for a short to ECM reference voltage between the IAT sensor connector terminal 2 and the ECM connector terminal 13. Is the problem found?	4.5–5.5V	Go to *Step 7*	Go to *Step 9*
7	1. Turn the ignition switch to LOCK. 2. Repair the wire or the connector terminal as needed. 3. Clear any DTCs from the ECM. 4. Run the engine until it reaches operating temperature. 5. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
8	1. Turn the ignition switch to LOCK. 2. Replace the IAT sensor. 3. Clear any DTCs from the ECM. 4. Run the engine until it reaches operating temperature. 5. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
9	1. Turn the ignition switch to LOCK. 2. Replace the engine control module(ECM). 3. Run the engine until it reaches operating temperature. 4. Perform the diagnostic system check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0113 INTAKE AIR TEMPERATURE SENSOR HIGH VOLTAGE

Circuit Description

The Intake Air Temperature (IAT) Sensor uses a thermistor to control the signal voltage to the engine control module (ECM). The ECM supplies a 5 volt reference voltage and a ground to the sensor . when the air is cold, the resistance is high ; therefore IAT sensor signal voltage will be high. If the intake air is warm, resistance is low ; therefore the IAT sensor signal voltage will be low.

Conditions for Setting the DTC

- IAT voltage is greater than 4.99V.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The ECM will default to 60°C(140°F) for intake air temperature. The scan tool will not show the defaulted value.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

If the vehicle is at ambient temperature, compare the IAT sensor to the engine coolant temperature (ECT) sensor. The IAT sensor and the ECT sensor should be relatively close to each other.

Use the temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to *"Temperature vs. Resistance"* in this Section.

DTC P0113 – Intake Air Temperature Sensor High voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Connect the scan tool to the data link connector (DLC). 2. Run the engine unit it reaches operating temperature. Does the scan tool show the intake air temperature (IAT) sensor reading within the value specified?	15~80°C (10~176°F)	Go to “Diagnostic Aids”	Go to *Step 3*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the IAT sensor connector. 3. Jumper to IAT sensor connector terminals. 4. Turn the ignition switch to ON. Does the scan tool show the IAT sensor reading the value specified?	180°C (356°F)	Go to *Step 4*	Go to *Step 5*
4	Check for a faulty connector or terminals 1 and 2 of the IAT sensor connector. Is the problem found?	–	Go to *Step 10*	Go to *Step 9*
5	Measure the voltage between terminals 1 and 2 of IAT sensor connector. Does the voltage measure within the value specified?	4.5~5.5V	Go to *Step 11*	Go to *Step 6*
6	Measure the voltage between the IAT sensor connector terminal 2 and the battery ground(negative) post. Does the voltage measure within the value specified?	4.5~5.5V	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition switch to LOCK. 2. Check for an open or short to battery voltage in the wire between the IAT sensor connector terminal 2 and the engine control module(ECM) connector terminal 13. Is the problem found?	–	Go to *Step 10*	Go to *Step 11*
8	1. Turn the ignition switch to LOCK. 2. Check for an open or short to battery voltage in the wire between the IAT sensor connector terminal 1 and the ECM connector terminal 78. Is the problem found?	–	Go to *Step 10*	Go to *Step 11*
9	1. Turn the ignition switch to LOCK 2. Replace the IAT sensor. 3. Clear any DTCs from the ECM. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
10	1. Turn the ignition switch to LOCK. 2.Repair the wire of the connector terminals as needed. 3. Clear any DTCs from the ECM. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	–

DTC P0113 – Intake Air Temperature Sensor High voltage (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Replace the ECM 2. Perform the diagnostic system check. Is the repair complete?	–	Go to *Step 12*	–
12	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

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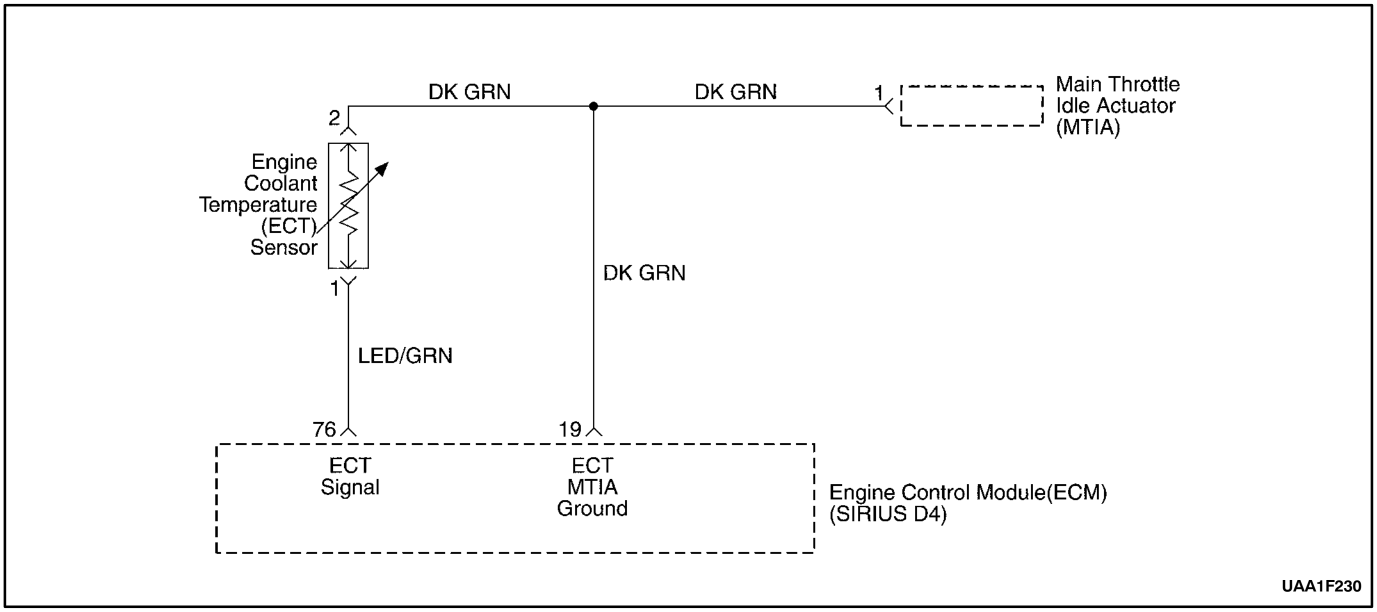


DIAGNOSTIC TROUBLE CODE (DTC) – P0117 ENGINE COOLANT TEMPERATURE SENSOR LOW VOLTAGE

Circuit Description

The Engine Coolant Temperature sensor (ECT) uses a thermistor to control the signal voltage to the engine control module (ECM).

The ECM supplies a voltage on the signal circuit to the sensor. When the engine coolant is cold, the resistance is high; therefore the ECT signal voltage will be high.

As the engine warms, the sensor resistance becomes less, and the voltage drops. At normal engine operating temperature, the voltage will be between 1.5 and 2.0 volts at the ECT signal terminal.

The ECT sensor is used to the following items:

- Fuel delivery.
- Lock Up Clutch (LUC).
- Ignition.
- Evaporator Emission (EVAP) Canister Purge Valve.
- Electric cooling fan.

Conditions for Setting the DTC

- ECT voltage is less than 0.03V.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The coolant fan turns ON.
- The ECM will default to 20°C(68°F) for the first 60 seconds of the engine run time, and then 92°C(198°F).
- the scan ttol will not show the defaulted value.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

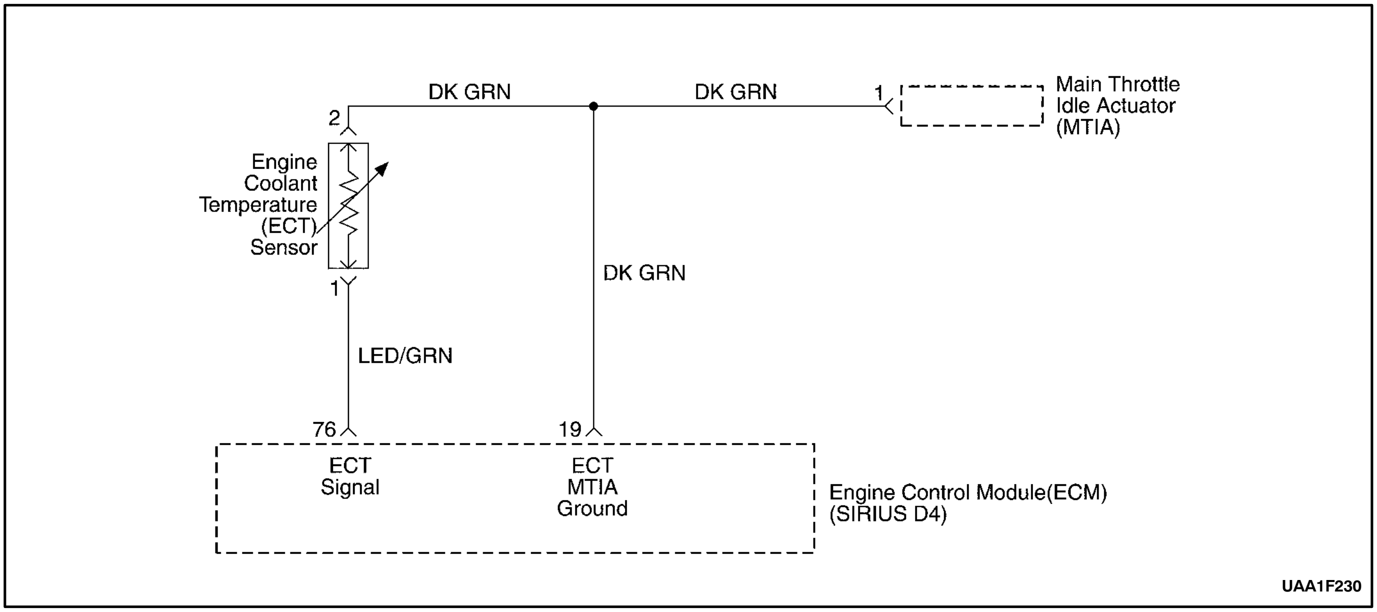
Diagnostic Aids

After the engine has started, the ECT should rise steadily to about 90°C(194°F) then stabilize when the thermostat opens.

Use the temperature vs. resistance values table to evaluate the possibility of a skewed sensor. Refer to *"Temperature vs. Resistance"* in this Section.

DTC P0117 – Engine Coolant Temperature Sensor Low voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Connect the scan tool to the data link connector (DLC). 2. Run the engine until it reaches operating temperature. Does the scan tool show the ECT sensor reading within the value specified?	80~110°C (176~230°F)	Go to “Diagnostic Aids”	Go to *Step 3*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the ECT sensor connector. 3. Turn the ignition switch to ON. Does the scan tool show the IAT sensor reading within the value specified?	≥-30°C(-22°F)	Go to *Step 4*	Go to *Step 6*
4	1. Jumper the ECT sensor signal circuits at terminal 1 and 2. 2. Turn the ignition switch to ON. Does the scan tool show the ECT sensor reading within the value specified?	≥ 120°C	Go to *Step 5*	Go to *Step 6*
5	1. Replace the ECT sensor. 2. Clear any DTCs from the ECM. 3. Perform the diagnostic system check. Is the replacement complete?	–	System OK	–
6	Measure the voltage between ECT terminal 2 and ground. Does the voltage measure within the value specified?	4.5–5.5V	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM wiring connector. 3. Check for a faulty connector or terminals at the ECT sensor connectors and ECM connectors for short to ECM reference voltage. Is the problem found?	–	Go to *Step 9*	Go to *Step 8*
8	1. Turn the ignition switch to LOCK. 2. Repair the wire of the connector terminals as needed. 3. Clear any DTCs from the ECM. 4. Run the engine until it reaches operating temperature. 5. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
9	1. Replace the ECM. 2. Run the engine until it reaches operating temperature. 3. Perform the diagnostic system check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0118 ENGINE COOLANT TEMPERATURE SENSOR HIGH VOLTAGE

Circuit Description

The coolant temperature sensor (ECT) uses a thermistor to control the signal voltage to the engine control module (ECM).

The ECM supplies a voltage on the signal circuit to the sensor. When the air is cold, the resistance is high; therefore the ECT sensor signal voltage will be high.

As the engine warms, the sensor resistance becomes less, and the voltage drops. At normal engine operating temperature, the voltage will be between 1.5 and 2.0 volts at the ECT sensor signal terminal.

The ECT sensor is used to the following items:

- Fuel delivery.
- Lock Up Clutch (LUC).
- Ignition.
- Evaporator Emission (EVAP) Canister Purge Valve.
- Idle Air Control (IAC) valve.
- Electric cooling fan.

Conditions for Setting the DTC

- ECT voltage is greater than 4.98V.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The coolant fan turns ON.
- The ECM will substitutes a fixed MAP value and use TP to control the fuel delivery (the scan tool will not show defaulted)

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

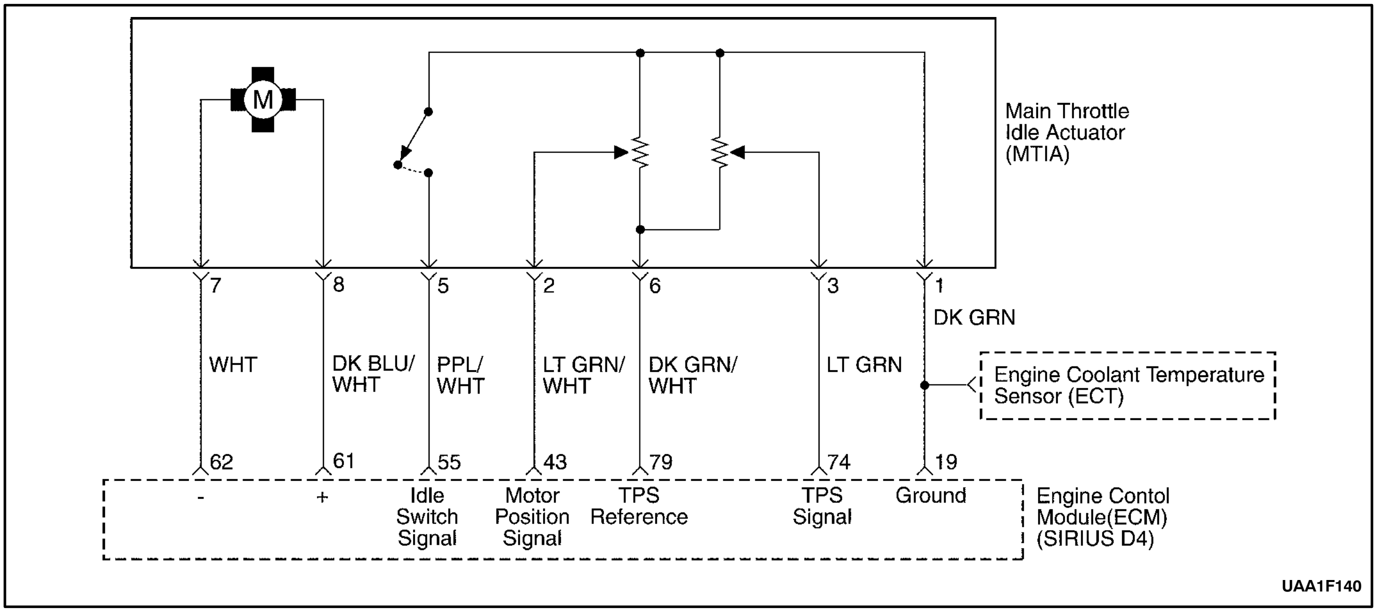
Diagnostic Aids

After the engine has started, the ECT should rise steadily to about 90°C(194°F) then stabilize when the thermostat opens.

Use the temperature vs. resistance values table to evaluate the possibility of a skewed sensor. Refer to *"Temperature vs. Resistance"* in this Section.

DTC P0118 – Engine Coolant Temperature Sensor High voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Connect the scan tool to the data link connector (DLC). 2. Run the engine until it reaches operating temperature. Does the scan tool show the ECT sensor reading within the value specified?	80~110°C (176~230°F)	Go to “Diagnostic Aids”	Go to *Step 3*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the ECT sensor connector. 3. Turn the ignition switch to ON. Does the scan tool show the ECT sensor reading within the value specified?	≥ -30°C	Go to *Step 4*	Go to *Step 6*
4	1. Jumper the ECT sensor signal circuits at terminal 1 and 2. 2. Turn the ignition switch to ON. Does the scan tool show the ECT sensor reading within the value specified?	≥180°C (356°F)	Go to *Step 5*	Go to *Step 6*
5	1. Replace the ECT sensor. 2. Clear any DTCs from the ECM. 3. Perform the diagnostic system check. Is the replacement complete?	–	System OK	–
6	Measure the voltage between ECT terminal 1 and ground. Does the voltage measure within the value specified?	4.5–5.5V	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM wiring connector. 3. Check for a faulty connector or terminals at the ECT sensor connector terminal 2 and the ECM connector terminal 19 for an open or short to battery voltage. Is the problem found?	–	Go to *Step 8*	Go to *Step 9*
8	1. Turn the ignition switch to LOCK. 2. Repair the wire of the connector terminals as needed. 3. Clear any DTCs from the ECM. 4. Run the engine until it reaches operating temperature. 5. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
9	1. Replace the ECM. 2. Run the engine until it reaches operating temperature. 3. Perform the diagnostic system check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0122 THROTTLE POSITION SENSOR LOW VOLTAGE

Circuit Description

The aim of the MTIA (Main Throttle Idle Actuator) is to control the idle speed with the throttle body itself. The throttle is motorized for low opening angle (0°, 19°). The characteristics of the airflow are not the same for low and high opening angles. As a matter of fact, the gradient of the mass air flow function of TPS is lower for small angles that permits to be more precise during the idle speed control. Out of idle speed the throttle is actuated mechanically by a classical bowdencable.

The throttle position sensor (TPS) provides a voltage signal that changes in relation to the throttle plate angle. The signal voltage will vary from about nearly 5.0 V at idles to about 0.2V to 0.4 V at wide-open throttle. The TPS is one of the most important inputs used by the ECM for fuel control and other functions such as idle, wide open throttle, deceleration enleanment, and acceleration enrichment.

Conditions for Setting the DTC

- TPS voltage is less than 0.3V.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The coolant fan turns ON.
- The ECM will default to 20°C(68°F) for the first 60 seconds of the engine run time, and then 92°C(198°F).
- the scan ttol will not show the defaulted value.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

If the DTC P0122 cannot be duplicated, the information included in the Freeze Frame data can be useful. Use the scan tool DTC information data to determine the status of the DTC. If the DTC occurs intermittently, using the DTC P0121 diagnostic table may help isolate the problem.

DTC P0122 – Throttle Position Sensor Low voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Turn the ignition switch to ON. Is the Malfunction Indicator Lamp (MIL) on steady?	–	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch to LOCK. 2. Connect the scan tool to the DLC. 3. Turn the Turn the ignition switch to ON. Are any diagnostic trouble codes (DTCs) displayed?	–	Go to *Step 4*	Try with another scan tool
4	Refer to the applicable DTC table. Is only one DTC identified as valid trouble code P0122?	–	Go to *Step 5*	Go to applicable DTC table and Go to "Multiple DTC"
5	1. Connect the scan tool to the DLC. 2. Turn the ignition switch to ON. 3. Press the accelerator pedal while watching TPS for smooth changes in the voltage Does the scan tool show the TPS voltage change smoothly within the value specified?	0.3V–4.8V	Go to "Diagnostic Aids"	Go to *Step 6*
6	1. Turn the ignition switch to lock. 2. Disconnect the MTIA connector. 3. Measure the voltage between terminal 6 and 1. Does the voltage measure within the value specified?	4.8V–5.0V	Go to *Step 7*	Go to *Step 8*
7	Connect a fused jumper between the MTIA connector terminal 6 and terminal 3. Does the scan tool show the TPS voltage above value specified?	4.8V–5.0V	Go to *Step 13*	Go to *Step 11*
8	Measure the voltage between the MTIA connector 6 and ground. Does the voltage measure within the value specified?	5.0V	Go to *Step 9*	Go to *Step 10*
9	1. Turn the ignition switch to lock. 2. Check for an open or short to ground in the wire between the MTIA connector 1 and ECM connector 19. Is the problem found?	–	Go to *Step 12*	Go to *Step 14*
10	1. Turn the ignition switch to LOCK. 2. Check for an open or short to ground in the wire between the MTIA connector 6 and ECM connector 79. Is the problem found?	–	Go to *Step 12*	Go to *Step 14*
11	1. Turn the ignition switch to LOCK. 2. Check for an open or short to ground in the wire between the MTIA connector 3 and ECM connector 74. Is the problem found?	–	Go to *Step 12*	Go to *Step 14*

DTC P0122 – Throttle Position Sensor Low voltage (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
13	1. Replace the MTIA. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
14	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 15*	–
15	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

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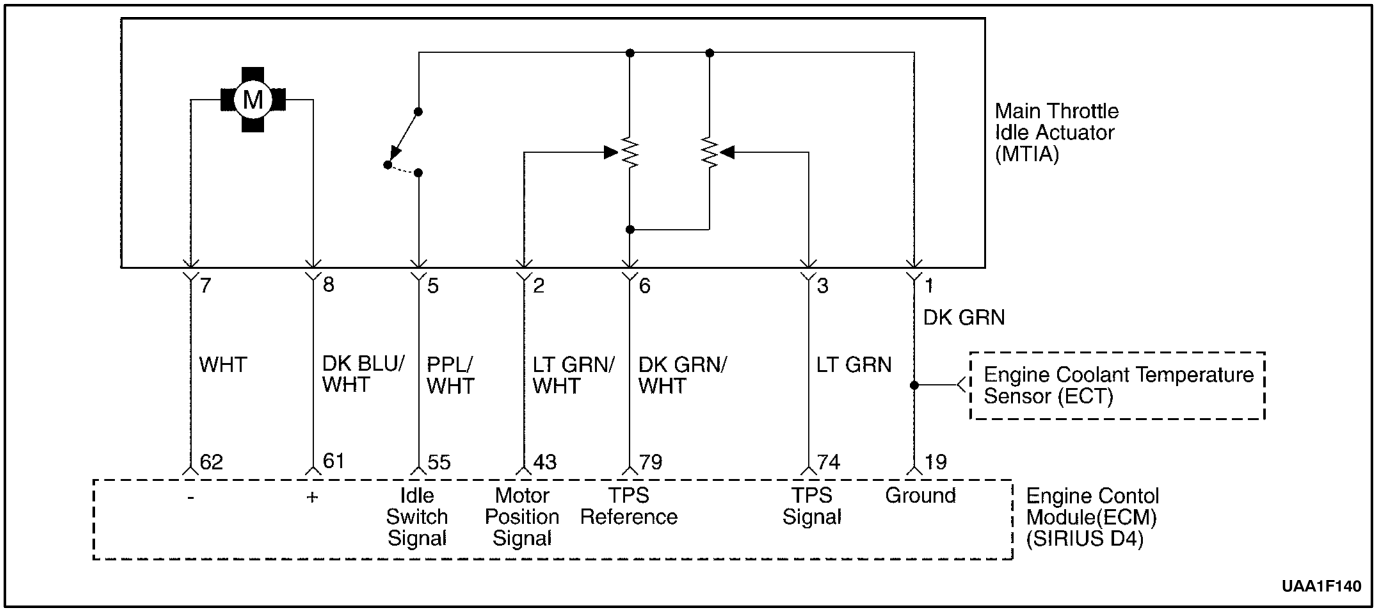

DIAGNOSTIC TROUBLE CODE (DTC) – P0123 THROTTLE POSITION SENSOR HIGH VOLTAGE

Circuit Description

The aim of the MTIA (Main Throttle Idle Actuator) is to control the idle speed with the throttle body itself. The throttle is motorized for low opening angle (0°, 19°). The characteristics of the airflow are not the same for low and high opening angles. As a matter of fact, the gradient of the mass air flow function of TPS is lower for small angles that permits to be more precise during the idle speed control. Out of idle speed the throttle is actuated mechanically by a classical bowdencable.

The throttle position sensor (TPS) provides a voltage signal that changes in relation to the throttle plate angle. The signal voltage will vary from about nearly 5.0 V at idles to about 0.2V to 0.4 V at wide-open throttle. The TPS is one of the most important inputs used by the ECM for fuel control and other functions such as idle, wide open throttle, deceleration enleanment, and acceleration enrichment.

Conditions for Setting the DTC

- TPS voltage is greater than 4.8V.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The coolant fan turns ON.
- The ECM will default to 20°C(68°F) for the first 60 seconds of the engine run time, and then 92°C(198°F).

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

If the DTC P0123 cannot be duplicated, the information included in the Freeze Frame data can be useful. Use the scan tool DTC information data to determine the status of the DTC. If the DTC occurs intermittently, using the DTC P0121 diagnostic table may help isolate the problem.

With the ignition ON and the throttle at closed position the voltage should read between 0.20 V and 0.90V and increase steadily to over 4.5V at WOT.

DTCs P0123 and P0113 stored at the same time could be the result of an open sensor ground circuit.

DTC P0123 – Throttle Position Sensor High voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Turn the ignition switch to ON. Is the Malfunction Indicator Lamp (MIL) on steady?	–	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch to LOCK. 2. Connect the scan tool to the DLC. 3. Turn the Turn the ignition switch to ON. Are any diagnostic trouble codes (DTCs) displayed?	–	Go to *Step 4*	Try with another scan tool
4	Refer to the applicable DTC table. Is only one DTC identified as valid trouble code P0122?	–	Go to *Step 5*	Go to applicable DTC table and Go to "Multiple DTC"
5	1. Connect the scan tool to the DLC. 2. Turn the ignition switch to ON. 3. Press the accelerator pedal while watching TPS for smooth changes in the voltage Does the scan tool show the TPS voltage change smoothly within the value specified?	0.3V–4.8V	Go to "Diagnostic Aids"	Go to *Step 6*
6	1. Turn the ignition switch to lock. 2. Disconnect the MTIA connector. 3. Measure the voltage between terminal 6 and 1. Does the voltage measure within the value specified?	4.8V–5.0V	Go to *Step 7*	Go to *Step 8*
7	Connect a fused jumper between the MTIA connector terminal 6 and terminal 3. Does the scan tool show the TPS voltage above value specified?	4.8V–5.0V	Go to *Step 13*	Go to *Step 11*
8	Measure the voltage between the MTIA connector 6 and ground. Does the voltage measure within the value specified?	< 5.0V	Go to *Step 9*	Go to *Step 10*
9	1. Turn the ignition switch to lock. 2. Check for short to battery voltage in the wire between the MTIA connector 1 and ECM connector 19. Is the problem found?	–	Go to *Step 12*	Go to *Step 14*
10	1. Turn the ignition switch to LOCK. 2. Check for short to battery voltage in the wire between the MTIA connector 6 and ECM connector 79. Is the problem found?	–	Go to *Step 12*	Go to *Step 14*
11	1. Turn the ignition switch to LOCK. 2. Check for short to battery voltage in the wire between the MTIA connector 3 and ECM connector 74. Is the problem found?	–	Go to *Step 12*	Go to *Step 14*

DTC P0123 – Throttle Position Sensor High voltage (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
13	1. Replace the MTIA. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
14	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 15*	–
15	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

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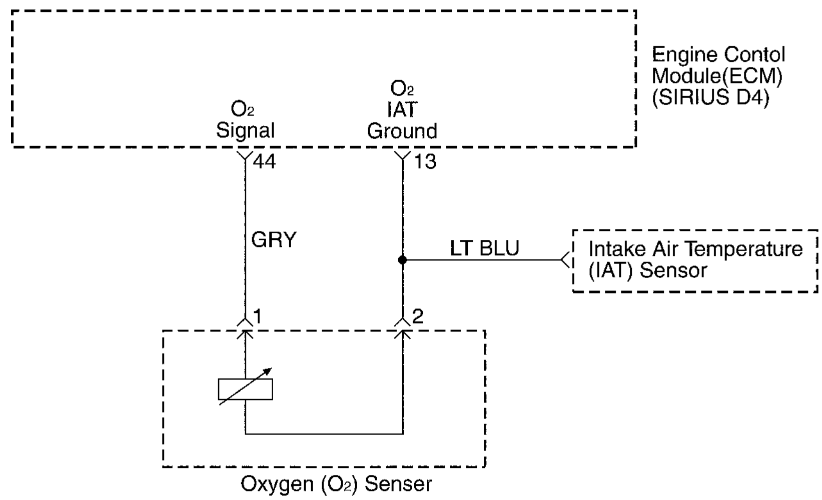

DIAGNOSTIC TROUBLE CODE (DTC) – P0131 OXYGEN SENSOR LOW VOLTAGE

Circuit Description

The engine control module (ECM) supplies a voltage of about 450mm volts between the ECM terminals 44 and 13. The oxygen (O_2) sensor varies the voltage within a range of about 1volt if the exhaust is rich, down to about 100mm volts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 360°C(600°F). An open O_2 sensor circuit or a cold O_2 sensor causes "open loop" operation.

Conditions for Setting the DTC

(Case A)

- The engine controls system is in closed loop.
- Engine speed is less than 6,000rpm.
- The oxygen sensor voltage is below 0.07V for at least 40seconds.
- DTCs P0107, P0108, P0117, P0118, P0122, P0123, P0335, P0336, P0341, P0342, P0400, P0404, P0405, P0406 are NOT SET.

(Case B)

- The engine controls system is in closed loop.
- Engine speed is less than 6,000rpm.
- The oxygen sensor voltage is between 0.352 and 0.499 at least 10seconds.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The coolant fan turns ON.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Normal scan tool voltage varies between 0.1volts and 0.9 volts while in closed loop.

Inspect the oxygen (O_2) sensor wire. The O_2 sensor may be positioned incorrectly and contacting the exhaust manifold.

Check for an intermittent ground in the wire between the O_2 sensor and the engine control module.

Perform an injector 2alance test to determine if a restricted fuel injector may be causing the lean condition.

Vacuum of crankcase leaks will cause a lean running condition.

An exhaust manifold gasket leak of a cracked exhaust manifold may cause outside air to be pulled into the exhaust and past the sensor.

DTC P0131 – Oxygen sensor Low voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Connect the scan tool to the data link connector(DLC). 2. Run the engine until it reaches operating temperature. 3. Check for closed loop operation. Does the engine control module(ECM) go into closed loop?	–	Go to *Step 3*	Go to *Step 9*
3	1. Run the until until it reaches operating temperature? 2. Run the engine at 1,200rpm. Does the scan tool read the upstream oxygen(O_2) sensor signal voltage between the valve specified?	0.25~0.65V	Go to *Step 5*	Go to *Step 4*
4	Does the scan tool read the Oxygen sensor signal voltage fixed below the valve specified?	0.01V	Go to *Step 7*	Go To "Diagnostic Aids"
5	1. Disconnect the Oxygen sensor connector. 2. Run the warm engine at idle. Does the scan tool read the Oxygen sensor signal voltage between the valve specified?	0.25~0.65V	Go To "Diagnostic Aids"	Go to *Step 6*
6	1. Turn the ignition switch to LOCK. 2. Check the Oxygen sensor wire between the Oxygen sensor and the ECM connector terminal 44 and 13 is open. Is the problem found?	–	Go to *Step 8*	Go to *Step 11*
7	1. Turn the ignition switch to LOCK. 2. Check the Oxygen sensor wire between the Oxygen sensor and the ECM connector terminal 44 for a short to ground. Is the problem found?	–	Go to *Step 8*	Go to *Step 11*
8	1. Repair the wire or the connector terminal as needed. 2. Clear the any DTCs from the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
9	1. Turn the ignition switch to LOCK. 2. Disconnect the Oxygen sensor connector. 3. Turn the ignition switch to ON. Does the scan tool the Oxygen sensor signal voltage between the valve specified?	0.3~0.6V	Go to *Step 10*	Go to *Step 11*
10	1. Replace the Oxygen sensor. 2. Clear the DTCs from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
11	1. Replace the ECM. 2. Perform the diagnostic system check. Is the repair complete?	–	Go to *Step 12*	–

DTC P0131 – Oxygen sensor Low voltage (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

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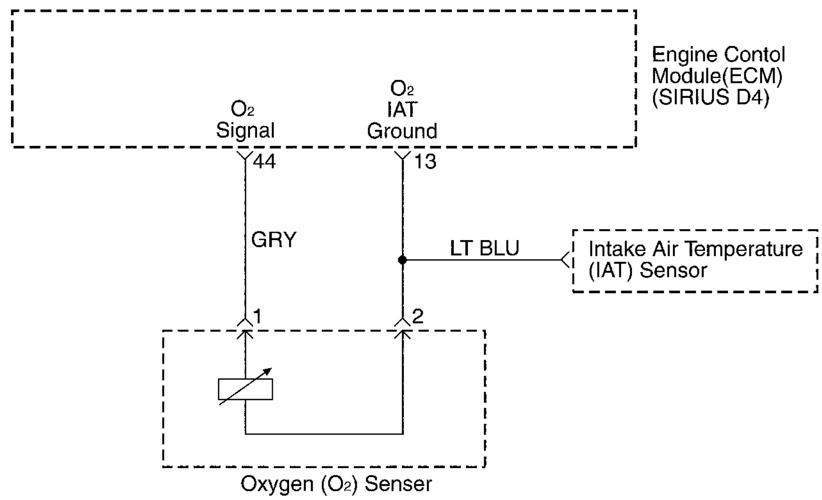


DIAGNOSTIC TROUBLE CODE (DTC) – P0132 OXYGEN SENSOR HIGH VOLTAGE

Circuit Description

The engine control module (ECM) supplies a voltage of about 450mm volts between the ECM terminals 44 and 13. The oxygen (O2) sensor varies the voltage within a range of about 1volt if the exhaust is rich, down to about 100mm volts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 360°C(600°F). An open O_2 sensor circuit or a cold O_2 sensor causes "open loop" operation.

Conditions for Setting the DTC

- The oxygen sensor voltage is more than 1.2V.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.
- The coolant fan turns ON.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

Normal scan tool voltage varies between 0.1volts and 0.9volts while in closed loop.

Inspect the oxygen (O_2) sensor wire. The O_2 sensor may be positioned incorrectly and contacting the exhaust manifold.

Check for an intermittent ground in the wire between the O_2 sensor and the engine control module.

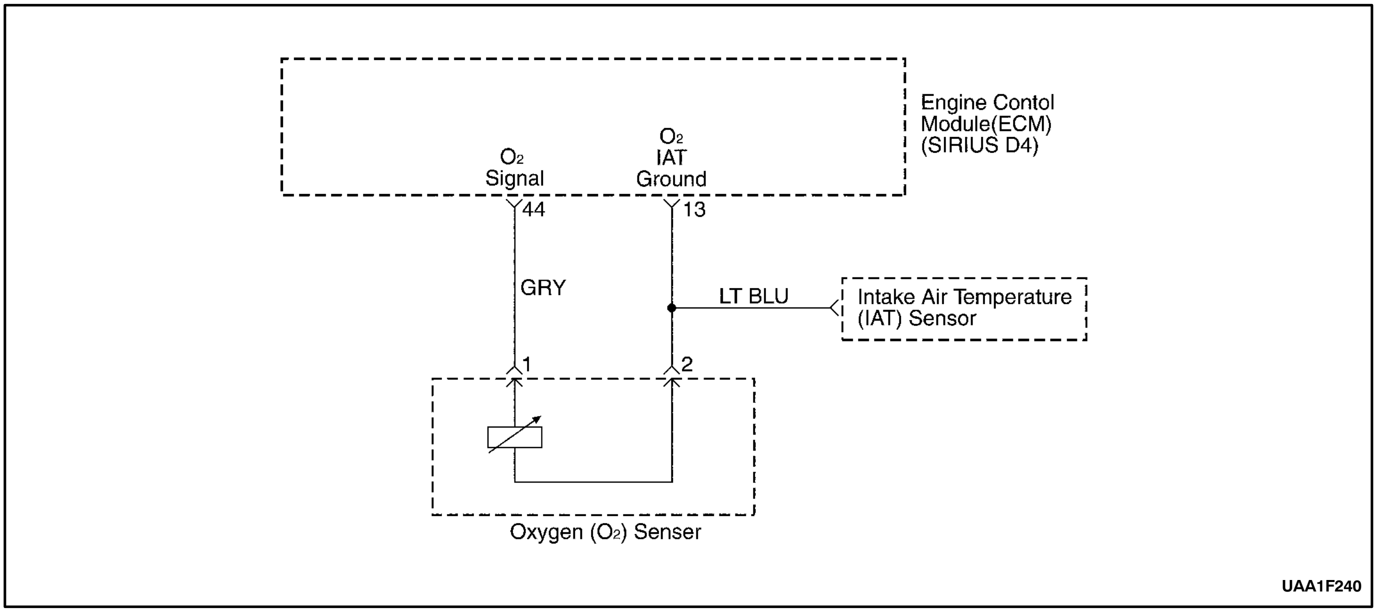
Perform an injector 2alance test to determine if a restricted fuel injector may be causing the lean condition.

Vacuum of crankcase leaks will cause a lean running condition.

An exhaust manifold gasket leak of a cracked exhaust manifold may cause outside air to be pulled into the exhaust and past the sensor.

DTC P0132 – Oxygen sensor High voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to ON, with the engine OFF. 2. Install a scan tool. 3. Engine at operating temperature. 4. Run the engine at 1,200rpm. Does the scan tool the upstream oxygen(O2) sensor1 voltage within the value specified?	More than 1.2V	Go to *Step 3*	Go to *Step 6*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the O2 sensor connector and engine control module (ECM) connector. 3. Check the O2 sensor wire between the O2 sensor and ECM connector terminal 44 for short to battery voltage. Is the problem found?	–	Go to *Step 4*	Go to *Step 5*
4	1. Repair the wire of the connector terminal as needed. 2. Clear the DTCs from the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
5	1. Turn the ignition switch to LOCK. 2. Replace the O2 sensor. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 7*	–
6	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 7*	–
7	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0133 OXYGEN SENSOR NO ACTIVITY

Circuit Description

The engine control module (ECM) supplies a voltage of about 450mm volts between the ECM terminals 44 and 13. The oxygen (O_2) sensor varies the voltage within a range of about 1volt if the exhaust is rich, down to about 100mm volts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 360°C(600°F). An open O_2 sensor circuit or a cold O_2 sensor causes "open loop" operation.

Conditions for Setting the DTC

- The engine controls system is in closed loop.
- Engine Coolant Temperature is higher than 60°C (140°F).
- The mass air flow(MAF) is between 60mg/tdc and 160mg/tdc.
- The engine speed is between 1,800rpm and 2,900 rpm.
- The vehicle speed is between 45km/h(28.0mph) and 55km/h(34.2mph).
- The manifold air pressure is higher than 700hPa.
- The ignition is at 10 volts.
- The upstream O_2 sensor periods higher than 1.6 seconds.
- A number of glitches higher than 5 during the test.
- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0131, P0132, P0137, P0138, P1671, P0300, P0335, P0336, P0341, P0400, P0404, P0405, P0444, P0445 are NOT SET.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The coolant fan turns ON.
- The vehicle will operate in Open Loop.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

Normal scan tool voltage varies between 0.15 to 8.5mV while in Closed Loop. If DTC P0133 is intermittent, refer to *"Intermittent"* in this Section.

DTC P0133 – Oxygen sensor No Activity

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Connect the scan tool to the data link connector (DLC). 2. Run the engine until it reaches operating temperature. 3. Check for the closed loop operation. Does the scan tool indicate the closed loop?	–	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition switch to LOCK. 2. Review the freeze frame data and note the parameters. 3. Operate the vehicle within the freeze frame conditions and Conditions for Setting the DTC. Does the scan tool indicate the closed loop?	–	Go to *Step 12*	Go to *Step 4*
4	1. Disconnect the upstream oxygen(O_2) sensor connector 2. Jumper the oxygen sensor connector terminal 1 to ground. 3. Turn the ignition switch to ON. Does the scan tool read the oxygen sensor signal voltage the specified valve?	0.4~0.5V	Go to *Step 5*	Go to *Step 8*
5	Check the oxygen sensorconnector for malfunction terminals or poor connection and repair as necessary. Is repair necessary?	–	Go to *Step 12*	Go to *Step 6*
6	1. Run the engine at idle. 2. Remove the jumper wire. 3. Measure the voltage between the oxygen sensor connector terminal 2 and ground. Does the oxygen sensor voltage measure above the specified value?	0.6V	Go to *Step 7*	Go to *Step 11*
7	1. Turn the ignition switch to LOCK 2. Measure the voltage between the upstream O_2 sensor connector terminal 2 and ground. Does the oxygen sensor voltage measure above the specified value?	0.3V	Go to *Step 9*	Go to *Step 11*
8	Repair the wire or the connector between the upstre O_2 sensor terminal 1 and the engine control module (ECM) terminal 44 is open or a short to ground. Is the repair complete?	–	Go to *Step 11*	Go to *Step 9*
9	Repair the wire and the connector terminal between the oxygen sensor connector terminal 2 and the ECM connector terminal 13 is open or a short to ground. Is the repair complete?	–	Go to *Step 12*	Go to *Step 10*
10	1. Turn the ignition switch to LOCK 2. Replace the ECM. 3. Perform the diagnostic system check.. Is the repair complete?	–	System OK	–

DTC P0133 – Oxygen sensor No Activity (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the O_2 sensor. Is the repair complete?	–	Go to *Step 12*	–
12	1. Clear any DTCs from the ECM 2. Perform the diagnostic system check Is the repair complete	–	Go to *Step 13*	–
13	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

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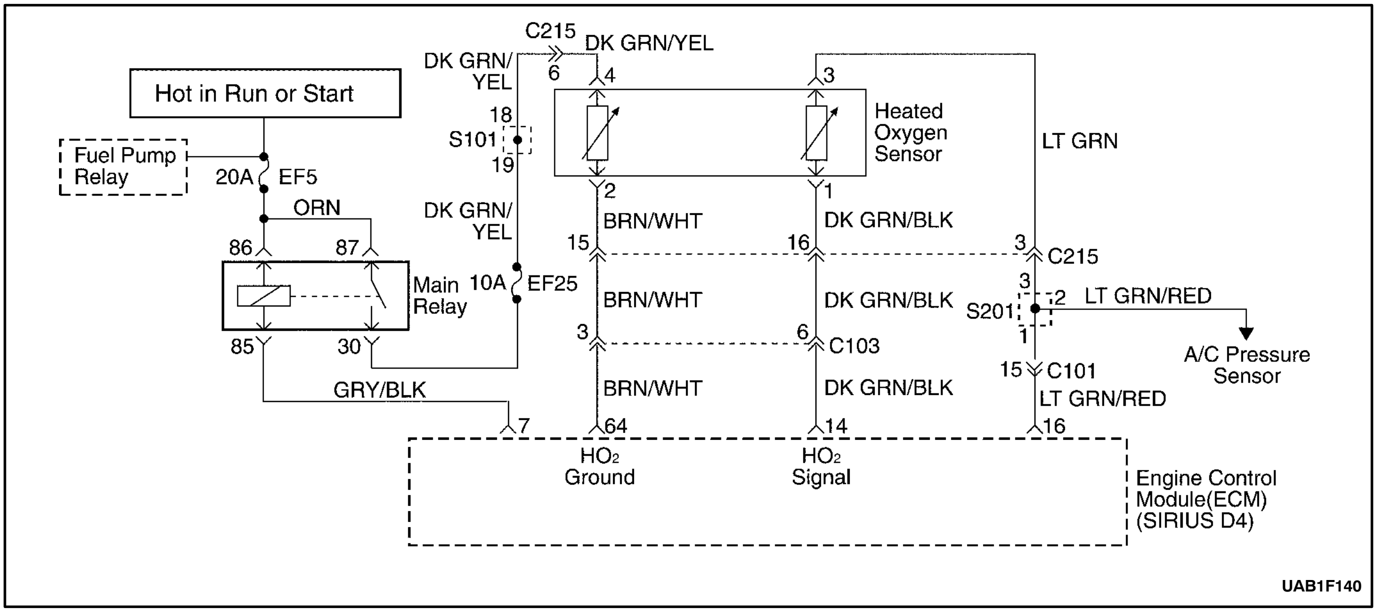

DIAGNOSTIC TROUBLE CODE (DTC) – P0137 HEATED OXYGEN SENSOR LOW VOLTAGE

Circuit Description

The engine control module (ECM) supplies a voltage of about 450mm volts between the ECM terminals 44 and 13. The oxygen (O_2) sensor varies the voltage within a range of about 1volt if the exhaust is rich, down to about 100mm volts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 360°C(600°F). An open O_2 sensor circuit or a cold O_2 sensor causes “open loop” operation.

Conditions for Setting the DTC

(Case A)

- The engine controls system is in closed loop.
- Engine speed is less than 6,000rpm.
- The heated oxygen sensor voltage is below 0.07V for at least 40 seconds.
- DTCs P0107, P0108, P0117, P0118, P0122, P0123, P0335, P0336, P0341, P0342, P0400, P0404, P0405, P0406 are NOT SET.

(Case B)

- The engine controls system is in full fuel cut off.
- Engine speed is less than 6,000rpm.
- The heated oxygen sensor voltage is between 0.352 and 0.499 at least 10 seconds.
- DTCs P0107, P0108 and P0141 are NOT SET.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The coolant fan turns ON.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

- Normal scan tool voltage varies between 0.1 volts and 0.9 volts while in closed loop.
- Inspect the oxygen (O_2) sensor wire. The O_2 sensor may be positioned incorrectly and contacting the exhaust manifold.
- Check for an intermittent ground in the wire between the O_2 sensor and the engine control module.
- Perform an injector 2alance test to determine if a restricted fuel injector may be causing the lean condition.
- Vacuum of crankcase leaks will cause a lean running condition.
- An exhaust manifold gasket leak of a cracked exhaust manifold may cause outside air to be pulled into the exhaust and past the sensor.

DTC P0137 – Heated oxygen sensor Low voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to ON, with the engine OFF. 2. Install a scan tool. 3. Engine at operating temperature. 4. Run the engine at 1,200rpm. Does the scan tool the downstream oxygen (O2) sensor1 voltage within the value specified?	0.07–0.352V	Go to *Step 4*	Go to *Step 3*
3	Does the scan tool the heated oxygen (O2) sensor1 voltage within the value specified?	0.1V	Go to *Step 9*	Go to “Diagnostic Aids”
4	1. Turn the ignition switch to LOCK. 2. Disconnect the Heated O2 sensor connector and engine control module (ECM) connector. 3. Check the Heated O2 sensor wire between the Heated O2 sensor connector terminal 2 and ECM connector terminal 64 for short to ground. Is the problem found?	–	Go to *Step 5*	Go to *Step 6*
5	1. Repair the wire of the connector terminal as needed. 2. Clear the DTCs from the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
6	1. Turn the ignition switch to LOCK. 2. Disconnect the Heated O2 sensor connector and engine control module (ECM) connector. 3. Check the O2 sensor wire between the O2 sensor connector terminal 1 and ECM connector terminal 14 for short to ground. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire of the connector terminal as needed. 2. Clear the DTCs from the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
8	1. Turn the ignition switch to LOCK. 2. Replace the Heated O2 sensor. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 10*	–
9	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 10*	–

DTC P0137 – Heated oxygen sensor Low voltage (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

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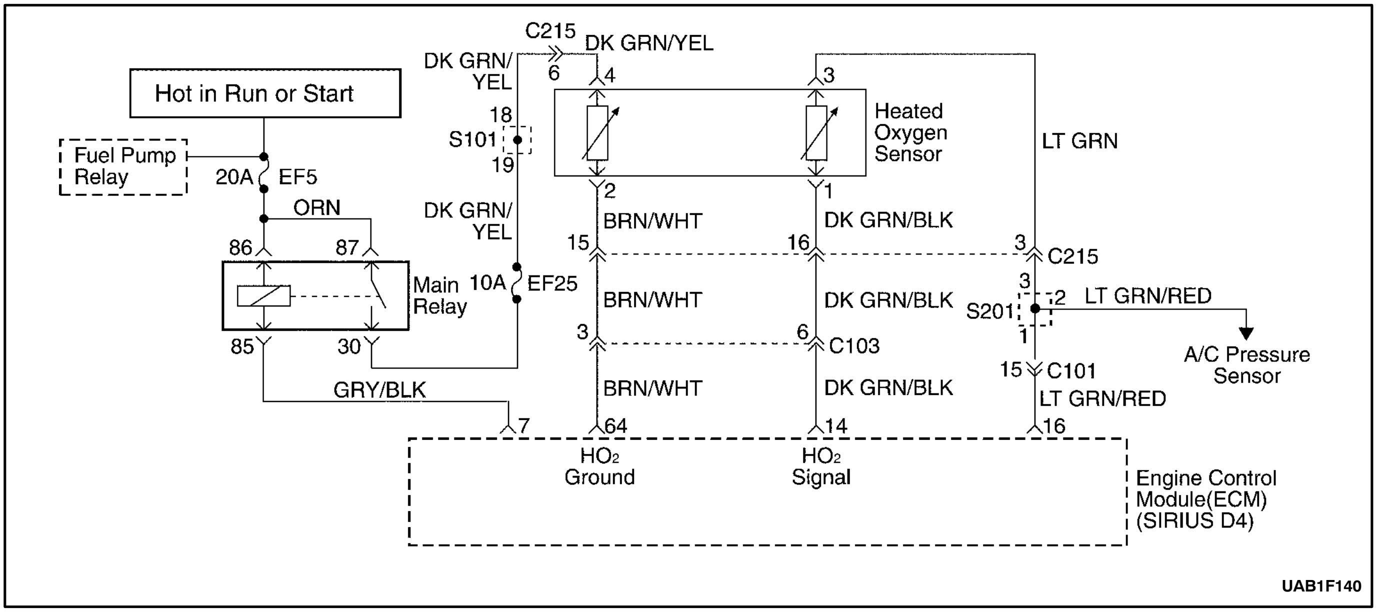


DIAGNOSTIC TROUBLE CODE (DTC) – P0138 HEATED OXYGEN SENSOR HIGH VOLTAGE

Circuit Description

The engine control module (ECM) supplies a voltage of about 450mm volts between the ECM terminals 64 and 13. The Heated oxygen (O_2) sensor varies the voltage within a range of about 1volt if the exhaust is rich, down to about 100mm volts if the exhaust is lean. The Heated O_2 sensor is like an open circuit and produces no voltage when it is below 360°C(600°F). An open O_2 sensor circuit or a cold O_2 sensor causes “open loop” operation.

Conditions for Setting the DTC

- The Heated oxygen sensor voltage is more than 1.2V.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

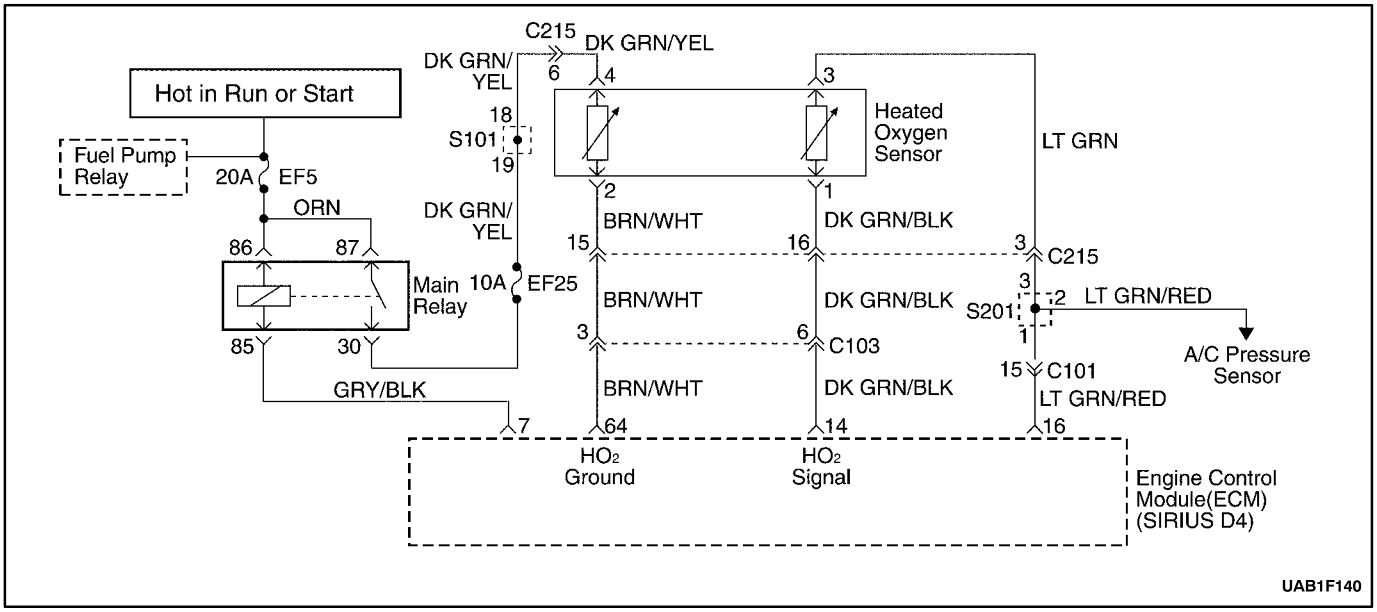
- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

- Normal scan tool voltage varies between 0.1volts and 0.9volts while in closed loop.
- Inspect the oxygen (O_2) sensor wire. The O_2 sensor may be positioned incorrectly and contacting the exhaust manifold.
- Check for an intermittent ground in the wire between the O_2 sensor and the engine control module.
- Perform an injector 2alance test to determine if a restricted fuel injector may be causing the lean condition.
- Vacuum of crankcase leaks will cause a lean running condition.
- An exhaust manifold gasket leak of a cracked exhaust manifold may cause outside air to be pulled into the exhaust and past the sensor.

DTC P0138 – Heated oxygen sensor High voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to ON, with the engine OFF. 2. Install a scan tool. 3. Engine at operating temperature. 4. Run the engine at 1,200rpm. Does the scan tool the Heated oxygen(O2) sensor voltage within the value specified?	More than 1.2V	Go to *Step 3*	Go to *Step 6*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the Heated O2 sensor connector and engine control module (ECM) connector. 3. Check the Heated O2 sensor wire between the Heated O2 sensor connector terminal 1 and ECM connector terminal 64 for an open or short to battery voltage. Is the problem found?	–	Go to *Step 4*	Go to *Step 5*
4	1. Repair the wire of the connector terminal as needed. 2. Clear the DTCs from the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
5	1. Turn the ignition switch to LOCK. 2. Replace the Heated O2 sensor. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 7*	–
6	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 7*	–
7	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0140 HEATED OXYGEN SENSOR NO ACTIVITY

Circuit Description

The engine control module (ECM) supplies a voltage of about 450mm volts between the ECM terminals 64 and 13. The oxygen (O_2) sensor varies the voltage within a range of about 1volt if the exhaust is rich, down to about 100mm volts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 360°C(600°F). An open O_2 sensor circuit or a cold O_2 sensor causes “open loop” operation.

Conditions for Setting the DTC

- The engine controls system is in closed loop.
- Engine Coolant Temperature is higher than 70°C (158°F).
- The engine speed is between 1,300rpm and 3,000 rpm.
- The vehicle speed is between 26km/h(16.2mph) and 54km/h(33.6mph).
- The manifold air pressure is higher than 760hPa.
- No transition from rich side to lean side or lean side to rich side during 7.8 seconds even with a forcing of O_2 sensor controller.
- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0137, P0138, P1671, P0300, P0335, P0336, P0341, P0400, P0404, P0405, P0644, P0645 are NOT SET.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The coolant fan turns ON.
- The vehicle will operate in Open Loop.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

- Normal scan tool voltage varies between 0.15 to 8.5mV while in Closed Loop. If DTC P0140 is intermittent, refer to *“Intermittent”* in this Section.

DTC P0140 – Heated Oxygen Sensor No Activity

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Run the engine to above the specified operating temperature. 2. Install a scan tool. 3. Operate the engine above the specified rpm for 2minuets. Does the scan tool the indicate Closed Loop?	80°C(176°F) 1,200 rpm	Go to *Step 3*	Go to *Step 4*
3	1. Turn the Turn the ignition switch to ON. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the freeze frame conditions and Conditions for Setting the DTC as noted? Does the scan tool the indicate Closed Loop?	–	Go to *Step 12*	Go to *Step 4*
4	Disconnect the Heated O2 sensor connector and jumper the Heated O2 sensor low circuit, terminal 2 to ground. Is the HO2 voltage below the specified value and does the scan tool indicate the heated oxygen sensor heater voltage within the specified value?	0.5V	Go to *Step 5*	Go to *Step 6*
5	Check the Heated O2 sensor connector for malfunction terminals or poor connection and repair as necessary. Is repair necessary?	–	Go to *Step 12*	Go to *Step 9*
6	1. Turn the ignition switch to On. 2. Remove the jumper wire. 3. Using a digital voltmeter(DVM), measure the voltage between the Heated O2 sensor signal circuit, terminal 1 to ground. Does the Heated O2 sensor voltage measure above the specified value?	0.6V	Go to *Step 10*	Go to *Step 9*
7	Does the Heated O2 sensor voltage measure below the specified value?	0.3V	Go to *Step 11*	Go to *Step 8*
8	Check the Heated O2 sensor ground circuit, terminal 2 for an open or poor connection and repair as necessary. Is repair necessary?	–	Go to *Step 12*	Go to *Step 8*
11	Check the Heated O2 sensor signal circuit, terminal 1 for an open or poor connection and repair as necessary. Is repair necessary?	–	Go to *Step 12*	Go to *Step 8*
10	1. If disconnected, reconnect Heated O2 sensor connector. 2. Using the scan tool, clear the DTCs. 3. Start the engine and idle at normal operating temperature. 4. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicated that this diagnostic has run and passed?	–	Go to *Step 13*	Go to *Step 2*

DTC P0140 – Heated Oxygen Sensor No Activity (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition switch to LOCK. 2. Replace the Heated O2 sensor. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 15*	–
12	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 15*	–
13	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

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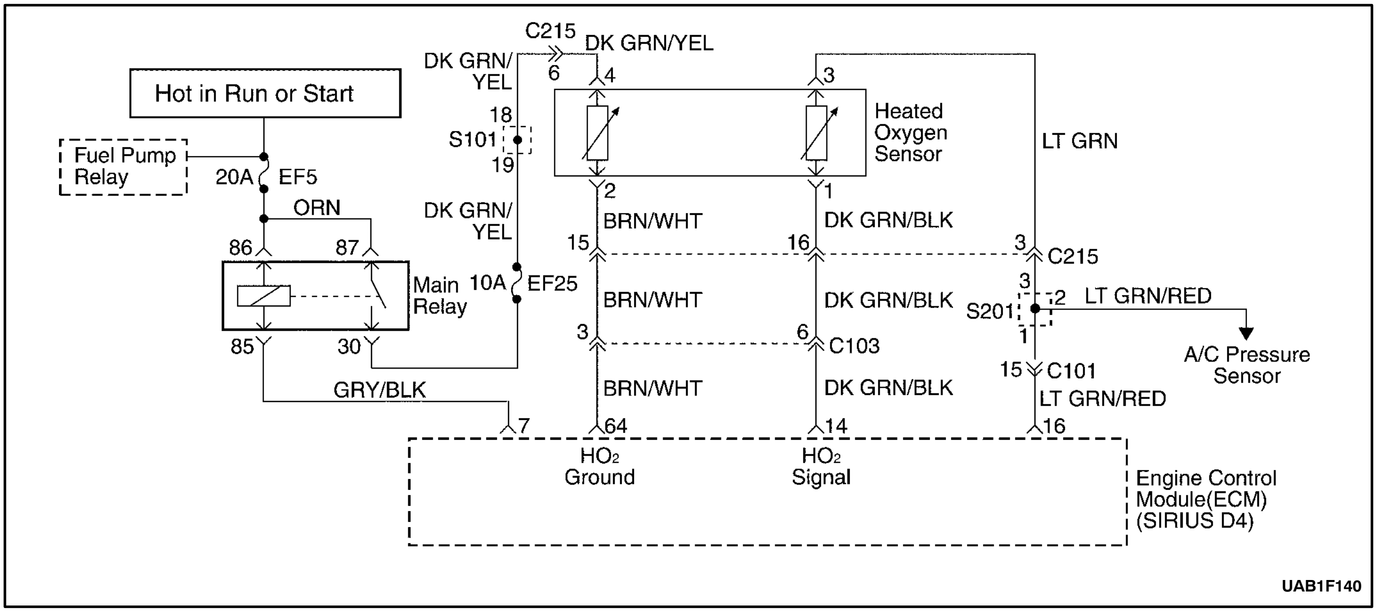

DIAGNOSTIC TROUBLE CODE (DTC) – P0141 HEATED OXYGEN SENSOR HEATER MALFUNCTION

Circuit Description

The engine control module (ECM) supplies a voltage of about 450mm volts between the ECM terminals 44 and 13. The oxygen (O_2) sensor varies the voltage within a range of about 1volt if the exhaust is rich, down to about 100mm volts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 360°C(600°F). An open O_2 sensor circuit or a cold O_2 sensor causes “open loop” operation.

Conditions for Setting the DTC

- The heated O_2 sensor heater resistance is less than 10Ω or greater than 30Ω .

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The coolant fan turns ON.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

- Normal scan tool voltage varies between 0.1volts and 0.9 volts while in closed loop.
- Inspect the oxygen (O_2) sensor wire. The O_2 sensor may be positioned incorrectly and contacting the exhaust manifold.
- Check for an intermittent ground in the wire between the O_2 sensor and the engine control module.
- Perform an injector 2alance test to determine if a restricted fuel injector may be causing the lean condition.
- Vacuum of crankcase leaks will cause a lean running condition.
- An exhaust manifold gasket leak of a cracked exhaust manifold may cause outside air to be pulled into the exhaust and past the sensor.

DTC P0141 – Heated Oxygen Sensor Heater Malfunction

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to LOCK. 2. Disconnect the Heated O2 sensor connector and engine control module (ECM) connector. 3. Check the Heated O2 sensor heater wire between the Heated O2 sensor connector terminal 2 and ECM connector terminal 64 for an open or short to ground. Is the problem found?	–	Go to *Step 3*	Go to *Step 4*
3	1. Repair the wire of the connector terminal as needed. 2. Clear the DTCs from the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
4	1. Turn the ignition switch to LOCK. 2. Replace the Heated O2 sensor. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 6*	–
5	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) – P0171 FUEL TRIM SYSTEM TOO LEAN

System Description

If the adaptation value threshold is permanently exceeded, the deviation of the adaptive terms enables to detect a slow default coming out. Two time counters (one for the rich side and another one for the lean side) are increased while the lambda controller exceeds the adaptation thresholds. As soon as one of the time counters reaches its maximum value, the error is detected.

The aim of this test is to simulate a failure that would result in exceeding the adaptive terms. Two kinds of failure must be created.

- A lean side deviation: P0171
- A rich side deviation : P0172

It is thus necessary to determine, for each kind of failure, the limit good and the limit bad. For a given failure, measure the emission threshold until the legal emission thresholds are exceeded.

Note that the problem is due to the emission thresholds required, it is not simple to disturb the system so that the emission thresholds will be exceeded. The tuning has been made thanks to a dedicated calibration but, as such a procedure is not permitted by the regulation, it is necessary to create some material malfunction (fuel pressure regulator, fuel injector, air leakage...).

Conditions for Setting the DTC

- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0131, P0132, P0337, P0338, P0341, P0342, P0400, P1319, P1402, P1404, P1405, P1671 and P1672 are not set.
- Coolant temperature is greater than 80°C (176°F).
- Manifold Absolute Pressure (MAP) is between 70 kPa (10.2 psi).
- System is in closed loop.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

Important: After repairs, use the scan tool Fuel Trim Reset function to reset the long-term fuel trim to 128 (0%).

- Fuel pressure – The system will be lean if the pressure is too low. It may be necessary to monitor fuel pressure while driving the vehicle at various road speeds and/or loads to confirm.
- Map sensor – An output that causes the ECM to sense a lower than normal manifold pressure (high vacuum) can cause the system to go lean. Disconnecting the MAP sensor will allow the ECM to substitute a fixed (default) value for the MAP sensor. If the lean condition is gone when the sensor is disconnected, substitute a known good sensor and recheck.
- Fuel contamination – Water, in even small amounts, near the in-tank fuel pump inlet can be delivered to the injector. The water causes a lean exhaust and can set DTC P0171.

Check for poor O2S or MAP sensor connection at the ECM. Inspect the harness connectors for the following conditions:

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection

Inspect the wiring harness for damage. If the harness appears to be OK, observe the O2S display on the scan tool while moving the connectors and the wiring harness related to the engine harness. A change in the display will indicate the location of the fault.

Check the brake power booster check valve for possible leaks.

DTC P0171 – Fuel Trim System Too Lean

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Are any component related Diagnostic Trouble Codes (DTCs) set?	–	Go to Applicable DTC table	Go to *Step 3*
3	With the engine running, operate the vehicle until the LOOP STATUS indicates closed. Is the Long Term Fuel Trim value below the specified value?	27%	Go to *Step 4*	Go to *Step 5*
4	1. Turn the ignition switch ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Does the Long Term Fuel Trim value go below the specified value while operating under the specified conditions?	27%	Go to *Step 16*	Go to *Step 5*
5	Visually/physically check the following items: • Vacuum hoses for splits, kinks and improper connections. • Crankcase ventilation oil/air separator for proper installation. • Exhaust system for corrosion, leaks, loose or missing hardware. • Oxygen sensor (O2S) is installed securely and the pigtail harness is not contacting exhaust manifold or engine. • Fuel for excessive water, alcohol, or other contaminants. • Engine Control Module (ECM) and sensor grounds are clean, tight, and in their proper locations. Do any of the above checks isolate a condition requiring repair?	–	Go to *Step 7*	Go to *Step 6*
6	1. Disconnect the Manifold Absolute Pressure (MAP) sensor electrical connector. 2. Operate the vehicle in Closed Loop while monitoring the Long Term Fuel Trim value. Is the Long Term Fuel Trim value below the specified value?	27%	Go to *Step 15*	Go to *Step 9*
7	1. Repair the malfunction found in Step 5. 2. Recheck the Long Term Fuel Trim value while operating the engine. Is the Long Term Fuel Trim value below the specified value?	27%	Go to *Step 8*	Go to *Step 9*
8	Lean condition is not present. Does a driveability problem exist?	–	Go to "Symptom Diagnosis"	Go to *Step 16*

DTC P0171 – Fuel Trim System Too Lean (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Visually/physically inspect the following items for vacuum leaks: • Intake manifold. • Throttle body. • Injector O-rings. 2. Repair any leaks found as necessary. Is the repair complete?	–	Go to *Step 16*	Go to *Step 16*
10	Allow the engine to idle. Are the Idle Air Control (IAC) counts above the specified value?	5	Go to *Step 11*	Go to *Step 12*
11	Check the fuel for excessive water, alcohol, or other contaminants and correct the contaminated fuel condition if present. Is the repair complete?	–	Go to *Step 16*	Go to *Step 13*
12	Check the IAC valve performance. Refer to *"DTC P0506 Idle Speed RPM Lower Than Desired Idle Speed"* or *"DTC P0507 Idle Speed RPM Higher Than Desired Idle Speed"* in this section and repair as necessary. Is the repair complete?	–	Go to *Step 16*	Go to *Step 13*
13	1. Connect a fuel pressure gauge to the fuel system. 2. Turn the ignition OFF for at least 10 seconds. 3. Turn the ignition ON, with the engine OFF. The fuel pump will run for approximately 2–3 seconds. It may be necessary to cycle the ignition switch ON more than once to obtain maximum fuel pressure. 4. Note the fuel pressure with the fuel pump running. The pressure should be within the specified value. When the fuel pump stops, the pressure may vary slightly then hold steady. Is the fuel pressure steady and does the fuel pressure hold?	241–276 KPa (30–40 psi)	Go to *Step 14*	Go to "Fuel System Diagnosis"
14	1. Start and idle the engine at normal operating temperature. 2. The fuel pressure noted in the above step should drop by the indicated value. Does the fuel pressure drop by the indicated value?	21–69 KPa (3–10 psi)	Go to "Fuel Injector 2alance Test"	Go to "Fuel System Diagnosis"
15	Replace the MAP sensor. Is the action complete?	–	Go to *Step 16*	–
16	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 17*	Go to *Step 2*
17	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

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DIAGNOSTIC TROUBLE CODE (DTC) – P0172 FUEL TRIM SYSTEM TOO RICH

System Description

If the adaptation value threshold is permanently exceeded, the deviation of the adaptive terms enables to detect a slow default coming out. Two time counters (one for the rich side and another one for the lean side) are increased while the lambda controller exceeds the adaptation thresholds. As soon as one of the time counters reaches its maximum value, the error is detected.The aim of this test is to simulate a failure that would result in exceeding the adaptive terms. Two kinds of failure must be created.

- A lean side deviation: P0171
- A rich side deviation : P0172

It is thus necessary to determine, for each kind of failure, the limit good and the limit bad. For a given failure, measure the emission threshold until the legal emission thresholds are exceeded.Note that the problem is due to the emission thresholds required, it is not simple to disturb the system so that the emission thresholds will be exceeded. The tuning has been made thanks to a dedicated calibration but, as such a procedure is not permitted by the regulation, it is necessary to create some material malfunction (fuel pressure regulator, fuel injector, air leakage...).

Conditions for Setting the DTC

- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0131, P0132, P0337, P0338, P0341, P0342, P0400, P1319, P1402, P1404, P1405, P1671 and P1672 are not set.
- Coolant temperature is greater than 80°C (176°F).
- Manifold Absolute Pressure (MAP) is between 70 kPa (10.2 psi).
- System is in closed loop.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

Important: After repairs, use the scan tool Fuel Trim Reset function to reset the long-term fuel trim to 128 (0%).

Check for poor connection at the ECM. Inspect the harness connectors for the following conditions:

- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connection.

Inspect the wiring harness for damage. If the harness appears to be OK, observe the O2S display on the scan tool while moving the connectors and the wiring harness related to the engine harness. A change in the display will indicate the location of the fault.

If a DTC P1404 is also set, check the 5 volt reference circuits for a short to voltage.

Check for a restricted exhaust system.

A shorted 5 volt reference circuit may cause a DTC P0172 to set. Check the 5 volt reference sensors for abnormal readings.

DTC P0172 – Fuel Trim System Too Rich

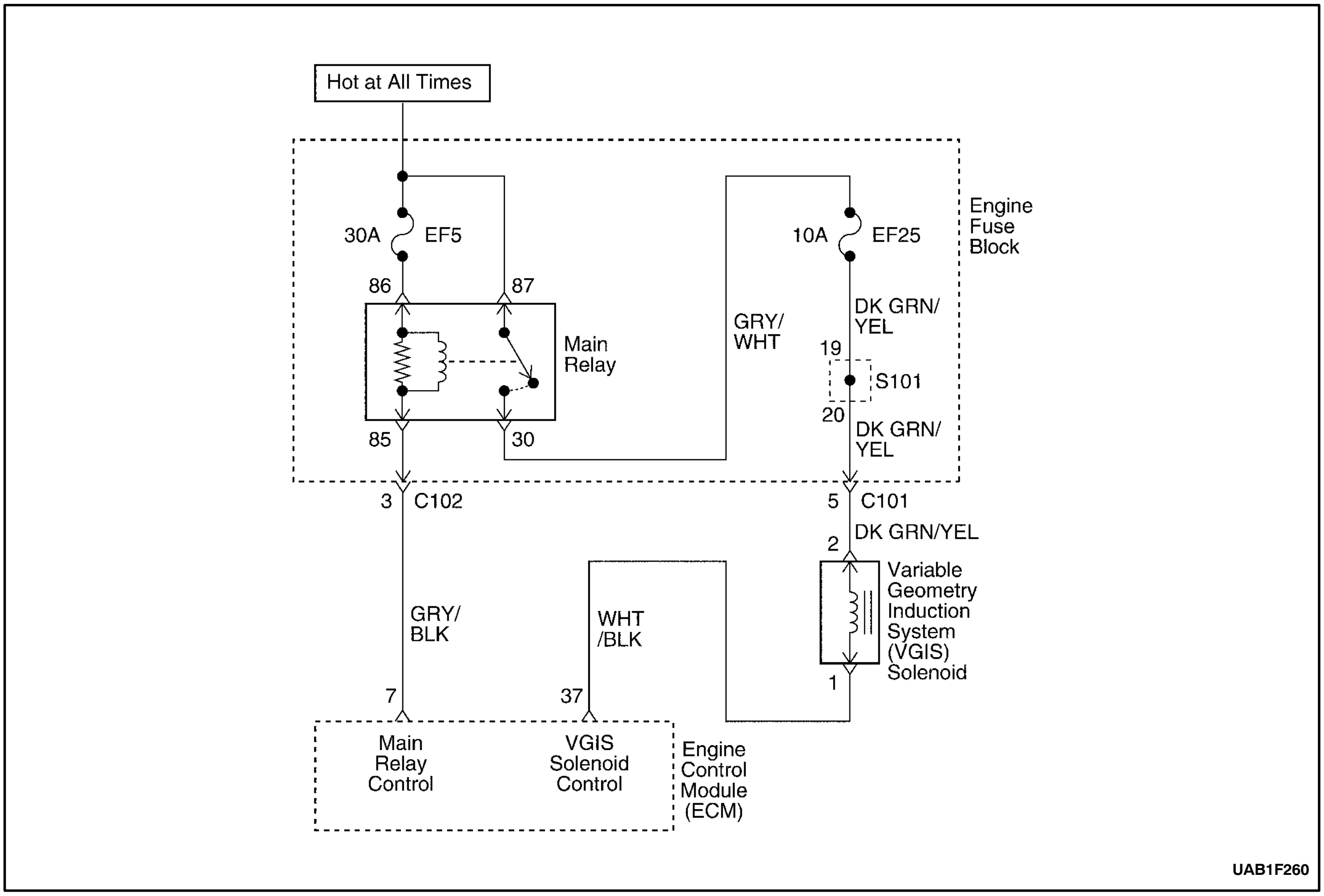
Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Install the scan tool to the Data Link Connector (DLC). Turn the ignition ON. Are any component related Diagnostic Trouble Codes (DTCs) set?	–	Go to Applicable DTC table	Go to *Step 3*
3	1. With the engine running, operate the vehicle until the LOOP STATUS indicates closed. Is the Long Term Fuel Trim value above the specified value?	–30%	Go to *Step 4*	Go to *Step 5*
4	1. Turn the ignition switch ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Does the Long Term Fuel Trim value above the specified value while operating under the specified conditions?	–30%	Go to *Step 21*	Go to *Step 5*
5	Visually/physically check the air cleaner filter for excessive dirt or being plugged and repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 6*
6	Visually/physically check the air intake system for collapsed or restricted and repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 7*
7	Inspect the throttle body inlet for damaged or foreign objects which may partially block the airflow and repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 8*
8	1. Turn the ignition OFF. 2. Inspect the throttle bore, throttle plate and Idle Air Control (IAC) passages for clocking and foreign objects and repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 9*
9	Start the engine with the vehicle in park or neutral and A/C off and note the idle quality. Is a low or unsteady idle being experienced?	–	Go to *Step 10*	Go to *Step 12*
10	Idle the engine. Are the IAC counts below the specified value?	100	Go to *Step 12*	Go to *Step 11*
11	1. Turn the ignition OFF. 2. Disconnect the Manifold Absolute Pressure (MAP) sensor electrical connector. 3. Start the engine. 4. Operate the vehicle in Closed Loop while monitoring the Long Term Fuel Trim value. Does the Long Term Fuel Trim value increase above the specified value?	–30%	Go to *Step 20*	Go to *Step 12*

DTC P0172 – Fuel Trim System Too Rich (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check the IAC valve performance. Refer to *"DTC P0506 Idle Speed RPM Lower Than Desired Idle Speed"* or *"DTC P0507 Idle Speed RPM Higher Than Desired Idle Speed"* in this section and repair as necessary. Is the repair complete?	–	Go to *Step 21*	Go to *Step 13*
13	1. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. 2. If fuel is presence in the vacuum hose, replace the fuel pressure regulator. Is the repair complete?	–	Go to *Step 21*	Go to *Step 14*
14	1. Turn the ignition ON. 2. Slowly press the acceleration pedal. Does the Throttle Position (TP) sensor display increase steady and evenly from its minimum voltage at closed throttle to its maximum voltage at Wide-Open Throttle (WOT).	–	Go to *Step 15*	Go to *Step 19*
15	1. Perform the Fuel System Diagnosis. 2. If the table isolate a problem, repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 16*
16	1. Perform the Evaporative Emission (EVAP) Control System Diagnosis. 2. If the table isolate a problem, repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 17*
17	1. Perform the Fuel Injector 2alance Test. 2. If the table isolate a problem, repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 18*
18	1. Remove the Oxygen Sensor (O2S) 2. Visually/physically inspect the O2S for silicone contamination. 3. Note: this will be indicated by a powdery white deposit on the portion of the O2S exposed to the exhaust stream. 4. If contamination is present on the O2S, find the source and repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to "Diagnostic Aids"
19	1. Check the TP sensor mounting screws. 2. If they are too loose or missing tighten or replace them as needed. 3. If the screws are OK, replace the TP sensor. Is the repair complete?	–	Go to *Step 21*	–
20	1. Turn the ignition OFF. 2. Replace the MAP sensor. Is the repair complete?	–	Go to *Step 21*	–

DTC P0172 – Fuel Trim System Too Rich (Cont'd)

Step	Action	Value(s)	Yes	No
21	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 21*	Go to *Step 2*
22	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1181 VARIABLE GEOMETRY INDUCTION SYSTEM SOLENOID LOW VOLTAGE

Circuit Description

The Engine Control Module(ECM) operates a solenoid to control the Variable Geometry Induction System (VGIS) solenoid electrical. The solenoid is normally closed. By providing a ground path, the ECM energizes the solenoid.

Conditions for Setting the DTC

- The VGIS solenoid circuit is an open or a short to ground condition exists.

Action Taken When the DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. The information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

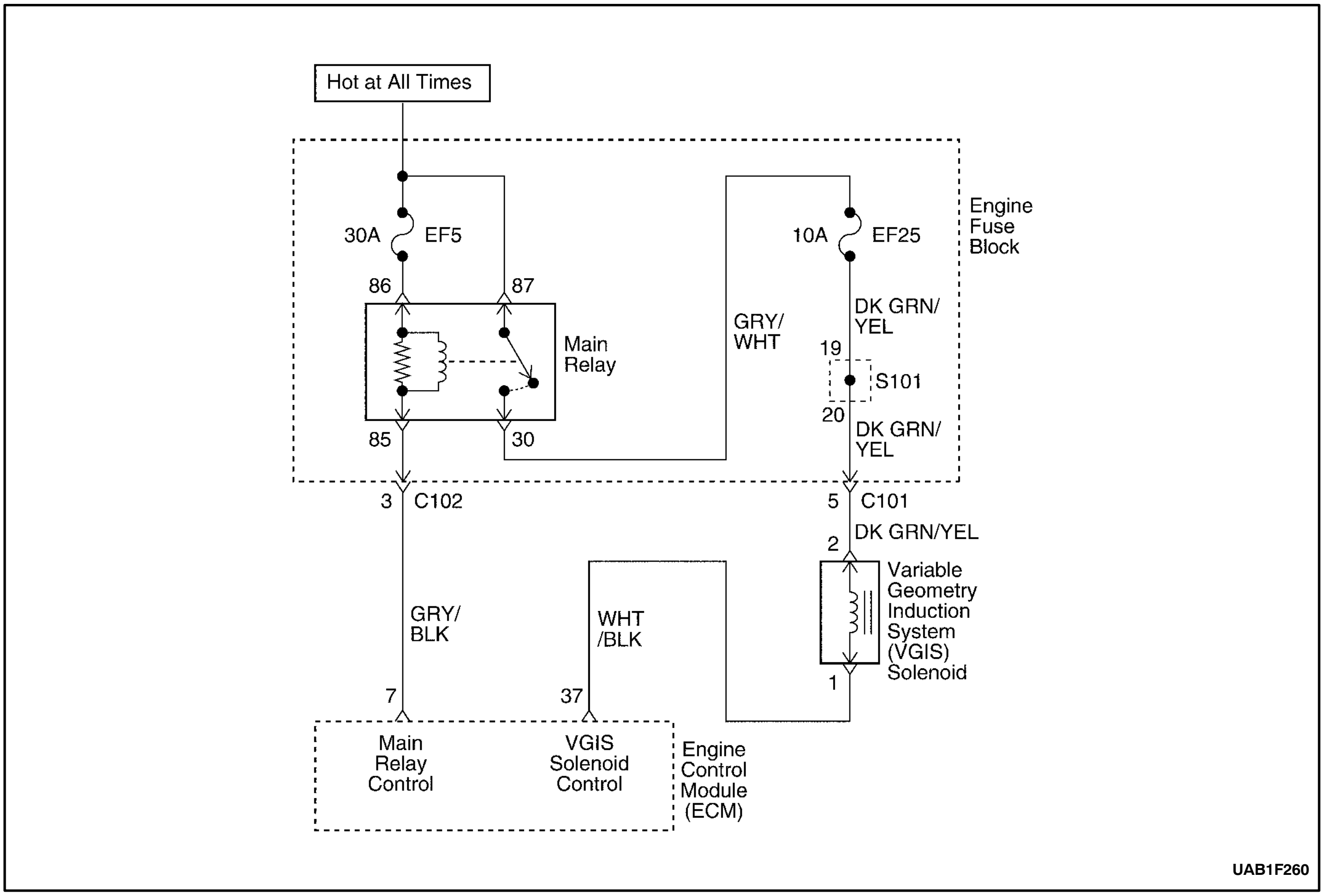
- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed-through wire insulation, or a wire that is broken inside the insulation.

DTC P1181 – Variable Geometry Induction System Solenoid Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to LOCK. 2. Disconnect the Variable Geometry Induction System (VGIS) solenoid connector. 3. Measure the resistance of the VGIS solenoid Does the resistance near the specified value?	0Ω	Go to *Step 3*	Go to *Step 6*
3	1. Disconnect the ignition relay connector. 2. Check for an open or a short to ground in the wire between the VGIS solenoid connector terminal 2 and the ignition relay connector terminal 30. Is the problem found?	–	Go to *Step 4*	Go to *Step 5*
4	Repair the wire and the connector terminal. Is the repair complete?	–	Go to *Step 8*	–
5	1. Turn the ignition switch to LOCK. 2. Disconnect the Engine Control Module(ECM) connector. 3. Check for an open or a short to ground in the wire between the VGIS solenoid connector terminal 1 and the ECM connector terminal 37. Is the problem found?	–	Go to *Step 4*	Go to *Step 7*
6	Replace the VGIS solenoid. Is the replacement complete?	–	Go to *Step 8*	–
7	Replace the ECM. Is the replacement complete?	–	Go to *Step 8*	–
8	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs). 2. Start the engine. 3. Run the engine until it reaches normal operating temperature at idle. 4. Operating the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to “Applicable DTC Table”	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1182
VARIABLE GEOMETRY INDUCTION SYSTEM SOLENOID HIGH VOLTAGE

Circuit Description

The Engine Control Module(ECM) operates a solenoid to control the Variable Geometry Induction System (VGIS) solenoid electrical. The solenoid is normally closed. By providing a ground path, the ECM energizes the solenoid.

Conditions for Setting the DTC

- The VGIS solenoid circuit is a short to battery condition exists.

Action Taken When the DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. The information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

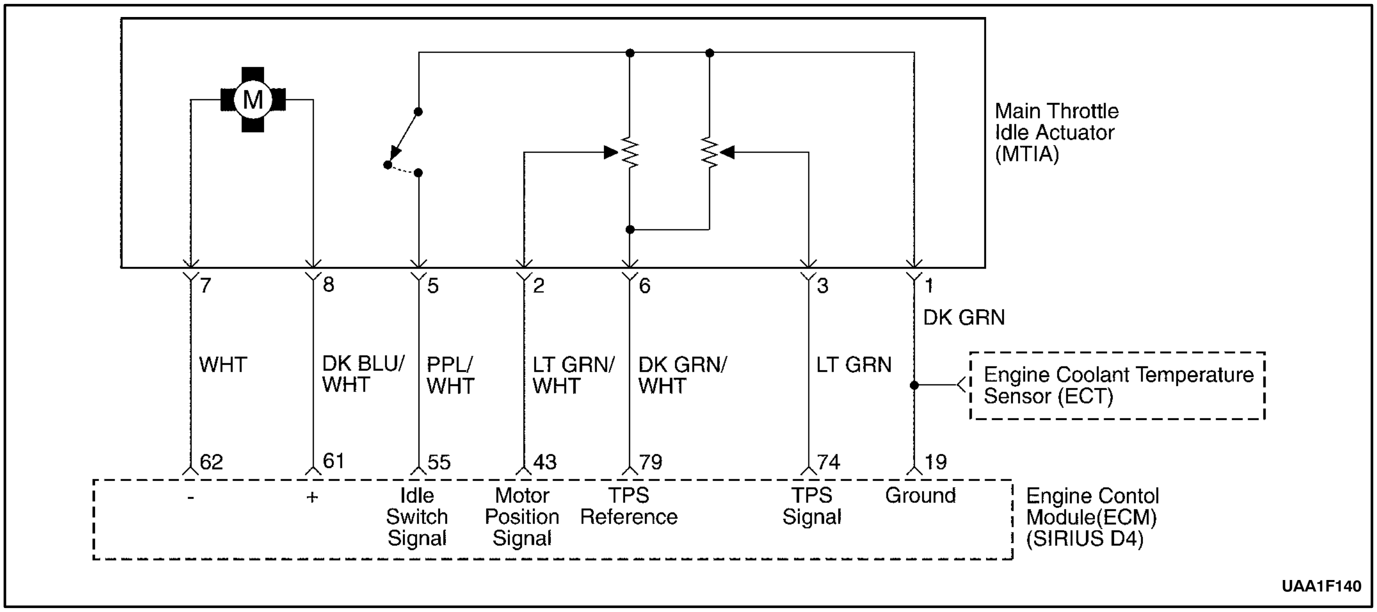
- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed-through wire insulation, or a wire that is broken inside the insulation

DTC P1182 – Variable Geometry Induction System Solenoid High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to LOCK. 2. Disconnect the Variable Geometry Induction System (VGIS) solenoid connector. 3. Measure the resistance of the VIM solenoid Does the resistance near the specified value?	0Ω	Go to *Step 3*	Go to *Step 6*
3	1.Disconnect the ignition relay connector. 2.Check for a short to battery in the wire between the VGIS solenoid connector terminal 2 and the ignition relay connector terminal 30. Is the problem found?	–	Go to *Step 4*	Go to *Step 5*
4	Repair the wire and the connector terminal. Is the repair complete?	–	Go to *Step 8*	–
5	1. Turn the ignition switch to LOCK. 2. Disconnect the Engine Control Module(ECM) connector. 3. Check for a short to battery voltage in the wire between the VGIS solenoid connector terminal 1 and the ECM connector terminal 37. Is the problem found?	–	Go to *Step 4*	Go to *Step 7*
6	Replace the VGIS solenoid. Is the replacement complete?	–	Go to *Step 8*	–
7	Replace the ECM. Is the replacement complete?	–	Go to *Step 8*	–
8	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs). 2. Start the engine. 3. Run the engine until it reaches normal operating temperature at idle. 4. Operating the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to “Applicable DTC Table”	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0222 MAIN THROTTLE IDLE ACTUATOR (MTIA) LOW VOLTAGE

Circuit Description

The aim of the MTIA (Main Throttle Idle Actuator) is to control the idle speed with the throttle body itself. The throttle is motorized for low opening angle (0°, 22.5°). The characteristics of the air flow are not the same for low and high opening angles. As a matter of fact, the gradient of the mass air flow function of TPS is lower for small angles that permits to be more precise during the idle speed control. Out of idle speed the throttle is actuated mechanically by a classical bowdencable.

The throttle position sensor (TPS) provides a voltage signal that changes in relation to the throttle plate angle. The signal voltage will vary from about nearly 5.0 V at idle to about 0.2 V to 0.4 V at wide open throttle. The TPS is one of the most important inputs used by the ECM for fuel control and other functions such as idle, wide open throttle, deceleration enleanment, and acceleration enrichment.

Conditions for Setting the DTC

- MTIA voltage is less than 0.275V.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

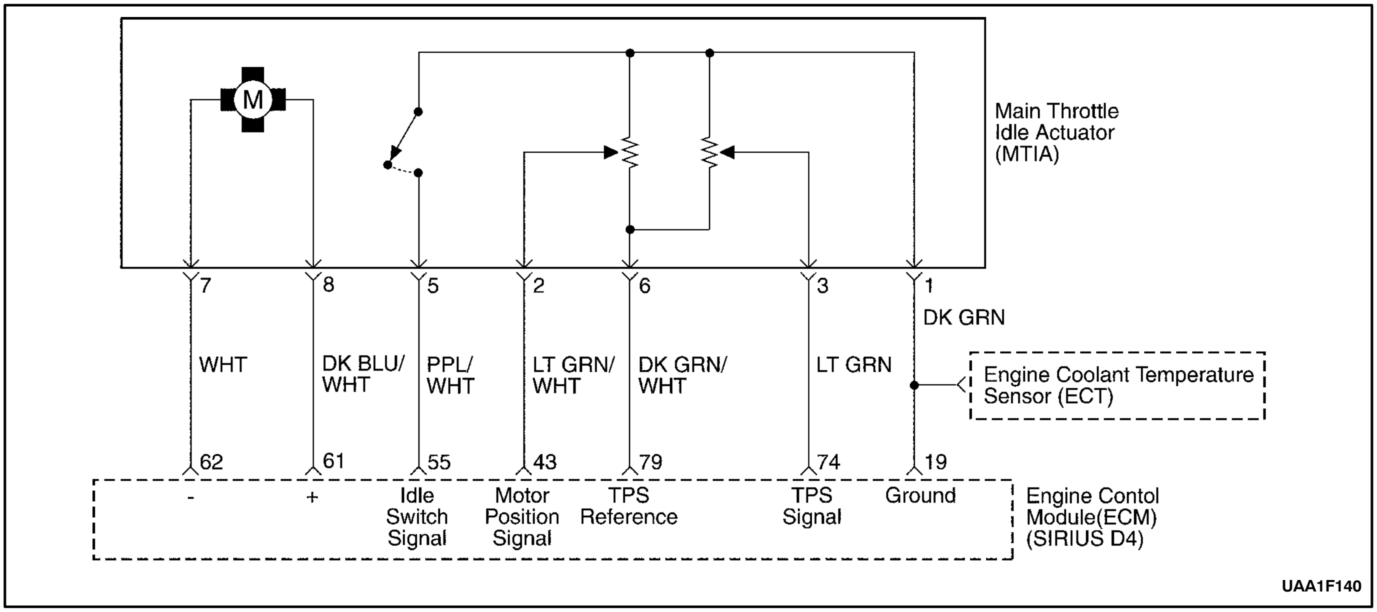
An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

DTC P0222 – Main Throttle Idle Actuator (MTIA) Low voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Connect the scan tool to the DLC. 2. Turn the ignition switch to ON. 3. Press the accelerator pedal while watching TPS for smooth changes in the voltage Does the scan tool show the TPS voltage change smoothly within the value specified?	0.3V–4.8V	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the MTIA connector. 3. Measure the voltage between terminal 8 and 7. Does the voltage measure within the value specified?	4.8–5.0V	Go to *Step 4*	Go to *Step 5*
4	Connect a fused jumper between the MTIA connector terminal 8 and terminal 5. Does the scan tool show the TPS voltage above value specified?	More than 4.8–5.0V	Go to *Step 10*	Go to *Step 8*
5	Measure the voltage between the MTIA connector 8 and ground. Does the voltage measure within the value specified?	Below 5.0V	Go to *Step 6*	Go to *Step 7*
6	1. Turn the ignition switch to LOCK. 2. Disconnect the engine control module(ECM) 3. Check for a short to ground in the wire between the MTIA connector 7 and ECM connector 62. Is the problem found?	–	Go to *Step 9*	Go to *Step 11*
7	1. Turn the ignition switch to LOCK. 2. Check for a short to ground in the wire between the MTIA connector 8 and ECM connector 61. Is the problem found?	–	Go to *Step 9*	Go to *Step 11*
8	1. Turn the ignition switch to LOCK. 2. Check for a short to ground in the wire between the MTIA connector 5 and ECM connector 55. Is the problem found?	–	Go to *Step 9*	Go to *Step 11*
9	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
10	1. Replace the throttle body assembly. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
11	1. Ignition OFF. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 12*	–
12	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0223 MAIN THROTTLE IDLE ACTUATOR (MTIA) HIGH VOLTAGE

Circuit Description

The aim of the MTIA (Main Throttle Idle Actuator) is to control the idle speed with the throttle body itself. The throttle is motorized for low opening angle (0°, 22.5°). The characteristics of the air flow are not the same for low and high opening angles. As a matter of fact, the gradient of the mass air flow function of TPS is lower for small angles that permits to be more precise during the idle speed control. Out of idle speed the throttle is actuated mechanically by a classical bowdencable.

The throttle position sensor (TPS) provides a voltage signal that changes in relation to the throttle plate angle. The signal voltage will vary from about nearly 5.0 V at idle to about 0.2 V to 0.4 V at wide open throttle. The TPS is one of the most important inputs used by the ECM for fuel control and other functions such as idle, wide open throttle, deceleration enleanment, and acceleration enrichment.

Conditions for Setting the DTC

- MTIA voltage is higher than 4.9V.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

DTC P0223 – Main Throttle Idle Actuator (MTIA) High voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Connect the scan tool to the DLC. 2. Turn the ignition switch to ON. 3. Press the accelerator pedal while watching TPS for smooth changes in the voltage Does the scan tool show the TPS voltage change smoothly within the value specified?	0.3V–4.8V	Go to “Diagnostic Aids”	Go to *Step 3*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the MTIA connector. 3. Measure the voltage between terminal 8 and 7. Does the voltage measure within the value specified?	4.8–5.0V	Go to *Step 4*	Go to *Step 5*
4	Connect a fused jumper between the MTIA connector terminal 8 and terminal 5. Does the scan tool show the TPS voltage above value specified?	More than 4.8–5.0V	Go to *Step 10*	Go to *Step 8*
5	Measure the voltage between the MTIA connector 8 and ground. Does the voltage measure within the value specified?	Below 5.0V	Go to *Step 6*	Go to *Step 7*
6	1. Turn the ignition switch to LOCK. 2. Disconnect the engine control module(ECM) 3. Check for an open or short to battery voltage in the wire between the MTIA connector 7 and ECM connector 62. Is the problem found?	–	Go to *Step 9*	Go to *Step 11*
7	1. Turn the ignition switch to LOCK. 2. Check for an open or short to battery voltage in the wire between the MTIA connector 8 and ECM connector 61. Is the problem found?	–	Go to *Step 9*	Go to *Step 11*
8	1. Turn the ignition switch to LOCK. 2. Check for an open or short to battery voltage in the wire between the MTIA connector 5 and ECM connector 55. Is the problem found?	–	Go to *Step 9*	Go to *Step 11*
9	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
10	1. Replace the throttle body assembly. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–

DTC P0223 – Main Throttle Idle Actuator (MTIA) High voltage (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Ignition OFF. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 12*	–
12	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

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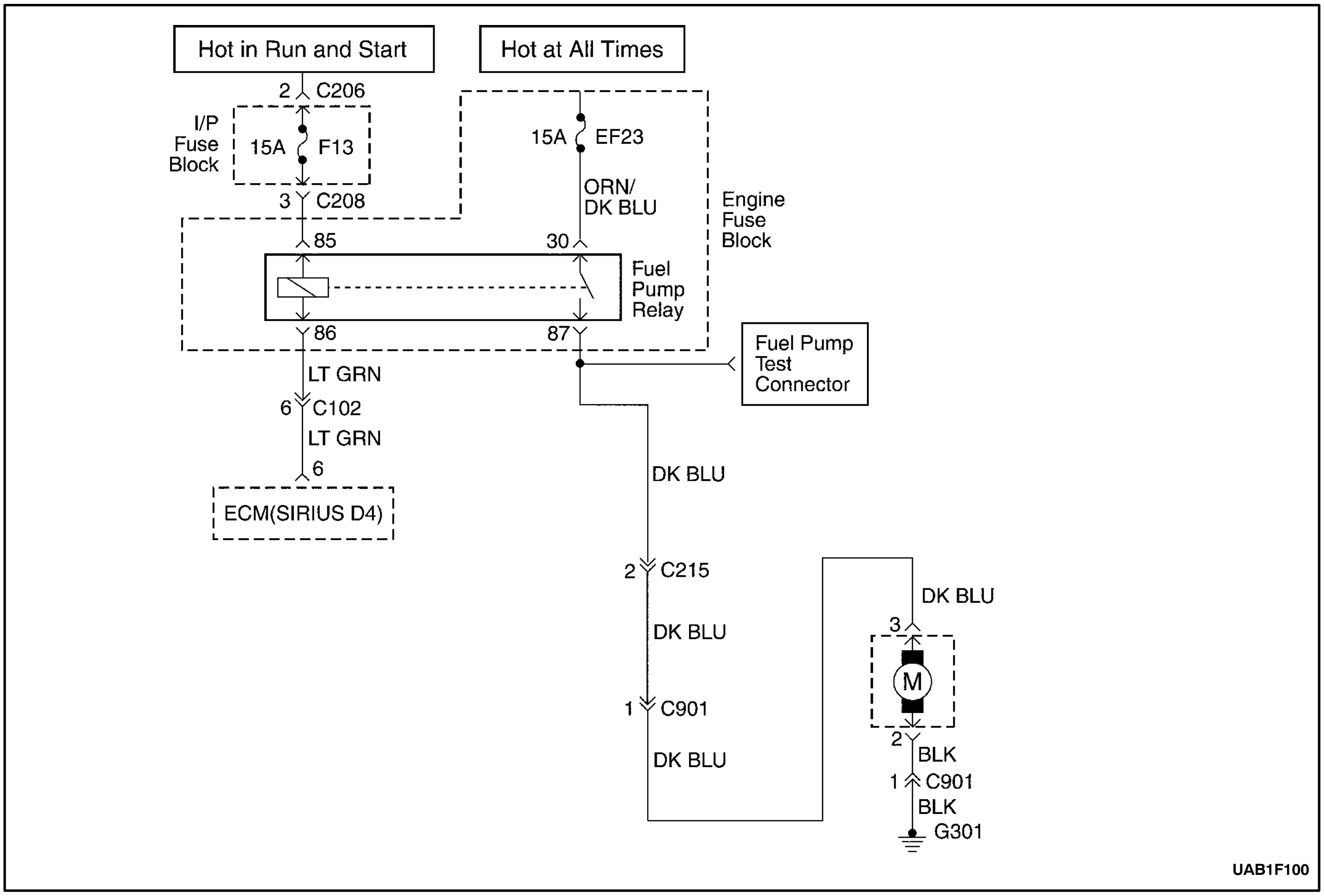

DIAGNOSTIC TROUBLE CODE (DTC) – P1230 FUEL PUMP RELAY LOW VOLTAGE

Circuit Description

When the ignition switch is turned ON, the ECM will activate the fuel pump relay and run the in-tank fuel pump.

The fuel pump will operate as long as the engine is cranking or running and the ECM is receiving ignition reference pulses.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- An open or low voltage condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.
- Coolant fan turns ON.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

DTC P1230 – Fuel Pump Relay Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to LOCK for 10 seconds. 2. Turn the Turn the ignition switch to ON. 3. Listen for in-tank fuel pump operation. Does the fuel pump operate?	2.55 seconds	Go to “Diagnostic Aids”	Go to *Step 3*
3	1. Turn the Turn the ignition switch to ON. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 86 and ground. 4. Turn the Turn the ignition switch to ON. Is the test light ON?	–	Go to *Step 4*	Go to *Step 10*
4	1. Turn the Turn the ignition switch to ON. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 85 and B+. 4. Turn the Turn the ignition switch to ON. Is the test light ON?	–	Go to *Step 5*	Go to *Step 9*
5	1. Turn the ignition switch to LOCK. 2. Connect a test light between the fuel pump relay connector terminal 30 and ground. Is the test light ON?	–	Go to *Step 6*	Go to *Step 8*
6	Check for short to ground in the wire between the fuel pump relay connector terminal 87 and fuel pump connector. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire between the fuel pump relay connector terminal 87 and fuel pump connector terminal 3. 2. Install the fuel pump relay. 3. Turn the engine OFF for 10 seconds. 4. Clear any DTCs from ECM. 5. Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	Go to *Step 14*	–
8	1. Replace the fuel pump relay. 2. Turn the ignition OFF for 10 seconds. 3. Clear any DTCs from ECM. 4. Turn the Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	Go to *Step 14*	Go to *Step 9*
9	Check for a short to ground wire between the fuel pump relay connector terminal 85 and the ignition after key ON 1(IGN 1). Is the problem found?	–	Go to *Step 11*	Go to *Step 10*
10	Check for a short to ground wire between the fuel pump relay connector terminal 86 and the ECM connector terminal 6. Is the problem found?	–	Go to *Step 12*	Go to *Step 13*

DTC P1230 – Fuel Pump Relay Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Repair the wire between the fuel pump relay connector terminal 85 and the ignition key ON (IGN1). 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Clear any DTCs from ECM. 5. Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	System OK	Go to *Step 13*
12	1. Repair the wire between the fuel pump relay connector terminal 86 and the ECM connector terminal 6. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Clear any DTCs from ECM. 5. Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	System OK	Go to *Step 13*
13	1. Replace the ECM. 2. Turn the ignition OFF for 10 seconds. 3. Clear any DTCs from ECM. 4. Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	System OK	Go to *Step 14*
14	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC ad specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

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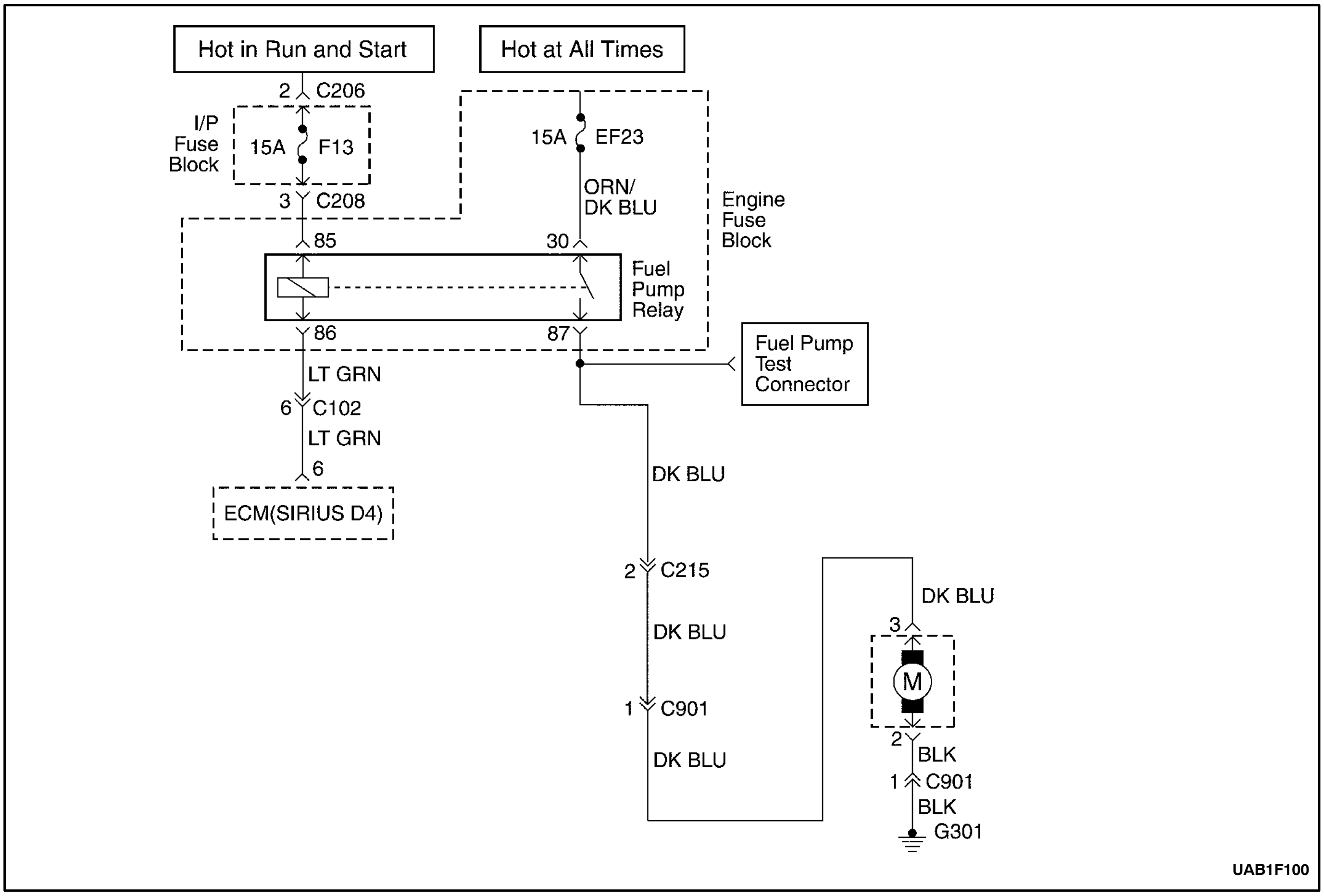

DIAGNOSTIC TROUBLE CODE (DTC) – P1231 FUEL PUMP RELAY HIGH VOLTAGE

Circuit Description

When the ignition switch is turned ON, the ECM will activate the fuel pump relay and run the in-tank fuel pump.

The fuel pump will operate as long as the engine is cranking or running and the ECM is receiving ignition reference pulses.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- A high voltage condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.
- Coolant fan turns ON.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

DTC P1231 – Fuel Pump Relay High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to LOCK for 10 seconds. 2. Turn the Turn the ignition switch to ON. 3. Listen for in-tank fuel pump operation. Does the fuel pump operate?	2.55 seconds	Go to “Diagnostic Aids”	Go to *Step 3*
3	Check for short to battery voltage or low voltage in the wire between the fuel pump relay connector terminal 87 and fuel pump connector 3. Is the problem found?	–	Go to *Step 7*	Go to *Step 5*
4	1. Repair the wire between the fuel pump relay connector terminal 87 and fuel pump connector terminal 3. 2. Install the fuel pump relay. 3. Turn the engine OFF for 10 seconds. 4. Clear any DTCs from ECM. 5. Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	Go to *Step 14*	–
5	1. Replace the fuel pump relay. 2. Turn the ignition OFF for 10 seconds. 3. Clear any DTCs from ECM. 4. Turn the Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	Go to *Step 11*	Go to *Step 6*
6	Check for short to battery voltage wire between the fuel pump relay connector terminal 85 and the ignition after key ON 1(IGN 1). Is the problem found?	–	Go to *Step 8*	Go to *Step 7*
7	Check for an open wire between the fuel pump relay connector terminal 86 and the ECM connector terminal 6. Is the problem found?	–	Go to *Step 9*	Go to *Step 10*
8	1. Repair the wire between the fuel pump relay connector terminal 85 and the ignition key ON (IGN1). 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Clear any DTCs from ECM. 5. Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	System OK	Go to *Step 13*
9	1. Repair the wire between the fuel pump relay connector terminal 86 and the ECM connector terminal 6. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Clear any DTCs from ECM. 5. Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	System OK	Go to *Step 10*

DTC P1231 – Fuel Pump Relay High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Replace the ECM. 2. Turn the ignition OFF for 10 seconds. 3. Clear any DTCs from ECM. 4. Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	System OK	Go to *Step 11*
11	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC ad specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 12*	Go to *Step 2*
12	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

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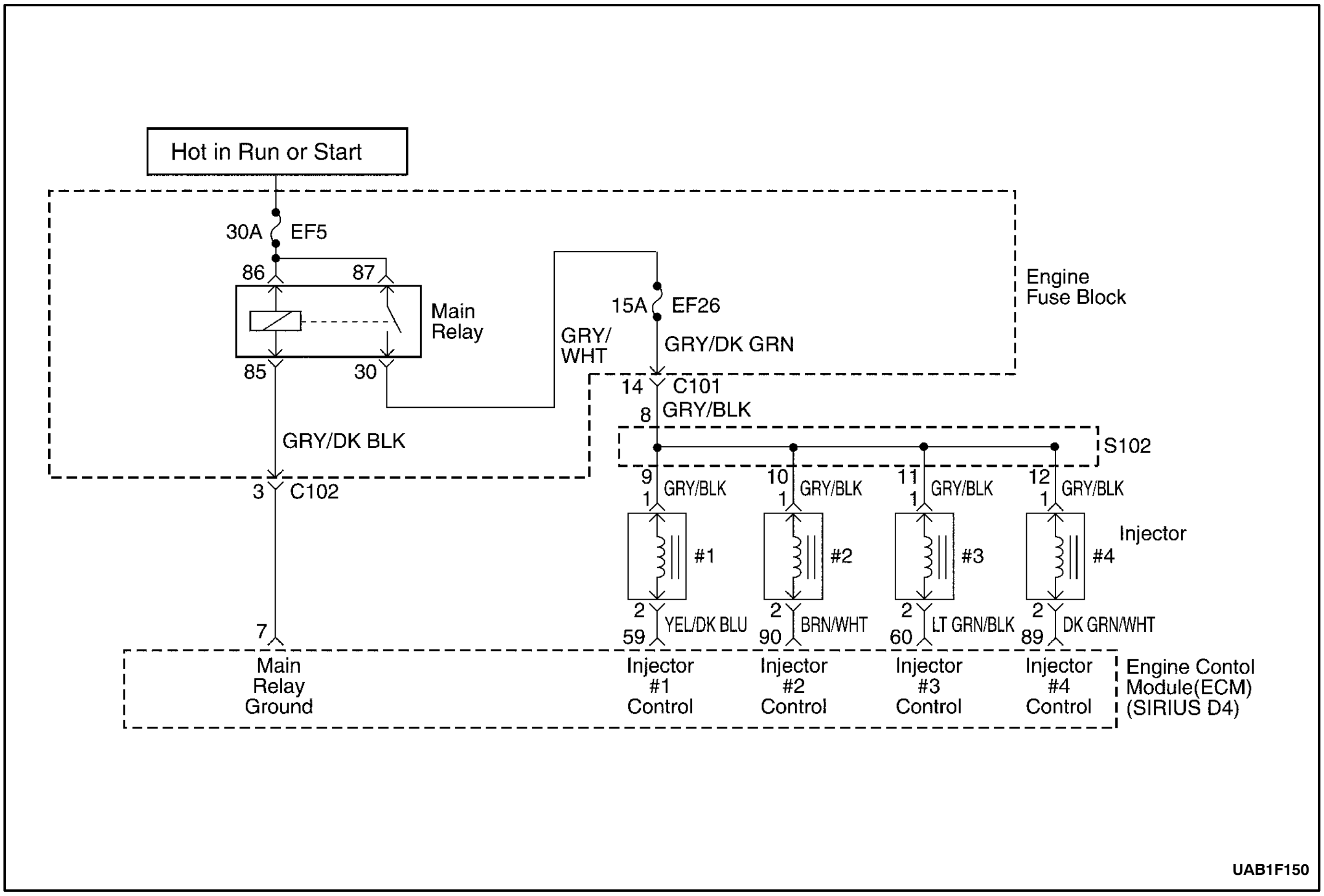


DIAGNOSTIC TROUBLE CODE (DTC) – P0261 INJECTOR 1 LOW VOLTAGE

Circuit Description

The transaxle control module(TCM)/engine control module (ECM) has four individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a low voltage and/or an open circuit and high voltage conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- The injector 1 circuit is an open or a short to ground condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

DIAGNOSTIC AIDS

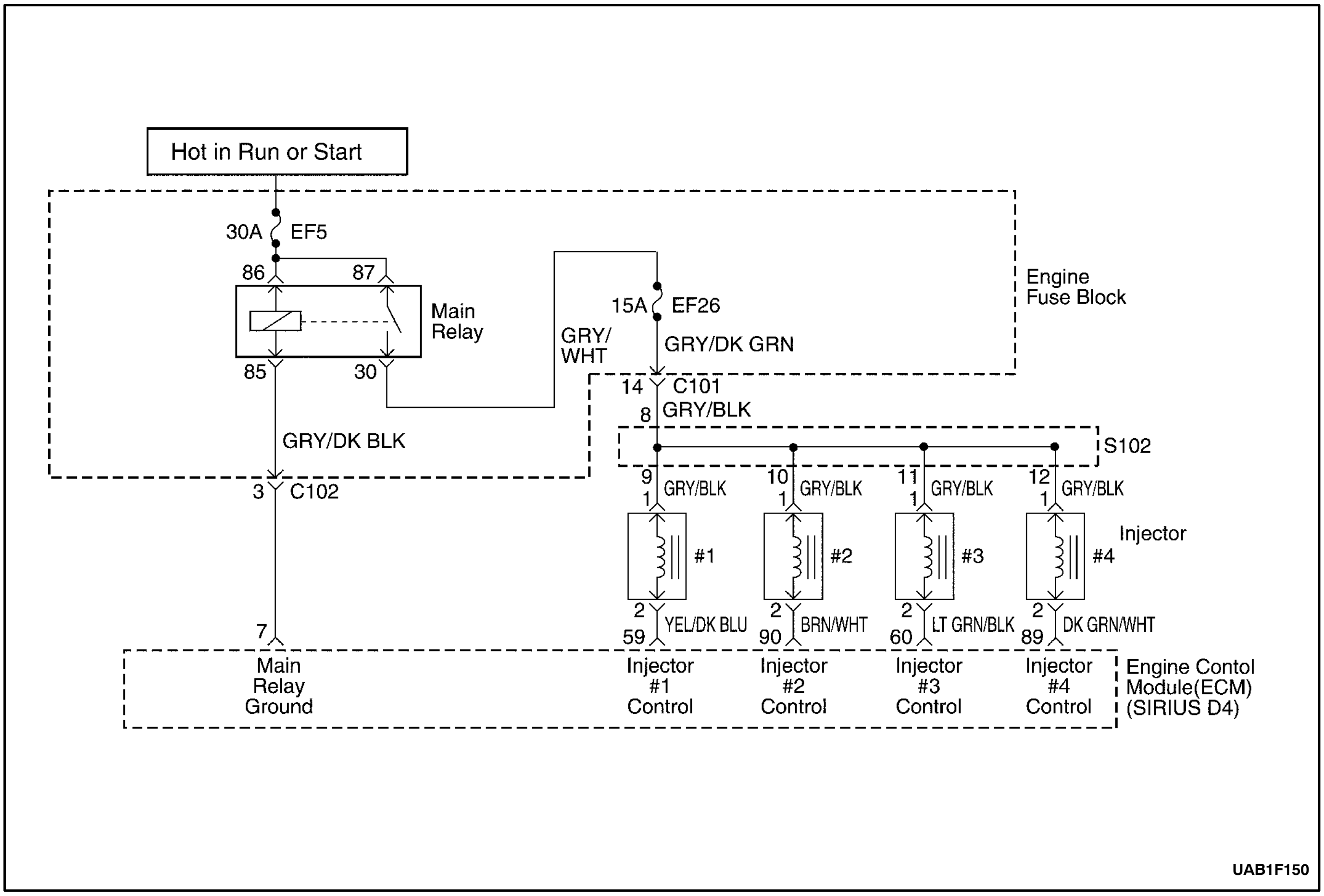
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0261 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-terms fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to *"Fuel Injector 2alance Test"* in this Section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than it tested directly at the injector 2ecause it includes resistance of the harness wires. The normal value is about 13.5Ω.

DTC P0261 – Injector 1 Low voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	With the engine start?	–	Go to *Step 3*	Go to “Engine Crank but will not Run”
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Idle the engine for one minuet. Does DTC P0261 reset?	–	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as notes. Does DTC P0261 reset?	–	Go to *Step 5*	Go to “Diagnostic Aids”
5	1. Turn the ignition switch to LOCK. 2. Check for short to ground in the wire between the injector 1 connector terminal 2 and ECM connector terminal 59. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
6	1. Turn the ignition switch to LOCK. 2. Check for short to ground in the wire between the injector 1 connector terminal 1 and battery positive. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
8	1. Replace the injector valve. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 9*	System OK
9	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Does DTC P0261 reset?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0262 INJECTOR 1 HIGH VOLTAGE

Circuit Description

The transaxle control module(TCM)/engine control module (ECM) has four individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a low voltage and/or an open circuit and high voltage conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- The injector 1 circuit is a short to battery condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

DIAGNOSTIC AIDS

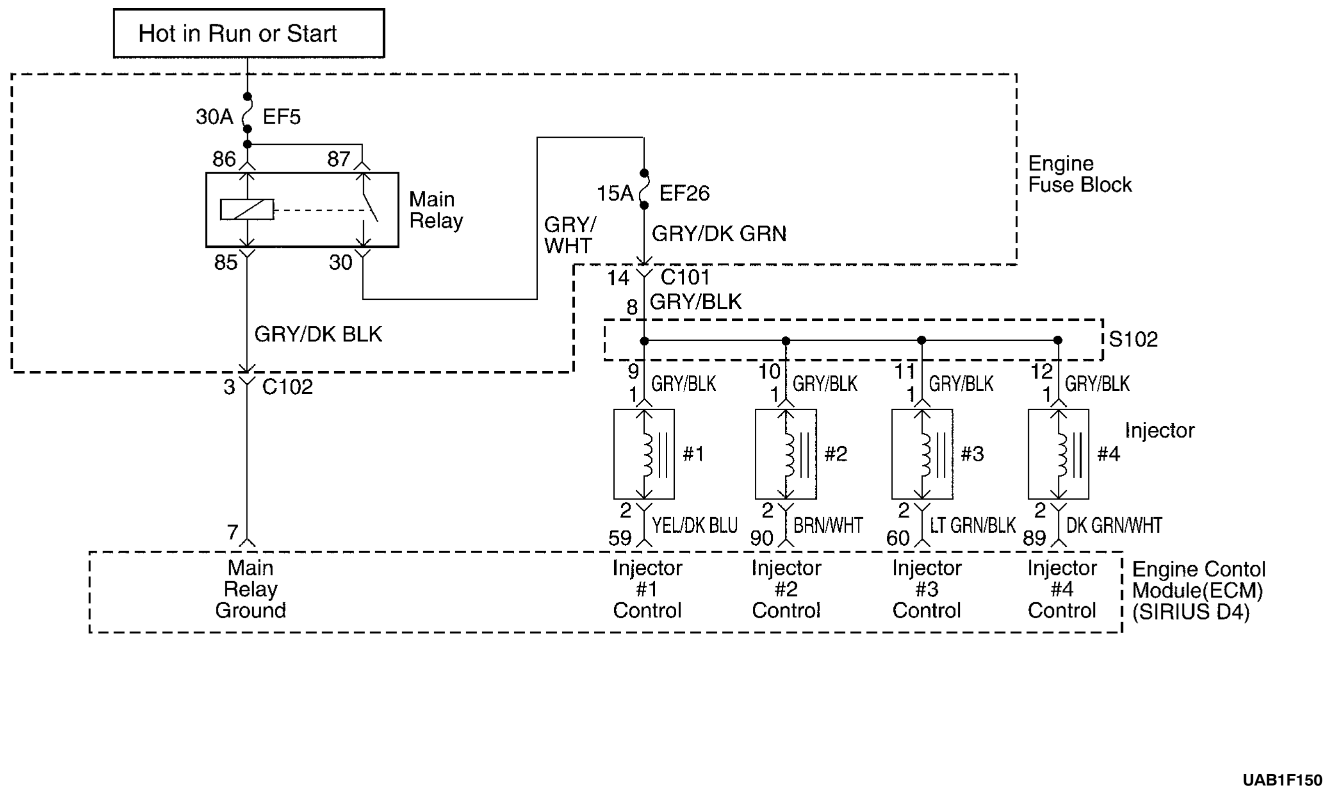
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0262 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-terms fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to *"Fuel Injector 2alance Test"* in this Section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than it tested directly at the injector 2ecause it includes resistance of the harness wires. The normal value is about 13.5Ω.

DTC P0262 – Injector 1 High voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	With the engine start?	–	Go to *Step 3*	Go to “Engine Crank but will not Run”
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Idle the engine for one minuet. Does DTC P0262 reset?	–	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as notes Does DTC P0262 reset?	–	Go to *Step 5*	Go to “Diagnostic Aids”
5	1. Turn the ignition switch to Lock. 2. Check for an open or short to battery voltage in the wire between the injector 1 connector terminal 2 and ECM connector terminal 59. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
6	1. Turn the ignition switch to Lock. 2. Check for short to battery voltage in the wire between the injector 1 connector terminal 1. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
8	1. Replace the injector valve 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Does DTC P0262 reset?	–	Go to *Step 9*	System OK
9	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0264 INJECTOR 2 LOW VOLTAGE

Circuit Description

The transaxle control module(TCM)/engine control module (ECM) has four individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a low voltage and/or an open circuit and high voltage conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- The injector 2 circuit is an open or a short to ground condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

DIAGNOSTIC AIDS

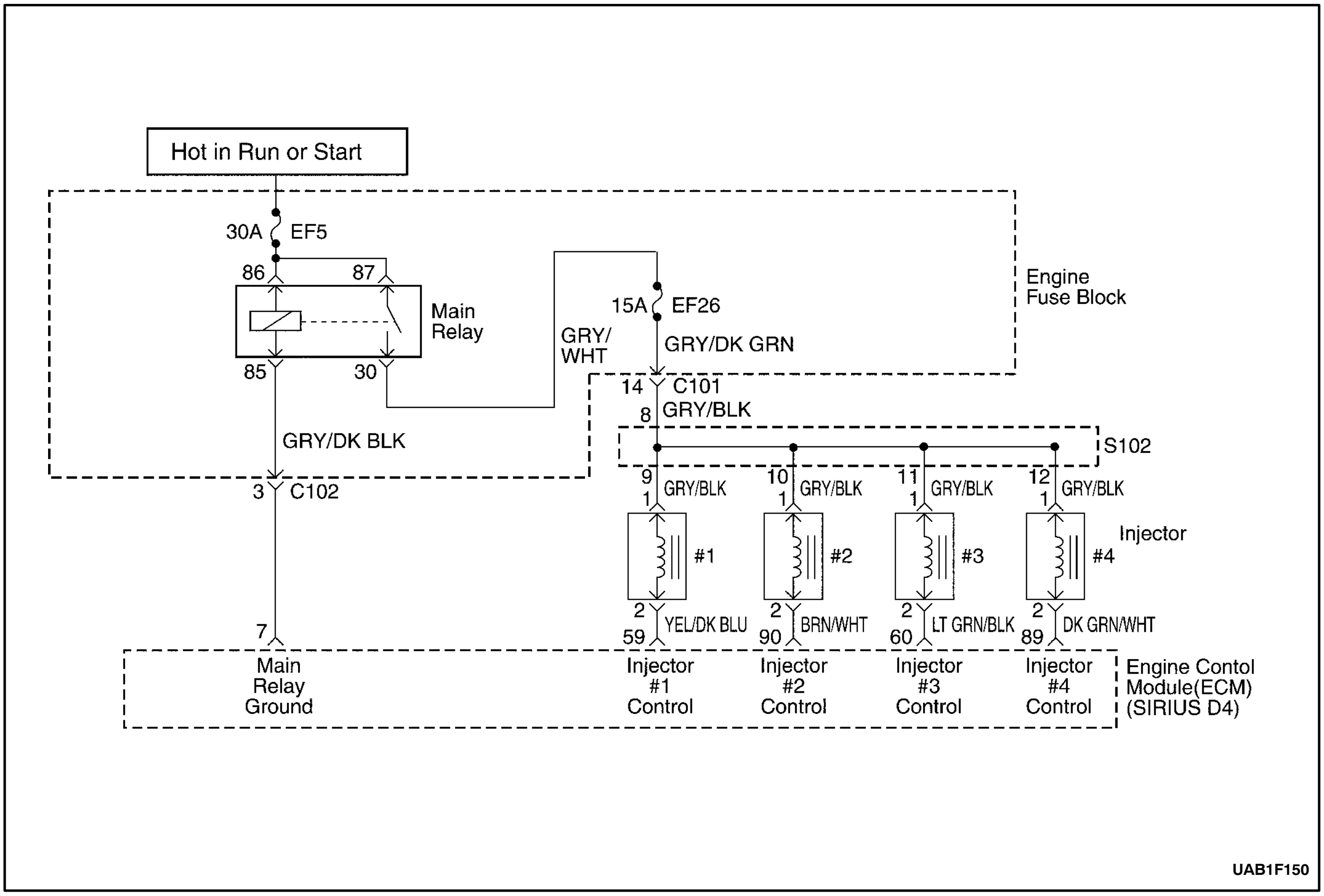
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0264 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-terms fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to *“Fuel Injector 2alance Test”* in this Section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than it tested directly at the injector 2ecause it includes resistance of the harness wires. The normal value is about 13.5Ω.

DTC P0264 – Injector 2 Low voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	With the engine start?	–	Go to *Step 3*	Go to “Engine Crank but will not Run”
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Idle the engine for one minuet. Does DTC P2064 reset?	–	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as notes Does DTC P0264 reset?	–	Go to *Step 5*	Go to “Diagnostic Aids”
5	1. Turn the ignition switch to LOCK. 2. Check for short to ground in the wire between the injector 2 connector terminal 2 and ECM connector terminal 90. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
6	1. Turn the ignition switch to LOCK. 2. Check for short to ground in the wire between the injector 2 connector terminal 1 and battery positive. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
8	1. Replace the injector valve. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Does DTC P0264 reset?	–	Go to *Step 9*	System OK
9	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0265 INJECTOR 2 HIGH VOLTAGE

Circuit Description

The transaxle control module(TCM)/engine control module (ECM) has four individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a low voltage and/or an open circuit and high voltage conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- The injector 2 circuit is a short to battery condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

DIAGNOSTIC AIDS

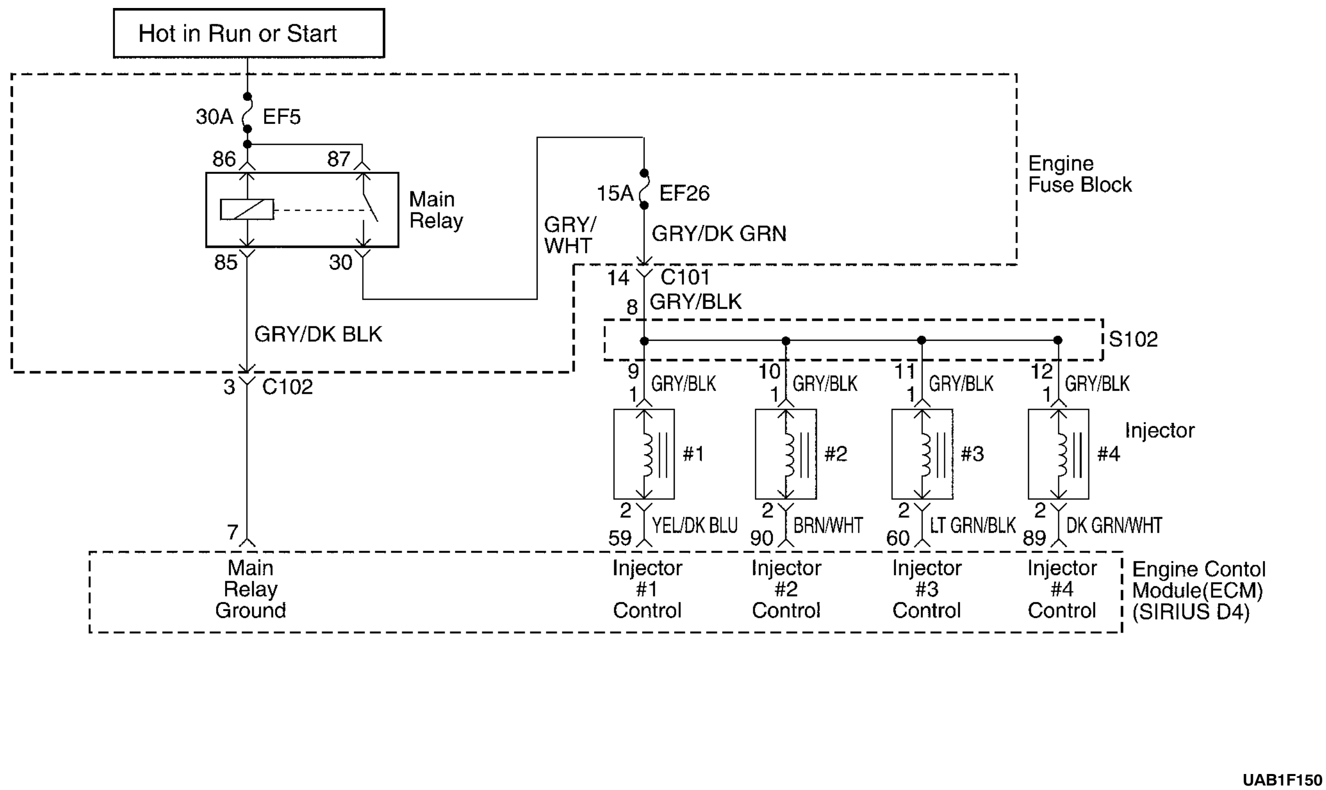
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0265 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-terms fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to *“Fuel Injector 2alance Test”* in this Section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than it tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5Ω.

DTC P0265 – Injector 2 High voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	With the engine start?	–	Go to *Step 3*	Go to “Engine Crank but will not Run”
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Idle the engine for one minuet. Does DTC P0265 reset?	–	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as notes. Does DTC P0265 reset?	–	Go to *Step 5*	Go to “Diagnostic Aids”
5	1. Turn the ignition switch to Lock. 2. Check for an open or short to battery voltage in the wire between the injector 2 connector terminal 2 and ECM connector terminal 90. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
6	1. Turn the ignition switch to Lock. 2. Check for short to battery voltage in the wire between the injector 2 connector terminal 1. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
8	1. Replace the injector valve. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Does DTC P0265 reset?	–	Go to *Step 9*	System OK
9	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0267 INJECTOR 3 LOW VOLTAGE

Circuit Description

The transaxle control module(TCM)/engine control module (ECM) has four individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a low voltage and/ or an open circuit and high voltage conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- The injector 3 circuit is an open or a short to ground condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

DIAGNOSTIC AIDS

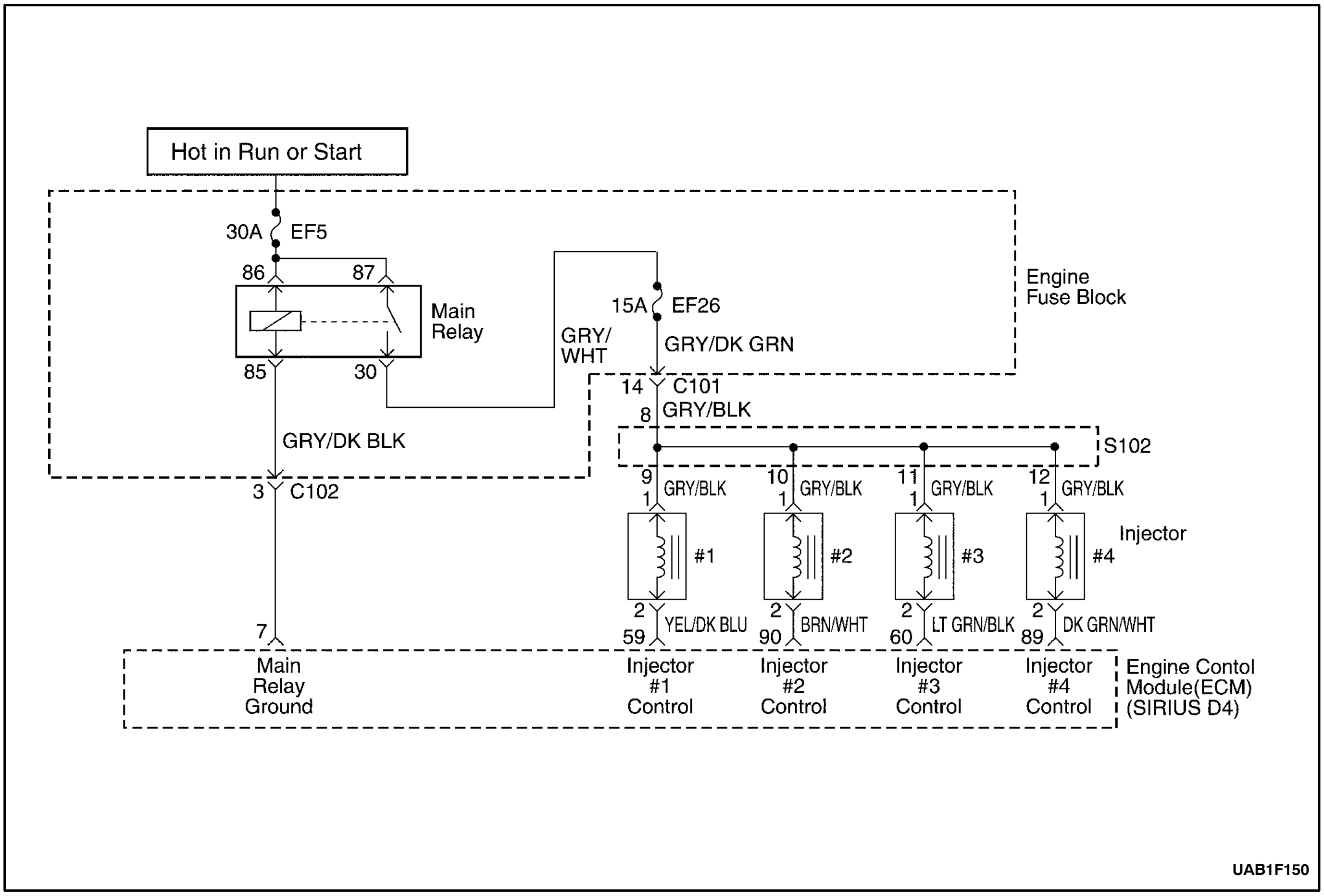
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0267 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-terms fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to *“Fuel Injector 3alance Test”* in this Section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than it tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5Ω.

DTC P0267 – Injector 3 Low voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	With the engine start?	–	Go to *Step 3*	Go to “Engine Crank but will not Run”
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Idle the engine for one minuet. Does DTC P0267 reset?	–	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as notes. Does DTC P0267 reset?	–	Go to *Step 5*	Go to “Diagnostic Aids”
5	1. Turn the ignition switch to LOCK. 2. Check for short to ground in the wire between the injector 3 connector terminal 2 and ECM connector terminal 60. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
6	1. Turn the ignition switch to LOCK. 2. Check for short to ground in the wire between the injector 3 connector terminal 1 and battery positive. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
8	1. Replace the injector valve. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Does DTC P0267 reset?	–	Go to *Step 9*	System OK
9	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0268 INJECTOR 3 HIGH VOLTAGE

Circuit Description

The transaxle control module(TCM)/engine control module (ECM) has four individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a low voltage and/or an open circuit and high voltage conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- The injector 3 circuit is a short to battery condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

DIAGNOSTIC AIDS

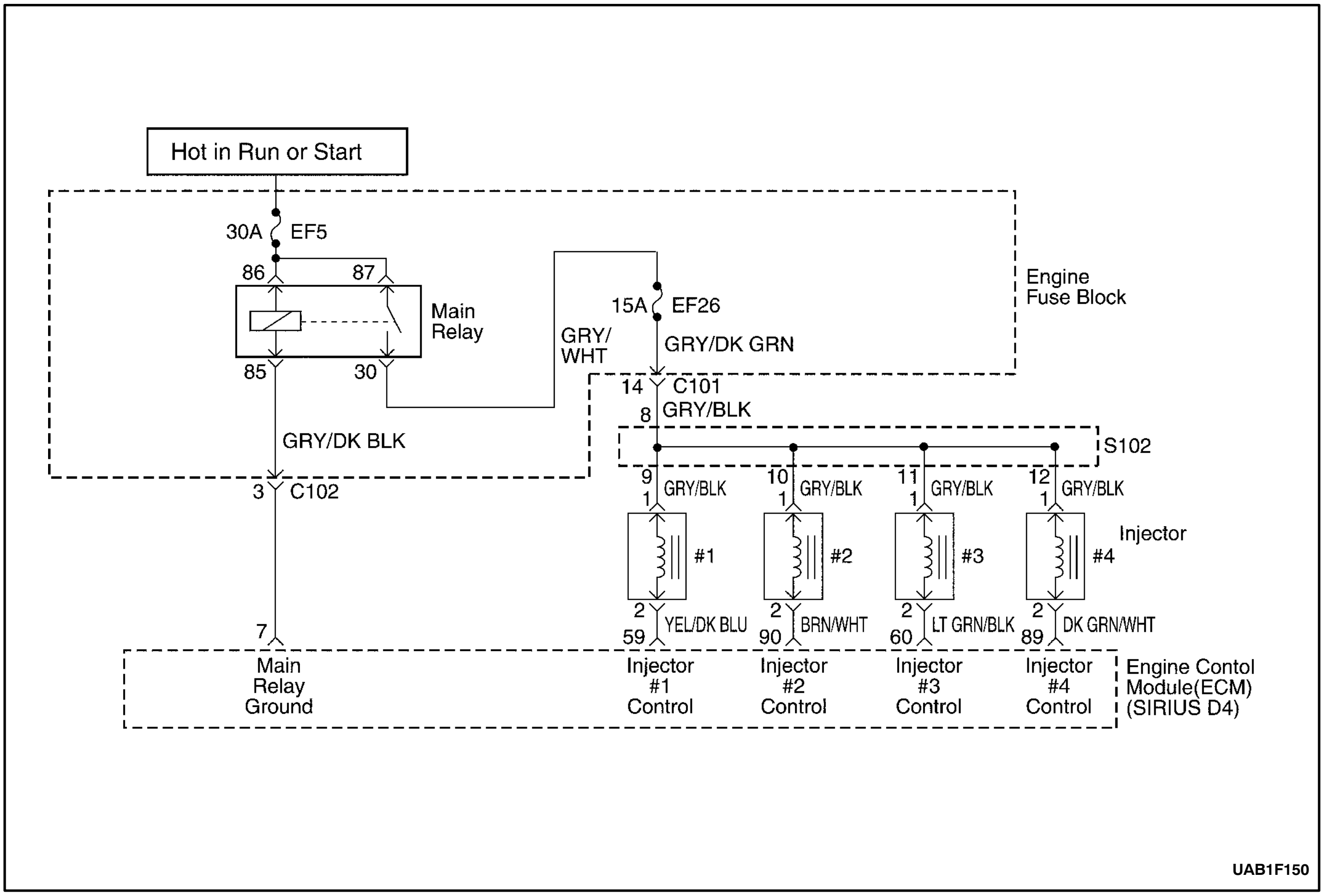
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0268 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-terms fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to *"Fuel Injector 3alance Test"* in this Section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than it tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5Ω.

DTC P0268 – Injector 3 High voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	With the engine start?	–	Go to *Step 3*	Go to "Engine Crank but will not Run"
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Idle the engine for one minuet. Does DTC P0268 reset?	–	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as notes. Does DTC P0268 reset?	–	Go to *Step 5*	Go to "Diagnostic Aids"
5	1. Turn the ignition switch to Lock. 2. Check for an open or short to battery voltage in the wire between the injector 3 connector terminal 2 and ECM connector terminal 60. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
6	1. Turn the ignition switch to Lock. 2. Check for short to battery voltage in the wire between the injector 3 connector terminal 1. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
8	1. Replace the injector valve. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Does DTC P0268 reset?	–	Go to *Step 9*	System OK
9	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0270 INJECTOR 4 LOW VOLTAGE

Circuit Description

The transaxle control module(TCM)/engine control module (ECM) has four individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a low voltage and/or an open circuit and high voltage conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- The injector 4 circuit is an open or a short to ground condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

DIAGNOSTIC AIDS

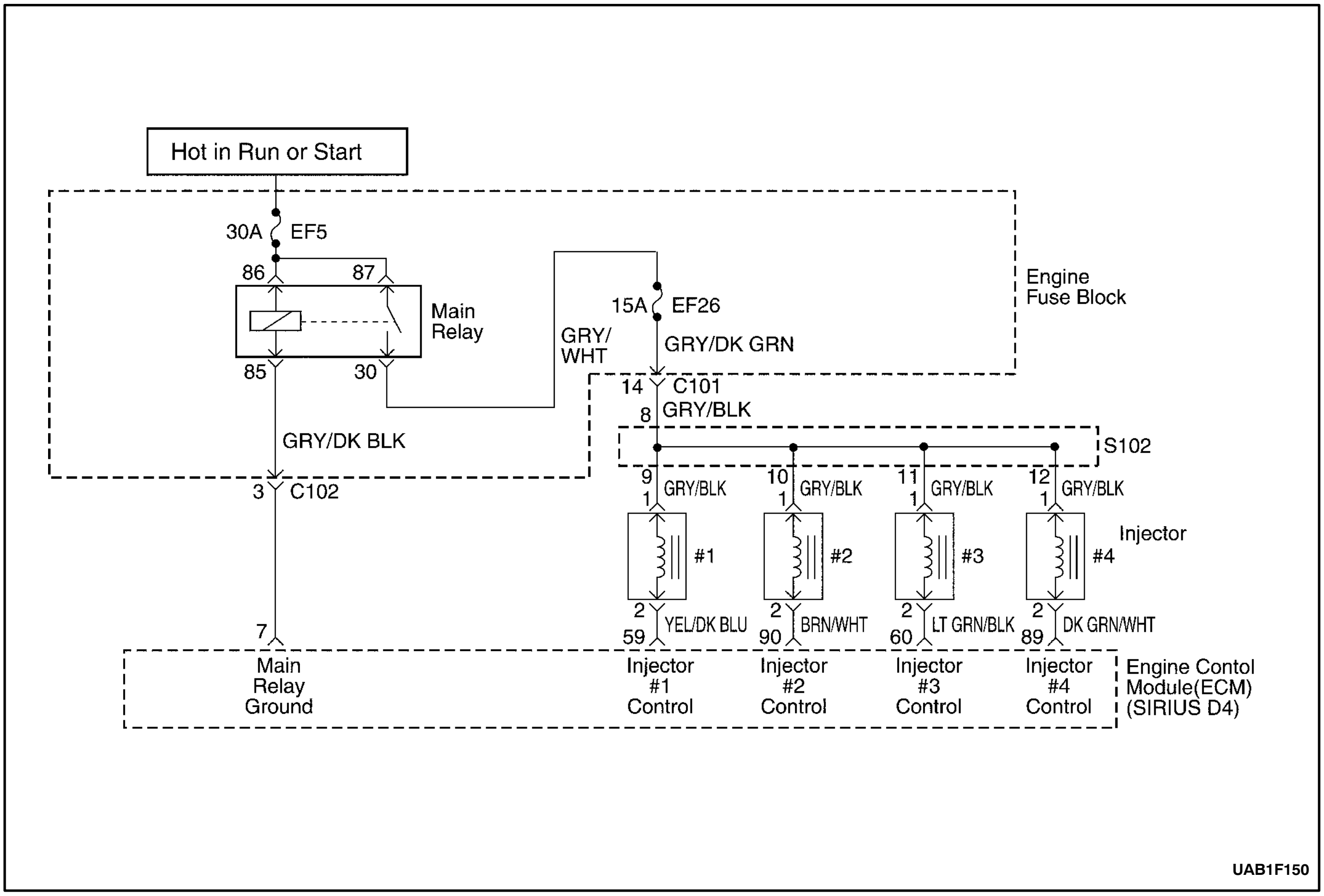
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0270 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-terms fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to *“Fuel Injector 4alance Test”* in this Section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than it tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5Ω.

DTC P0270 – Injector 4 Low voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	With the engine start?	–	Go to *Step 3*	Go to "Engine Crank but will not Run"
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTC). 2. Idle the engine for one minuet. Does DTC P0270 reset?	–	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as notes Does DTC P0270 reset?	–	Go to *Step 5*	Go to "Diagnostic Aids"
5	1. Turn the ignition switch to LOCK. 2. Check for short to ground in the wire between the injector 4 connector terminal 2 and ECM connector terminal 89. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
6	1. Turn the ignition switch to LOCK. 2. Check for short to ground in the wire between the injector 4 connector terminal 1 and battery positive. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
8	1. Replace the injector valve. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Does DTC P0270 reset?	–	Go to *Step 9*	System OK
9	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0271 INJECTOR 4 HIGH VOLTAGE

Circuit Description

The transaxle control module(TCM)/engine control module (ECM) has four individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a low voltage and/or an open circuit and high voltage conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- The injector 4 circuit is a short to battery condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

DIAGNOSTIC AIDS

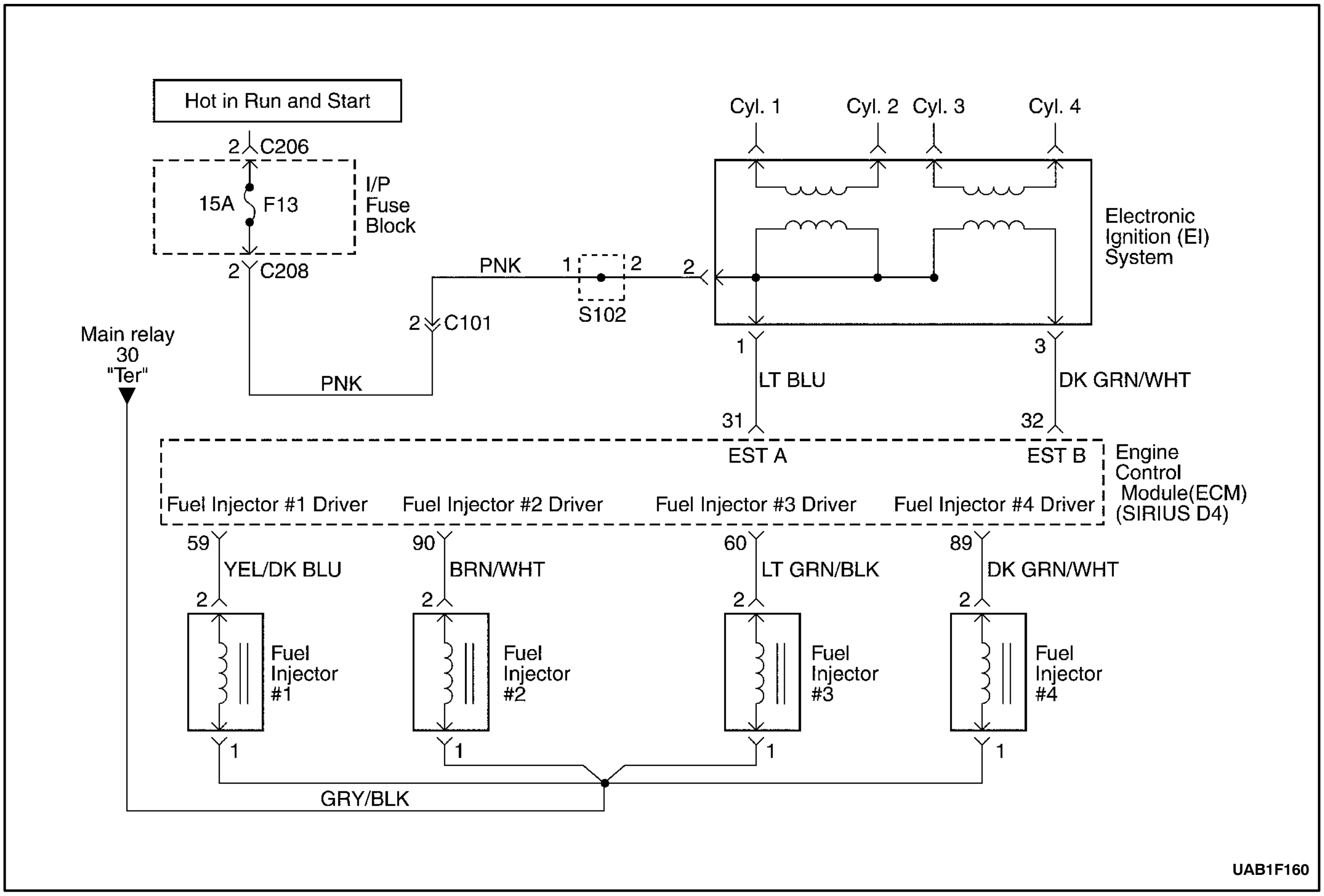
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0271 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-terms fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to *"Fuel Injector balance Test"* in this Section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than it tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5Ω.

DTC P0271 – Injector 4 High voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	With the engine start?	–	Go to *Step 3*	Go to "Engine Crank but will not Run"
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Idle the engine for one minuet. Does DTC P0271 reset?	–	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as notes Does DTC P0271 reset?	–	Go to *Step 5*	Go to "Diagnostic Aids"
5	1. Turn the ignition switch to Lock. 2. Check for an open or short to battery voltage in the wire between the injector 4 connector terminal 2 and ECM connector terminal 60. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
6	1. Turn the ignition switch to Lock. 2. Check for high voltage in the wire between the injector 4 connector terminal 1. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
8	1. Replace the injector valve. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Does DTC P0271 reset?	–	Go to *Step 9*	System OK
9	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0300 MULTIPLE CYLINDER MISFIRE (CATALYST DAMAGE)

System Description

The Engine Control Module (ECM) monitors the crankshaft and camshaft positions to detect if the engine is misfiring. The ECM looks for a quick drop in crankshaft speed. This test is executed in blocks of 200 engine revolution tests. It may take between one to several tests to store a Diagnostic Trouble Code (DTC), the Malfunction Indicator Lamp (MIL). Severe misfire will flash the MIL, indicating that catalyst damage is possible.

Conditions for Setting the DTC

- The engine speed is less than 4,500 rpm.
- The fuel tank level is greater than 20%.
- No anti–jerk correction.
- No rough road detection.
- No crankshaft oscillation detection.
- DTCs P0107, P0108, P0122, P0123, P0341, P0342, P0336 and P0337 are not set.

Action Taken when the DTC Sets

- The malfunction Indicator Lamp (MIL) will blinking.
- The ECM will record operating conditions at the time the diagnostic fails. The information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

An intermittent can also be the result of a defective reluctor wheel. Remove the CKP sensor and inspect the reluctor wheel through the sensor mount hole. Check for porosity and the condition of wheel. If the DTC is intermittent refer to *"Symptoms Diagnosis"* in this section.

DTC P0300 – Multiple Cylinder Misfire(Catalyst Damage)

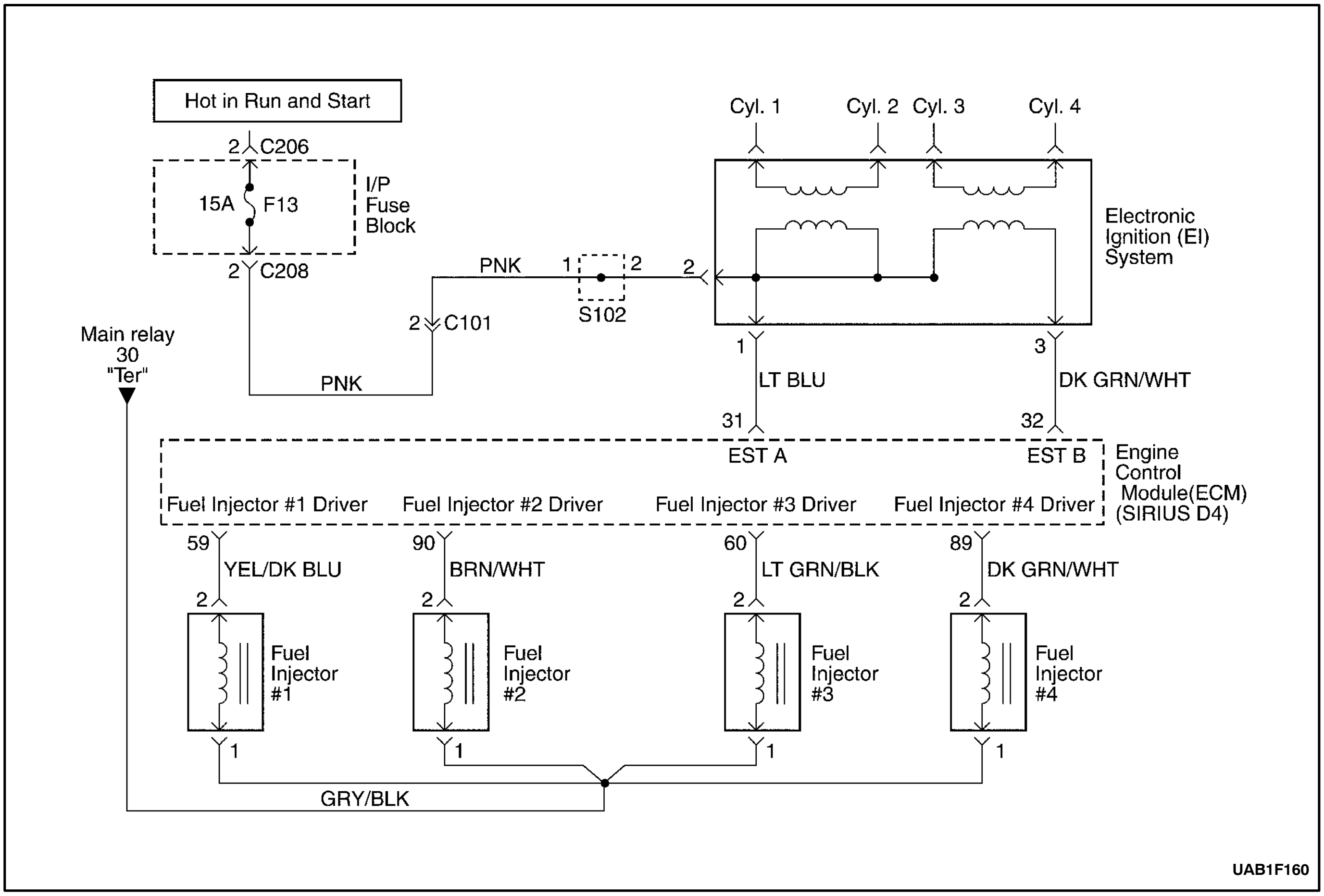
Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON, with the engine OFF. 3. Request Diagnostic Trouble Codes (DTCs). Are DTCs P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271 set?	–	Go to Applicable DTC table	Go to *Step 3*
3	Perform a visual/physical inspection. Make any repairs that are necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 4*
4	Start the engine and allow it to idle. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to *Step 6*
5	Are all counters equal (within a percentage of each other)?	–	Go to *Step 7*	Go to *Step 11*
6	1. Turn the ignition ON, with the engine OFF. 2. Review the Freeze Frame data, and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and conditions for setting this DTC as noted. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to “Diagnostic Aids”
7	1. Turn the engine OFF. 2. Install a fuel pressure gauge to the fuel rail. 3. Observe the fuel pressure with the engine running. Is the fuel pressure within the specified value?	284–325 kPa (41–47 psi)	Go to *Step 8*	Go to “Fuel System Diagnosis”
8	Check the fuel for contamination. Is the fuel OK?	–	Go to *Step 9*	Go to *Step 10*
9	Check for a basic engine problem and repair as necessary. Is the repair complete?	–	Go to *Step 27*	–
10	Replace the contaminated fuel. Is the repair complete?	–	Go to *Step 27*	–
11	1. Turn the engine OFF. 2. Disconnect the fuel injector harness connector. 3. Install a spark tester on cylinder #1 spark plug cable. 4. Crank the engine and check for spark. 5. Repeat the above procedure on cylinders #2, #3 and #4. Is a spark observed on all four spark plug cables?	–	Go to *Step 12*	Go to *Step 20*
12	Replace any malfunctioning spark plugs if necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 13*

DTC P0300 – Multiple Cylinder Misfire(Catalyst Damage) (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. Turn the engine OFF. 2. Disconnect the fuel injector connectors from the injectors. 3. Install an injector test light on the injector harness connector for the cylinders that had misfired. 4. Crank the engine and note the test light. Does the injector test light blink?	–	Go to *Step 14*	Go to *Step 15*
14	Perform the Fuel Injector Balance Test. Are the fuel injectors OK?	–	Go to *Step 9*	Go to *Step 16*
15	1. Disconnect the injector test light. 2. With a test light connected to ground, probe the ignition feed terminal 1 of the injector harness connector for each cylinder that had misfire. 3. Crank the engine. Does the test light illuminate?	–	Go to *Step 17*	Go to *Step 19*
16	Replace any malfunctioning fuel injectors. Is the repair complete?	–	Go to *Step 27*	–
17	Check the affected fuel injector driver circuit at terminals 59, 89, 90, and 60 for an open, short, or short to voltage. Is a problem found?	–	Go to *Step 18*	Go to *Step 24*
18	Repair the open or the shorted fuel injector driver circuit. Is the repair complete?	–	Go to *Step 27*	–
19	Repair the open ignition feed circuit between the fuel injector harness connector and the fuel injector connector. Is the repair complete?	–	Go to *Step 27*	–
20	Measure the resistance of the spark plug cable that the spark plug tester did not spark. Is the resistance of the spark plug cable less than the specified value?	30000Ω	Go to *Step 21*	Go to *Step 25*
21	Inspect the Engine Control Module (ECM) connector and connections. Are the connections OK?	–	Go to *Step 22*	Go to *Step 23*
22	Check the affected cylinders ignition control circuit for an open or short and repair as necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 26*
23	Repair the connector or connections. Is the repair complete?	–	Go to *Step 27*	–
24	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 27*	–
25	Replace the spark plug cable. Is the repair complete?	–	Go to *Step 27*	–
26	Replace the faulty ignition coil. Is the repair complete?	–	Go to *Step 27*	Go to *Step 24*

DTC P0300 – Multiple Cylinder Misfire(Catalyst Damage) (Cont'd)

Step	Action	Value(s)	Yes	No
27	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 28*	Go to *Step 2*
28	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0300 MULTIPLE CYLINDER MISFIRE (INCREASE EMISSION)

System Description

The Engine Control Module (ECM) monitors the crankshaft and camshaft positions to detect if the engine is misfiring. The ECM looks for a quick drop in crankshaft speed. This test is executed in blocks of 1,000 engine revolution tests. It may take between one to several tests to store a Diagnostic Trouble Code (DTC) and illuminate the Malfunction Indicator Lamp (MIL).

Conditions for Setting the DTC

- The engine speed is less than 4,500 rpm.
- The fuel tank level is greater than 20%.
- No anti–jerk correction.
- No rough road detection.
- No crankshaft oscillation detection.
- DTCs P0107, P0108, P0122, P0123, P0341, P0342, P0336 and P0337 are not set.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

An intermittent can also be the result of a defective reluctor wheel. Remove the CKP sensor and inspect the reluctor wheel through the sensor mount hole. Check for porosity and the condition of wheel. If the DTC is intermittent refer to *"Symptoms Diagnosis"* in this section.

DTC P0300 – Multiple Cylinder Misfire(Increase Emission)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON, with the engine OFF. 3. Request Diagnostic Trouble Codes (DTCs) Are DTCs P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271 set?	–	Go to Applicable DTC table	Go to *Step 3*
3	Perform a visual/physical inspection. Make any repairs that are necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 4*
4	Start the engine and allow it to idle. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to *Step 6*
5	Are all counters equal (within a percentage of each other)?	–	Go to *Step 7*	Go to *Step 11*
6	1. Turn the ignition ON, with the engine OFF. 2. Review the Freeze Frame data, and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and conditions for setting this DTC as noted. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to “Diagnostic Aids”
7	1. Turn the engine OFF. 2. Install a fuel pressure gauge to the fuel rail. 3. Observe the fuel pressure with the engine running. Is the fuel pressure within the specified value?	284–325 kPa (41–47 psi)	Go to *Step 8*	Go to “Fuel System Diagnosis”
8	Check the fuel for contamination. Is the fuel OK?	–	Go to *Step 9*	Go to *Step 10*
9	Check for a basic engine problem and repair as necessary. Is the repair complete?	–	Go to *Step 27*	–
10	Replace the contaminated fuel. Is the repair complete?	–	Go to *Step 27*	–
11	1. Turn the engine OFF. 2. Disconnect the fuel injector harness connector. 3. Install a spark tester on cylinder #1 spark plug cable. 4. Crank the engine and check for spark. 5. Repeat the above procedure on cylinders #2, #3 and #4. Is a spark observed on all four spark plug cables?	–	Go to *Step 12*	Go to *Step 20*
12	Replace any malfunctioning spark plugs if necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 13*

DTC P0300 – Multiple Cylinder Misfire(Increase Emission) (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. Turn the engine OFF. 2. Disconnect the fuel injector connectors from the injectors. 3. Install an injector test light on the injector harness connector for the cylinders that had misfired. 4. Crank the engine and note the test light. Does the injector test light blink?	–	Go to *Step 14*	Go to *Step 15*
14	Perform the Fuel Injector Balance Test. Are the fuel injectors OK?	–	Go to *Step 9*	Go to *Step 16*
15	1. Disconnect the injector test light. 2. With a test light connected to ground, probe the ignition feed terminal 1 of the injector harness connector for each cylinder that had misfire. 3. Crank the engine. Does the test light illuminate?	–	Go to *Step 17*	Go to *Step 19*
16	Replace any malfunctioning fuel injectors. Is the repair complete?	–	Go to *Step 27*	–
17	Check the affected fuel injector driver circuit at terminals 59, 89, 90, and 60 for an open, short, or short to voltage. Is a problem found?	–	Go to *Step 18*	Go to *Step 24*
18	Repair the open or the shorted fuel injector driver circuit. Is the repair complete?	–	Go to *Step 27*	–
19	Repair the open ignition feed circuit between the fuel injector harness connector and the fuel injector connector. Is the repair complete?	–	Go to *Step 27*	–
20	Measure the resistance of the spark plug cable that the spark plug tester did not spark. Is the resistance of the spark plug cable less than the specified value?	30000Ω	Go to *Step 21*	Go to *Step 25*
21	Inspect the Engine Control Module (ECM) connector and connections. Are the connections OK?	–	Go to *Step 22*	Go to *Step 23*
22	Check the affected cylinders ignition control circuit for an open or short and repair as necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 26*
23	Repair the connector or connections. Is the repair complete?	–	Go to *Step 27*	–
24	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 27*	–
25	Replace the spark plug cable. Is the repair complete?	–	Go to *Step 27*	–
26	Replace the faulty ignition coil. Is the repair complete?	–	Go to *Step 27*	Go to *Step 24*

DTC P0300 – Multiple Cylinder Misfire(Increase Emission) (Cont'd)

Step	Action	Value(s)	Yes	No
27	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 28*	Go to *Step 2*
28	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) – P1320 CRANKSHAFT SEGMENT PERIOD SEGMENT ADAPTATION AT LIMIT

Circuit Description

The 58X reference signal is produced by the Crankshaft Position (CKP) sensor. During one crankshaft revolution, 58 crankshaft pulses will be produced. The Engine Control Module (ECM) uses the 58X reference signal to calculate engine rpm and CKP. The ECM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of Camshaft Position (CMP) signal pulses being received. If the ECM receives and incorrect number of pulses on the 58X reference circuit, Diagnostic Trouble Code (DTC) P1320 will set.

Conditions for Setting the DTC

- Segment adaptation valve at the limit.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition ON and observe a voltmeter connected to the 58X reference circuit at the ECM harness connector while moving the connectors and the wiring harnesses related to the ECM. A change in voltage will indicate the location of the fault.
- Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P1320 – Crankshaft Segment Period Segment Adaptation at Limit

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Attempt to start the engine. Does the engine start?	–	Go to *Step 3*	Refer to "Engine Cranks But Will Not Run"
3	1. Turn the ignition OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Turn the ignition ON, with the engine OFF. 4. Review and record Failure Records information. 5. Clear the Diagnostic Trouble Codes (DTCs). 6. Start the engine and idle for 1 minute. Is DTC P1320 set?	–	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Remove the crankshaft. 2. Check for a problem with the crahkshaft's visual defection and tooth. Is a problem found?	–	Go to *Step 5*	Go to *Step 6*
5	Replace the crankshaft. Is the replacement complete?	–	System OK	–
6	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 7*	–
7	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 8*	Go to *Step 2*
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) – P1321 CRANKSHAFT SEGMENT PERIOD TOOTH ERROR

Circuit Description

The 58X reference signal is produced by the Crankshaft Position (CKP) sensor. During one crankshaft revolution, 58 crankshaft pulses will be produced. The Engine Control Module (ECM) uses the 58X reference signal to calculate engine rpm and CKP. The ECM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of Camshaft Position (CMP) signal pulses being received. If the ECM receives and incorrect number of pulses on the 58X reference circuit, Diagnostic Trouble Code (DTC) P1321 will set.

Conditions for Setting the DTC

- Missing or additional teeth detected.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

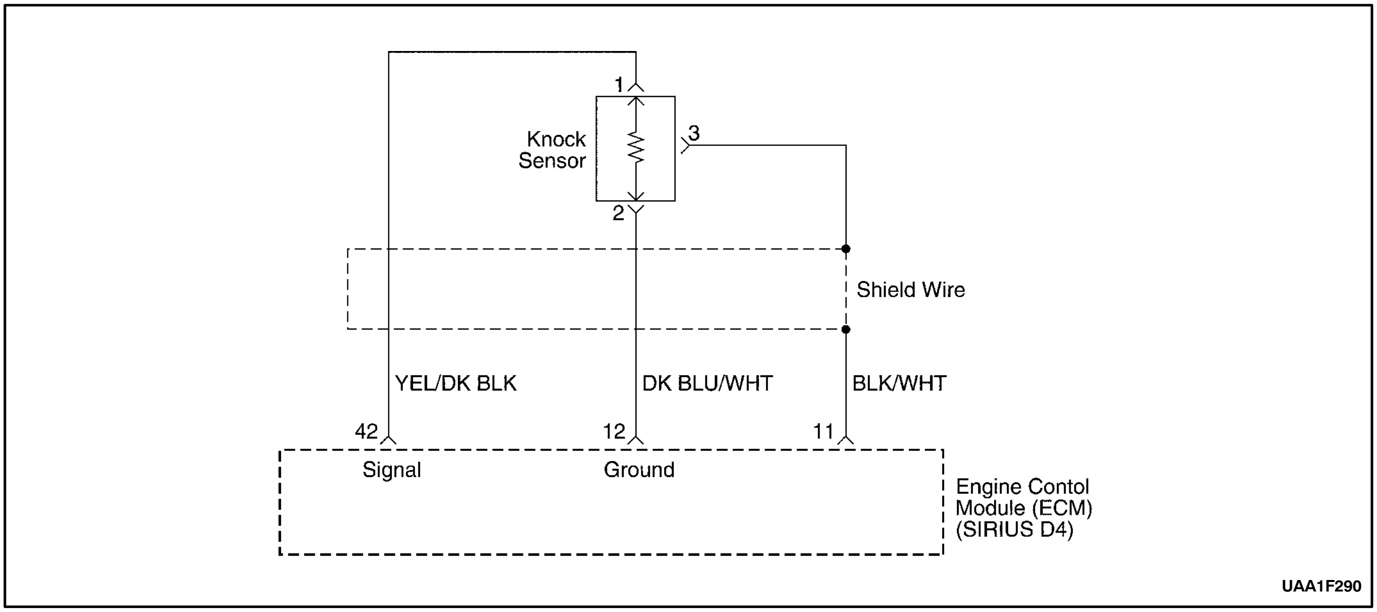
Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition ON and observe a voltmeter connected to the 58X reference circuit at the ECM harness connector while moving the connectors and the wiring harnesses related to the ECM. A change in voltage will indicate the location of the fault.
- Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P1321 – Crankshaft Segment Period Tooth Error

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Attempt to start the engine. Does the engine start?	–	Go to *Step 3*	Refer to "Engine Cranks But Will Not Run"
3	1. Turn the ignition OFF. 2. Install a scan tool to the Data Link Connector (DLC) 3. Turn the ignition ON, with the engine OFF. 4. Review and record Failure Records information. 5. Clear the Diagnostic Trouble Codes (DTCs). 6. Start the engine and idle for 1 minute. Is DTC P1321 set?	–	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Remove the crankshaft. 2. Check for a problem with the crahkshaft's visual defection and tooth. Is a problem found?	–	Go to *Step 5*	Go to *Step 6*
5	Replace the crankshaft. Is the replacement complete?	–	System OK	–
6	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 7*	–
7	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 8*	Go to *Step 2*
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0327 KNOCK SENSOR CIRCUIT FAULT

Circuit Description

The knock sensor(KS) system is used to detect engine detonation, allowing the transaxle control module(TCM)/engine control module(ECM) to retard ignition control spark timing based on the KS signal being received. The KS produces an AC signal so that under a no knock condition the signal on the KS circuit measures about 0.007V AC. The KS signal's amplitude and frequency depend upon the amount of knock being experienced. The ECM contains a non-replaceable knock filter module called a signal-to-noise enhancement filter (SNEF) module. This filter module in the ECM determines whether knock is occurring by comparing the signal level on the KS circuit with the voltage level on the noise channel. The noise channel allows the ECM to reject any false knock signal by knowing the amount of normal engine mechanical noise present. Normal engine noise varies depending on engine speed and load. When the ECM determines that an abnormally low noise channel voltage level is being experienced, a DTC P0327 will set.

Conditions for Setting the DTC

- The knock sensor SPI bus in failure during 10 seconds.

Or

- The knock sensor voltage is less than 0.3V.
- The engine coolant temperature is greater than 60°C (145°F).
- The engine speed is greater than 1,500rpm.
- The mass air flow is higer than 180mg/tdc.

Or

- When difference between a original signal valve and filtering valve is less than 5%.
- The engine coolant temperature is greater than 60°C (145°F).
- The mass air flow is greater than 170mg/tdc.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DIAGNOSTIC AIDS

Check and correct any abnormal engine noise before using the diagnostic table.

Any circuitry that is suspected as causing engine noise complaint should be thoroughly checked for the following conditions :

- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connections.
- Physical damage to the wiring harness.

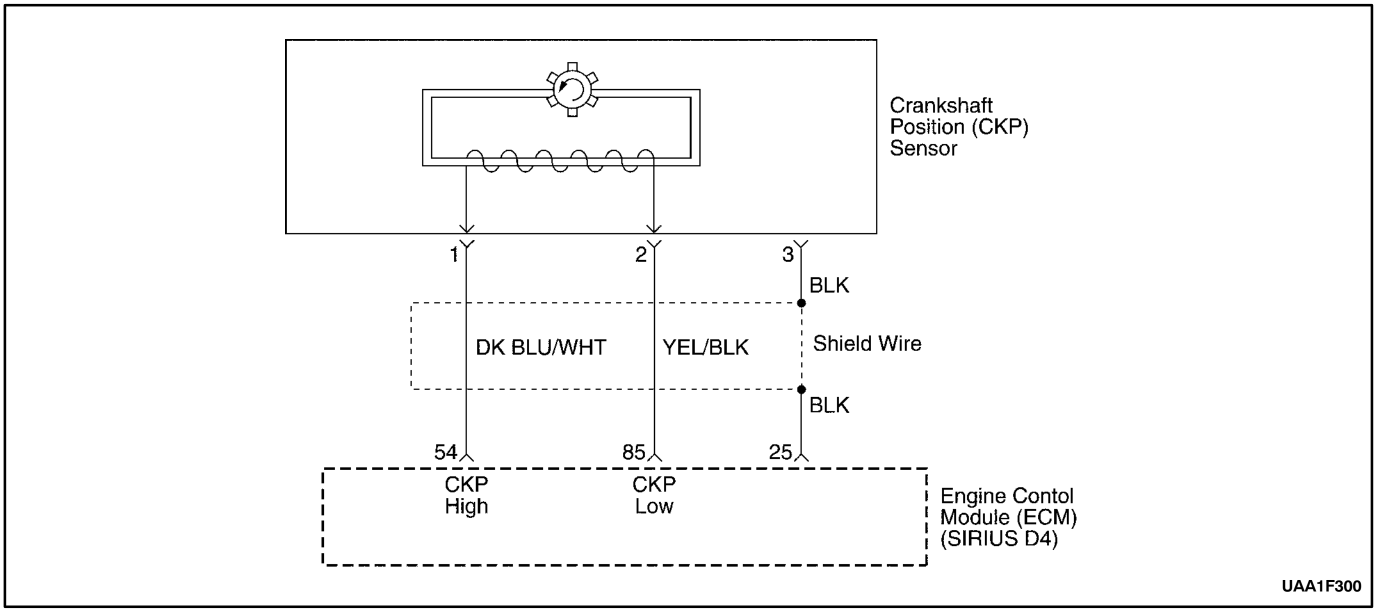
DTC P0327 – Knock Sensor Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD II) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Start the engine. 2. Install a scan tool. 3. Clear the Diagnostic Trouble Codes (DTCs). 4. Operate the vehicle within the Freeze Frame conditions and conditions for setting the DTC as noted. Does the Malfunction Indicator (MIL) illuminate?	–	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and conditions for Setting The DTC as noted. Does the Malfunction Indicator (MIL) illuminate?	–	Go to *Step 4*	Go to *Step 12*
4	Listen to the engine while raising and lowering the engine speed. Is a knock or audible noise present?	–	Go to *Step 5*	Go to *Step 6*
5	Repair the mechanical engine problem or a loose bracket or component. Is the repair complete?	–	Go to *Step 12*	–
6	1. Turn the ignition switch to lock. 2. Disconnect the engine control module(ECM). 3. With a digital voltmeter (DVM) connected to ground, measure the resistance of the knock sensor through the knock sensor signal circuit, terminal 42. Is the measured value within the specified value?	90–110KΩ	Go to *Step 7*	Go to *Step 9*
7	Check for a poor connection at the ECM connector, knock sensor (KS) signal circuit and repair as necessary. Is a repair necessary?	–	Go to *Step 12*	Go to *Step 8*
8	Replace the engine control module(ECM). Is the replacement complete?	–	Go to *Step 12*	Go to *Step 10*
9	Check the KS electrical connector for a poor connection and repair an necessary. Is a repair necessary?	–	Go to *Step 12*	Go to *Step 10*
10	Check the KS signal circuit for an open or a low voltage or voltage and repair as necessary. Is a repair necessary?	–	Go to *Step 12*	Go to *Step 11*
11	Replace the KS. Is the replacement complete?	–	Go to *Step 12*	–

DTC P0327 – Knock Sensor Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Using the scan tool, clear the DTCs. • Start the engine and idle at normal operating temperature. • Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0335 MAGNETIC CRANKSHAFT POSITION SENSOR ELECTRICAL ERROR

Circuit Description

The 58X reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, 58 crankshaft pulses will be produced. The transaxle control module(TCM)/engine control module(ECM) uses the 58X reference signal to calculate engine rpm and CKP. The ECM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of camshaft position (CKP) signal pulses being received. If the ECM receive and incorrect number of pulses on the 58X reference circuit, DTC P0335 will set.

Conditions for Setting the DTC

- The magnetic crankshaft position sensor is greater than 0.2V.

Or

- The minimum value of magnetic crankshaft position sensor is less than 1.5V.

Or

- The maximum value of magnetic crankshaft position sensor is higher than 2.2V.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DIAGNOSTIC AIDS

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for :

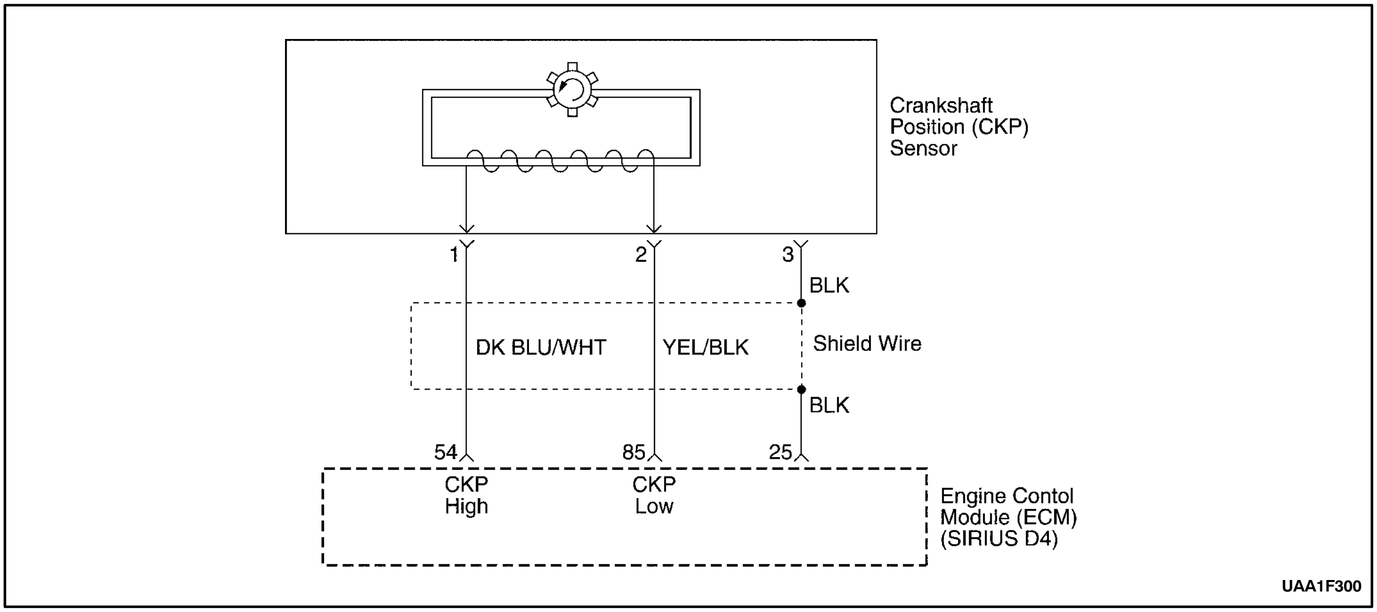
Poor connection – inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

Damaged harness – inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition ON and observe a voltmeter connected to the 58X reference circuit at the ECM harness connector while moving the connectors and the wiring harness related to the ECM. A change in voltage will indicate the location of the fault.

Review the failure records vehicle mileage since the diagnostic test failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0335 – Magnetic Crankshaft Position Sensor Electrical Error

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	Attempt to start the engine. Does the engine start?	–	Go to *Step 3*	Refer to “Engine Cranks But Will Not Run”
3	1. Review and record Failure Records information. 2. Clear the DTC P0335. 3. Start the engine and idle for 1 minute. 4. Observe the diagnostic trouble codes (DTCs). Is the DTC P0335 set?	–	Go to *Step 4*	Go to “Diagnostic Aids”
4	1. Disconnect the engine control module(ECM) and the crankshaft position (CKP) sensor. 2. Check for an open or an open or short to ground in the CKP sensor connector and the ECM harness connector. Is the problem found?	–	Go to *Step 5*	Go to *Step 6*
5	Repair the open or an open or short to ground in the 58X reference circuit between the CKP sensor connector and the ECM harness connector. Is the repair complete?	–	Go to *Step 11*	–
6	1. Reconnect the ECM and CKP sensor. 2. Connect a digital voltmeter (DVM) to measure voltage on the 58X reference circuit, terminal 54 at the ECM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5V	Go to *Step 9*	Go to *Step 7*
7	Check the connection at the CKP sensor and replace the terminals if necessary. Do any terminals require replacement?	–	Go to *Step 11*	Go to *Step 8*
8	Replace the CKP sensor. Is the replacement complete?	–	Go to *Step 11*	–
9	Check the connections at the ECM and replace the terminals if necessary. Do any terminal require replacement?	–	Go to *Step 11*	Go to *Step 10*
10	Replace the ECM. Is the replacement complete?	–	Go to *Step 11*	–
11	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic run and passed?	–	Go to *Step 12*	Go to *Step 2*
12	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0336 58X CRANKSHAFT POSITION SENSOR NO PLAUSIBLE SIGNAL

Circuit Description

The 58X reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, 58 crankshaft pulses will be produced. The transaxle control module(TCM)/engine control module(ECM) uses the 58X reference signal to calculate engine rpm and CKP. The ECM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of camshaft position (CKP) signal pulses being received. If the ECM receive and incorrect number of pulses on the 58X reference circuit, DTC P0336 will set.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- Detected number of teeth is differs by 3 or higher.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DIAGNOSTIC AIDS

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for :

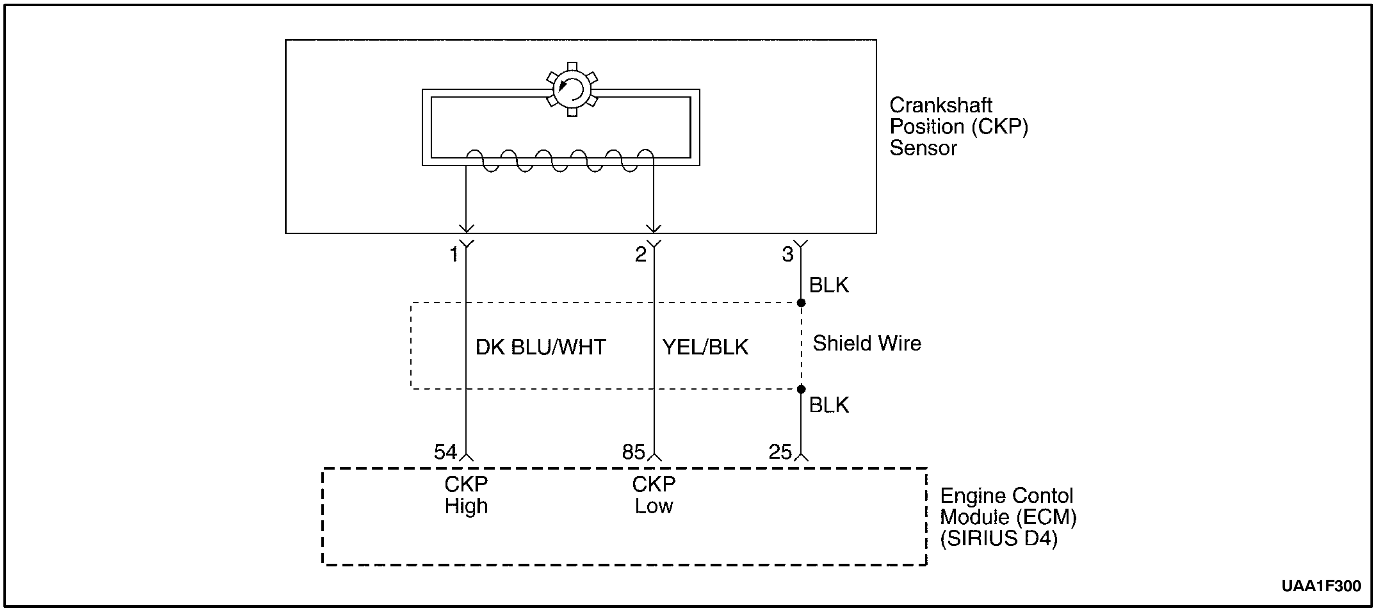
Poor connection – inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

Damaged harness – inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition ON and observe a voltmeter connected to the 58X reference circuit at the ECM harness connector while moving the connectors and the wiring harness related to the ECM. A change in voltage will indicate the location of the fault.

Review the failure records vehicle mileage since the diagnostic test failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0336 – 58X Crankshaft Position Sensor No Plausible Signal

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	Attempt to start the engine. Does the engine start?	–	Go to ***Step* 3**	Refer to "Engine Cranks But Will Not Run"
3	1. Review and record Failure Records information. 2. Clear the DTC P0336. 3. Start the engine and idle for 1 minute. 4. Observe the diagnostic trouble codes (DTCs). Is the DTC P0336 set?	–	Go to ***Step* 4**	Go to "Diagnostic Aids"
4	1. Disconnect the engine control module(ECM) and the crankshaft position (CKP) sensor. 2. Check for an open or a low voltage in the CKP sensor connector and the ECM harness connector. Is the problem found?	–	Go to ***Step* 5**	Go to ***Step* 6**
5	Repair the open or low voltage in the 58X reference circuit between the CKP sensor connector and the ECM harness connector. Is the repair complete?	–	Go to ***Step* 11**	–
6	1. Reconnect the ECM and CKP sensor. 2. Connect a digital voltmeter (DVM) to measure voltage on the 58X reference circuit, terminal 54 at the ECM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5V	Go to ***Step* 9**	Go to ***Step* 7**
7	Check the connection at the CKP sensor and replace the terminals if necessary. Do any terminals require replacement?	–	Go to ***Step* 11**	Go to ***Step* 8**
8	Replace the CKP sensor. Is the replacement complete?	–	Go to ***Step* 11**	–
9	Check the connections at the ECM and replace the terminals if necessary. Do any terminal require replacement?	–	Go to ***Step* 11**	Go to ***Step* 10**
10	Replace the ECM. Is the replacement complete?	–	Go to ***Step* 11**	–
11	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic run and passed?	–	Go to ***Step* 12**	Go to ***Step* 2**
12	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0337 58X CRANKSHAFT POSITION SENSOR NO SIGNAL

Circuit Description

The 58X reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, 58 crankshaft pulses will be produced. The transaxle control module(TCM)/engine control module(ECM) uses the 58X reference signal to calculate engine rpm and CKP. The ECM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of camshaft position (CKP) signal pulses being received. If the ECM receive and incorrect number of pulses on the 58X reference circuit, DTC P0337 will set.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- No crankshaft teeth detected.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DIAGNOSTIC AIDS

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for :

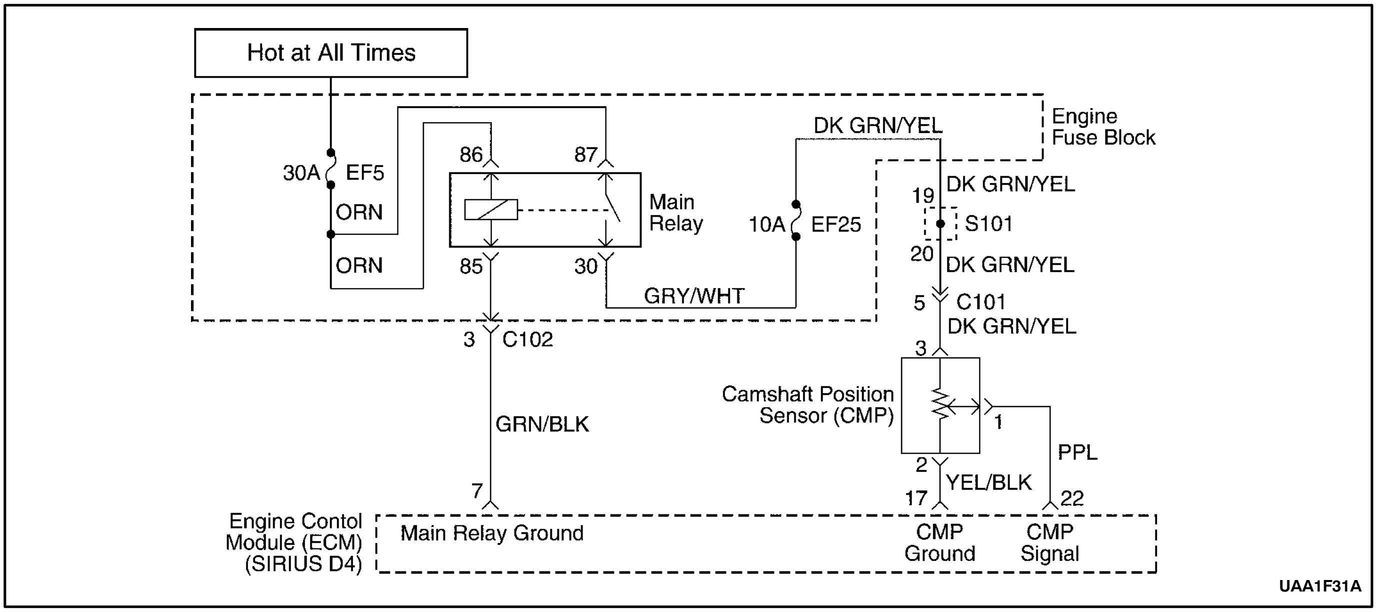
Poor connection – inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

Damaged harness – inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition ON and observe a voltmeter connected to the 58X reference circuit at the ECM harness connector while moving the connectors and the wiring harness related to the ECM. A change in voltage will indicate the location of the fault.

Review the failure records vehicle mileage since the diagnostic test failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0337 – 58X Crankshaft Position Sensor No Signal

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	Attempt to start the engine. Does the engine start?	–	Go to ***Step* 3**	Refer to "Engine Cranks But Will Not Run"
3	1. Review and record Failure Records information. 2. Clear the DTC P0337. 3. Start the engine and idle for 1 minute. 4. Observe the diagnostic trouble codes (DTCs). Is the DTC P0337 set?	–	Go to ***Step* 4**	Go to "Diagnostic Aids"
4	1. Disconnect the engine control module(ECM) and the crankshaft position (CKP) sensor. 2. Check for an open or a low voltage in the CKP sensor connector and the ECM harness connector. Is the problem found?	–	Go to ***Step* 5**	Go to ***Step* 6**
5	Repair the open or low voltage in the 58X reference circuit between the CKP sensor connector and the ECM harness connector. Is the repair complete?	–	Go to ***Step* 11**	–
6	1. Reconnect the ECM and CKP sensor. 2. Connect a digital voltmeter (DVM) to measure voltage on the 58X reference circuit, terminal 54 at the ECM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5V	Go to ***Step* 9**	Go to ***Step* 7**
7	Check the connection at the CKP sensor and replace the terminals if necessary. Do any terminals require replacement?	–	Go to ***Step* 11**	Go to ***Step* 8**
8	Replace the CKP sensor. Is the replacement complete?	–	Go to ***Step* 11**	–
9	Check the connections at the ECM and replace the terminals if necessary. Do any terminal require replacement?	–	Go to ***Step* 11**	Go to ***Step* 10**
10	Replace the ECM. Is the replacement complete?	–	Go to ***Step* 11**	–
11	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic run and passed?	–	Go to ***Step* 12**	Go to ***Step* 2**
12	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0341 CAMSHAFT POSITION SENSOR RATIONALITY

Circuit Description

The Camshaft Position Sensor is used to detect Camshaft position and to have correlation with Crankshaft position so that the ECM can determine which cylinder is ready to be fueled by the injector. The polarity of camshaft sensor signal must be changed only once per crankshaft position.

Conditions for Setting the DTC

- No traction of CMP signal between teeth 25 and 33 but change in polarity.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

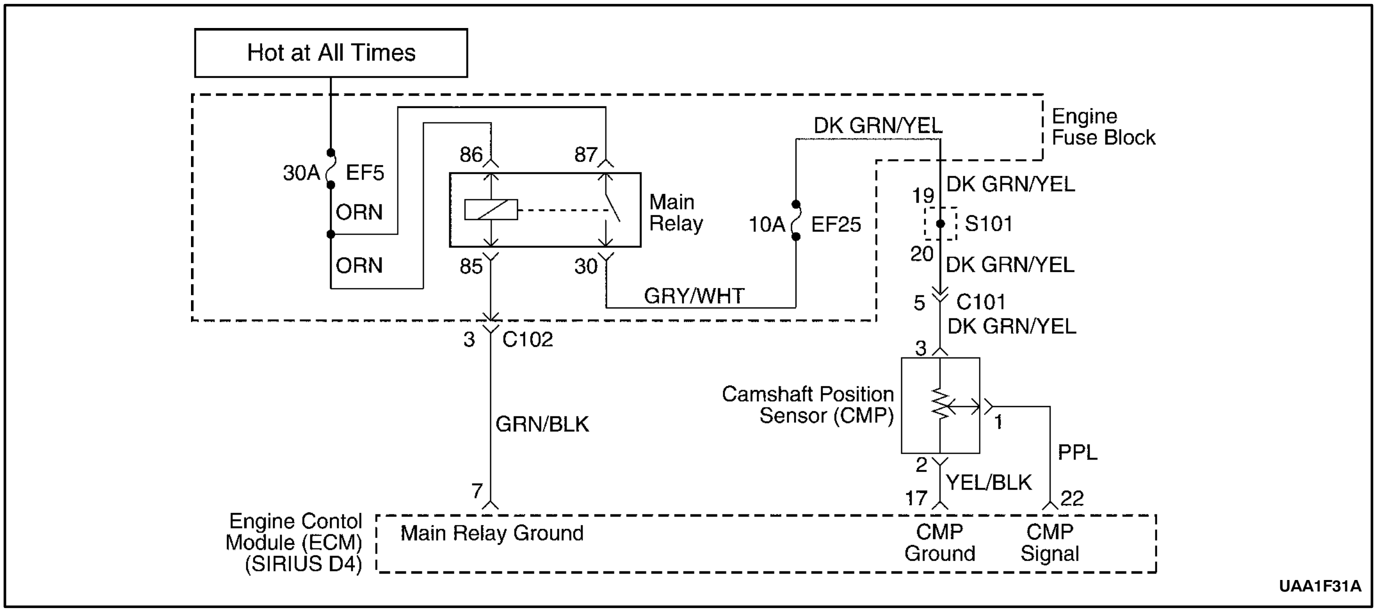
Check and correct any abnormal engine noise before using the diagnostic table.

Any circuitry that is suspected as causing engine noise complaint should be thoroughly checked for the following conditions :

- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connections.
- Physical damage to the wiring harness.

DTC P0341 – Camshaft Position Sensor Rationality

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to LOCK. 2. Disconnect the CMP sensor connector. 3. Check for a faulty connector or terminals. Is the problem found?	–	Go to **Step 4**	Go to **Step 3**
3	1. Turn the Turn the ignition switch to ON. 2. Disconnect the ECM connector. 3. Inspect the ECM pins and connector for bent or damaged terminals. 4. Check the wire between the CMP sensor terminal 1 and ECM connector 22 for an open or short to ground or short to battery voltage while related connectors and wiring harness. 5. Check the wires between the CMP sensor terminal 2 and ECM connector 17 for an open while moving related connectors and wiring harness. Is the problem found?	–	Go to **Step 4**	Go to **Step 5**
4	1. Turn the ignition switch to LOCK. 2. Repair or replace the wire or the connector. 3. Clear any DTCs from the ECM. 4. Run the engine. 5. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
5	1. Turn the ignition switch to LOCK. 2. Replace the CMP sensor. 3. Clear any DTCs from the ECM. 4. Run the engine. 5. Perform the diagnostic system check. Does DTC P0341 reset?	–	System OK	Go to **Step 6**
6	1. Replace the ECM. 2. Run the engine. 3. Perform the Diagnostic system check. Is the replacement complete?	–	Go to **Step 7**	–
7	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic run and passed?	–	Go to **Step 8**	–
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0342 CAMSHAFT POSITION SENSOR NO SIGNAL

Circuit Description

The Camshaft Position Sensor is used to detect Camshaft position and to have correlation with Crankshaft position so that the ECM can determine which cylinder is ready to be fueled by the injector. The polarity of camshaft sensor signal must be changed only once per crankshaft position.

Conditions for Setting the DTC

- No traction of CMP signal between teeth 25 and 33 but change in polarity.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DIAGNOSTIC AIDS

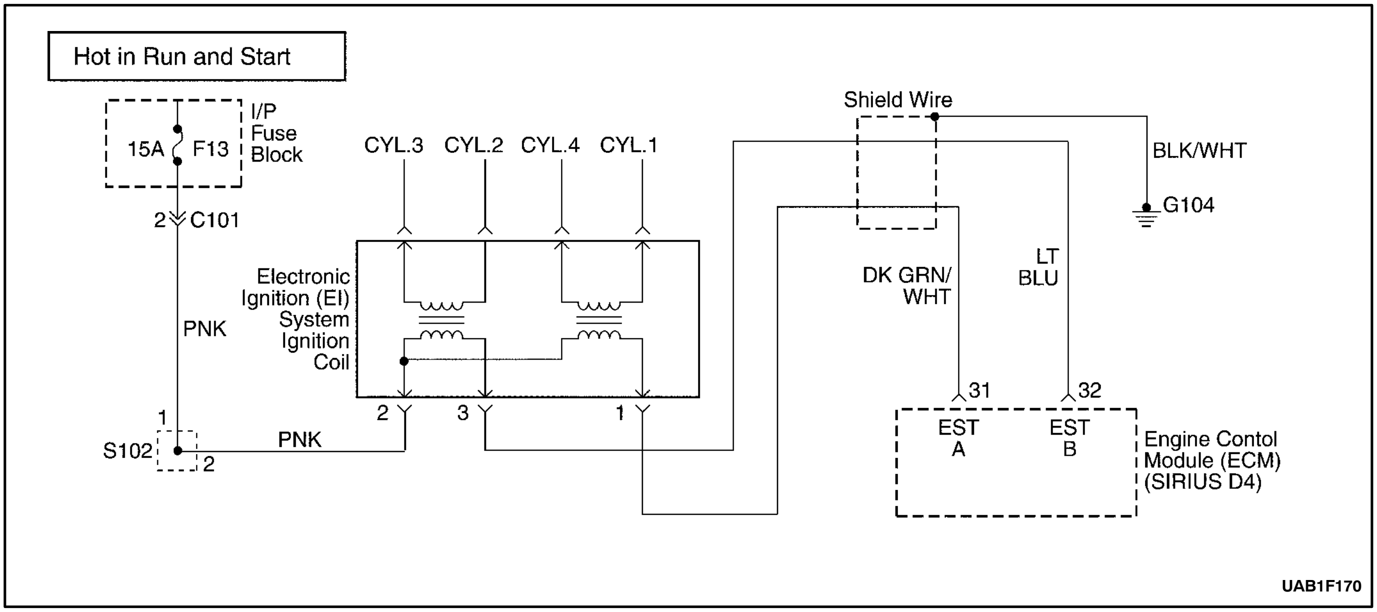
Check and correct any abnormal engine noise before using the diagnostic table.

Any circuitry that is suspected as causing engine noise complaint should be thoroughly checked for the following conditions :

- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connections.
- Physical damage to the wiring harness.

DTC P0342 – Camshaft Position Sensor No Signal

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to LOCK. 2. Disconnect the CMP sensor connector. 3. Check for a faulty connector or termin1als. Is the problem found?	–	Go to ***Step* 4**	Go to ***Step* 3**
3	1. Turn the Turn the ignition switch to ON. 2. Disconnect the ECM connector. 3. Inspect the ECM pins and connector for bent or damaged terminals. 4. Check the wire between the CMP sensor terminal 1 and ECM connector 22 for an open or short to ground or short to battery voltage while related connectors and wiring harness. 5. Check the wires between the CMP sensor terminal 2 and ECM connector 17 for an open while moving related connectors and wiring harness. Is the problem found?	–	Go to ***Step* 4**	Go to ***Step* 5**
4	1. Turn the ignition switch to LOCK. 2. Repair or replace the wire or the connector. 3. Clear any DTCs from the ECM. 4. Run the engine. 5. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
5	1. Turn the ignition switch to LOCK. 2. Replace the CMP sensor. 3. Clear any DTCs from the ECM. 4. Run the engine. 5. Perform the diagnostic system check. Does DTC P0342 reset?	–	System OK	Go to ***Step* 6**
6	1. Replace the ECM. 2. Run the engine. 3. Perform the Diagnostic system check. Is the replacement complete?	–	Go to ***Step* 7**	–
7	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic run and passed?	–	Go to ***Step* 8**	–
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0351 IGNITION SIGNAL COIL A FAULT

Circuit Description

The engine control module (ECM) provides a ground for the electronic spark timing 1 circuit. When the ECM removes the ground path of the ignition primary coil, the magnetic field produced by the coil collapses. The collapsing magnetic field produces a voltage in the secondary coil which fires the spark plug. The circuit between the ECM and the electronic ignition system is monitored for an open circuit, short to voltage, and low voltage. When the ECM detects a problem in the spark timing 1 circuit, it will set DTC P0351.

Conditions for Setting the DTC

- The ignition signal coil A circuit is an open or a short to ground or short to battery condition exists.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DIAGNOSTIC AIDS

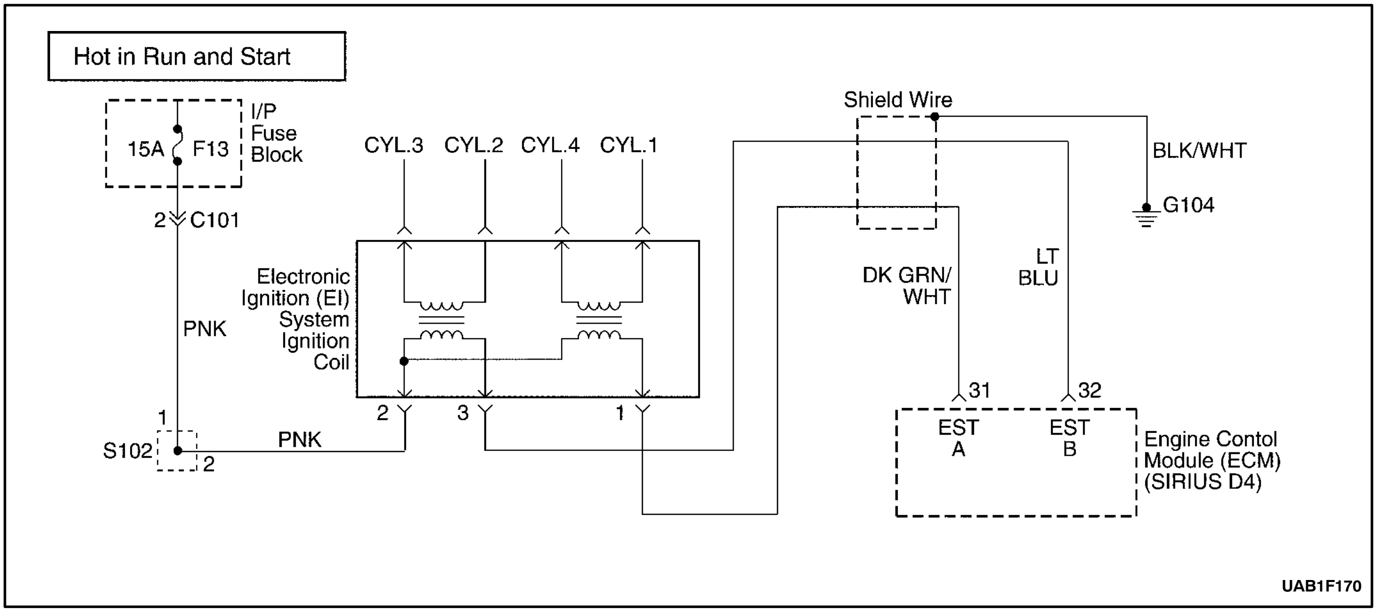
Check and correct any abnormal engine noise before using the diagnostic table.

Any circuitry that is suspected as causing engine noise complaint should be thoroughly checked for the following conditions :

- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connections.
- Physical damage to the wiring harness.

DTC P0351 – Ignition Signal Coil A FAULT

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to "On-Board Diagnostic System Check"
2	Check for a faulty connection or a damaged terminal 1 at the ignition coil. Is a problem found?	–	Go to **Step 8**	Go to **Step 3**
3	Check for a faulty connection or a damaged terminal 31 at the engine control module(ECM) connector. Is the problem found?	–	Go to **Step 8**	Go to **Step 4**
4	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM. 3. Check the ignition control circuit for a short to ground. Is the problem found?	–	Go to **Step 8**	Go to **Step 5**
5	Check the ignition control circuit for a short to battery voltage. Is the problem found?	–	Go to **Step 8**	Go to **Step 6**
6	Check for an open in the ignition control. Is the problem found?	–	Go to **Step 8**	Go to **Step 7**
7	Replace the ECM. Is the replacement complete?	–	Go to **Step 8**	–
8	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs). • Start the engine and Idle at normal operating temperature. • Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to **Step 9**	–
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0352 IGNITION SIGNAL COIL B FAULT

Circuit Description

The engine control module (ECM) provides a ground for the electronic spark timing 3 circuit. When the ECM removes the ground path of the ignition primary coil, the magnetic field produced by the coil collapses. The collapsing magnetic field produces a voltage in the secondary coil, which fires the spark plug. The circuit between the ECM and the electronic ignition system is monitored for an open circuit, short to voltage, and low voltage. When the ECM detects a problem in the spark timing 3 circuit, it will set DTC P0352.

Conditions for Setting the DTC

- The ignition signal coil B circuit is an open or a short ground or short to battery condition exists.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The ECM will default to 6 degree timing.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using the scan tool can clear DTC(s).
- Disconnecting the ECM battery feed for 10 seconds.

DIAGNOSTIC AIDS

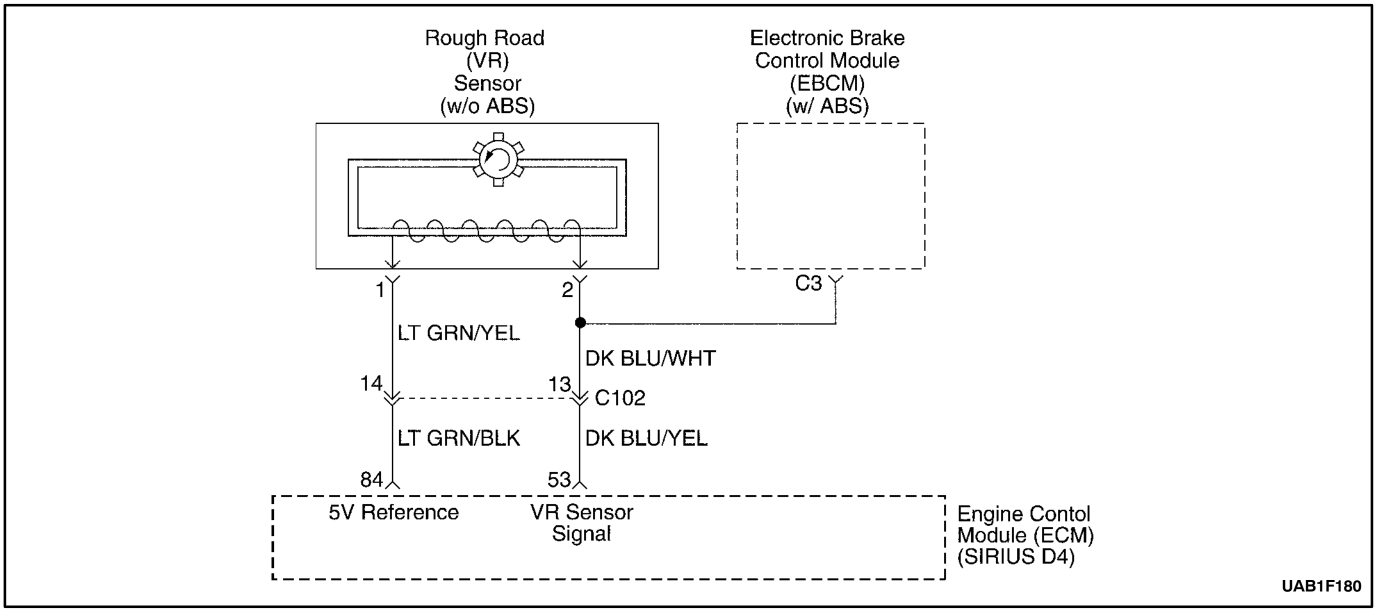
Check and correct any abnormal engine noise before using the diagnostic table.

Any circuitry that is suspected as causing engine noise complaint should be thoroughly checked for the following conditions :

- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connections.
- Physical damage to the wiring harness.

DTC P0352 – Ignition Signal Coil B FAULT

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	Check for a faulty connection or a damaged terminal 3 at the ignition coil. Is a problem found?	–	Go to ***Step* 8**	Go to ***Step* 3**
3	Check for a faulty connection or a damaged terminal 32 at the engine control module(ECM) connector. Is the problem found?	–	Go to ***Step* 8**	Go to ***Step* 4**
4	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM. 3. Check the ignition control circuit for a short to ground Is the problem found?	–	Go to ***Step* 8**	Go to ***Step* 5**
5	Check the ignition control circuit for a short to battery voltage. Is the problem found?	–	Go to ***Step* 8**	Go to ***Step* 6**
6	Check for an open in the ignition control. Is the problem found?	–	Go to ***Step* 8**	Go to ***Step* 7**
7	Replace the ECM. Is the replacement complete?	–	Go to ***Step* 8**	–
8	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs). • Start the engine and Idle at normal operating temperature. • Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step* 9**	–
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1382 ROUGH ROAD DATA INVALID (NON ABS)

Circuit Description

The VR sensor is used to detecting the road situation.

By sensing difference of wheel rotation duration caused by bumps or potholes in the road, the Engine Control Module (ECM) can determine if the changes in crankshaft speed are due to engine misfire or are driveline induced. If the VR sensor detects a rough road condition, the ECM misfire detection diagnostic will be de-activated.

Conditions for Setting the DTC

- Vehicle speed is higher than 5km/h(3.1mph).
- No Vehicle Speed Sensor error not set.
- VR sensor output signal is higher than 0.26.
- VR sensor output signal is not change for 30seconds.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P1382 – Rough Road Data Invalid (NON ABS)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to **Step** 2	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with engine OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Review and record the scan tool Failure Records data. 4. Operate the vehicle within Failure Records conditions as noted. 5. Using the scan tool, monitor specific Diagnostic Trouble Code (DTC) info for DTC P1382. Does the scan tool indicate that DTC P1382 failed?	–	Go to **Step** 4	Go to **Step** 3
3	1. Check for the following conditions and repair as needed: 2. VR sensor seal missing or damaged. 3. VR sensor mounting flanges cracked, missing, or incorrectly installed. Is the repair complete?	–	Go to **Step** 14	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Disconnect the VR sensor electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. Observe the VR sensor value displayed on the scan tool. Is the VR sensor value near the specified value?	0V	Go to **Step** 5	Go to **Step** 12
5	1. Jumper the 5 volt reference circuit, terminal 1 and the VR sensor signal circuit, terminal 2 together at the VR sensor harness connector. 2. Observe the VR sensor value displayed on the scan tool. Is the VR sensor value near the specified value?	4.95V	Go to **Step** 6	Go to **Step** 7
6	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) and check the sensor ground circuit for high resistance, an open between the ECM and the VR sensor, or for a poor connection at the terminal 53 of the ECM and repair as needed. Is the repair complete?	–	Go to **Step** 14	Go to **Step** 10
7	Check the 5 volt reference circuit for high resistance, an open between the ECM and the VR sensor, or a poor connection at the terminal 84 of the ECM and repair as needed. Is the repair complete?	–	Go to **Step** 14	Go to **Step** 8
8	1 Turn the ignition OFF. 2. Disconnect the ECM and check the VR sensor signal circuit for high resistance, an open, a low voltage, or a short to the sensor ground circuit and repair as needed. Is the repair complete?	–	Go to **Step** 14	Go to **Step** 9
9	Check the VR sensor signal circuit for a poor connection at the ECM and repair as needed. Is the repair complete?	–	Go to **Step** 14	Go to **Step** 13

DTC P1382 – Rough Road Data Invalid (NON ABS) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check for a poor connection at terminal 2 of the VR sensor and repair as needed. Is the repair complete?	–	Go to ***Step*** **14**	Go to ***Step*** **11**
11	Replace the VR sensor. Is the repair complete?	–	Go to ***Step*** **14**	–
12	1. Turn the ignition OFF. 2. Disconnect the ECM. 3. Turn the ignition ON. 4. Check the VR sensor signal circuit for a short to battery voltage or a short to the 5 volt reference circuit and repair as needed. Is the repair complete?	–	Go to ***Step*** **14**	Go to ***Step*** **13**
13	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to ***Step*** **14**	–
14	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step*** **15**	Go to ***Step*** **2**
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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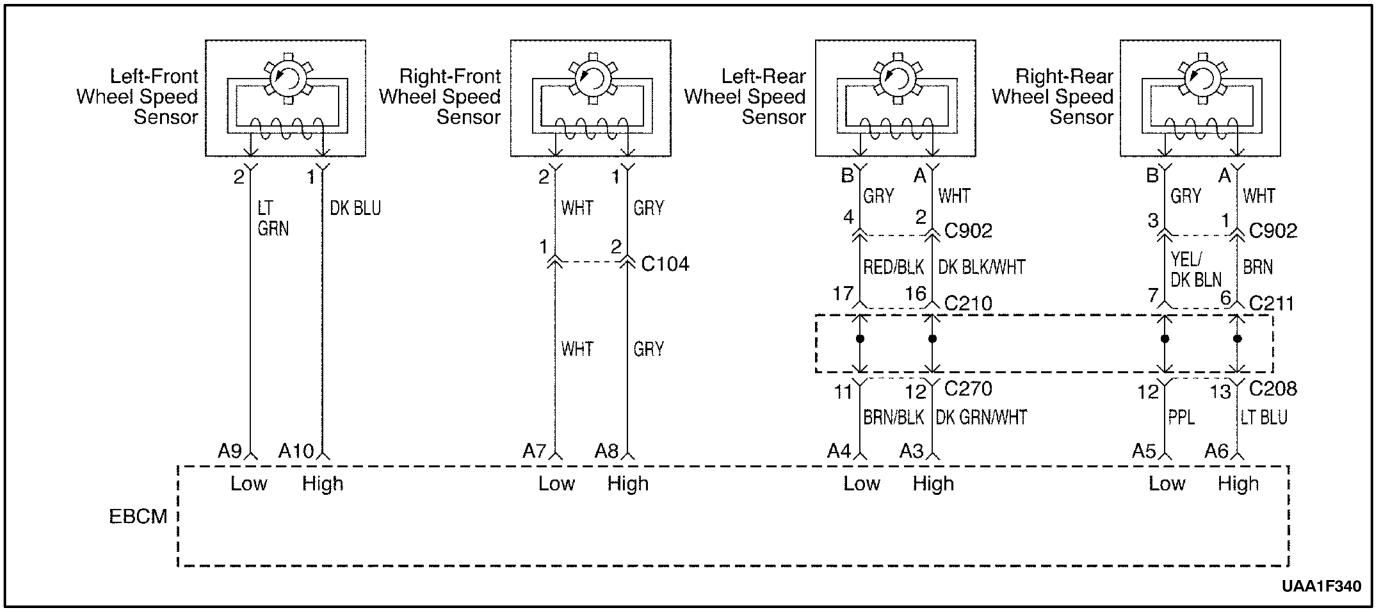

DIAGNOSTIC TROUBLE CODE (DTC) – P1382 ROUGH ROAD DATA INVALID (ABS)

Circuit Description

The wheel speed sensor is used to detecting the road situation.

As the wheel is rotated, the wheel speed sensor produces an AC voltage that increase with wheel speed. The EBCM uses the frequency of the AC signal to calculate wheel speed. The wheel speed sensor is connected to EBCM by a “twisted pair” of wires. Twisting reduces noise susceptibility than may cause a DTC to set. If the wheel speed sensor detects a rough road condition, the ECM misfire detection diagnostic will be de-activated.

Conditions for Setting the DTC

- Vehicle speed is higher than 5km/h(3.1mph).
- No Vehicle Speed Sensor error not set.
- VR sensor output signal is higher than 0.26.
- VR sensor output signal is not change for 30seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P1382 – Rough Road Data Invalid (ABS)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition On, with engine OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Review and record the scan tool Failure Records data. 4. Operate the vehicle within Failure Records conditions as noted. 5. Using the scan tool, monitor specific Diagnostic Trouble Code (DTC) info for DTC P1382. Does the scan tool indicate that DTC P1382 failed?	–	Go to ***Step* 4**	Go to ***Step* 3**
3	1. Check for the following conditions and repair as needed: 2. Wheel speed sensor seal missing or damaged. 3. Wheel speed sensor mounting flanges cracked, missing, or incorrectly installed. Is the repair complete?	–	Go to ***Step* 14**	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Disconnect the defected Wheel speed sensor electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. Observe the Wheel speed sensor value displayed on the scan tool. Is the Wheel speed sensor value near the specified value?	0V	Go to ***Step* 5**	Go to ***Step* 12**
5	1. Jumper the 5 volt reference circuit, the Wheel speed sensor signal circuit, together at the defected Wheel speed sensor harness connector. 2. Observe the defected Wheel speed sensor value displayed on the scan tool. Is the VR sensor value near the specified value?	4.95V	Go to ***Step* 6**	Go to ***Step* 7**
6	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) and check the sensor ground circuit for high resistance, an open between the ECM and the Wheel speed sensor, or for a poor connection of the ECM and repair as needed. Is the repair complete?	–	Go to ***Step* 14**	Go to ***Step* 10**
7	Check the 5 volt reference circuit for high resistance, an open between the ECM and the Wheel speed sensor, or a poor connection of the ECM and repair as needed. Is the repair complete?	–	Go to ***Step* 14**	Go to ***Step* 8**
8	1. Turn the ignition OFF. 2. Disconnect the ECM and check the Wheel speed sensor signal circuit for high resistance, an open, a low voltage, or a short to the sensor ground circuit and repair as needed. Is the repair complete?	–	Go to ***Step* 14**	Go to ***Step* 9**

DTC P1382 – Rough Road Data Invalid (ABS) (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the Wheel speed sensor signal circuit for a poor connection at the ECM and repair as needed. Is the repair complete?	–	Go to ***Step*** **14**	Go to ***Step*** **13**
10	Check for a poor connection at terminal 3 of the Wheel speed sensor and repair as needed. Is the repair complete?	–	Go to ***Step*** **14**	Go to ***Step*** **11**
11	Replace the Wheel speed sensor. Is the repair complete?	–	Go to ***Step*** **14**	–
12	1. Turn the ignition OFF. 2. Disconnect the ECM. 3. Turn the ignition ON. 4. Check the Wheel speed sensor signal circuit for a short to voltage or a short to the 5 volt reference circuit and repair as needed. Is the repair complete?	–	Go to ***Step*** **14**	Go to ***Step*** **13**
13	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to ***Step*** **14**	–
14	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step*** **15**	Go to ***Step*** **2**
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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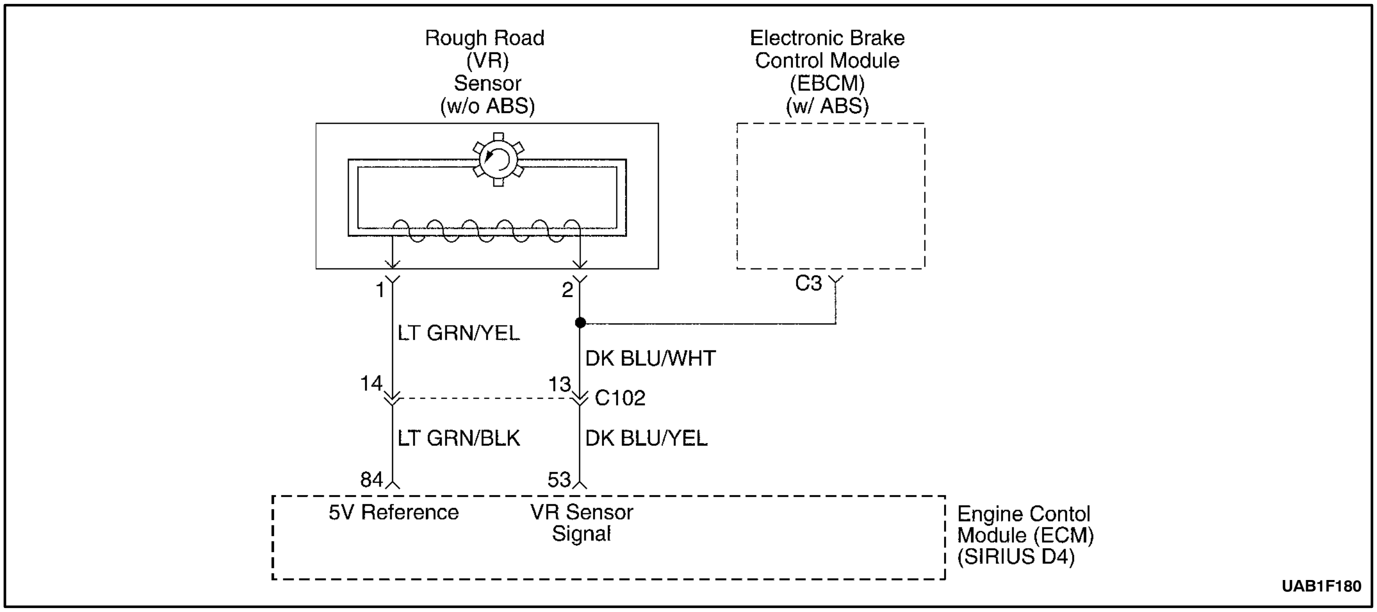

DIAGNOSTIC TROUBLE CODE (DTC) – P1385 ROUGH ROAD SENSOR CIRCUIT FAULT (NON ABS)

Circuit Description

The VR sensor is used to detecting the road situation.

By sensing difference of wheel rotation duration caused by bumps or potholes in the road, the Engine Control Module (ECM) can determine if the changes in crankshaft speed are due to engine misfire or are driveline induced. If the VR sensor detects a rough road condition, the ECM misfire detection diagnostic will be de-activated.

Conditions for Setting the DTC

- The VR sensor is greater than 0.06V.

Or

- The minimum value of the VR sensor is less than 1.5V.

Or

- The maximum value of the VR sensor is greater than 2.2V.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P1385 – Rough Road Sensor Circuit Fault (NON ABS)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to **Step 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with engine OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Review and record the scan tool Failure Records data. 4. Operate the vehicle within Failure Records conditions as noted. 5. Using the scan tool, monitor specific Diagnostic Trouble Code (DTC) info for DTC P1385. Does the scan tool indicate that DTC P1385 failed?	–	Go to **Step 4**	Go to **Step 3**
3	1. Check for the following conditions and repair as needed: 2. VR sensor seal missing or damaged. 3. VR sensor mounting flanges cracked, missing, or incorrectly installed. Is the repair complete?	–	Go to **Step 14**	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Disconnect the VR sensor electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. Observe the VR sensor value displayed on the scan tool. Is the VR sensor value near the specified value?	0V	Go to **Step 5**	Go to **Step 12**
5	1. Jumper the 5 volt reference circuit, terminal 1 and the VR sensor signal circuit, terminal 2 together at the VR sensor harness connector. 2. Observe the VR sensor value displayed on the scan tool. Is the VR sensor value near the specified value?	4.95V	Go to **Step 6**	Go to **Step 7**
6	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) and check the sensor ground circuit for high resistance, an open between the ECM and the VR sensor, or for a poor connection at the terminal 53 of the ECM and repair as needed. Is the repair complete?	–	Go to **Step 14**	Go to **Step 10**
7	Check the 5 volt reference circuit for high resistance, an open between the ECM and the VR sensor, or a poor connection at the terminal 84 of the ECM and repair as needed. Is the repair complete?	–	Go to **Step 14**	Go to **Step 8**
8	1. Turn the ignition OFF. 2. Disconnect the ECM and check the VR sensor signal circuit for high resistance, an open, a low voltage, or a short to the sensor ground circuit and repair as needed. Is the repair complete?	–	Go to **Step 14**	Go to **Step 9**
9	Check the VR sensor signal circuit for a poor connection at the ECM and repair as needed. Is the repair complete?	–	Go to **Step 14**	Go to **Step 13**

DTC P1385 – Rough Road Sensor Circuit Fault (NON ABS) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check for a poor connection at terminal 2 of the VR sensor and repair as needed. Is the repair complete?	–	Go to ***Step*** **14**	Go to ***Step*** **11**
11	Replace the VR sensor. Is the repair complete?	–	Go to ***Step*** **14**	–
12	1. Turn the ignition OFF. 2. Disconnect the ECM. 3. Turn the ignition ON. 4. Check the VR sensor signal circuit for a short to battery voltage or a short to the 5 volt reference circuit and repair as needed. Is the repair complete?	–	Go to ***Step*** **14**	Go to ***Step*** **13**
13	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to ***Step*** **14**	–
14	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step*** **15**	Go to ***Step*** **2**
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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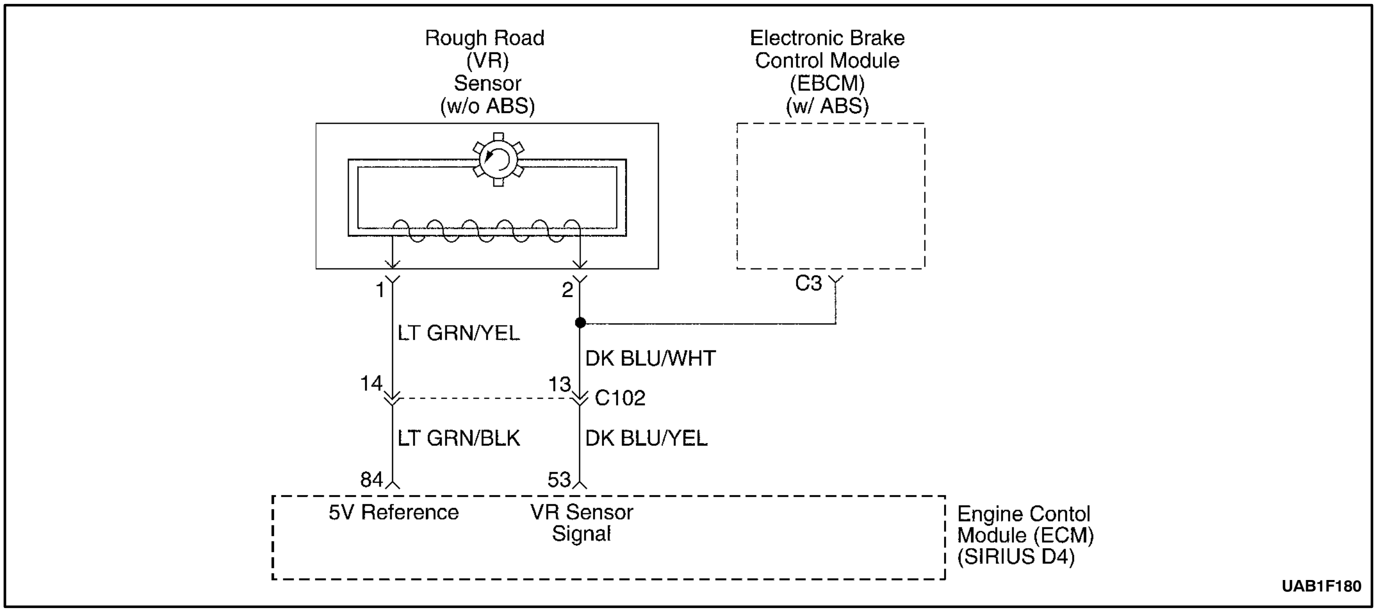


DIAGNOSTIC TROUBLE CODE (DTC) – P1385 ROUGH ROAD SENSOR CIRCUIT FAULT (ABS)

Circuit Description

The wheel speed sensor is used to detecting the road situation.

As the wheel is rotated, the wheel speed sensor produces an AC voltage that increase with wheel speed. The EBCM uses the frequency of the AC signal to calculate wheel speed. The wheel speed sensor is connected to EBCM by a “twisted pair” of wires. Twisting reduces noise susceptibility than may cause a DTC to se.If the wheel speed sensor detects a rough road condition, the ECM misfire detection diagnostic will be de-activated.

Conditions for Setting the DTC

- The vehicle speed sensor is greater than 0.06V.

Or

- The minimum value of the vehicle speed sensor is less than 1.5V.

Or

- The maximum value of the VR sensor is greater than 2.2V.

Action Taken When The DTCs Sets

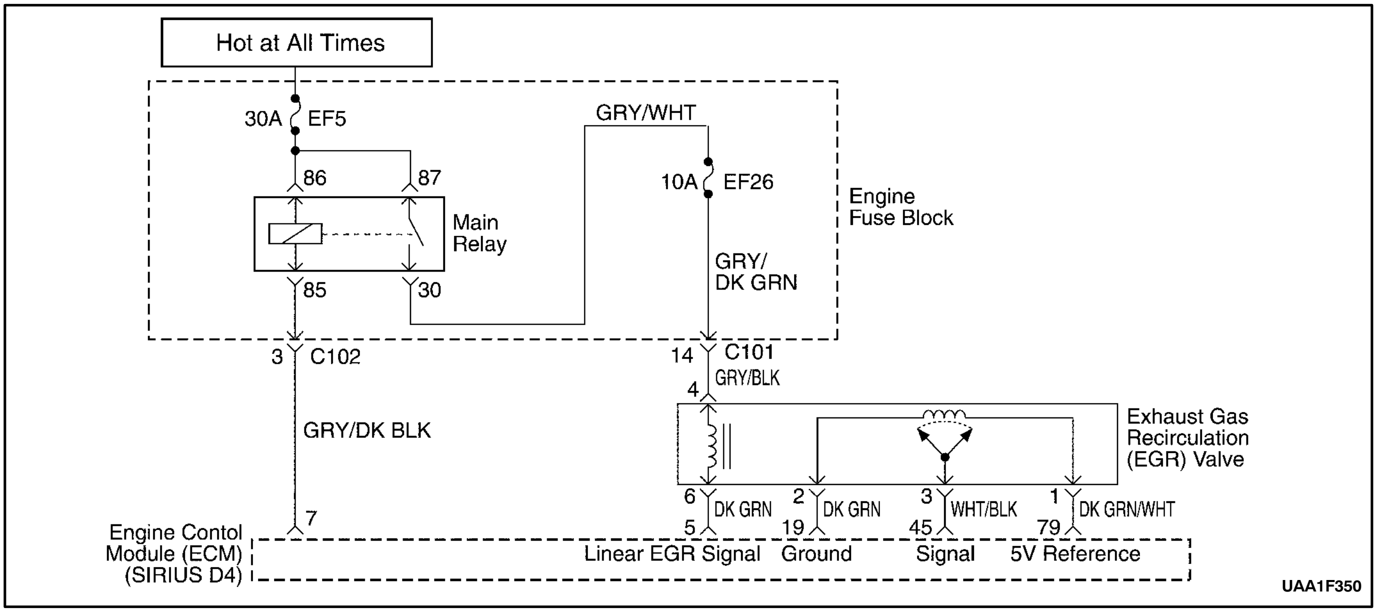
- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P1385 – Rough Road Sensor Circuit Fault (ABS)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with engine OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Review and record the scan tool Failure Records data. 4. Operate the vehicle within Failure Records conditions as noted. 5. Using the scan tool, monitor specific Diagnostic Trouble Code (DTC) info for DTC P1385. Does the scan tool indicate that DTC P1385 failed?	–	Go to ***Step* 5**	Go to ***Step* 3**
3	Check for poor or fault connection between the Engine Control Module (ECM) and the Electronic Brake Control Module (EBCM). Is the problem found?	–	Go to ***Step* 4**	Go to "Diagnostic Aids"
4	Repair the connection as needed. Is the repair complete?	–	Go to ***Step* 8**	–
5	1. Turn the ignition switch to lock. 2. Disconnect the ECM connector and EBCM connector. 3. Check for an open or a short to ground or a short to battery in the wire between the ECM connector terminal 53 and the EBCM connector terminal 25. Is the problem found?	–	Go to ***Step* 6**	Go to ***Step* 7**
6	Repair the wire as needed. Is the repair complete?	–	Go to ***Step* 8**	Refer to Section 4F "***Antilock Brake System***"
7	Replace the ECM. Is the replacement complete?	–	Go to ***Step* 9**	Refer to Section 4F "***Antilock Brake System***"
8	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step* 9**	Go to ***Step* 2**
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0400 EXHAUST GAS RECIRCULATION OUT OF LIMIT

Circuit Description

An Exhaust Gas Re-circulation (EGR) system is used to lower oxides of nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with a engine control module(ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and the Manifold Absolute Pressure (MAP) sensor. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The actual EGR position should always be near the commanded or Desired EGR position.

This Diagnostic Trouble Code(DTC) will detect an open or short circuit.

Conditions for Setting the DTC

- The vehicle is part load.
- The engine controls system is in closed loop.
- Engine Coolant Temperature(ECT) is higher than 60°C(140°F).
- Intake Air Temperature(IAT) is higher than 15°C (59°F).
- Manifold Absolute Pressure is greater than 75kPA.
- The EGR is higher than 10%.
- Mass Air Flow is between 71~174mg/tdc.
- Engine Speed is Between 1,950~2,600rpm.
- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0131, P0300, P0335, P0336, P0341, P0342, P1671, P1672, P1673 are NOT SET.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P0400 – Exhaust Gas Recirculation Out of Limit

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to with the engine OFF. 2. Install the scan tool. 3. Command the exhaust gas recirculation (EGR) valve to the specified values. Does the Actual EGR Position follow the desired EGR position?	25%, 50%, 75%, 100%	Go to **Step 19**	Go to **Step 3**
3	1. Turn the ignition switch to ON. 2. Disconnect the EGR valve electrical connector. 3. With a test light connected to B+, probe the ground circuit to the EGR valve. Does the test light illuminate?	–	Go to **Step 4**	Go to **Step 5**
4	1. Connect the test light to ground. 2. Probe the EGR control circuit at terminal 3 to the EGR valve. 3. Command the EGR valve to the specified values using a scan tool. After the command is raised, does the test light glow brighter, flash or maintain a steady glow?	25%, 50%, 75%, 100%	Go to **Step 6**	Go to **Step 7**
5	Repair the open or poor connection in the EGR ground circuit. Is the repair complete?	–	Go to **Step 19**	–
6	With a test light still connected to ground, probe the signal circuit at terminal 3. Does the test light illuminate?	–	Go to **Step 8**	Go to **Step 9**
7	With a test light still connected to ground, again probe the signal circuit without commanding the EGR valve with the scan tool. Does the test light illuminate?	–	Go to **Step 10**	Go to **Step 11**
8	Check the signal circuit for a short to voltage and repair as necessary. Is a repair necessary?	–	Go to **Step 19**	Go to **Step 12**
9	With a digital voltmeter (DVM) connected to ground, probe the 5V reference circuit at terminal 1. Is the voltage measured near the specified value?	5V	Go to **Step 13**	Go to **Step 14**
10	Check the control circuit for a short to battery voltage and repair as necessary. Is a repair necessary?	–	Go to **Step 19**	Go to **Step 12**
11	Connect the test light to B+ and again probe the control circuit at terminal 4. Does the test light illuminate?	–	Go to **Step 15**	Go to **Step 16**
12	Replace the engine control module (ECM). Is the replacement complete?	–	Go to **Step 19**	–
13	Check the EGR ground circuit for a poor connection or proper terminal tension at the ECM and repair as necessary. Is a repair necessary?	–	Go to **Step 19**	Go to **Step 17**

DTC P0400 – Exhaust Gas Recirculation Out of Limit (Cont'd)

Step	Action	Value(s)	Yes	No
14	Check the 5V reference circuit for a shortage to vattery voltage and repair as necessary. Is a repair necessary?	–	Go to ***Step*** **19**	Go to ***Step*** **12**
15	Check the control circuit for a shortage to ground and repair as necessary. Is a repair necessary?	–	Go to ***Step*** **19**	Go to ***Step*** **12**
16	Check the control circuit for an open or poor connection at the EGR valve electrical connector and repair as necessary. Is a repair necessary?	–	Go to ***Step*** **19**	Go to ***Step*** **18**
17	Replace the EGR valve. Is the replacement complete?	–	Go to ***Step*** **19**	–
18	Check the ECM electrical connector for a poor connection and repair as necessary. Is a repair necessary?	–	Go to ***Step*** **19**	Go to ***Step*** **12**
19	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step*** **20**	Go to ***Step*** **2**
20	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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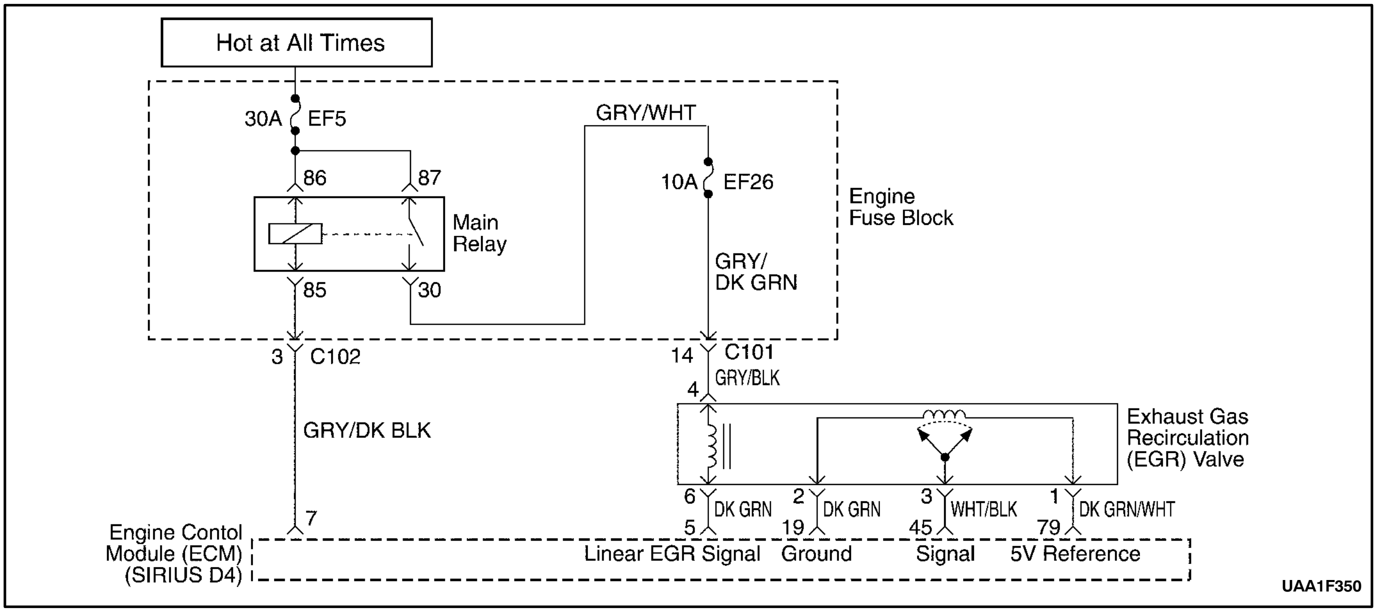


DIAGNOSTIC TROUBLE CODE (DTC) – P1402 EXHAUST GAS RECIRCULATION BLOCKED

Circuit Description

An Exhaust Gas Re-circulation (EGR) system is used to lower oxides of nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with a engine control module(ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and the Manifold Absolute Pressure (MAP) sensor. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The actual EGR position should always be near the commanded or Desired EGR position.

This Diagnostic Trouble Code(DTC) will detect an open or short circuit.

Conditions for Setting the DTC

- The vehicle is part load.
- The engine controls system is in closed loop.
- Engine Coolant Temperature(ECT) is greater than 60°C(140°F).
- Intake Air Temperature(IAT) is greater than 15°C (59°F).
- Manifold Absolute Pressure is greater than 75kPA.
- The EGR is greater than 10%.
- Mass Air Flow is between 71~174mg/tdc.
- Engine Speed Is Between 1,950~2,600rpm.
- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0131, P0300, P0335, P0336, P0341, P0342, P1671, P1672, P1673 are NOT SET.
- EGR is disabled.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

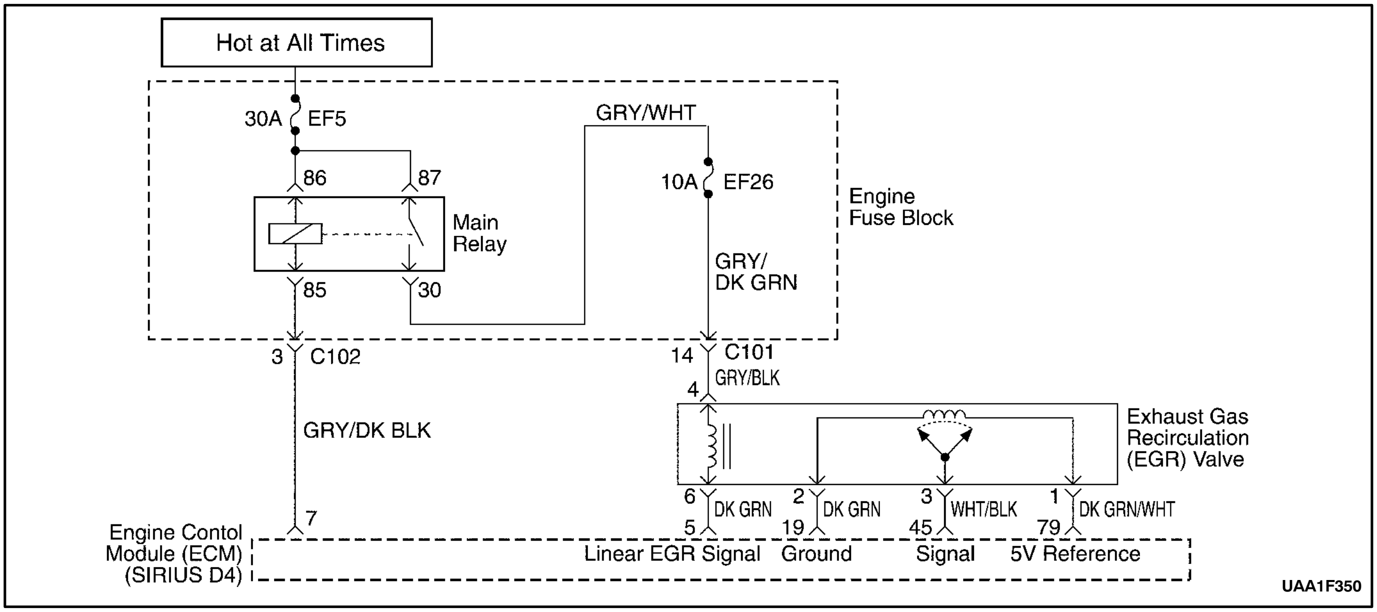
- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and desired EGR positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the Freeze Frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

DTC P0402 – Exhaust Gas Recirculation Blocked

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to “On-Board Diagnostic System Check”
2	1. Start the engine and allow the engine to idle. 2. Install the scan tool. 3. Command the exhaust gas recirculation (EGR) valve to the specified values. Does the engine stall or attempt to stall?	50%	Go to **Step 5**	Go to **Step 3**
3	1. Turn the ignition switch to LOCK. 2. Remove the EGR valve assembly. 3. Inspect the EGR valve, passages and pipe for a restriction or damage and repair as necessary. Is a repair necessary?	–	Go to **Step 5**	Go to **Step 4**
4	Replace the EGR valve. Is the replacement complete?	–	Go to **Step 5**	–
5	1. Start the engine. 2. Disconnect the battery for the specified time. 3. Drive the vehicle to the specified value. 4. Release the throttle and allow the vehicle to decelerate to the specified value. Is the EGR Decel Filter Values less than the specified value?	10 secnds 60mph (97km/h) 20mph (32km/h) 0mph	Go to **Step 3**	Go to **Step 6**
6	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to **Step 7**	Go to **Step 2**



DIAGNOSTIC TROUBLE CODE (DTC) – P1403 EXHAUST GAS RECIRCULATION VALVE FAILURE

Circuit Description

An Exhaust Gas Re-circulation (EGR) system is used to lower oxides of nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with a engine control module(ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and the Manifold Absolute Pressure (MAP) sensor. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The actual EGR position should always be near the commanded or Desired EGR position.

This Diagnostic Trouble Code(DTC) will detect an open or short circuit.

Conditions for Setting THE DTC

- The vehicle is part load.
- The engine controls system is in closed loop.
- Engine Coolant Temperature(ECT) is greater than 60°C(140°F).
- Intake Air Temperature(IAT) is greater than 15°C (59°F).
- Manifold Absolute Pressure is greater than 75kPA.
- The open EGR value is higher than 10%.
- Mass Air Flow is between 71~174mg/tdc.
- Engine Speed Is Between 1,950~2,600rpm.
- EGR potentiometer voltage is less than 0.4V.
- EGR potentiometer voltage is higher than 1.75V or integral term of EGR controller blocked in high or low limit.
- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0131, P0300, P0335, P0336, P0341, P0342, P1671, P1672, P1673 are NOT SET.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and desired EGR positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the Freeze Frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

DTC P1403 – Exhaust Gas Recirculation Valve Failure

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to with the engine OFF. 2. Install the scan tool. 3. Command the exhaust gas recirculation (EGR) valve to the specified values. Does the Actual EGR Position follow the desired EGR position?	25%, 50%, 75%, 100%	Go to ***Step* 19**	Go to ***Step* 3**
3	1. Turn the ignition switch to ON. 2. Disconnect the EGR valve electrical connector. 3. With a test light connected to B+, probe the ground circuit to the EGR valve. Does the test light illuminate?	–	Go to ***Step* 4**	Go to ***Step* 5**
4	1. Connect the test light to ground. 2. Probe the EGR control circuit at terminal 3 to the EGR valve. 3. Command the EGR valve to the specified values using a scan tool. After the command is raised, does the test light glow brighter, flash or maintain a steady glow?	25%, 50%, 75%, 100%	Go to ***Step* 6**	Go to ***Step* 7**
5	Repair the open or poor connection in the EGR ground circuit. Is the repair complete?	–	Go to ***Step* 19**	–
6	With a test light still connected to ground, probe the signal circuit at terminal 3. Does the test light illuminate?	–	Go to ***Step* 8**	Go to ***Step* 9**
7	With a test light still connected to ground, again probe the signal circuit without commanding the EGR valve with the scan tool. Does the test light illuminate?	–	Go to ***Step* 10**	Go to ***Step* 11**
8	Check the signal circuit for a short to voltage and repair as necessary. Is a repair necessary?	–	Go to ***Step* 19**	Go to ***Step* 12**
9	With a digital voltmeter (DVM) connected to ground, probe the 5V reference circuit at terminal 1. Is the voltage measured near the specified value?	5V	Go to ***Step* 13**	Go to ***Step* 14**
10	Check the control circuit for a short to battery voltage and repair as necessary. Is a repair necessary?	–	Go to ***Step* 19**	Go to ***Step* 12**
11	Connect the test light to B+ and again probe the control circuit at terminal 4. Does the test light illuminate?	–	Go to ***Step* 15**	Go to ***Step* 16**
12	Replace the engine control module (ECM). Is the replacement complete?	–	Go to ***Step* 19**	–

DTC P1403 – Exhaust Gas Recirculation Valve Failure (Cont'd)

Step	Action	Value(s)	Yes	No
13	Check the EGR ground circuit for a poor connection or proper terminal tension at the ECM and repair as necessary. Is a repair necessary?	–	Go to ***Step*** **19**	Go to ***Step*** **17**
14	Check the 5V reference circuit for a shortage to battery voltage and repair as necessary. Is a repair necessary?	–	Go to ***Step*** **19**	Go to ***Step*** **12**
15	Check the control circuit for a shortage to ground and repair as necessary. Is a repair necessary?	–	Go to ***Step*** **19**	Go to ***Step*** **12**
16	Check the control circuit for an open or poor connection at the EGR valve electrical connector and repair as necessary. Is a repair necessary?	–	Go to ***Step*** **19**	Go to ***Step*** **18**
17	Replace the EGR valve. Is the replacement complete?	–	Go to ***Step*** **19**	–
18	Check the ECM electrical connector for a poor connection and repair as necessary. Is a repair necessary?	–	Go to ***Step*** **19**	Go to ***Step*** **12**
19	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step*** **20**	Go to ***Step*** **2**
20	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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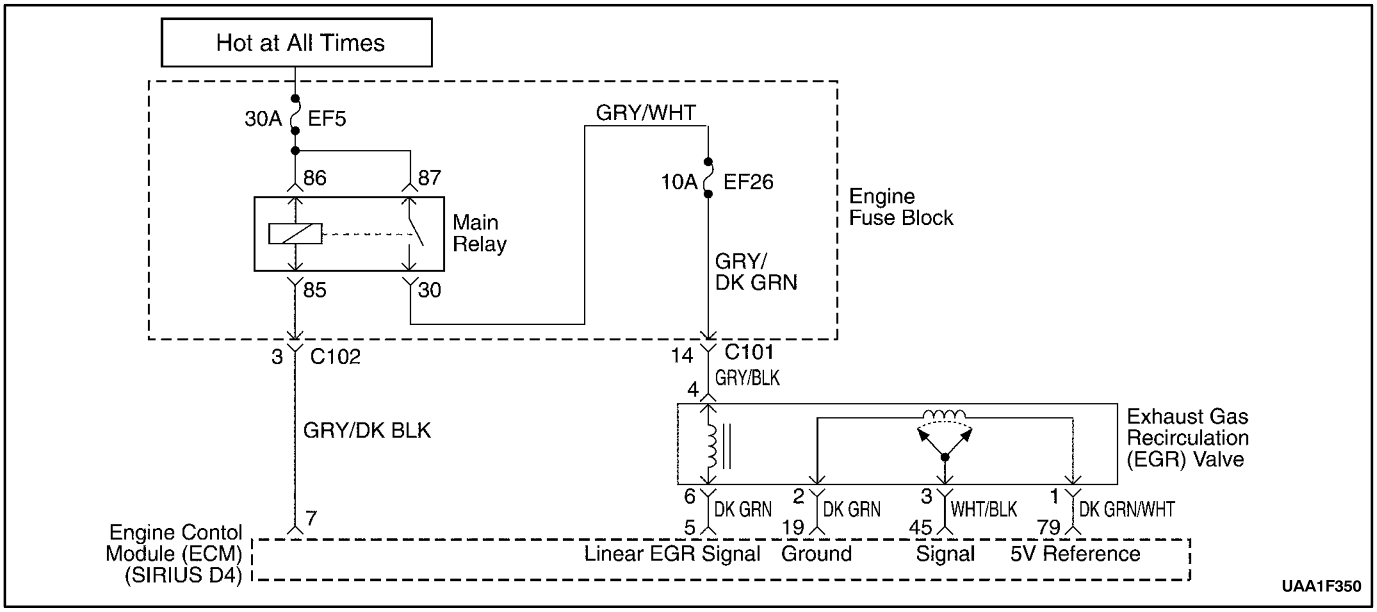

DIAGNOSTIC TROUBLE CODE (DTC) – P0404 EXHAUST GAS RECIRCULATION OPENED

Circuit Description

An Exhaust Gas Re-circulation (EGR) system is used to lower oxides of nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with a engine control module(ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and the Manifold Absolute Pressure (MAP) sensor. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The actual EGR position should always be near the commanded or Desired EGR position.

This Diagnostic Trouble Code(DTC) will detect an open or short circuit.

Conditions for Setting THE DTC

- EGR circuit is a short to ground or an open condition exist.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and desired EGR positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the Freeze Frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

DTC P0404 – Exhaust Gas Recirculation Opened

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to with the engine OFF. 2. Install the scan tool. 3. Command the exhaust gas recirculation (EGR) valve to the specified values. Does the Actual EGR Position follow the desired EGR position?	25%, 50%, 75%, 100%	Go to ***Step* 19**	Go to ***Step* 3**
3	1. Turn the ignition switch to ON. 2. Disconnect the EGR valve electrical connector. 3. With a test light connected to B+, probe the ground circuit to the EGR valve. Does the test light illuminate?	–	Go to ***Step* 4**	Go to ***Step* 5**
4	1. Connect the test light to ground. 2. Probe the EGR control circuit at terminal 3 to the EGR valve. 3. Command the EGR valve to the specified values using a scan tool. After the command is raised, does the test light glow brighter, flash or maintain a steady glow?	25%, 50%, 75%, 100%	Go to ***Step* 6**	Go to ***Step* 7**
5	Repair the open or poor connection in the EGR ground circuit. Is the repair complete?	–	Go to ***Step* 19**	–
6	With a test light still connected to ground, probe the signal circuit at terminal 3. Does the test light illuminate?	–	Go to ***Step* 8**	Go to ***Step* 9**
7	With a test light still connected to ground, again probe the signal circuit without commanding the EGR valve with the scan tool. Does the test light illuminate?	–	Go to ***Step* 10**	Go to ***Step* 11**
8	Check the signal circuit for a short to voltage and repair as necessary. Is a repair necessary?	–	Go to ***Step* 19**	Go to ***Step* 12**
9	With a digital voltmeter (DVM) connected to ground, probe the 5V reference circuit at terminal 1. Is the voltage measured near the specified value?	5V	Go to ***Step* 13**	Go to ***Step* 14**
10	Check the control circuit for a short to battery voltage and repair as necessary. Is a repair necessary?	–	Go to ***Step* 19**	Go to ***Step* 12**
11	Connect the test light to B+ and again probe the control circuit at terminal 4. Does the test light illuminate?	–	Go to ***Step* 15**	Go to ***Step* 16**
12	Replace the engine control module (ECM). Is the replacement complete?	–	Go to ***Step* 19**	–
13	Check the EGR ground circuit for a poor connection or proper terminal tension at the ECM and repair as necessary. Is a repair necessary?	–	Go to ***Step* 19**	Go to ***Step* 17**

DTC P0404 – Exhaust Gas Recirculation Opened (Cont'd)

Step	Action	Value(s)	Yes	No
14	Check the 5V reference circuit for a shortage to battery voltage and repair as necessary. Is a repair necessary?	–	Go to ***Step*** **19**	Go to ***Step*** **12**
15	Check the control circuit for a shortage to ground and repair as necessary. Is a repair necessary?	–	Go to ***Step*** **19**	Go to ***Step*** **12**
16	Check the control circuit for an open or poor connection at the EGR valve electrical connector and repair as necessary. Is a repair necessary?	–	Go to ***Step*** **19**	Go to ***Step*** **18**
17	Replace the EGR valve. Is the replacement complete?	–	Go to ***Step*** **19**	–
18	Check the ECM electrical connector for a poor connection and repair as necessary. Is a repair necessary?	–	Go to ***Step*** **19**	Go to ***Step*** **12**
19	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step*** **20**	Go to ***Step*** **2**
20	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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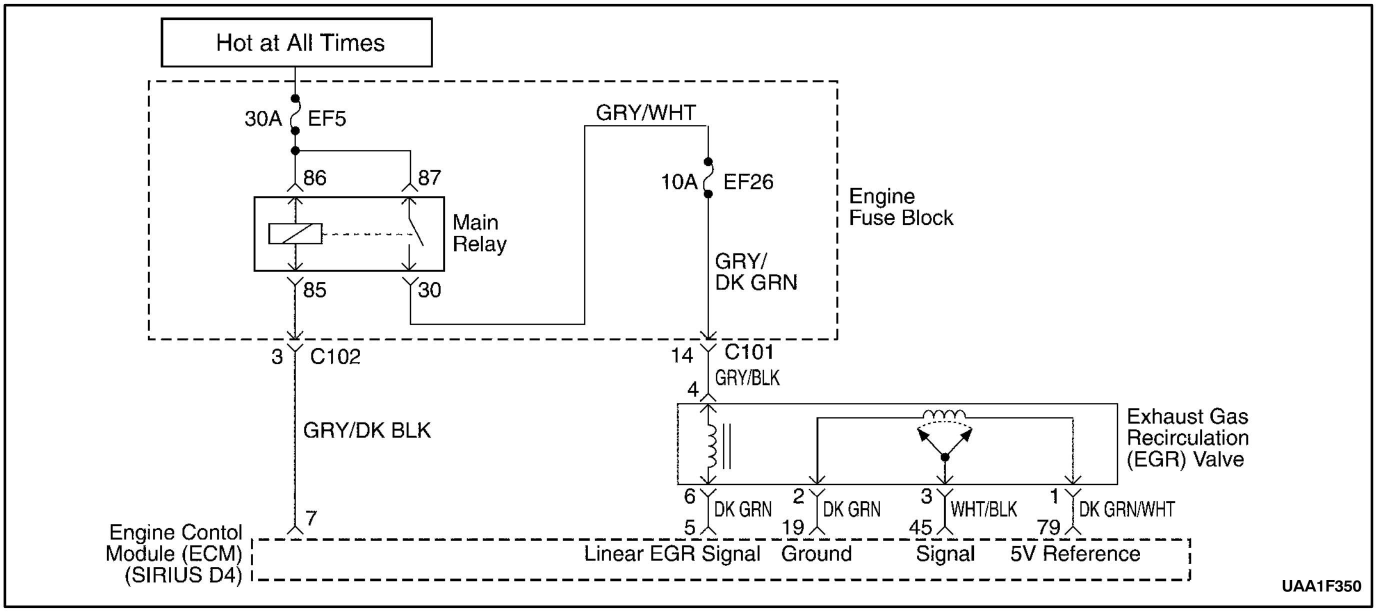

DIAGNOSTIC TROUBLE CODE (DTC) – P1404 EXHAUST GAS RECIRCULATION CLOSED

Circuit Description

An Exhaust Gas Re-circulation (EGR) system is used to lower oxides of nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with a engine control module(ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and the Manifold Absolute Pressure (MAP) sensor. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The actual EGR position should always be near the commanded or Desired EGR position.

This Diagnostic Trouble Code(DTC) will detect an open or short circuit.

Conditions for Setting THE DTC

- EGR circuit is a short to battery condition exist.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and desired EGR positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the Freeze Frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

DTC P1404 – Exhaust Gas Recirculation Closed

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch ON with the engine OFF. 2. Install the scan tool. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specified values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to ***Step* 13**	Go to ***Step* 3**
3	Disconnect the EGR valve electrical connector. Is the Actual EGR Position near the specified value?	100%	Go to ***Step* 4**	Go to ***Step* 5**
4	Check the signal circuit terminal 3 for a short to voltage and repair as necessary. Is a repair necessary?	–	Go to ***Step* 13**	Go to ***Step* 6**
5	With a Digital Voltmeter (DVM) connected to ground, probe the 5 volt reference circuit terminal 1 to the EGR valve. Does the DVM read near the specified valve?	5 v	Go to ***Step* 7**	Go to ***Step* 8**
6	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM) Is the repair complete?	–	Go to ***Step* 13**	–
7	1. Connect a test light to ground. 2. Probe the EGR control circuit to the EGR valve. Does the test light illuminate?	–	Go to ***Step* 9**	Go to ***Step* 10**
8	Check the 5 volt reference circuit for a short to voltage and repair as necessary. Is a repair necessary?	–	Go to ***Step* 13**	Go to ***Step* 6**
9	Check the control circuit for a short to voltage and repair as necessary. Is a repair necessary?	–	Go to ***Step* 13**	Go to ***Step* 6**
10	Check the EGR valve ground circuit for an open or poor connection at the EGR valve electrical connector and repair as necessary. Is a repair necessary?	–	Go to ***Step* 13**	Go to ***Step* 12**
11	Replace the EGR valve. Is a action complete?	–	Go to ***Step* 13**	–
12	Check the EGR electrical connector for a poor connection and repair as necessary. Is a repair necessary?	–	Go to ***Step* 13**	–
13	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step* 14**	Go to ***Step* 2**

DTC P1404 – Exhaust Gas Recirculation Closed (Cont'd)

Step	Action	Value(s)	Yes	No
14	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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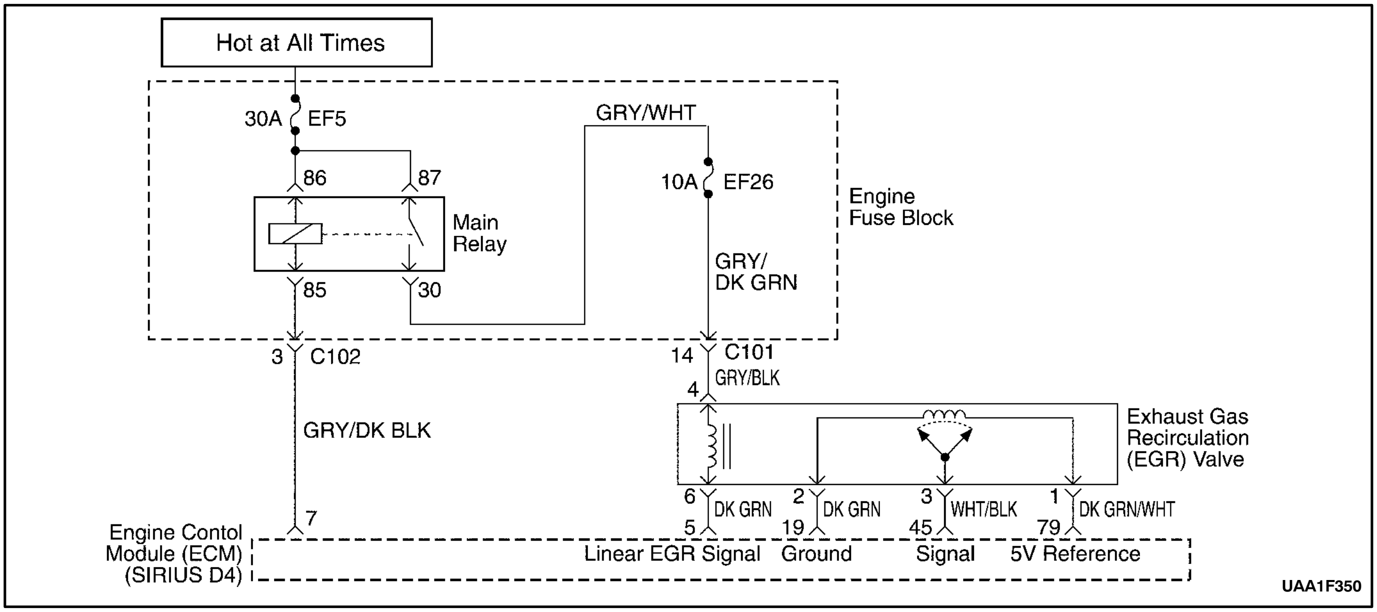

DIAGNOSTIC TROUBLE CODE (DTC) – P0405 EGR PINTLE POSITION SENSOR LOW VOLTAGE

Circuit Description

An Exhaust Gas Re-circulation (EGR) system is used to lower oxides of nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with a engine control module(ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and the Manifold Absolute Pressure (MAP) sensor. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The actual EGR position should always be near the commanded or Desired EGR position.

This Diagnostic Trouble Code(DTC) will detect an open or short circuit.

Conditions for Setting THE DTC

- EGR voltage is less than 0.01V.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and desired EGR positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the Freeze Frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

DTC P0405 – EGR Pintle Position Sensor Low voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch ON with the engine OFF. 2. Install the scan tool. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specified values. Does the Actual EGR Position follow the desired EGR position?	25%, 50%, 75%, 100%	Go to **Step 15**	Go to **Step 3**
3	1. Turn the ignition switch ON with the engine OFF. 2. Disconnect the EGR valve electrical connector. 3. With a Digital Voltmeter (DVM) connected to ground, probe the 5 volt reference circuit at terminal 1 to the EGR valve. Does the DVM read near the specified value?	5 v	Go to **Step 4**	Go to **Step 5**
4	Jumper the 5 volt reference circuit to the signal circuit at terminals 1 and 3. Does the actual EGR position display the specified value ?	100%	Go to **Step 6**	Go to **Step 7**
5	1. Connect the test light to B+. 2. Probe the 5 volt reference circuit to the EGR valve. Does the test light illuminate?	–	Go to **Step 8**	Go to **Step 9**
6	Check the 5 volt reference and signal circuit for a poor connection or proper terminal tension and repair as necessary. Is a repair necessary?	–	Go to **Step 15**	Go to **Step 10**
7	1. Connect the test light to B+. 2. Probe the signal circuit at terminal 3 to the EGR valve. Does the test light illuminate?	–	Go to **Step 11**	Go to **Step 12**
8	Check for a short to ground in the EGR valve 5 volt reference circuit and repair as necessary. Is a repair necessary?	–	Go to **Step 15**	Go to **Step 13**
9	Check for an open in the EGR valve 5 volt reference circuit and repair as necessary. Is a repair necessary?	–	Go to **Step 15**	Go to **Step 14**
10	Replace the EGR valve Is the action complete?	–	Go to **Step 15**	–
11	Check for a short to ground in the EGR valve signal circuit and repair as necessary. Is a repair necessary?	–	Go to **Step 15**	Go to **Step 13**
12	Check for an open in the EGR valve signal circuit and repair as necessary. Is a repair necessary?	–	Go to **Step 15**	Go to **Step 14**
13	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the action complete?	–	Go to **Step 15**	–

DTC P0405 – EGR Pintle Position Sensor Low voltage (Cont'd)

Step	Action	Value(s)	Yes	No
14	Check the affected circuit for a poor connection or proper terminal at the ECM and repair as necessary. Is a repair necessary?	–	Go to ***Step* 15**	Go to ***Step* 13**
15	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step* 16**	Go to ***Step* 2**
16	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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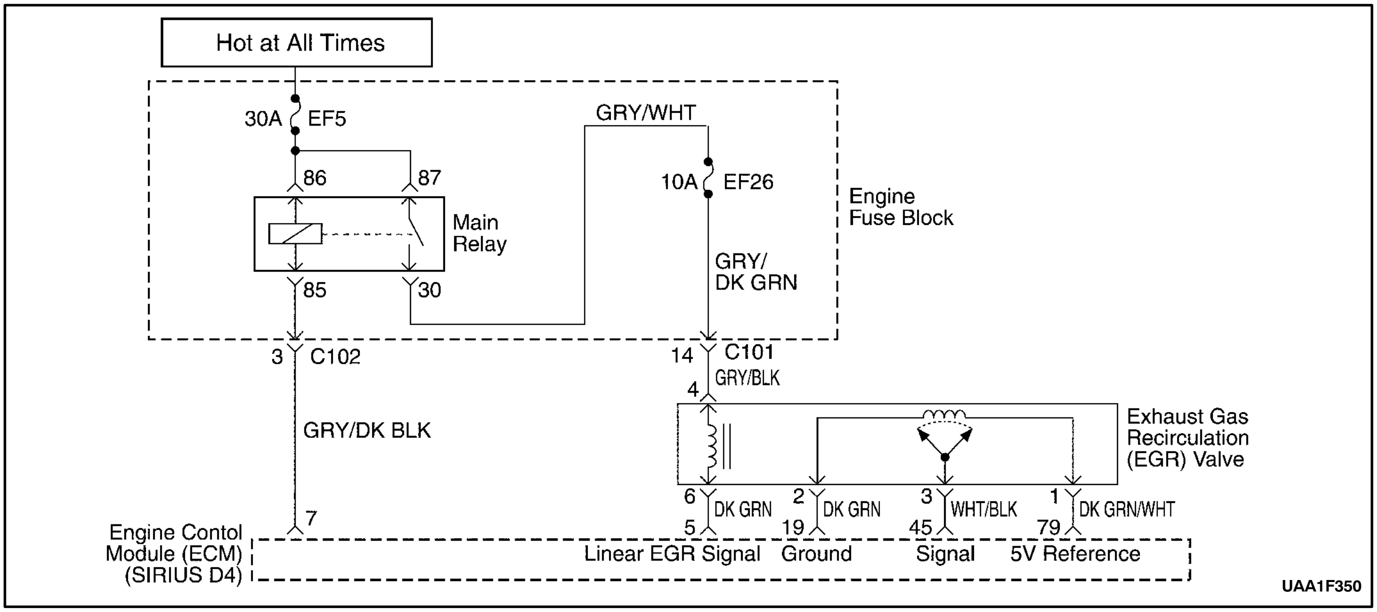

DIAGNOSTIC TROUBLE CODE (DTC) – P0406 EGR PINTLE POSITION SENSOR HIGH VOLTAGE

Circuit Description

An Exhaust Gas Re-circulation (EGR) system is used to lower oxides of nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with a engine control module(ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and the Manifold Absolute Pressure (MAP) sensor. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The actual EGR position should always be near the commanded or Desired EGR position.

This Diagnostic Trouble Code(DTC) will detect an open or short circuit.

Conditions for Setting THE DTC

- EGR voltage is higher than 4.99V.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and desired EGR positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the Freeze Frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

DTC P0406 – EGR Pintle Position Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch ON with the engine OFF. 2. Install the scan tool. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specified values. Does the Actual EGR Position follow the Desired EGR position?	25%, 50%, 75%, 100%	Go to **Step 14**	Go to **Step 3**
3	1. Turn the ignition switch ON with the engine OFF. 2. Disconnect the EGR valve electrical connector. 3. With a Digital Voltmeter (DVM) connected to ground, probe the 5 volt reference circuit at terminal 1 to the EGR valve. Does the DVM read near the specified value?	5 v	Go to **Step 4**	Go to **Step 5**
4	Jumper the 5 volt reference circuit to the signal circuit at terminals 1 and 3. Does the actual EGR position display the specified value ?	100%	Go to **Step 6**	Go to **Step 7**
5	1. Connect the test light to B+. 2. Probe the 5 volt reference circuit to the EGR valve. Does the test light illuminate?	–	Go to **Step 8**	Go to **Step 9**
6	Check the 5 volt reference and signal circuit for a poor connection or proper terminal tension and repair as necessary. Is a repair necessary?	–	Go to **Step 14**	Go to **Step 10**
7	1. Connect the test light to ground. 2. Probe the signal circuit at terminal 3 to the EGR valve. Does the test light illuminate?	–	Go to **Step 11**	Go to **Step 13**
8	Check for a short to ground in the EGR valve 5 volt reference circuit and repair as necessary. Is a repair necessary?	–	Go to **Step 14**	Go to **Step 12**
9	Check for an open in the EGR valve 5 volt reference circuit and repair as necessary. Is a repair necessary?	–	Go to **Step 14**	Go to **Step 13**
10	Replace the EGR valve Is the action complete?	–	Go to **Step 14**	–
11	Check for a short to voltage in the EGR valve signal circuit and repair as necessary. Is a repair necessary?	–	Go to **Step 14**	Go to **Step 12**
12	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the action complete?	–	Go to **Step 14**	–
13	Check the affected circuit for a poor connection or proper terminal at the ECM and repair as necessary. Is a repair necessary?	–	Go to **Step 14**	Go to **Step 12**

DTC P0406 – EGR Pintle Position Sensor High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step*** **15**	Go to ***Step*** **2**
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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DIAGNOSTIC TROUBLE CODE (DTC) – P0420 CATALYST LOW EFFICIENCY

Circuit Description

In order to control exhaust emissions of Hydrocarbons (HC), Carbon Monoxide (CO) and Nitrogen Oxide (NOx), a Three-Way Catalytic Converter (TWC) is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide, it also reduces NOx, converting it into nitrogen. The catalytic converter also has the ability to store oxygen. The Engine Control Module (ECM) has the capability to monitor this process using a Heated

Oxygen Sensor (HO2S) located in the exhaust stream past the TWC. The HO2S produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust emissions effectively. The ECM monitors the catalyst efficiency by first allowing the catalyst to heat up, waiting for a stabilization period while the engine is idling, and then adding and removing fuel while monitoring the reaction of the HO2S. When the catalyst is functioning properly, the HO2S response to the extra fuel is slow compared to the Oxygen Sensor (O2S). When the HO2S response is close to that of the O2S, the Oxygen storage capability or efficiency of the catalyst is considered to be bad, and the Malfunction Indicator Lamp (MIL) will illuminate.

Conditions for Setting the DTC

- Closed loop stoichiometry.
- Engine Coolant Temperature (ECT) is more than 70°C(158°F) .
- Engine speed between 1,760rpm and 2,530rpm.
- Vehicle speed is between 60km/h(37.3mph) and 76km/h(47.2mph).
- The manifold absolute pressure is greater than 76 kpa.
- Activity of the heated oxygen sensor excited by lambda controller stimuli higher than a threshold.
- DTC(s) P0107, P0108, P0117, P0118, P0122, P0123, P0131, P0132, P0133, P0137, P0138, P0140, P0141, P0171, P0172, P0300, P0336, P0337, P0341, P0342, P0351, P0352, P0404, P0405, P0405 and P0562 are not sets.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

The catalyst test may abort due to a change in the engine load. Do not change the engine load (i.e. A/C, coolant fan, heater motor) while a catalyst test is in progress.

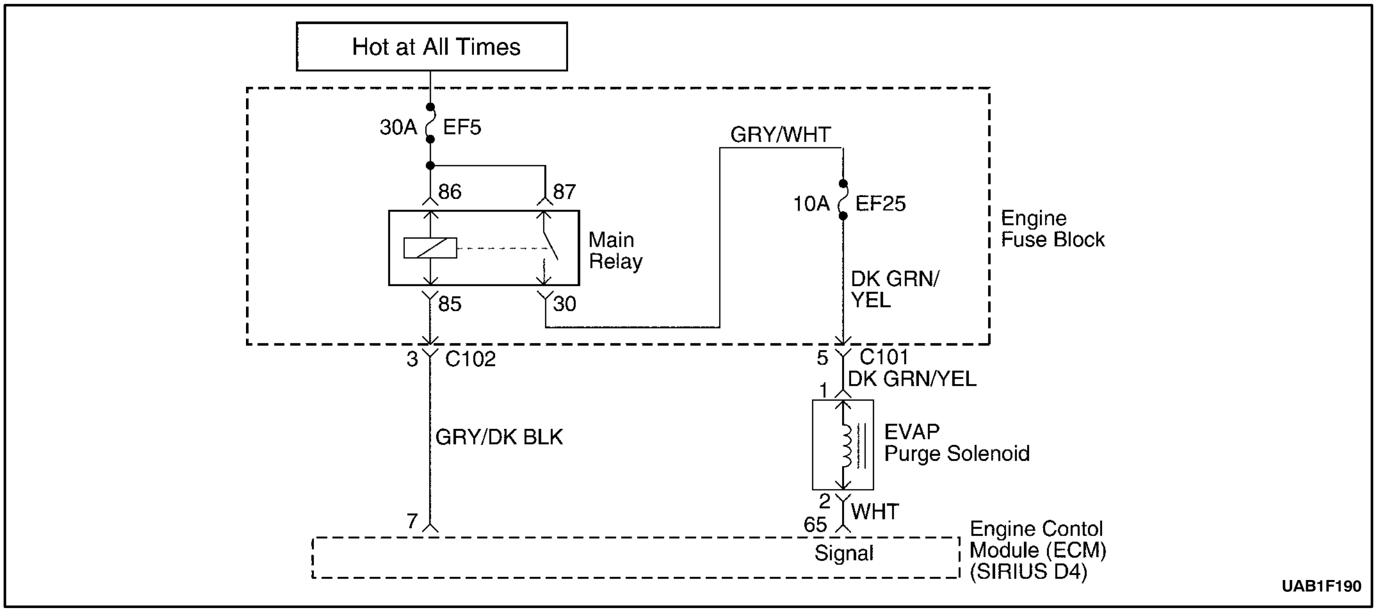
An intermittent problem may be caused by a poor connection, rubbed-through wire insulation, or a wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the intermittent complaint, should be thoroughly checked for the following conditions:

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection.

DTC P0420 – Catalyst Low Efficiency

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data link Connector (DLC). 2. Turn the ignition ON. Are any component Diagnostic Trouble Codes (DTCs) set?	–	Go to Applicable DTC table	Go to ***Step* 3**
3	1. Visually/physically check the following: 2. Exhaust system for a leak. 3. Heated Oxygen Sensor (HO2S). Is a problem found?	–	Go to ***Step* 4**	Go to ***Step* 5**
4	Repair the exhaust system as needed. Is the repair complete?	–	Go to ***Step* 6**	–
5	Replace the Three Way Catalytic Converter (TWC). Is the repair complete?	–	Go to ***Step* 6**	–
6	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to ***Step* 7**	Go to ***Step* 2**
7	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0444 EVAP PURGE CONTROL CIRCUIT NO SIGNAL

Circuit Description

The evaporative emission (EVAP) system includes the following components :

- Fuel tank.
- EVAP vent solenoid.
- Fuel tank pressure sensor.
- Fuel pipes and hoses.
- Fuel vapor lines.
- Fuel cap.
- EVAP canister.
- Purge lines.
- EVAP canister purge valve.
- EVAP service port.

The evaporative emission system is checked by applying vacuum to the EVAP system and monitoring for a vacuum decay. The engine control module(ECM) monitors the vacuum level through the fuel tank pressure sensor signal. At the appropriate time, the EVAP canister purge valve and the EVAP vent solenoid are turned on, allowing the engine to draw a small vacuum on the entire EVAP system. After the desired vacuum level has been achieved, the EVAP canister purge valve is turned OFF, sealing the system. If a sufficient vacuum level cannot be achieved, a large leak is indicated. This can be caused by the following conditions :

Missing or faulty fuel cap.

Disconnected or faulty fuel tank pressure sensor.

Disconnected, damaged, pinched, or blocked EVAP purge line.

Disconnected or faulty EVAP canister purge valve.

Disconnected or faulty EVAP vent solenoid.

Open ignition feed circuit to the EVAP vent or purge solenoid.

Damaged EVAP canister.

Leaking fuel sensor assembly O-ring.

Leaking fuel tank or fuel filler beck.

Any of the above conditions can set DTC P0444.

The test is failed if the tank vacuum is less than 10 in H20 for 15 seconds and the manifold vacuum integral is greater than 49512 (proportional to purge mass from the tank).

Conditions for Setting the DTC

- The canister purge solenoid circuit is an open condition exist.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Although this DTC is considered a type. A diagnostic, it acts like a type B diagnostic under certain conditions. Whenever this diagnostic reports the system has passed, or if the battery is disconnected, the diagnostic must fail twice before setting a DTC. The initial failure is not reported to the diagnostic executive or displayed on a scan tool. A passing system always reports to the diagnostic executive immediately.

Check for the following conditions :

- Missing or damaged fuel cap.
- Missing or damaged O-rings at fuel vapor and EVAP purge line canister fittings.
- Cracked or punctured EVAP canister.
- Damaged source vacuum line, EVAP purge line, EVAP vent hose or fuel tank vapor line.
- Poor connection at the ECM. Inspect the harness connectors for the following conditions.
- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connection.
- Damaged harness. Inspect the wiring harness to the EVAP vent solenoid, EVAP canister purge valve, and the fuel tank pressure sensor for an intermittent open or short circuit.
- Kinked, pinched or plugged vacuum source, EVAP purge, or fuel tank vapor line. Verify that the lines are not restricted.

DTC P0444 – EVAP Purge Control Circuit No Signal

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	1. Disconnect the evaporative emission (EVAP) canister purge valve connector. 2. Connect a test light between the EVAP canister purge valve connector terminal 1 and battery positive. Is the test light ON?	–	Go to ***Step* 3**	Go to ***Step* 5**
3	1. Disconnect the ECM connector. 2. Connect a test light between the ECM connector terminal 65 and ground. Is the test light ON?	–	Go to ***Step* 4**	Go to ***Step* 6**
4	1. Repair the line break in the wire between the EVAP canister purge valve connector 2 and the ECM connector terminal 65. 2. Clear any Diagnostic Trouble Codes (DTCs) from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
5	1. Repair the line break in the wire between the EVAP canister purge valve connector 1 and the main relay connector terminal 30. 2. Clear any Diagnostic Trouble Codes (DTCs) from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
6	1. Replace the ECM. 2. Perform the diagnostic system check. Is the repair complete?	–	Go to ***Step* 7**	–
7	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step* 7**	Go to ***Step* 2**
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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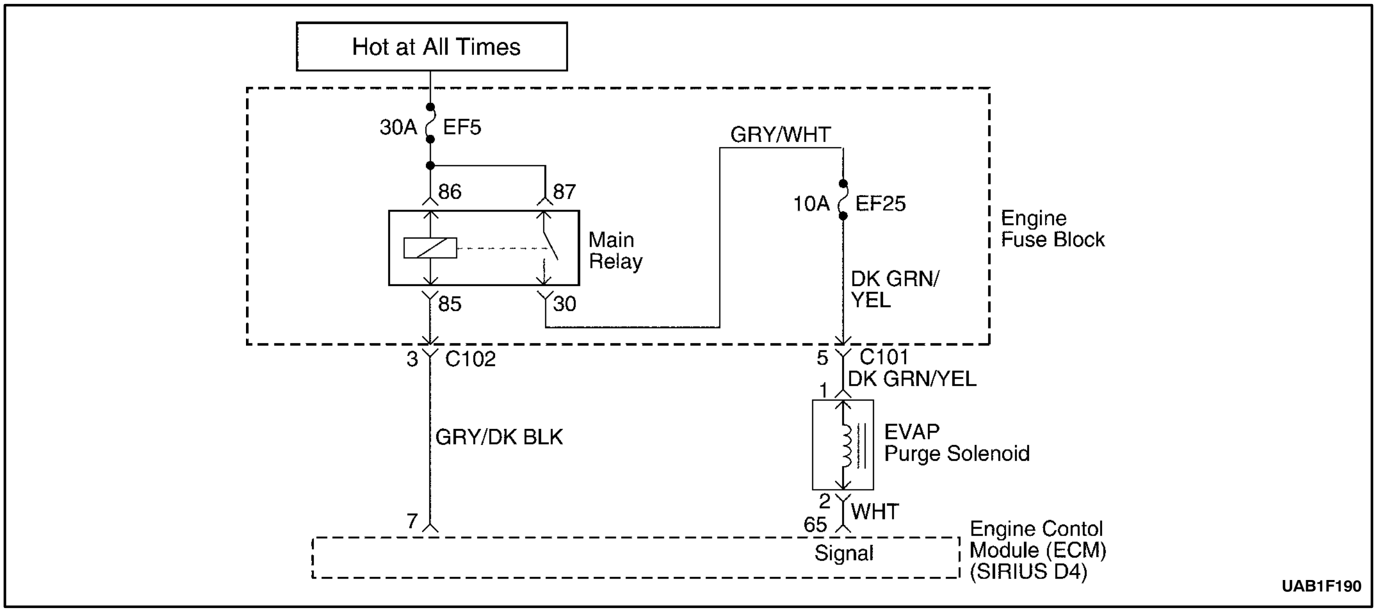

DIAGNOSTIC TROUBLE CODE (DTC) – P0445 EVAP PURGE CONTROL CIRCUIT FAULT

Circuit Description

The evaporative emission (EVAP) system includes the following components :

- Fuel tank.
- EVAP vent solenoid.
- Fuel tank pressure sensor.
- Fuel pipes and hoses.
- Fuel vapor lines.
- Fuel cap.
- EVAP canister.
- Purge lines.
- EVAP canister purge valve.
- EVAP service port.

The evaporative emission system is checked by applying vacuum to the EVAP system and monitoring for a vacuum decay. The engine control module(ECM) monitors the vacuum level through the fuel tank pressure sensor signal. At the appropriate time, the EVAP canister purge valve and the EVAP vent solenoid are turned on, allowing the engine to draw a small vacuum on the entire EVAP system. After the desired vacuum level has been achieved, the EVAP canister purge valve is turned OFF, sealing the system. If a sufficient vacuum level cannot be achieved, a large leak is indicated. This can be caused by the following conditions :

Missing or faulty fuel cap.

Disconnected or faulty fuel tank pressure sensor.

Disconnected, damaged, pinched, or blocked EVAP purge line.

Disconnected or faulty EVAP canister purge valve.

Disconnected or faulty EVAP vent solenoid.

Open ignition feed circuit to the EVAP vent or purge solenoid.

Damaged EVAP canister.

Leaking fuel sensor assembly O-ring.

Leaking fuel tank or fuel filler beck.

Any of the above conditions can set DTC P0445.

The test is failed if the tank vacuum is less than 10 in H20 for 15 seconds and the manifold vacuum integral is greater than 49512 (proportional to purge mass from the tank).

Conditions for Setting the DTC

- The canister purge solenoid valve circuit is a short to battery or short to ground condition exist.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Although this DTC is considered a type. A diagnostic, it acts like a type B diagnostic under certain conditions. Whenever this diagnostic reports the system has passed, or if the battery is disconnected, the diagnostic must fail twice before setting a DTC. The initial failure is not reported to the diagnostic executive or displayed on a scan tool. A passing system always reports to the diagnostic executive immediately.

Check for the following conditions :

Missing or damaged fuel cap.

Missing or damaged O-rings at fuel vapor and EVAP purge line canister fittings.

Cracked or punctured EVAP canister.

Damaged source vacuum line, EVAP purge line, EVAP vent hose or fuel tank vapor line.

Poor connection at the ECM. Inspect the harness connectors for the following conditions.

- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connection.
- Damaged harness. Inspect the wiring harness to the EVAP vent solenoid, EVAP canister purge valve, and the fuel tank pressure sensor for an intermittent open or short circuit.
- Kinked, pinched or plugged vacuum source, EVAP purge, or fuel tank vapor line. Verify that the lines are not restricted.

DTC P0445 – EVAP Purge Control Circuit fault

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to "On-Board Diagnostic System Check"
2	1. Disconnect the evaporative emission (EVAP) canister purge valve connector. 2. Measure the resistance of the EVAP canister purge valve connector. Does the resistance measure near within the value specified?	30•	Go to **Step 3**	Go to **Step 9**
3	Connect a test light between EVAP canister purge valve connector terminal 2 and ground. Is the test light ON?	–	Go to **Step 4**	Go to **Step 6**
4	1. Disconnect the ECM connector. 2. Connect a test light between the ECM connector terminal 65 and ground. Is the test light ON?	–	Go to **Step 5**	Go to **Step 7**
5	1. Repair the high voltage or ground in the wire between the EVAP canister purge valve connector terminal 2 and the ECM connector terminal 65. 2. Clear any Diagnostic Trouble Codes (DTCs) from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
6	1. Disconnect the EVAP canister purge valve connector. 2. Connect a test light between the EVAP canister purge valve connector terminal 1 and battery. Is the test light ON?	–	Go to **Step 7**	Go to **Step 9**

DTC P0445 – EVAP Purge Control Circuit fault (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Disconnect the ECM connector. 2. Connect a test light between the ECM connector terminal 65 and ground. Is the test light ON?	–	Go to ***Step* 8**	Go to ***Step* 10**
8	1. Repair the low voltage in the wire between the EVAP canister purge valve connector terminal 2 and the ECM connector terminal 65. 2. Clear any Diagnostic Trouble Codes (DTCs) from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
9	1. Replace the EVAP canister purge valve. 2. Clear any Diagnostic Trouble Codes (DTCs) from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	Go to ***Step* 10**	–
10	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step* 11**	Go to ***Step* 2**
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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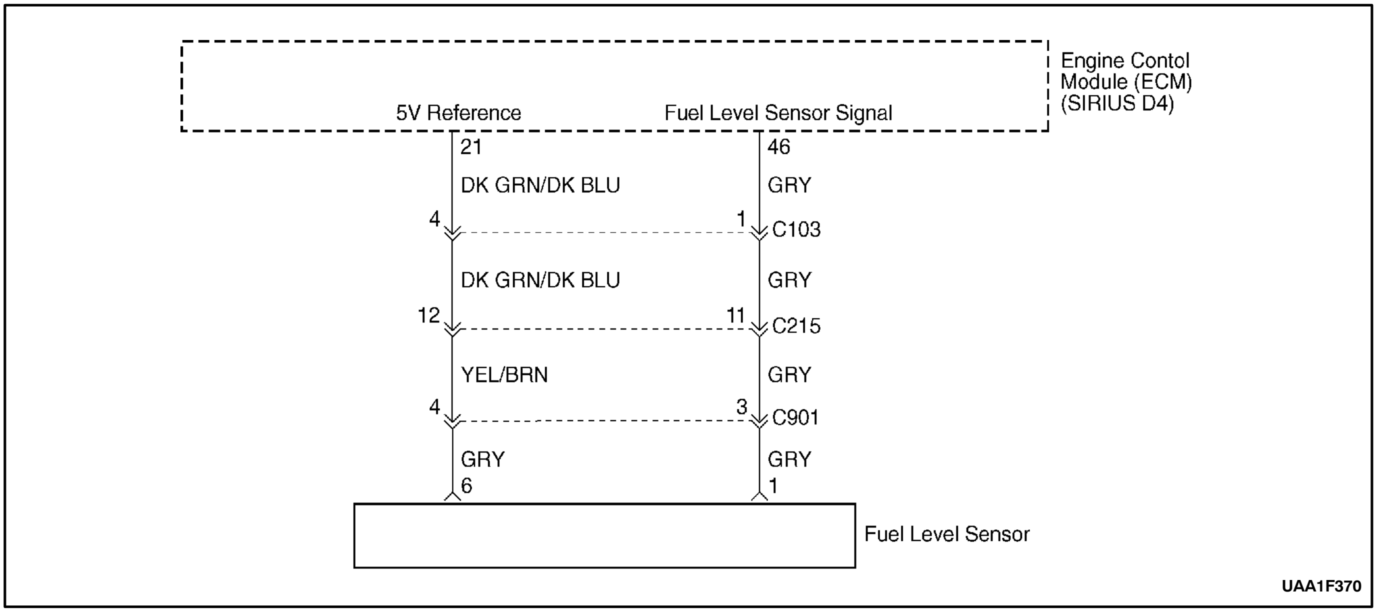

DIAGNOSTIC TROUBLE CODE (DTC) – P0462 FUEL LEVEL SENSOR LOW VOLTAGE

Circuit Description

The engine control module(ECM) uses the fuel level input from the Fuel Level Sensor to calculate expected vapor pressures within the fuel system. Vapor pressure vary as the fuel level changes. Vapor pressure is critical in determining if the evaporative emission (EVAP) system is operating properly. Fuel Level is also used to determine if the Fuel level is too high or too low to be able to accurately detect EVAP system faults. This Diagnostic Trouble Code(DTC) detects a stuck fuel level sender.

Conditions for Setting the DTC

- Fuel Level Sensor voltage is less than 0.2V.
- Fuel Level Sensor circuit low voltage.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Inspect harness connectors for backed-out terminal, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

Inspect the wiring harness for damage.

A stuck Fuel Level Sensor may cause the DTC to set. If DTC P0463 cannot be duplicated, the information included in the Freeze Frame data can be useful in determining vehicle operating conditions when the DTC was first set.

Resistance check for the Fuel Level Sensor.

Empty = 100 ohms or over.

Half full = about 32.5 ohms.

Full = 10 ohms or less.

DTC P0462 – Fuel Level Sensor Low voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to ON. 2. Install a scan tool. 3. Operate the vehicle within Freeze Frame conditions as noted. Is the Diagnostic Trouble Code (DTC) P0462 set?	–	Go to ***Step* 3**	Go to "Diagnostic Aids"
3	1. Disconnect the fuel sender electircal connector from the fuel pump. 2. Using a digital voltmeter (DVM), measure the voltage in the signal circuit at terminal 1. Is the voltage within the specified value?	0.2–4.8V	Go to ***Step* 4**	Go to ***Step* 6**
4	Check for a proper ground connection at the fuel tank and repair as necessary. Is a repair necessary?	–	Go to ***Step* 11**	Go to ***Step* 5**
5	1. Remove the fuel sender from the fuel tank. 2. Reconnect the fuel sender electrical connector. 3. Monitor the Fuel Level Sensor parameter on the scan tool while moving the Fuel Level Sensor float from the empty position to the full position. 4. Repeat the procedure several times. Does the Fuel Level Sensor value on the scan tool increase and then decrease steadily when the float is moved?	–	Go to "Diagnostic Aids"	Go to ***Step* 8**
6	Check for an open or short to ground in the Fuel Level Sensor circuit and repair as necessary. Is the repair necessary?	–	Go to ***Step* 11**	Go to ***Step* 9**
7	Repair the open or short to ground in the Fuel Level Sensor circuit between the Fuel Level Sensor harness connector and the Fuel Level Sensor. Is the repair complete?	–	Go to ***Step* 11**	–
8	Replace the fuel sender assembly. Is the replacement complete?	–	Go to ***Step* 11**	–
9	1. Connect the fuel sender electrical connector. 2. Disconnect the engine control module(ECM) connector. 3. Using a digital voltmeter (DVM) measure the voltage in the signal circuit, at terminal 46. Does the DVM read within the specified value?	0.2–4.8V	Go to ***Step* 10**	Go to section **9E*, Instrumenta-tion/Driver Information***
10	Replace the ECM. Is the repair complete?	–	Go to ***Step* 11**	–
11	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step* 12**	Go to ***Step* 2**

DTC P0462 – Fuel Level Sensor Low voltage (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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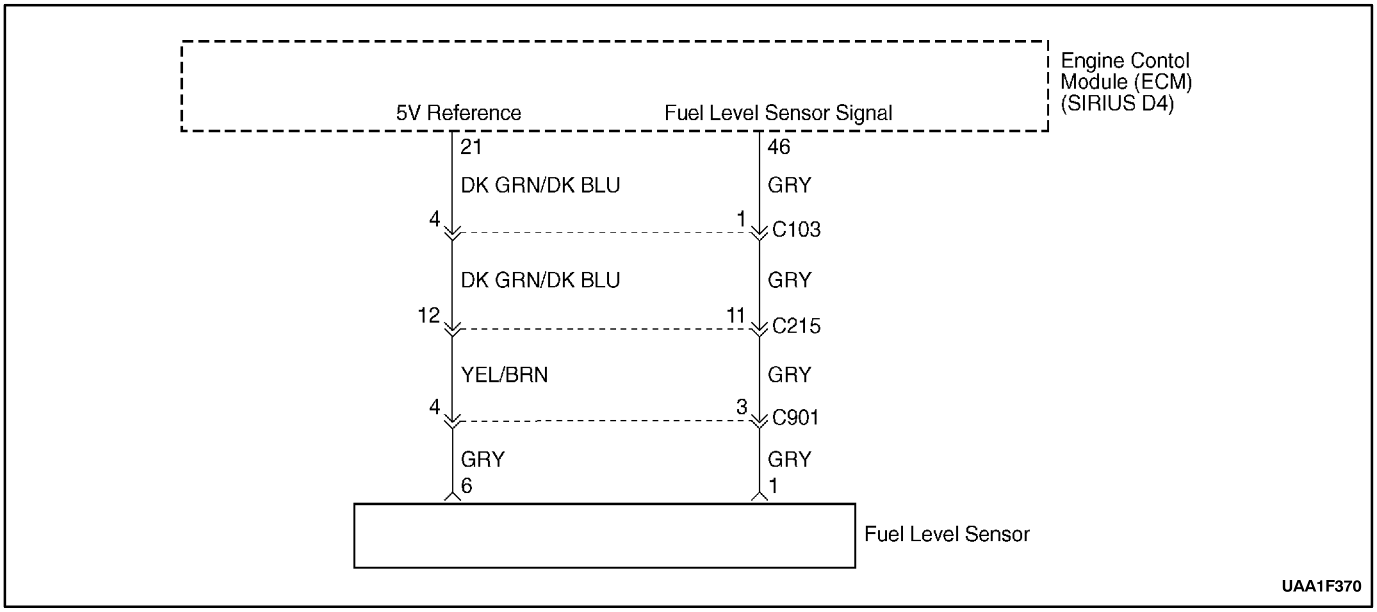

DIAGNOSTIC TROUBLE CODE (DTC) – P0463 FUEL LEVEL SENSOR HIGH VOLTAGE

Circuit Description

The engine control module(ECM) uses the fuel level input from the Fuel Level Sensor to calculate expected vapor pressures within the fuel system. Vapor pressure vary as the fuel level changes. Vapor pressure is critical in determining if the evaporative emission (EVAP) system is operating properly. Fuel Level is also used to determine if the Fuel level is too high or too low to be able to accurately detect EVAP system faults. This Diagnostic Trouble Code(DTC) detects a stuck fuel level sender.

Conditions for Setting the DTC

- Fuel Level Sensor voltage is higher than 4.8V.
- Fuel Level Sensor circuit high voltage.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Inspect harness connectors for backed-out terminal, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

Inspect the wiring harness for damage.

A stuck Fuel Level Sensor may cause the DTC to set. If DTC P0463 cannot be duplicated, the information included in the Freeze Frame data can be useful in determining vehicle operating conditions when the DTC was first set.

Resistance check for the Fuel Level Sensor.

Empty = 100 ohms or over.

Half full = about 32.5 ohms.

Full = 10 ohms or less.

DTC P0463 – Fuel Level Sensor High voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to ON. 2. Install a scan tool. 3. Operate the vehicle within Freeze Frame conditions as noted. Is the Diagnostic Trouble Code (DTC) P0463 set?	–	Go to ***Step* 3**	Go to "Diagnostic Aids"
3	1. Disconnect the fuel sender electrical connector from the fuel pump. 2. Using a digital voltmeter (DVM), measure the voltage in the signal circuit at terminal 1. Is the voltage within the specified value?	0.2–4.8V	Go to ***Step* 4**	Go to ***Step* 6**
4	Check for a proper ground connection at the fuel tank and repair as necessary. Is a repair necessary?	–	Go to ***Step* 11**	Go to ***Step* 5**
5	1. Remove the fuel sender from the fuel tank. 2. Reconnect the fuel pump electrical connector. 3. Monitor the Fuel Level Sensor parameter on the scan tool while moving the Fuel Level Sensor float from the empty position to the full position. 4. Repeat the procedure several times. Does the Fuel Level Sensor value on the scan tool increase and then decrease steadily when the float is moved?	–	Go to "Diagnostic Aids"	Go to ***Step* 8**
6	Check for an open or short to battery voltage in the Fuel Level Sensor circuit and repair as necessary. Is the repair necessary?	–	Go to ***Step* 11**	Go to ***Step* 9**
7	Repair the open or short to battery voltage in the Fuel Level Sensor circuit between the Fuel Level Sensor harness connector and the Fuel Level Sensor. Is the repair complete?	–	Go to ***Step* 11**	–
8	Replace the fuel sender assembly. Is the replacement complete?	–	Go to ***Step* 11**	–
9	1. Connect the fuel pump electrical connector. 2. Disconnect the engine control module(ECM) connector. 3. Using a digital voltmeter (DVM) measure the voltage in the signal circuit, at terminal 46. Does the DVM read within the specified value?	0.2–4.8V	Go to ***Step* 10**	Go to section **9E*, Instrumentation/Driver Information***
10	Replace the ECM. Is the repair complete?	–	Go to ***Step* 11**	–
11	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step* 12**	Go to ***Step* 2**

DTC P0463 – Fuel Level Sensor High voltage (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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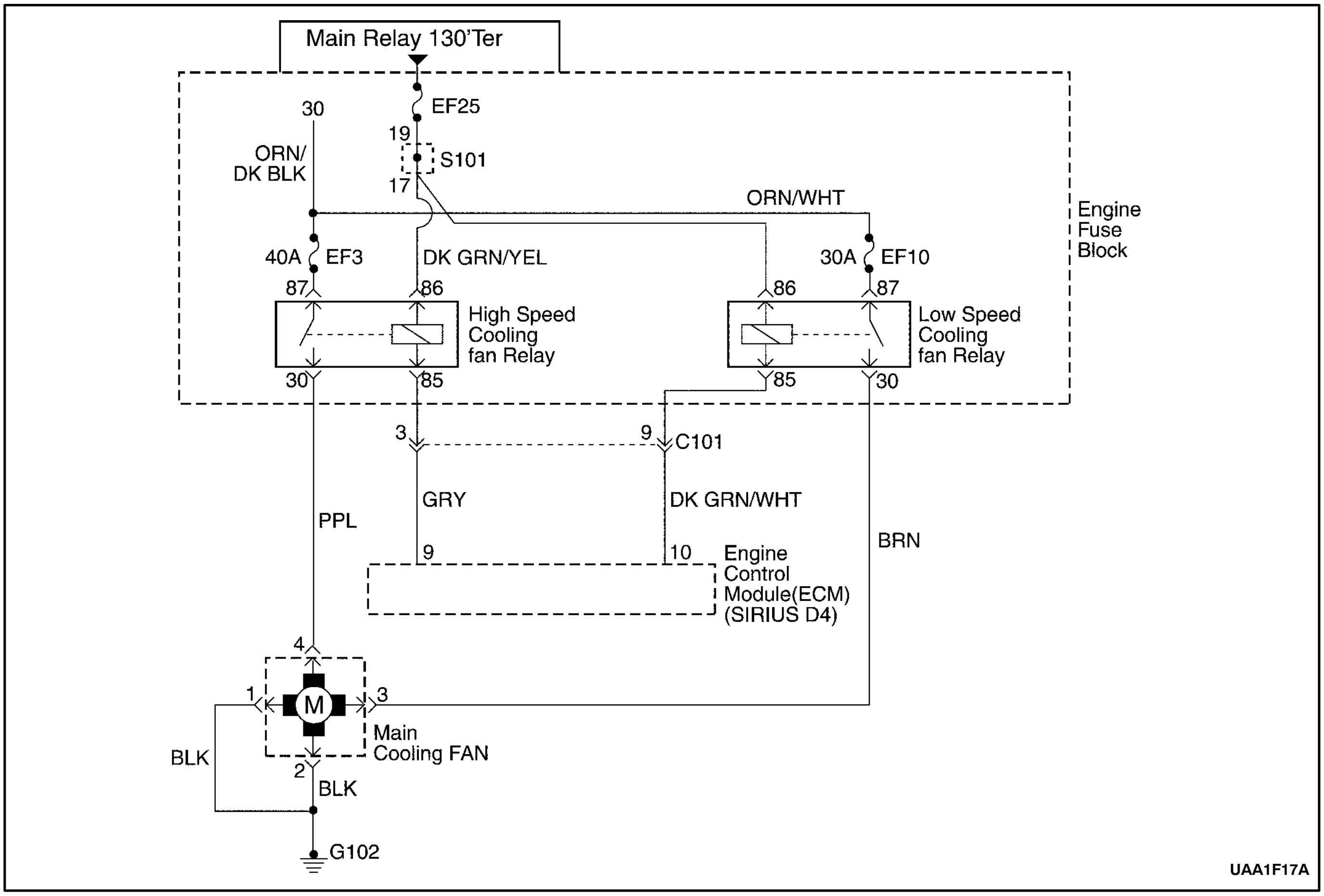

DIAGNOSTIC TROUBLE CODE (DTC) – P0480 LOW SPEED COOLING FAN RELAY CIRCUIT FAULT (WITHOUT A/C)

Circuit Description

Ignition voltage is supplied directly to the cooling fan relay coil. The engine control module(ECM) controls the relay by grounding the control circuit via an internal switch called a driver. The primary function of the driver is supply the ground for the component being controlled. Each driver has a fault line which is monitored by the ECM. When the ECM is commanding a component ON, the voltage of the control circuit should be low (near 0volts). When the ECM is commanding the control circuit to a component OFF, the voltage potential of the circuit should be high(near battery voltage). If the fault detection circuit senses a voltage other than what is expected, the fault line status will change causing the DTC to set.

The relay is used to control the high current flow to the cooling fan motors. This allows the ECM driver to only have to handle the relatively low current used by the relay.

Conditions for Setting the DTC

- The low speed cooling fan control circuit is an open or a short to battery to ground condition exist.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Using Freeze Frame and/or failure records data may aid in locating an intermittent condition. If the DTC cannot be duplicated, the information included in the Freeze Frame and/or failure records data can be useful in determining how many miles since the DTC set. The fail counter and Pass Counter can also be used to determine how many ignition cycles the diagnostics reported a Freeze Frame conditions (rpm, load, vehicle speed, temperature, etc.) that .are noted. This will isolate when the DTC failed.

DTC P0480 – Low Speed Cooling Fan Relay Circuit Fault (WITHOUT A/C)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to ON with the engine OFF. 2. Install a scan tool. 3. Command the relay ON and OFF. Does the relay turn ON and OFF when commanded?	–	Go to ***Step* 3**	Go to ***Step* 5**
3	1. Turn the ignition switch to LOCK. 2. Disconnect the engine control module (ECM) connector. 3. Turn the ignition switch to ON. 4. Using a digital voltmeter(DVM), measure the current in low speed relay control circuit, at terminal 10 to ground for 2 minutes. Does the amperage measure less than the specified value?	0.75 amps	Go to "Diagnostic Aids"	Go to ***Step* 4**
4	1. Turn the ignition switch to LOCK. 2. Disconnect the relay. 3. Using a DVM, measure the resistance between terminals 85 and 10 in the relay control circuit in the ECM harness connector to ground. Does the DVM display infinite resistance?	–	Go to ***Step* 12**	Go to ***Step* 10**
5	1. Turn the ignition switch to LOCK. 2. Disconnect the relay. 3. Connect a test light between the relay coil terminals 86 and 85 in the relay harness connector. 4. Turn the Turn the ignition switch to ON. 5. Using the scan tool, command the relay ON and OFF. Does the test light turn ON and OFF with each commanded?	–	Go to ***Step* 8**	Go to ***Step* 6**
6	With the test light connected to ground, probe the ignition feed circuit in the relay harness connector. Does the test light illuminate?	–	Go to ***Step* 7**	Go to ***Step* 11**
7	1. Turn the ignition switch to LOCK. 2. Reconnect the relay. 3. Disconnect the ECM connector containing the relay control circuit. 4. Turn the Turn the ignition switch to ON. 5. With a fused jumper wire connected to ground, probe the relay control circuit at terminal 10 in the ECM harness connector. Does the relay operate?	–	Go to ***Step* 9**	Go to ***Step* 10**
8	Check the connections at the relay. Is a problem found and corrected?	–	Go to ***Step* 14**	Go to ***Step* 12**
9	Check the connection at the ECM. Is a problem found and corrected?	–	Go to ***Step* 11**	Go to ***Step* 13**

DTC P0480 – Low Speed Cooling Fan Relay Circuit Fault (WITHOUT A/C) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Repair the faulty relay control circuit. Is the repair complete?	–	Go to ***Step*** **14**	–
11	Repair the faulty relay ignition feed circuit. Is the repair complete?	–	Go to ***Step*** **14**	–
12	Replace the relay. Is the replacement complete?	–	Go to ***Step*** **14**	–
13	Replace the ECM. Is the replacement complete?	–	Go to ***Step*** **14**	–
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step*** **15**	Go to ***Step*** **2**
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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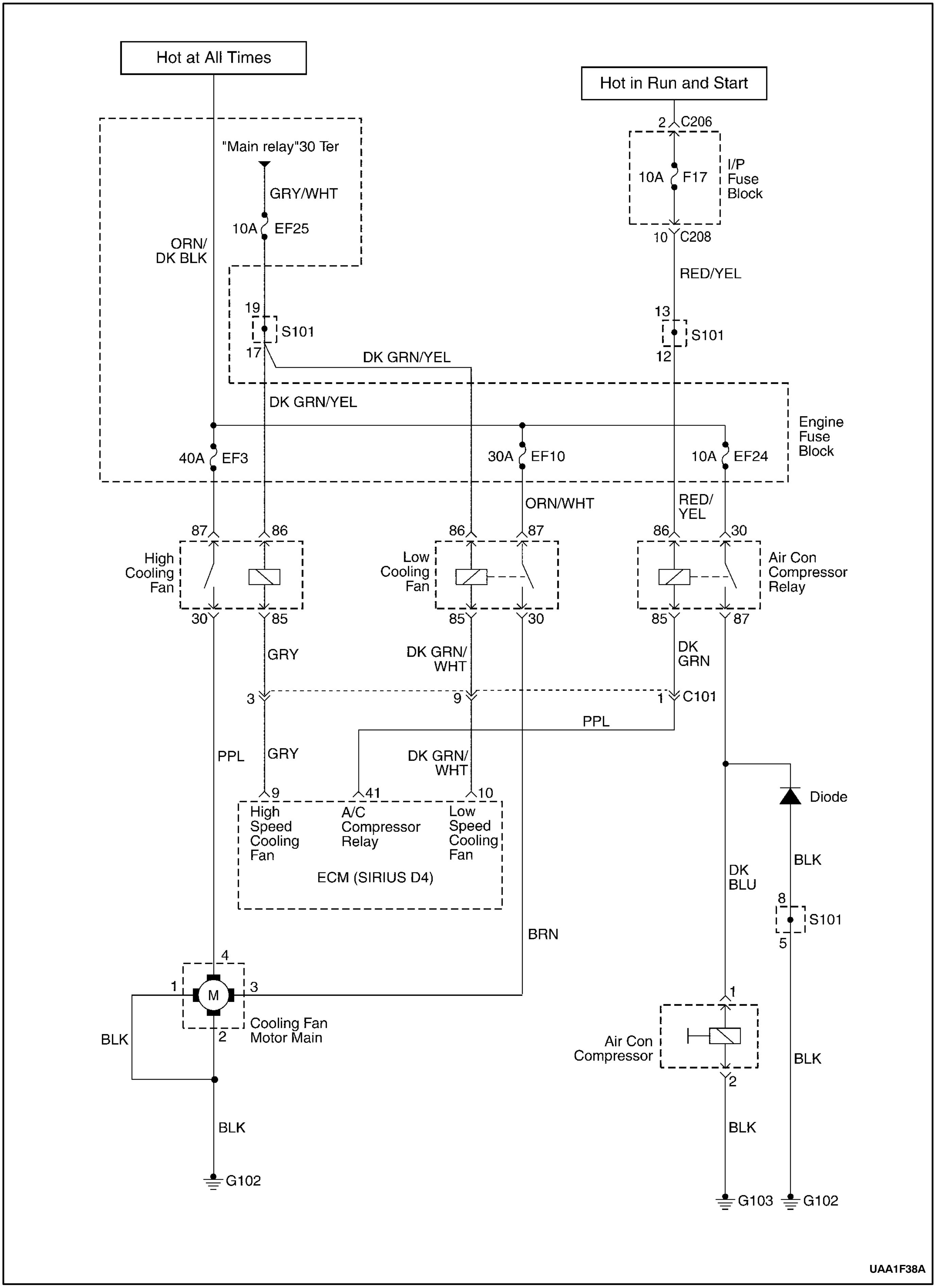

Hot at All Times
Hot in Run and Start
2 C206
"Main relay"30 Ter
GRY/WHT
10A EF25
ORN/
DK BLK
10A F17
I/P
Fuse
Block
10 C208
RED/YEL
19
S101
17
DK GRN/YEL
13
S101
12
DK GRN/YEL
Engine
Fuse
Block
40A EF3
30A EF10
10A EF24
ORN/WHT
RED/
YEL
87
86
86
87
86
30
High
Cooling
Fan
Low
Cooling
Fan
Air Con
Compressor
Relay
30
85
85
30
85
87
GRY
DK GRN/
WHT
DK
GRN
3
9
1 C101
PPL
PPL
GRY
DK GRN/
WHT
9
41
10
High
Speed
Cooling
Fan
A/C
Compressor
Relay
Low
Speed
Cooling
Fan
ECM (SIRIUS D4)
Diode
BLK
DK
BLU
8
S101
5
BRN
4
1
3
M
2
Cooling Fan
Motor Main
BLK
1
Air Con
Compressor
2
BLK
BLK
BLK
G102
G103
G102
UAA1F38A

DIAGNOSTIC TROUBLE CODE (DTC) – P0480 LOW SPEED COOLING FAN RELAY CIRCUIT FAULT (WITH A/C)

Circuit Description

Ignition voltage is supplied directly to the cooling fan relay coil. The engine control module(ECM) controls the relay by grounding the control circuit via an internal switch called a driver. The primary function of the driver is supply the ground for the component being controlled. Each driver has a fault line which is monitored by the ECM. When the ECM is commanding a component ON, the voltage of the control circuit should be low (near 0volts). When the ECM is commanding the control circuit to a component OFF, the voltage potential of the circuit should be high(near battery voltage). If the fault detection circuit senses a voltage other than what is expected, the fault line status will change causing the DTC to set.

The relay is used to control the high current flow to the cooling fan motors. This allows the ECM driver to only have to handle the relatively low current used by the relay.

Conditions for Setting the DTC

- The low speed cooling fan control circuit is an open or a short to battery or a short to ground condition exist.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Using Freeze Frame and/or failure records data may aid in locating an intermittent condition. If the DTC cannot be duplicated, the information included in the Freeze Frame and/or failure records data can be useful in determining how many miles since the DTC set. The fail counter and Pass Counter can also be used to determine how many ignition cycles the diagnostics reported a Freeze Frame conditions (rpm, load, vehicle speed, temperature, etc.) that .are noted. This will isolate when the DTC failed.

DTC P0480 – Low Speed Cooling Fan Relay Circuit Fault (with A/C)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to ON with the engine OFF. 2. Install a scan tool. 3. Command the relay ON and OFF. Does the relay turn ON and OFF when commanded?	–	Go to **Step 3**	Go to **Step 5**
3	1. Turn the ignition switch to LOCK. 2. Disconnect the engine control module (ECM) connector. 3. Turn the ignition switch to ON. 4. Using a digital voltmeter(DVM), measure the current in low speed relay control circuit, at terminal 10 to ground for 2 minutes. Does the amperage measure less than the specified value?	0.75 amps	Go to "Diagnostic Aids"	Go to **Step 4**

DTC P0480 – Low Speed Cooling Fan Relay Circuit Fault (with A/C) (Cont'd)

Step	Action	Value(s)	Yes	No
4	1. Turn the ignition switch to LOCK. 2. Disconnect the relay. 3. Using a DVM, measure the resistance between terminals 85 and 10 in the relay control circuit in the ECM harness connector to ground. Does the DVM display infinite resistance?	–	Go to **Step 12**	Go to **Step 10**
5	1. Turn the ignition switch to LOCK. 2. Disconnect the relay. 3. Connect a test light between the relay coil terminals 86 and 85 in the relay harness connector. 4. Turn the Turn the ignition switch to ON. 5. Using the scan tool, command the relay ON and OFF. Does the test light turn ON and OFF with each commanded?	–	Go to **Step 8**	Go to **Step 6**
6	With the test light connected to ground, probe the ignition feed circuit in the relay harness connector. Does the test light illuminate?	–	Go to **Step 7**	Go to **Step 11**
7	1. Turn the ignition switch to LOCK. 2. Reconnect the relay. 3. Disconnect the ECM connector containing the relay control circuit. 4. Turn the Turn the ignition switch to ON. 5. With a fused jumper wire connected to ground, probe the relay control circuit at terminal 10 in the ECM harness connector. Does the relay operate?	–	Go to **Step 9**	Go to **Step 10**
8	Check the connections at the relay. Is a problem found and corrected?	–	Go to **Step 14**	Go to **Step 12**
9	Check the connection at the ECM. Is a problem found and corrected?	–	Go to **Step 11**	Go to **Step 13**
10	Repair the faulty relay control circuit. Is the repair complete?	–	Go to **Step 14**	–
11	Repair the faulty relay ignition feed circuit. Is the repair complete?	–	Go to **Step 14**	–
12	Replace the relay. Is the replacement complete?	–	Go to **Step 14**	–
13	Replace the ECM. Is the replacement complete?	–	Go to **Step 14**	–
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to **Step 15**	Go to **Step 2**
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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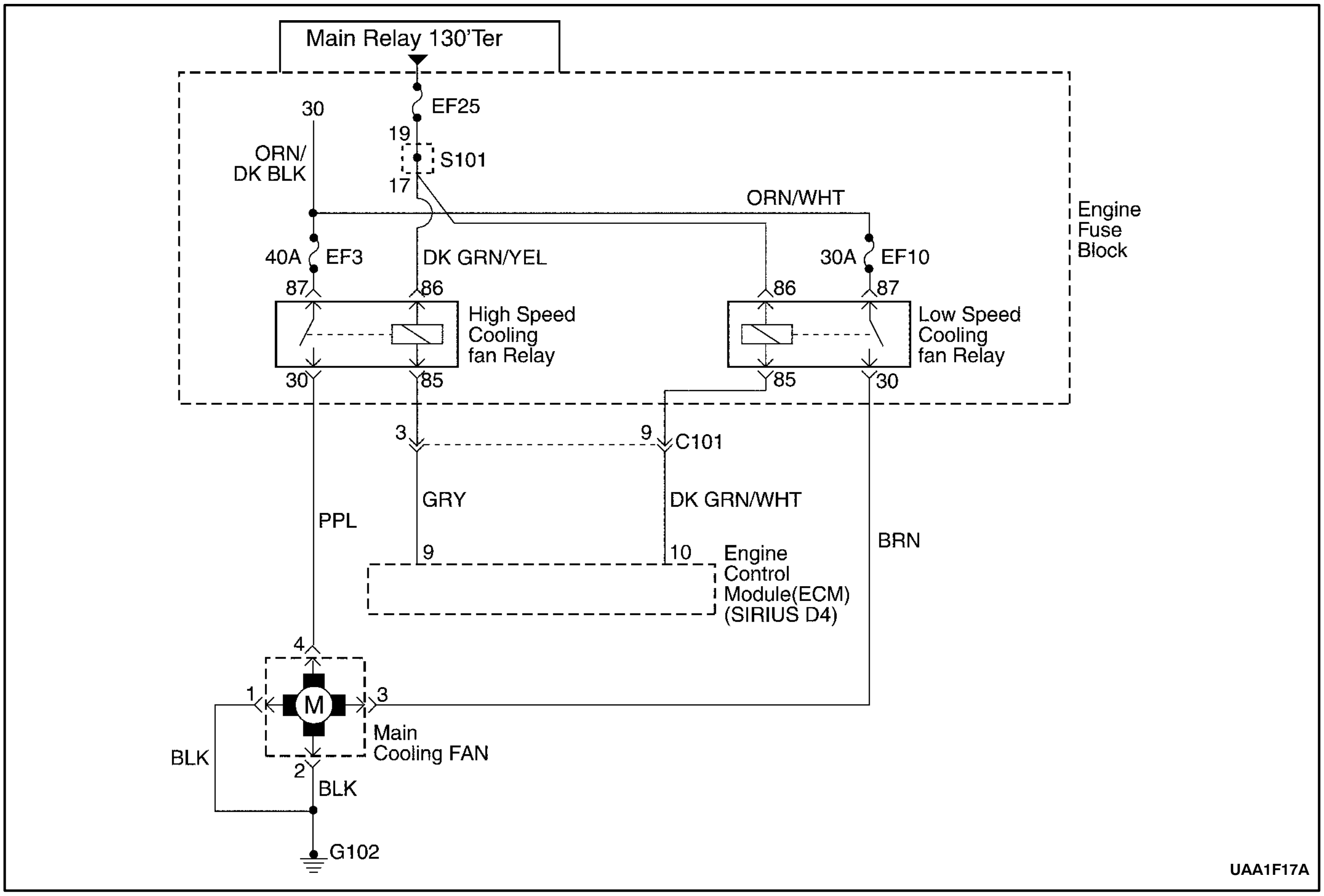

DIAGNOSTIC TROUBLE CODE (DTC) – P0481 HIGH SPEED COOLING FAN RELAY CIRCUIT FAULT (WITHOUT A/C)

Circuit Description

Ignition voltage is supplied directly to the cooling fan relay coil. The engine control module(ECM) controls the relay by grounding the control circuit via an internal switch called a driver. The primary function of the driver is supply the ground for the component being controlled. Each driver has a fault line which is monitored by the ECM. When the ECM is commanding a component ON, the voltage of the control circuit should be low (near 0volts). When the ECM is commanding the control circuit to a component OFF, the voltage potential of the circuit should be high(near battery voltage). If the fault detection circuit senses a voltage other than what is expected, the fault line status will change causing the DTC to set.

The relay is used to control the high current flow to the cooling fan motors. This allows the ECM driver to only have to handle the relatively low current used by the relay.

Conditions for Setting the DTC

- The high speed cooling fan control circuit is an open or a short to battery or a short to ground condition exist.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Using Freeze Frame and/or failure records data may aid in locating an intermittent condition. If the DTC cannot be duplicated, the information included in the Freeze Frame and/or failure records data can be useful in determining how many miles since the DTC set. The fail counter and Pass Counter can also be used to determine how many ignition cycles the diagnostics reported a Freeze Frame conditions (rpm, load, vehicle speed, temperature, etc.) that .are noted. This will isolate when the DTC failed.

DTC P0481 – High Speed Cooling Fan Relay Circuit Fault (without A/C)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to ON with the engine OFF. 2. Install a scan tool. 3. Command the relay ON and OFF. Does the relay turn ON and OFF when commanded?	–	Go to ***Step* 3**	Go to ***Step* 5**
3	1. Turn the ignition switch to LOCK. 2. Disconnect the engine control module (ECM) connector. 3. Turn the ignition switch to ON. 4. Using a digital voltmeter(DVM), measure the current in high speed relay control circuit, at terminal 9 to ground for 2 minutes. Does the amperage measure less than the specified value?	0.75 amps	Go to "Diagnostic Aids"	Go to ***Step* 4**
4	1. Turn the ignition switch to LOCK. 2. Disconnect the relay. 3. Using a DVM, measure the resistance between terminals 85 and 9 in the relay control circuit in the ECM harness connector to ground. Does the DVM display infinite resistance?	–	Go to ***Step* 12**	Go to ***Step* 10**
5	1. Turn the ignition switch to LOCK. 2. Disconnect the relay. 3. Connect a test light between the relay coil terminals 86 and 85 in the relay harness connector. 4. Turn the Turn the ignition switch to ON. 5. Using the scan tool, command the relay ON and OFF. Does the test light turn ON and OFF with each commanded?	–	Go to ***Step* 8**	Go to ***Step* 6**
6	With the test light connected to ground, probe the ignition feed circuit in the relay harness connector. Does the test light illuminate?	–	Go to ***Step* 7**	Go to ***Step* 11**
7	1. Turn the ignition switch to LOCK. 2. Reconnect the relay. 3. Disconnect the ECM connector containing the relay control circuit. 4. Turn the Turn the ignition switch to ON. 5. With a fused jumper wire connected to ground, probe the relay control circuit at terminal 10 in the ECM harness connector. Does the relay operate?	–	Go to ***Step* 9**	Go to ***Step* 10**
8	Check the connections at the relay. Is a problem found and corrected?	–	Go to ***Step* 14**	Go to ***Step* 12**

DTC P0481 – High Speed Cooling Fan Relay Circuit Fault (without A/C) (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the connection at the ECM. Is a problem found and corrected?	–	Go to ***Step*** **11**	Go to ***Step*** **13**
10	Repair the faulty relay control circuit. Is the repair complete?	–	Go to ***Step*** **14**	–
11	Repair the faulty relay ignition feed circuit. Is the repair complete?	–	Go to ***Step*** **14**	–
12	Replace the relay. Is the replacement complete?	–	Go to ***Step*** **14**	–
13	Replace the ECM. Is the replacement complete?	–	Go to ***Step*** **14**	–
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step*** **15**	Go to ***Step*** **2**
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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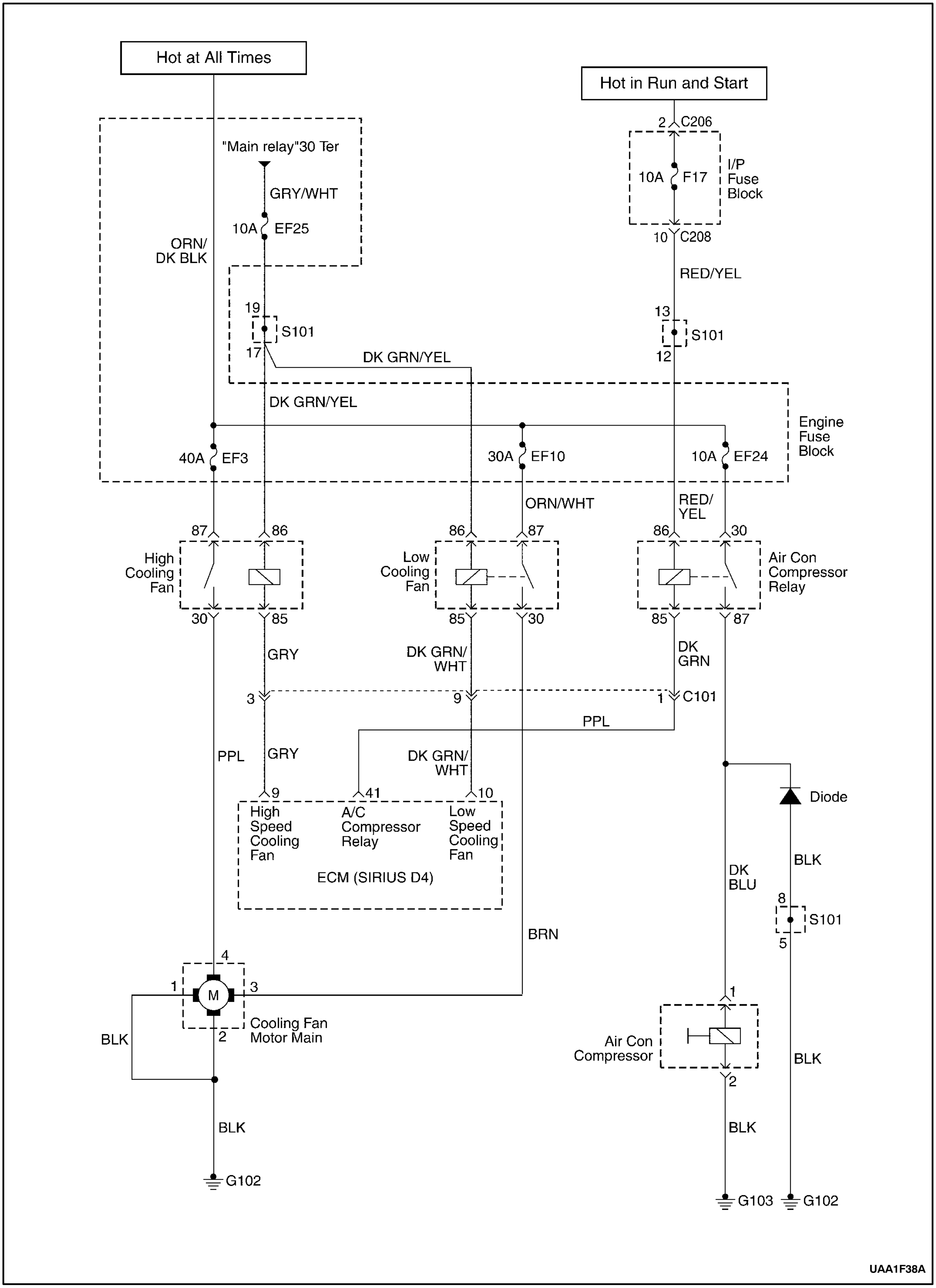
Hot at All Times
Hot in Run and Start
"Main relay"30 Ter
GRY/WHT
10A EF25
ORN/
DK BLK
2 C206
10A F17
I/P
Fuse
Block
10 C208
RED/YEL
19
S101
17
13
S101
12
DK GRN/YEL
DK GRN/YEL
Engine
Fuse
Block
40A EF3
30A EF10
10A EF24
ORN/WHT
RED/
YEL
87
86
86
87
86
30
High
Cooling
Fan
Low
Cooling
Fan
Air Con
Compressor
Relay
30
85
85
30
85
87
GRY
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WHT
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GRN
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PPL
PPL
GRY
DK GRN/
WHT
Diode
9
41
10
High
Speed
Cooling
Fan
A/C
Compressor
Relay
Low
Speed
Cooling
Fan
ECM (SIRIUS D4)
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BLU
8
S101
5
BRN
4
1
M
3
Cooling Fan
Motor Main
BLK
2
1
Air Con
Compressor
2
BLK
BLK
BLK
G102
G103
G102
UAA1F38A

DIAGNOSTIC TROUBLE CODE (DTC) – P0481 HIGH SPEED COOLING FAN RELAY CIRCUIT FAULT (WITH A/C)

Circuit Description

Ignition voltage is supplied directly to the cooling fan relay coil. The engine control module(ECM) controls the relay by grounding the control circuit via an internal switch called a driver. The primary function of the driver is supply the ground for the component being controlled. Each driver has a fault line which is monitored by the ECM. When the ECM is commanding a component ON, the voltage of the control circuit should be low (near 0volts). When the ECM is commanding the control circuit to a component OFF, the voltage potential of the circuit should be high(near battery voltage). If the fault detection circuit senses a voltage other than what is expected, the fault line status will change causing the DTC to set.

The relay is used to control the high current flow to the cooling fan motors. This allows the ECM driver to only have to handle the relatively low current used by the relay.

Conditions for Setting the DTC

- The high speed cooling fan control circuit is an open or a short to battery or a short to ground condition exist.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Using Freeze Frame and/or failure records data may aid in locating an intermittent condition. If the DTC cannot be duplicated, the information included in the Freeze Frame and/or failure records data can be useful in determining how many miles since the DTC set. The fail counter and Pass Counter can also be used to determine how many ignition cycles the diagnostics reported a Freeze Frame conditions (rpm, load, vehicle speed, temperature, etc.) that .are noted. This will isolate when the DTC failed.

DTC P0481 – High Speed Cooling Fan Relay Circuit Fault (with A/C)

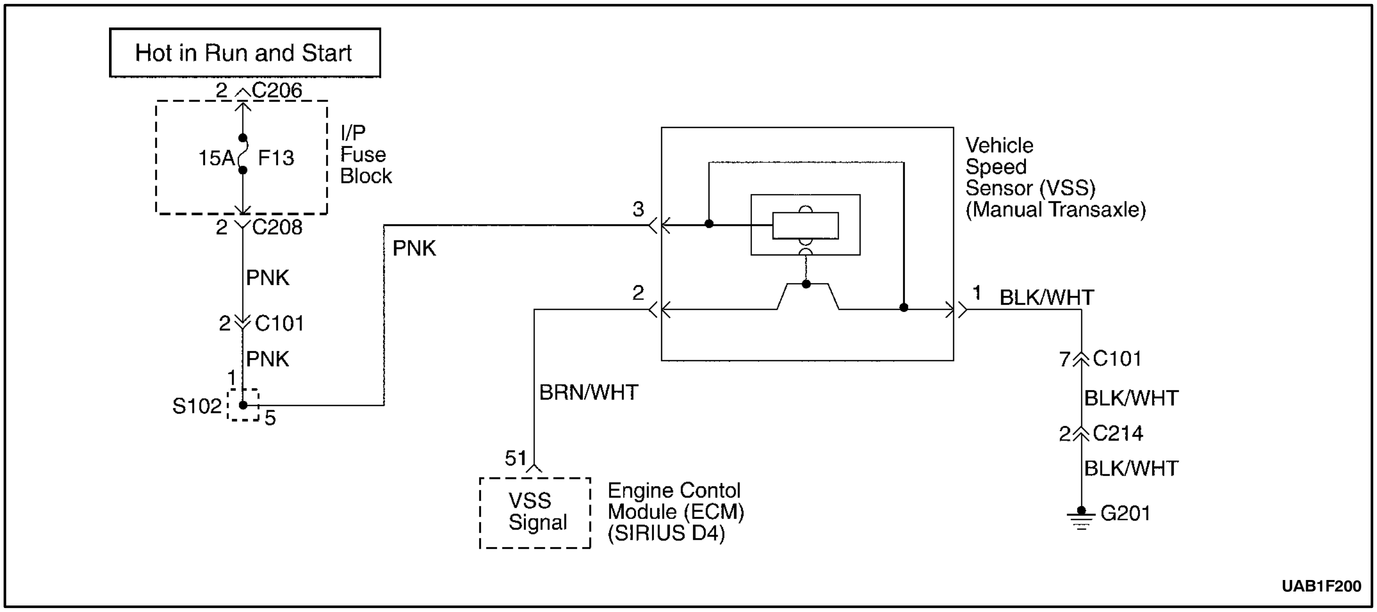
Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to ON with the engine OFF. 2. Install a scan tool. 3. Command the relay ON and OFF. Does the relay turn ON and OFF when commanded?	–	Go to **Step 3**	Go to **Step 5**
3	1. Turn the ignition switch to LOCK. 2. Disconnect the engine control module (ECM) connector. 3. Turn the ignition switch to ON. 4. Using a digital voltmeter(DVM), measure the current in high speed relay control circuit, at terminal 9 to ground for 2 minutes. Does the amperage measure less than the specified value?	0.75 amps	Go to “Diagnostic Aids”	Go to **Step 4**

DTC P0481 – High Speed Cooling Fan Relay Circuit Fault (with A/C) (Cont'd)

Step	Action	Value(s)	Yes	No
4	1. Turn the ignition switch to LOCK. 2. Disconnect the relay. 3. Using a DVM, measure the resistance between terminals 85 and 9 in the high speed cooling fan relay control circuit in the ECM harness connector to ground. Does the DVM display infinite resistance?	–	Go to ***Step*** **12**	Go to ***Step*** **10**
5	1. Turn the ignition switch to LOCK. 2. Disconnect the relay. 3. Connect a test light between the relay coil terminals 86 and 85 in the relay harness connector. 4. Turn the Turn the ignition switch to ON. 5. Using the scan tool, command the relay ON and OFF. Does the test light turn ON and OFF with each commanded?	–	Go to ***Step*** **8**	Go to ***Step*** **6**
6	With the test light connected to ground, probe the ignition feed circuit in the relay harness connector. Does the test light illuminate?	–	Go to ***Step*** **7**	Go to ***Step*** **11**
7	1. Turn the ignition switch to LOCK. 2. Reconnect the relay. 3. Disconnect the ECM connector containing the relay control circuit. 4. Turn the Turn the ignition switch to ON. 5. With a fused jumper wire connected to ground, probe the relay control circuit at terminal 10 in the ECM harness connector. Does the relay operate?	–	Go to ***Step*** **9**	Go to ***Step*** **10**
8	Check the connections at the relay. Is a problem found and corrected?	–	Go to ***Step*** **14**	Go to ***Step*** **12**
9	Check the connection at the ECM. Is a problem found and corrected?	–	Go to ***Step*** **11**	Go to ***Step*** **13**
10	Repair the faulty relay control circuit. Is the repair complete?	–	Go to ***Step*** **14**	–
11	Repair the faulty relay ignition feed circuit. Is the repair complete?	–	Go to ***Step*** **14**	–
12	Replace the relay. Is the replacement complete?	–	Go to ***Step*** **14**	–
13	Replace the ECM. Is the replacement complete?	–	Go to ***Step*** **14**	–
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step*** **15**	Go to ***Step*** **2**

DTC P0481 – High Speed Cooling Fan Relay Circuit Fault (with A/C) (Cont'd)

Step	Action	Value(s)	Yes	No
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0501 VEHICLE SPEED NO SIGNAL (M/T ONLY)

Circuit Description

Vehicle speed information is provided to the engine control module (ECM) by the voltage speed sensor (VSS) is a permanent magnet generator that is mounted in the transaxle and produces a pulsing voltage whenever vehicle speed is over 3 mph (5km/h). The A/C voltage level and the number of pulses increase with vehicle speed. The ECM converts the pulsing voltage into mph (km/h) and than supplies the necessary signal to the instrument panel for speedometer / odometer operation and to the cruise control module and multi-function alarm module operation. The Diagnostic Trouble Code (DTC) will detect if vehicle speed is reasonable according to engine rpm and load.

Conditions for Setting the DTC

- Vehicle speed is not change at least 25 seconds.
- Engine speed is greater than 2,500rpm.
- MAF is greater than 180mg/tdc.

Action taken when The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- Coolant fan turns on.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using the scan tool can clear DTC(s).
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

VSS signal circuit should be thoroughly checked for the following conditions

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

Ensure the VSS is correctly torqued to the trnasaxle housing.

Refer to *“**intermittents**”* in this Section.

DTC P0501 – Vehicle Speed No Signal(M/T only)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to “On-Board Diagnostic System Check”
2	**Notice:** Running the vehicle in gear with the wheels hanging down at full travel will damage the drive axles. 1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Raise the drive wheels. 4. Support the lower control arms so that the drive axles are in a horizontal (straight) position. 5. Allow the engine to idle in gear. Does the scan tool display vehicle speed above the specified value?	0 mph	Go to **Step 3**	Go to **Step 4**
3	1. Turn the ignition ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting this DTC. Does the scan tool display the vehicle speed above the specified value?	0 mph	Go to **Step 12**	Go to **Step 4**
4	1. Turn the ignition OFF. 2. Disconnect the engine control module(ECM) connector 29. 4. using a digital voltmeter(DVM) connected to ground, measure the voltage in the Vehicle Speed Sensor (VSS) signal circuit, at terminal 3 while rotating the wheels. Is the voltage greater than or eqaul to specified value?	0.5 v	Go to **Step 12**	Go to **Step 5**
5	Measure the resistant in the VSS signal circuit while rotating the wheels. Is the resistance greater than the specified value?	1950 •	Go to **Step 6**	Go to **Step 7**
6	Check the VSS signal circuit for an open and repair as necessary. Is the repair complete?	–	Go to **Step 12**	Go to **Step 9**
7	Is the resistance value within or equal to the specified value?	1300–1950 •	Go to **Step 8**	Go to **Step 9**
8	Check the VSS signal circuit for a short to ground or for being shorted together and repair as necessary. Is a repair necessary?	–	Go to **Step 12**	Go to **Step 12**
9	1. Remove the VSS. 2. Measure the resistance between terminals 1 and 3. Is the resistance value within the specified value?	1300–1950 •	Go to **Step 11**	Go to **Step 10**
10	Replace the VSS. Is the action complete?	–	Go to **Step 12**	–
11	Replace the ECM. Is the action complete?	–	Go to **Step 12**	–

DTC P0501 Vehicle Speed No Signal (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step* 15**	Go to ***Step* 2**
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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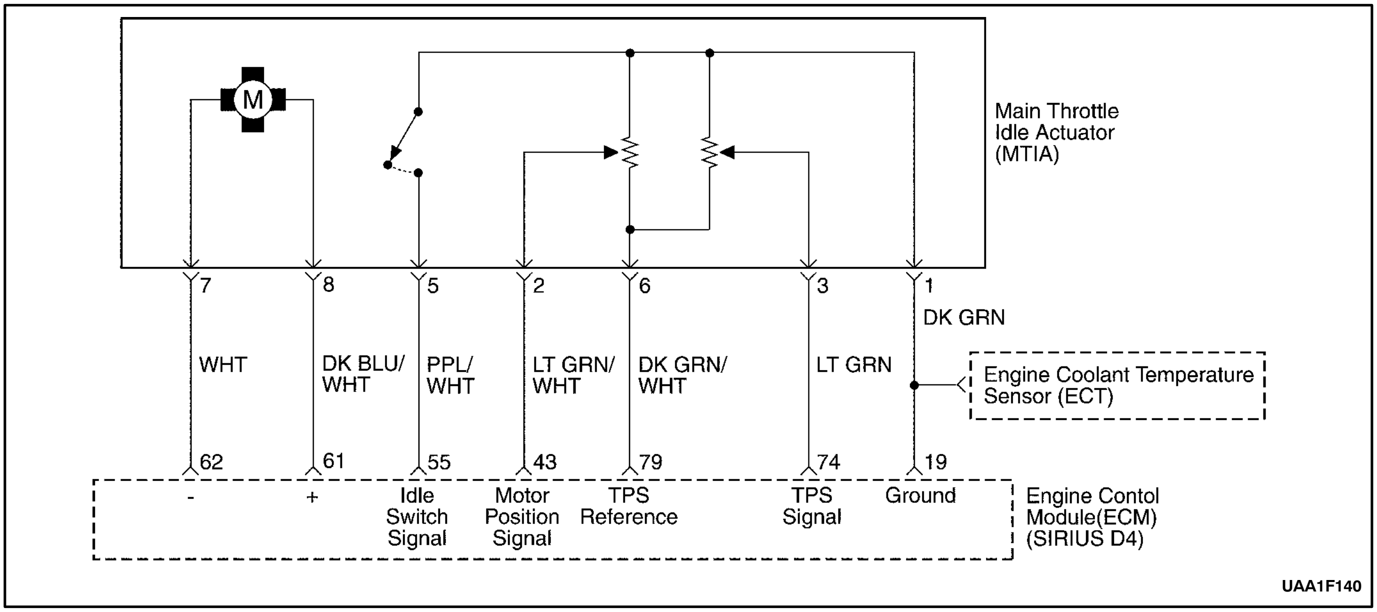


DIAGNOSTIC TROUBLE CODE (DTC) – P0510 THROTTLE POSITION SWITCH CIRCUIT FAULT

Circuit Description

The aim of the MTIA(Main Throttle Idle Actuator) is to control the idle speed with the throttle body itself. The throttle is motorized for low opening angle (0°, 19°). The characteristics of the air flow are not the same for low and high opening angles. As a matter of fact, the gradient of the mass air flow function of TP sensor is lower for small angles that permits to be more precise during the idle speed control. Out of idle speed the throttle is actuated mechanically by a classical bowdencable.

This switch indicates throttle plate in idle position when contact closed. This switch is fixed at the DC-motor drive and the throttle plate closes the contact in dependence to the actual motor drive position.

Conditions for Setting the DTC

- The engine stopped and ignition switch turned ON.
- DTCs P0122, P0123, P0222 and P0223 are not set.
- MTIA output signal is highter than throttle position + 2.5° and throttle position is open at least 0.2 seconds.

Or

- DTCs P0122, P0123, P0222, and P0223 are not set.
- The throttle position output signal is greater than 30° and throttle position is closed at least 2 seconds.

Action taken when The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- Coolant fan turns on.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using the scan tool can clear DTC(s).
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

VSS signal circuit should be thoroughly checked for the following conditions

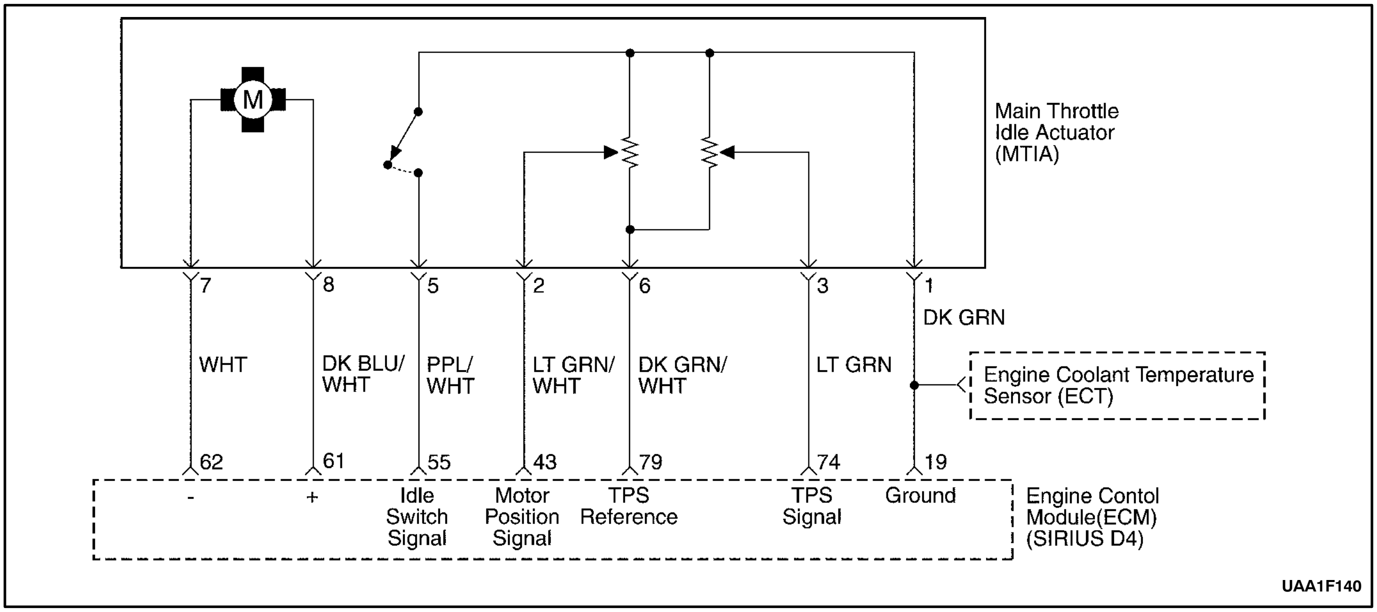
- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

Ensure the VSS is correctly torqued to the transaxle housing.

Refer to *"**intermittents**"* in this Section.

DTC P0510 – Throttle Position Switch Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to LOCK. 2. Disconnect the MTIA connector. 3. Disconnect the ECM connector. 4. Check for a short to ground or open in the wire between the MTIA connector terminal 5 and ECM connector terminal 55. Is the problem found?	–	Go to **Step 4**	Go to **Step 3**
3	Check for a high voltage or open in the wire between the MTIA connector terminal 5 and ECM connector terminal 55. Is the problem found?	–	Go to **Step 4**	Go to **Step 5**
4	1. Turn the ignition switch to LOCK. 2. Repair the wire or the connector terminal as needed. 3. Clear any DTCs from ECM. 4. Perform the diagnostic system check.(start engine and turn LOCK). Is the repair complete?	–	System OK	–
5	1. Repair the short to battery voltage or ground in the wire between the EVAP canister purge valve connector terminal 6 and the ECM connector terminal 79. 2. Clear any Diagnostic Trouble Codes (DTCs) from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	Go to **Step 6**	–
6	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to **Step 7**	Go to **Step 2**
7	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1511 IDLE CHARGE ACTUATOR CIRCUIT FAULT

Circuit Description

The aim of the MTIA (Main Throttle Idle Actuator) is to control the idle speed with the throttle body itself. The throttle is motorized for low opening angle (0°, 19°). The characteristics of the air flow are not the same for low and high opening angles. As a matter of fact, the gradient of the mass air flow function of TPS is lower for small angles that permits to be more precise during the idle speed control. Out of idle speed the throttle is actuated mechanically by a classical accelcable.

The DC-motor commands the actuator for idle

Conditions for Setting the DTC

- The engine is running.
- The throttle position is set between 0.2° and 5.6°.
- DTCs P0222 and P0223 are not set.
- The reference range of MTIA higher than 35% of less than –35% at least 5seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

DTC P1511 – Idle Charge Actuator Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to "On-Board Diagnostic System Check"
2	Turn the Turn the ignition switch to ON. Is the Malfunction Indicator Lamp(MIL) on steady?	–	Go to **Step 4**	Go to **Step 3**
3	1. Connect the scan tool the DLC. 2. Turn the Turn the ignition switch to ON. Does the scan tool display serial data?	–	Go to **Step 4**	Try with another scan tool
4	Start the engine. Does the engine start?	–	Go to **Step 5**	Go to "Engine Cranks but Sill Not Star"
5	1. Turn the ignition switch to LOCK. 2. Connect the scan tool to the DLC. 3. Turn the Turn the ignition switch to ON. Are any Diagnostic Trouble Codes (DTCs) displayed?	–	Go to **Step 6**	Try with another scan tool
6	Refer to the applicable DTC table. Is only one DTC identified as valid trouble code P1511?	–	Go to **Step 7**	Go to Applicable DTC Table And Go to "Multiple DTC"
7	1. Turn the ignition switch to LOCK. 2. Disconnect the MTIA connector. 3. Disconnect the ECM connector. 4. Measure resistance between MTIA connector terminal 2 and ECM connector terminal 43. Does the resistance measure with the value specified?	0•	Go to **Step 8**	Go to **Step 9**
8	Measure resistance between MTIA connector terminal 1 and ECM connector terminal 19. Does the resistance measure within the value specified?	0•	Go to **Step 10**	Go to **Step 11**
9	1. Repair the wire or the connector terminal as needed. • Clear any DTCs from ECM. • Perform the diagnostic system check. Is the repair complete?	–	System OK	Go to **Step 8**
10	1. Repair the wire or the connector terminal as needed. • Clear any DTCs from ECM. • Perform the diagnostic system check. Is the repair complete?	–	System OK	Go to **Step 11**
11	1. Turn the ignition switch to LOCK. 2. Replace the throttle body assembly. • Clear any DTCs from ECM. • Perform the diagnostic system check. Is the repair complete?	–	System OK	Go to **Step 12**

DTC P1511 – Idle Charge Actuator Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	Go to ***Step*** **13**	–
13	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step*** **14**	Go to ***Step*** **2**
14	Check if any additional DTCs are set. Are any DTCs displaye that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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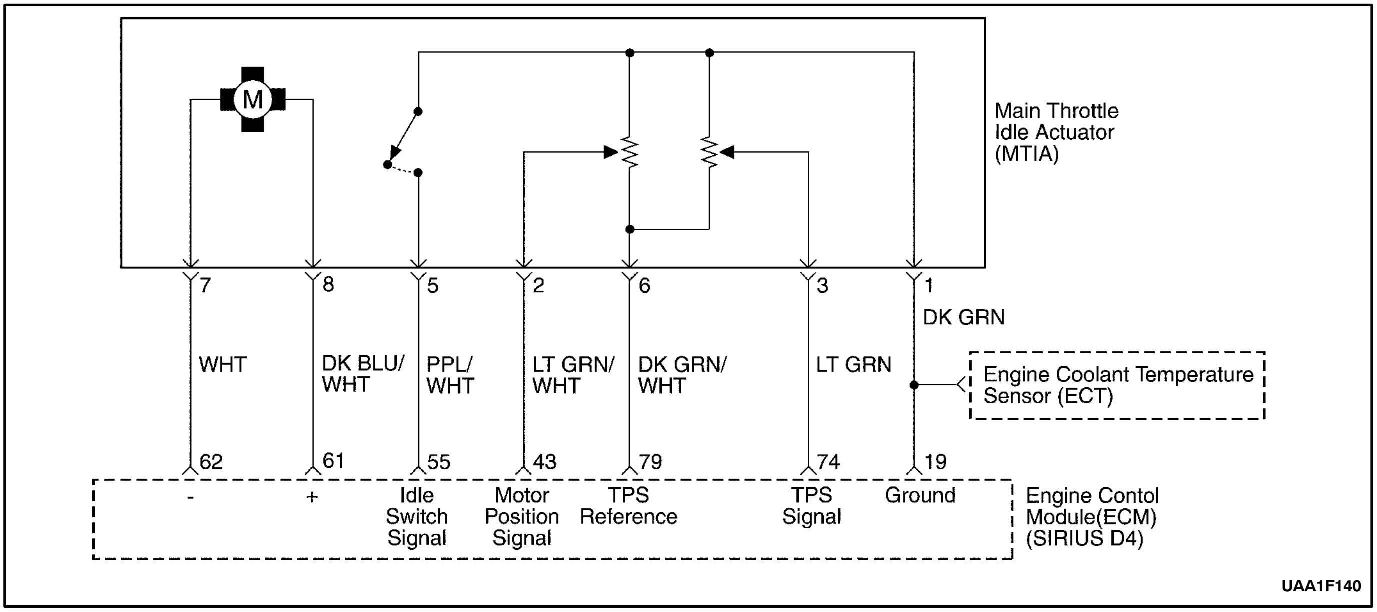


DIAGNOSTIC TROUBLE CODE (DTC) – P1512 IDLE CHARGE ACTUATOR MECHANICAL ERROR

Circuit Description

The aim of the MTIA (Main Throttle Idle Actuator) is to control the idle speed with the throttle body itself. The throttle is motorized for low opening angle (0°, 19°). The characteristics of the air flow are not the same for low and high opening angles. As a matter of fact, the gradient of the mass air flow function of TPS is lower for small angles that permits to be more precise during the idle speed control. Out of idle speed the throttle is actuated mechanically by a classical accelcable.

The DC-motor commands the actuator for idle

Conditions for Setting the DTC

- The engine is running.
- The MTIA set point is between 0.2° and 5.6°.
- DTCs P0222 and P0223 are not set.
- The reference range of MTIA higher than 35% of less than –35% at least 10seconds.
- Mechanical problems exists.
  - problem of accel cable hose
  - problem inside MTIA : seizing by friction, snooted, fouling.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

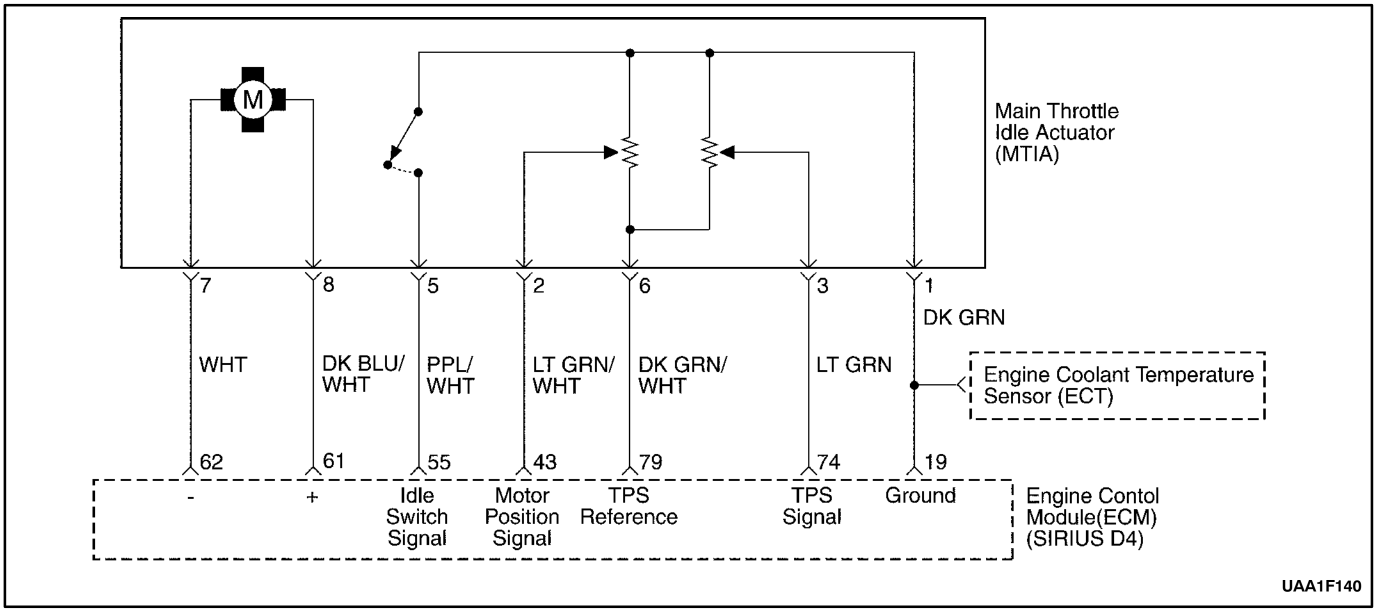
An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

DTC P1512 – Idle charge Actuator Mechanical Error

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	Turn the Turn the ignition switch to ON. Is the Malfunction Indicator Lamp(MIL) on steady?	–	Go to ***Step* 4**	Go to ***Step* 3**
3	1. Connect the scan tool the DLC. 2. Turn the Turn the ignition switch to ON. Does the scan tool display serial data?	–	Go to ***Step* 4**	Try with another scan tool
4	Start the engine. Does the engine start?	–	Go to ***Step* 5**	Go to "Engine Cranks but Sill Not Star"
5	1. Turn the ignition switch to LOCK. 2. Connect the scan tool to the DLC. 3. Turn the Turn the ignition switch to ON. Are any Diagnostic Trouble Codes (DTCs) displayed?	–	Go to ***Step* 6**	Try with another scan tool
6	Refer to the applicable DTC table. Is only one DTC identified as valid trouble code P1512?	–	Go to ***Step* 7**	Go to Applicable DTC Table And Go to "Multiple DTC"
7	Check if the accel cable of MTIA is not on accel cable stop repair the accel cable as necessary Is it necessary?	–	Go to ***Step* 9**	Go to ***Step* 8**
8	1. Turn the ignition switch to LOCK. 2. Replace the throttle body assembly. 3. Clear any DTCs from ECM. 4. Perform the diagnostic system check. Is the repair complete?	–	Go to ***Step* 10**	–
9	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step* 10**	Go to ***Step* 2**
10	Check if any additional DTCs are set. Are any DTCs displaye that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1513 IDLE CHARGE ACTUATOR FUNCTIONAL ERROR

Circuit Description

The aim of the MTIA (Main Throttle Idle Actuator) is to control the idle speed with the throttle body itself. The throttle is motorized for low opening angle (0°, 19°). The characteristics of the air flow are not the same for low and high opening angles. As a matter of fact, the gradient of the mass air flow function of TPS is lower for small angles that permits to be more precise during the idle speed control. Out of idle speed the throttle is actuated mechanically by a classical accelcable.

The DC-motor commands the actuator for idle

Conditions for Setting the DTC

- Mechanical problems exists.
  - problem of accel cable hose
  - problem inside MTIA : seizing by friction, snooted, fouling.
- Absolute adaptation or relative is not correct after 16 attemps.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

DTC P1513 – Idle Charge Actuator Functional Error

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to "On-Board Diagnostic System Check"
2	Turn the Turn the ignition switch to ON. Is the Malfunction Indicator Lamp(MIL) on steady?	–	Go to **Step 4**	Go to **Step 3**
3	1. Connect the scan tool the DLC. 2. Turn the Turn the ignition switch to ON. Does the scan tool display serial data?	–	Go to **Step 4**	Try with another scan tool
4	Start the engine. Does the engine start?	–	Go to **Step 5**	Go to "Engine Cranks but Sill Not Star"
5	1. Turn the ignition switch to LOCK. 2. Connect the scan tool to the DLC. Turn the Turn the ignition switch to ON. Are any Diagnostic Trouble Codes (DTCs) displayed?	–	Go to **Step 6**	Try with another scan tool
6	Refer to the applicable DTC table. Is only one DTC identified as valid trouble code P1513?	–	Go to **Step 7**	Go to Applicable DTC Table And Go to "Multiple DTC"
7	1. Turn the ignition switch to LOCK. 2. Disconnect the MTIA connector. 3. Disconnect the ECM connector. 4. Measure resistance between MTIA connector terminal 2 and ECM connector terminal 43. Does the resistance measure with the value specified?	0•	Go to **Step 8**	Go to **Step 9**
8	Measure resistance between MTIA connector terminal 1 and ECM connector terminal 19. Does the resistance measure within the value specified?	0•	Go to **Step 10**	Go to **Step 11**
9	1. Repair the wire or the connector terminal as needed. 2 Clear any DTCs from ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	Go to **Step 8**
10	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	Go to **Step 11**
11	1. Turn the ignition switch to LOCK. 2. Replace the throttle body assembly. 3. Clear any DTCs from ECM. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	Go to **Step 12**

DTC P1513 – Idle Charge Actuator Functional Error (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	Go to ***Step*** **13**	–
13	1. Using the scan tool, clear the Doniagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to ***Step*** **14**	Go to ***Step*** **2**
14	Check if any additional DTCs are set. Are any DTCs displaye that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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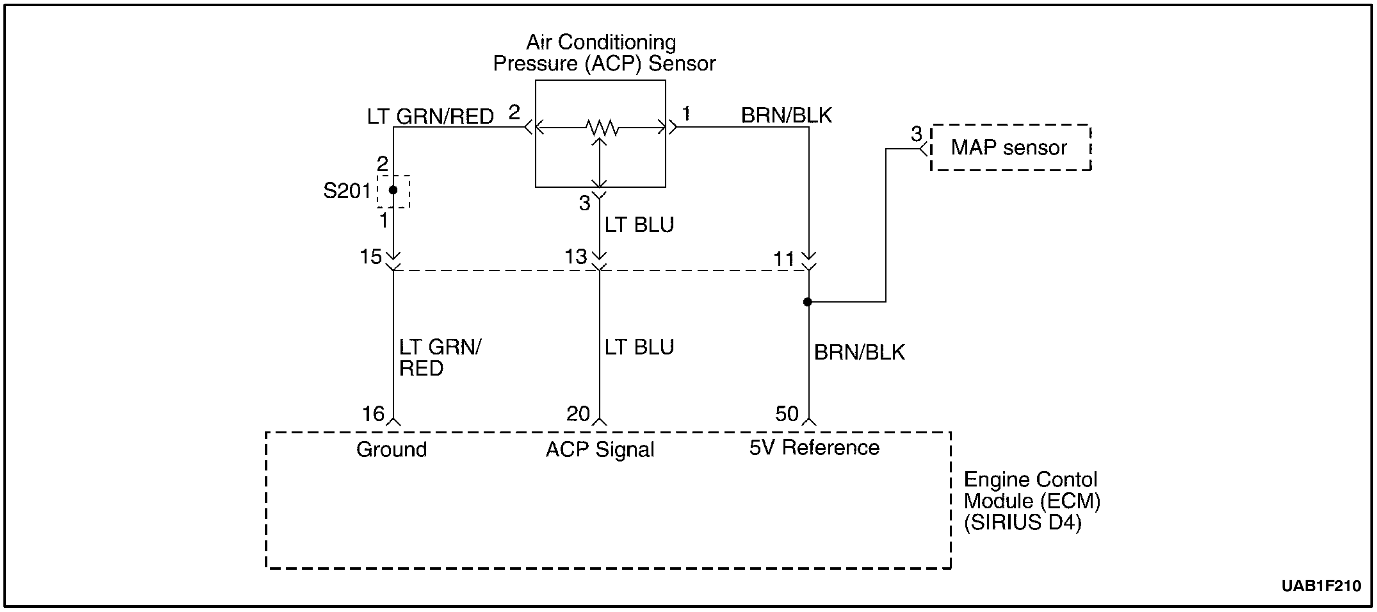

DIAGNOSTIC TROUBLE CODE (DTC) – P0532 A/C PRESSURE SENSOR LOW VOLTAGE

Circuit Description

The A/C system uses an air conditioning pressure(ACP) sensor mounted in the high pressure side of the A/C refrigerant system to monitor the A/C refrigerant pressure. The engine control module(ECM) uses this information to turn the cooling fans on at high speed when the A/C refrigerant pressure is high and to keep the A/C compressor disengaged when the A/C refrigerant pressure is excessively high or low.

Conditions for Setting the DTC

- A/C pressure is less than 1.2kPa.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections at the ECM.

Inspect the wiring harness for damage. If the harness appears to be OK, observe the A/C pressure display on the scan tool while moving the connectors and wiring harnesses related to the ACP sensor. A change in the A/C pressure display will indicate the location of the fault.

If DTC P0532 cannot be duplicated, reviewing the fail records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to set occurs. This may assist in diagnosing the condition.

DTC P0532 – A/C Pressure Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to “On-Board Diagnostic System Check”
2	With engine idling, install a scan tool. Does the scan tool display Air Conditioning Pressure (ACP) voltage below the specified value?	0.06V	Go to ***Step* 3**	Go to ***Step* 4**
3	1.Turn the ignition switch OFF. 2. Disconnect the Manifold Absolute Pressure (MAP) sensor electrical connector. 3. Jumper the ACP signal circuit, terminal 3 to the 5 volt reference circuit, terminal 1. 4. Turn the ignition switch on. Does the ACP voltage read more than the specified value?	4.9V	Go to ***Step* 5**	Go to ***Step* 6**
4	1. Turn the ignition switch ON, with the engine OFF, review the Freeze Frame data and note the parameters. 2. Operate the vehicle within the freeze frame conditions and Conditions For Setting the DTC as noted. Does the scan tool display ACP voltage below the specified value?	0.06V	Go to ***Step* 3**	Go to “Diagnostic Aids”
5	Inspect the ACP sensor harness electrical connector terminals for the following conditions: • Poor connections • Proper contact tension • Poor terminal-to-wire connection Is a problem found?	–	Go to ***Step* 8**	Go to ***Step* 9**
6	1. Turn the ignition switch OFF. 2. Remove the jumper wire. 3.Probe the ACP sensor signal circuit terminal 3 with a test light to B+. 4. Turn the ignition switch ON. Does the scan tool read over the specified value?	4.0V	Go to ***Step* 7**	Go to ***Step* 12**
7	Check the ACP sensor 5 volt referene circuit for an open or short to ground. Is a problem found?	–	Go to ***Step* 10**	Go to ***Step* 11**
8	Repair the connection terminals as necessary. Is the action complete?	–	Go to ***Step* 14**	–
9	Replace the ACP sensor. Is the action complete?	–	Go to ***Step* 14**	–
10	Repair the ACP sensor 5 volt reference circuit. Is the action complete?	–	Go to ***Step* 14**	–
11	Replace the engine control module (ECM). Is the action complete?	–	Go to ***Step* 14**	–
12	Check the ACP sensor signal circuit for the following conditions: • Open • Short to ground • Short to sensor ground Is a problem found?	–	Go to ***Step* 13**	Go to ***Step* 11**

DTC P0532 – A/C Pressure Sensor Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
13	Repair the ACP sensor signal circuit. Is the action complete?	–	Go to ***Step* 14**	–
14	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate the this diagnostic has run and passed?	–	Go to ***Step* 15**	Go to ***Step* 2**
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

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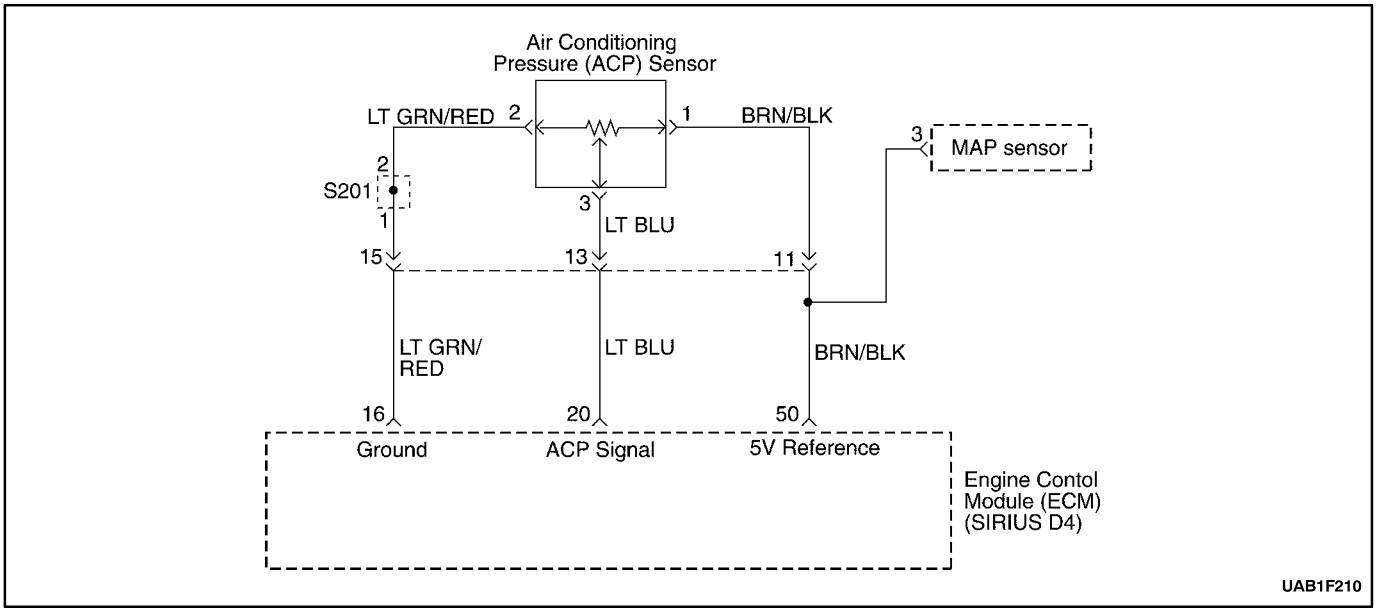

DIAGNOSTIC TROUBLE CODE (DTC) – P0533 A/C PRESSURE SENSOR HIGH VOLTAGE

Circuit Description

The A/C system uses an air conditioning pressure(ACP) sensor mounted in the high pressure side of the A/C refrigerant system to monitor the A/C refrigerant pressure. The engine control module(ECM) uses this information to turn the cooling fans on at high speed when the A/C refrigerant pressure is high and to keep the A/C compressor disengaged when the A/C refrigerant pressure is excessively high or low.

Conditions for Setting the DTC

- A/C pressure is higher than 293kPa.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections at the ECM.

Inspect the wiring harness for damage. If the harness appears to be OK, observe the A/C pressure display on the scan tool while moving the connectors and wiring harnesses related to the ACP sensor. A change in the A/C pressure display will indicate the location of the fault.

If DTC P0533 cannot be duplicated, reviewing the fail records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to set occurs. This may assist in diagnosing the condition.

DTC P0533 – A/C Pressure Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	With engine idling, install a scan tool. Does the scan tool display Air Conditioning Pressure (ACP) voltage below the specified value?	0.06V	Go to ***Step* 3**	Go to ***Step* 4**
3	1 Turn the ignition switch OFF. 2 Disconnect the MAP sensor electrical connector. 3 Jumper the ACP signal circuit, terminal 3 to the 5 volt reference circuit, terminal 1. 4 Turn the ignition switch ON. Does the ACP voltage read more than the specified value?	4.9V	Go to ***Step* 5**	Go to ***Step* 6**
4	1. Turn the ignition switch ON, with the engine OFF, review the Freeze Frame data, and note the parameters. 2. Operate the vehicle within the freeze frame conditions and Conditions For Setting the DTC as noted. Does the scan tool display Manifold Absolute Pressure (ACP) voltage below the specified value?	0.06V	Go to ***Step* 3**	Go to "Diagnostic Aids"
5	Inspect the ACP sensor harness electrical connector terminals for the following conditions: • Poor connections • Proper contact tension • Poor terminal-to-wire connection Is a problem found?	–	Go to ***Step* 8**	Go to ***Step* 9**
6	1. Turn the ignition switch OFF. 2. Remove the jumper wire. 3.Probe the ACP sensor signal circuit terminal 3 with a test light to B+. 4. Turn the ignition switch ON. Does the scan tool read over the specified value?	4.0V	Go to ***Step* 7**	Go to ***Step* 12**
7	Check the ACP sensor 5 volt referene circuit for an open or short to ground. Is a problem found?	–	Go to ***Step* 10**	Go to ***Step* 11**
8	Repair the connection terminals as necessary. Is the action complete?	–	Go to ***Step* 14**	–
9	Replace the ACP sensor. Is the action complete?	–	Go to ***Step* 14**	–
10	Repair the ACP sensor 5 volt reference circuit. Is the action complete?	–	Go to ***Step* 14**	–
11	Replace the engine control module (ECM). Is the action complete?	–	Go to ***Step* 14**	–
12	Check the ACP sensor signal circuit for the following conditions: • Open • Short to ground • Short to sensor ground Is a problem found?	–	Go to ***Step* 13**	Go to ***Step* 11**

DTC P0533 – A/C Pressure Sensor High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
13	Repair the ACP sensor signal circuit. Is the action complete?	–	Go to ***Step* 14**	–
14	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate the this diagnostic has run and passed?	–	Go to ***Step* 15**	Go to ***Step* 2**
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

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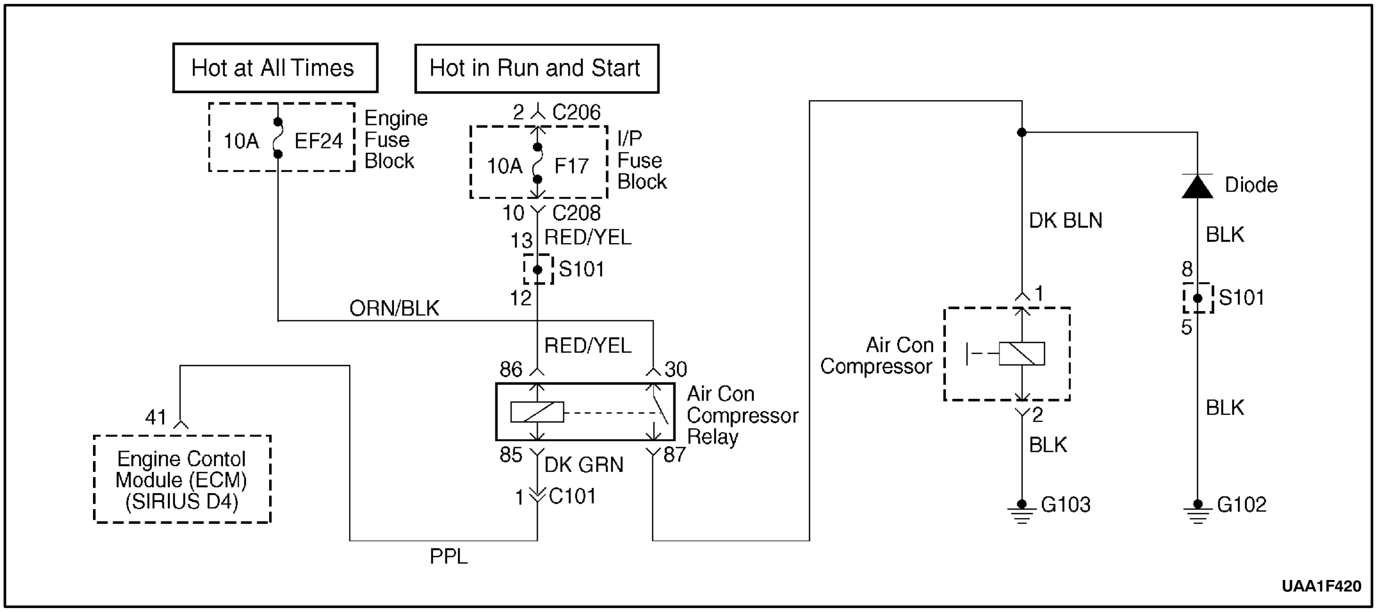


DIAGNOSTIC TROUBLE CODE (DTC) – P1537 A/C COMPRESSOR RELAY HIGH VOLTAGE

Circuit Description

The A/C system uses an A/C refrigerant pressure sensor mounted in the high pressure side of the A/C refrigerant system to monitor A/C refrigerant pressure. The engine control module (ECM) uses this information to turn ON the engine coolant fans when the A/C refrigerant pressure is high and to keep the compressor disengaged when A/C refrigerant pressure is excessively high or low.

The air conditioning pressure (ACP) sensor operates like other 3-wire sensors. The ECM applies a 5.0 volt reference and a sensor ground to the sensor. Changes in the A/C refrigerant pressure will causes the ACP sensor input to the ECM to vary. The ECM monitors the ACP sensor signal circuit and can determine when the signal is out of the possible range of the sensor. When the signal is out of range for a prolonged period of time, the ECM will not allow the A/C compressor clutch to engage. This is done to protect the compressor.

Conditions for Setting the DTC

- The air conditioning compressor relay circuit is a short to battery condition exists.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

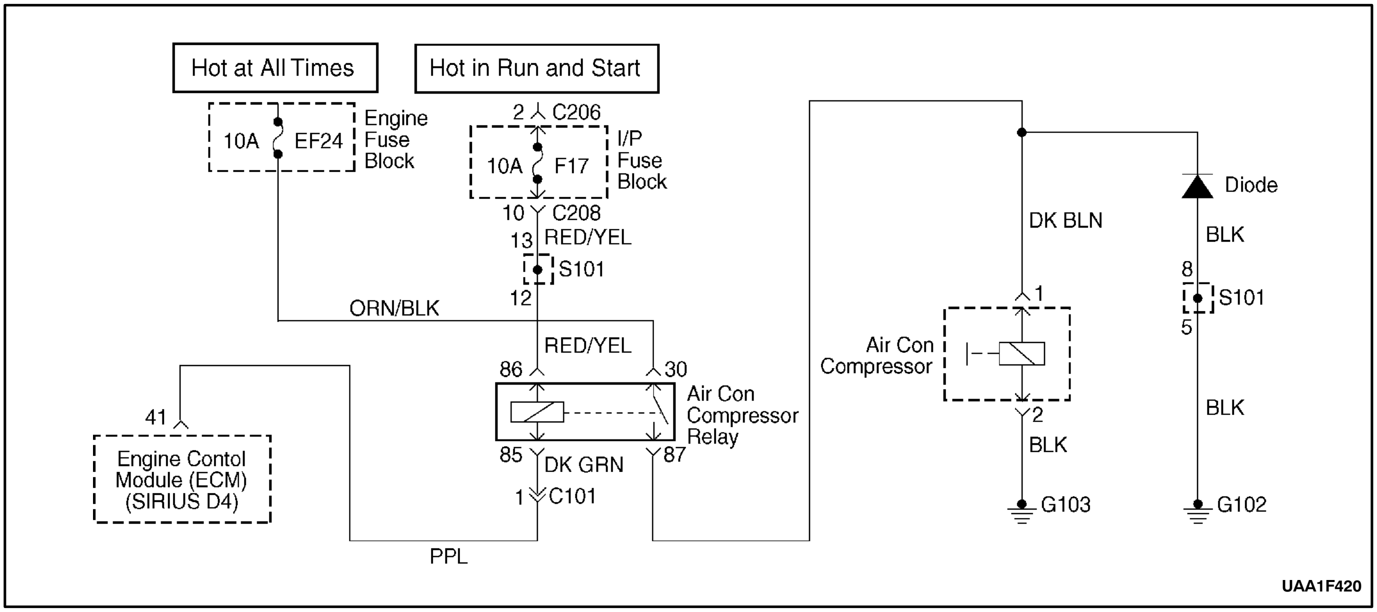
Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection at the ECM.

Inspect the wiring harness for damage. If the harness appears to be OK, observe the A/C pressure display on the scan tool while moving the connectors and wiring harnesses related to the ACP sensor. A change in the A/C pressure display will indicate the location of the fault.

If DTC P1537 cannot be duplicated, reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to set occurs. This may assist in diagnosing the condition.

DTC P1537 – A/C Compressor Relay High voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	1.. Turn the ignition switch to LOCK. 2. Disconnect the A/C compressor relay. 3. Measure the resistance between A/C compressor relay terminals 85 and 86. Does the resistance within the specified value?	0•	Go to ***Step* 3**	Go to ***Step* 7**
3	1. Turn the ignition switch to LOCK. 2. With the test light, connected to ground, probe the ignition feed circuit, at terminal 86 in the relay harness connector. Does the test light illuminate?	–	Go to ***Step* 5**	Go to ***Step* 4**
4	Repair a short to battery voltage between the ignition switch terminal and A/C compressor relay terminal 86. Is the repair complete?	–	Go to ***Step* 9**	–
5	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM. 3. With the test light, connected to ground, probe the ignition feed circuit, at terminal 85 in the relay harness connector. Does the test light illuminate?	–	Go to ***Step* 8**	Go to ***Step* 6**
6	Repair a short to battery voltage between the ECM wiring connector terminal 41 and A/C compressor relay terminal 86. Is the repair complete?	–	Go to ***Step* 9**	–
7	Replace the A/C compressor relay. Is the replacement complete?	–	Go to ***Step* 9**	–
8	1. Turn the ignition switch to LOCK. 2. Replace the ECM. Is the repair complete?	–	Go to ***Step* 9**	–
9	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to ***Step* 10**	Go to ***Step* 2**
10	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1538 A/C COMPRESSOR RELAY LOW VOLTAGE

Circuit Description

The A/C system uses an A/C refrigerant pressure sensor mounted in the high pressure side of the A/C refrigerant system to monitor A/C refrigerant pressure. The engine control module (ECM) uses this information to turn ON the engine coolant fans when the A/C refrigerant pressure is high and to keep the compressor disengaged when A/C refrigerant pressure is excessively high or low.

The air conditioning pressure (ACP) sensor operates like other 3-wire sensors. The ECM applies a 5.0 volt reference and a sensor ground to the sensor. Changes in the A/C refrigerant pressure will causes the ACP sensor input to the ECM to vary. The ECM monitors the ACP sensor signal circuit and can determine when the signal is out of the possible range of the sensor. When the signal is out of range for a prolonged period of time, the ECM will not allow the A/C compressor clutch to engage. This is done to protect the compressor.

Conditions for Setting the DTC

- The air conditioning compressor relay circuit is a short to ground an open condition exists.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

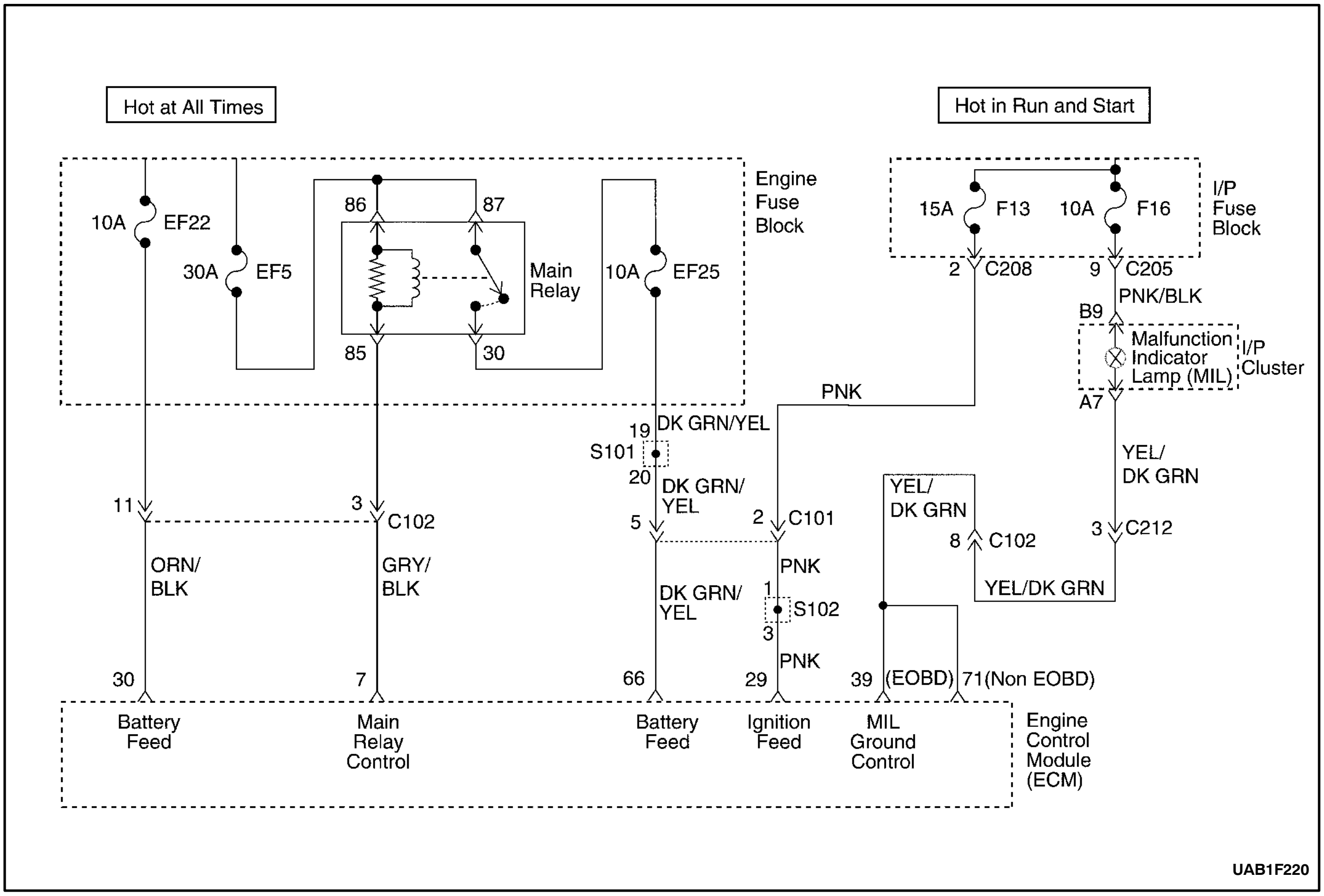
Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection at the ECM.

Inspect the wiring harness for damage. If the harness appears to be OK, observe the A/C pressure display on the scan tool while moving the connectors and wiring harnesses related to the ACP sensor. A change in the A/C pressure display will indicate the location of the fault.

If DTC P1538 cannot be duplicated, reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to set occurs. This may assist in diagnosing the condition.

DTC P1538 – A/C Compressor Relay Low voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to LOCK. 2. Disconnect the A/C compressor relay. 3. Measure the resistance between A/C compressor relay terminals 85 and 86. Does the resistance within the specified value?	0•	Go to **Step 3**	Go to **Step 7**
3	1. Turn the ignition switch to LOCK. 2. With the test light, connected to ground, probe the ignition feed circuit, at terminal 86 in the relay harness connector. Does the test light illuminate?	–	Go to **Step 5**	Go to **Step 4**
4	Repair a short to ground between the ignition switch terminal 4 and A/C compressor relay terminal 86. Is the repair complete?	–	Go to **Step 9**	–
5	1. 5. Turn the ignition switch to LOCK. 2. Disconnect the ECM. 3. With the test light, connected to ground, probe the ignition feed circuit, at terminal 86 in the relay harness connector. Does the test light illuminate?	–	Go to **Step 8**	Go to **Step 6**
6	Repair a short to ground between the ECM wiring connector terminal 41 and A/C compressor relay terminal 86. Is the repair complete?	–	Go to **Step 9**	–
7	Replace the A/C compressor relay. Is the replacement complete?	–	Go to **Step 9**	–
8	1. Turn the ignition switch to LOCK. 2. Replace the ECM. Is the repair complete?	–	Go to **Step 9**	–
9	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to **Step 10**	Go to **Step 2**
10	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0562 SYSTEM VOLTAGE(ENGINE SIDE) TOO LOW

Circuit Description

The engine control module (ECM) monitors the ignition voltage on the ignition feed circuit to terminal 29 at the ECM. A system voltage Diagnostic Trouble Code (DTC) will set whenever the voltage is below a calibrated value.

Conditions for Setting the DTC

- The main relay voltage is less than 5.0V or higher than 26V during 7.6 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

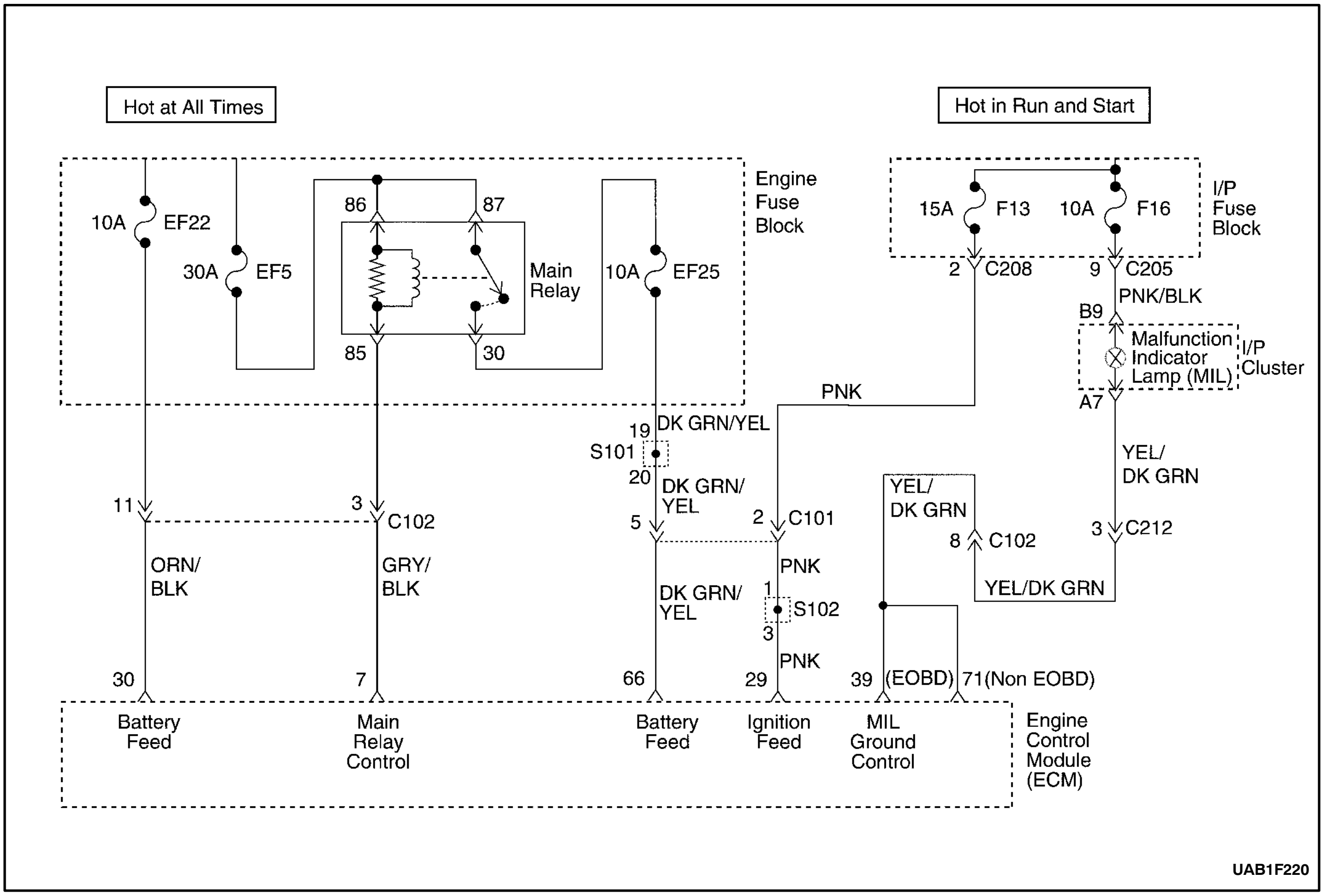
An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

DTC P0562 – System Voltage (Engine Side) Too Low

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and raise the engine speed to the specified value. 3. Load the electrical system by turning on the headlights, high blower motor, etc. Is the ignition voltage less than the specified value?	1,400rpm 10V	Go to **Step 3**	Go to **Step 8**
3	1. With the engine still running at the specified value. 2. Using a digital voltmeter(DVM), measure the battery voltage at the battery. Is the battery voltage greater than the specified value?	1,400rpm 12V	Go to **Step 4**	Go to “Diagnostic Aids”
4	1. Turn the ignition switch to LOCK. 2. Disconnect the engine control module(ECM) connector at the ECM. 3. Turn the Turn the ignition switch to ON with the engine OFF. 4 Using a DVM, measure the ignition voltage at the ignition feed circuit, terminal 29. Is the ignition voltage greater than the specified value?	10V	Go to **Step 5**	Go to **Step 6**
5	Check for a malfunctioning connection at the ECM harness terminals and repair as necessary. Is a repair necessary?	–	Go to **Step 8**	Go to **Step 7**
6	Repair the poor connection (high resistance) in the ignition feed circuit. Is the repair complete?	–	Go to **Step 8**	–
7	Replace the ECM. Is the replacement complete?	–	Go to **Step 8**	–
8	1 Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC ad specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to **Step 9**	Go to **Step 2**
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0563 SYSTEM VOLTAGE (ENGINE SIDE) TOO HIGH

Circuit Description

The engine control module (ECM) monitors the ignition voltage on the ignition feed circuit to terminal 7 at the ECM. A system voltage Diagnostic Trouble Code (DTC) will set whenever the voltage is below a calibrated value.

Conditions for Setting the DTC

- The main relay voltage is greater than 7.9V.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

DTC P0563 – System Voltage (Engine Side) Too High

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and raise the engine speed to the specified value. 3. Load the electrical system by turning on the headlights, high blower motor, etc. Is the ignition voltage less than the specified value?	1,400rpm 10V	Go to **Step 3**	Go to **Step 8**
3	1. With the engine still running at the specified value. 2. Using a digital voltmeter(DVM), measure the battery voltage at the battery. Is the battery voltage greater than the specified value?	1,400rpm 12V	Go to **Step 4**	Go to "Diagnostic Aids"
4	1. Turn the ignition switch to LOCK. 2. Disconnect the engine control module(ECM) connector at the ECM. 3. Turn the Turn the ignition switch to ON with the engine OFF. 4. Using a DVM, measure the ignition voltage at the ignition feed circuit, terminal 29. Is the ignition voltage greater than the specified value?	10V	Go to **Step 5**	Go to **Step 6**
5	Check for a malfunctioning connection at the ECM harness terminals and repair as necessary. Is a repair necessary?	–	Go to **Step 8**	Go to **Step 7**
6	Repair the poor connection (high resistance) in the ignition feed circuit. Is the repair complete?	–	Go to **Step 8**	–
7	Replace the ECM. Is the replacement complete?	–	Go to **Step 8**	–
8	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC ad specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to **Step 9**	Go to **Step 2**
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) – P0601 ENGINE CONTROL MODULE CHECKSUM ERROR

Circuit Description

The engine control module (ECM) is the control center of the fuel injection system. It constantly looks at the information from various sensors, and controls the systems that after vehicle performance. The ECM also performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL), and store a Diagnostic Trouble Code (DTC) or DTCs which identify the problem areas to aid the technician in making repairs. An electrically erasable programmable read only memory (EEPROM) is used to house the program information and the calibrations required for engine, transaxle, transaxle diagnostics operation. The ECM uses a value called a checksum for error detection of the software. The checksum is a value that is equal to all the numbers in the software added together. The ECM adds all the values in the software and if that value does not equal the checksum value, a checksum error is indicated.

Conditions for Setting the DTC

- The ECM detects incorrect checksum.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycle in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P0601– Engine Control Module Checksum Error

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to “On-Board Diagnostic System Check”
2	Replace the engine control module(ECM). Is the replacement complete?	–	Go to **Step 3**	–
3	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC ad specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to **Step 4**	Go to **Step 2**
4	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) – P0604 ENGINE CONTROL MODULE INTERNAL/EXTERNAL RAM ERROR

Circuit Description

The engine control module (ECM) is the control center of the fuel injection system. It constantly looks at the information from various sensors, and controls the systems that after vehicle performance. The ECM also performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL), and store a Diagnostic Trouble Code (DTC) or DTCs which identify the problem areas to aid the technician in making repairs. An electrically erasable programmable read only memory (EEPROM) is used to house the program information and the calibrations required for engine, transaxle, transaxle diagnostics operation. The ECM uses a value called a checksum for error detection of the software. The checksum is a value that is equal to all the numbers in the software added together. The ECM adds all the values in the software and if that value does not equal the checksum value, a checksum error is indicated.

Conditions for Setting the DTC

- The ECM detects an internal or external Random Acess Memory (RAM) error.

Action taken when The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P0604 – Engine Control Module RAM Error

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	Replace the engine control module(ECM). Is the replacement complete?	–	Go to ***Step* 3**	–
3	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC ad specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to Step 4	Go to ***Step* 2**
4	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) – P0605 ENGINE CONTROL MODULE INMVY WRITE ERROR

Circuit Description

The engine control module (ECM) is the control center of the fuel injection system. It constantly looks at the information from various sensors, and controls the systems that after vehicle performance. The ECM also performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL), and store a Diagnostic Trouble Code (DTC) or DTCs which identify the problem areas to aid the technician in making repairs. An electrically erasable programmable read only memory (EEPROM) is used to house the program information and the calibrations required for engine, transaxle, transaxle diagnostics operation. The ECM uses a value called a checksum for error detection of the software. The checksum is a value that is equal to all the numbers in the software added together. The ECM adds all the values in the software and if that value does not equal the checksum value, a checksum error is indicated.

Conditions for Setting the DTC

- The ECM detects a INMVY write error.

Action taken when The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P0605 Engine Control Module INMVY Write Error

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to “On-Board Diagnostic System Check”
2	Replace the engine control module(ECM). Is the replacement complete?	–	Go to ***Step* 3**	–
3	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC ad specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to ***Step* 4**	Go to ***Step* 2**
4	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

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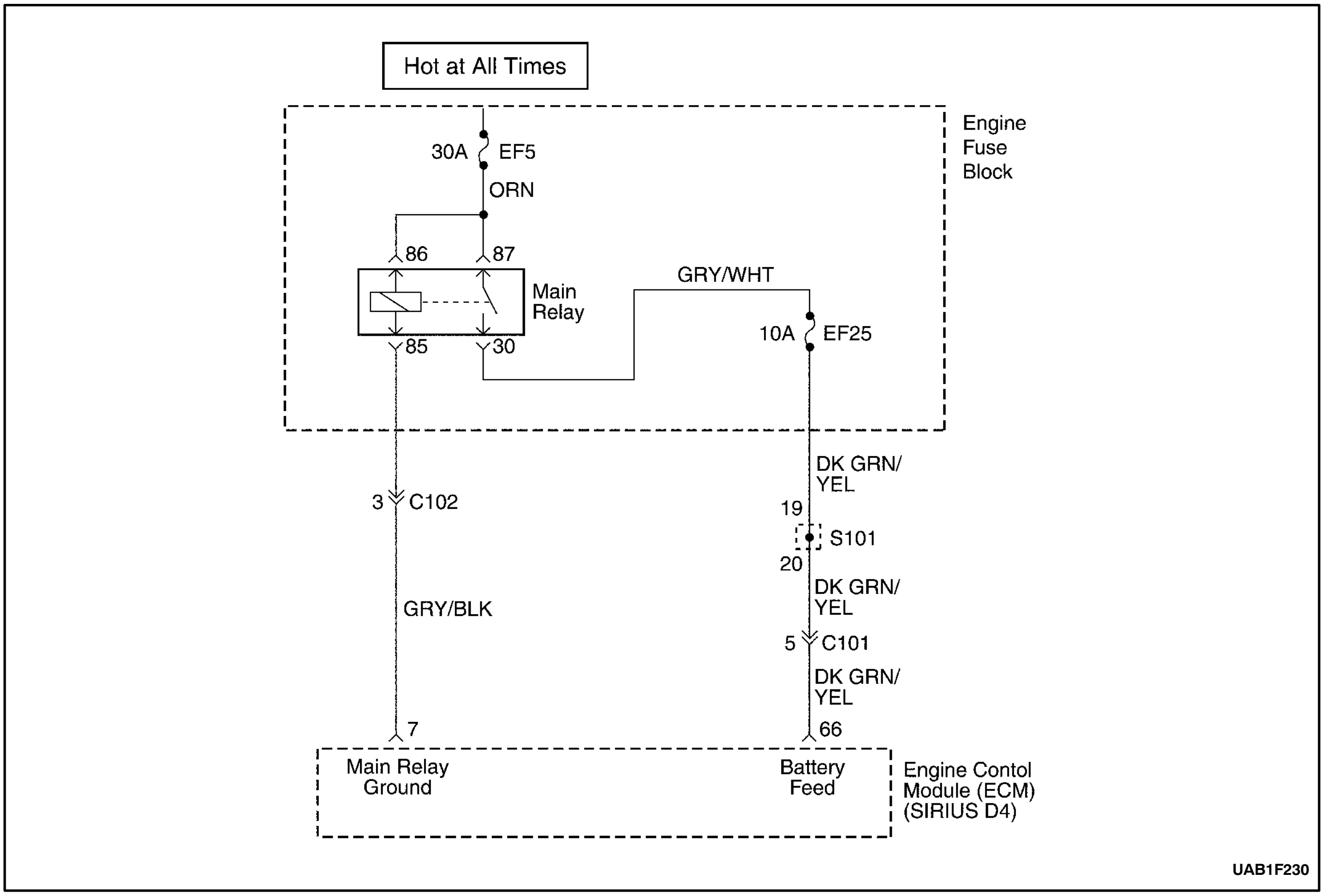


DIAGNOSTIC TROUBLE CODE (DTC) – P1610 MAIN RELAY HIGH VOLTAGE

Circuit Description

When the ignition switch to ON, main relay will grounded to ECM internal ground by ECM controlling.

A system voltage Diagnostic Trouble Code (DTC) will set whenever the voltage is below a calibrated value.

Conditions for Setting the DTC

- The main relay circuit is a short to battery condition exists.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using the scan tool can clear DTC(s).
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

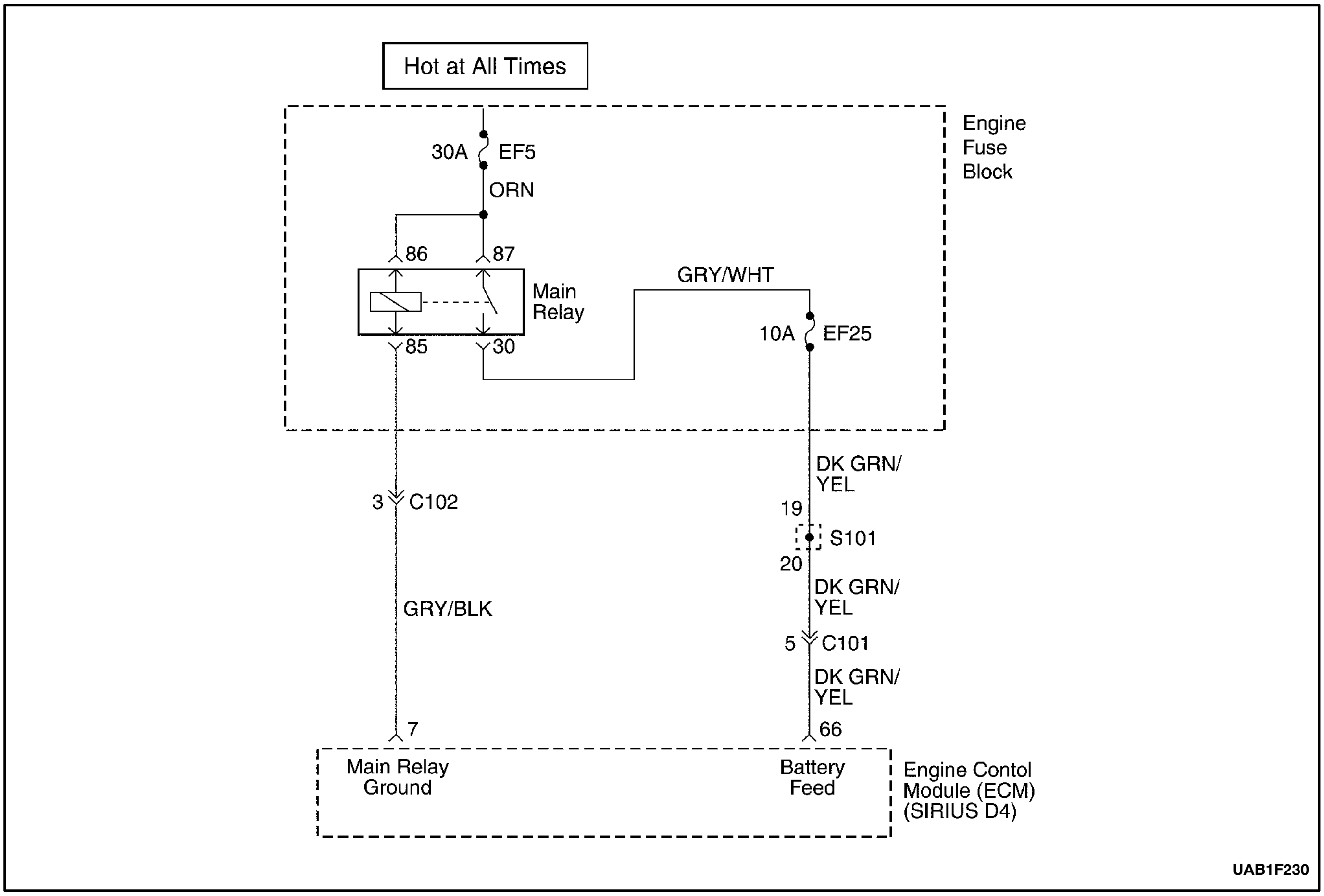
Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection at the ECM.

Inspect the wiring harness for damage. If the harness appears to be OK, observe the A/C pressure display on the scan tool while moving the connectors and wiring harnesses related to the ACP sensor. A change in the A/C pressure display will indicate the location of the fault.

If DTC P1610 cannot be duplicated, reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to set occurs. This may assist in diagnosing the condition.

DTC P1610 – Main Relay High voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to “On-Board Diagnostic System Check”
2	1. Disconnect the main relay. 2. Measure the resistance between main relay terminals 85 and 86. Does the resistance within the specified value?	75~85•	Go to **Step 3**	Go to **Step 6**
3	1. Turn the ignition switch to LOCK. 2. With the test light, connected to ground, probe the ignition feed circuit, at terminal 85 in the relay harness connector. Does the test light illuminate?	–	Go to **Step 4**	Go to “Diagnostic Aids”
4	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM wiring harness connector. 3. With the test light, connected to ground, probe the ignition feed circuit, at terminal 85 in the relay harness connector. Does the test light illuminate?	–	Go to **Step 5**	Go to **Step 7**
5	Repair a high voltage between the ECM wiring connector terminal 7 and main relay terminal 85. Is the repair complete?	–	Go to **Step 7**	–
6	Replace the main relay. Is the replacement complete?	–	Go to **Step 7**	–
7	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to **Step 8**	Go to **Step 2**
8	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1611 MAIN RELAY LOW VOLTAGE

Circuit Description

When the ignition switch to ON, main relay will grounded to ECM internal ground by ECM controlling.

A system voltage Diagnostic Trouble Code (DTC) will set whenever the voltage is below a calibrated value.

Conditions for Setting the DTC

- The main relay circuit is a short to ground or an open condition exists.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using the scan tool can clear DTC(s).
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

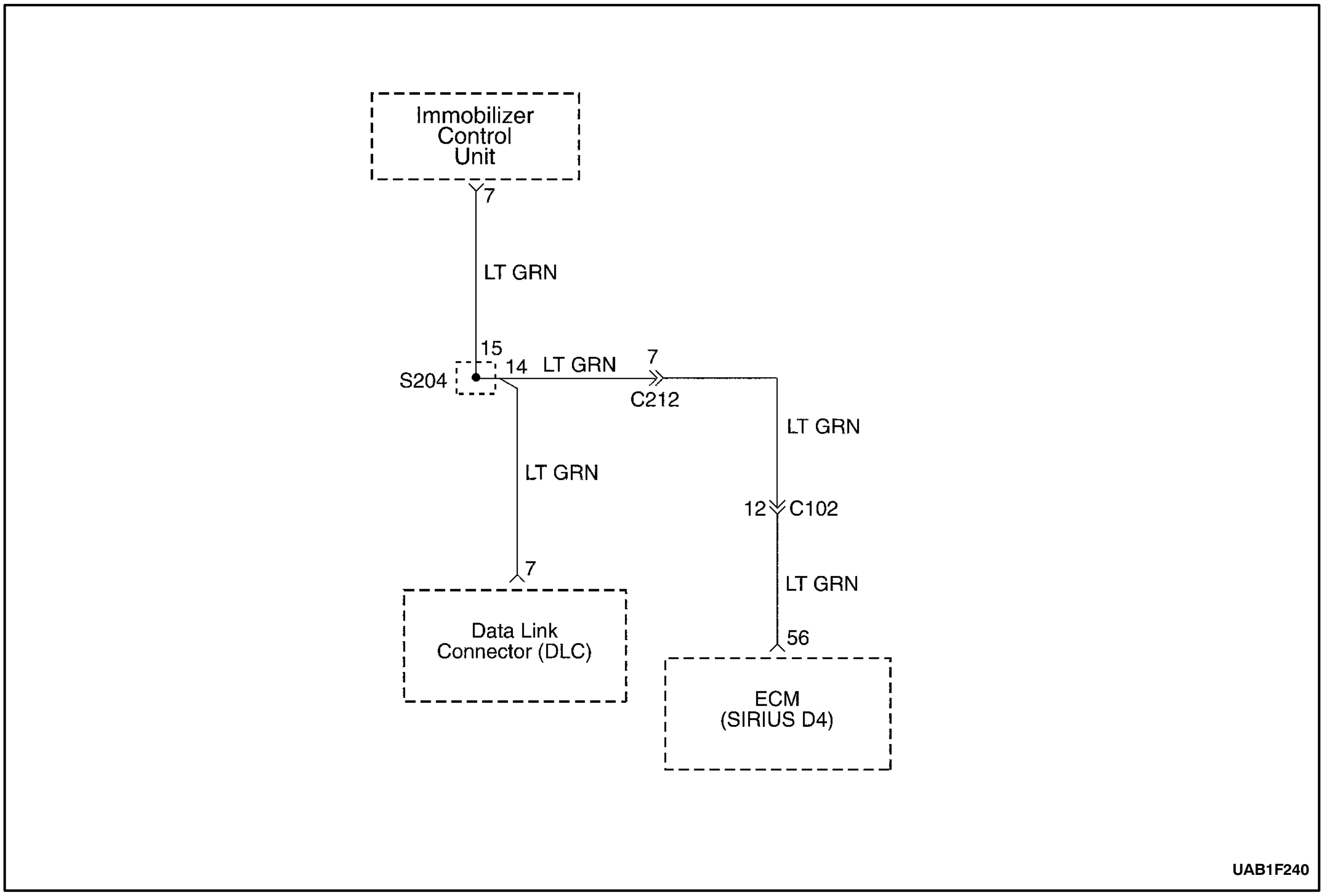
Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection at the ECM.

Inspect the wiring harness for damage. If the harness appears to be OK, observe the A/C pressure display on the scan tool while moving the connectors and wiring harnesses related to the ACP sensor. A change in the A/C pressure display will indicate the location of the fault.

If DTC P1611 cannot be duplicated, reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to set occurs. This may assist in diagnosing the condition.

DTC P1611 – Main Relay Low voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to “On-Board Diagnostic System Check”
2	1. Disconnect the main relay. 2. Measure the resistance between main relay terminals 85 and 86. Does the resistance within the specified value?	75~85•	Go to **Step 3**	Go to **Step 6**
3	1. Turn the ignition switch to LOCK. 2. With the test light, connected to ground, probe the ignition feed circuit, at terminal 85 in the relay harness connector. Does the test light illuminate?	–	Go to **Step 4**	Go to “Diagnostic Aids”
4	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM wiring harness connector. 3. With the test light, connected to ground, probe the ignition feed circuit, at terminal 85 in the relay harness connector. Does the test light illuminate?	–	Go to **Step 5**	Go to **Step 7**
5	Repair a high voltage between the ECM wiring connector terminal 7 and main relay terminal 85. Is the repair complete?	–	Go to **Step 7**	–
6	Replace the main relay. Is the replacement complete?	–	Go to **Step 7**	–
7	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to **Step 8**	Go to **Step 2**
8	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1628 IMMOBILIZER NO SUCCESSFUL COMMUNICATION

Circuit Description

When the ignition switch is turned to ON, the key tested by immobilizer anti-theft system. While the key code is being read by immobilizer control unit or integrated anti-theft control unit, the engine can start run with any key that will turn the lock cylinder. the key code is read and compared with key codes that have been stored in the memory of the immobilizer control unit. If a valid key is detected, the immobilizer control unit sends a serial data release message to the Engine Control Module (ECM). Included in the release message is an identification (ID) code which assures that neither the immobilizer control unit nor the ECM have been substituted to defeat the system. If the ECM receives an invalid release message, the ECM performs the following action:

- Disable the fuel injector circuit.
- Disable the fuel pump circuit.
- Disable the ignition coil.
- A Diagnostic Trouble Code (DTC) will stored if detect communication link failure between the ECM and immobilizer control unit.

Conditions for Setting the DTC

- No safety security strategy allowed.
- Time–out delay has elapsed without successful communication or a transmission key ON/OFF occurred before a successful communication.

Action Taken When the DTC Sets

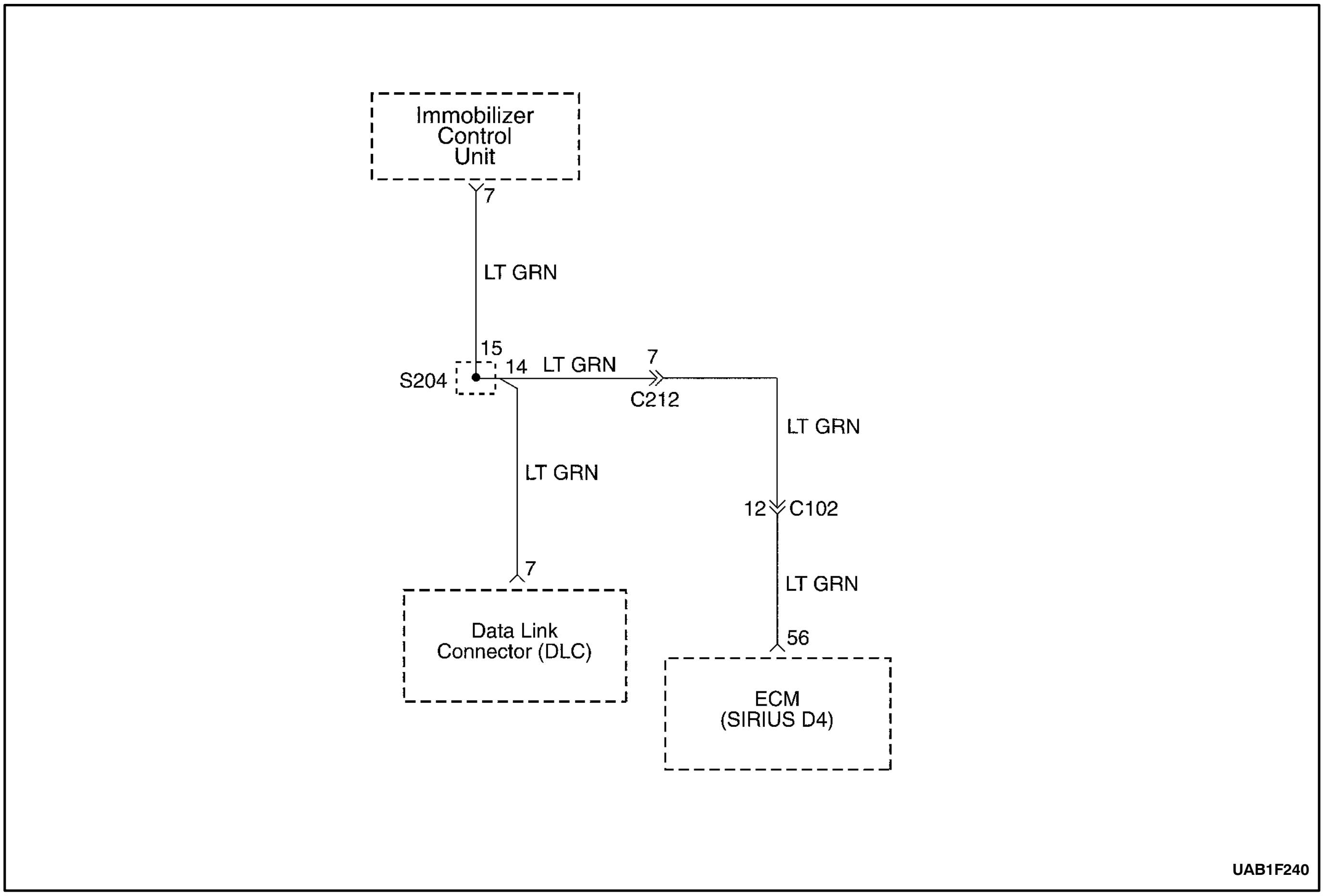
- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P1628 – Immobilizer No Successful Communication

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step*** **2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition OFF. 2. Install a scan too to the Data Link Connector (DLC). 3. Turn the ignition ON. 4. Select IMMOBILIZER DIAGNOSIS STATUS from the scan tool menu. Is the communication established between the scan tool and the immobilizer control unit?	–	Go to ***Step*** **3**	Go to ***Section 9T, Immobilizer Anti-Theft System***
3	1. Turn the ignition OFF. 2. Disconnect the Immobilizer Control Unit and Engine Control Module (ECM) connectors. 3. Measure the resistance between terminal 7 of immoblizer control unit and terminal 56 of the ECM. Is the resistance within the specified value?	0 •	Go to ***Step*** **5**	Go to ***Step*** **4**
4	Repair an open circuit between terminal 7 of immobilizer control unit and terminal 56 of the ECM. Is the repair complete?	–	Go to ***Step*** **8**	–
5	Check the terminals in immobilizer control unit and the ECM for damages and repair as needed. Is the repair complete?	–	Go to ***Step*** **8**	Go to ***Step*** **6**
6	Replace the immobilizer control unit. Is the repair complete?	–	Go to ***Step*** **8**	Go to ***Step*** **7**
7	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to ***Step*** **8**	–
8	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to ***Step*** **9**	Go to ***Step*** **2**
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1629 IMMOBILIZER WRONG COMPUTATION

Circuit Description

When the ignition switch is turned to ON, the key tested by immobilizer anti-theft system. While the key code is being read by immobilizer control unit or integrated anti-theft control unit, the engine can start run with any key that will turn the lock cylinder. the key code is read and compared with key codes that have been stored in the memory of the immobilizer control unit. If a valid key is detected, the immobilizer control unit sends a serial data release message to the Engine Control Module (ECM). Included in the release message is an identification (ID) code which assures that neither the immobilizer control unit nor the ECM have been substituted to defeat the system. If the ECM receives an invalid release message, the ECM performs the following action:

- Disable the fuel injector circuit.
- Disable the fuel pump circuit.
- Disable the ignition coil.

A Diagnostic Trouble Code (DTC) will stored if detect communication link failure between the ECM and immobilizer control unit.

Conditions for Setting the DTC

- Wrong coded value from ICU.

Action Taken When the DTC Sets

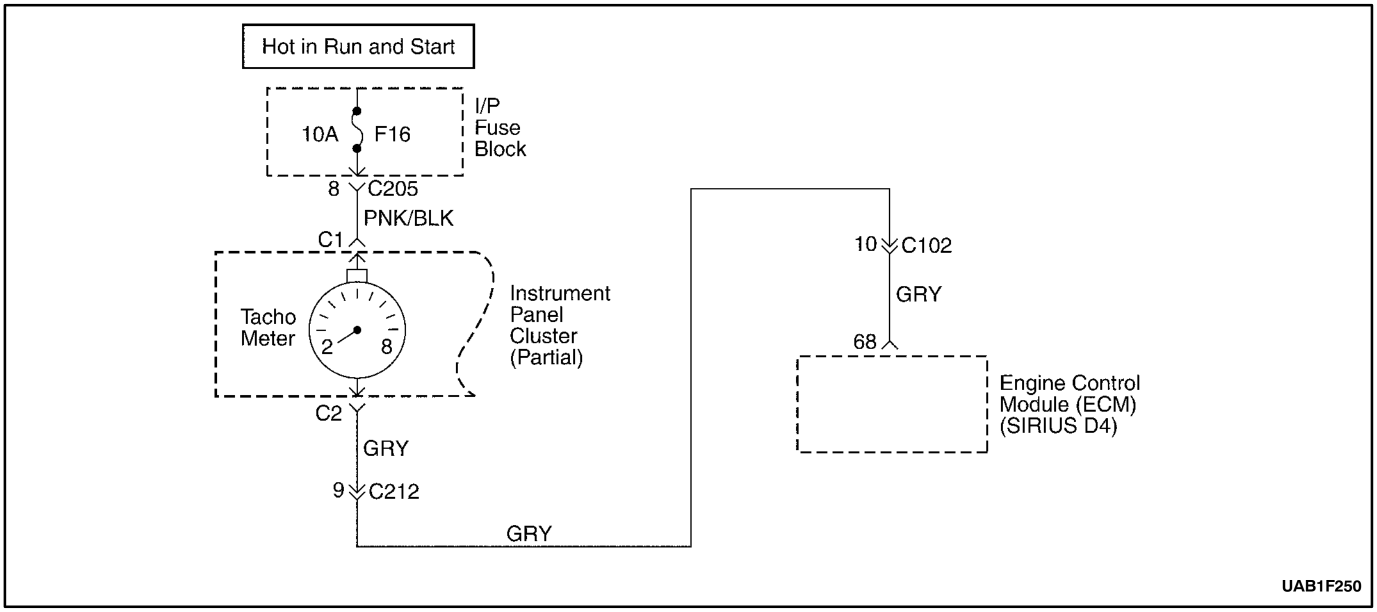
- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P1629 – Immobilizer Wrong Computation

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Install a scan too to the Data Link Connector (DLC). 3. Turn the ignition ON. 4. Select IMMOBILIZER DIAGNOSIS STATUS from the scan tool menu. Is the communication established between the scan tool and the immobilizer control unit?	–	Go to **Step 3**	Go to ***Section 9T, Immobilizer Anti-Theft System***
3	1. Turn the ignition OFF. 2. Disconnect the Immobilizer Control Unit and Engine Control Module (ECM) connectors. 3. Measure the resistance between terminal 7 of immoblizer control unit and terminal 56 of the ECM. Is the resistance within the specified value?	0 •	Go to **Step 5**	Go to **Step 4**
4	Repair an open circuit between terminal 7 of immobilizer control unit and terminal 56 of the ECM. Is the repair complete?	–	Go to **Step 8**	–
5	Check the terminals in immobilizer control unit and the ECM for damages and repair as needed. Is the repair complete?	–	Go to **Step 8**	Go to **Step 6**
6	Replace the immobilizer control unit. Is the repair complete?	–	Go to **Step 8**	Go to **Step 7**
7	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to **Step 8**	–
8	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to **Step 9**	Go to **Step 2**
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0654 ENGINE SPEEDOMETER CIRCUIT FAULT

Circuit Description

The tachometer is directly controlled by the Engine Control Module (ECM) using a Pulse Width Modulated (PWM) signal based on information received from the Crankshaft Position (CKP) sensor. When the key is ON, the ECM receives battery voltage from the Instrument Panel Cluster (IPC) and senses if the circuit contains a fault by using a diagnostic feedback signal. The ECM provides the ground for the tach signal directly.

Conditions for Setting the DTC

- The engine speed signal output circuit is a short to battery or a short to ground or an open condition exists.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

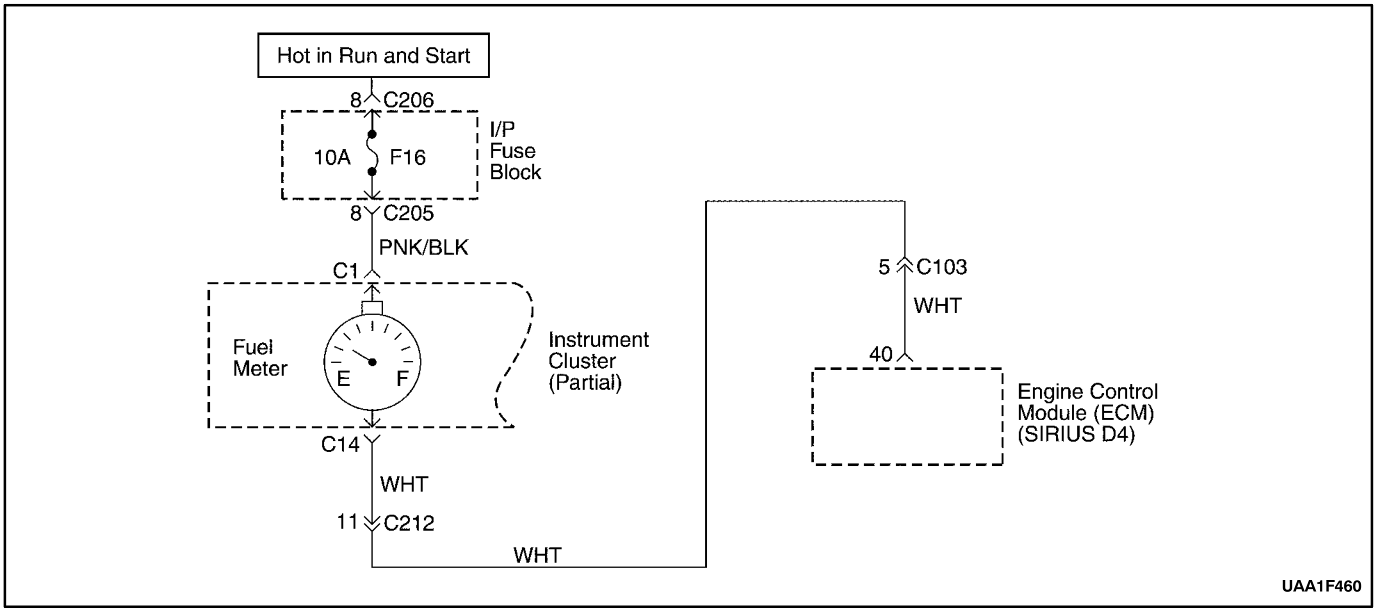
An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

DTC P0654 – Engine Speedometer Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to ***Step* 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to LOCK. 2. Connect the scan tool to the DLC. 3. Turn the Turn the ignition switch to ON. Are any Diagnostic Trouble Codes (DTCs) displayed?	–	Go to ***Step* 3**	Try with another scan tool
3	Refer to the applicable DTC table. Start with the DTC with the lowest numerical value and move up. Is the DTC identified as valid trouble code P0654?	–	Go to ***Step* 4**	Go to applicable DTC table
4	1. Disconnect the cluster connector 2. Turn the ignition switch to LOCK. 3. Check for an open or short to ground in the wire between the ECM connector 68 and cluster connector terminal C2. Is the problem found?	–	Go to ***Step* 6**	Go to ***Step* 5**
5	1. Turn the ignition switch to LOCK. 2. Check for short to battery in the wire between the the ECM connector 68 and cluster connector terminal C2. Is the problem found?	–	Go to ***Step* 6**	Go to ***Step* 7**
6	1. Change the between cluster and ECM or repair the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
7	1. Replace the cluster. 2. Clear any DTCs from ECM. 3. Perform the diagnostic system check. Are any Diagnostic Trouble Codes (DTCs) displayed?	–	Go to ***Step* 8**	System OK
8	Replace the ECM. Is the replcement complete?	–	Go to ***Step* 9**	–
9	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to ***Step* 10**	Go to ***Step* 2**
10	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0656 FUEL LEVEL GAUGE CIRCUIT FAULT

Circuit Description

The engine control module(ECM) uses the fuel level input from the Fuel Level Sensor to calculate expected vapor pressures within the fuel system. Vapor pressure vary as the fuel level changes. Vapor pressure is critical in determining if the evaporative emission (EVAP) system is operating properly. Fuel Level is also used to determine if the Fuel level is too high or too low to be able to accurately detect EVAP system faults. This Diagnostic Trouble Code(DTC) detects a stuck fuel level sender.

Conditions for Setting the DTC

- The fuel tank level output circuit is a short to ground or a short to battery or an open condition exists.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Inspect harness connectors for backed-out terminal, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

Inspect the wiring harness for damage.

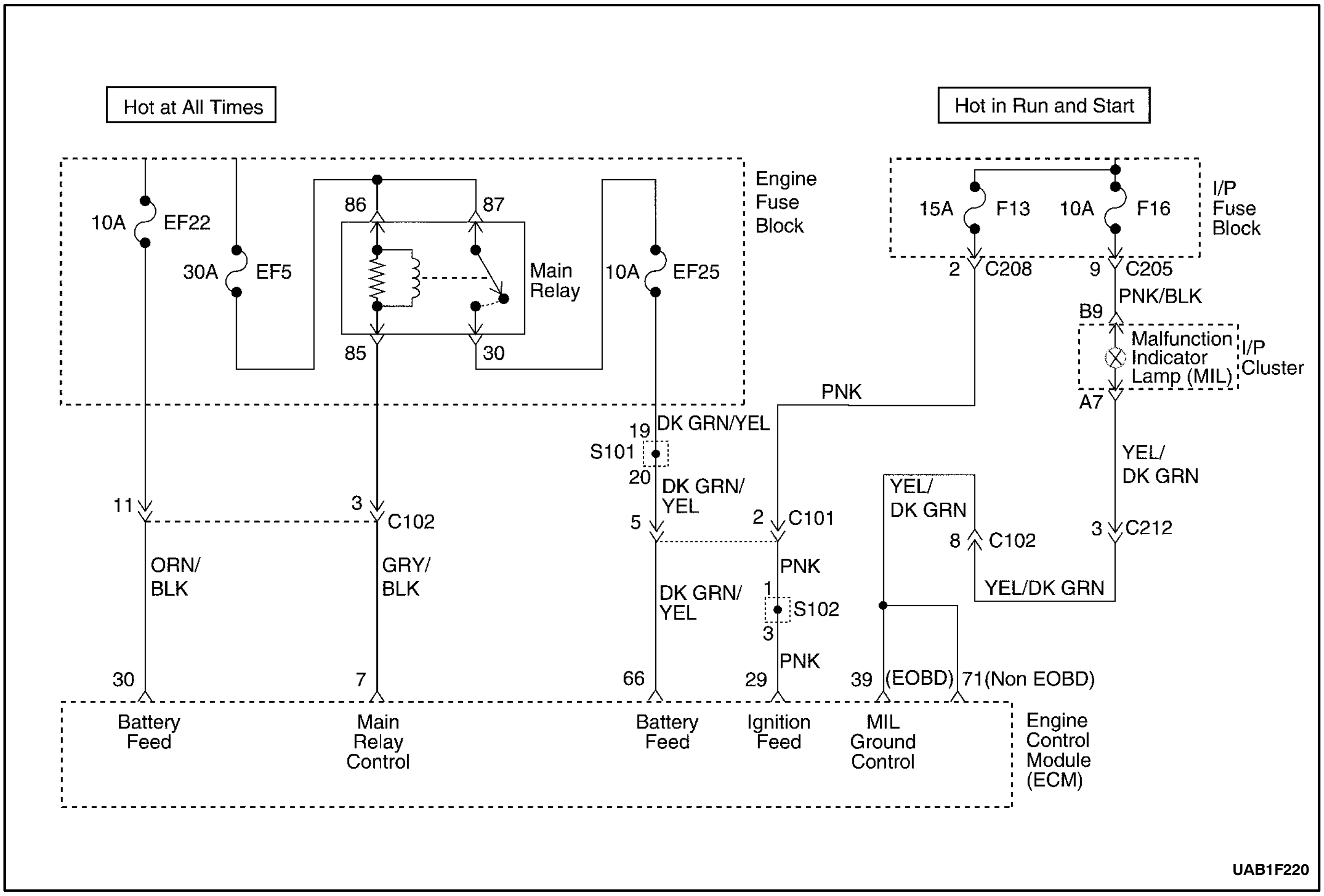
A stuck Fuel Level Sensor may cause the DTC to set. If DTC P0656 cannot be duplicated, the information included in the Freeze Frame data can be useful in determining vehicle operating conditions when the DTC was first set.

Resistance check for the Fuel Level Sensor.

- Empty = 100 ohms or over.
- Half full = about 32.5 ohms.
- Full = 10 ohms or less.

DTC P0656 – Fuel Level Gauge Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to LOCK. 2. connect the scan tool to the DLC. 3. Turn the Turn the ignition switch to ON. Are any Diagnostic Trouble Codes (DTCs) displayed?	–	Go to **Step 3**	Try with another scan tool
3	Refer to the applicable DTC table. Start with the DTC with the lowest numerical value and move up. Is the DTC identified as valid trouble code P0656?	–	Go to **Step 4**	Go to applicable DTC table
4	1. Disconnect the cluster connector 2. Turn the ignition switch to LOCK. 3. Check for an open or short to ground in the wire between the ECM connector 40 and cluster connector terminal C14. Is the problem found?	–	Go to **Step 6**	Go to **Step 5**
5	1. Turn the ignition switch to LOCK. 2. Check for short to battery in the wire between the the ECM connector 40 and cluster connector terminal C14. Is the problem found?	–	Go to **Step 6**	Go to **Step 7**
6	1. Change the between cluster and ECM or repair the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
7	1. Replace the cluster. 2. Clear any DTCs from ECM. 3. Perform the diagnostic system check. Are any Diagnostic Trouble Codes (DTCs) displayed?	–	Go to **Step 8**	System OK
8	Replace the ECM. Is the replcement complete?	–	Go to **Step 9**	–
9	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to **Step 10**	Go to **Step 2**
10	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1660 MALFUNCTION INDICATOR LAMP (MIL) HIGH VOLTAGE

Circuit Description

When the ignition switch to ON, the Malfunction Indicator Lamp (MIL) is ON steady.

When the engine cranking, the Malfunction Indicator Lamp (MIL) is OFF after one flashing time.

If a system have some difficulties, the Malfunction Indicator Lamp (MIL) is ON.

Conditions for Setting the DTC

- The Malfunction Indicator Lamp (MIL) wiring harness high voltage.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

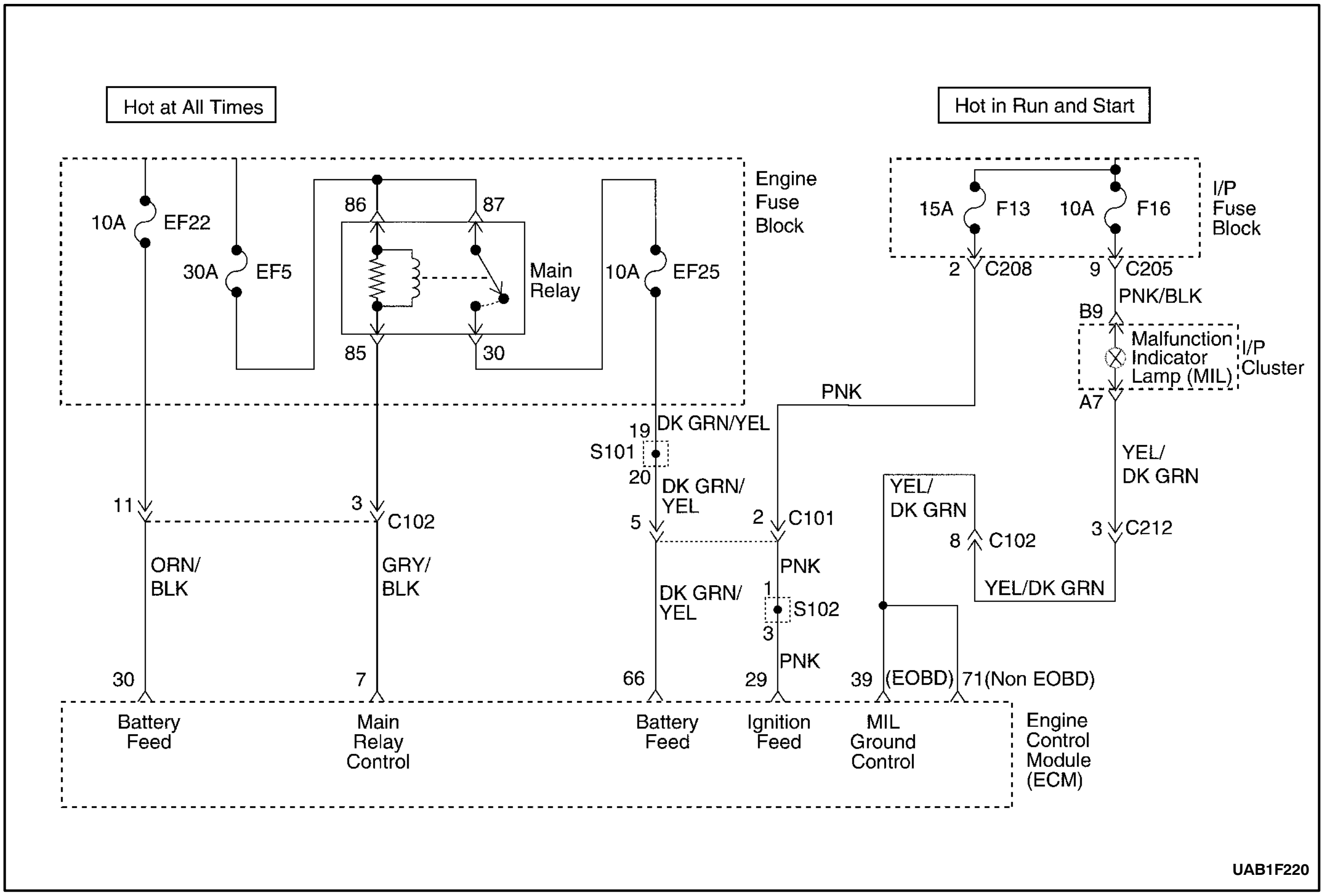
An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

DTC P1660 – Malfunction Indicator Lamp (MIL) High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to LOCK. 2. Disconnect the cluster wiring connector. 3. With the test light, connected to ground, probe the ignition feed circuit, at terminal A7 in the harness connector. Does the resistance within the specified value?	0 •	Go to **Step 3**	Go to **Step 6**
3	1. Turn the ignition switch to LOCK. 2. With the test light, connected to ground, probe the ignition feed circuit, at ECM wiring connector terminal 39. Does the test light illuminate?	–	Go to **Step 4**	Go to Step 5
4	1. Turn the ignition switch to LOCK. 2. Replace the cluster. Is the replacement complete?	–	Go to **Step 6**	–
5	Repair a short to battery between the ECM wiring connector terminal 39 and cluster wiring connector terminal A7. Is the repair complete?	–	Go to **Step 6**	–
6	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to **Step 7**	Go to **Step 2**
7	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1661 MALFUNCTION INDICATOR LAMP (MIL) LOW VOLTAGE

Circuit Description

When the ignition switch to ON, the Malfunction Indicator Lamp (MIL) is ON steady.

When the engine cranking, the Malfunction Indicator Lamp (MIL) is OFF after one flashing time.

If a system have some difficulties, the Malfunction Indicator Lamp (MIL) is ON.

Conditions for Setting the DTC

- The Malfunction Indicator Lamp (MIL) wiring harness low voltage.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after three consecutive trip with a fail.
- The ECM will record operating conditions at the time the diagnostic fail. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

DTC P1661 – Malfunction Indicator Lamp (MIL) Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to **Step 2**	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to LOCK. 2. Disconnect the cluster wiring connector. 3. With the test light, connected to ground, probe the ignition feed circuit, at terminal A7 in the harness connector. Does the resistance within the specified value?	–	Go to Step 3	Go to Step 6
3	1. Turn the ignition switch to LOCK. 2. With the test light, connected to ground, probe the ignition feed circuit, at ECM wiring connector terminal 39. Does the test light illuminate?	–	Go to **Step 4**	Go to **Step 5**
4	1. Turn the ignition switch to LOCK. 2. Replace the cluster. Is the replacement complete?	–	Go to **Step 6**	–
5	Repair a short to ground or open between the ECM wiring connector terminal 39 and cluster wiring connector terminal A7. Is the repair complete?	–	Go to **Step 6**	–
6	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to **Step 7**	Go to **Step 2**
7	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE DIAGNOSIS (2.0L DOHC)

CLEARING TROUBLE CODES

Notice: To prevent Engine Control Module (ECM) damage, the key must be OFF when disconnecting or reconnecting the power to the ECM (for example battery cable, ECM pigtail connector, ECM fuse, jumper cables, etc.).

When the ECM sets a Diagnostic Trouble Code (DTC), the Malfunction Indicator Lamp (MIL) lamp will be turned on only for type A, B and E but a DTC will be stored in the ECM's memory for all types of DTC. If the problem is intermittent, the MIL will go out after 10 seconds if the fault is no longer present. The DTC will stay in the ECM's memory until cleared by scan tool. Removing battery voltage for 10 seconds will clear some stored DTCs.

DTCs should be cleared after repairs have been completed. Some diagnostic tables will tell you to clear the codes before using the chart. This allows the ECM to set the DTC while going through the chart, which will help to find the cause of the problem more quickly.

DIAGNOSTIC TROUBLE CODES TABLE (2.0L DOHC)

DTC	Description	Type	Illuminate MIL
P0106	Manifold Absolute Pressure Sensor Rationality	E	Yes
P1106	Manifold Absolute Pressure Sensor Intermittent High Voltage	Cnl	
P0107	Manifold Absolute Pressure Sensor Low Voltage	A	Yes
P1107	Manifold Absolute Pressure Sensor Intermittent Low Voltage	Cnl	
P0108	Manifold Absolute Pressure Sensor High Voltage	A	Yes
P1111	Intake Air Temperature Sensor Intermittent High Voltage	Cnl	
P0112	Intake Air Temperature Sensor Low Voltage	E	Yes
P1112	Intake Air Temperature Sensor Intermittent Low Voltage	Cnl	
P0113	Intake Air Temperature Sensor High Voltage	E	Yes
P1114	Engine Coolant Temperature Sensor Intermittent Low Voltage	Cnl	
P1115	Engine Coolant Temperature Sensor Intermittent High Voltage	Cnl	
P0117	Engine Coolant Temperature Sensor Low Voltage	A	Yes
P0118	Engine Coolant Temperature Sensor High Voltage	A	Yes
P1121	Throttle Position Sensor Intermittent High Voltage	Cnl	
P0122	Throttle Position Sensor Low Voltage	A	Yes
P1122	Throttle Position Sensor Intermittent Low Voltage	Cnl	
P0123	Throttle Position Sensor High Voltage	A	Yes
P0125	Engine Coolant Temperature Insufficient For Closed Loop Fuel Control	E	Yes
P0131	Oxygen Sensor Low Voltage	A	Yes
P0132	Oxygen Sensor High Voltage	A	Yes
P0133	Oxygen Sensor Average Response Time	E	Yes
P1133	Oxygen Sensor Too Few Transition	E	Yes
P0134	Oxygen Sensor No Activity	A	Yes
P1134	Oxygen Sensor Transition Ratio	E	Yes
P0137	Heated Oxygen Sensor Low Voltage	E	Yes
P0138	Heated Oxygen Sensor High Voltage	E	Yes
P0140	Heated Oxygen Sensor No Activity	E	Yes
P0141	Heated Oxygen Sensor Heater Malfunction	E	Yes
P1167	Oxygen Sensor Rich in Decel Fuel Cut–Off (DFCO)	A	Yes

Diagnostic Trouble Codes Table (2.0L DOHC) (Cont'd)

DTC	Description	Type	Illuminate MIL
P0171	Fuel Trim System Too Lean	E	Yes
P1171	Fuel Trim System Lean During Power Enrichment	B	Yes
P0172	Fuel Trim System Too Rich	E	Yes
P0201	Injector 1 Output Circuit Fault	A	Yes
P0202	Injector 2 Output Circuit Fault	A	Yes
P0203	Injector 3 Output Circuit Fault	A	Yes
P0204	Injector 4 Output Circuit Fault	A	Yes
P0300	Multiple Cylinder Misfire	B	Yes
P0301	Cylinder 1 Misfire	A or B	Yes
P0302	Cylinder 2 Misfire	A or B	Yes
P0303	Cylinder 3 Misfire	A or B	Yes
P0304	Cylinder 4 Misfire	A or B	Yes
P0317	Rough Road Sensor Source Not Detected	Cnl	
P0325	Knock Sensor Internal Malfunction	Cnl	
P0327	Knock Sensor Circuit Fault	Cnl	
P0336	58X Crank Position Sensor Extra/Missing Pulse	E	Yes
P1336	58X Crank Position Sensor Tooth Error Not Learned	A	Yes
P0337	58X Crank Position Sensor No Signal	A	Yes
P0341	Camshaft Position Sensor Rationality	E	Yes
P0342	Camshaft Position Sensor No Signal	A	Yes
P0351	Ignition Control Circuit A Fault(Cylinder 2 and 3)	A	Yes
P0352	Ignition Control Circuit B Fault(Cylinder 1 and 4)	A	Yes
P1380	ABS Rough Road Sensor Rough Road Data Invalid	Cnl	
P1381	ABS Rough Road Sensor Serial Data Fault	Cnl	
P1391	G Sensor Rough Road Rationality	Cnl	
P1392	G Sensor Rough Road Low Voltage	Cnl	
P1393	G Sensor Rough Road High Voltage	Cnl	
P0401	Exhaust Gas Recirculation Insufficient Flow	Cnl	
P0402	Exhaust Gas Recirculation Excessive Flow	E	Yes
P0404	Exhaust Gas Recirculation Opened	E	Yes
P1404	Exhaust Gas Recirculation Closed	E	Yes
P0405	Exhaust Gas Recirculation Pintle Position Sensor Circuit Low Voltage	E	Yes
P0406	Exhaust Gas Recirculation Pintle Position Sensor Circuit High Voltage	E	Yes
P0420	Catalyst (Oxygen Sensor) Low Efficiency	A	Yes
P0443	Evaporative Emission (EVAP) Purge Control Circuit Fault	E	Yes
P0461	Fuel Level Stuck	Cnl	
P0462	Fuel Level Sensor Low Voltage	Cnl	
P0463	Fuel Level Sensor High Voltage	Cnl	
P0502	Vehicle Speed Sensor No Signal (M/T only)	E	Yes
P0506	Idle Speed RPM Lower Than Desired Idle Speed	E	Yes
P0507	Idle Speed RPM Higher Than Desired Idle Speed	E	Yes

Diagnostic Trouble Codes Table (2.0L DOHC) (Cont'd)

DTC	Description	Type	Illuminate MIL
P0532	A/C Pressure Sensor Low Voltage	Cnl	
P0533	A/C Pressure Sensor High Voltage	Cnl	
P0562	System Voltage (Engine Side) Too Low	Cnl	
P0563	System Voltage (Engine Side) Too High	Cnl	
P0601	Engine Control Module Check Sum Error	A	Yes
P1601	SPI Communications Between ECM and TCM (A/T only)	A	Yes
P0607	Lower Power Count Error	Cnl	
P1607	Lower Power Count Reset	Cnl	
P1626	Immobilizer No Response	Cnl	
P1631	Immobilizer Incorrect Response	Cnl	
P1650	SPI Communications Between Error with SIDM Chip	Cnl	
P1655	SPI Communications Between Error with PSVI Chip	E	Yes
P0700	Transaxle Control Module (TCM) Malfunction	Refer to TCM	

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DIAGNOSTIC TROUBLE CODE (DTC) P0106 MANIFOLD ABSOLUTE PRESSURE SENSOR RATIONALITY (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) uses the Manifold Absolute Pressure (MAP) sensor to control the fuel delivery and the ignition timing. The MAP sensor measures the changes in the intake manifold pressure which results from engine load (intake manifold vacuum) and the rpm changes, and it converts these into voltage outputs. The ECM can detect if the MAP sensor is not responding to the Throttle Position (TP) changes by comparing the actual MAP change to a predicted MAP change based on the amount of TP change that occurs. If the ECM does not see the expected MAP change or more, DTC P0106 will set.

Conditions for Setting the DTC

J Altitude compensated MAP reading is higher than high threshold or lower than low threshold table based on rpm and TP signal.

J DTCs P0107, P0108, P0117, P0118, P0122, P0123, P0201, P0202, P0203, P0204, P0300, P0351, P0352, P0402, P0404, P1404, P0405, P0406, P0506, P0507 or P0125 are not set.

J Engine running.

J Valid Barometric Pressure (BARO) update.

J Torque Converter Clutch (TCC) steady (A/T).

J A/C steady state.

J No TP sensor fail conditions present.

J No MAP fail conditions present.

J Change in Idle Air Control (IAC) is less than 5%.

J Coolant temperature is greater than –10bC (–14bF).

J Change in rpm is less than 200.

J Change in TP sensor is less than 3%.

J Change in Exhaust Gas Recirculation (EGR) value is less than 6%.

J The rpm is between 1300 and 4500.

J All of the above are stabilized for 1.5 seconds.

Action Taken When the DTC Sets

J The Malfunction Indicator Lamp (MIL) will illuminate.

J The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.

J A history DTC is stored.

J The ECM will substitute a fixed MAP value and use TP sensor to control the fuel delivery. (The scan tool will not show defaulted value.)

Conditions for Clearing the MIL/DTC

J The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.

J A history DTC will clear after 40 consecutive warm-up cycles without a fault.

J DTC(s) can be cleared by using the scan tool.

J Disconnecting the ECM battery feed for more than 10 seconds.

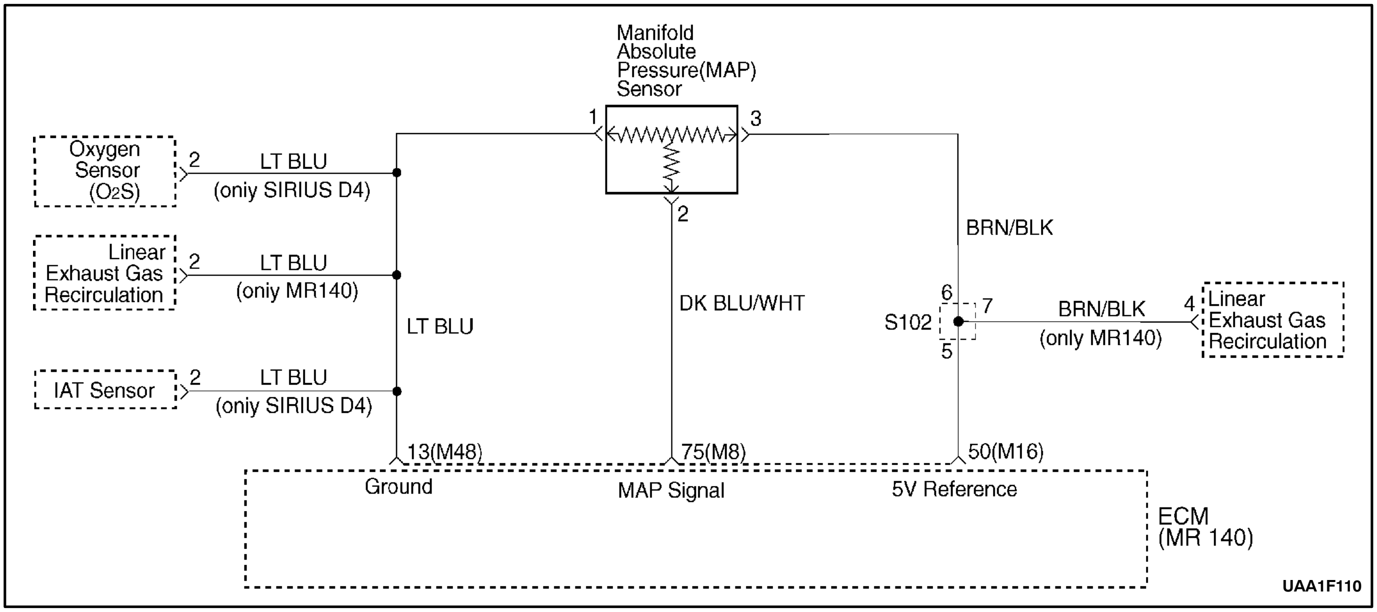
Diagnostic Aids

With the ignition ON and the engine stopped, the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the ECM as an indication of vehicle altitude. Comparison of this reading with a known good vehicle with the same sensor is a good way to check the accuracy of a suspect sensor. Readings should be the same +0.4 volts.

The MAP sensor vacuum source should be thoroughly checked for restrictions at the intake manifold.

DTC P0106 – Manifold Absolute Pressure Sensor Rationality (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition switch to ON, with the engine not running. 3. Compare the Barometric Pressure (BARO) reading with a known good vehicle. Is the BARO reading similar?	–	Go to *Step 3*	Go to *Step 8*
3	Start the engine while watching the Manifold Absolute Pressure (MAP) sensor value. Does the MAP sensor value change while starting the engine?	–	Go to *Step 4*	Go to *Step 5*
4	With the engine still running, snap the throttle while watching the MAP sensor display on the scan tool. Does the MAP sensor value change rapidly with the throttle position changes?	–	Go to *Step 9*	Go to *Step 6*
5	1. Turn the ignition switch OFF. 2. Remove the MAP sensor and install a vacuum pump to the MAP sensor. 3. Turn the ignition switch ON, with the engine OFF. 4. Apply 380 mm Hg (15 in Hg) to the MAP sensor. Does the MAP sensor value on the scan tool change?	–	Go to *Step 7*	Go to *Step 8*
6	1. Remove the MAP sensor from the manifold port. 2. Inspect the port and MAP sensor for restrictions and repair as necessary. Is the repair complete?	–	Go to *Step 9*	Go to *Step 8*
7	Repair the restriction in the MAP sensor or vacuum port as necessary. Is the repair complete?	–	Go to *Step 9*	–
8	Replace the MAP sensor. Is the repair complete?	–	Go to *Step 9*	–
9	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 10*	Go to *Step 2*
10	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P1106 MANIFOLD ABSOLUTE PRESSURE SENSOR INTERMITTENT HIGH VOLTAGE (2.0L DOHC)

Circuit Description

The Manifold Absolute Pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP signal voltage to the Engine Control Module (ECM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the key in the ON position, engine not running or at Wide Open Throttle (WOT) (low vacuum).

A "speed density" method of determining engine load is used. This is calculated using inputs from the MAP sensor, the rpm (58X), and the Intake Air Temperature (IAT) sensor. The MAP sensor is the main sensor used in this calculation, and measuring engine load is its main function.

The MAP sensor is also used to determine manifold pressure changes while the linear Exhaust Gas Recirculation (EGR) flow test diagnostic is being run (refer to DTC P0401). This determines the engine vacuum level for some other diagnostics and determines Barometric Pressure (BARO). The ECM compares the MAP sensor signal to calculated MAP based on Throttle Position (TP) and various other engine load factors. If the ECM detects a MAP signal voltage that is intermittently above the calculated value, DTC P1106 will set.

Conditions for Setting the DTC

- No TP sensor fail conditions present.
- Engine running more than 10 seconds
- TP sensor is less than 15 % if rpm is less than 2500.
- TP sensor less than 35% if rpm is greater than 2500.
- The MAP is greater than 103 kPa (15 psi).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

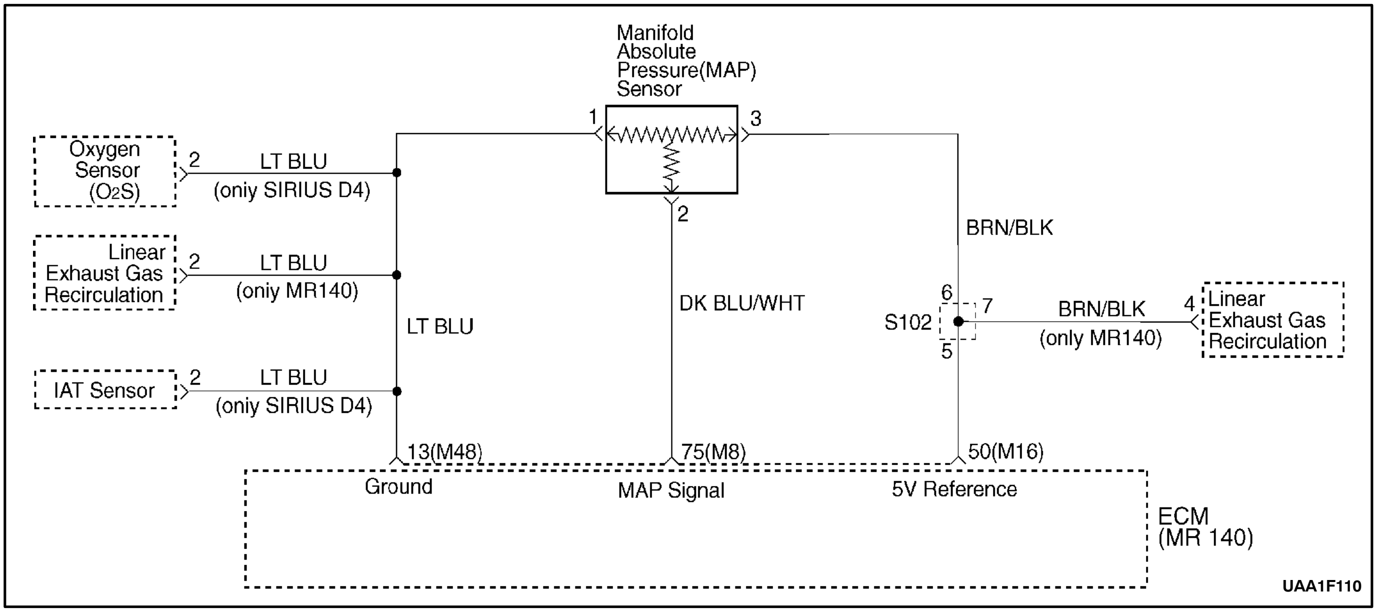
Check for the following conditions:

- Leaking or plugged vacuum supply line to the MAP sensor.
- Inspect ECM harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P1106 – Manifold Absolute Pressure Sensor Intermittent High Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition switch to ON, with the engine not running. 3. Select diagnostic Trouble Code (DTC) information. 4. Check Last Test Fail and note any other DTCs set. Is DTC P0108 also set?	–	Go to Applicable DTC table	Go to *Step 3*
3	Check for a poor sensor ground circuit terminal 1 connection at the Manifold Absolute Pressure (MAP) sensor. Is a repair necessary?	–	Go to *Step 7*	Go to *Step 4*
4	Check the MAP signal circuit between the MAP sensor connector and Engine Control Module (ECM) for an intermittent short to voltage. Is a problem found?	–	Go to *Step 7*	Go to *Step 5*
5	Check for an intermittent short to voltage on the 5 volt reference M16 circuit between the MAP sensor and ECM. Is a problem found?	–	Go to *Step 8*	Go to *Step 6*
6	Check for a poor sensor ground circuit terminal M48 connection at the ECM. Is a problem found?	–	Go to *Step 7*	Go to *Step 9*
7	Repair the faulty harness connector terminal for sensor ground circuit or replace it. Is the repair complete?	–	Go to *Step 9*	–
8	Locate and repair intermittent open or short circuit in the wiring harness as needed. Is the repair complete?	–	Go to *Step 9*	–
9	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 10*	Go to *Step 2*
10	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0107 MANIFOLD ABSOLUTE PRESSURE SENSOR LOW VOLTAGE (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) uses the Manifold Absolute Pressure (MAP) sensor to control the fuel delivery and the ignition timing. The MAP sensor measures the changes in the intake manifold pressure which results from engine load (intake manifold vacuum) and the rpm changes, and it converts these into voltage outputs. The ECM sends a 5 volt reference voltage to the MAP sensor. As the manifold pressure changes, the output of MAP sensor also changes. By monitoring the Map sensor output voltage, the ECM knows the manifold pressure. A low pressure (low voltage) output voltage will be about 1.0 to 1.5 volts while the higher pressure (high voltage) output voltage will be about 4.5 to 4.8 volts at Wide Open Throttle(WOT). The MAP sensor is also used, under certain conditions to measure Barometric Pressure (BARO), allowing the ECM to make adjustments for different altitude.

Conditions for Setting the DTC

- No TP sensor fail conditions present.
- TP sensor is greater than or equal to 0% if the rpm is less than or equal to 1000.
- TP sensor is greater than 5% if the rpm is great than 1000.
- System voltage is greater than 11 volts.
- MAP is less than 12 kPa (1.7 psi)

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The ECM will substitute a fixed MAP value and use TP sensor to control the fuel delivery. (The scan tool will not show defaulted value.)

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

With the ignition ON and the engine stopped, the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the ECM as an indication of vehicle altitude. Comparison of this reading with a known good vehicle with the same sensor is a good way to check the accuracy of a suspect sensor. Readings should be the same ±12 kPa.

If a DTC P0107 is intermittent, refer to “Manifold Absolute Pressure Check: in this section for further diagnosis.

Note: After repairs, use the scan tool FUEL TRIM RESET function to reset long-term fuel trim to 128 (0%).

DTC P0107 Manifold Absolute Pressure Sensor Low Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Start the engine. 3. Read the Manifold Absolute Pressure (MAP). Does the scan tool display a MAP below the specified value?	12 kPa	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition switch OFF. 2. Disconnect the MAP sensor electrical connector. 3. Jumper the MAP signal circuit at terminal 2 to the 5 volt reference circuit at terminal 3. 4. Turn the ignition switch ON. Does the MAP read more than the specified value?	96 kPa	Go to *Step 5*	Go to *Step 6*
4	1. Turn the ignition switch ON with the engine OFF, review the Freeze Frame data, and note the parameters. 2. Operate the vehicle within the freeze frame conditions and Conditions For Setting the DTC as noted. Does the scan tool display MAP below the specified value?	12 kPa	Go to *Step 3*	Go to "Diagnostic Aids"
5	Inspect the MAP sensor harness electrical connector terminals for the following conditions: J Poor connections. J Proper contact tension. J Poor terminal to wire connection. Is a problem found?	–	Go to *Step 8*	Go to *Step 9*
6	1. Turn the ignition switch OFF. 2. Remove the jumper wire. 3. Probe the MAP sensor signal circuit terminal 2 with a test light to B+. 4. Turn the ignition switch ON. Does the scan tool read over the specified value?	90 kPa	Go to *Step 7*	Go to *Step 12*
7	Check the MAP sensor 5 volt reference circuit at terminal 3 for an open or short to ground. Is a problem found?	–	Go to *Step 10*	Go to *Step 11*
8	Repair the connection terminals as necessary. Is the action complete?	–	Go to *Step 14*	–
9	Replace the MAP sensor. Is the action complete?	–	Go to *Step 14*	–
10	Repair the MAP sensor 5 volt reference circuit. Is the action complete?	–	Go to Step 14	–
11	1. Turn the ignition switch OFF. 2. Replace the Engine Control Module (ECM). Is the action complete?	–	Go to *Step 14*	–

DTC P0107 Manifold Absolute Pressure Sensor Low Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check the MAP sensor signal circuit for the following conditions: **J** Open. **J** Short to ground. **J** Short to sensor ground. Is a problem found?	–	Go to *Step 13*	Go to *Step 11*
13	Repair the MAP sensor signal circuit. Is the action complete?	–	Go to *Step 14*	–
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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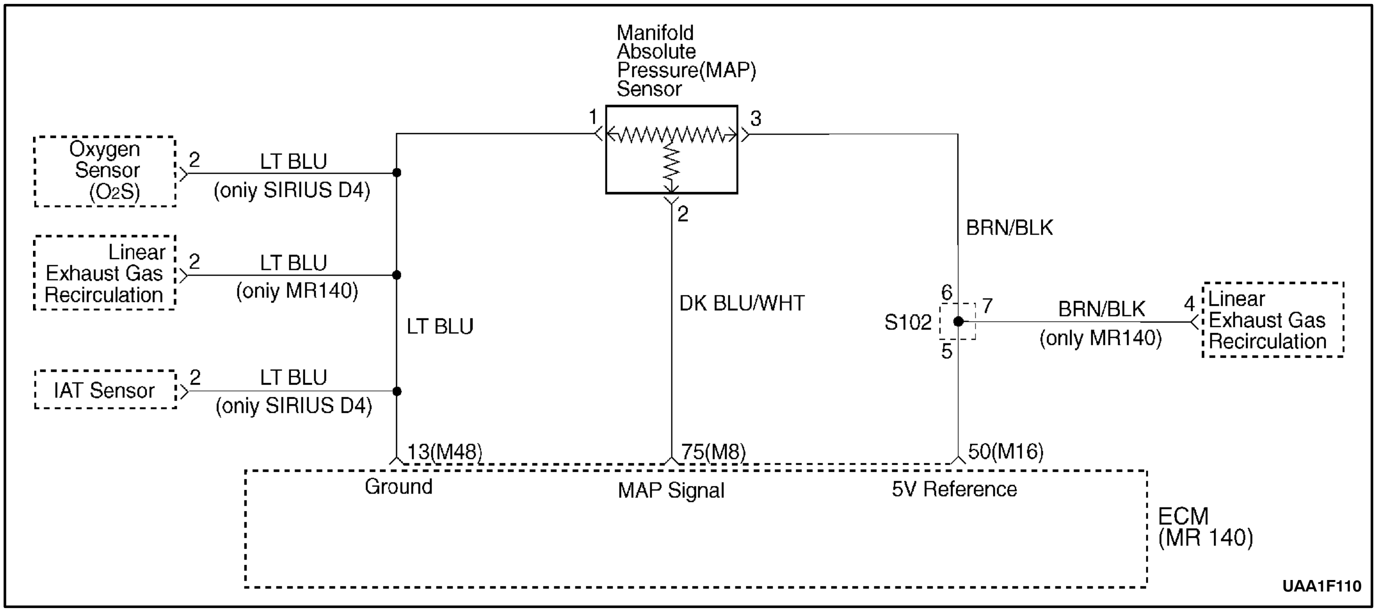


DIAGNOSTIC TROUBLE CODE (DTC) P1107 MANIFOLD ABSOLUTE PRESSURE SENSOR INTERMITTENT LOW VOLTAGE (2.0L DOHC)

Circuit Description

The Manifold Absolute Pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP signal voltage to the Engine Control Module (ECM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the key in the ON position, engine not running or at Wide Open Throttle (WOT) (low vacuum).

A “speed density” method of determining engine load is used. This is calculated using inputs from the MAP sensor, the rpm (58X), and the Intake Air Temperature (IAT) sensor. The MAP sensor is the main sensor used in this calculation, and measuring engine load is its main function.

The MAP sensor is also used to determine manifold pressure changes while the linear Exhaust Gas Recirculation (EGR) flow test diagnostic is being run (refer to *DTC P0401*). This determines the engine vacuum level for some other diagnostics and determines Barometric Pressure (BARO). The ECM compares the MAP sensor signal to calculated MAP based on Throttle Position (TP) and various other engine load factors. If the ECM detects a MAP signal voltage that is intermittently below the calculated value, DTC P1107 will set.

Conditions for Setting the DTC

- No TP sensor fail conditions present.
- TP sensor is greater than or equal to 0% if rpm is less than or equal to 1000.
- TP sensor greater than 5% if rpm is greater than 1000.
- System voltage is greater than 11 volts.
- The MAP is less than 12 kPa (1.7 psi).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

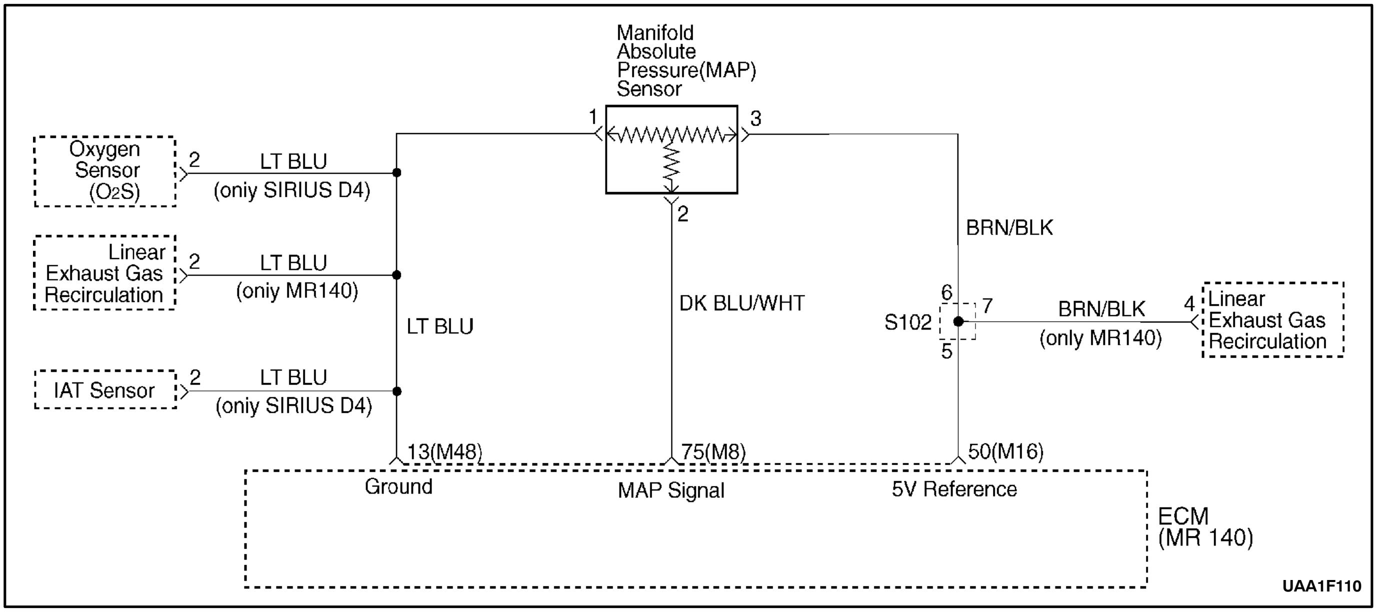
Diagnostic Aids

- Check for the following conditions:
- Leaking or plugged vacuum supply line to the MAP sensor.
- Inspect ECM harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P1107 – Manifold Absolute Pressure Sensor Intermittent Low Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition switch to ON, with the engine not running. 3. Select diagnostic Trouble Code (DTC) information. 4. Check Last Test Fail and note any other DTCs set. Is DTC P0107 also set?	–	Go to Applicable DTC table	Go to *Step 3*
3	Check for a poor 5 volt reference circuit or Manifold Absolute Pressure (MAP) signal circuit terminal connection at the MAP sensor. Is a repair necessary?	–	Go to *Step 5*	Go to *Step 4*
4	Check the MAP signal circuit between the MAP sensor connector and Engine Control Module (ECM) for an intermittent short to ground. Is a problem found?	–	Go to *Step 6*	Go to *Step 7*
5	Replace the faulty harness connector terminal for the 5 volt reference circuit and/or the MAP signal circuit. Is the repair complete?	–	Go to *Step 7*	–
6	Repair intermittent open/short circuit in the wiring harness. Is the repair complete?	–	Go to *Step 7*	–
7	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 8*	Go to *Step 2*
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0108 MANIFOLD ABSOLUTE PRESSURE SENSOR HIGH VOLTAGE (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) uses the Manifold Absolute Pressure (MAP) sensor to control the fuel delivery and the ignition timing. The MAP sensor measures the changes in the intake manifold pressure which results from engine load (intake manifold vacuum) and the rpm changes, and it converts these into voltage outputs. The ECM sends a 5 volt reference voltage to the MAP sensor. As the manifold pressure changes, the output of MAP sensor also changes. By monitoring the Map sensor output voltage, the ECM knows the manifold pressure. A low pressure (low voltage) output voltage will be about 1.0 to 1.5 volts while the higher pressure (high voltage) output voltage will be about 4.5 to 4.8 volts at Wide Open Throttle(WOT). The MAP sensor is also used, under certain conditions to measure Barometric Pressure (BARO), allowing the ECM to make adjustments for different altitude.

Conditions for Setting the DTC

- No Throttle Position (TP) sensor fail conditions present.
- Engine is running more than 10 seconds.
- TP sensor is less than 15% if the rpm is less than 2500.
- TP sensor is less than 35 % if the rpm is great than 2500.
- MAP is greater than 103 kPa (15 psi)

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The ECM will substitute a fixed MAP value and use TP sensor to control the fuel delivery. (The scan tool will not show defaulted value 0.)

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

With the ignition ON and the engine stopped, the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the ECM as an indication of vehicle altitude. Comparison of this reading with a known good vehicle with the same sensor is a good way to check the accuracy of a suspect sensor. Readings should be the same ±12 kPa.

If a DTC P0108 is intermittent, refer to “Manifold Absolute Pressure Check” in this section for further diagnosis.

DTC P0108 may set as result of a misfire. If misfire is present, repair the cause of misfire before using this table. The misfire counters may be used to determine which cylinder(s) is misfiring.

Note: After repairs, use the scan tool FUEL TRIM RESET function to reset long-term fuel trim to 128 (0%).

If DTC P0172 is also set, check 5 volt reference circuit for short to voltage.

DTC P0108 – Manifold Absolute Pressure Sensor High Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Start the engine. 3. Read the Manifold Absolute Pressure (MAP). Does the scan tool display a MAP of the specified value or over?	85 kPa	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition switch OFF. 2. Disconnect the MAP sensor electrical connector. 3. Turn the ignition switch ON. Does the MAP read less than the specified value?	28 kPa	Go to *Step 5*	Go to *Step 6*
4	1. Turn the ignition switch ON with the engine OFF, review the Freeze Frame data, and note the parameters. 2. Operate the vehicle within the freeze frame conditions and Conditions For Setting the DTC as noted. Does the scan tool display MAP equal to or greter than the specified value?	85 kPa	Go to *Step 3*	Go to “Diagnostic Aids”
5	Probe the MAP sensor signal ground circuit at terminal 1 with a test light connected to battery +. Does the test light illuminate?	–	Go to *Step 7*	Go to *Step 11*
6	Check the MAP sensor signal circuit at terminal M8 of ECM for a short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 12*
7	With a ohmmeter connected to the ground, probe the 5 volt reference circuit terminal M16. Is the resistance within near the specified value.	5 V	Go to *Step 8*	Go to *Step 9*
8	Check the MAP sensor vacuum source for being plugged or leaking. Is a problem found?	–	Go to *Step 10*	Go to *Step 13*
9	Check the 5 volt reference circuit at terminal M16 for a short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 12*
10	Repair the vacuum source as needed. Is the action complete?	–	Go to *Step 14*	–
11	Check for an open in the MAP sensor ground circuit at terminal 1 and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 12*
12	1. Turn the ignition switch OFF. 2. Replace the Engine Control Module (ECM). Is the action complete?	–	Go to *Step 14*	–
13	Replace the MAP sensor. Is the action complete?	–	Go to *Step 14*	–

DTC P0108 – Manifold Absolute Pressure Sensor High Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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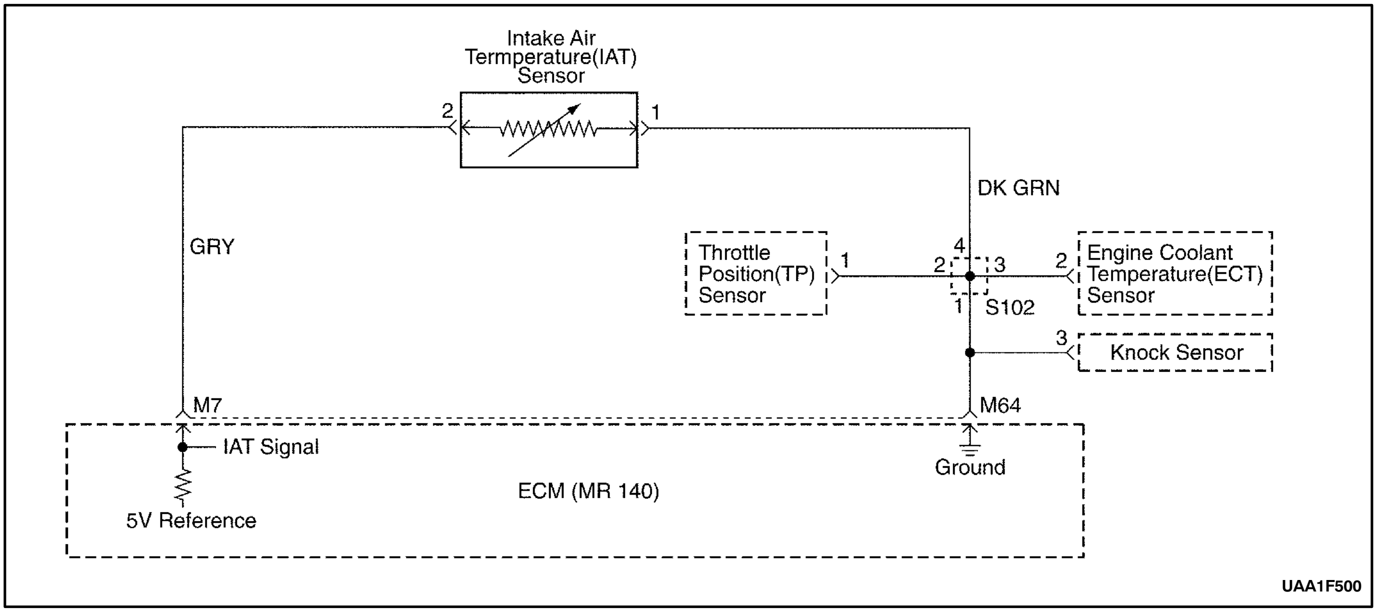

DIAGNOSTIC TROUBLE CODE (DTC) P1111 INTAKE AIR TEMPERATURE SENSOR INTERMITTENT HIGH VOLTAGE (2.0L DOHC)

Circuit Description

The Intake Air Temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The Engine Control Module (ECM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the resistance is high, and the ECM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the ECM to monitor a lower voltage. Diagnostic Trouble Code (DTC) P1111 will set when the ECM detects an intermittent high signal voltage in the intake air temperature sensor signal circuit or sensor.

Conditions for Setting the DTC

J DTC P0502 not set

J Engine has been running for over two minutes.

J Vehicles speed is less than 25 km/h (16 mph).

J Calculated air flow is less than 15 g/second.

J Engine Coolant Temperature (ECT) is above 70 **b**C (158 **b**F).

J IAT is less than –38 **b**C (–36 **b**F).

Action Taken When the DTC Sets

J The ECM will substitute a default value for IAT.

J The ECM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

J The Malfunction Indicator Lamp (MIL) will not illuminate.

J A history DTC is stored.

Conditions for Clearing the MIL/DTC

J A history DTC will clear after 40 consecutive warm-up cycles without a fault.

J DTC(s) can be cleared by using the scan tool.

J Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Check for the following conditions:

J Poor connection at the ECM. Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

J Damaged harness. Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the scan tool while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

J Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

J Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to “Temperature vs. Resistance” in this section.

Intake Air Temperature Sensor (Temperature Vs. Resistance Value)

°C	°F	Ω	°C	°F	Ω
100	212	177	15	59	4450
80	176	332	5	41	7280
60	140	667	–5	23	12300
45	113	1188	–15	5	21450
35	95	1802	–30	–22	52700
25	77	2796	–40	–40	100700
Above resistance is approximate value					

DTC P1111 – Intake Air Temperature Sensor Intermittent High Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. 3. Request engine Diagnostic Trouble Code (DTC). Is DTC P0113 set?	–	Go to Applicable DTC table	Go to *Step 3*
3	Is DTC P1115 also set.	–	Go to *Step 7*	Go to *Step 4*
4	Check for a poor sensor ground circuit terminal 1 at the Intake Air Temperature (IAT) sensor and repair as needed. Is the repair complete?	–	Go to *Step 9*	Go to *Step 5*
5	Check for a poor sensor signal circuit between terminal 2 of the IAT sensor and terminal M7 of the Engine Control Module (ECM) for an intermittent open and repair as needed. Is the repair complete?	–	Go to *Step 9*	Go to *Step 6*
6	Check for sensor signal circuit between terminal 2 of the IAT sensor and terminal M7 of the ECM for an intermittent short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 9*	Go to *Step 7*
7	Check for poor sensor ground circuit terminal M64 at the ECM and repair as needed. Is the repair complete?	–	Go to *Step 9*	Go to *Step 8*
8	Check for an intermittent open or a faulty splice in the sensor ground circuit and repair as needed. Is the repair complete?	–	Go to *Step 9*	Go to "Diagnostic Aids"
9	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 10*	Go to *Step 2*

DTC P1111 – Intake Air Temperature Sensor Intermittent High Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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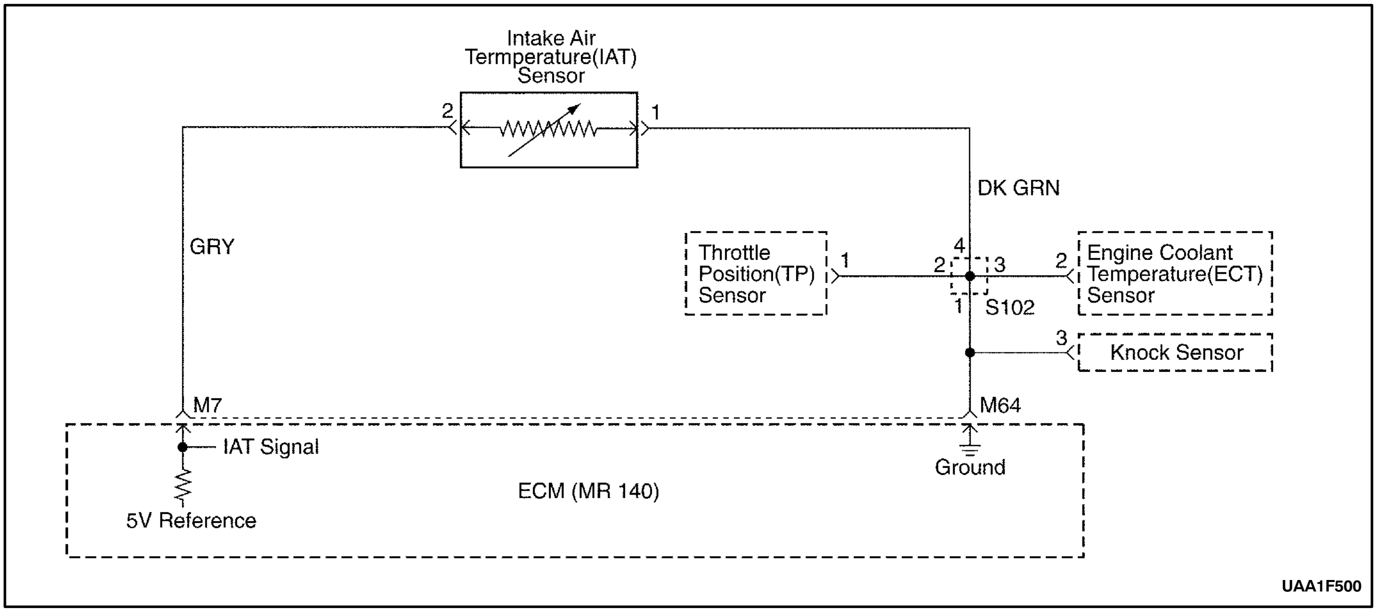


DIAGNOSTIC TROUBLE CODE (DTC) P0112 INTAKE AIR TEMPERATURE SENSOR LOW VOLTAGE (2.0L DOHC)

Circuit Description

The Intake Air Temperature (IAT) sensor uses a thermistor to control the signal voltage to the Engine Control Module (ECM). The ECM supplies a 5 volt reference and a ground to the sensor. When the air is cold, the resistance is high; therefore the IAT signal voltage will be high. If the intake air is warm, resistance is low; therefore the IAT signal voltage will be low.

Conditions for Setting the DTC

- IAT is greater than 149 °C (300 °F).
- Engine run time is greater than 2 minutes.
- Vehicles speed is greater than or equal to 50 km/h (31 mph).
- DTC P0502 is not set.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The ECM will default to 60°C (140°F) for intake air temperature. The scan tool will not show the defaulted value.

Conditions for Clearing the MIL/DTC

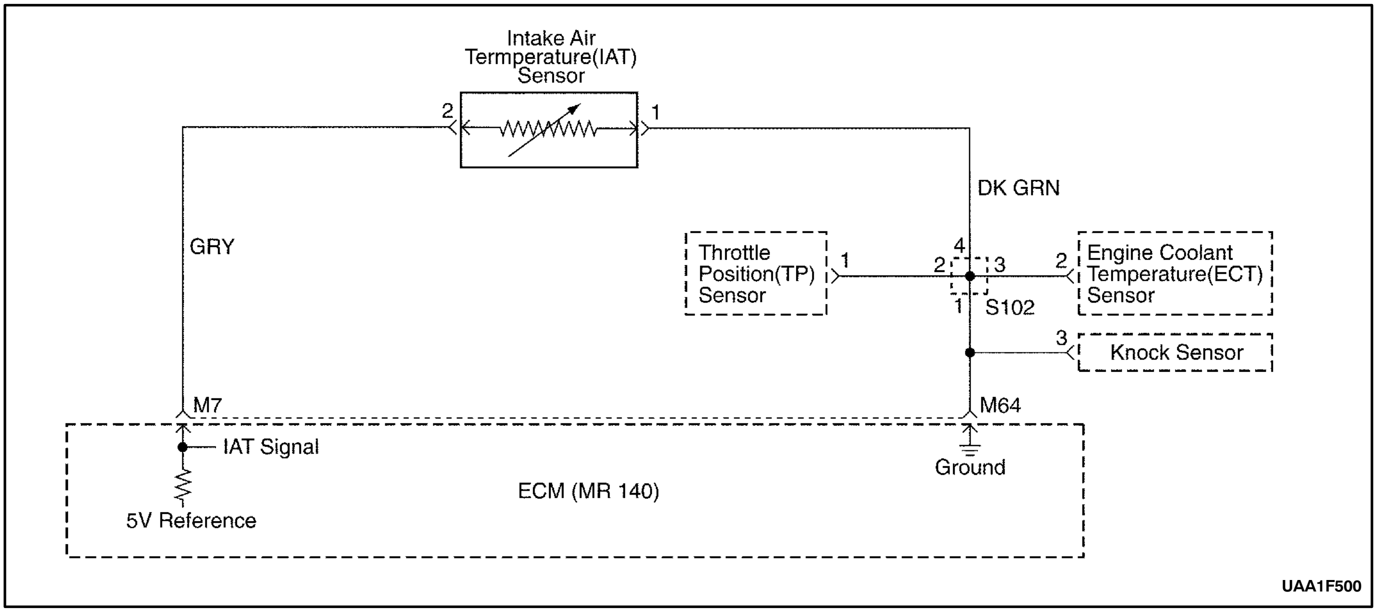
- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

- If the vehicle is at ambient temperature, compare the IAT sensor to the Engine Coolant Temperature (ECT) sensor. The IAT sensor and the ECT sensor should be relatively close to each other.
- Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to "Temperature vs. Resistance" in this section.

DTC P0112 – Intake Air Temperature Sensor Low Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Is the Intake Air Temperature (IAT) value greater than the specified value?	128bC (262bF)	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch ON with the engine OFF, review Freeze Frame data, and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Is the IAT sensor value greater than the specified value?	128bC (262bF)	Go to *Step 4*	Go to “Diagnostic Aids”
4	1. Turn the ignition switch OFF. 2. Disconnect the IAT sensor electrical connector. 3. Turn the ignition switch ON. Is the IAT sensor value below the specified value?	–30bC (–22bF)	Go to *Step 5*	Go to *Step 6*
5	Replace IAT sensor. Is the repair complete?	–	Go to *Step 10*	–
6	With a test light connected to battery +, probe the IAT sensor signal circuit, terminal 2 at the IAT sensor connector. Does the test light illuminate?	–	Go to *Step 7*	Go to *Step 9*
7	1. Turn the ignition switch OFF. 2. Disconnect the Engine Control Module (ECM) connector. 3. With a test light connected to B+, probe the IAT sensor signal circuit, terminal 2 at the IAT sensor electrical connector. Does the test light illuminate?	–	Go to *Step 8*	Go to *Step 9*
8	Repair the short to ground circuit in the IAT sensor signal circuit as needed. Is the repair complete?	–	Go to *Step 10*	–
9	1. Turn the ignition OFF. 2. Replace the ECM. Is the action complete?	–	Go to *Step 10*	–
10	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 11*	Go to *Step 2*
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P1112 INTAKE AIR TEMPERATURE SENSOR INTERMITTENT LOW VOLTAGE (2.0L DOHC)

Circuit Description

The Intake Air Temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The Engine Control Module (ECM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the resistance is high, and the ECM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the ECM to monitor a lower voltage. Diagnostic Trouble Code (DTC) P1111 will set when the ECM detects an intermittent high signal voltage in the intake air temperature sensor signal circuit or sensor.

Conditions for Setting the DTC

- DTC P0502 not set
- Engine has been running for over two minutes.
- Vehicles speed is greater than or equal to 50 km/h (31 mph).
- IAT is greater than 149°C (300°F).

Action Taken When the DTC Sets

- The ECM will substitute a default value for IAT.
- The ECM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.
- The Malfunction Indicator Lamp (MIL) will not illuminate.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

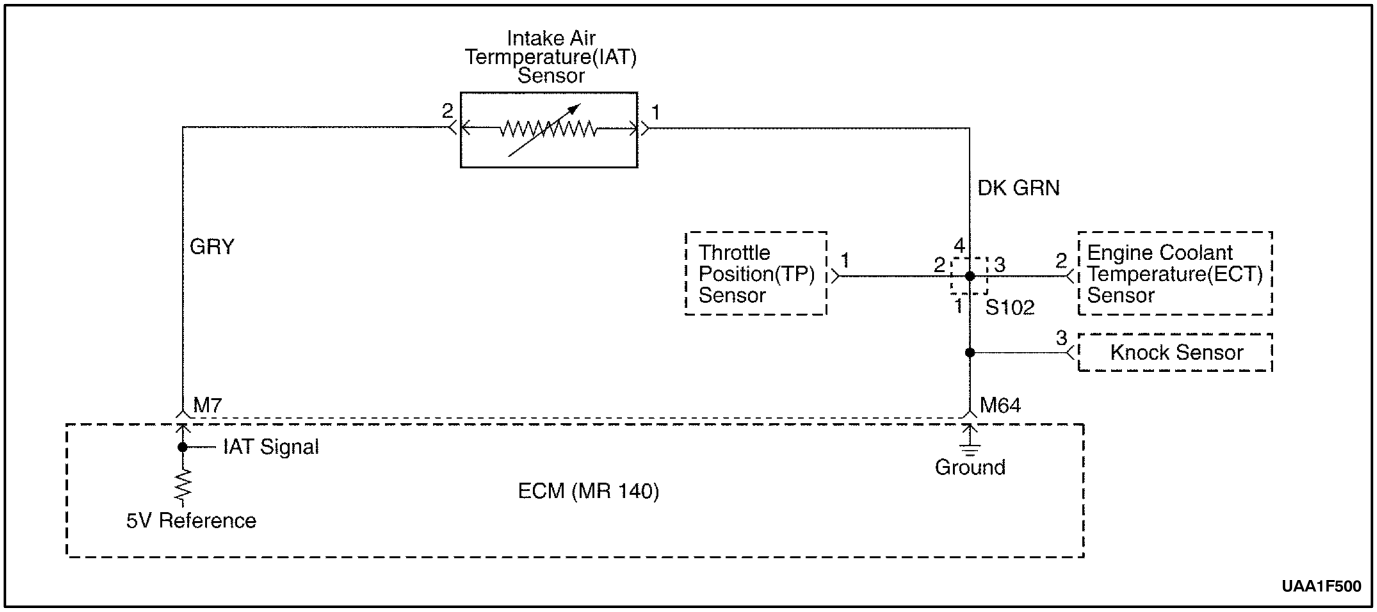
Diagnostic Aids

Check for the following conditions:

- Poor connection at the ECM. Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness. Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the scan tool while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.
- Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.
- Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to “Temperature vs. Resistance” in this section.

DTC P1112 – Intake Air Temperature Sensor Intermittent Low Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. 3. Request engine Diagnostic Trouble Code (DTC). Is DTC P0112 also set?	–	Go to Applicable DTC table	Go to *Step 3*
3	Check the Intake Air Temperature (IAT) signal circuit between terminal 2 of the IAT sensor and terminal M7 of the ECM for an intermittent short to ground and repair as needed. Is the repair complete?	–	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 5*	Go to *Step 2*
5	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0113 INTAKE AIR TEMPERATURE SENSOR HIGH VOLTAGE (2.0L DOHC)

Circuit Description

The Intake Air Temperature (IAT) sensor uses a thermistor to control the signal voltage to the Engine Control Module (ECM). The ECM supplies a 5 volt reference and a ground to the sensor. When the air is cold, the resistance is high; therefore the IAT signal voltage will be high. If the intake air is warm, resistance is low; therefore the IAT signal voltage will be low.

Conditions for Setting the DTC

- Vehicles speed is less than 25 km/h (16 mph).
- Engine run time is greater than 2 minutes.
- Engine Coolant Temperature (ECT) is above 70°C (158°F).
- Calculated air flow is less than 15 g/second.
- DTC P0502 is not set.
- IAT is less than –38°C (–36°F).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The ECM will default to 60°C (140°F) for intake air temperature. The scan tool will not show the defaulted value.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

- If the vehicle is at ambient temperature, compare the IAT sensor to the Engine Coolant Temperature (ECT) sensor. The IAT sensor and the ECT sensor should be relatively close to each other.
- Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to “Temperature vs. Resistance” in this section.

DTC P0113 – Intake Air Temperature Sensor High Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Is the Intake Air Temperature (IAT) value less than the specified value?	–30bC (–22bF)	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch ON with the engine OFF, review Freeze Frame data, and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Is the IAT sensor value less than the specified value?	–30bC (–22bF)	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Turn the ignition switch OFF. 2. Disconnect the IAT sensor electrical connector. 3. Turn the ignition switch ON. 4. Jumper the IAT sensor signal circuit terminal 2 and ground circuit terminal 1. Is the IAT sensor value greater than the specified value?	130bC (266bF)	Go to *Step 6*	Go to *Step 5*
5	Jumper the IAT sensor signal circuit at terminal 2 to ground. Is the IAT sensor value greater than the specified value?	130bC (266bF)	Go to *Step 7*	Go to *Step 8*
6	Check for a poor connection at the IAT sensor connector and repair or replace any malfunctioning terminal as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 10*
7	Check the IAT sensor ground circuit for an open and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 9*
8	Check the IAT sensor signal circuit for an open and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 9*
9	Check for a poor IAT sensor ground circuit at terminal M64 or a poor IAT sensor signal circuit terminal M7 connection at Engine Control Module (ECM) and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 11*
10	Replace the IAT sensor. Is the repair complete?	–	Go to *Step 12*	–
11	1. Turn the ignition OFF. 2. Replace the ECM. Is the action complete?	–	Go to *Step 12*	–

DTC P0113 – Intake Air Temperature Sensor High Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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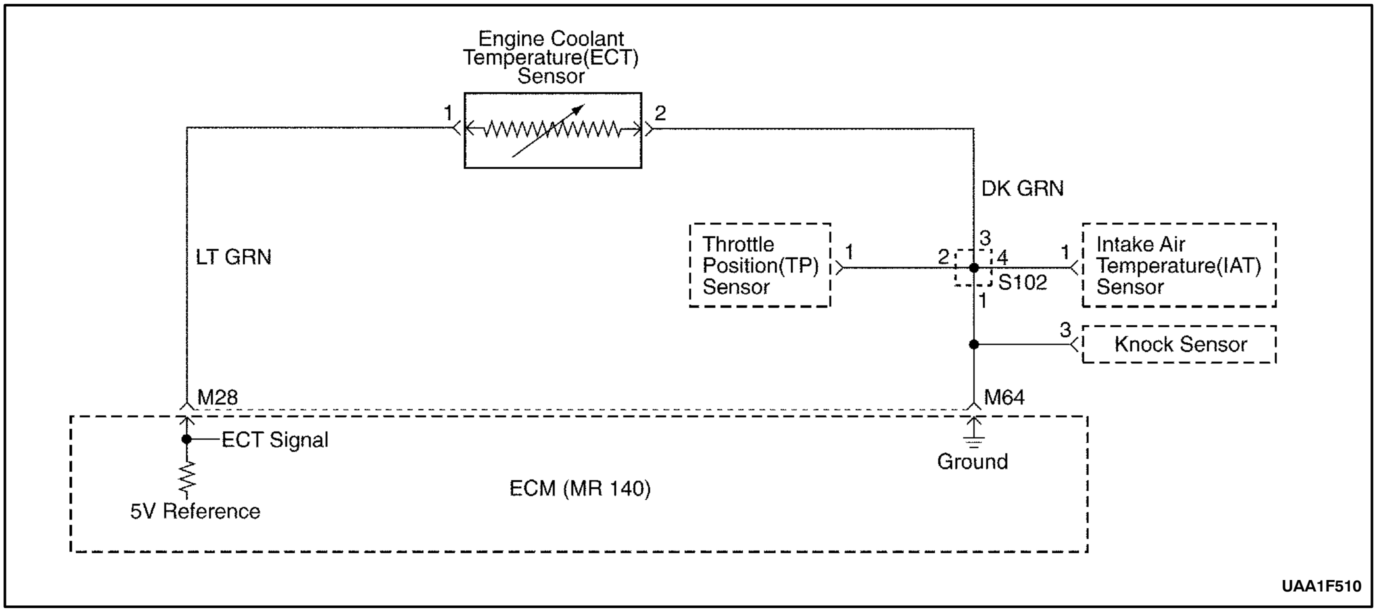


DIAGNOSTIC TROUBLE CODE (DTC) P1114 ENGINE COOLANT TEMPERATURE SENSOR INTERMITTENT LOW VOLTAGE (2.0L DOHC)

Circuit Description

The Engine Coolant Temperature sensor (ECT) is a thermistor mounted in the engine coolant stream. The Engine control Module (ECM) applies 5 volt reference voltage through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor resistance is high, and the ECM will monitor a high signal voltage. As the engine coolant warms, the sensor resistance is less, and the ECT signal voltage measured at the ECM drops. With a fully warmed engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the ECM detects an ECT signal that is intermittently below the range of the ECT sensor, Diagnostic Trouble Code (DTC) P1114 will set.

Conditions for Setting the DTC

- Engine has been running for over one minutes.
- ECT is greater than 149°C (300°F).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Check for the following conditions:

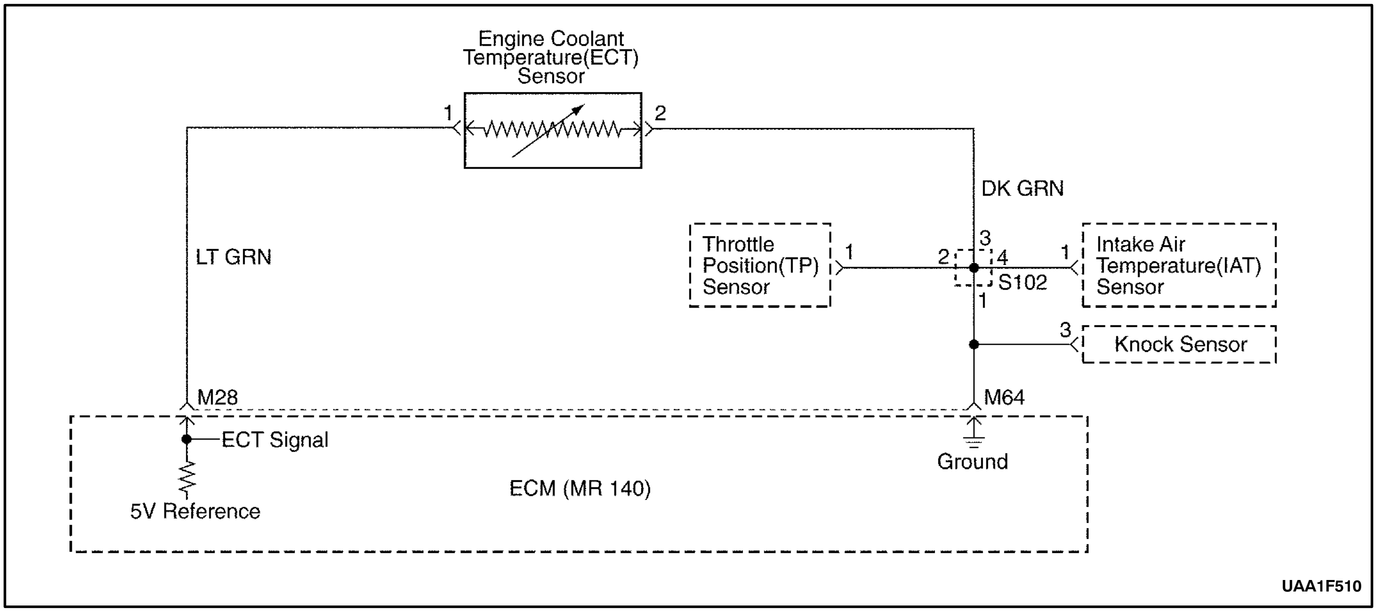
- Poor connection at the ECM. Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness. Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the scan tool while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.
- Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.
- Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to “Temperature vs. Resistance” in this section.

Engine Coolant Temperature Sensor (Temperature Vs. Resistance Value)

°C	°F	Ω	°C	°F	Ω
100	212	177	15	59	4450
80	176	332	5	41	7280
60	140	667	–5	23	12300
45	113	1188	–15	5	21450
35	95	1802	–30	–22	52700
25	77	2796	–40	–40	100700
Above resistance is approximate value					

DTC P1114 – Engine Coolant Temperature Sensor Intermittent Low Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. 3. Request engine Diagnostic Trouble Code (DTC). Is Diagnostic Trouble Code (DTC) P0117 also set?	–	Go to Applicable DTC table	Go to *Step 3*
3	Check the Engine Coolant Temperature (ECT) signal circuit between terminal 1 of the ECT sensor and terminal M28 of the ECM for an intermittent short to ground and repair as needed. Is the repair complete?	–	Go to *Step 4*	Go to “Diagnostic Aids”
4	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 5*	Go to *Step 2*
5	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P1115 ENGINE COOLANT TEMPERATURE SENSOR INTERMITTENT HIGH VOLTAGE (2.0L DOHC)

Circuit Description

The Engine Coolant Temperature sensor (ECT) is a thermistor mounted in the engine coolant stream. The Engine control Module (ECM) applies 5 volt reference voltage through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor resistance is high, and the ECM will monitor a high signal voltage. As the engine coolant warms, the sensor resistance is less, and the ECT signal voltage measured at the ECM drops. With a fully warmed engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the ECM detects an ECT signal that is intermittently above the range of the ECT sensor, Diagnostic Trouble Code (DTC) P1115 will set.

Conditions for Setting the DTC

- Engine has been running for over 90 seconds.
- ECT is less than –38bC (–36bF).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

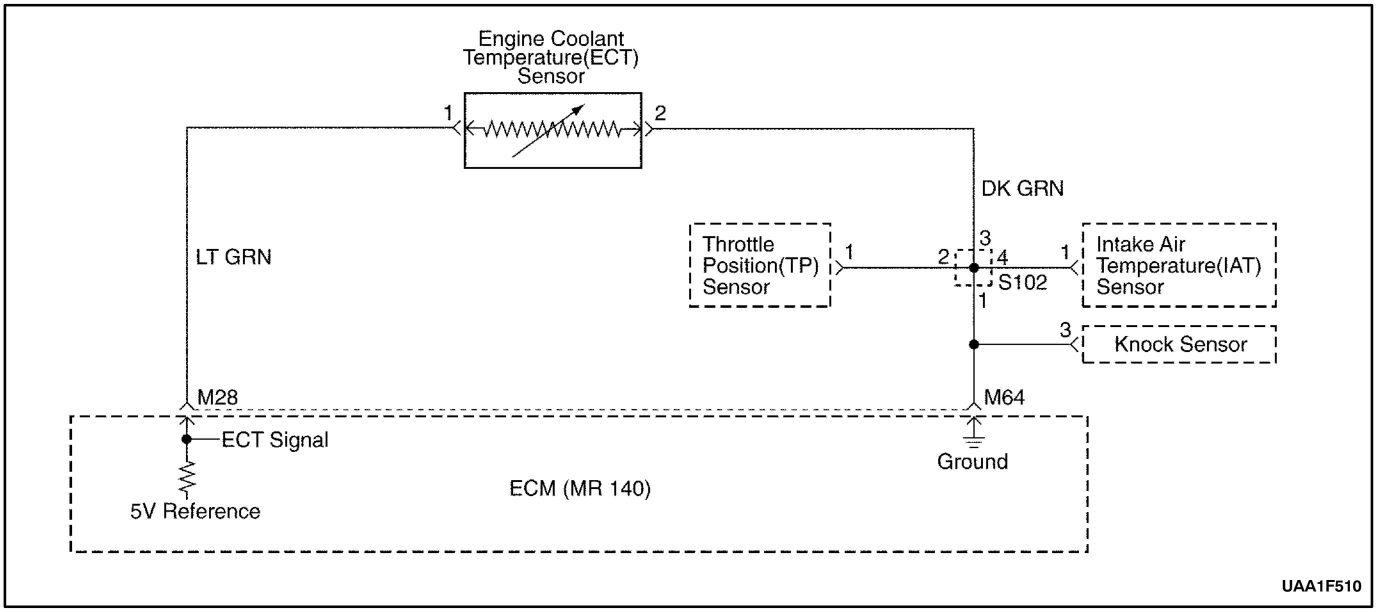
Diagnostic Aids

Check for the following conditions:

- Poor connection at the ECM. Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness. Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the scan tool while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.
- Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.
- Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to “Temperature vs. Resistance” in this section.

DTC P1115 – Engine Coolant Temperature Sensor Intermittent High Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. 3. Request engine Diagnostic Trouble Code (DTC). Is Diagnostic Trouble Code (DTC) P0118 set?	–	Go to Applicable DTC table	Go to *Step 3*
3	Is DTC P1111 also set?	–	Go to Step 7	Go to Step 4
4	Check for a poor sensor ground circuit terminal 2 at the Engine Coolant Temperature (ECT) sensor and repair as needed. Is the repair complete?	–	Go to *Step 9*	Go to *Step 5*
5	Check for a poor sensor signal circuit between terminal 1 of the ECT sensor and terminal M28 of the Engine Control Module (ECM) for an intermittent open and repair as needed. Is the repair complete?	–	Go to *Step 9*	Go to *Step 6*
6	Check for sensor signal circuit between terminal 1 of the ECT sensor and terminal M28 of the ECM for an intermittent short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 9*	Go to *Step 7*
7	Check for poor sensor ground circuit terminal M64 at the ECM and repair as needed. Is the repair complete?	–	Go to *Step 9*	Go to *Step 8*
8	Check for an intermittent open or a faulty splice in the sensor ground circuit and repair as needed. Is the repair complete?	–	Go to *Step 9*	Go to "Diagnostic Aids"
9	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 10*	Go to *Step 2*
10	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0117
ENGINE COOLANT TEMPERATURE SENSOR LOW VOLTAGE (2.0L DOHC)

Circuit Description

The Engine Coolant Temperature (ECT) sensor uses a thermistor to control the signal voltage to the Engine Control Module (ECM). The ECM supplies a 5 volt reference and a ground to the sensor. When the engine coolant is cold, the resistance is high; therefore the ECT signal voltage will be high. If the engine coolant is warm, sensor resistance becomes less; therefore the IAT signal voltage drops. At normal engine operating temperature, the voltage will be between 1.5 to 2.0 volts at the ECT signal terminal.

The ECT sensor is used to control following items:

- Fuel delivery.
- Ignition.
- Evaporative Emission (EVAP) canister purge valve.
- Idle Air Control (IAC) valve.
- Electric cooling fan.

Conditions for Setting the DTC

- Engine run time is greater than 60 seconds.
- ECT is greater than 149°C (300°F).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- Both cooling fans turns on.
- The ECM will default to 20°C (68°F) for engine coolant temperature for the first 60 seconds of engine run time and then 92°C (198°F). The scan tool will not show the defaulted value.

Conditions for Clearing the MIL/DTC

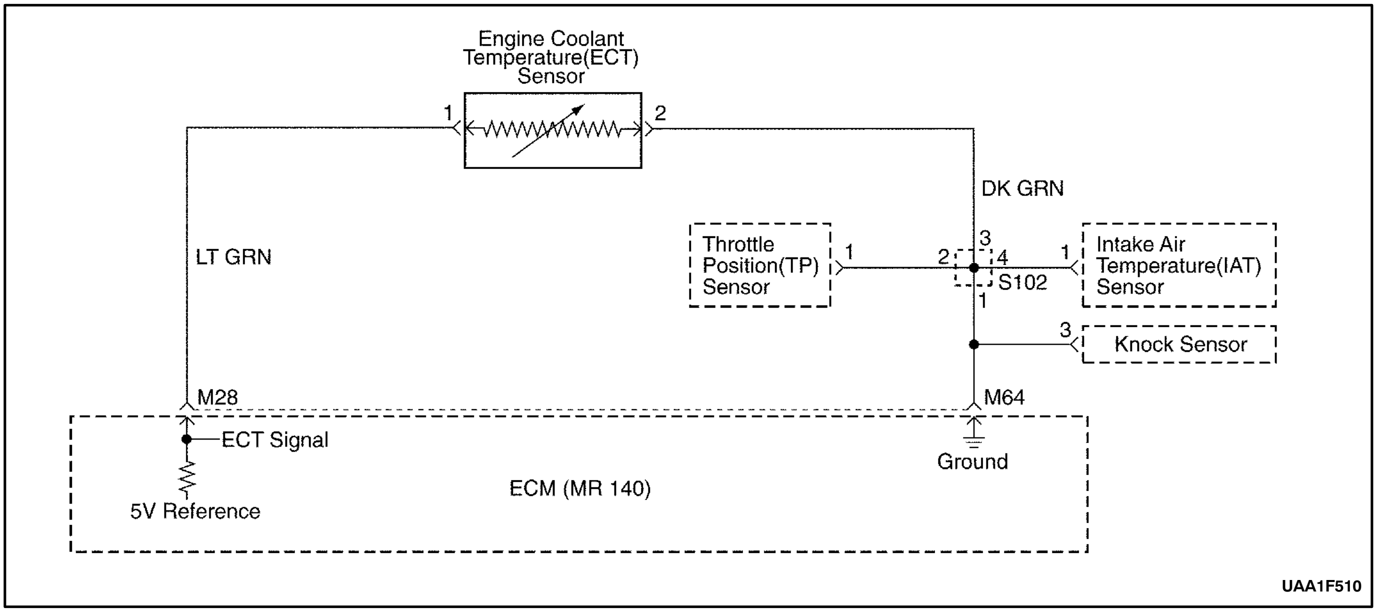
- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

- After engine start the ECT should rise steadily to about 90°C (194°F) then stabilize when the thermostat opens.
- Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to “Temperature vs. Resistance” in this section.

DTC P0117 – Engine Coolant Temperature Sensor Low Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Is the Engine Coolant Temperature (ECT) sensor value greater than the specified value?	130°C (266°F)	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch ON with the engine OFF, review Freeze Frame data, and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Is the ECT sensor value greater than the specified value?	130°C (266°F)	Go to *Step 4*	Go to “Diagnostic Aids”
4	1. Turn the ignition switch OFF. 2. Disconnect the ECT sensor connector. 3. Turn the ignition switch ON. Is the ECT sensor value below the specified value?	–30°C (–22°F)	Go to *Step 6*	Go to *Step 5*
5	Check the ECT sensor signal circuit at terminal 1 for a short to ground and repair as needed. Is the repair complete?	–	Go to *Step 8*	Go to Step 7
6	Replace ECT sensor. Is the repair complete?	–	Go to *Step 8*	–
7	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the action complete?	–	Go to *Step 8*	–
8	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0118
ENGINE COOLANT TEMPERATURE SENSOR HIGH VOLTAGE (2.0L DOHC)

Circuit Description

The Engine Coolant Temperature (ECT) sensor uses a thermistor to control the signal voltage to the Engine Control Module (ECM). The ECM supplies a 5 volt reference and a ground to the sensor. When the engine coolant is cold, the resistance is high; therefore the ECT signal voltage will be high. If the engine coolant is warm, sensor resistance becomes less; therefore the IAT signal voltage drops. At normal engine operating temperature, the voltage will be between 1.5 to 2.0 volts at the ECT signal terminal.

The ECT sensor is used to control following items:

J Fuel delivery.

J Ignition.

J Evaporative Emission (EVAP) canister purge valve.

J Idle Air Control (IAC) valve.

J Electric cooling fan.

Conditions for Setting the DTC

J Engine run time is greater than 90 seconds.

J ECT is greater than –38**b**C (–36**b**F).

Action Taken When the DTC Sets

J The Malfunction Indicator Lamp (MIL) will illuminate.

J The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.

J A history DTC is stored.

J Both cooling fans turns on.

J The ECM will default to 20**b**C (68**b**F) for engine coolant temperature for the first 60 seconds of engine run time and then 92**b**C (198**b**F). The scan tool will not show the defaulted value.

Conditions for Clearing the MIL/DTC

J The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.

J A history DTC will clear after 40 consecutive warm-up cycles without a fault.

J DTC(s) can be cleared by using the scan tool.

J Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

J Normal operating temperature of the engine cooling system is between 90**b**C (194**b**F)and 95**b**C (203**b**F).

J Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to "Temperature vs. Resistance" in this section.

DTC P0118 – Engine Coolant Temperature Sensor High Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Is the engine Coolant Temperature (ECT) value less than the specified value?	–30bC (–22bF)	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch ON with the engine OFF, review Freeze Frame data, and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Is the ECT sensor value less than the specified value?	–30bC (–22bF)	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Turn the ignition switch OFF. 2. Disconnect the ECT sensor connector. 3. Turn the ignition switch ON. 4. Jumper the ECT sensor signal circuit terminal 1 and ground circuit terminal 2. Is the ECT sensor value greater than the specified value?	130bC (266bF)	Go to *Step 6*	Go to *Step 5*
5	Jumper the ECT sensor signal circuit at terminal 1 to ground. Is the ECT sensor value greater than the specified value?	130bC (266bF)	Go to *Step 7*	Go to *Step 8*
6	Check for a poor connection at the ECT sensor connector and repair or replace any malfunctioning terminal as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 10*
7	Check the ECT sensor ground circuit for an open and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to Step 9
8	Check the ECT sensor signal circuit for an open and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 9*
9	Check for a poor ECT sensor ground circuit at terminal M64 or a poor ECT sensor signal circuit terminal M28 connection at Engine Control Module (ECM) and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 11*
10	Replace the ECT sensor. Is the repair complete?	–	Go to *Step 12*	–
11	1. Turn the ignition OFF. 2. Replace the ECM. Is the action complete?	–	Go to *Step 12*	–

DTC P0118 – Engine Coolant Temperature Sensor High Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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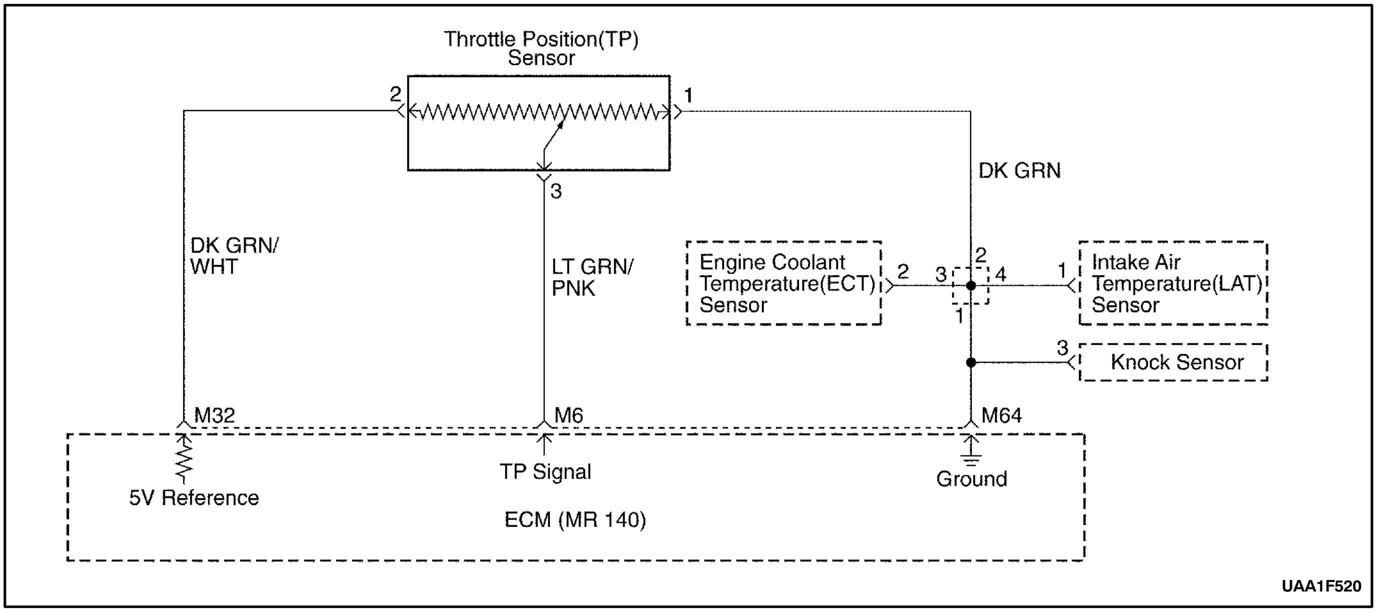


DIAGNOSTIC TROUBLE CODE (DTC) P1121 THROTTLE POSITION SENSOR INTERMITTENT HIGH VOLTAGE (2.0L DOHC)

Circuit Description

The Throttle Position (TP) sensor circuit provides a voltage signal that changes relative to throttle blade angle. The TP sensor sends a voltage signal back to the Engine Control Module (ECM) relative to the throttle plate opening. The voltage signal will vary from approximately 0.33 volts at closed throttle, to over 4.3 volts at Wide Open Throttle (WOT).

The TP signal is used by the ECM for fuel control and for most of the ECM controlled outputs. The TP signal is one of the most important inputs used by the ECM for fuel control and most of the ECM controlled outputs. If the ECM detects a TP signal that is intermittently above the range of the TP sensor, Diagnostic Trouble Code (DTC) P1121 will be set.

Conditions for Setting the DTC

- TP sensor voltage indicates a throttle voltage intermittently greater than 4.9 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history will clear after 40 consecutive warm-up cycles in which the diagnostic runs without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

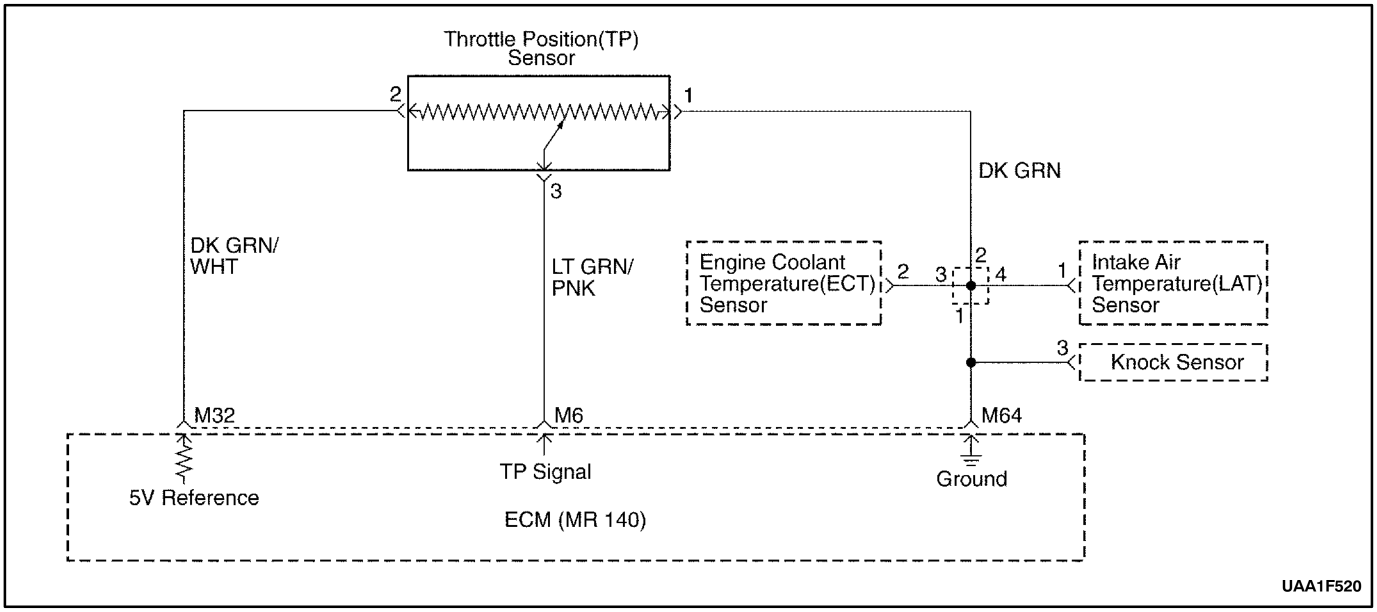
Check for the following conditions:

- Poor connection at the ECM. Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness. Inspect the wiring harness for damage. If the harness appears OK, observe the throttle position display on the scan tool while moving connectors and wiring harnesses related to the TP sensor. A change in the display will indicate the location of the fault.

If DTC P1121 cannot be duplicated, reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P1121 – Throttle Position Sensor Intermittent High Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Is Diagnostic Trouble Code (DTC) P0123 also set?	–	Go to Applicable DTC table	Go to *Step 3*
3	Check for poor sensor ground circuit terminal 1 connection at the Throttle Position (TP) sensor. Is a problem found?	–	Go to *Step 7*	Go to *Step 4*
4	Check the TP signal circuit between TP sensor connector and the Engine Control Module (ECM) for an intermittent short to voltage. Is a problem found?	–	Go to *Step 8*	Go to *Step 5*
5	Check for a poor sensor ground terminal M64 at the ECM. Is a problem found?	–	Go to *Step 7*	Go to *Step 6*
6	Check for an intermittent open or faulty spice in the sensor ground circuit. Is a problem found?	–	Go to *Step 8*	Go to "Diagnostic Aids"
7	Repair or replace the faulty harness connector terminal for sensor ground circuit. Is the repair complete?	–	Go to *Step 9*	–
8	Repair the intermittent open/short circuit in wiring harness as needed. Is the repair complete?	–	Go to *Step 9*	–
9	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 10*	Go to *Step 2*
10	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0122 THROTTLE POSITION SENSOR LOW VOLTAGE (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) supplies a 5 volt reference voltage signal and a ground to the Throttle Position (TP) sensor. The TP sensor sends a voltage signal back to the ECM relative to the throttle plate opening. The voltage signal will vary from approximately 0.33 volts at closed throttle, to over 4.3 volts at Wide Open Throttle (WOT).

The TP signal is used by the ECM for fuel control and for most of the ECM controlled outputs. The TP signal is one of the most important inputs used by the ECM for fuel control and most of the ECM controlled outputs.

Conditions for Setting the DTC

- TP sensor voltage indicates a throttle voltage less than 0.14 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The TP angle will default to 0% when the vehicle speed is less than 3 km/h (2 mph) and 10% when the vehicle speed is greater than 3 km/h (2 mph). The scan tool will not display the default value.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

If the DTC P0122 cannot be duplicated, the information included in the Freeze Frame data can be useful. Use a scan tool information data to determine the status of the DTC. If the dc occurs intermittently, using the Diagnostic table may help isolate the problem.

DTC P0122 – Throttle Position Sensor Low Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Is the Throttle Position (TP) sensor voltage below the specified value?	0.20 V	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition ON. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting the DTC as noted. Is the TP sensor voltage below the specified value?	0.20 V	Go to *Step 4*	Go to *Step 12*
4	1. Turn the ignition OFF. 2. Disconnect the TP sensor connector. 3. Turn the ignition ON. 4. Jump the 5 volt reference circuit terminal 2 and the TP signal circuit terminal 3 at the TP sensor connector. Is the TP sensor voltage over the specified value?	4.0 V	Go to *Step 10*	Go to *Step 5*
5	Connect a test light between B+ and the TP sensor signal circuit terminal 3. Is the TP sensor voltage greater than the specified value?	4.0 V	Go to *Step 6*	Go to *Step 8*
6	Check the TP sensor 5 volt reference circuit for an open or short to ground and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 7*
7	Check the 5 volt reference circuit for a poor connection at terminal M32 of the Engine Control Module (ECM) and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 11*
8	Check the TP sensor signal circuit between terminal 3 of the TP sensor and terminal M6 of the ECM for an open or a short to ground and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 9*
9	Check the TP sensor signal circuit, terminal M6 of the ECM for a poor connection and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 11*
10	Replace the TP sensor. Is the action complete?	–	Go to *Step 12*	–
11	1. Turn the ignition switch OFF. 2. Replace the ECM. Is the action complete?	–	Go to *Step 12*	–

DTC P0122 – Throttle Position Sensor Low Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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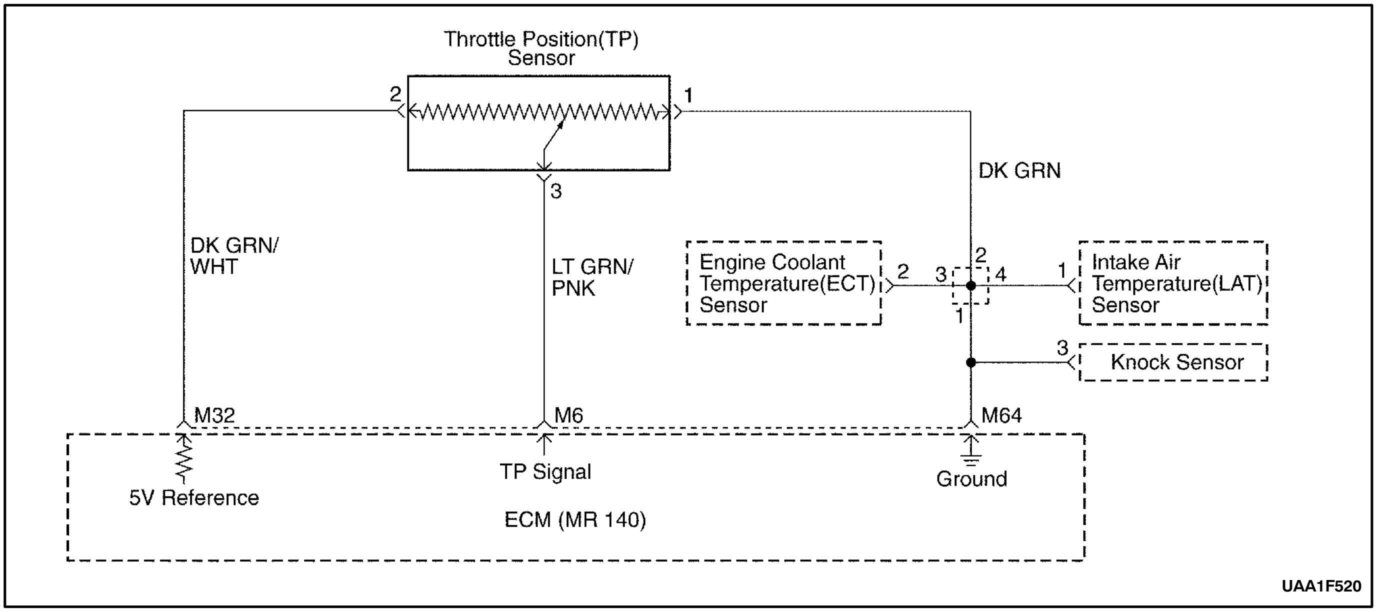


DIAGNOSTIC TROUBLE CODE (DTC) P1122 THROTTLE POSITION SENSOR INTERMITTENT LOW VOLTAGE (2.0L DOHC)

Circuit Description

The Throttle Position (TP) sensor circuit provides a voltage signal that changes relative to throttle blade angle. The TP sensor sends a voltage signal back to the Engine Control Module (ECM) relative to the throttle plate opening. The voltage signal will vary from approximately 0.33 volts at closed throttle, to over 4.3 volts at Wide Open Throttle (WOT).

The TP signal is used by the ECM for fuel control and for most of the ECM controlled outputs. The TP signal is one of the most important inputs used by the ECM for fuel control and most of the ECM controlled outputs. If the ECM detects a TP signal that is intermittently above the range of the TP sensor, Diagnostic Trouble Code (DTC) P1122 will be set.

Conditions for Setting the DTC

- TP sensor voltage indicates a throttle voltage intermittently less than 0.14 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history will clear after 40 consecutive warm-up cycles in which the diagnostic runs without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

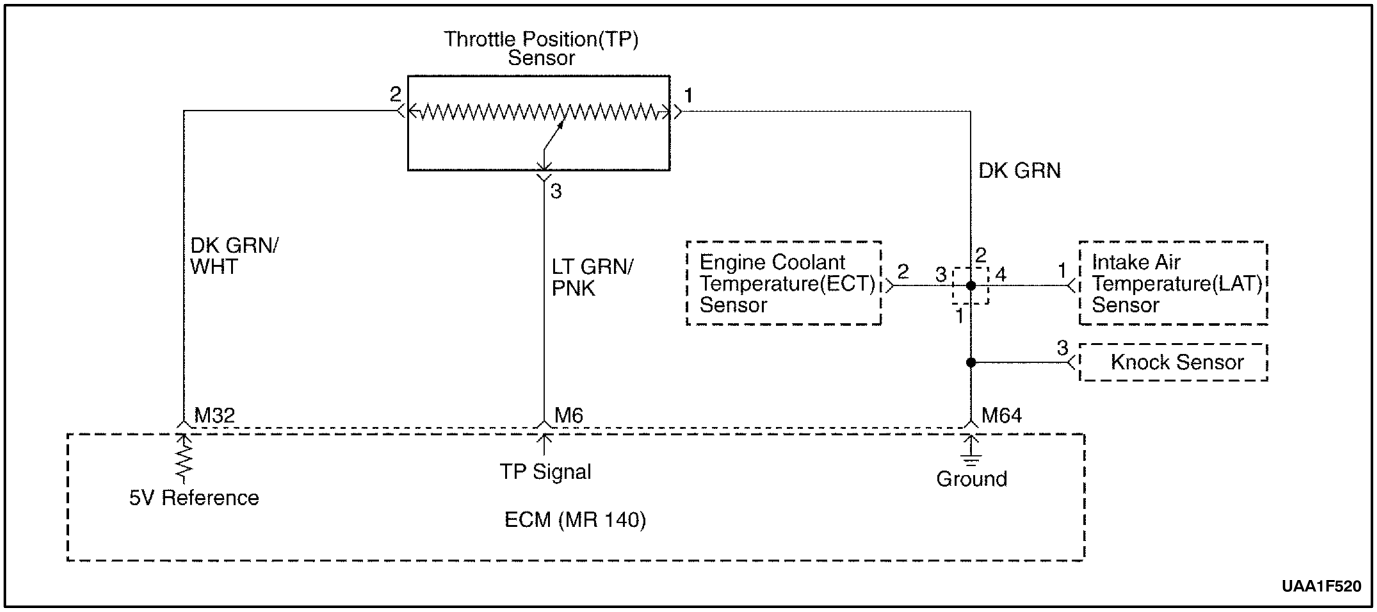
Check for the following conditions:

- Poor connection at the ECM. Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness. Inspect the wiring harness for damage. If the harness appears OK, observe the throttle position display on the scan tool while moving connectors and wiring harnesses related to the TP sensor. A change in the display will indicate the location of the fault.

If DTC P1122 cannot be duplicated, reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P1122 – Throttle Position Sensor Intermittent Low Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Is Diagnostic Trouble Code (DTC) P0123 also set?	–	Go to Applicable DTC table	Go to *Step 3*
3	Check for poor 5 volt reference circuit terminal 2 connection at the Throttle Position (TP) sensor. Is a problem found?	–	Go to *Step 7*	Go to *Step 4*
4	Check the TP signal circuit between TP sensor connector and the Engine Control Module (ECM) for an intermittent open or short to ground. Is a problem found?	–	Go to *Step 8*	Go to *Step 5*
5	Check for a poor 5 volt reference circuit terminal M32 at the ECM. Is a problem found?	–	Go to *Step 7*	Go to *Step 6*
6	Check for an intermittent open in the 5 volt reference circuit. Is a problem found?	–	Go to *Step 8*	Go to "Diagnostic Aids"
7	Repair or replace the faulty harness connector terminal for 5 volt reference circuit and/or the TP signal circuit as needed. Is the repair complete?	–	Go to *Step 9*	–
8	Repair the intermittent open/short circuit in wiring harness as needed. Is the repair complete?	–	Go to *Step 9*	–
9	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 10*	Go to *Step 2*
10	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0123 THROTTLE POSITION SENSOR HIGH VOLTAGE (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) supplies a 5 volt reference voltage signal and a ground to the Throttle Position (TP) sensor. The TP sensor sends a voltage signal back to the ECM relative to the throttle plate opening. The voltage signal will vary from approximately 0.33 volts at closed throttle, to over 4.3 volts at Wide Open Throttle (WOT).

The TP signal is used by the ECM for fuel control and for most of the ECM controlled outputs. The TP signal is one of the most important inputs used by the ECM for fuel control and most of the ECM controlled outputs.

Conditions for Setting the DTC

- TP sensor voltage indicates a throttle voltage greater than 4.9 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The TP angle will default to 0% when the vehicle speed is less than 3 km/h (2 mph) and 10% when the vehicle speed is greater than 3 km/h (2 mph). The scan tool will not display the default value.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

If the DTC P0123 cannot be duplicated, the information included in the Freeze Frame data can be useful. Use a scan tool information data to determine the status of the DTC. If the dc occurs intermittently, using the Diagnostic table may help isolate the problem.

With ignition ON and the throttle at closed position, the voltage should read between 0.2 and 0.90 volts and increase steadily to over 4.3 volts at WOT.

DTCs P0123 and P0113 stored at the same time could be result of an open sensor ground circuit.

DTC P0123 – Throttle Position Sensor High Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Is the Throttle Position (TP) sensor voltage greater than the specified value?	1.0 V	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition ON. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting the DTC as noted. Is the TP sensor voltage greater than the specified value?	3.9 V	Go to *Step 4*	Go to *Step 12*
4	1. Turn the ignition OFF. 2. Disconnect the TP sensor connector. 3. Turn the ignition ON. Is the TP sensor voltage less than the specified value?	0.2 V	Go to *Step 5*	Go to *Step 6*
5	Probe the TP sensor ground circuit, terminal 1 at the TP sensor connector with a test light connected to B+. Does the test light illuminate?	–	Go to *Step 7*	Go to *Step 9*
6	Check the TP sensor signal circuit for an short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 11*
7	Check the 5 volt reference circuit for a short to B+ and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 8*
8	Check the TP sensor electric connector for a poor connection and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 10*
9	Check the TP sensor ground circuit for an open and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 11*
10	Replace the TP sensor. Is the action complete?	–	Go to *Step 12*	–
11	1. Turn the ignition switch OFF. 2. Replace the Engine Control Module (ECM). Is the action complete?	–	Go to Step 12	–
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 13*	Go to *Step 2*

DTC P0123 – Throttle Position Sensor High Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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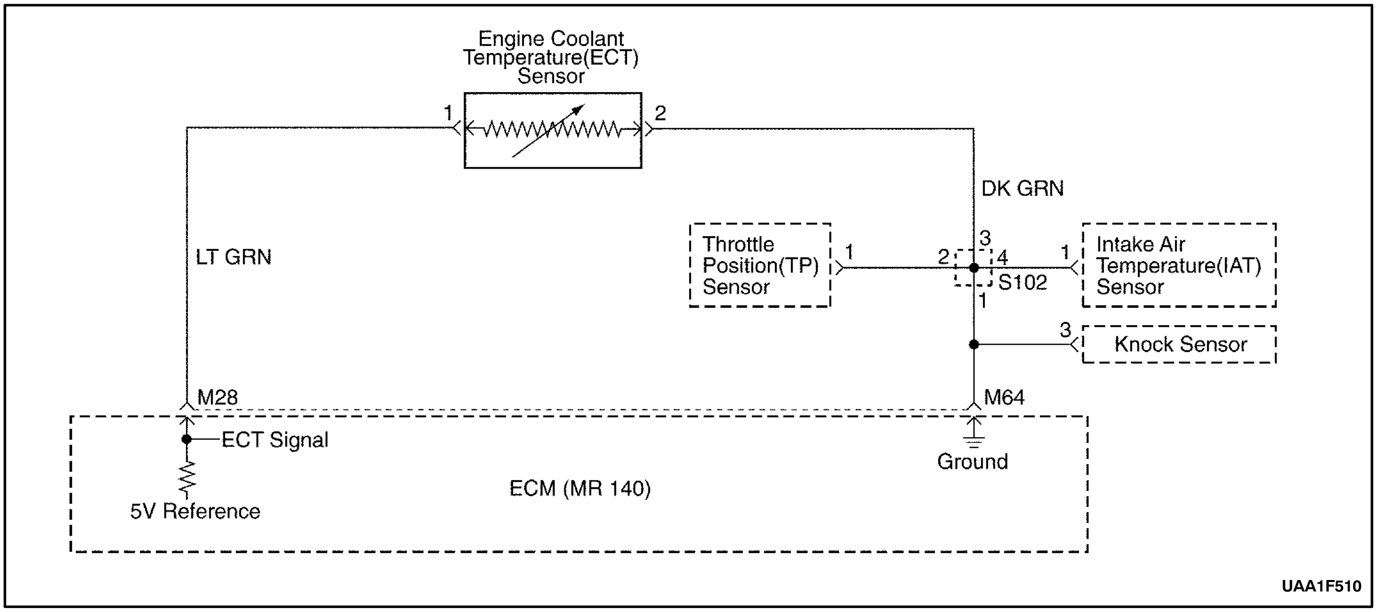

DIAGNOSTIC TROUBLE CODE (DTC) P0125 ENGINE COOLANT TEMPERATURE INSUFFICIENT FOR CLOSED LOOP FUEL CONTROL (2.0L DOHC)

Circuit Description

When the vehicle is first started, it operates in Open Loop, ignoring the oxygen sensor (O2S) signal and calculating the fuel/air ratio based on inputs from the Engine Coolant Temperature (ECT), Throttle Position (TP), and Manifold Absolute Pressure (MAP) sensors only. The Engine Control Module (ECM) will begin using the O2S signal for controlling fuel delivery (Closed Loop) when the following conditions are met:

- **J** The engine has run a minimum amount of time based on ECT at engine start up.
- **J** The O2S has a varying voltage output showing that it is hot enough to operate properly.
- **J** The ECT has increased a minimum amount based on ECT at engine start up.

Conditions for Setting the DTC

- **J** Engine running.
- **J** DTCs P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0201, P0202, P0203, P0204, P0351, P0352, and P0502 are not set.
- **J** Start-up coolant temperature is less than or equal to 32**b**C (89.6**b**F).
- **J** If the ambient temperature is less than or equal to 10**b**C (50**b**F) the accumulated airflow is greater than 1200 grams and accumulated idle time is less than 90 seconds.
- **J** If ambient temperature is between –7**b**C (20**b**F) and 10**b**C (50**b**F) the accumulated airflow is greater than 3200 grams and accumulated idle time is less than 225 seconds.
- **J** If ambient temperature is between –38**b**C (–36.4**b**F) and –7**b**C (20**b**F) the accumulated airflow is greater than 5000 grams and accumulated idle time is less than 675 seconds.
- **J** If ambient temperature is greater than 10**b**C (50**b**F), the time for coolant to reach a stabilized closed loop value (21**b**C [69.8**b**F]) is greater than 2 minutes.
- **J** If ambient temperature is between –7**b**C (20**b**F) and 10**b**C (50**b**F), the time for coolant to reach a stabilized closed loop value (16**b**C [60.8**b**F]) is greater than 5 minutes.
- **J** If ambient temperature is between –38**b**C (–36.4**b**F) and –7**b**C (20**b**F) the time for coolant to reach a stabilized closed loop value (20**b**C [68**b**F]) is greater than to 15 minutes.

Action Taken When the DTC Sets

- **J** The Malfunction Indicator Lamp (MIL) will illuminate.
- **J** The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- **J** A history DTC is stored.
- **J** Both coolant fans turn on.

Conditions for Clearing the MIL/DTC

- **J** The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- **J** A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- **J** The DTC(s) can be cleared by using the scan tool.

J Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

When DTC P0125 is set, a skewed ECT sensor or a stuck open thermostat is indicated.

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation.

Check for a poor connection or damaged ECM harness. Inspect the ECT sensor signal circuit and ground circuit terminals for the following conditions:

J Improper mating.

J Broken locks.

J Improperly formed.

J Damaged terminals.

J Poor terminal-to-wire connection.

J Damaged harness.

Perform an intermittent test. If the connections and the harness check OK, monitor a Digital Voltmeter connected between ECT sensor signal circuit and ground circuit terminals while moving the related connectors and the wiring harness. If a fault is induced, the resistance reading will change. This may help to isolate the location of the malfunction.

Use the Temperature vs. Resistance table to evaluate the possibility of a skewed sensor.

DTC P0125 – Engine Coolant Temperature Insufficient For Closed Loop Fuel Control (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Allow the engine to cool fully to ambient temperature. 2. Install a scan tool to the Data Link Connector (DLC). 3. Turn the ignition switch ON. 4. Compare the Engine Coolant Temperature (ECT) sensor reading to the Intake Air Temperature (IAT) sensor readings. Are the temperature readings close?	–	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the ECT sensor connector. 3. Turn the ignition ON, engine OFF. 4. Using a ohmmeter, measure the resistance across the ECT sensor terminals 1 and 2. 5. Check the ECT sensor value to actual coolant temperature using the Temperature vs. Resistance table. Does the ECT sensor accurately reflect the actual engine coolant temperature?	–	Go to *Step 4*	Go to *Step 11*
4	1. Turn the ignition OFF. 2. Disconnect the ECT sensor connector. 3. Turn the ignition ON, engine OFF. Is the ECT sensor value less than the specified value?	–30bC (–22bF).	Go to *Step 5*	Go to *Step 8*
5	Jumper the ECT sensor signal circuit terminal 1 and the sensor ground circuit terminal 2 at the connector. Is the ECT sensor value greater than the specified value?	130bC (266bF).	Go to *Step 6*	Go to *Step 7*
6	Check for proper cooling system operation and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to "Diagnostic Aids"

DTC P0125 – Engine Coolant Temperature Insufficient For Closed Loop Fuel Control (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
7	Check the ECT sensor connector terminals 2 and 1 and Engine Control Module (ECM) electrical connector terminals M28 and M64 for poor connectors or malfunctioning terminals and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 8*
8	Check the ECT sensor signal circuit for an open or short to ground and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 9*
9	Check the ECT ground circuit for an open and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 10*
10	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 12*	–
11	Replace the ECT sensor. Is the repair complete?	–	Go to *Step 12*	–
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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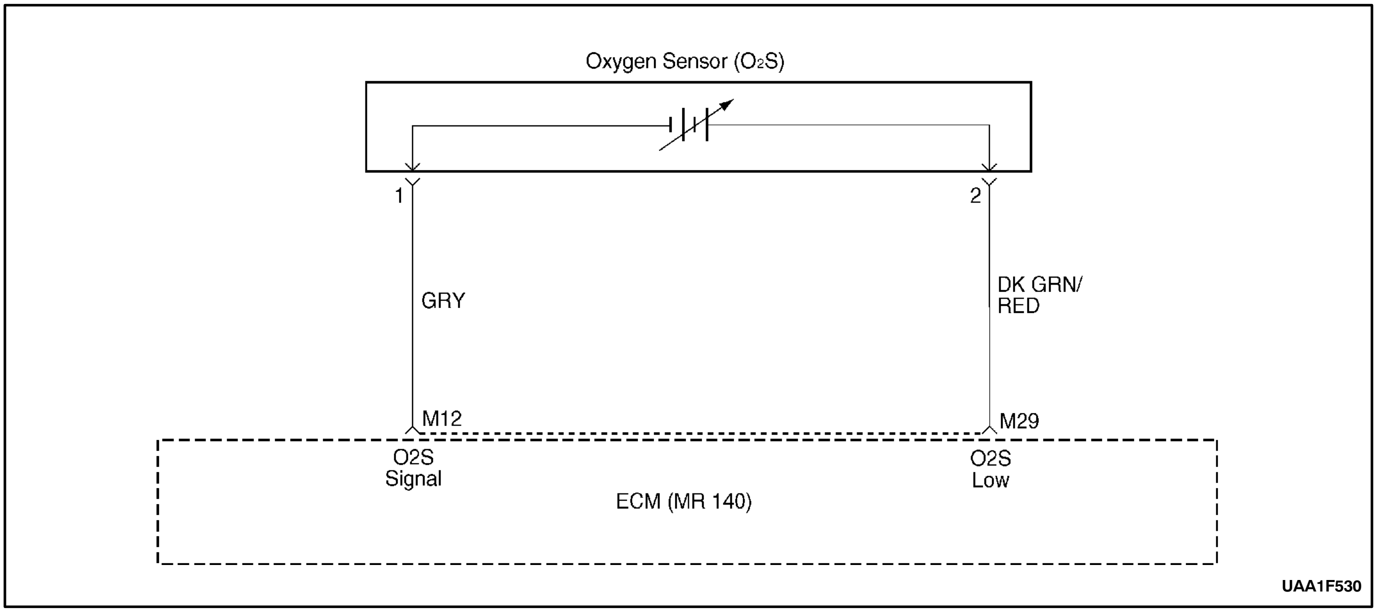


DIAGNOSTIC TROUBLE CODE (DTC) P0131
OXYGEN SENSOR LOW VOLTAGE (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) supplies a voltage of about 0.45 volts between terminals M12 and M29 (if measured with a 10 megohm digital voltmeter, this may read as low as 0.32 volts). The Oxygen Sensor (O2S) varies the voltage within a range of about 1 volt if the exhaust is rich, down through about 0.10 volts if the exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below 315**b**C (600**b**F). An open sensor circuit or cold sensor causes Open Loop operation.

If the O2S pigtail wiring, connector, or terminal is damaged, the entire O2S assembly must be replaced. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the O2S wire(s). Any attempt to repair the wires, connector or terminals could result in the obstruction of the air reference and degrade the O2S performance. Refer to “Oxygen Sensor” in this section.

Conditions for Setting the DTC

J O2S voltage is less than 0.05 volts.

J Closed loop stoichiometry.

J Engine Coolant Temperature (ECT) is greater than 60**b**C (140**b**F).

J System voltage is greater than 10 volts.

J DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0351, P0352, P0402, P0404, P0405, P0406, P0506, P0507, P1404, and P0443 are not set.

J 3 second delay after conditions are met.

Action Taken When the DTC Sets

J The Malfunction Indicator Lamp (MIL) will illuminate.

J The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.

J A history DTC is stored.

J The vehicle will operate in Open Loop.

Conditions for Clearing the MIL/DTC

J The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.

J A history DTC will clear after 40 consecutive warm-up cycles without a fault.

J The DTC(s) can be cleared by using the scan tool.

J Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

The DTC P0131 or lean exhaust is most likely caused by one of the following items:

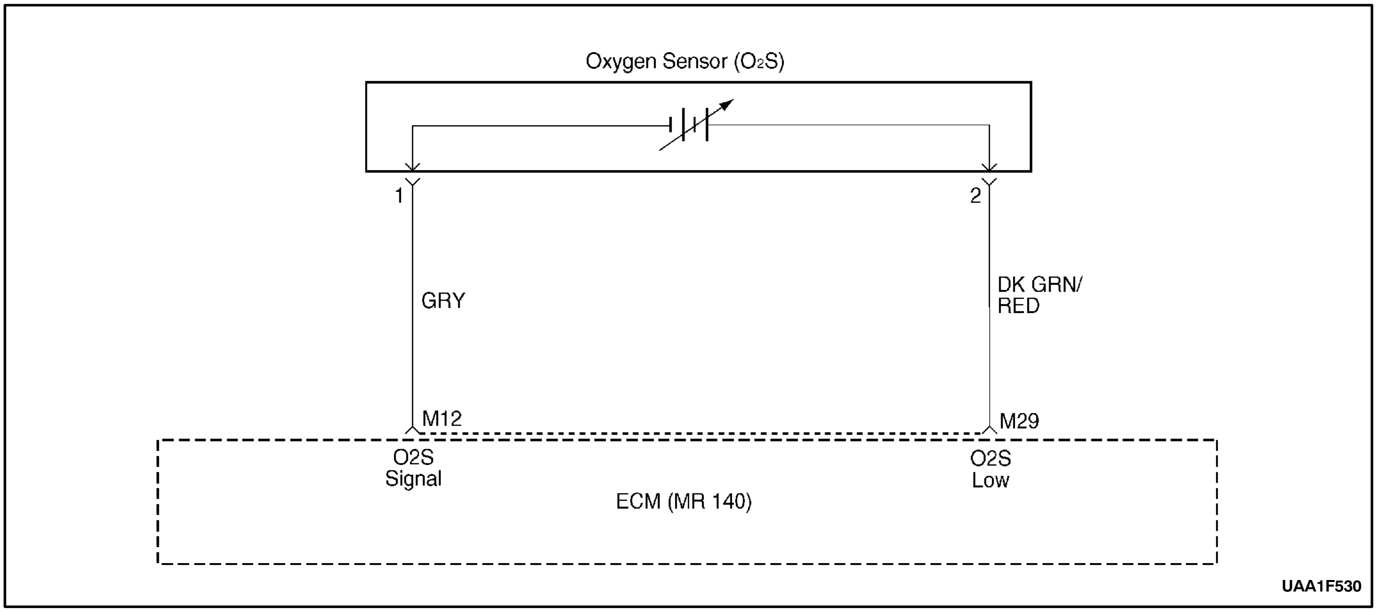
J Fuel pressure – The system will be lean if the fuel pressure is too low. It may be necessary to monitor the fuel pressure while driving the vehicle at various road speeds and/or loads to confirm. Refer to “Fuel System Diagnosis” in this section.

J Manifold Absolute Pressure (MAP) sensor – An output that causes the ECM to sense a lower than normal manifold pressure (high vacuum) can cause the system to go lean. Disconnecting the MAP sensor will allow the ECM to substitute a fixed (default) value for the MAP sensor. If the lean condition is gone when the sensor is disconnected, substitute a known good sensor and recheck.

- Fuel contamination – Water, in even small amounts near the in-tank fuel pump inlet can be delivered to the injector. The water causes a lean exhaust and can set DTC P0131.
- Sensor harness – The O2S sensor pigtail may be mis-positioned and contacting the exhaust manifold.
- Engine misfire – A misfiring cylinder will result in unburned oxygen in the exhaust, which could cause DTC P0131 to set. Refer to DTC P0300 Engine Misfire in this section.
- Cracked Oxygen sensor – A cracked O2S or poor ground at the sensor could cause DTC P0131. Refer to "Symptoms Diagnosis" in this section.
- Plugged fuel filter – A plugged fuel filter can cause a lean condition and cause a DTC P0131 to set.
- Plugged Oxygen Sensor – A plugged reference port on the O2S will indicate a lower-than-normal voltage output from the O2S.

DTC P0131 – Oxygen Sensor Low Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Start the engine and idle at normal operating temperature. Does the Oxygen Sensor (O2S) voltage remain below the value specified?	0.1 V	Go to *Step 4*	Go to *Step 3*
3	1. Review the Freeze Frame data and note the parameters. 2. Operate the vehicle within the Freeze frame conditions and Conditions For Setting the DTC as noted. Does the O2S voltage stay below the specified value?	0.1 V	Go to *Step 4*	Go to *Step 7*
4	1. Turn the ignition OFF. 2. Disconnect O2S connector. 3. Turn the ignition ON. Does the scan tool indicate the O2S voltage within the specified value?	407–509 mV	Go to "Diagnostic Aids"	Go to *Step 5*
5	Check the O2S signal circuit, terminal 1 for a short to ground and repair as needed. Is the repair complete?	–	Go to *Step 7*	Go to *Step 6*
6	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 7*	–
7	1. If disconnected, reconnect O2S connector. 2. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle at normal operating temperature. 4. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 8*	Go to *Step 2*
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0132
OXYGEN SENSOR HIGH VOLTAGE (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) supplies a voltage of about 0.45 volts between terminals M12 and M29 (if measured with a 10 megohm digital voltmeter, this may read as low as 0.32 volts). The Oxygen Sensor (O2S) varies the voltage within a range of about 1 volt if the exhaust is rich, down through about 0.10 volts if the exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below 315°C (600°F). An open sensor circuit or cold sensor causes Open Loop operation.

If the O2S pigtail wiring, connector, or terminal is damaged, the entire O2S assembly must be replaced. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the O2S wire(s). Any attempt to repair the wires, connector or terminals could result in the obstruction of the air reference and degrade the O2S performance. Refer to “Oxygen Sensor” in this section.

Conditions for Setting the DTC

- O2S voltage is less than 0.952 volts.
- Closed loop stoichiometry.
- Engine Coolant Temperature (ECT) is greater than 60°C (140°F).
- System voltage is greater than 10 volts.
- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0351, P0352, P0402, P0404, P0405, P0406, P0506, P0507, P1404, and P0443 are not set.
- 3 second delay after conditions are met.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The vehicle will operate in Open Loop.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

The DTC P0132 or rich exhaust is most likely caused by one of the following items:

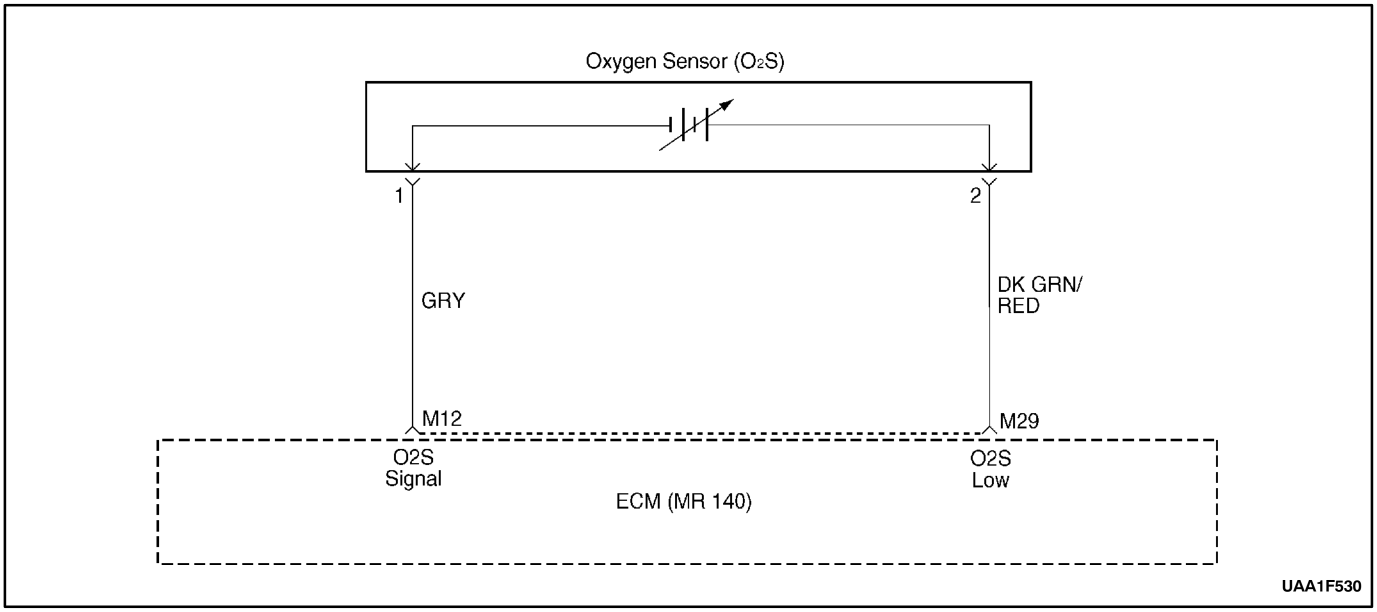
- Fuel pressure – The system will go rich if the fuel pressure is too high. The ECM can compensate for some increase, but if it gets too high, a DTC P0132 will be set
- Leaking injector – A leaking or malfunctioning injector can cause the system to go rich causing a DTC P0132.
- Manifold Absolute Pressure (MAP) sensor – An output that causes the ECM to sense a higher than normal manifold pressure (low vacuum) can cause the system to go rich. Disconnecting the MAP sensor will allow the ECM to substitute a fixed value for the MAP

sensor. Substitute a different a MAP sensor, if the rich condition is gone while the sensor is disconnected.

- Pressure regulator – Check for a leaking fuel pressure regulator diaphragm by checking for the presence of liquid fuel in the vacuum line to the regulator.
- TP sensor – An intermittent TP sensor output will cause the system to go rich due to a false indication of the engine accelerating.
- O2S contamination – Inspect the O2S for silicone contamination from fuel or the use of improper Room Temperature Vulcanizing sealant. The sensor may have a white powdery coating which may result in a high but false voltage signal (rich exhaust indication). The ECM will then reduce the amount of fuel delivered to the engine, causing a severe surge or driveability problem.

DTC P0132 – Oxygen Sensor High Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Start the engine and idle at normal operating temperature. Does the Oxygen Sensor (O2S) voltage remain below the value specified?	952 mV	Go to *Step 4*	Go to *Step 3*
3	1. Review the Freeze Frame data and note the parameters. 2. Operate the vehicle within the Freeze frame conditions and Conditions For Setting the DTC as noted. Does the O2S voltage stay below the specified value?	952 mV	Go to *Step 4*	Go to *Step 7*
4	1. Turn the ignition OFF. 2. Disconnect O2S connector. 3. Turn the ignition ON. 4. Jumper the Engine Control Module (ECM) side O2S signal circuit to ground. Does the scan tool indicate the O2S voltage below the specified value?	500 mV	Go to “Diagnostic Aids”	Go to *Step 5*
5	Check the O2S signal circuit, terminal 1 for a short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 7*	Go to *Step 6*
6	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 7*	–
7	1. If disconnected, reconnect O2S connector. 2. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle at normal operating temperature. 4. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 8*	Go to *Step 2*
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0133 OXYGEN SENSOR AVERAGE RESPONSE TIME (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) continuously monitors the Oxygen Sensor (O2S) activity for 100 seconds. During the monitor period, the ECM counts the number of times that the O2S switches from rich to lean and from lean to rich and adds the amount of time it took to complete all switches. With this information, an average time for all switches can be determined. If the average time to switch is too out of specification, a DTC P0133 will set.

If the O2S pigtail wiring, connector, or terminal is damaged, the entire O2S assembly must be replaced. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the O2S wire(s). Any attempt to repair the wires, connector, or terminals could result in the obstruction of the air reference and degrade O2S performance.

Conditions for Setting the DTC

- O2S average transition time between 0.3–0.6 volts, lean to rich is greater than 86 milliseconds or rich to lean is greater than 117 milliseconds.
- Closed loop stoichiometry.
- Engine Coolant Temperature (ECT) is greater than 70°C (158°F).
- System voltage is greater than 10 volts.
- Engine run time is greater than 60 seconds.
- Purge Duty Cycle (DC) is less than 20%.
- The rpm is between 1600 and 4300.
- Airflow is between 9 and 40 g/sec.
- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0131, P0132, P0134, P1167, P0171, P1171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0351, P0352, P0402, P0404, P0405, P0406, P0506, P0507, P1404, and P0443 are not set.
- 2 second delay after conditions are met.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

DTC P0133 or slow response is most likely caused by one of the following items:

- Fuel pressure – The system will go rich if fuel pressure is too high. The ECM can compensate for some increase, but if it gets too high, a DTC P0133 may set. Refer to “Fuel System Diagnosis” in this section.

- Leaking injector – A leaking or malfunctioning injector can cause the system to go rich.
- Manifold Absolute Pressure (MAP) sensor – An output that causes the ECM to sense a higher than normal manifold pressure (low vacuum) can cause the system to go rich. Disconnecting the MAP sensor will allow the ECM to set a fixed value for the MAP sensor. Substitute a different MAP sensor if the rich condition is gone while the sensor is disconnected.
- Pressure regulator – Check for a leaking fuel pressure regulator diaphragm by checking for the presence of liquid fuel in the vacuum line to the pressure regulator.
- Throttle Position (TP) sensor – An intermittent TP sensor output can cause the system to go rich due to a false indication of the engine accelerating.
- O2S contamination – Inspect O2S for silicone contamination from fuel or use of improper room temperature vulcanizing (RTV) sealant. The sensor may have a white powdery coating, resulting in a high but false voltage signal (rich exhaust indication). The ECM will then reduce the amount of fuel delivered to the engine causing a severe surge or driveability problem..

DTC P0133 – Oxygen Sensor Average Response Time (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Are any additional Diagnostic Trouble Codes (DTCs) set?	–	Go to Applicable DTC table	Go to *Step 3*
3	1. Start the engine and idle at normal operating temperature. 2. Operate the vehicle within the specified parameter under the Conditions For Setting the DTC. 3. Using the scan tool monitor the specific DTC information for DTC P0133 until DTC P0133 test run. Does the scan tool indicate DTC P0133 failed this ignition cycle?	–	Go to *Step 4*	Go to "Diagnostic Aids"
4	Did the scan tool indicate that DTC P1133 or P1134 failed this ignition cycle.	–	Go to Applicable DTC table	Go to Step 5
5	Check the exhaust manifold/catalytic converter for a leak and repair as needed. Is the repair complete?	–	Go to *Step 16*	Go to *Step 6*
6	Visually/physically inspect for the following items: • Oxygen Sensor (O2S) is securely installed. • Corrosion on the terminals. • Terminal tension. • O2S wiring harness for poor terminal connection or damaged wiring. Is a problem found in any of the above areas?	–	Go to *Step 9*	Go to *Step 7*
7	1. Turn the ignition OFF. 2. Disconnect the O2S connector. 3. Jumper the O2S low circuit, terminal 2 to ground. 4. Turn the ignition ON. Does the scan tool indicate the voltage between the specified value?	400–500 mV	Go to *Step 8*	Go to *Step 10*

DTC P0133 – Oxygen Sensor Average Response Time (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
8	Jumper the O2S signal and low circuit terminal 1 and 2 to ground. Does the scan tool indicate the voltage below the specified value?	200 mV	Go to *Step 15*	Go to *Step 13*
9	Repair the condition as needed. Is the repair complete?	–	Go to *Step 16*	–
10	1. Turn the ignition OFF. 2. Disconnect the ECM connector. 3. Check the O2S low circuit for an open or poor connection and repair as needed. Is the repair complete?	–	Go to *Step 16*	Go to *Step 11*
11	Check the terminal M29 of the ECM for poor connection and repair as needed. Is the repair complete?	–	Go to *Step 16*	Go to *Step 14*
12	Check the O2S signal circuit for an open or short to ground and repair as needed. Is the repair complete?	–	Go to *Step 16*	Go to *Step 13*
13	Check the terminal M12 of the ECM for poor connection and repair as needed. Is the repair complete?	–	Go to *Step 16*	Go to *Step 14*
14	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 16*	–
15	Replace the O2S. Is the repair complete?	–	Go to *Step 16*	–
16	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 17*	Go to *Step 2*
17	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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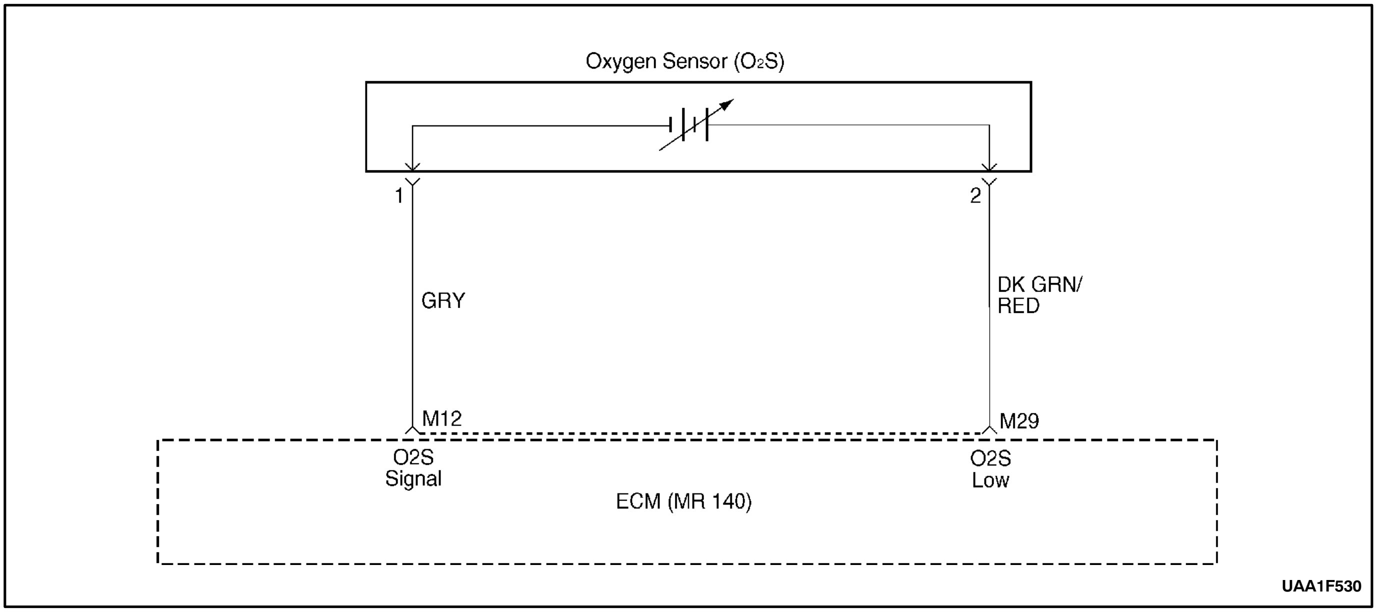

DIAGNOSTIC TROUBLE CODE (DTC) P1133
OXYGEN SENSOR TOO FEW TRANSITION (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) continuously monitors the Oxygen Sensor (O2S) activity for 100 seconds. During the monitor period, the ECM counts the number of times that the O2S switches from rich to lean and from lean to rich. With this information, a total for all switches can be determined. If the number of switches is too low, a Diagnostic Trouble code (DTC) P1133 will set. The lean-to-rich and rich-to-lean are less than 15 switches.

Conditions for Setting the DTC

J O2S signal switches from 0.3 to 0.6 volts and 06 to 03 volts is less than 15 times within 90seconds.

J Closed loop stoichiometry.

J Engine Coolant Temperature (ECT) is greater than 70**b**C (158**b**F).

J System voltage is greater than 10 volts.

J Engine run time is greater than 60 seconds.

J Purge Duty Cycle (DC) is less than 20%.

J The rpm is between 1600 and 4300.

J Airflow is between 9 and 40 g/sec.

J DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0131, P0132, P0134, P1167, P0171, P1171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0351, P0352, P0402, P0404, P0405, P0406, P0506, P0507, P1404, and P0443 are not set.

J 2 second delay after conditions are met.

Action Taken When the DTC Sets

J The Malfunction Indicator Lamp (MIL) will illuminate.

J The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.

J A history DTC is stored.

Conditions for Clearing the MIL/DTC

J The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.

J A history DTC will clear after 40 consecutive warm-up cycles without a fault.

J The DTC(s) can be cleared by using the scan tool.

J Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

DTC P1133 is most likely caused by one of the following items:

J Fuel Pressure – The system will go rich if the fuel pressure is too high. The ECM can compensate for some increase. However, if it gets too high, a DTC P1133 may set. Refer to “Fuel System Diagnosis” in this section.

J Leaking injector – A leaking or malfunctioning injector can cause the system to go rich.

J Manifold Absolute Pressure (MAP) sensor – An output that causes the ECM to sense a higher than normal manifold pressure (low vacuum) can cause the system to go rich. Disconnecting the MAP sensor will allow the ECM to set a fixed value for the MAP sensor. Substitute a different MAP sensor if the rich condition is gone while the sensor is disconnected.

- **J** Pressure regulator – Check for a leaking fuel pressure regulator diaphragm by checking for the presence of liquid fuel in the vacuum line to the pressure regulator.
- **J** Throttle Position (TP) sensor – An intermittent TP sensor output can cause the system to go rich due to a false indication of the engine accelerating.
- **J** O2S contamination – Inspect the O2S for silicone contamination from fuel or improper use of Room Temperature Vulcanizing (RTV) sealant. The sensor may have a white powdery coating and result in a high but false voltage signal (rich exhaust indication). The ECM will then reduce the amount of fuel delivered to the engine causing a severe surge or driveability problem.

DTC P1133 – Oxygen Sensor Too Few Transition (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Are any additional Diagnostic Trouble Codes (DTCs) set?	–	Go to Applicable DTC table	Go to *Step 3*
3	1. Start the engine and idle at normal operating temperature. 2. Operate the vehicle within the specified parameter under the Conditions For Setting the DTC. 3. Monitor the lean-to-rich transition and rich-to-lean transition and note the number of switches. Does the parameter show fewer transitions than the specified value within 90 seconds.	15	Go to *Step 4*	Go to *Step 16*
4	Visually/physically inspect for the following items: **J** Oxygen Sensor (O2S) is securely installed. **J** Corrosion on the terminals. **J** Terminal tension. **J** O2S wiring harness for poor terminal connection or damaged wiring. Is a problem found in any of the above areas?	–	Go to *Step 9*	Go to *Step 5*
5	Check the exhaust manifold for a leak near the engine and repair as needed. Is the repair complete?	–	Go to *Step 3*	Go to *Step 6*
6	1. Turn the ignition OFF. 2. Disconnect the O2S connector. 3. Jumper the O2S low circuit, terminal 2 to ground. 4. Turn the ignition ON. Does the scan tool indicate the voltage between the specified value?	400–500 mV	Go to *Step 7*	Go to *Step 10*
7	Jumper the O2S signal and low circuit terminal 1 and 2 to ground. Does the scan tool indicate the voltage below the specified value?	200 mV	Go to *Step 8*	Go to *Step 11*

DTC P1133 – Oxygen Sensor Too Few Transition (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition OFF. 2. Replace the O2S. **Note:** before replacing the sensor, the cause of the contamination must be determined and corrected in order to prevent further damage to the sensor. Check for following: J Fuel contamination. J Use of improper Room Temperature Vulcanizing sealant. J Engine oil/coolant consumption. Is the repair complete?	–	Go to *Step 15*	–
9	Repair the condition as needed. Is the repair complete?	–	Go to *Step 15*	–
10	Repair the O2S signal circuit for a short to ground. Is the repair complete?	–	Go to *Step 15*	–
11	1. Remove he jumper wire. 2. Using voltmeter measure the voltage between the O2S signal circuit, terminal 1 and ground. Does the voltage above the specified value?	407 mV	Go to *Step 12*	Go to *Step 13*
12	1. Turn the ignition OFF. 2. Disconnect the ECM connectors and check the continuity between terminal 2 of O2S and the terminal M29 of the ECM. 3. If the circuit measures over the specified value, repair open or poor connection as needed. Is the repair complete?	5 Ω	Go to *Step 15*	Go to *Step 14*
13	1. Turn the ignition OFF. 2. Check the continuity between terminal 1 of O2S and the terminal M12 of the ECM. 3. If the circuit measures over the specified value, repair open or poor connection as needed. Is the repair complete?	5 Ω	Go to *Step 15*	Go to *Step 14*
14	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 15*	–
15	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 16*	Go to *Step 2*
16	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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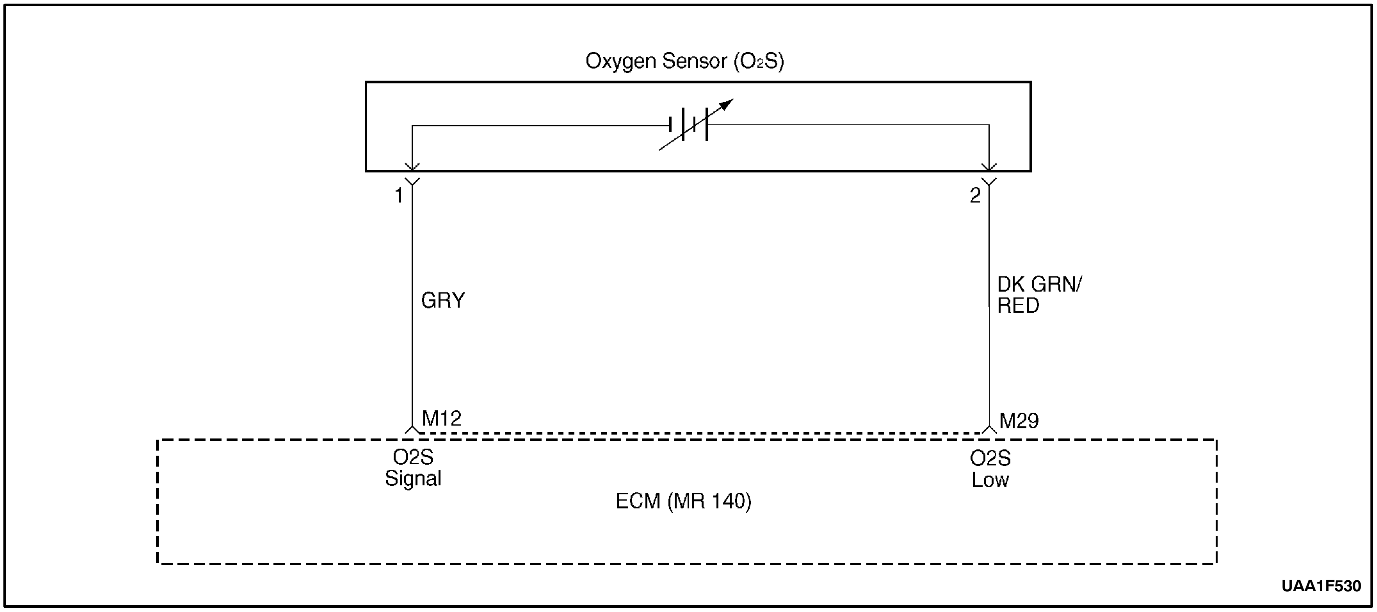

DIAGNOSTIC TROUBLE CODE (DTC) P0134
OXYGEN SENSOR NO ACTIVITY (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) supplies a voltage of about 0.45 volts between terminals M12 and M29 (if measured with a 10 megohm digital voltmeter, this may read as low as 0.32 volts). The Oxygen Sensor (O2S) varies the voltage within a range of about 1 volt if the exhaust is rich, down through about 0.10 volts if the exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below 315°C (600°F). An open sensor circuit or cold sensor causes Open Loop operation.

If the O2S pigtail wiring, connector, or terminal is damaged, the entire O2S assembly must be replaced. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the O2S wire(s). Any attempt to repair the wires, connector or terminals could result in the obstruction of the air reference and degrade the O2S performance. Refer to “Oxygen Sensor” in this section.

Conditions for Setting the DTC

- O2S voltage is between 300 and 600 mV.
- Engine Coolant Temperature (ECT) is greater than 60°C (140°F).
- System voltage is greater than 10 volts..
- Engine run time is greater than 60 seconds.
- Airflow is greater than 9 g/sec.
- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0351, P0352, P0402, P0404, P0405, P0406, P0506, P0507, P1404, and P0443 are not set.
- 3 second delay after conditions are met.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The vehicle will operate in Open Loop.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

- Normal scan tool voltage varies from 150 mV to 850 mV while in Closed Loop. If DTC P0134 is intermittent, refer to “Intermittent” in this section.

DTC P0134 – Oxygen Sensor No Activity (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Start the engine and idle at normal operating temperature. 3. Operate the engine above the specified rpm for 2 minutes. Does the scan tool indicate Closed Loop?	80°C (176°F) 1200 rpm	Go to *Step 3*	Go to Step 4
3	1. Review the Freeze Frame data and note the parameters. 2. Operate the vehicle within the Freeze frame conditions and Conditions For Setting the DTC as noted. Does the scan tool indicate Closed Loop?	–	Go to *Step 12*	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect O2S connector. 3. Jumper the terminal 2 of O2S connector and ground. 4. Turn the ignition ON. Does the scan tool indicate the O2S voltage within the specified value?	400–500 mV	Go to *Step 5*	Go to *Step 8*
5	Check the O2S harness connector for malfunction or poor connection and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 6*
6	1. Idle the engine. 2. Remove the jumper wire. 3. Using a voltmeter, measure the voltage between terminal 1 of O2S and ground Is the voltage above the specified value?	600 mV	Go to *Step 7*	Go to *Step 11*
7	1. Turn the ignition OFF. 2. Using a voltmeter, measure the voltage between terminal 1 of the O2S and ground. Is the voltage below the specified value?	300 mV	Go to *Step 9*	Go to *Step 11*
8	Check the O2S low circuit for an open or short to ground between terminal 2 of the O2S and terminal M29 of the ECM and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 10*
9	Check the O2S signal circuit for an open or short to ground between terminal 1 of the O2S and terminal M12 of the ECM and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 10*
10	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 12*	–
11	Replace the O2S. Is the repair complete?	–	Go to Step 12	–

DTC P0134 – Oxygen Sensor No Activity (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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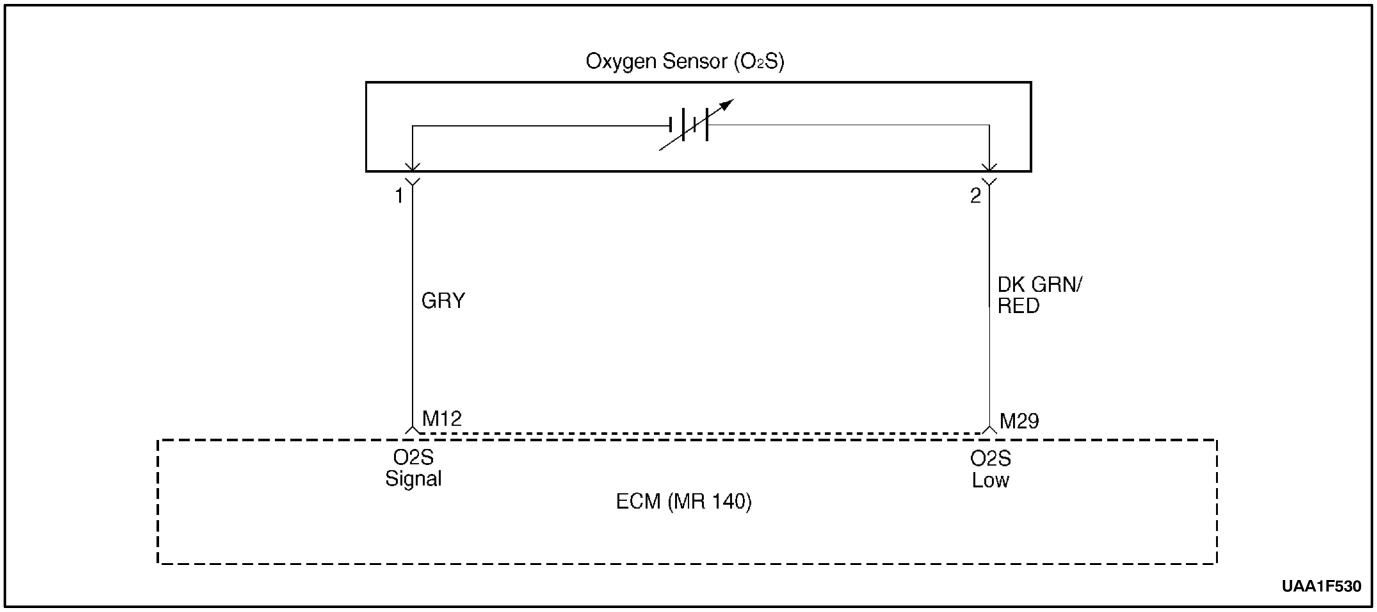

DIAGNOSTIC TROUBLE CODE (DTC) P1134
OXYGEN SENSOR TRANSITION RATIO (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) monitors the Oxygen Sensor (O2S) activity for 100 seconds after closed loop and stoichiometric operation have been established. During the monitoring period the ECM counts the number of times that the O2S responds from rich to lean and adds the amount of time it took to complete all transitions. With this information, an average time for all transitions can be determined. The ECM then divides the -to-lean average by the lean-to-rich average to obtain the ratio. If the O2S transition time ratio is not within the range, Diagnostic Trouble Code (DTC) P1134 will be set, indicating that the O2S is not responding as expected to changes in exhaust oxygen content.

Conditions for Setting the DTC

- O2S rich-to-lean and lean-to rich transition ratio is out of specification(between 0.375 and 3.5).
- Closed Loop stoichiometry.
- Engine Coolant Temperature (ECT) is greater than 70°C (158°F).
- System voltage is greater than 10 volts.
- Engine run time is greater than 60 seconds.
- Purge Duty Cycle (DC) is less than 20%.
- Engine speed is between 1600 and 4300 rpm.
- Calculated airflow is between 9 to 40 g/sec.
- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0131, P0132, P0134, P1167, P0171, P1171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0351, P0352, P0402, P0404, P1404, P0405, P0406, P0506, P0507, and P0443 are not set.
- 2 second delay after conditions are met.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The vehicle will operate in Open Loop.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

- A malfunction in the O2S ignition feed or ground circuit may cause a DTC P1134 to set. Check O2S circuitry for intermittent faults or poor connections. If connections and wiring are OK and DTC P1134 continues to set, replace the O2S.
- Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how open the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P1134 – Oxygen Sensor Transition Ratio (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	**Important:** If any Diagnostic Trouble Codes (DTCs) are set, refer to those DTCs before processing with this diagnostic chart. 1. Install a scan tool to the Data Link Connector (DLC). 2. Start the engine and idle at normal operating temperature. 3. Operate the engine within parameters specified under Conditions for Setting the DTC. 4. Using a scan tool, monitor specific DTC info for DTC P1134 until the DTC P1134 test runs. 5. Note the test result. Does the scan tool indicate DTC P1134 failed this ignition?	–	Go to *Step 3*	Refer to "Diagnostic Aids"
3	Perform an exhaust system leak test. If an exhaust leak is found, repair as needed. The exhaust leak isolated?	–	Go to *Step 14*	Go to *Step 4*
4	Visually/physically inspect for the following items: **J** Oxygen Sensor (O2S) is securely installed. **J** Corrosion on the terminals. **J** Terminal tension. **J** O2S wiring harness for poor terminal connection or damaged wiring. Is a problem found in any of the above areas?	–	Go to *Step 7*	Go to *Step 5*
5	1. Turn the ignition OFF. 2. Disconnect the O2S connector. 3. Turn the ignition ON. 4. Using a voltmeter, measure the voltage between following terminals. 5. Terminal 1 of Engine Control Module (ECM) side O2S connector and ground. 6. Terminal 2 of ECM side O2S connector and ground. Are both voltages in the specified value?	3–5 V	Go to *Step 6*	Go to *Step 8*
6	1. With the O2S disconnected, jumper the ECM side O2S connector terminals 1 and 2. 2. Turn the ignition ON. 3. Using a scan tool, monitor the O2S voltage. Does the scan tool indicates less than 10 millivolts and immediately return to about 450 millivolts when the jumper is removed?	–	Go to *Step 10*	Go to *Step 9*
7	Repair conditions as needed. Is the repair complete?	–	Go to *Step 14*	–
8	Check for faulty ECM connections or terminal damages and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 9*
9	Repair open, short, or grounded signal circuit. Is the repair complete?	–	Go to *Step 14*	Go to *Step 11*

DTC P1134 Oxygen Sensor Transition Ratio (2.0L DOHC)

Step	Action	Value(s)	Yes	No
10	Remove the O2S and examine it for sign of: J Fuel contamination. J Improper room temperature vulcanizing sealant (white powdery coating on the sensor) J Engine oil/coolant consumption. Are sign of contamination observed?	–	Go to *Step 12*	Go to *Step 13*
11	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 14*	Go to *Step 13*
12	Determine and correct the cause of contamination. Is the repair complete?	–	Go to *Step 14*	–
13	Replace the O2S. Is the repair complete?	–	Go to *Step 14*	–
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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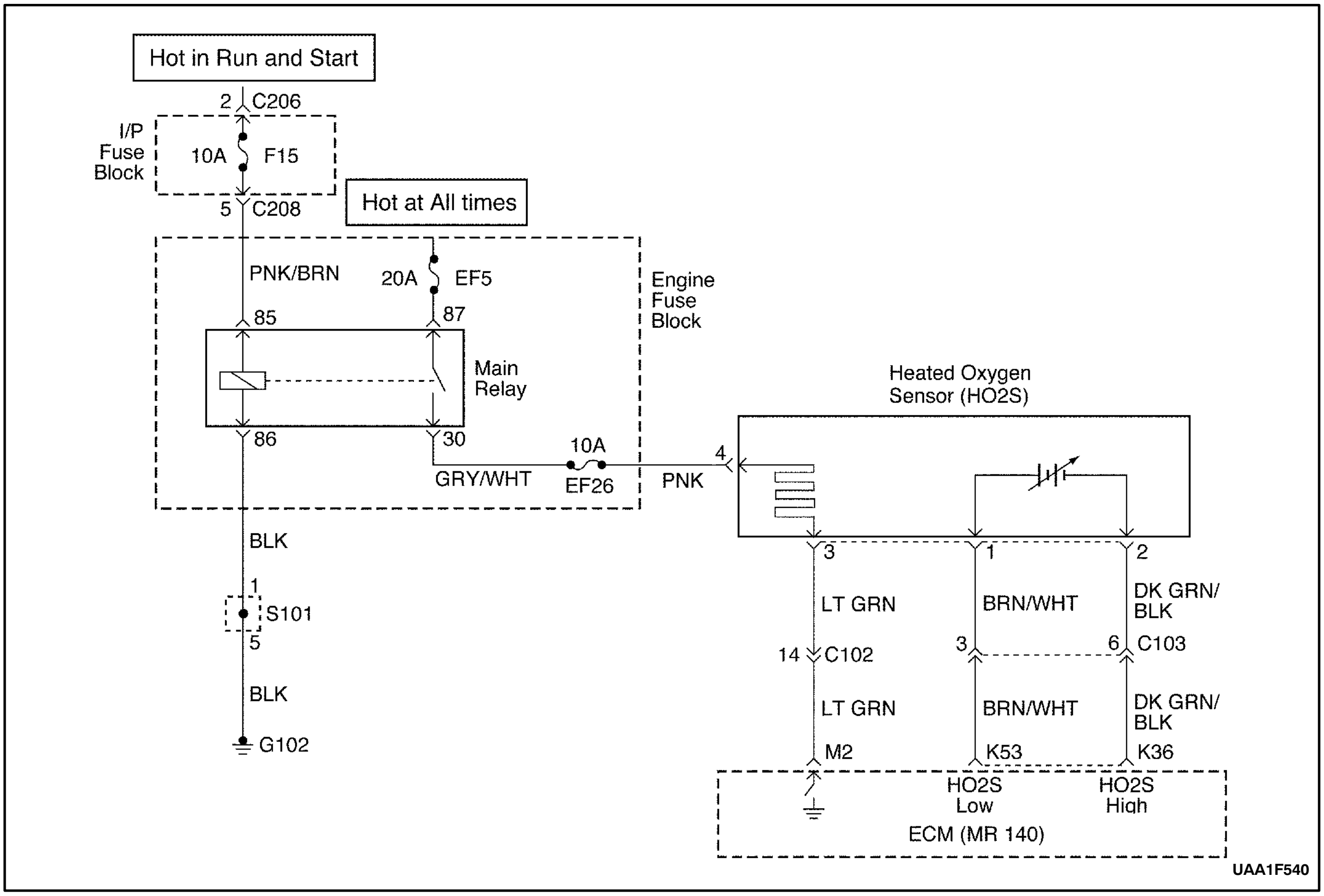

DIAGNOSTIC TROUBLE CODE (DTC) P0137 HEATED OXYGEN SENSOR LOW VOLTAGE (2.0L DOHC)

Circuit Description

In order to control emissions, a catalytic converter is used to convert harmful emissions into harmless water vapor and carbon dioxide.

The Engine Control Module (ECM) has the ability to monitor this process by using a Heated Oxygen Sensor (HO2S). The HO2S, located in the exhaust stream past the catalytic converter, produces an output signal which indicates the storage capacity of the catalyst. This in turn indicates the catalyst's ability to convert exhaust emissions effectively. If the catalyst is functioning properly, the HO2S signal will be far less active than the signal produced by the Oxygen Sensor (O2S).

If the HO2S pigtail wiring, connector, or terminal is damaged, the entire HO2S assembly must be replaced. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the HO2S wire(s). Any attempt to repair the wires, connector, or terminals could result in the obstruction of the air reference and degrade the HO2S performance.

Conditions for Setting the DTC

- HO2S voltage is less than 0.052 volt in Closed Loop control or less than 0.35 volt in Power Enrichment (PE) mode.
- Engine Coolant Temperature (ECT) is greater than 60°C (140°F).
- Closed Loop test: 3 seconds delay after in Closed Loop.
- Power Enrichment test: Air/Fuel ration is less than or equal to 13.5 and 2 seconds delay after in Power Enrichment mode.
- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0351, P0352, P0141, P0402, P0404, P0405, P0406, P0506, P0507, P1404, and P0443 are not set.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.

- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent may be caused by rubbed–through wire insulation or a wire contacting the exhaust.

Check for the following conditions:

- Exhaust system – Inspect the exhaust system for leaks. Check the exhaust between the three-way catalytic converter and the flange for leaks, corrosion, or for loose or missing hardware and repair as necessary.
- Poor connection or damaged harness – Ensure that the HO2S pigtail is not contacting the exhaust. Check for the following conditions:
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection
- Damaged harness
- Intermittent test – Observe the HO2S on the scan tool while moving related connections and the wiring harness with the ignition ON. If the failure is induced, the HO2S display will change. This may help isolate the location of the malfunction.

DTC P0137 – Heated Oxygen Sensor Low Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Is the Heated Oxygen Sensor (HO2S) voltage less than the value specified?	0.1 V	Go to *Step 4*	Go to *Step 3*
3	1. Start the engine. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze frame conditions and Conditions For Setting the DTC as noted. Is the HO2S voltage less than the specified value?	0.4 V	Go to *Step 4*	Go to *Step 8*
4	1. Turn the ignition OFF. 2. Disconnect HO2S connector. 3. Connect a jumper wire between terminal 1 of HO2S connector and ground. 4. Turn the ignition ON. Does the scan tool indicate that the HO2S voltage is within the specified value?	350–550 mV	Go to *Step 7*	Go to *Step 5*
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector and check the HO2S high circuit, terminal K36 for short to ground or short to the HO2S low circuit terminal K53 and repair as needed. Is the repair complete?	–	Go to *Step 8*	Go to *Step 6*

DTC P0137 – Heated Oxygen Sensor Low Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 8*	–
7	1. Turn the ignition OFF. 2. Replace the HO2S. Is the repair complete?	–	Go to *Step 8*	–
8	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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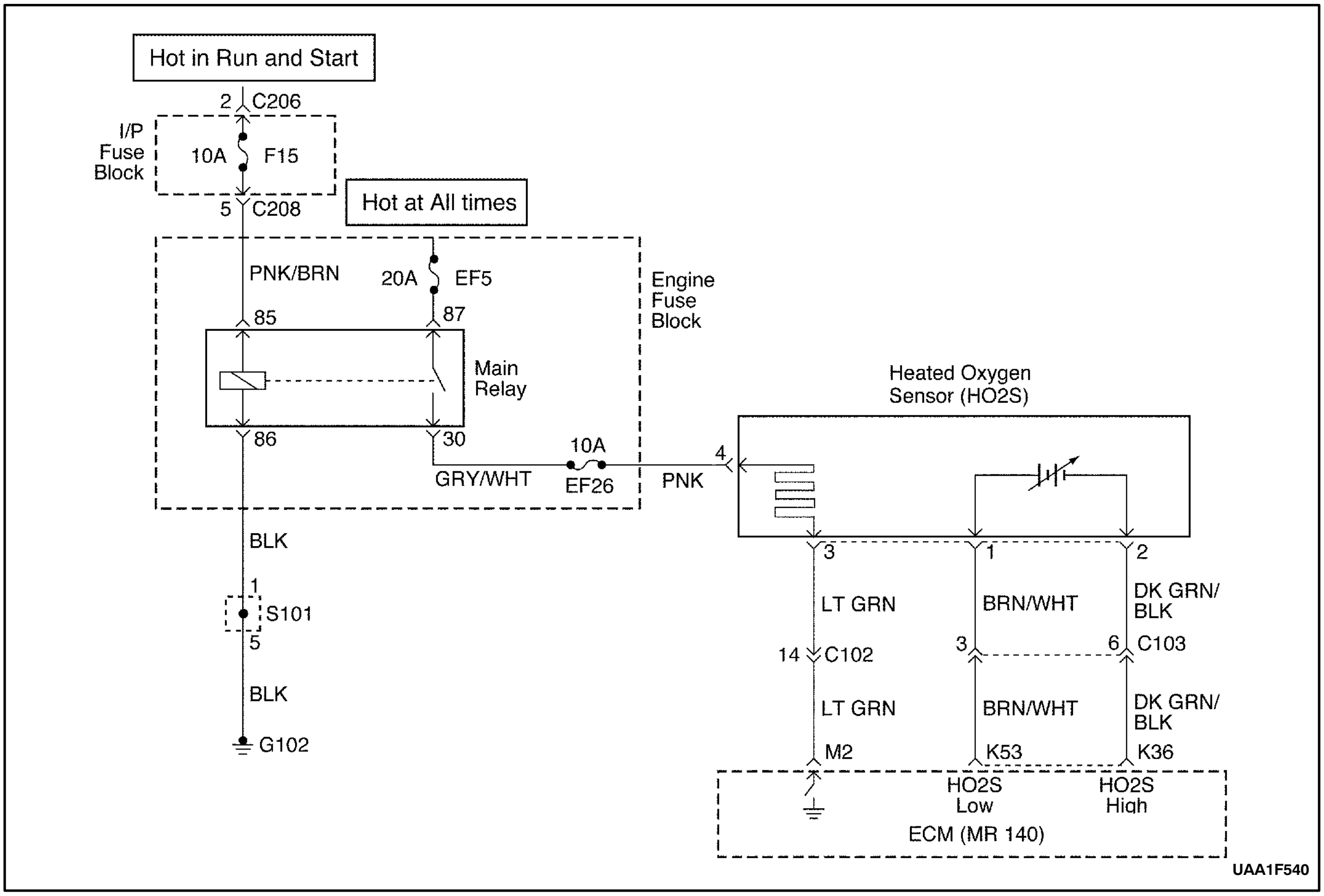

DIAGNOSTIC TROUBLE CODE (DTC) P0138 HEATED OXYGEN SENSOR HIGH VOLTAGE (2.0L DOHC)

Circuit Description

In order to control emissions, a catalytic converter is used to convert harmful emissions into harmless water vapor and carbon dioxide.

The Engine Control Module (ECM) has the ability to monitor this process by using a Heated Oxygen Sensor (HO2S). The HO2S, located in the exhaust stream past the catalytic converter, produces an output signal which indicates the storage capacity of the catalyst. This in turn indicates the catalyst's ability to convert exhaust emissions effectively. If the catalyst is functioning properly, the HO2S signal will be far less active than the signal produced by the Oxygen Sensor (O2S).

If the HO2S pigtail wiring, connector, or terminal is damaged, the entire HO2S assembly must be replaced. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the HO2S wire(s). Any attempt to repair the wires, connector, or terminals could result in the obstruction of the air reference and degrade the HO2S performance.

Conditions for Setting the DTC

- HO2S voltage is greater than 0.952 volt in Closed Loop control or greater than 0.55 volt in Decel Fuel Cutoff (DFCO) mode.
- Engine Coolant Temperature (ECT) is greater than 60°C (140°F).
- Closed Loop test: 3 seconds delay after in Closed Loop.
- DFCO test: 2 seconds delay after in DFCO.
- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0351, P0352, P0141, P0402, P0404, P0405, P0406, P0506, P0507, P1404, and P0443 are not set.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Check for the following conditions:

- Rich exhaust – An overly rich exhaust may load the catalyst, causing high HO2S signal voltages.
- Silicone contamination – A false rich condition may be caused by silicone contamination of the HO2S. This will be indicated by a powdery white deposit on the sensor.
- Faulty HO2S – If HO2S is internally shorted, the HO2S voltage displayed on a scan tool will be over 1 volt. Disconnect the HO2S and jumper the sensor low circuit to engine ground; if the displayed voltage goes from over 1000 millivolt to around 450 millivolt, replace the HO2S.
- Intermittent test – Observe HO2S on the scan tool while moving related connectors and the wiring harness with the key in the ON position. If the failure is induced, the HO2S display will change. This may help isolate the location of the malfunction.

DTC P0138 – Heated Oxygen Sensor High Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Is the Heated Oxygen Sensor (HO2S) voltage above the value specified?	0.9 V	Go to *Step 4*	Go to *Step 3*
3	1. Review the Freeze Frame data and note the parameters. 2. Operate the vehicle within the Freeze frame conditions and Conditions For Setting the DTC as noted. Is the HO2S voltage above the specified value?	0.9 V	Go to *Step 4*	Go to *Step 9*
4	1. Turn the ignition OFF. 2. Disconnect HO2S connector. 3. Disconnect the Engine Control Module (ECM) connector. 4. With voltmeter connected to ground, probe the HO2S high signal circuit, terminal K36. Is the voltage within the specified value?	≈ 0 V	Go to *Step 5*	Go to *Step 6*
5	1. Reconnect the ECM connector. 2. Turn the ignition ON. 3. Jumper the high and low circuits at the HO2S connector, terminals 1and 2 to ground. Does the scan tool indicate the HO2S voltage below the specified value?	0.1 V	Go to *Step 7*	Go to *Step 8*
6	Repair the short to voltage in the HO2S high circuit. Is the repair complete?	–	Go to *Step 9*	–
7	1. Turn the ignition OFF. 2. Replace the HO2S. Is the repair complete?	–	Go to *Step 9*	–
8	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 9*	–

DTC P0138 – Heated Oxygen Sensor High Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 10*	Go to *Step 2*
10	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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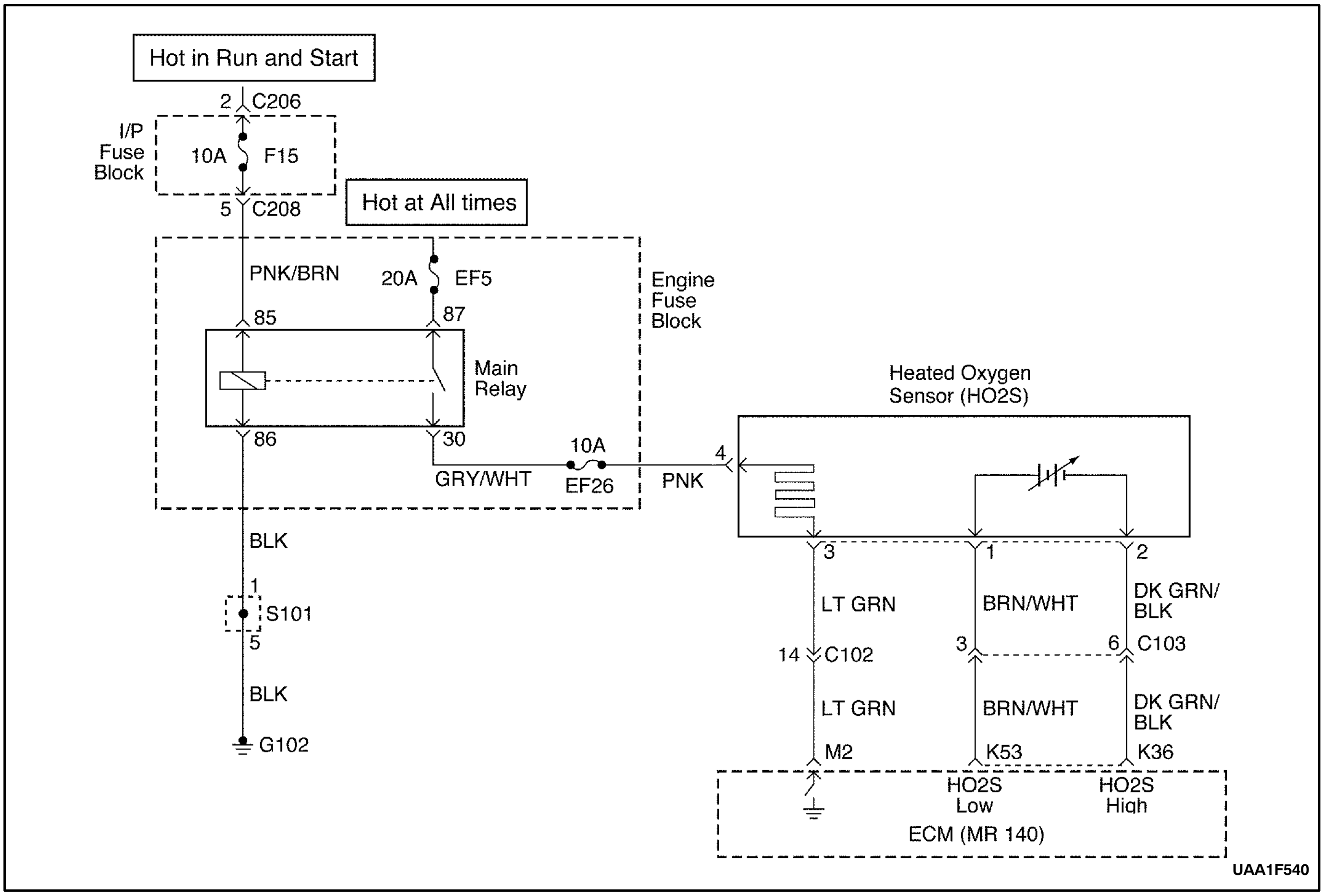

DIAGNOSTIC TROUBLE CODE (DTC) P0140 HEATED OXYGEN SENSOR NO ACTIVITY (2.0L DOHC)

Circuit Description

In order to control emissions, a catalytic converter is used to convert harmful emissions into harmless water vapor and carbon dioxide.

The Engine Control Module (ECM) has the ability to monitor this process by using a Heated Oxygen Sensor (HO2S). The HO2S, located in the exhaust stream past the catalytic converter, produces an output signal which indicates the storage capacity of the catalyst. This in turn indicates the catalyst's ability to convert exhaust emissions effectively. If the catalyst is functioning properly, the HO2S signal will be far less active than the signal produced by the Oxygen Sensor (O2S).

If the HO2S pigtail wiring, connector, or terminal is damaged, the entire HO2S assembly must be replaced. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the HO2S wire(s). Any attempt to repair the wires, connector, or terminals could result in the obstruction of the air reference and degrade the HO2S performance.

Conditions for Setting the DTC

- HO2S voltage is between 0.422 and 0.478 volts.
- Engine Coolant Temperature (ECT) is greater than 60°C (140°F).
- Closed Loop stoichiometry.
- 3 second delay after exiting Decel Fuel Cutoff (DFCO) mode.
- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0351, P0352, P0141, P0402, P0404, P0405, P0406, P0506, P0507, P1404, and P0443 are not set.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTC(s) can be cleared by using the scan tool.

J Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent may be caused by a rubbed-through wire insulation or a wire contacting the exhaust.

Check for the following conditions:

J A poor connection or a damaged harness – Inspect the harness for a short to ground in the sensor signal circuit. Ensure that the HO2S pigtail is not contacting the exhaust. Check for the following conditions:

J Improper mating

J Broken locks

J Improperly formed

J Damaged terminals

J Poor terminal-to-wire connection

J Damaged harness

J Intermittent test – Observe HO2S on the scan tool while moving the related connections and the wiring harness with the ignition ON. If the failure is induced, the HO2S display will change. This may help isolate the location of the malfunction.

DTC P0140 – Heated Oxygen Sensor No Activity (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Start the engine and operate to normal operating temperature. 3. Run the engine above the specified rpm for two minutes. Does the scan tool display a Heated Oxygen Sensor (HO2S) voltage between the value specified?	80bC (176bF) 1200 rpm 422–478 mV	Go to *Step 4*	Go to *Step 3*
3	1. Allow the engine to idle. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze frame conditions and Conditions For Setting the DTC as noted. Does the scan tool display the HO2S voltage steady around the value specified?	422–478 mV	Go to *Step 11*	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect HO2S connector. 3. Turn the ignition ON. 4. Jumper the high and low circuits at the HO2S connector, terminals 1and 2 to ground. Does the scan tool indicate the HO2S voltage below the specified value?	0.1 V	Go to *Step 5*	Go to *Step 6*
5	1. Turn the ignition OFF. 2. Check for a malfunctioning connection at the HO2S Engine Control Module (ECM) side and repair as needed. Is the repair complete?	–	Go to *Step 11*	Go to *Step 7*
6	1. Remove the jumper wire. 2. With a voltmeter connected to ground, probe the terminal 2 of the HO2S. Does the voltage within the specified value?	4.5 V	Go to *Step 8*	Go to *Step 9*
7	1. Turn the ignition OFF. 2. Replace the HO2S. Is the repair complete?	–	Go to *Step 11*	–

DTC P0140 – Heated Oxygen Sensor No Activity (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
8	Check the HO2S low circuit for an open or poor connection and repair as needed. Is the repair complete?	–	Go to *Step 11*	Go to *Step 10*
9	1. Turn the ignition OFF. 2. Disconnect the ECM connector. 3. Check the HO2S high circuit for continuity and repair as needed. Is the repair complete?	–	Go to *Step 11*	Go to *Step 5*
10	1. Turn the ignition OFF. 2. Replace the HO2S. Is the repair complete?	–	Go to *Step 11*	–
11	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 12*	Go to *Step 2*
12	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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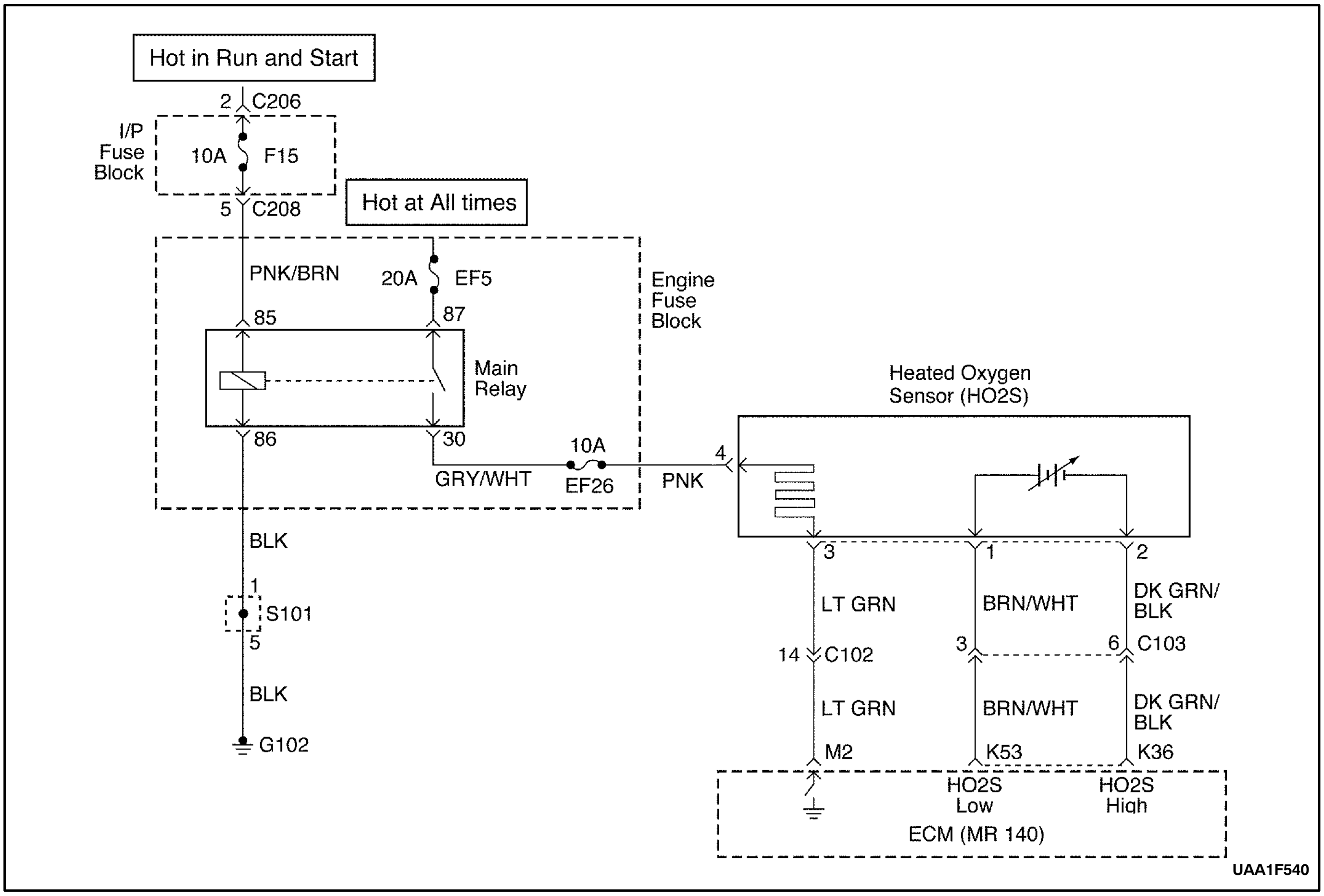

DIAGNOSTIC TROUBLE CODE (DTC) P0141
HEATED OXYGEN SENSOR HEATER MALFUNCTION (2.0L DOHC)

Circuit Description

In order to control emissions, a catalytic converter is used to convert harmful emissions into harmless water vapor and carbon dioxide.

The Engine Control Module (ECM) has the ability to monitor this process by using a Heated Oxygen Sensor (HO2S). The HO2S, located in the exhaust stream past the catalytic converter, produces an output signal which indicates the storage capacity of the catalyst. This in turn indicates the catalyst's ability to convert exhaust emissions effectively. If the catalyst is functioning properly, the HO2S signal will be far less active than the signal produced by the Oxygen Sensor (O2S).

If the HO2S pigtail wiring, connector, or terminal is damaged, the entire HO2S assembly must be replaced. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the HO2S wire(s). Any attempt to repair the wires, connector, or terminals could result in the obstruction of the air reference and degrade the HO2S performance.

The ECM will check if HO2S is functioning properly by monitoring the current to HO2S heater. If the current is less than 0.1 ampere, DTC P0141 will set.

Conditions for Setting the DTC

J HO2S heater current is less than 0.1 amperes.

J Engine Coolant Temperature (ECT) is greater than 60bC (140bF).

J System voltage is greater than 10 volts.

Action Taken When the DTC Sets

J The Malfunction Indicator Lamp (MIL) will illuminate.

J The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.

J A history DTC is stored.

Conditions for Clearing the MIL/DTC

J The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.

J A history DTC will clear after 40 consecutive warm-up cycles without a fault.

- The DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent may be caused by a rubbed-through wire insulation or a wire contacting the exhaust.

Check for a poor connection or a damaged harness – inspect the harness connectors for the following conditions:

- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection
- Damaged harness

DTC P0141 – Heated Oxygen Sensor Heater Malfunction (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Disconnect the Heated Oxygen Sensor (HO2S) connector. 3. Turn the ignition ON. 4. Using a voltmeter, measure the voltage at terminal 4 of HO2S and ground. Is the voltage within the specified value?	11–14 V	Go to *Step 3*	Go to “Main Relay Circuit Check”
3	1. Turn the ignition OFF. 2. Disconnect the HO2S connector. 3. Check the connections at HO2S connector, terminal 3 and 4 and repair as needed. Is the repair complete?	–	Go to *Step 10*	Go to *Step 4*
4	1. Disconnect the Engine control Module (ECM) connector. 2. Check the connection at the ECM connector, terminal M2 and repair as needed. Is the repair complete?	–	Go to *Step 10*	Go to *Step 5*
5	1. Using ohmmeter, measure the resistance between terminal 3 of the HO2S and terminal M2 of the ECM. Is the resistance equal to the specified value? 2. Using a voltmeter, measure the voltage between terminal M2 of the ECM and ground. Is the voltage within the specified value?	0 Ω ≈ 0 V	Go to *Step 7*	Go to *Step 6*
6	Repair an open or short to voltage circuit. Is the repair complete?	–	Go to *Step 10*	–
7	Check he continuity between terminal 3 and 4of the HO2S. Is a problem found?	–	Go to *Step 8*	Go to *Step 9*
8	1. Turn the ignition OFF. 2. Replace the HO2S. Is the repair complete?	–	Go to *Step 10*	–
9	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 10*	–

DTC P0141 – Heated Oxygen Sensor Heater Malfunction (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 11*	Go to *Step 2*
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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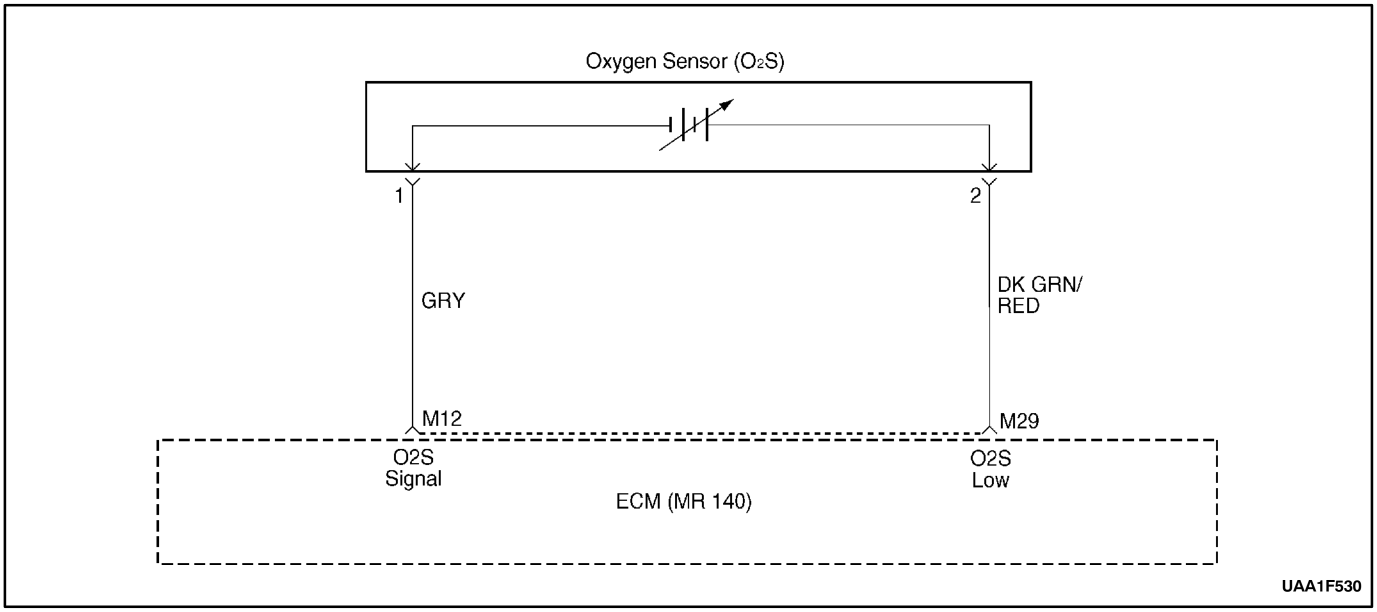

DIAGNOSTIC TROUBLE CODE (DTC) P1167 OXYGEN SENSOR RICH IN DECEL FUEL CUTOFF (DFCO) (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) supplies a voltage of about 0.45 volts between terminals M12 and M29 (if measured with a 10 megohm digital voltmeter, this may read as low as 0.32 volts). The Oxygen Sensor (O2S) varies the voltage within a range of about 1 volt if the exhaust is rich, down through about 0.10 volts if the exhaust is lean.

In internal circuitry of the Engine control Module (ECM) can identify if the vehicle fuel system is capable of cutoff amount of the fuel supply during deceleration. When a Decel Fuel Cutoff (DFCO) mode of operation is requested during Closed Loop operation, the ECM will cutoff the fuel supply to the engine. Under these conditions the ECM should detect a lean condition. If the ECM detect a rich condition at this time, Diagnostic Trouble Code (DTC) P1167 will set. Damaged fuel pressure regulator and faulty injector will be the cause of this DTC.

Conditions for Setting the DTC

- O2S voltage is greater than 0.55 volts in Decel Fuel Cutoff (DFCO) mode.
- Engine Coolant Temperature (ECT) is greater than 60°C (140°F).
- Engine run time is greater than 60 seconds.
- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0351, P0352, P0402, P0404, P0405, P0406, P0506, P0507, P1404, and P0443 are not set.
- 2 second delay after in DFCO mode.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The vehicle will operate in Open Loop.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

The DTC P1167 or rich exhaust is most likely caused by one of the following items:

- Leaking injector – A leaking or malfunctioning injector can cause the system to go rich causing a DTC P0132.
- Pressure regulator – Check for a leaking fuel pressure regulator diaphragm by checking for the presence of liquid fuel in the vacuum line to the regulator.

DTC P1167 – Oxygen Sensor Rich in Decel Fuel Cutoff (DFCO) (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Any other component related Diagnostic Trouble Codes (DTCs) set?	–	Go to Applicable DTC table	Go to *Step 3*
3	1. Using a scan tool, observe the Oxygen Sensor (O2S) voltage while decelerating the engine. 2. The O2S voltage should vary from specified voltage (100–900 mV) and while decelerating occasionally toggle below the specified voltage. Is the O2S voltage toggle?	550 mV	Go to *Step 4*	Go to “DTC P0134 Oxygen Sensor No Activity”
4	Check the items in “Diagnostic Aids” and repair or replace component as needed. Refer to “Fuel System Diagnosis”. Is the repair complete?	–	Go to *Step 6*	Go to *Step 5*
5	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 6*	–
6	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 7*	Go to *Step 2*
7	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P0171
FUEL TRIM SYSTEM TOO LEAN (2.0L DOHC)

System Description

To provide the best possible combination of driveability, fuel economy, and emission control, a Closed Loop air/fuel metering system is used. While in Closed Loop, the Engine Control Module (ECM) monitors the oxygen sensor (O2S) signal voltage and adjusts fuel delivery based on signal voltage. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with the scan tool. Ideal fuel trim values are around 128 (0%). If the O2S signal is indicating a lean condition, the ECM will add fuel resulting in fuel trim values above 128 (0% to 100%). If a rich condition is detected, the fuel trim values will be below 128 (0% to –100%), indicating that the ECM is reducing the amount of fuel delivered. If exhaust emissions reach an excessive level due to a lean or rich condition, a fuel trim Diagnostic Trouble Code (DTC) is set.

Conditions for Setting the DTC

J No intrusive tests active.

J DTCs P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0125, P0131, P0132, P0133, P0134, P0137, P0138, P0140, P0141, P1167, P1171, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0341, P0342, P0402, P0404, P1404, P0405, P0406, P0443, P0506, and P0507 are not set.

J The average of short term fuel trim value is greater than or equal to 120.

J Throttle Position (TP) is less than 95%.

J Engine speed is between 700 and 6000 rpm.

J Barometric Pressure (BARO) is greater than 72.0 kPa (10.4 psi).

J Coolant temperature is between 70bC (158bF) and 115bC (239bF).

J Manifold Absolute Pressure (MAP) is between 25 kPa (3.6 psi) and 99.7 kPa (14.5 psi).

J Intake Air Temperature (IAT) is between –40bC (–40bF) and 120bC (248bF).

J Airflow is between 1.5 and 45 g/sec.

J Vehicle speed is less than 140 km/h (87 mph).

J System is in closed loop.

J Adaptive index is ready.

Action Taken When the DTC Sets

J The Malfunction Indicator Lamp (MIL) will illuminate after four consecutive ignitions in which the diagnostic runs with the fault active.

J The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.

J A history DTC is stored.

Conditions for Clearing the MIL/DTC

J The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault within the freeze frame conditions that the DTC failed.

J A history DTC will clear after 40 consecutive warm-up cycles without a fault.

J The DTC(s) can be cleared by using the scan tool.

J Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Important: After repairs, use the scan tool Fuel Trim Reset function to reset the long-term fuel trim to 128 (0%).

J Fuel pressure – The system will be lean if the pressure is too low. It may be necessary to monitor fuel pressure while driving the vehicle at various road speeds and/or loads to confirm.

J Map sensor – An output that causes the ECM to sense a lower than normal manifold pressure (high vacuum) can cause the system to go lean. Disconnecting the MAP sensor will allow the ECM to substitute a fixed (default) value for the MAP sensor. If the lean condition is gone when the sensor is disconnected, substitute a known good sensor and recheck.

J Fuel contamination – Water, in even small amounts, near the in-tank fuel pump inlet can be delivered to the injector. The water causes a lean exhaust and can set DTC P0171.

Check for poor O2S or MAP sensor connection at the ECM. Inspect the harness connectors for the following conditions:

J Backed-out terminals

J Improper mating

J Broken locks

J Improperly formed

J Damaged terminals

J Poor terminal-to-wire connection

Inspect the wiring harness for damage. If the harness appears to be OK, observe the O2S display on the scan tool while moving the connectors and the wiring harness related to the engine harness. A change in the display will indicate the location of the fault.

Check the brake power booster check valve for possible leaks.

DTC P0171 – Fuel Trim System Too Lean (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Are any component related Diagnostic Trouble Codes (DTCs) set?	–	Go to Applicable DTC table	Go to *Step 3*
3	With the engine running, operate the vehicle until the LOOP STATUS indicates closed. Is the Long Term Fuel Trim value below the specified value?	25 %	Go to *Step 4*	Go to *Step 5*
4	1. Turn the ignition switch ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Does the Long Term Fuel Trim value go below the specified value while operating under the specified conditions?	25%	Go to *Step 16*	Go to *Step 5*
5	Visually/physically check the following items: **J** Vacuum hoses for splits, kinks and improper connections. **J** Crankcase ventilation oil/air separator for proper installation. **J** Exhaust system for corrosion, leaks, loose or missing hardware. **J** Oxygen sensor (O2S) is installed securely and the pigtail harness is not contacting exhaust manifold or engine. **J** Fuel for excessive water, alcohol, or other contaminants. **J** Engine Control Module (ECM) and sensor grounds are clean, tight, and in their proper locations. Do any of the above checks isolate a condition requiring repair?	–	Go to *Step 7*	Go to *Step 6*
6	1. Disconnect the Manifold Absolute Pressure (MAP) sensor electrical connector. 2. Operate the vehicle in Closed Loop while monitoring the Long Term Fuel Trim value. Is the Long Term Fuel Trim value below the specified value?	25 %	Go to *Step 15*	Go to *Step 9*
7	1. Repair the malfunction found in Step 5. 2. Recheck the Long Term Fuel Trim value while operating the engine. Is the Long Term Fuel Trim value below the specified value?	25 %	Go to *Step 8*	Go to *Step 9*
8	Lean condition is not present. Does a driveability problem exist?	–	Go to "Symptom Diagnosis"	Go to *Step 16*

DTC P0171 – Fuel Trim System Too Lean (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Visually/physically inspect the following items for vacuum leaks: • Intake manifold. • Throttle body. • Injector O-rings. 2. Repair any leaks found as necessary. Is the repair complete?	–	Go to *Step 16*	Go to *Step 10*
10	Allow the engine to idle. Are the Idle Air Control (IAC) counts above the specified value?	5	Go to *Step 11*	Go to *Step 12*
11	Check the fuel for excessive water, alcohol, or other contaminants and correct the contaminated fuel condition if present. Is the repair complete?	–	Go to *Step 16*	Go to *Step 13*
12	Check the IAC valve performance. Refer to "DTC P0506 Idle Speed RPM Lower Than Desired Idle Speed" or "DTC P0507 Idle Speed RPM Higher Than Desired Idle Speed" in this section and repair as necessary. Is the repair complete?	–	Go to *Step 16*	Go to *Step 13*
13	1. Connect a fuel pressure gauge to the fuel system. 2. Turn the ignition OFF for at least 10 seconds. 3. Turn the ignition ON, with the engine OFF. The fuel pump will run for approximately 2–3 seconds. It may be necessary to cycle the ignition switch ON more than once to obtain maximum fuel pressure. 4. Note the fuel pressure with the fuel pump running. The pressure should be within the specified value. When the fuel pump stops, the pressure may vary slightly then hold steady. Is the fuel pressure steady and does the fuel pressure hold?	241–276 kPa (35–40 psi)	Go to *Step 14*	Go to "Fuel System Diagnosis"
14	1. Start and idle the engine at normal operating temperature. 2. The fuel pressure noted in the above step should drop by the indicated value. Does the fuel pressure drop by the indicated value?	21–69 kPa (3–10 psi)	Go to "Fuel Injector Balance Test"	Go to "Fuel System Diagnosis"
15	Replace the MAP sensor. Is the action complete?	–	Go to *Step 16*	–
16	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 17*	Go to *Step 2*
17	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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DIAGNOSTIC TROUBLE CODE (DTC) P1171 FUEL TRIM SYSTEM LEAN DURING POWER ENRICHMENT (2.0L DOHC)

System Description

The internal circuitry of the Engine control Module (ECM) can identify if the vehicle fuel system is capable of supplying adequate amounts of fuel during heavy acceleration(power enrichment). When a Power Enrichment (PE) mode of operation is requested by heavy acceleration during Closed Loop operation, the ECM will provide more fuel to the engine. Under these conditions the ECM should detect a rich condition. If this reich condition is nor detected at this time, Diagnostic Trouble Code (DTC) P1171 will set. A plugged fuel filter or restricted fuel line can prevent adequate amount of fuel from being supplied during Power Enrichment mode.

Conditions for Setting the DTC

- O2S voltage is less than 0.35 volts in Power Enrichment (PE) mode.
- Engine is operating in Closed Loop and in PE mode.
- Engine Coolant Temperature (ECT) is greater than 60°C (140°F).
- System voltage is greater than 10 volts.
- Engine run time is greater than 60 seconds.
- Air/Fuel ration is less than or equal to 13.5:1.
- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0351, P0352, P0402, P0404, P0405, P0406, P0506, P0507, P1404, and P0443 are not set.
- 2 second delay after in PE mode.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The vehicle will operate in Open Loop.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

A restricted fuel filter can supply adequate amounts of the fuel at idle, but may not be able to supply enough fuel during heavy acceleration.

Water or alcohol n fuel may cause low O2S voltage during acceleration.

Check for adequate amount of fuel in the fuel tank.

When the engine is idling or at steady cruise, the O2S voltage should vary from between approximately a00 to 900 millivolts. During power enrichment mode, more fuel is needed, and the O2S should rise above 444 millivolts.

DTC P1171 – Fuel Trim System Lean During Power Enrichment (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Any other component related Diagnostic Trouble Codes (DTCs) set?	–	Go to Applicable DTC table	Go to *Step 3*
3	1. Check the vehicle for adequate amount of fuel. 2. Add fuel to the vehicle's fuel tank if the fuel tank is almost empty. Is the repair complete?	–	Go to Step 5	Go to *Step 4*
4	1. Using a scan tool, observe the Oxygen Sensor (O2S) voltage while accelerating the engine over 1200 rpm. 2. The O2S voltage should vary from specified voltage (100–900 mV) and occasionally toggle above the specified voltage while accelerating. Is the O2S voltage toggle?	3507 mV	Go to "Fuel System Diagnosis"	Go to "DTC P0134 Oxygen Sensor No Activity"
5	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 6*	Go to *Step 2*
6	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P0172 FUEL TRIM SYSTEM TOO RICH (2.0L DOHC)

System Description

To provide the best possible combination of driveability, fuel economy, and emission control, a Closed Loop air/fuel metering system is used. While in Closed Loop, the Engine Control Module (ECM) monitors the oxygen sensor (O2S) signal voltage and adjusts fuel delivery based on signal voltage. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with the scan tool. Ideal fuel trim values are around 128 (0%). If the O2S signal is indicating a lean condition, the ECM will add fuel resulting in fuel trim values above 128 (0% to 100%). If a rich condition is detected, the fuel trim values will be below 128 (0% to –100%), indicating that the ECM is reducing the amount of fuel delivered. If exhaust emissions reach an excessive level due to a lean or rich condition, a fuel trim Diagnostic Trouble Code (DTC) is set.

Conditions for Setting the DTC

- No intrusive tests active.
- DTCs P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0131, P0132, P0133, P0134, P0137, P0138, P1167, P1171, P0300, P0336, P0337, P0341, P0342, P0402, P0404, P1404, P0405, P0406, P0443, P0506, and P0507 are not set.
- The average of short term fuel trim value is less than or equal to 135.
- Throttle Position (TP) is less than 95%.
- Engine speed is between 700 and 6000 rpm.
- Barometric Pressure (BARO) is greater than 72.0 kPa (10.4 psi).
- Coolant temperature is between 70°C (158°F) and 115°C (239°F).
- Manifold Absolute Pressure (MAP) is between 25 kPa (3.6 psi) and 99.7 kPa (14.5 psi).
- Intake Air Temperature (IAT) is between –40°C (–40°F) and 120°C (248°F).
- Airflow is between 1.5 and 45 g/sec.
- Vehicle speed is less than 140 km/h (87 mph).
- System is in closed loop.
- Adaptive index is ready.
- System voltage is greater than 11 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after four consecutive ignitions in which the diagnostic runs with the fault active.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- l A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault within the freeze frame conditions that the DTC failed.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Important: After repairs, use the scan tool Fuel Trim Reset function to reset the long-term fuel trim to 128 (0%).

Check for poor connection at the ECM. Inspect the harness connectors for the following conditions:

- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connection.

Inspect the wiring harness for damage. If the harness appears to be OK, observe the O2S display on the scan tool while moving the connectors and the wiring harness related to the engine harness. A change in the display will indicate the location of the fault.

If a DTC P1404 is also set, check the 5 volt reference circuits for a short to voltage.

Check for a restricted exhaust system.

A shorted 5 volt reference circuit may cause a DTC P0172 to set. Check the 5 volt reference sensors for abnormal readings.

DTC P0172 – Fuel Trim System Too Rich (2.0L DOHC)

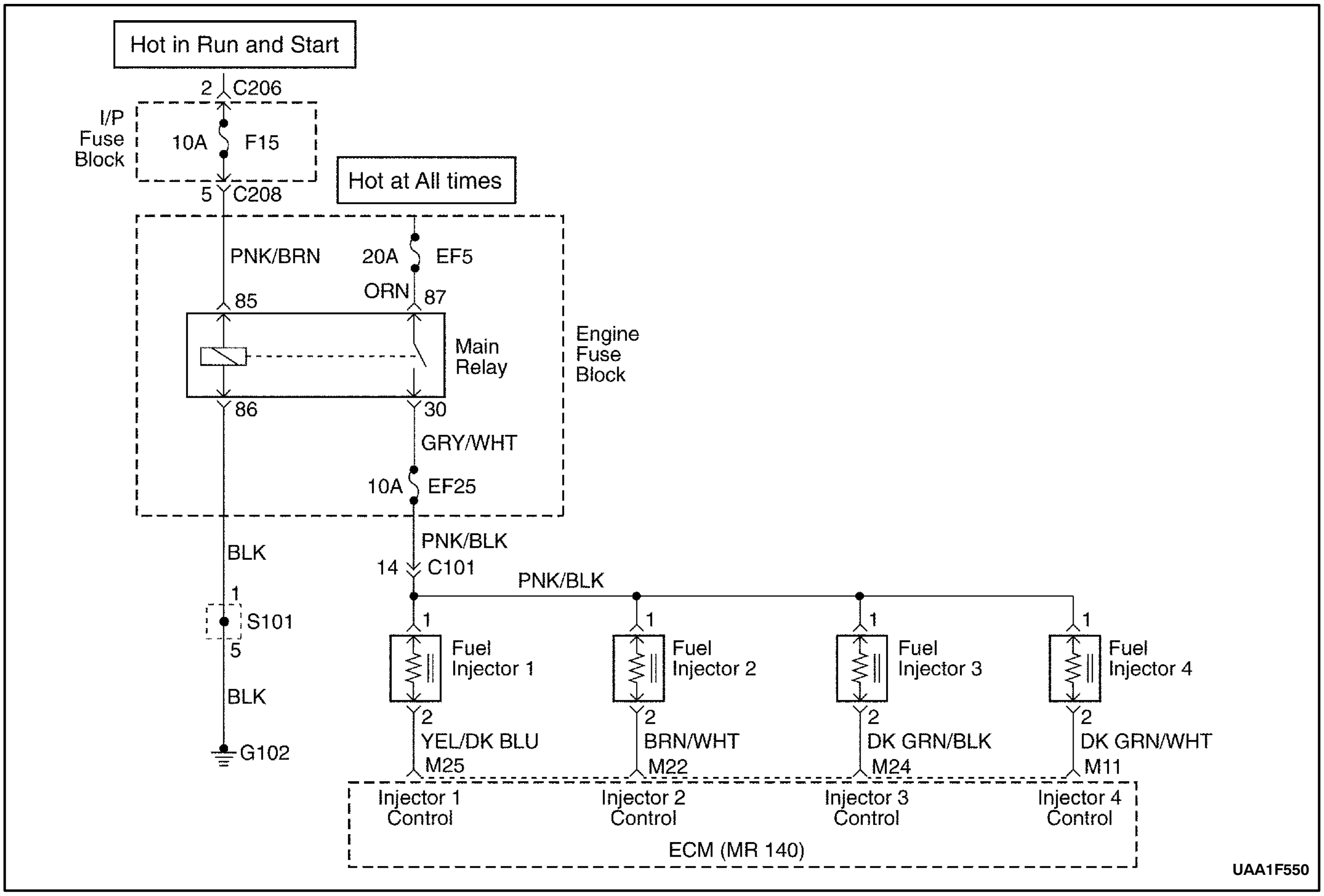
Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Are any component related Diagnostic Trouble Codes (DTCs) set?	–	Go to Applicable DTC table	Go to *Step 3*
3	With the engine running, operate the vehicle until the LOOP STATUS indicates closed. Is the Long Term Fuel Trim value above the specified value?	–20 %	Go to *Step 4*	Go to *Step 5*
4	1. Turn the ignition switch ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Does the Long Term Fuel Trim value above the specified value while operating under the specified conditions?	–20 %	Go to *Step 21*	Go to *Step 5*
5	Visually/physically check the air cleaner filter for excessive dirt or being plugged and repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 6*
6	Visually/physically check the air intake system for collapsed or restricted and repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to Step 7
7	Inspect the throttle body inlet for damaged or foreign objects which may partially block the airflow and repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 8*
8	1. Turn the ignition OFF. 2. Inspect the throttle bore, throttle plate and Idle Air Control (IAC) passages for clocking and foreign objects and repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 9*
9	Start the engine with the vehicle in park or neutral and A/C off and note the idle quality. Is a low or unsteady idle being experienced?	–	Go to *Step 10*	Go to *Step 12*
10	Idle the engine. Are the IAC counts below the specified value?	100	Go to *Step 12*	Go to *Step 11*
11	1. Turn the ignition OFF. 2. Disconnect the Manifold Absolute Pressure (MAP) sensor electrical connector. 3. Start the engine. 4. Operate the vehicle in Closed Loop while monitoring the Long Term Fuel Trim value. Does the Long Term Fuel Trim value increase above the specified value?	–20 %	Go to *Step 20*	Go to *Step 12*

DTC P0172 – Fuel Trim System Too Rich (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check the IAC valve performance. Refer to "DTC P0506 Idle Speed RPM Lower Than Desired Idle Speed" or "DTC P0507 Idle Speed RPM Higher Than Desired Idle Speed" in this section and repair as necessary. Is the repair complete?	–	Go to *Step 21*	Go to *Step 13*
13	1. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. 2. If fuel is presence in the vacuum hose, replace the fuel pressure regulator. Is the repair complete?	–	Go to *Step 21*	Go to *Step 14*
14	1. Turn the ignition ON. 2. Slowly press the acceleration pedal. Does the Throttle Position (TP) sensor display increase steady and evenly from its minimum voltage at closed throttle to its maximum voltage at Wide-Open Throttle (WOT).	–	Go to *Step 15*	Go to *Step 19*
15	1. Perform the Fuel System Diagnosis. 2. If the table isolate a problem, repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 16*
16	1. Perform the Evaporative Emission (EVAP) Control System Diagnosis. 2. If the table isolate a problem, repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 17*
17	1. Perform the Fuel Injector Balance Test. 2. If the table isolate a problem, repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 18*
18	1. Remove the Oxygen Sensor (O2S). 2. Visually/physically inspect the O2S for silicone contamination. **Note:** this will be indicated by a powdery white deposit on the portion of the O2S exposed to the exhaust stream. 3. If contamination is present on the O2S, find the source and repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to "Diagnostic Aids"
19	1. Check the TP sensor mounting screws. 2. If they are too loose or missing tighten or replace them as needed. 3. If the screws are OK, replace the TP sensor. Is the repair complete?	–	Go to *Step 21*	–
20	1. Turn the ignition OFF. 2. Replace the MAP sensor. Is the repair complete?	–	Go to *Step 21*	–

DTC P0172 – Fuel Trim System Too Rich (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
21	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 22*	Go to *Step 2*
22	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0201 INJECTOR 1 OUTPUT CIRCUIT FAULT (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) has four individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a short to ground and/or an open circuit and short to battery conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Engine is in run mode.
- Battery voltage is greater than 9 volts.
- Engine speed is greater than 700 rpm.
- Fault is present for more than 5 seconds.

Action Taken When the DTC Sets

- The ECM will illuminate the Malfunction Indicator Lamp (MIL) the first time the fault is Detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The ECM will turn off the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history will clear after 40 consecutive warm-up cycles without a fault.
- DTC can be cleared by using the scan tool Clear Info function.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An injector 1 driver circuit that is open or shorted to voltage will cause a DTC P0201 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-term fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to “Fuel Injector Balance Test” in this section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than if tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5 **W**.

DTC P0201 – Injector 1 Output Circuit Fault (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	Will the engine start?	–	Go to *Step 3*	Go to “Engine Cranks But Will Not Run”
3	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON, with the engine OFF. 3. Clear the Diagnostic Trouble Codes (DTCs) using a scan tool. 4. Start the engine and idle for one minute. Does DTC P0201 reset?	–	Go to *Step 5*	Go to *Step 4*
4	1. Turn the ignition ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions as noted. Does DTC P0201 reset?	–	Go to *Step 5*	Go to “Diagnostic Aids”
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector for injector 1. 3. Turn the ignition ON, with the engine OFF. 4. With a test light connected to ground, probe the driver circuit, terminal M25. Does the test light illuminate?	–	Go to *Step 7*	Go to *Step 6*
6	Repair the short to ground or open in the injector driver circuit. Is the repair complete?	–	Go to *Step 10*	–
7	1. Disconnect the injector 1 wiring connection. 2. With a test light connected to ground, probe the driver circuit, terminal 2. Does the test light illuminate?	–	Go to *Step 8*	Go to *Step 9*
8	Repair the short to voltage in the injector driver circuit. Is the repair complete?	–	Go to *Step 10*	–
9	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 10*	–
10	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 10*	Go to *Step 2*

DTC P0201 – Injector 1 Output Circuit Fault (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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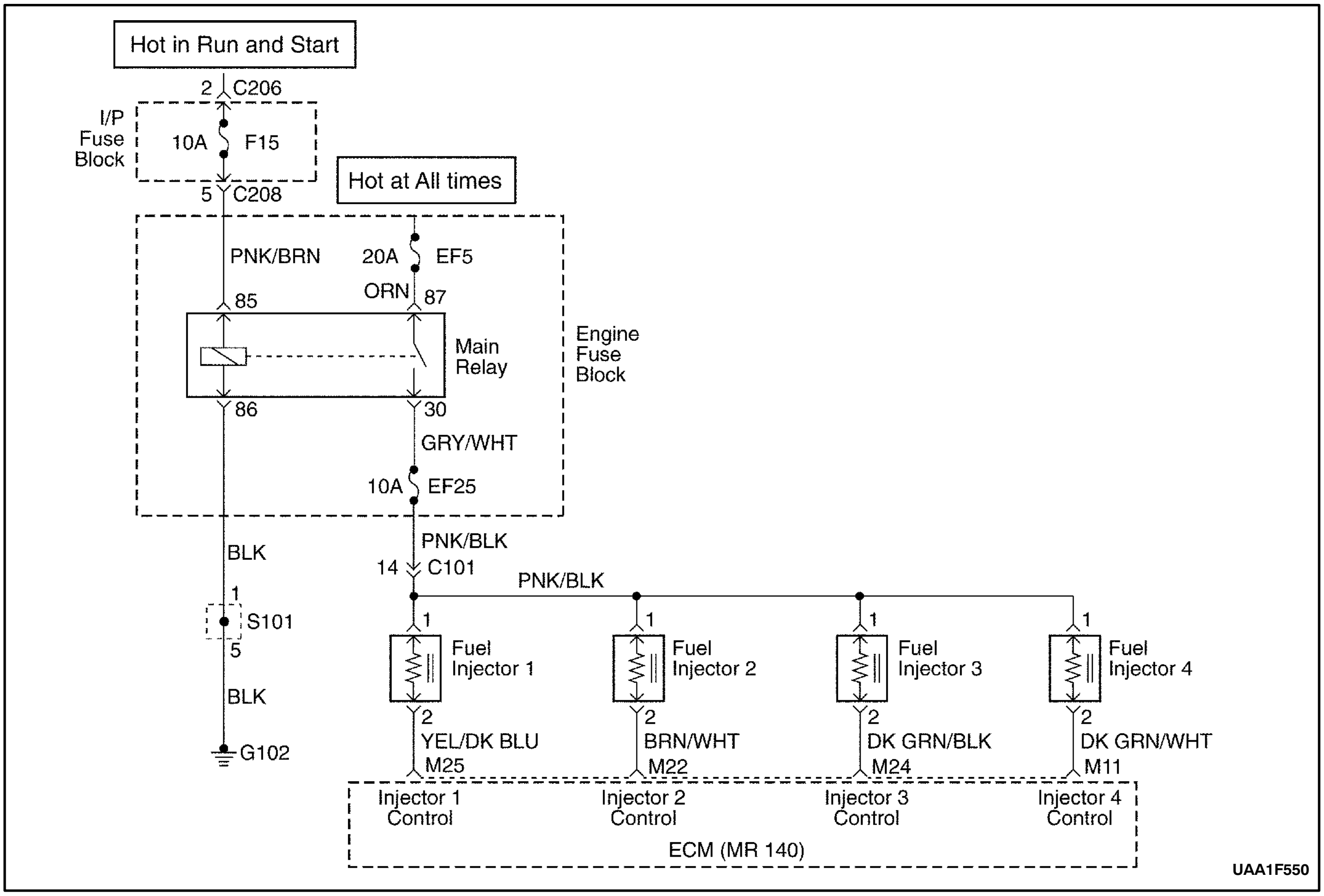

DIAGNOSTIC TROUBLE CODE (DTC) P0202 INJECTOR 2 OUTPUT CIRCUIT FAULT (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) has four individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a short to ground and/or an open circuit and short to battery conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Engine is in run mode.
- Battery voltage is greater than 9 volts.
- Engine speed is greater than 700 rpm.
- Fault is present for more than 5 seconds.

Action Taken When the DTC Sets

- The ECM will illuminate the Malfunction Indicator Lamp (MIL) the first time the fault is Detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The ECM will turn off the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history will clear after 40 consecutive warm-up cycles without a fault.
- DTC can be cleared by using the scan tool Clear Info function.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An injector 2 driver circuit that is open or shorted to voltage will cause a DTC P0202 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-term fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to “Fuel Injector Balance Test” in this section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than if tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5 **W**.

DTC P0202 – Injector 2 Output Circuit Fault (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	Will the engine start?	–	Go to *Step 3*	Go to “Engine Cranks But Will Not Run”
3	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON, with the engine OFF. 3. Clear the Diagnostic Trouble Codes (DTCs) using a scan tool. 4. Start the engine and idle for one minute. Does DTC P0202 reset?	–	Go to *Step 5*	Go to *Step 4*
4	1. Turn the ignition ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions as noted. Does DTC P0202 reset?	–	Go to *Step 5*	Go to “Diagnostic Aids”
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector for injector 2. 3. Turn the ignition ON, with the engine OFF. 4. With a test light connected to ground, probe the driver circuit, terminal M22. Does the test light illuminate?	–	Go to *Step 7*	Go to *Step 6*
6	Repair the short to ground or open in the injector driver circuit. Is the repair complete?	–	Go to *Step 10*	–
7	1. Disconnect the injector 2 wiring connection. 2. With a test light connected to ground, probe the driver circuit, terminal 2. Does the test light illuminate?	–	Go to *Step 8*	Go to *Step 9*
8	Repair the short to voltage in the injector driver circuit. Is the repair complete?	–	Go to *Step 10*	–
9	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 10*	–
10	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 10*	Go to *Step 2*

DTC P0202 – Injector 2 Output Circuit Fault (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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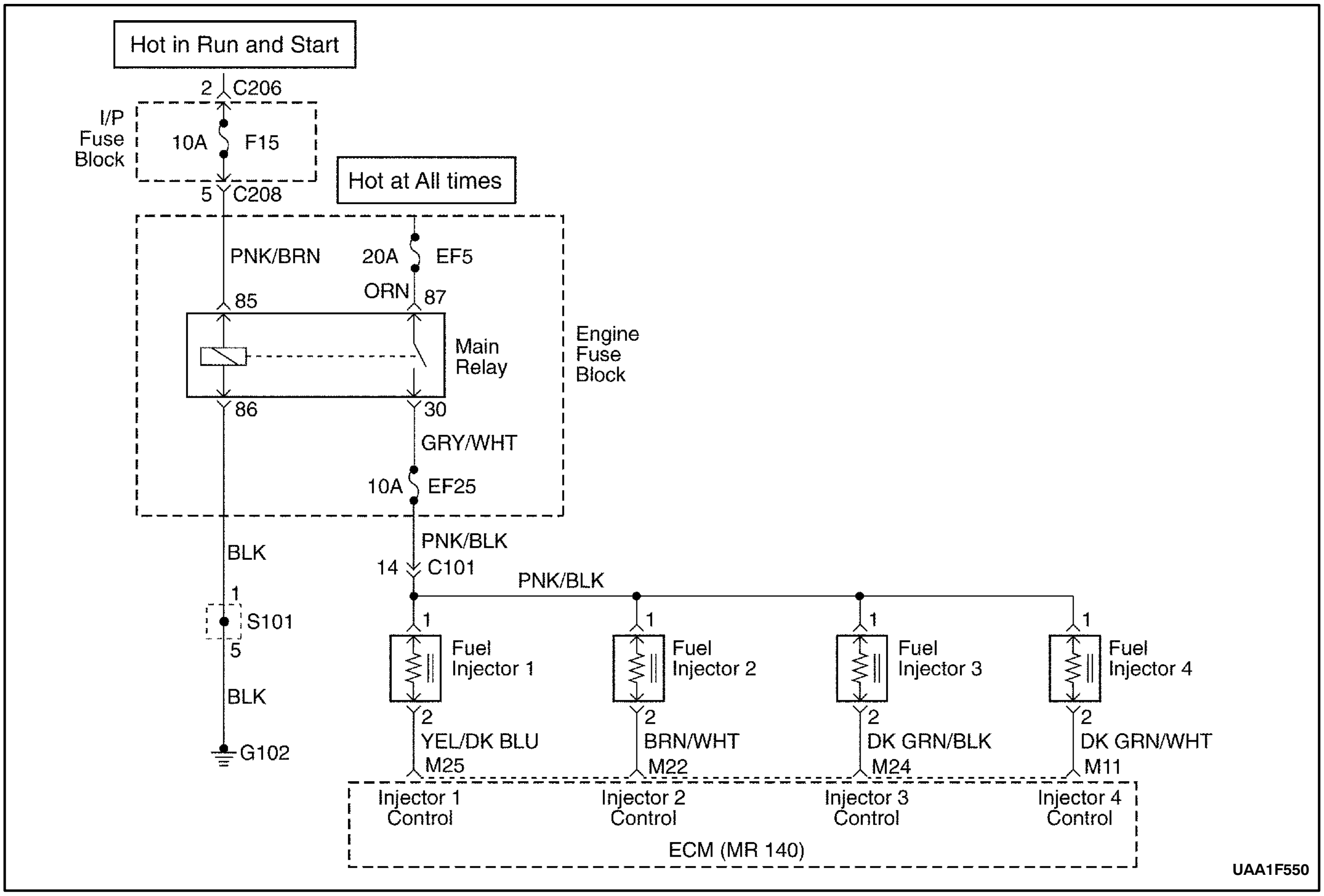

DIAGNOSTIC TROUBLE CODE (DTC) P0203 INJECTOR 3 OUTPUT CIRCUIT FAULT (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) has four individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a short to ground and/or an open circuit and short to battery conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Engine is in run mode.
- Battery voltage is greater than 9 volts.
- Engine speed is greater than 700 rpm.
- Fault is present for more than 5 seconds.

Action Taken When the DTC Sets

- The ECM will illuminate the Malfunction Indicator Lamp (MIL) the first time the fault is Detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The ECM will turn off the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC can be cleared by using the scan tool Clear Info function.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An injector 3 driver circuit that is open or shorted to voltage will cause a DTC P0203 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-term fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to “Fuel Injector Balance Test” in this section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than if tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5 **W**.

DTC P0203 – Injector 3 Output Circuit Fault (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	Will the engine start?	–	Go to *Step 3*	Go to “Engine Cranks But Will Not Run”
3	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON, with the engine OFF. 3. Clear the Diagnostic Trouble Codes (DTCs) using a scan tool. 4. Start the engine and idle for one minute. Does DTC P0203 reset?	–	Go to *Step 5*	Go to *Step 4*
4	1. Turn the ignition ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions as noted. Does DTC P0203 reset?	–	Go to Step 5	Go to “diagnostic Aids”
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector for injector 3. 3. Turn the ignition ON, with the engine OFF. 4. With a test light connected to ground, probe the driver circuit, terminal M24. Does the test light illuminate?	–	Go to *Step 7*	Go to *Step 6*
6	Repair the short to ground or open in the injector driver circuit. Is the repair complete?	–	Go to *Step 10*	–
7	1. Disconnect the injector 3 wiring connection. 2. With a test light connected to ground, probe the driver circuit, terminal 2. Does the test light illuminate?	–	Go to *Step 8*	Go to *Step 9*
8	Repair the short to voltage in the injector driver circuit. Is the repair complete?	–	Go to *Step 10*	–
9	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 10*	–
10	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 10*	Go to *Step 2*

DTC P0203 – Injector 3 Output Circuit Fault (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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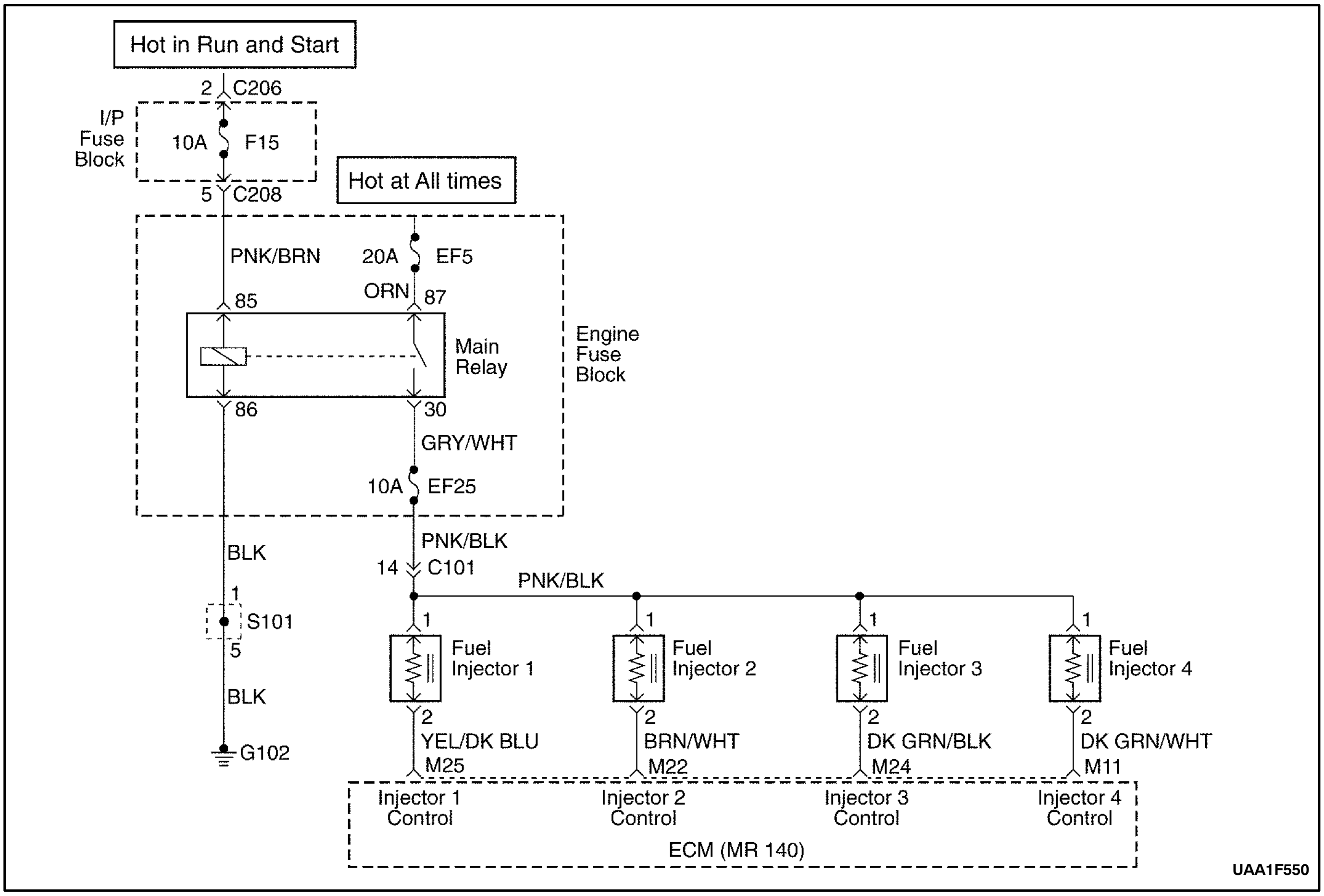

DIAGNOSTIC TROUBLE CODE (DTC) P0204 INJECTOR 4 OUTPUT CIRCUIT FAULT (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) has four individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a short to ground and/or an open circuit and short to battery conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Engine is in run mode.
- Battery voltage is greater than 9 volts.
- Engine speed is greater than 700 rpm.
- Fault is present for more than 5 seconds.

Action Taken When the DTC Sets

- The ECM will illuminate the Malfunction Indicator Lamp (MIL) the first time the fault is Detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The ECM will turn off the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC can be cleared by using the scan tool Clear Info function.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An injector 4 driver circuit that is open or shorted to voltage will cause a DTC P0204 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-term fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to “Fuel Injector Balance Test” in this section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than if tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5 **W**.

DTC P0204 – Injector 4 Output Circuit Fault (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	Will the engine start?	–	Go to *Step 3*	Go to “Engine Cranks But Will Not Run”
3	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON, with the engine OFF. 3. Clear the Diagnostic Trouble Codes (DTCs) using a scan tool. 4. Start the engine and idle for one minute. Does DTC P0204 reset?	–	Go to *Step 5*	Go to *Step 4*
4	1. Turn the ignition ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions as noted. Does DTC P0204 reset?	–	Go to *Step 5*	Go to “Diagnostic Aids”
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector for injector 4. 3. Turn the ignition ON, with the engine OFF. 4. With a test light connected to ground, probe the driver circuit, terminal M11. Does the test light illuminate?	–	Go to *Step 7*	Go to *Step 6*
6	Repair the short to ground or open in the injector driver circuit. Is the repair complete?	–	Go to *Step 10*	–
7	1. Disconnect the injector 4 wiring connection. 2. With a test light connected to ground, probe the driver circuit, terminal 2. Does the test light illuminate?	–	Go to *Step 8*	Go to *Step 9*
8	Repair the short to voltage in the injector driver circuit. Is the repair complete?	–	Go to *Step 10*	–
9	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 10*	–
10	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 10*	Go to *Step 2*

DTC P0204 – Injector 4 Output Circuit Fault (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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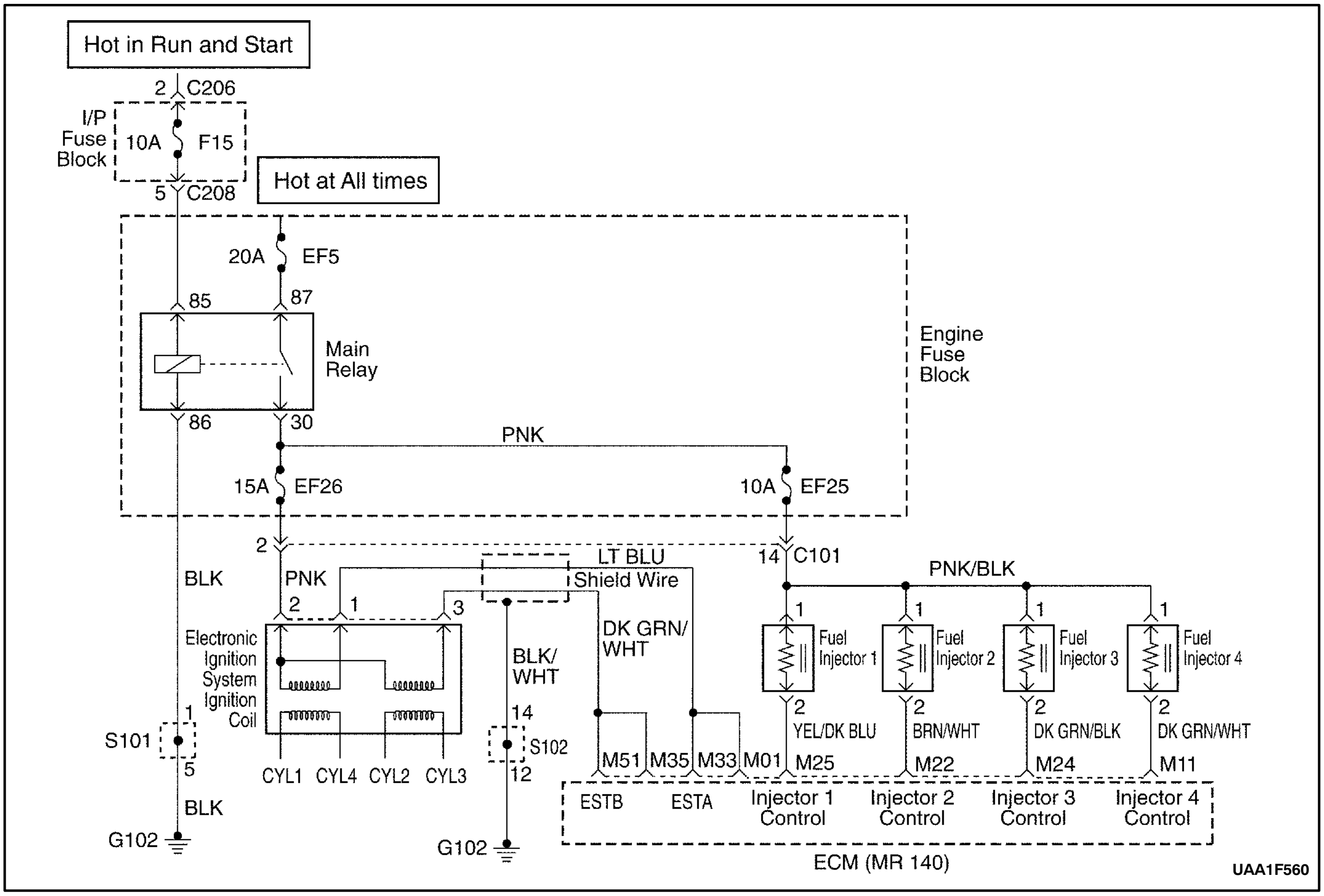


DIAGNOSTIC TROUBLE CODE (DTC) P0300 MULTIPLE CYLINDER MISFIRE (2.0L DOHC)

System Description

The Engine Control Module (ECM) monitors the crankshaft and camshaft positions to detect if the engine is misfiring. The ECM looks for a quick drop in crankshaft speed. This test is executed in blocks of 100 engine revolution tests. It may take between one to several tests to store a Diagnostic Trouble Code (DTC) and illuminate the Malfunction Indicator Lamp (MIL). Under light misfire conditions, it may also take more than one trip to set a DTC. Severe misfire will flash the MIL, indicating that catalyst damage is possible.

Conditions for Setting the DTC

- Emission threshold is 3.0% for automatic transaxle and 3.0% for manual transaxle.
- 20 engine cycles have occurred since cranking has started.
- A/C compressor clutch has not just engaged or disengaged.
- Engine load and engine speed are in a detectable region and are at or above zero torque.
- Camshaft Position (CMP) sensor is in synchronization.
- Exhaust Gas Recirculation (EGR) flow diagnostic is not in progress.
- Fuel level is greater than or equal to 20% of rated tank capacity.
- Decel Fuel Cutoff (DFCO) not active.
- Fuel is not shutoff from high engine speed of 6500 rpm for manual transaxle vehicle or 6500 rpm in drive and 6250 rpm in park for automatic transaxle vehicles.
- Fuel is not shutoff at 255 km/h (158 mph).
- An automatic transmission is not shifting.
- Throttle position change is less than 3% per 125 ms.
- Vehicle has not encountered an abusive engine speed of 7000 rpm.
- Crankshaft speed patters are normal.
- Throttle position is less than 4% when vehicle speed is greater than 10 km/h (6 mph).
- Engine speed is between 600 and 4500 rpm.
- Vehicle voltage is between 11 and 16 volts.
- Engine Coolant Temperature (ECT) is between –7°C (20°F) and 120°C (248°F).

- The engine speed is less than or equal to 1800 rpm or the crank angle sensing error has not been learned.
- There is the correct ratio between Crankshaft Position (CKP) sensor pulses and CMP sensor pulses.
- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0336, P0337, P0341, P0342 and P0502 are not set.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive ignition cycles in which the diagnostic runs with the fault active.

Or

- The MIL will illuminate immediately and flash if misfire is present.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault within the freeze frame conditions that the DTC failed.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent can also be the result of a defective reluctor wheel. Remove the CKP sensor and inspect the reluctor wheel through the sensor mount hole. Check for porosity and the condition of wheel. If the DTC is intermittent refer to “Symptoms Diagnosis” in this section.

DTC P0300 – Multiple Cylinder Misfire (2.0L DOHC)

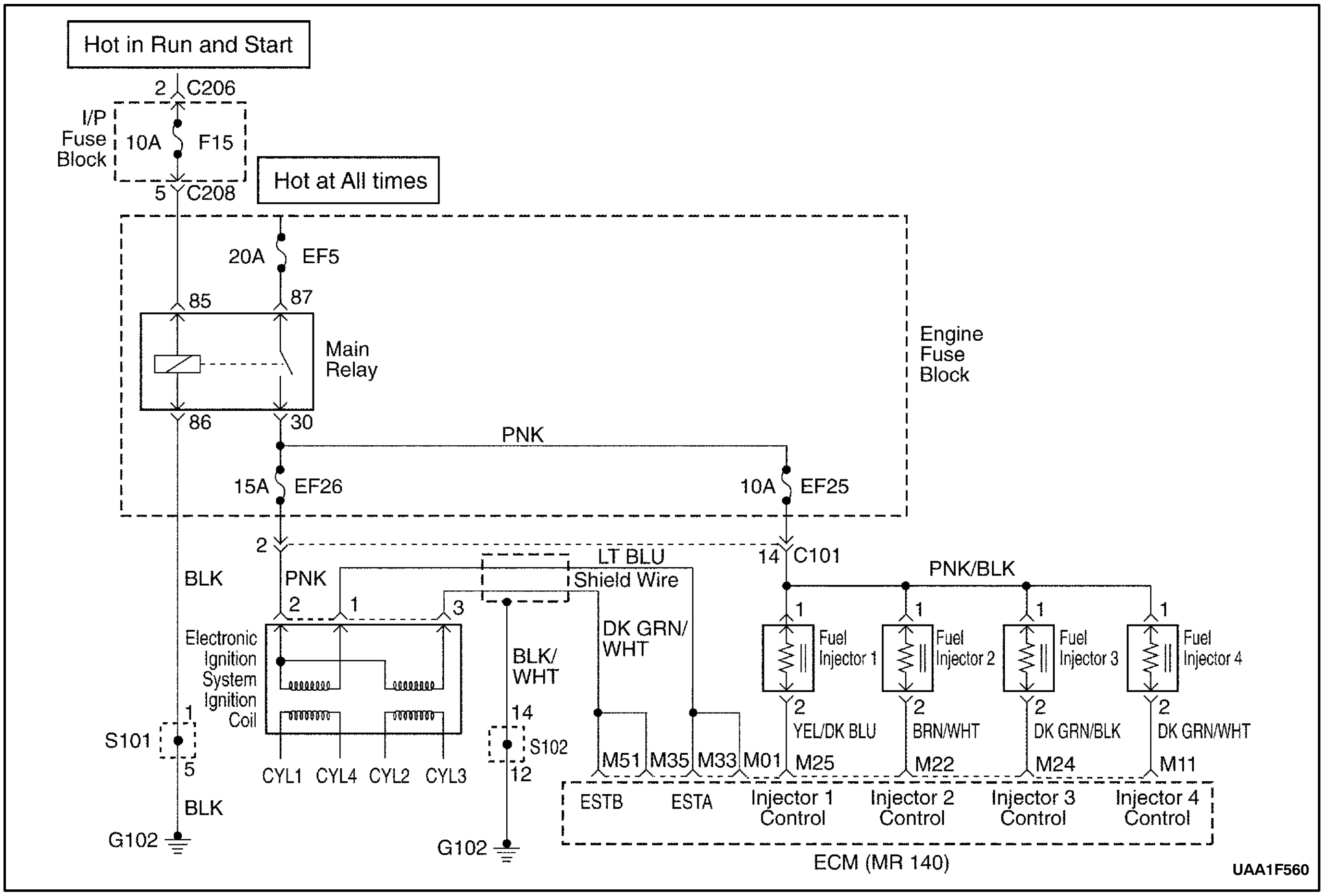
Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON, with the engine OFF. 3. Request Diagnostic Trouble Codes (DTCs) Are DTCs P0201, P0202, P0203, P0204 set?	–	Go to Applicable DTC table	Go to *Step 3*
3	1. Perform a visual/physical inspection. 2. Make any repairs that are necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 4*
4	Start the engine and allow it to idle. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to *Step 6*
5	Are all counters equal (within a percentage of each other)?	–	Go to *Step 7*	Go to *Step 11*
6	1. Turn the ignition ON, with the engine OFF. 2. Review the Freeze Frame data, and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and conditions for setting this DTC as noted. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to “Diagnostic Aids”
7	1. Turn the engine OFF. 2. Install a fuel pressure gauge to the fuel rail. 3. Observe the fuel pressure with the engine running. Is the fuel pressure within the specified value?	284–325 kPa (41–47 psi)	Go to *Step 8*	Go to “Fuel System Diagnosis”
8	Check the fuel for contamination. Is the fuel OK?	–	Go to *Step 9*	Go to *Step 10*
9	Check for a basic engine problem and repair as necessary. Is the repair complete?	–	Go to *Step 27*	–

DTC P0300 – Multiple Cylinder Misfire (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the contaminated fuel. Is the repair complete?	–	Go to *Step 27*	–
11	1. Turn the engine OFF. 2. Disconnect the fuel injector harness connector. 3. Install a spark tester on cylinder #1 spark plug cable. 4. Crank the engine and check for spark. 5. Repeat the above procedure on cylinders #2, #3 and #4. Is a spark observed on all four spark plug cables?	–	Go to *Step 12*	Go to *Step 20*
12	Replace any malfunctioning spark plugs if necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 13*
13	1. Turn the engine OFF. 2. Disconnect the fuel injector connectors from the injectors. 3. Install an injector test light on the injector harness connector for the cylinders that had misfired. 4. Crank the engine and note the test light. Does the injector test light blink?	–	Go to *Step 14*	Go to *Step 15*
14	Perform the Fuel Injector Balance Test. Are the fuel injectors OK?	–	Go to *Step 9*	Go to *Step 16*
15	1. Disconnect the injector test light. 2. With a test light connected to ground, probe the ignition feed terminal 1 of the injector harness connector for each cylinder that had misfire. 3. Crank the engine. Does the test light illuminate?	–	Go to *Step 17*	Go to *Step 19*
16	Replace any malfunctioning fuel injectors. Is the repair complete?	–	Go to *Step 27*	–
17	Check the affected fuel injector driver circuit at terminals M25, M22, M24, and M11 for an open, short, or short to voltage. Is a problem found?	–	Go to *Step 18*	Go to *Step 24*
18	Repair the open or the shorted fuel injector driver circuit. Is the repair complete?	–	Go to *Step 27*	–
19	Repair the open ignition feed circuit between the fuel injector harness connector and the fuel injector connector. Is the repair complete?	–	Go to Step 27	–
20	Measure the resistance of the spark plug cable that the spark plug tester did not spark. Is the resistance of the spark plug cable less than the specified value?	30000 **W**	Go to *Step 21*	Go to *Step 25*
21	Inspect the Engine Control Module (ECM) connector and connections. Are the connections OK?	–	Go to *Step 22*	Go to *Step 23*
22	Check the affected cylinders ignition control circuit for an open or short and repair as necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 26*

DTC P0300 – Multiple Cylinder Misfire (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
23	Repair the connector or connections. Is the repair complete?	–	Go to *Step 27*	–
24	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 27*	–
25	Replace the spark plug cable. Is the repair complete?	–	Go to *Step 27*	–
26	Replace the faulty ignition coil. Is the repair complete?	–	Go to *Step 27*	Go to *Step 24*
27	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 28*	Go to *Step 2*
28	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0301 CYLINDER 1 MISFIRE (2.0L DOHC)

System Description

The Engine Control Module (ECM) monitors the crankshaft and camshaft positions to detect if the engine is misfiring. The ECM looks for a quick drop in crankshaft speed. This test is executed in blocks of 100 engine revolution tests. It may take between one to several tests to store a Diagnostic Trouble Code (DTC) and illuminate the Malfunction Indicator Lamp (MIL). Under light misfire conditions, it may also take more than one trip to set a DTC. Severe misfire will flash the MIL, indicating that catalyst damage is possible.

Conditions for Setting the DTC

- Emission threshold is 3.0% for automatic transaxle and 3.0% for manual transaxle.
- 20 engine cycles have occurred since cranking has started.
- A/C compressor clutch has not just engaged or disengaged.
- Engine load and engine speed are in a detectable region and are at or above zero torque.
- Camshaft Position (CMP) sensor is in synchronization.
- Exhaust Gas Recirculation (EGR) flow diagnostic is not in progress.
- Fuel level is greater than or equal to 20% of rated tank capacity.
- Decel Fuel Cutoff (DFCO) not active.
- Fuel is not shutoff from high engine speed of 6500 rpm for manual transaxle vehicle or 6500 rpm in drive and 6250 rpm in park for automatic transaxle vehicles.
- Fuel is not shutoff at 255 km/h (158 mph).
- An automatic transmission is not shifting.
- Throttle position change is less than 3% per 125 ms.
- Vehicle has not encountered an abusive engine speed of 7000 rpm.
- Crankshaft speed patters are normal.
- Throttle position is less than 4% when vehicle speed is greater than 10 km/h (6 mph).
- Engine speed is between 600 and 4500 rpm.
- Vehicle voltage is between 11 and 16 volts.
- Engine Coolant Temperature (ECT) is between –7 °C (20 °F) and 120 °C (248 °F).

- The engine speed is less than or equal to 1800 rpm or the crank angle sensing error has not been learned.
- There is the correct ratio between Crankshaft Position (CKP) sensor pulses and CMP sensor pulses.
- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0336, P0337, P0341, P0342 and P0502 are not set.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive ignition cycles in which the diagnostic runs with the fault active.

Or

- The MIL will illuminate immediately and flash if misfire is present.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault within the freeze frame conditions that the DTC failed.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent can also be the result of a defective reluctor wheel. Remove the CKP sensor and inspect the reluctor wheel through the sensor mount hole. Check for porosity and the condition of wheel. If the DTC is intermittent refer to “Symptoms Diagnosis” in this section.

DTC P0301 – Cylinder 1 Misfire (2.0L DOHC)

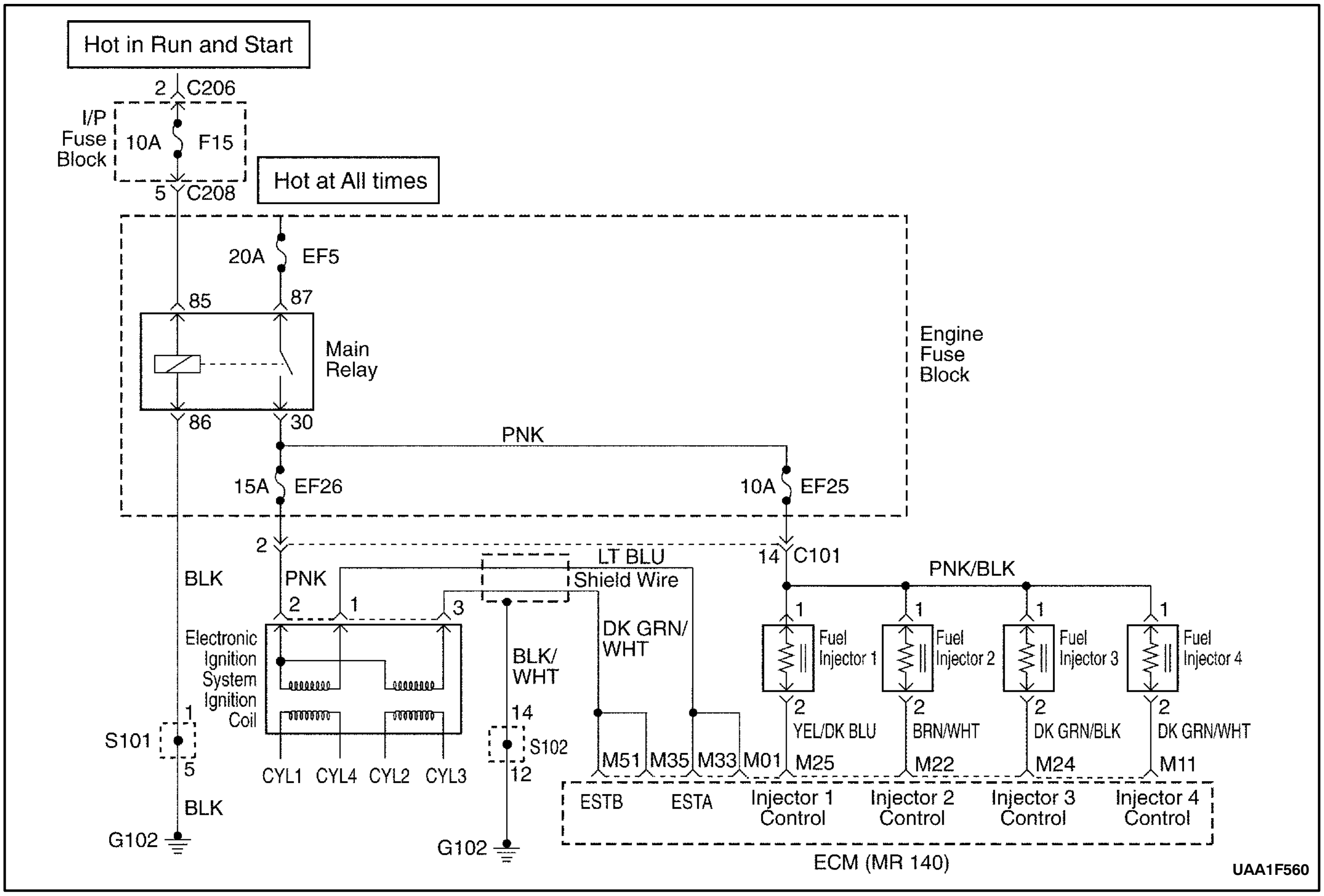
Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC) 2. Turn the ignition ON, with the engine OFF. 3. Request Diagnostic Trouble Codes (DTCs) Are DTCs P0201 or P300 set?	–	Go to Applicable DTC table	Go to *Step 3*
3	1. Perform a visual/physical inspection. 2. Make any repairs that are necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 4*
4	Start the engine and allow it to idle. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to *Step 6*
5	Are all counters equal (within a percentage of each other)?	–	Go to *Step 7*	Go to *Step 11*
6	1. Turn the ignition ON, with the engine OFF. 2. Review the Freeze Frame data, and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and conditions for setting this DTC as noted. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to “Diagnostic Aids”
7	1. Turn the engine OFF. 2. Install a fuel pressure gauge to the fuel rail. 3. Observe the fuel pressure with the engine running. Is the fuel pressure within the specified value?	284–325 kPa (41–47 psi)	Go to *Step 8*	Go to “Fuel System Diagnosis”
8	Check the fuel for contamination. Is the fuel OK?	–	Go to *Step 9*	Go to *Step 10*
9	Check for a basic engine problem and repair as necessary. Is the repair complete?	–	Go to *Step 27*	–

DTC P0301 – Cylinder 1 Misfire (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the contaminated fuel. Is the repair complete?	–	Go to *Step 27*	–
11	1. Turn the engine OFF. 2. Disconnect the fuel injector harness connector. 3. Install a spark tester on cylinder #1 spark plug cable. 4. Crank the engine and check for spark. Is a spark observed on all four spark plug cables?	–	Go to *Step 12*	Go to *Step 20*
12	Replace the malfunctioning spark plug. Is the repair complete?	–	Go to *Step 27*	Go to *Step 13*
13	1. Turn the engine OFF. 2. Disconnect the cylinder #1 fuel injector connectors from the injector. 3. Install an injector test light on the injector harness connector, terminal 2. 4. Crank the engine and note the test light. Does the injector test light blink?	–	Go to *Step 14*	Go to *Step 15*
14	Perform the Fuel Injector Balance Test. Are the fuel injectors OK?	–	Go to *Step 9*	Go to *Step 16*
15	1. Disconnect the injector test light. 2. With a test light connected to ground, probe the ignition feed terminal 1 of the injector harness connector. 3. Crank the engine. Does the test light illuminate?	–	Go to *Step 17*	Go to *Step 19*
16	Replace the malfunctioning fuel injector. Is the repair complete?	–	Go to *Step 27*	–
17	Check the affected fuel injector driver circuit for an open, short, or short to voltage. Is a problem found?	–	Go to *Step 18*	Go to *Step 24*
18	Repair the open or the shorted fuel injector driver circuit. Is the repair complete?	–	Go to *Step 27*	–
19	Repair the open ignition feed circuit between the fuel injector harness connector and the fuel injector connector. Is the repair complete?	–	Go to *Step 27*	–
20	Measure the resistance of the spark plug cable. Is the resistance of the spark plug cable less than the specified value?	30000 **W**	Go to *Step 21*	Go to *Step 25*
21	Inspect the Engine Control Module (ECM) connector and connections. Are the connections OK?	–	Go to *Step 22*	Go to *Step 23*
22	Check the affected cylinders ignition control circuit for an open or short and repair as needed. Is the repair complete?	–	Go to *Step 27*	Go to *Step 26*
23	Repair the connector or connections. Is the repair complete?	–	Go to *Step 27*	–
24	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 27*	–

DTC P0301 – Cylinder 1 Misfire (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
25	Replace the spark plug cable. Is the repair complete?	–	Go to *Step 27*	–
26	Replace the faulty ignition coil. Is the repair complete?	–	Go to *Step 27*	Go to *Step 24*
27	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 28*	Go to *Step 2*
28	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0302 CYLINDER 2 MISFIRE (2.0L DOHC)

System Description

The Engine Control Module (ECM) monitors the crankshaft and camshaft positions to detect if the engine is misfiring. The ECM looks for a quick drop in crankshaft speed. This test is executed in blocks of 100 engine revolution tests. It may take between one to several tests to store a Diagnostic Trouble Code (DTC) and illuminate the Malfunction Indicator Lamp (MIL). Under light misfire conditions, it may also take more than one trip to set a DTC. Severe misfire will flash the MIL, indicating that catalyst damage is possible.

Conditions for Setting the DTC

- Emission threshold is 3.0% for automatic transaxle and 3.0% for manual transaxle.
- 20 engine cycles have occurred since cranking has started.
- A/C compressor clutch has not just engaged or disengaged.
- Engine load and engine speed are in a detectable region and are at or above zero torque.
- Camshaft Position (CMP) sensor is in synchronization.
- Exhaust Gas Recirculation (EGR) flow diagnostic is not in progress.
- Fuel level is greater than or equal to 20% of rated tank capacity.
- Decel Fuel Cutoff (DFCO) not active.
- Fuel is not shutoff from high engine speed of 6500 rpm for manual transaxle vehicle or 6500 rpm in drive and 6250 rpm in park for automatic transaxle vehicles.
- Fuel is not shutoff at 255 km/h (158 mph).
- An automatic transmission is not shifting.
- Throttle position change is less than 3% per 125 ms.
- Vehicle has not encountered an abusive engine speed of 7000 rpm.
- Crankshaft speed patters are normal.
- Throttle position is less than 4% when vehicle speed is greater than 10 km/h (6 mph).
- Engine speed is between 600 and 4500 rpm.
- Vehicle voltage is between 11 and 16 volts.
- Engine Coolant Temperature (ECT) is between –7°C (20°F) and 120°C (248°F).

- The engine speed is less than or equal to 1800 rpm or the crank angle sensing error has not been learned.
- There is the correct ratio between Crankshaft Position (CKP) sensor pulses and CMP sensor pulses.
- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0336, P0337, P0341, P0342 and P0502 are not set.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive ignition cycles in which the diagnostic runs with the fault active.

Or

- The MIL will illuminate immediately and flash if misfire is present.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault within the freeze frame conditions that the DTC failed.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent can also be the result of a defective reluctor wheel. Remove the CKP sensor and inspect the reluctor wheel through the sensor mount hole. Check for porosity and the condition of wheel. If the DTC is intermittent refer to "Symptoms Diagnosis" in this section.

DTC P0302 – Cylinder 2 Misfire (2.0L DOHC)

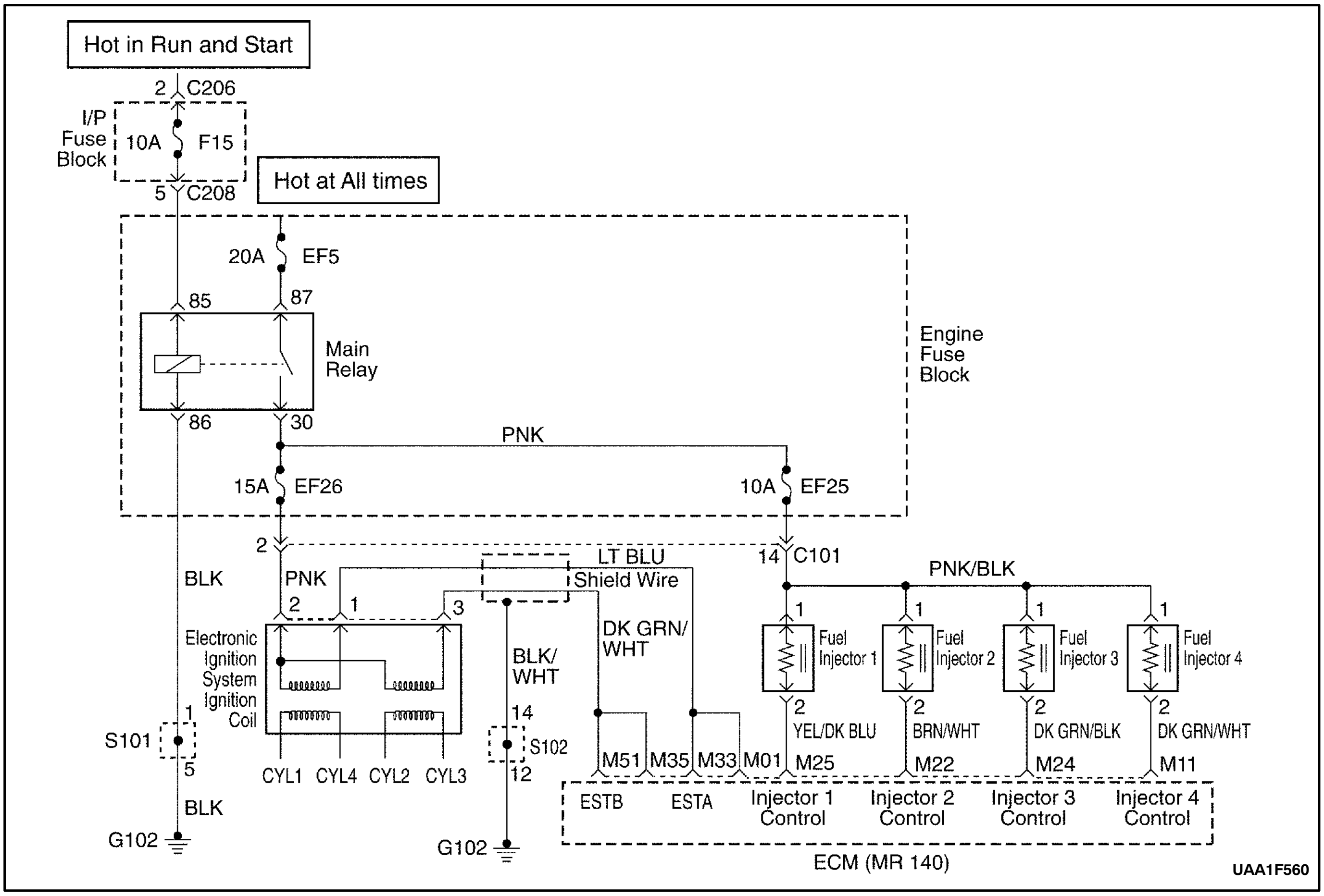
Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON, with the engine OFF. 3. Request Diagnostic Trouble Codes (DTCs) Are DTCs P0202 or P300 set?	–	Go to Applicable DTC table	Go to *Step 3*
3	1. Perform a visual/physical inspection. 2. Make any repairs that are necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 4*
4	Start the engine and allow it to idle. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to *Step 6*
5	Are all counters equal (within a percentage of each other)?	–	Go to *Step 7*	Go to *Step 11*
6	1. Turn the ignition ON, with the engine OFF. 2. Review the Freeze Frame data, and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and conditions for setting this DTC as noted. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to "Diagnostic Aids"
7	1. Turn the engine OFF. 2. Install a fuel pressure gauge to the fuel rail. 3. Observe the fuel pressure with the engine running. Is the fuel pressure within the specified value?	284–325 kPa (41–47 psi)	Go to *Step 8*	Go to "Fuel System Diagnosis"
8	Check the fuel for contamination. Is the fuel OK?	–	Go to *Step 9*	Go to *Step 10*
9	Check for a basic engine problem and repair as necessary. Is the repair complete?	–	Go to *Step 27*	–

DTC P0302 – Cylinder 2 Misfire (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the contaminated fuel. Is the repair complete?	–	Go to *Step 27*	–
11	1. Turn the engine OFF. 2. Disconnect the fuel injector harness connector. 3. Install a spark tester on cylinder #2 spark plug cable. 4. Crank the engine and check for spark. Is a spark observed on all four spark plug cables?	–	Go to *Step 12*	Go to *Step 20*
12	Replace the malfunctioning spark plug. Is the repair complete?	–	Go to *Step 27*	Go to *Step 13*
13	1. Turn the engine OFF. 2. Disconnect the cylinder #2 fuel injector connectors from the injector. 3. Install an injector test light on the injector harness connector, terminal 2. 4. Crank the engine and note the test light. Does the injector test light blink?	–	Go to *Step 14*	Go to *Step 15*
14	Perform the Fuel Injector Balance Test. Are the fuel injectors OK?	–	Go to *Step 9*	Go to *Step 16*
15	1. Disconnect the injector test light. 2. With a test light connected to ground, probe the ignition feed terminal 1 of the injector harness connector. 3. Crank the engine. Does the test light illuminate?	–	Go to *Step 17*	Go to *Step 19*
16	Replace the malfunctioning fuel injector. Is the repair complete?	–	Go to *Step 27*	–
17	Check the affected fuel injector driver circuit for an open, short, or short to voltage. Is a problem found?	–	Go to *Step 18*	Go to *Step 24*
18	Repair the open or the shorted fuel injector driver circuit. Is the repair complete?	–	Go to *Step 27*	–
19	Repair the open ignition feed circuit between the fuel injector harness connector and the fuel injector connector. Is the repair complete?	–	Go to *Step 27*	–
20	Measure the resistance of the spark plug cable. Is the resistance of the spark plug cable less than the specified value?	30000 **W**	Go to *Step 21*	Go to *Step 25*
21	Inspect the Engine Control Module (ECM) connector and connections. Are the connections OK?	–	Go to *Step 22*	Go to *Step 23*
22	Check the affected cylinders ignition control circuit for an open or short and repair as needed. Is the repair complete?	–	Go to *Step 27*	Go to *Step 26*
23	Repair the connector or connections. Is the repair complete?	–	Go to *Step 27*	–
24	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 27*	–

DTC P0302 – Cylinder 2 Misfire (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
25	Replace the spark plug cable. Is the repair complete?	–	Go to Step 27	–
26	Replace the faulty ignition coil. Is the repair complete?	–	Go to *Step 27*	Go to *Step 24*
27	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 28*	Go to *Step 2*
28	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0303 CYLINDER 3 MISFIRE (2.0L DOHC)

System Description

The Engine Control Module (ECM) monitors the crankshaft and camshaft positions to detect if the engine is misfiring. The ECM looks for a quick drop in crankshaft speed. This test is executed in blocks of 100 engine revolution tests. It may take between one to several tests to store a Diagnostic Trouble Code (DTC) and illuminate the Malfunction Indicator Lamp (MIL). Under light misfire conditions, it may also take more than one trip to set a DTC. Severe misfire will flash the MIL, indicating that catalyst damage is possible.

Conditions for Setting the DTC

- Emission threshold is 3.0% for automatic transaxle and 3.0% for manual transaxle.
- 20 engine cycles have occurred since cranking has started.
- A/C compressor clutch has not just engaged or disengaged.
- Engine load and engine speed are in a detectable region and are at or above zero torque.
- Camshaft Position (CMP) sensor is in synchronization.
- Exhaust Gas Recirculation (EGR) flow diagnostic is not in progress.
- Fuel level is greater than or equal to 20% of rated tank capacity.
- Decel Fuel Cutoff (DFCO) not active.
- Fuel is not shutoff from high engine speed of 6500 rpm for manual transaxle vehicle or 6500 rpm in drive and 6250 rpm in park for automatic transaxle vehicles.
- Fuel is not shutoff at 255 km/h (158 mph).
- An automatic transmission is not shifting.
- Throttle position change is less than 3% per 125 ms.
- Vehicle has not encountered an abusive engine speed of 7000 rpm.
- Crankshaft speed patters are normal.
- Throttle position is less than 4% when vehicle speed is greater than 10 km/h (6 mph).
- Engine speed is between 600 and 4500 rpm.
- Vehicle voltage is between 11 and 16 volts.
- Engine Coolant Temperature (ECT) is between –7°C (20°F) and 120°C (248°F).

- The engine speed is less than or equal to 1800 rpm or the crank angle sensing error has not been learned.
- There is the correct ratio between Crankshaft Position (CKP) sensor pulses and CMP sensor pulses.
- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0336, P0337, P0341, P0342 and P0502 are not set.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive ignition cycles in which the diagnostic runs with the fault active.

Or

- The MIL will illuminate immediately and flash if misfire is present.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault within the freeze frame conditions that the DTC failed.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent can also be the result of a defective reluctor wheel. Remove the CKP sensor and inspect the reluctor wheel through the sensor mount hole. Check for porosity and the condition of wheel. If the DTC is intermittent refer to "Symptoms Diagnosis" in this section.

DTC P0303 – Cylinder 3 Misfire (2.0L DOHC)

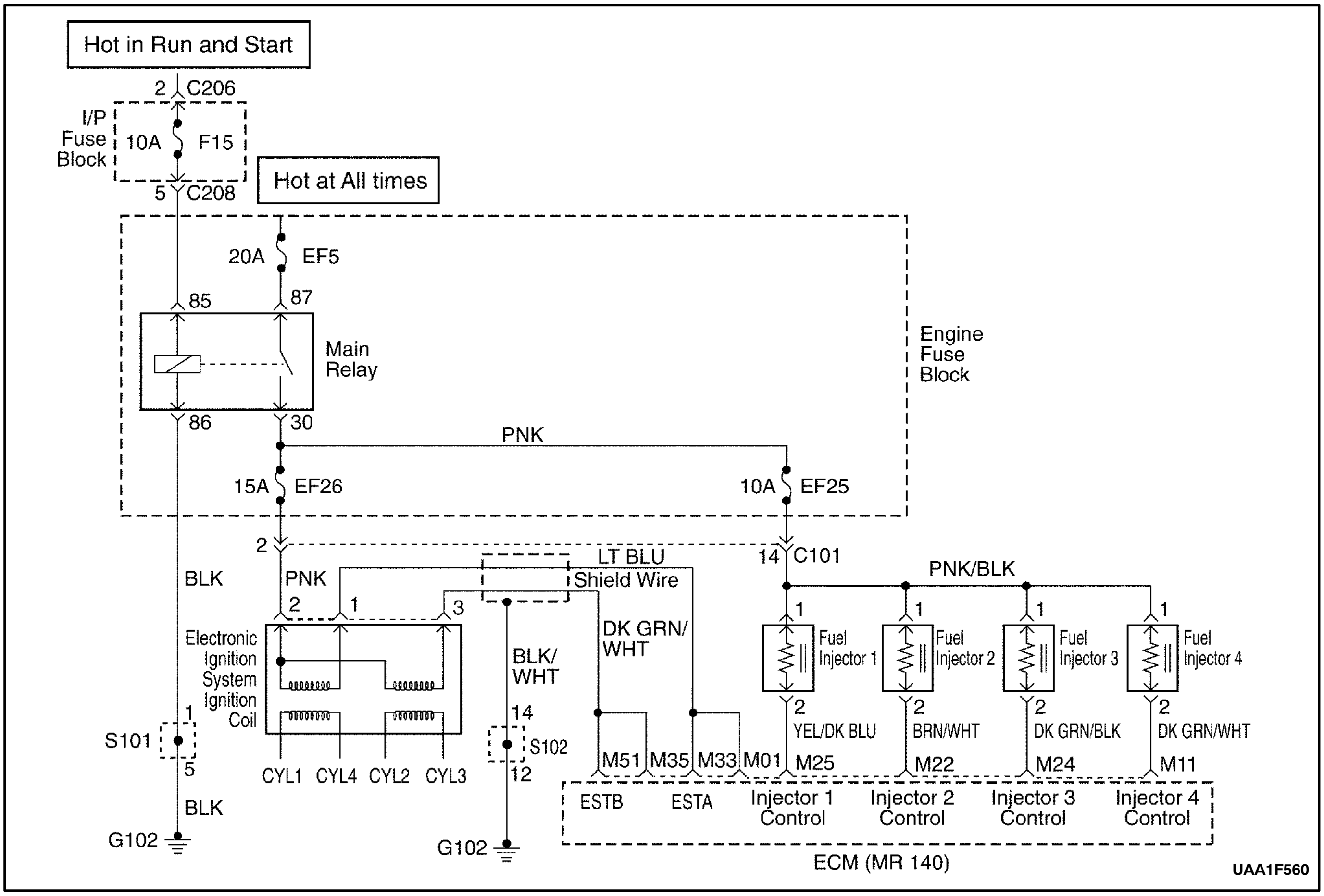
Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC) 2. Turn the ignition ON, with the engine OFF. 3. Request Diagnostic Trouble Codes (DTCs) Are DTCs P0203 or P300 set?	–	Go to Applicable DTC table	Go to *Step 3*
3	1. Perform a visual/physical inspection. 2. Make any repairs that are necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 4*
4	Start the engine and allow it to idle. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to *Step 6*
5	Are all counters equal (within a percentage of each other)?	–	Go to *Step 7*	Go to *Step 11*
6	1. Turn the ignition ON, with the engine OFF. 2. Review the Freeze Frame data, and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and conditions for setting this DTC as noted. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to "Diagnostic Aids"
7	1. Turn the engine OFF. 2. Install a fuel pressure gauge to the fuel rail. 3. Observe the fuel pressure with the engine running. Is the fuel pressure within the specified value?	284–325 kPa (41–47 psi)	Go to *Step 8*	Go to "Fuel System Diagnosis"
8	Check the fuel for contamination. Is the fuel OK?	–	Go to *Step 9*	Go to *Step 10*
9	Check for a basic engine problem and repair as necessary. Is the repair complete?	–	Go to *Step 27*	–

DTC P0303 – Cylinder 3 Misfire (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the contaminated fuel. Is the repair complete?	–	Go to *Step 27*	–
11	1. Turn the engine OFF. 2. Disconnect the fuel injector harness connector. 3. Install a spark tester on cylinder #3 spark plug cable. 4. Crank the engine and check for spark. Is a spark observed on all four spark plug cables?	–	Go to *Step 12*	Go to *Step 20*
12	Replace the malfunctioning spark plug. Is the repair complete?	–	Go to *Step 27*	Go to *Step 13*
13	1. Turn the engine OFF. 2. Disconnect the cylinder #3 fuel injector connectors from the injector. 3. Install an injector test light on the injector harness connector, terminal 2. 4. Crank the engine and note the test light. Does the injector test light blink?	–	Go to *Step 14*	Go to *Step 15*
14	Perform the Fuel Injector Balance Test. Are the fuel injectors OK?	–	Go to *Step 9*	Go to *Step 16*
15	1. Disconnect the injector test light. 2. With a test light connected to ground, probe the ignition feed terminal 1 of the injector harness connector. 3. Crank the engine. Does the test light illuminate?	–	Go to *Step 17*	Go to *Step 19*
16	Replace the malfunctioning fuel injector. Is the repair complete?	–	Go to *Step 27*	–
17	Check the affected fuel injector driver circuit for an open, short, or short to voltage. Is a problem found?	–	Go to *Step 18*	Go to *Step 24*
18	Repair the open or the shorted fuel injector driver circuit. Is the repair complete?	–	Go to *Step 27*	–
19	Repair the open ignition feed circuit between the fuel injector harness connector and the fuel injector connector. Is the repair complete?	–	Go to *Step 27*	–
20	Measure the resistance of the spark plug cable. Is the resistance of the spark plug cable less than the specified value?	30000 **W**	Go to *Step 21*	Go to *Step 25*
21	Inspect the Engine Control Module (ECM) connector and connections. Are the connections OK?	–	Go to *Step 22*	Go to *Step 23*
22	Check the affected cylinders ignition control circuit for an open or short and repair as needed. Is the repair complete?	–	Go to *Step 27*	Go to *Step 26*
23	Repair the connector or connections. Is the repair complete?	–	Go to *Step 27*	–
24	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 27*	–

DTC P0303 – Cylinder 3 Misfire (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
25	Replace the spark plug cable. Is the repair complete?	–	Go to *Step 27*	–
26	Replace the faulty ignition coil. Is the repair complete?	–	Go to *Step 27*	Go to *Step 24*
27	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 28*	Go to *Step 2*
28	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0304 CYLINDER 4 MISFIRE (2.0L DOHC)

System Description

The Engine Control Module (ECM) monitors the crankshaft and camshaft positions to detect if the engine is misfiring. The ECM looks for a quick drop in crankshaft speed. This test is executed in blocks of 100 engine revolution tests. It may take between one to several tests to store a Diagnostic Trouble Code (DTC) and illuminate the Malfunction Indicator Lamp (MIL). Under light misfire conditions, it may also take more than one trip to set a DTC. Severe misfire will flash the MIL, indicating that catalyst damage is possible.

Conditions for Setting the DTC

- Emission threshold is 3.0% for automatic transaxle and 3.0% for manual transaxle.
- 20 engine cycles have occurred since cranking has started.
- A/C compressor clutch has not just engaged or disengaged.
- Engine load and engine speed are in a detectable region and are at or above zero torque.
- Camshaft Position (CMP) sensor is in synchronization.
- Exhaust Gas Recirculation (EGR) flow diagnostic is not in progress.
- Fuel level is greater than or equal to 20% of rated tank capacity.
- Decel Fuel Cutoff (DFCO) not active.
- Fuel is not shutoff from high engine speed of 6500 rpm for manual transaxle vehicle or 6500 rpm in drive and 6250 rpm in park for automatic transaxle vehicles.
- Fuel is not shutoff at 255 km/h (158 mph).
- An automatic transmission is not shifting.
- Throttle position change is less than 3% per 125 ms.
- Vehicle has not encountered an abusive engine speed of 7000 rpm.
- Crankshaft speed patters are normal.
- Throttle position is less than 4% when vehicle speed is greater than 10 km/h (6 mph).
- Engine speed is between 600 and 4500 rpm.
- Vehicle voltage is between 11 and 16 volts.
- Engine Coolant Temperature (ECT) is between –7°C (20°F) and 120°C (248°F).

- The engine speed is less than or equal to 1800 rpm or the crank angle sensing error has not been learned.
- There is the correct ratio between Crankshaft Position (CKP) sensor pulses and CMP sensor pulses.
- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0336, P0337, P0341, P0342 and P0502 are not set.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive ignition cycles in which the diagnostic runs with the fault active.

Or

- The MIL will illuminate immediately and flash if misfire is present.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault within the freeze frame conditions that the DTC failed.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent can also be the result of a defective reluctor wheel. Remove the CKP sensor and inspect the reluctor wheel through the sensor mount hole. Check for porosity and the condition of wheel. If the DTC is intermittent refer to “Symptoms Diagnosis” in this section.

DTC P0304 – Cylinder 4 Misfire (2.0L DOHC)

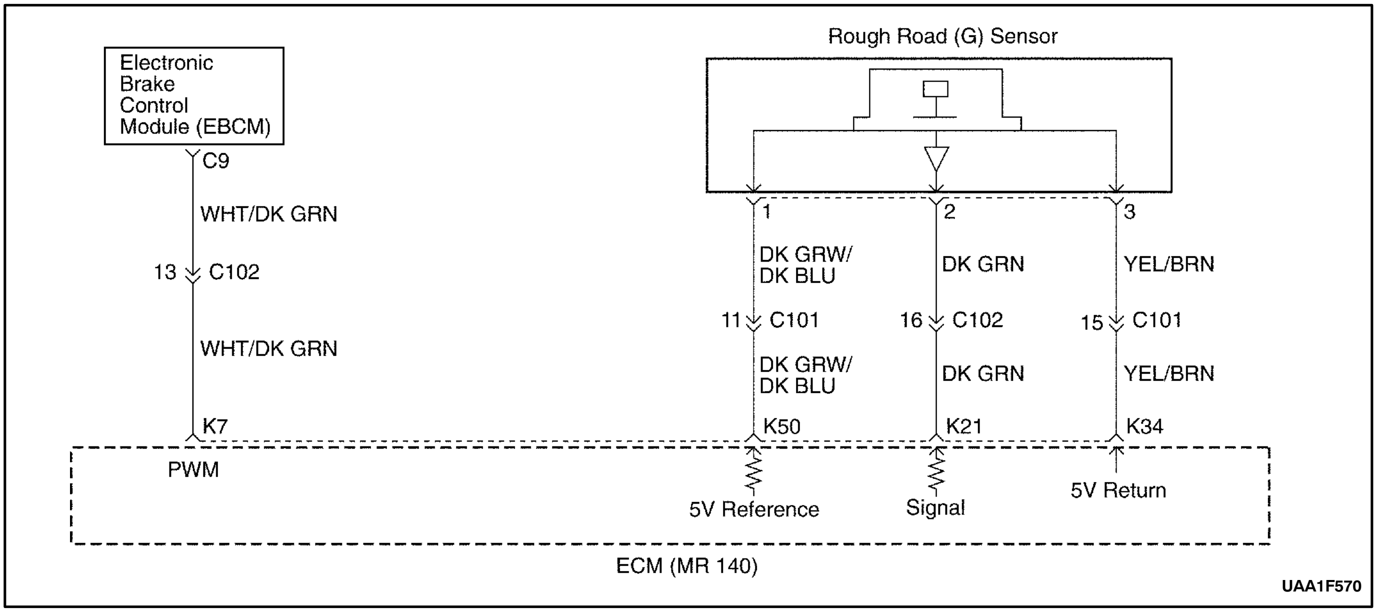
Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON, with the engine OFF. 3. Request Diagnostic Trouble Codes (DTCs) Are DTCs P0201 or P300 set?	–	Go to Applicable DTC table	Go to *Step 3*
3	1. Perform a visual/physical inspection. 2. Make any repairs that are necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 4*
4	Start the engine and allow it to idle. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to *Step 6*
5	Are all counters equal (within a percentage of each other)?	–	Go to *Step 7*	Go to *Step 11*
6	1. Turn the ignition ON, with the engine OFF. 2. Review the Freeze Frame data, and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and conditions for setting this DTC as noted. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to “Diagnostic Aids”
7	1. Turn the engine OFF. 2. Install a fuel pressure gauge to the fuel rail. 3. Observe the fuel pressure with the engine running. Is the fuel pressure within the specified value?	284–325 kPa (41–47 psi)	Go to *Step 8*	Go to “Fuel System Diagnosis”
8	Check the fuel for contamination. Is the fuel OK?	–	Go to *Step 9*	Go to *Step 10*
9	Check for a basic engine problem and repair as necessary. Is the repair complete?	–	Go to *Step 27*	–

DTC P0304 – Cylinder 4 Misfire (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the contaminated fuel. Is the repair complete?	–	Go to *Step 27*	–
11	1. Turn the engine OFF. 2. Disconnect the fuel injector harness connector. 3. Install a spark tester on cylinder #4 spark plug cable. 4. Crank the engine and check for spark. Is a spark observed on all four spark plug cables?	–	Go to *Step 12*	Go to *Step 20*
12	Replace the malfunctioning spark plug. Is the repair complete?	–	Go to *Step 27*	Go to *Step 13*
13	1. Turn the engine OFF. 2. Disconnect the cylinder #4 fuel injector connectors from the injector. 3. Install an injector test light on the injector harness connector, terminal 2. 4. Crank the engine and note the test light. Does the injector test light blink?	–	Go to *Step 14*	Go to *Step 15*
14	Perform the Fuel Injector Balance Test. Are the fuel injectors OK?	–	Go to *Step 9*	Go to *Step 16*
15	1. Disconnect the injector test light. 2. With a test light connected to ground, probe the ignition feed terminal 1 of the injector harness connector. 3. Crank the engine. Does the test light illuminate?	–	Go to *Step 17*	Go to *Step 19*
16	Replace the malfunctioning fuel injector. Is the repair complete?	–	Go to *Step 27*	–
17	Check the affected fuel injector driver circuit for an open, short, or short to voltage. Is a problem found?	–	Go to *Step 18*	Go to *Step 24*
18	Repair the open or the shorted fuel injector driver circuit. Is the repair complete?	–	Go to *Step 27*	–
19	Repair the open ignition feed circuit between the fuel injector harness connector and the fuel injector connector. Is the repair complete?	–	Go to *Step 27*	–
20	Measure the resistance of the spark plug cable. Is the resistance of the spark plug cable less than the specified value?	30000 **W**	Go to *Step 21*	Go to *Step 25*
21	Inspect the Engine Control Module (ECM) connector and connections. Are the connections OK?	–	Go to *Step 22*	Go to *Step 23*
22	Check the affected cylinders ignition control circuit for an open or short and repair as needed. Is the repair complete?	–	Go to *Step 27*	Go to *Step 26*
23	Repair the connector or connections. Is the repair complete?	–	Go to *Step 27*	–
24	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 27*	–

DTC P0304 – Cylinder 4 Misfire (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
25	Replace the spark plug cable. Is the repair complete?	–	Go to *Step 27*	–
26	Replace the faulty ignition coil. Is the repair complete?	–	Go to *Step 27*	Go to *Step 24*
27	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 28*	Go to *Step 2*
28	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0317 ROUGH ROAD SOURCE NOT DETECTED (2.0L DOHC)

System Description

The Engine Control Module (ECM) identifies engine misfire by detecting variations in crankshaft speed. Crankshaft speed variations can also occur when a vehicle is operating over a rough road. The ECM receives rough road signal by gravity sensing rough road (G) sensor or Electronic Brake Control Module (EBCM) if equipped with the Anti-Lock Brake System (ABS). The ABS can detect if the vehicle is on the rough surface based on wheel acceleration/deceleration data supplied by each wheel speed sensor. This information sent to the ECM by EBCM through Pulse Width Modulation (PWM) serial data line. The G sensor is vertical low g-acceleration sensor. By sensing vertical acceleration caused by bumps or portholes in the road, the ECM determine if the changes in crankshaft speed are due to engine misfire or are driveline induced. If the ECM can not receive any of those signal, a historic Diagnostic Trouble Code (DTC) will be stored.

Conditions for Setting the DTC

- ECM can not detect any rough road source.
- Engine run time is greater than or equal to 10 seconds.

Action Taken When the DTC Sets

- The MIL will illuminate will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An open signal circuit of G sensor or open PWM serial data line between the ECM and the EBCM will be the cause of this DTC.

DTC P0317 – Rough Road Source Not Detected (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON, with the engine OFF. 3. Request Diagnostic Trouble Codes (DTCs) Are DTCs P1380, P1381, P1391, P1392 or P1393 set?	–	Go to Applicable DTC table	Go to *Step 3*
3	Is the vehicle equipped with the Anti-lock Brake System (ABS)?	–	Go to *Step 8*	Go to *Step 4*
4	1. Disconnect the gravity sensing rough road (G) sensor connector. 2. Disconnect the Engine control Module (ECM) connector. 3. Measure resistance between terminal 2 of the G sensor and terminal K21 of the ECM. Is the resistance within the specified value?	0 **W**	Go to *Step 6*	Go to *Step 5*
5	Repair open circuit. Is the repair complete?	–	Go to *Step 11*	Go to *Step 6*
6	1. Reconnect the ECM and G sensor connectors. 2. Turn the ignition ON. 3. Probe the voltage at terminal 2 of G sensor. Is the voltage within the specified value?	2.35–2.65 V	Go to *Step 10*	Go to *Step 7*
7	1. Turn the ignition OFF. 2. Replace the G sensor. Is the repair complete?	–	Go to *Step 11*	–
8	1. Turn the ignition OFF. 2. Disconnect the Electronic Brake Control Module (EBCM) connector and the ECM connector. 3. Measure the resistance between terminal C9 of the EBCM and terminal K7 of the ECM. Is the resistance within the specified value?	0 **W**	Go to *Step 10*	Go to *Step 9*
9	Repair open circuit. Is the repair complete?	–	Go to *Step 11*	Go to *Step 10*
10	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 11*	–
11	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 12*	Go to *Step 2*
12	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P0325 KNOCK SENSOR INTERNAL MALFUNCTION (2.0L DOHC)

System Description

The Knock Sensor (KS) system is used to detect engine detonation, allowing the Engine Control Module (ECM) to retard the ignition control spark timing based on the KS signal being received. The KS produces an AC signal so that under a no-knock condition the signal on the KS circuit measures about 0.007 volts AC. The KS signal's amplitude and frequency depend upon the amount of knock being experienced. The ECM contains a nonreplaceable knock filter module called a Digitally Controlled Signal-to-Noise Enhancement Filter (DSNEF) module. This filter module in the ECM determines whether or not knock is occurring by comparing the signal level on the KS circuit with the voltage level on the noise channel. The noise channel allows the ECM to reject any false knock signal by knowing the amount of normal engine mechanical noise present. Normal engine noise varies depending on engine speed and load. When the ECM determines that an abnormally low noise channel voltage level is being experienced, Diagnostic Trouble Code (DTC) P0325 will set.

Conditions for Setting the DTC

- Vacuum is less than the predetermined value (10 to 50 kPa, based on rpm).
- The rpm is greater than 1600.
- Engine Coolant Temperature (ECT) is greater than 50°C (122°F).
- DSNEF A/D reading is less than 3.9% or greater than 80% any of the 4 cylinders.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

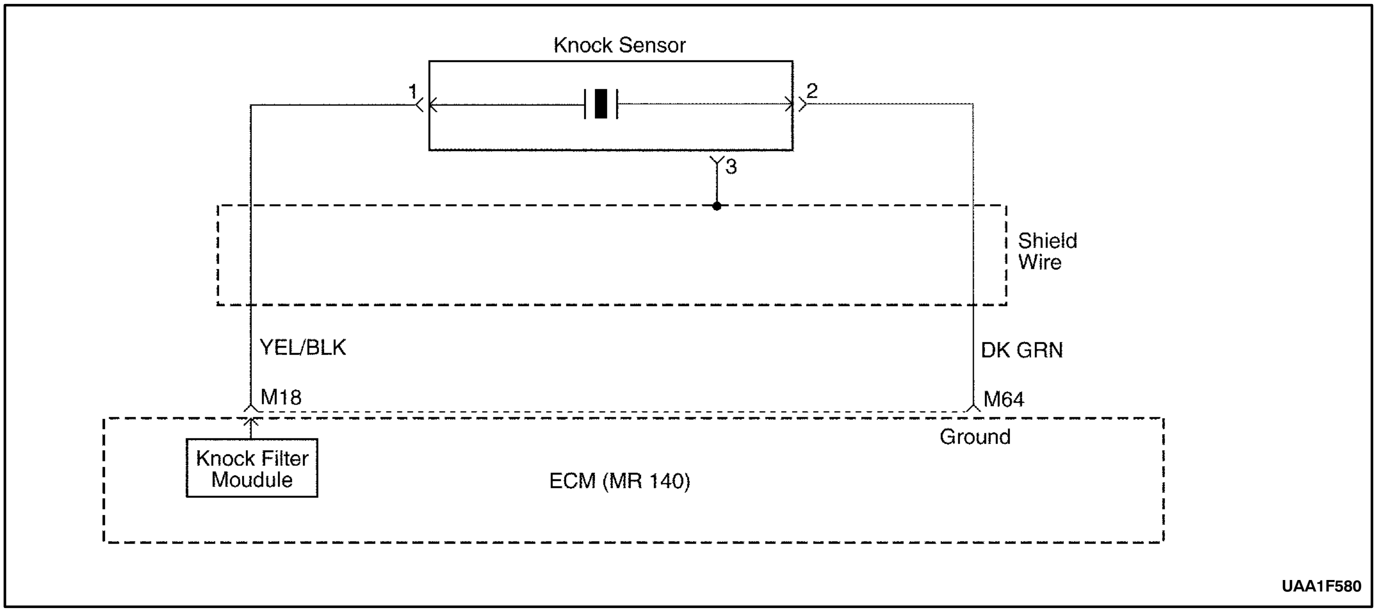
Check and correct any abnormal engine noise before using the diagnostic table.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions:

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection
- Physical damage to the wiring harness

DTC P0325 – Knock Sensor Internal Malfunction (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine. 4. Operate the vehicle within the Conditions for Setting the DTC as noted. Is the DTC set again.	–	Go to *Step 3*	Go to *Step 6*
3	Listen to the engine while rising and lowing the engine speed. Is a knock or audible noise present?	–	Go to *Step 4*	Go to *Step 5*
4	Repair mechanical engine problem or a loose bracket or components as needed. Is the repair complete?	–	Go to *Step 6*	–
5	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 6*	–
6	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 7*	Go to *Step 2*
7	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0327 KNOCK SENSOR CIRCUIT FAULT (2.0L DOHC)

System Description

The Knock Sensor (KS) system is used to detect engine detonation, allowing the Engine Control Module (ECM) to retard the ignition control spark timing based on the KS signal being received. The KS produces an AC signal so that under a no-knock condition the signal on the KS circuit measures about 0.007 volts AC. The KS signal's amplitude and frequency depend upon the amount of knock being experienced. The ECM monitors the KS signal and can diagnose the KS and circuitry.

Conditions for Setting the DTC

- Vacuum is less than the predetermined value (10 to 50 kPa, based on rpm).
- The rpm is greater than 1600.
- Engine Coolant Temperature (ECT) is greater than 50°C (122°F).
- Minimum difference between cylinders is greater than 0.4%.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

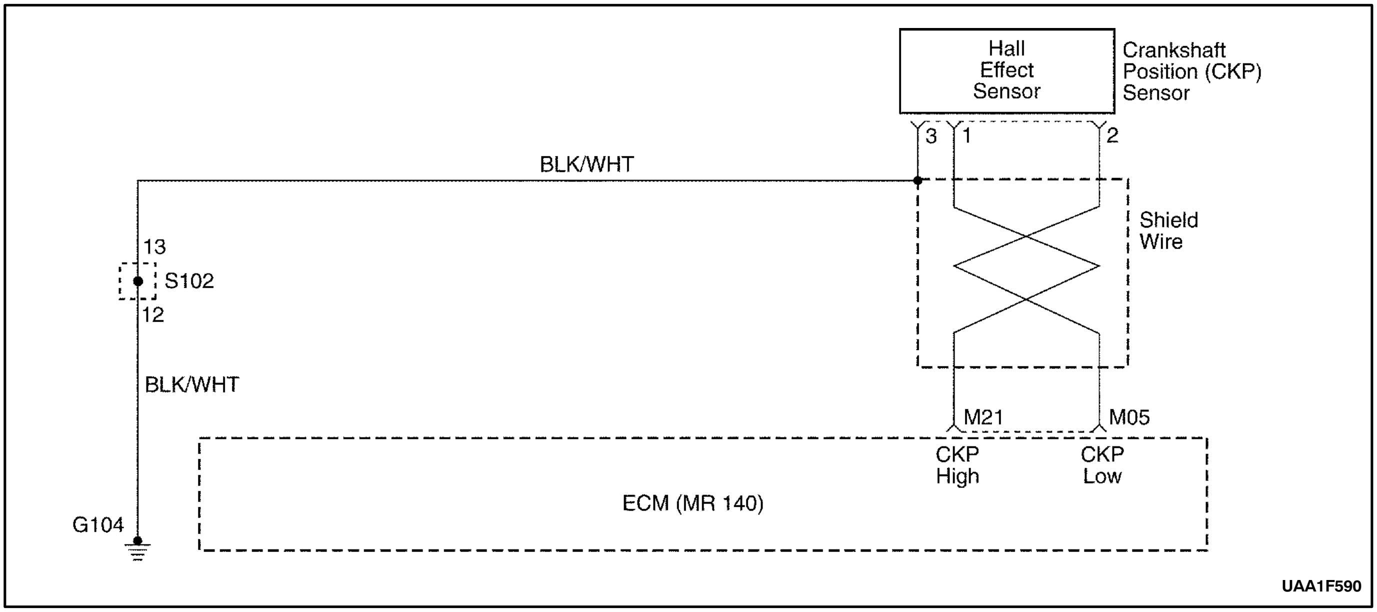
Check and correct any abnormal engine noise before using the diagnostic table.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions:

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection
- Physical damage to the wiring harness

DTC P0327 – Knock Sensor Circuit Fault (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine. 4. Operate the vehicle within the Conditions for Setting the DTC as noted. Is the DTC set again.	–	Go to *Step 3*	Go to *Step 6*
3	Listen to the engine while rising and lowing the engine speed. Is a knock or audible noise present?	–	Go to *Step 4*	Go to *Step 5*
4	Repair mechanical engine problem or a loose bracket or components as needed. Is the repair complete?	–	Go to *Step 11*	–
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector. 3. With a ohmmeter connected ground, measure the resistance of the Knock Sensor (KS) through the KS signal circuit, terminal M18. Is the resistance between the specified value?	90–110 kW	Go to *Step 6*	Go to *Step 8*
6	Check for a poor connection at the ECM connector KS signal circuit and repair as needed. Is the repair complete?	–	Go to *Step 11*	Go to *Step 7*
7	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 11*	–
8	Check the KS connector for a poor connection and repair as needed. Is the repair complete?	–	Go to *Step 11*	Go to *Step 9*
9	Check the KS signal circuit for an open or a short to ground or voltage and repair as needed. Is the repair complete?	–	Go to *Step 11*	–
10	1. Turn the ignition OFF. 2. Replace the KS. Is the repair complete?	–	Go to *Step 11*	–
11	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 12*	Go to *Step 2*
12	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0336 58X CRANK POSITION EXTRA/MISSING PULSE (2.0L DOHC)

Circuit Description

The 58X reference signal is produced by the Crankshaft Position (CKP) sensor. During one crankshaft revolution, 58 crankshaft pulses will be produced. The Engine Control Module (ECM) uses the 58X reference signal to calculate engine rpm and CKP. The ECM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of Camshaft Position (CMP) signal pulses being received. If the ECM receives and incorrect number of pulses on the 58X reference circuit, Diagnostic Trouble Code (DTC) P0336 will set.

Conditions for Setting the DTC

- Engine is running.
- Number of extra or missing teeth is greater than or equal to 2 per revolution.
- Above condition is detected in 10 of 100 crankshaft rotations.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffer.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a fault.
- The DTC(s) can be cleared using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition ON and observe a voltmeter connected to the 58X reference circuit at the ECM harness connector while moving the connectors and the wiring harnesses related to the ECM. A change in voltage will indicate the location of the fault.
- Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0336 – 58X Crank Position Extra/Missing Pulse (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Attempt to start the engine. Does the engine start?	–	Go to *Step 3*	Refer to "Engine Cranks But Will Not Run"
3	1. Turn the ignition OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Turn the ignition ON, with the engine OFF. 4. Review and record Failure Records information. 5. Clear the Diagnostic Trouble Codes (DTCs). 6. Start the engine and idle for 1 minute. Is DTC P0336 set?	–	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector and Crankshaft Position (CKP) sensor. 3. Check for an open or short to ground in the 58X reference circuit between CKP sensor connector and the ECM harness connector. Is a problem found?	–	Go to *Step 5*	Go to *Step 6*
5	Repair an open or short to ground in the 58X reference circuit between the CKP sensor connector and the ECM harness connector. Is the repair complete?	–	Go to *Step 11*	–
6	Reconnect the ECM and CKP sensor. Connect a voltmeter to measure the voltage at terminal M21 of the ECM connector. Observe the voltage while cranking the engine. Is the voltage near the specified value?	1.6 V	Go to *Step 9*	Go to *Step 7*
7	Check the connections at CKP sensor and repair or replace the terminals. Is the repair complete?	–	Go to *Step 11*	Go to *Step 8*
8	1. Turn the ignition OFF. 2. Replace the CKP sensor. Is the repair complete?	–	Go to *Step 11*	–
9	Check the connections at ECM and repair or replace the terminals. Is the repair complete?	–	Go to *Step 11*	Go to *Step 10*
10	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 11*	–
11	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 12*	Go to *Step 2*

DTC P0336 – 58X Crank Position Extra/Missing Pulse (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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DIAGNOSTIC TROUBLE CODE (DTC) P1336
58X CRANK POSITION TOOTH ERROR NOT LEARNED (2.0L DOHC)

System Description

In order to detect engine misfire at higher engine speeds, the Engine Control Module (ECM) must know of any variation between the crankshaft sensor pulses. Most variations are due to the machining of the crankshaft reluctor wheel. However, other sources of variation are also possible. A Crankshaft Position (CKP) system variation learning procedure must be performed any time a change is made to the crankshaft sensor to crankshaft relationship of if the ECM is replaced or reprogrammed. The ECM measures the variations and then calculates compensation factors needed to enable the ECM to accurately detect engine misfire at all speeds and loads. A scan tool must be used to command the ECM to learn these variations. If for any reason the ECM is unable to learn these variations or they are out of an acceptable range, the ECM will set Diagnostic Trouble Code (DTC) P1336. An ECM that has not had the CKP system variation learning procedure performed due to replacement or reprogramming will also set DTC P1336.

Conditions for Setting the DTC

- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0132, P0201, P0202, P0203, P0204, P0336, P0337, P0341, P0342, P0351, P0352, P0402, P1404, P0404, P0405 and P0502 are not set.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffer.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Caution: To avoid personal injury when performing the crankshaft position system variation learning procedure, always set the vehicle parking brake and block the drive wheels. Release the throttle immediately when the engine starts to decelerate. Once the learn procedure is completed, engine control will be returned to the operator, and the engine will respond to throttle position.

DTC P1336 will only set if the ECM has not learned the CKP system variation. The ECM only needs to learn this variation once per life cycle of the vehicle unless the crank sensor to crankshaft relationship is disturbed. Removing a part is considered a disturbance. A fully warmed engine is critical to learning the variation correctly. If a valid learn occurs, no other learns can be completed that ignition cycle.

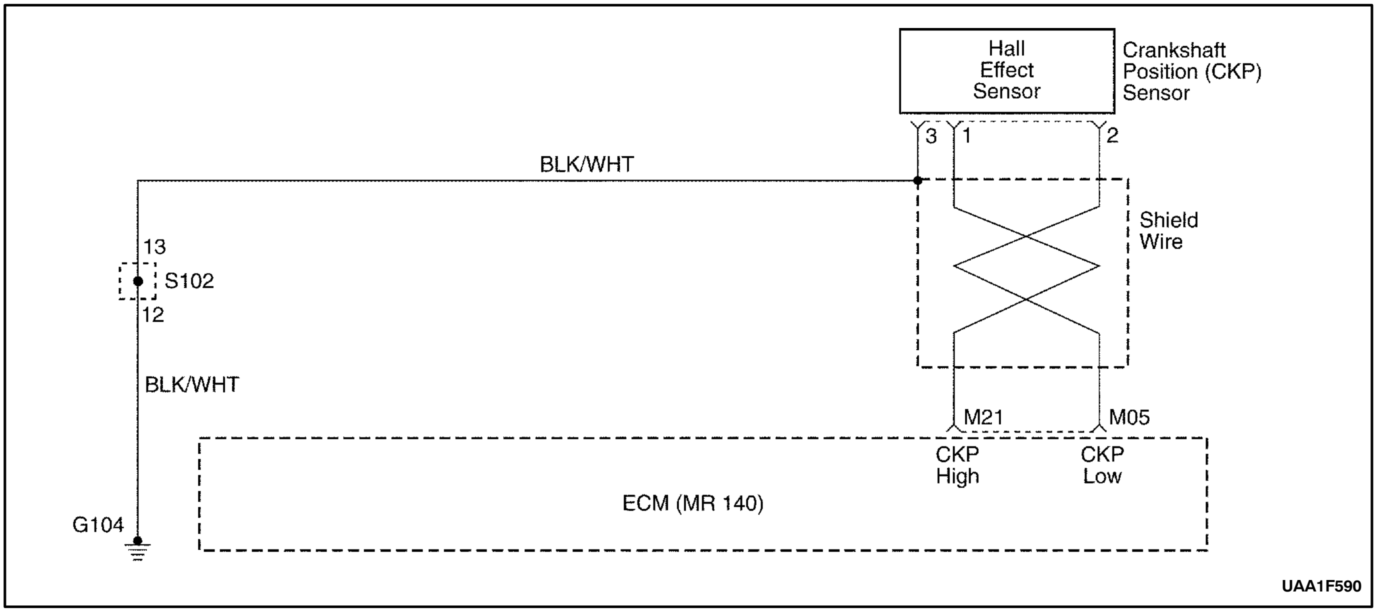
If the engine cuts out before the specified learn procedure engine speed or at normal fuel cutoff rpm, the ECM is not in the learn procedure mode.

Test Description

1. The On-Board Diagnostic (EOBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the fault occurred. The information is then stored on the scan tool for later reference.
2. Engine temperature is critical to properly learn the CKP system variation. Failure to properly warm the engine before performing this procedure will result in an inaccurate measurement of the CKP system variation The ECM learns this variation as the engine is decelerating and then allows engine control to be returned to the operator. All accessories must be OFF when learning the CKP system angle variation. If the A/C is not disabled when the learn procedure is enable, the ECM will disable the A/C.
3. If after the specified number attempts the ECM cannot learn the CKP system variation, then the variation is too large and no further attempts should be made until the variation problem is corrected.
4. Being unable to learn the procedure indicates that the variation is out of range.
5. After the CKP system variation has been learned, wait above 10 seconds with ignition switch OFF to prevent being cleared the learned value.

DTC P1336 – 58X Crank Position Tooth Error Not Learned (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Put the vehicle in PARK or NEUTRAL. 4. Start the engine and operate to normal operating temperature. 5. Turn the all accessories OFF. 6. Enable the TEC (Tooth Error Correction) LEARN PROCEDURE with the scan tool. 7. Raise the engine rpm to the specified value, then release the throttle as soon as the engine cuts out. Does the scan tool indicate that the Crankshaft Position (CKP) system variation has been learned?	65°C (149°F) 4000 rpm	Go to *Step 5*	Go to *Step 3*
3	Attempt the CKP system variation procedure as many times as the specific value. Does the scan tool indicate that the CKP system variation has been learned?	10	Go to *Step 5*	Go to *Step 4*
4	Check for a problem with the CKP sensor to crankshaft relationship. Is the repair complete?	–	Go to *Step 5*	–
5	1. Turn the ignition OFF and wait above specified value. 2. Turn the ignition ON, with engine OFF. 3. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 4. Start the engine and idle at normal operating temperature. 5. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	10 sec	Go to *Step 6*	Go to *Step 2*
6	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0337
58X CRANK POSITION NO SIGNAL (2.0L DOHC)

Circuit Description

The 58X reference signal is produced by the Crankshaft Position (CKP) sensor. During one crankshaft revolution, 58 crankshaft pulses will be produced. The Engine Control Module (ECM) uses the 58X reference signal to calculate engine rpm and CKP. The ECM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of Camshaft Position (CMP) signal pulses being received. If the ECM does not receive any 58X reference pulses on the 58X reference circuit while cranking, Diagnostic Trouble Code (DTC) P0337 will set.

Conditions for Setting the DTC

- Engine is cranking.
- DTCs P0341 and P0342 are not set.
- Change in voltage drop is greater than 1.5 volts and change in Manifold Absolute Pressure (MAP) is greater than 2.2 kPa (0.32 psi) for manual transaxle.
- Change in voltage drop is greater than 1.5 volts and change in MAP is greater than 1.0 kPa (0.15 psi) for automatic transaxle.
- 58X reference pulse not seen for 8 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffer.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a fault.
- The DTC(s) can be cleared using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition ON and observe a voltmeter connected to the 58X reference circuit at the ECM harness connector while moving the connectors and the wiring harnesses related to the ECM. A change in voltage will indicate the location of the fault.
- Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0337 – 58X Crank Position No Signal (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Start the engine. 4. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting the DTC as noted. Is Diagnostic Trouble Code (DTC) P0337 set?	–	Go to *Step 3*	Go to *Step 10*
3	1. Turn the ignition OFF. 2. Disconnect the Crankshaft Position (CKP) sensor connector. 3. Turn the ignition ON. 4. Using a voltmeter, check the voltage between the CKP sensor wiring harness connector (Engine Control Module [ECM] side) terminal 1 and ground. Does the voltage within the value specified?	1.4 V	Go to *Step 4*	Go to *Step 5*
4	Using a voltmeter, check the voltage between the CKP sensor wiring harness connector (Engine Control Module [ECM] side) terminal 2 and ground. Does the voltage within the value specified?	1.4 V	Go to *Step 6*	Go to *Step 5*
5	1. Turn the ignition OFF. 2. Disconnect the ECM connector. 3. Turn the ignition ON. 4. Using a voltmeter, check the out put voltage of the ECM terminal M21 and M05. Does the voltage within the value specified?	11–14 V	Go to *Step 8*	Go to *Step 9*
6	1. Reconnect the CKP sensor. 2. Using a voltmeter, back probe the ECM connector terminal M21 and M05. 3. Observe the voltage while cranking the engine. Does the voltage fluctuate between the specified value?	1.3–1.6 V	Go to “Diagnostic Aids”	Go to *Step 7*
7	1. Turn the ignition OFF. 2. Replace the CKP sensor. Is the repair complete?	–	Go to *Step 10*	–
8	Check the CKP sensor high and low circuits for an open, short to ground or voltage and repair as needed. Is the repair complete?	–	Go to *Step 10*	–
9	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 10*	–

DTC P0337 – 58X Crank Position No Signal (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 11*	Go to *Step 2*
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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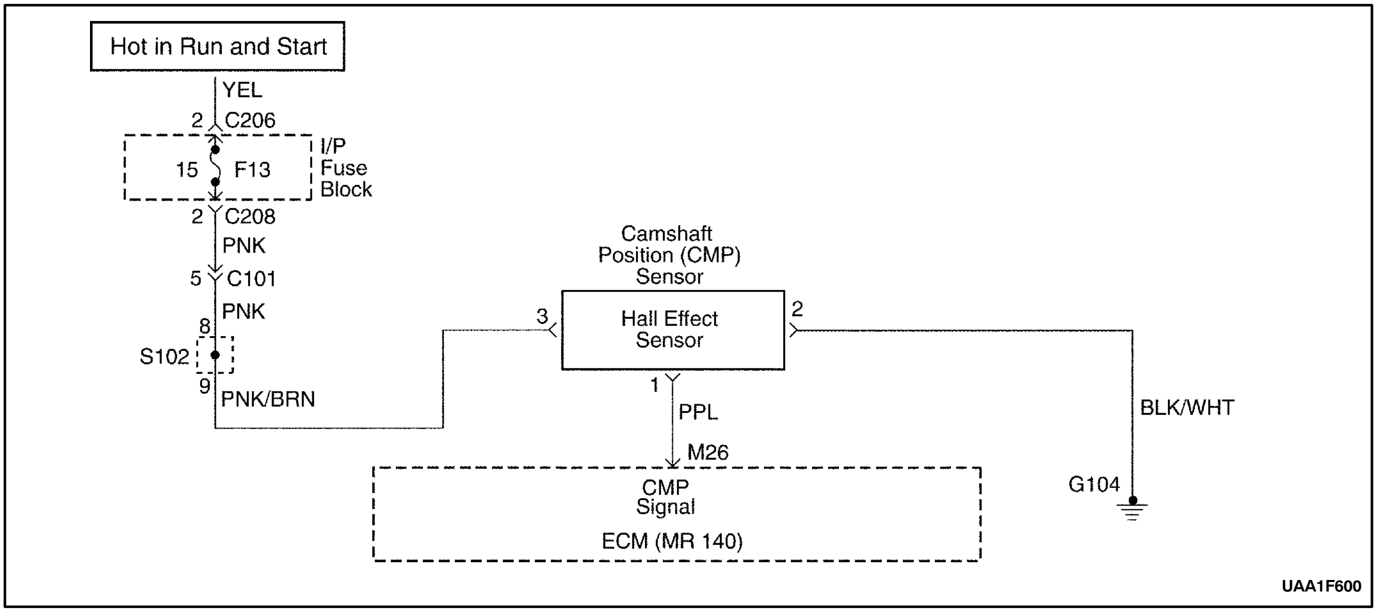

DIAGNOSTIC TROUBLE CODE (DTC) P0341 CAMSHAFT POSITION SENSOR RATIONALITY (2.0L DOHC)

System Description

The Camshaft Position (CMP) Sensor is used to correlate crankshaft to camshaft position so that the Engine Control Module (ECM) can determine which cylinder is ready to be fueled by the injector. The CMP is also used to determine which cylinder is misfiring when a misfire is present. When the ECM cannot use the information from the CMP sensor, a Diagnostic Trouble Code (DTC) is set, and the ECM will fuel the engine using the Alternating Synchronous Double Fire (ASDF) method.

Conditions for Setting the DTC

- Engine is running.
- CMP Sensor reference pulse is not detected at the correct interval every 4 cylinders.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed-through wire insulation, or a wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions:

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection
- Physical damage to the wiring harness

Anytime a poor connection is present, the CMP Reference Activity counter will stop incrementing..

DTC P0341 – Camshaft Position Sensor Rationality (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Start the engine and operate the vehicle within the Freeze Frame Conditions and Conditions for Setting the DTC as noted. Is Diagnostic Trouble Code (DTC) P0341 set?	–	Go to *Step 3*	Go to “Diagnostic Aids”
3	1. Turn the ignition OFF. 2. Disconnect the Camshaft Position (CMP) sensor connector. 3. Turn the ignition ON. 4. Using a voltmeter, check the voltage between the CMP sensor harness connector (Engine Control Module (ECM) side) terminal 1 and ground. Does the voltage near the specified value?	5 V	Go to *Step 4*	Go to *Step 5*
4	Using a voltmeter, check the voltage between the CMP sensor wiring harness connector terminal 3 and ground. Is the voltage over the specified value?	10 V	Go to *Step 6*	Go to *Step 10*
5	With a test light connected to B+, probe the CMP harness connector terminal 1, Does the test light illuminate?	–	Go to *Step 8*	Go to *Step 9*
6	With a test light connected to B+, probe the CMP harness connector terminal 2, Does the test light illuminate?	–	Go to *Step 7*	Go to *Step 11*
7	Check for a poor connections at the CMP connector and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 13*
8	1. Turn the ignition OFF. 2. Disconnect the ECM connector. 3. Repair the short to voltage on the CMP signal circuit. Is the repair complete?	–	Go to *Step 15*	Go to *Step 14*
9	Check the CMP signal circuit for an open or short to ground and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 12*
10	Check for a poor connections or open in the CMP B+ feed circuit and repair as needed. Is the repair complete?	–	Go to *Step 15*	–
11	Check for a poor connections or open in the CMP ground circuit and repair as needed. Is the repair complete?	–	Go to *Step 15*	–
12	Check for a poor connections or open in the CMP signal circuit and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 14*
13	1. Turn the ignition OFF. 2. Replace the CMP sensor. Is the repair complete?	–	Go to *Step 15*	–

DTC P0341 – Camshaft Position Sensor Rationality (2.0L DOHC)

Step	Action	Value(s)	Yes	No
14	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 15*	–
15	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 16*	Go to *Step 2*
16	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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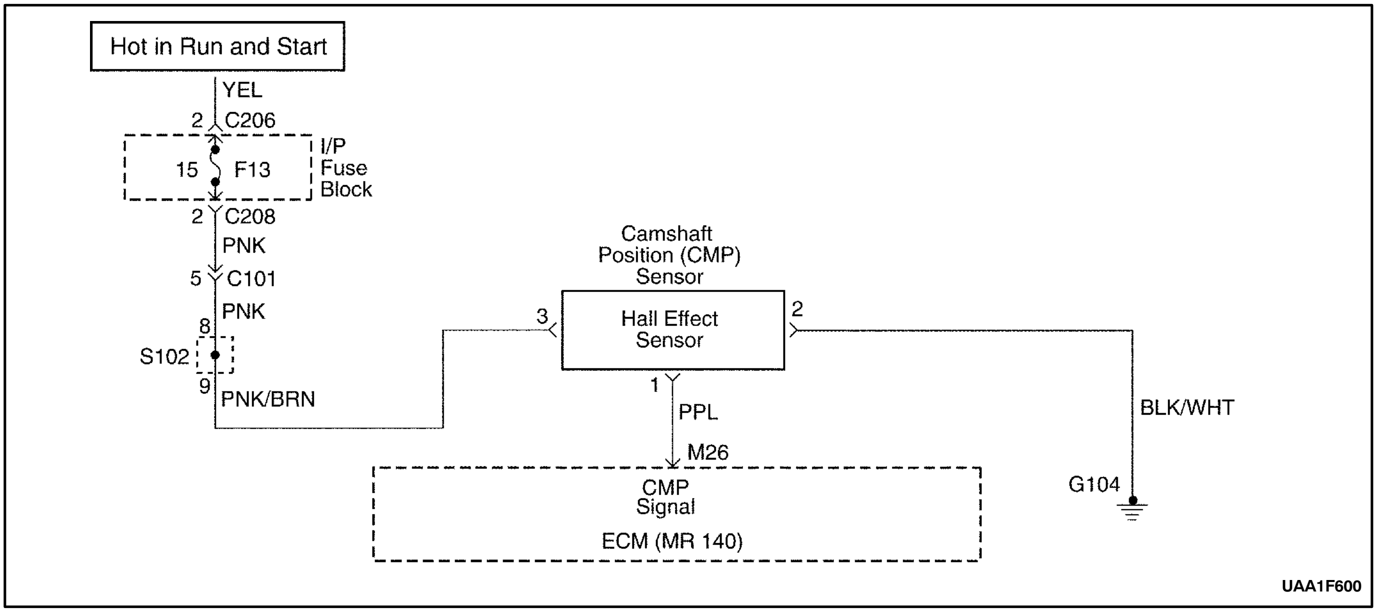

DIAGNOSTIC TROUBLE CODE (DTC) P0342
CAMSHAFT POSITION SENSOR NO SIGNAL (2.0L DOHC)

System Description

The Camshaft Position (CMP) Sensor is used to correlate crankshaft to camshaft position so that the Engine Control Module (ECM) can determine which cylinder is ready to be fueled by the injector. The CMP is also used to determine which cylinder is misfiring when a misfire is present. When the ECM cannot use the information from the CMP sensor, a Diagnostic Trouble Code (DTC) is set, and the ECM will fuel the engine using the Alternating Synchronous Double Fire (ASDF) method.

Conditions for Setting the DTC

- Engine is running.
- CMP Sensor reference pulse is not detected at the correct interval every 4 cylinders.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed-through wire insulation, or a wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions:

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection
- Physical damage to the wiring harness

DTC P0342 – Camshaft Position Sensor No Signal (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Idle the engine. Is the Camshaft Position (CMP) Active Count incrementing?	–	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition ON. 2. Review the Freeze Frame data and note the parameters. 3. Start the engine and operate the vehicle within the Freeze Frame Conditions and Conditions for Setting the DTC as noted. Is the CMP Active Counter incrementing?	–	Go to *Step 13*	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the CMP sensor connector. 3. Turn the ignition ON. 4. With a test light connected to ground, probe the CMP sensor harness connector, terminal 3. Does the test light illuminate?	–	Go to *Step 5*	Go to *Step 6*
5	With a test light connected to B+, probe the CMP sensor harness connector, terminal 2. Does the test light illuminate?	–	Go to *Step 7*	Go to *Step 8*
6	Check for a poor connections or open in the CMP B+ feed circuit and repair as needed. Is the repair complete?	–	Go to *Step 13*	Go to “Diagnostic Aids”
7	Using a voltmeter, check the voltage between the CMP harness connector terminal 1 and ground. Does the voltage near the specified value?	5 V	Go to *Step 11*	Go to *Step 9*
8	Check the CMP signal circuit for an open or short to ground and repair as needed. Is the repair complete?	–	Go to *Step 13*	–
9	1. Turn the ignition OFF. 2. Disconnect the engine Control Module (ECM) connector. 3. Check for the CMP signal circuit for an open or short to round or short to B+, and repair as needed. Is the repair complete?	–	Go to *Step 13*	Go to *Step 10*
10	Check the CMP signal circuit for an open or short to ground and repair as needed. Is the repair complete?	–	Go to *Step 13*	Go to *Step 12*
11	1. Turn the ignition OFF. 2. Replace the CMP sensor. Is the repair complete?	–	Go to *Step 13*	–
12	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 13*	–

DTC P0342 – Camshaft Position Sensor No Signal (2.0L DOHC)

Step	Action	Value(s)	Yes	No
13	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 14*	Go to *Step 2*
14	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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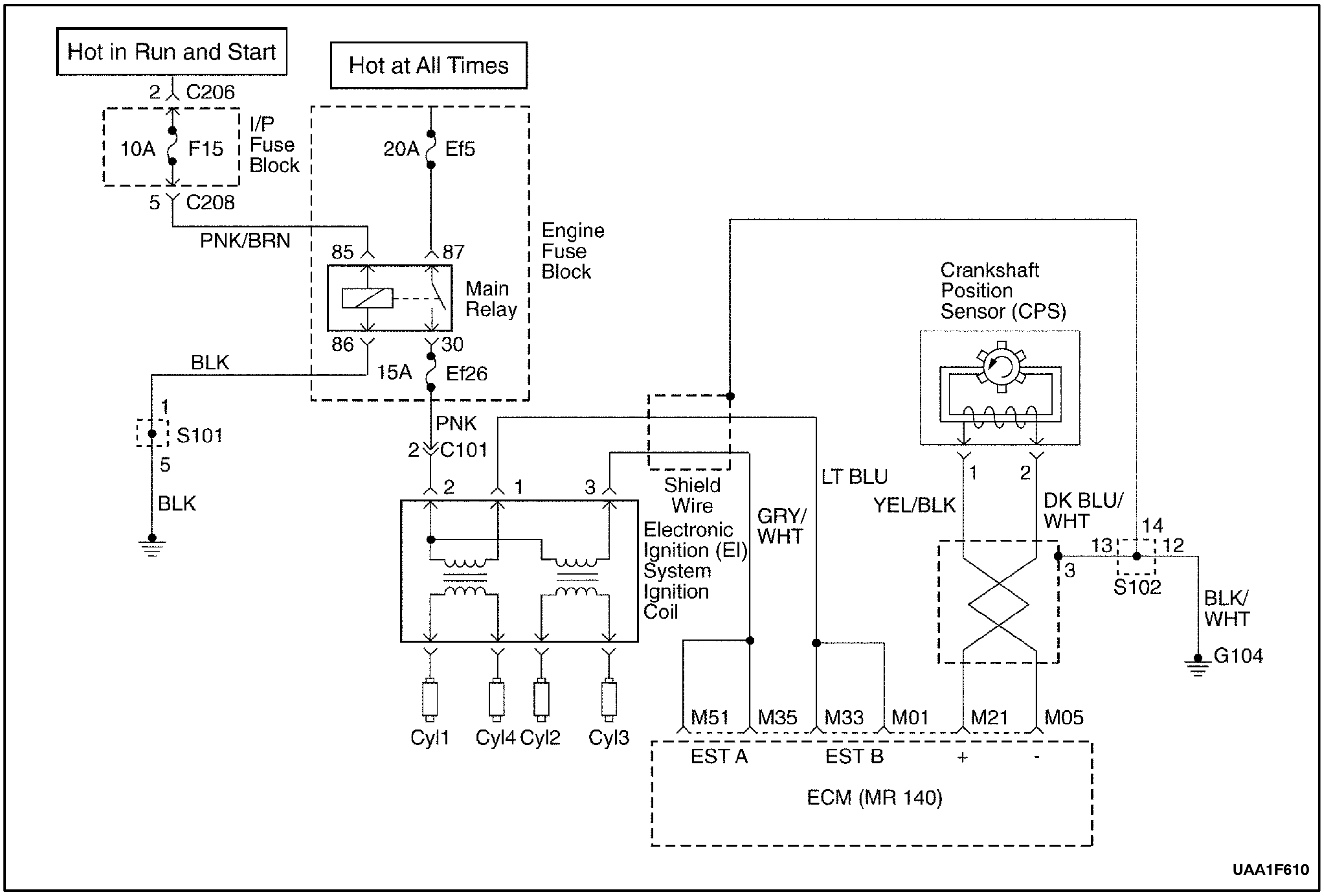


DIAGNOSTIC TROUBLE CODE (DTC) P0351 IGNITION CONTROL CIRCUIT A FAULT (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) provides a ground for the electronic spark timing A circuit. When the ECM removes the ground path of the ignition primary coil, the magnetic field produced by the coil collapses. The collapsing magnetic field produces a voltage in the secondary coil which fires the spark plug.

The circuit between the ECM and the electronic ignition system ignition coil is monitored for an open circuit, short to voltage, and short to ground. When the ECM detects a problem in the electronic spark timing A circuit, it will set Diagnostic Trouble Code (DTC) P0351.

Conditions for Setting the DTC

- Ignition ON.
- Fault flag increments fail count.
- Must receive more than 20 failures within 40 test cycles.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- Low speed coolant fan turns on.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

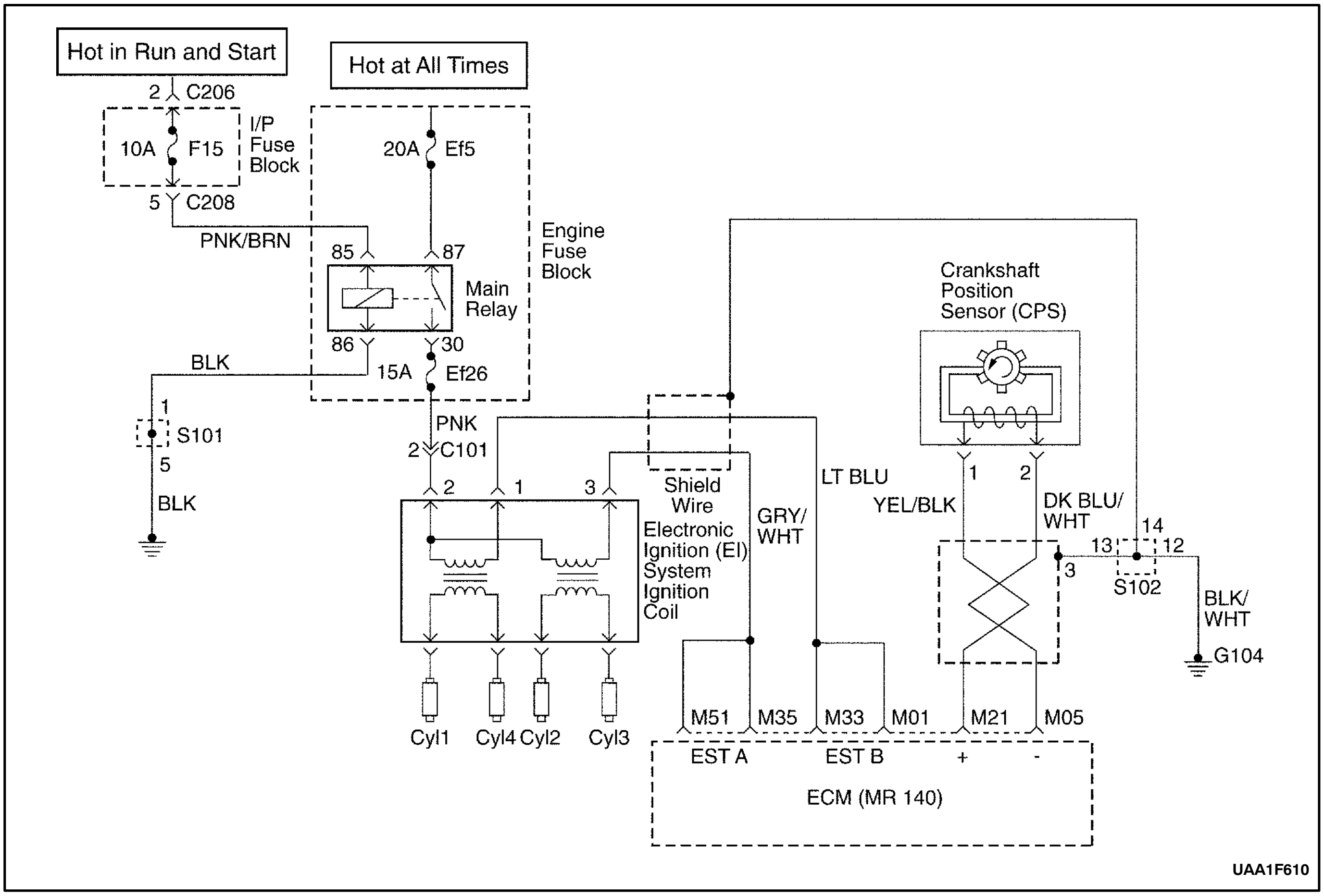
- Poor connection – Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition on, and observe a voltme-

ter connected to the 58X reference circuit at the ECM harness connector while moving connectors and wiring harnesses related to the ECM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0351 – Ignition Control Circuit A Fault (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	Check for a faulty connection or damaged terminal 3 at the Electronic Ignition (EI) system ignition coil and repair as needed. Is the repair complete?	–	Go to *Step 8*	Go to *Step 3*
3	Check for a faulty connection or damaged terminal M51/M35 at the Engine Control Module (ECM) and repair as needed. Is the repair complete?	–	Go to *Step 8*	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the ECM connector. 3. Check the ignition control circuit for a short to ground and repair as needed. Is the repair complete?	–	Go to *Step 8*	Go to *Step 5*
5	Check the ignition control circuit for a short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 8*	Go to *Step 6*
6	Check an open ignition control circuit and repair as needed. Is the repair complete?	–	Go to *Step 8*	Go to *Step 7*
7	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 8*	–
8	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0352 IGNITION CONTROL CIRCUIT B FAULT (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) provides a ground for the electronic spark timing A circuit. When the ECM removes the ground path of the ignition primary coil, the magnetic field produced by the coil collapses. The collapsing magnetic field produces a voltage in the secondary coil which fires the spark plug.

The circuit between the ECM and the electronic ignition system ignition coil is monitored for an open circuit, short to voltage, and short to ground. When the ECM detects a problem in the electronic spark timing A circuit, it will set Diagnostic Trouble Code (DTC) P0351.

Conditions for Setting the DTC

- Ignition ON.
- Fault flag increments fail count.
- Must receive more than 20 failures within 40 test cycles.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- Low speed coolant fan turns on.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

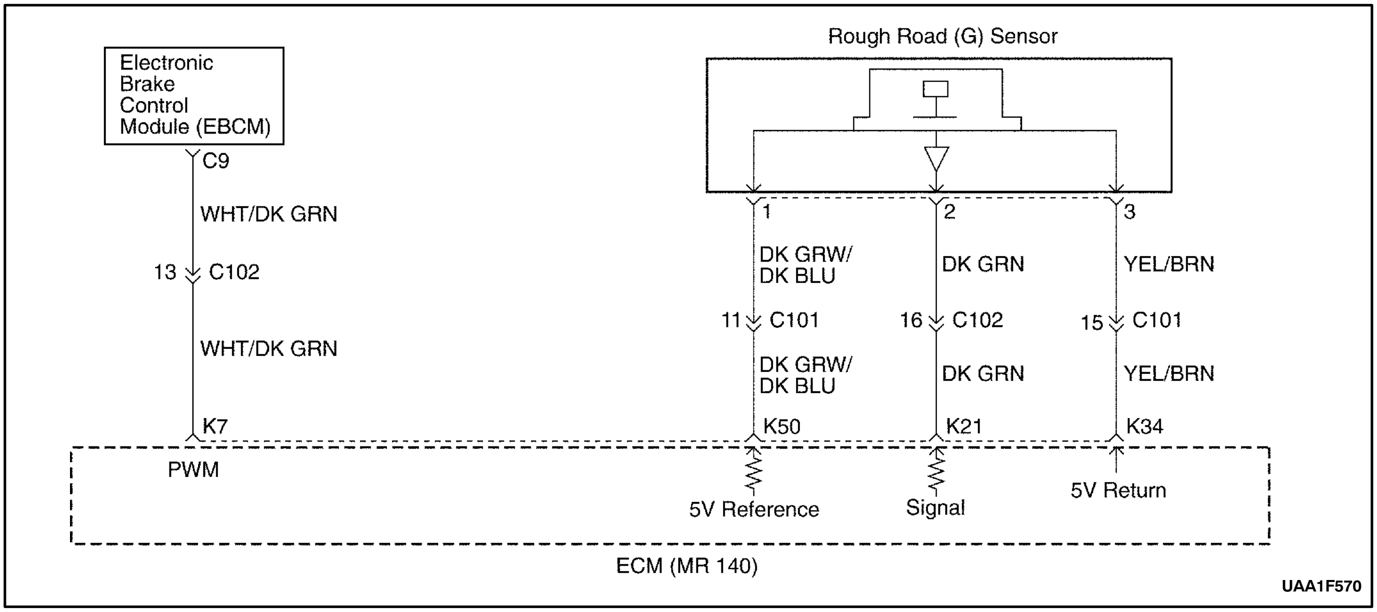
- Poor connection – Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition on, and observe a voltme-

ter connected to the 58X reference circuit at the ECM harness connector while moving connectors and wiring harnesses related to the ECM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0352 – Ignition Control Circuit B Fault (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	Check for a faulty connection or damaged terminal 1 at the Electronic Ignition (EI) system ignition coil and repair as needed. Is the repair complete?	–	Go to *Step 8*	Go to *Step 3*
3	Check for a faulty connection or damaged terminal M33/M1 at the Engine Control Module (ECM) and repair as needed. Is the repair complete?	–	Go to *Step 8*	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the ECM connector. 3. Check the ignition control circuit for a short to ground and repair as needed. Is the repair complete?	–	Go to *Step 8*	Go to *Step 5*
5	Check the ignition control circuit for a short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 8*	Go to *Step 6*
6	Check an open ignition control circuit and repair as needed. Is the repair complete?	–	Go to *Step 8*	Go to *Step 7*
7	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 8*	–
8	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P1380 ABS PWM ROUGH ROAD ROUGH ROAD DATA INVALID (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) identifies engine misfire by detecting variations in crankshaft speed. Crankshaft speed variations can also occur when a vehicle is operated over a rough road. The Anti-Lock Brake System (ABS) can detect if the vehicle is on a rough surface based on wheel acceleration/deceleration data supplied by each wheel speed sensor. This information is sent to the ECM by the Electronic Brake Control Module (EBCM) through Pulse Width Modulation (PWM) serial data line. The ECM then uses this information to determine if the crankshaft variations are being caused by an actual engine misfire or from being driven on a rough surface.

If the ABS is found to be malfunctioning, the ECM will still continue to detect for misfire. However, if a misfire Diagnostic Trouble Code (DTC) is set, this additional DTC will also be set, indicating that rough surface data was not usable during the misfire detection due to the ABS malfunction.

Conditions for Setting the DTC

- Engine run time is greater than or equal to 10 seconds.
- PWM signal is between 95 to 98 %(ABS system fault).
- 15 test failures between 31 test samples.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

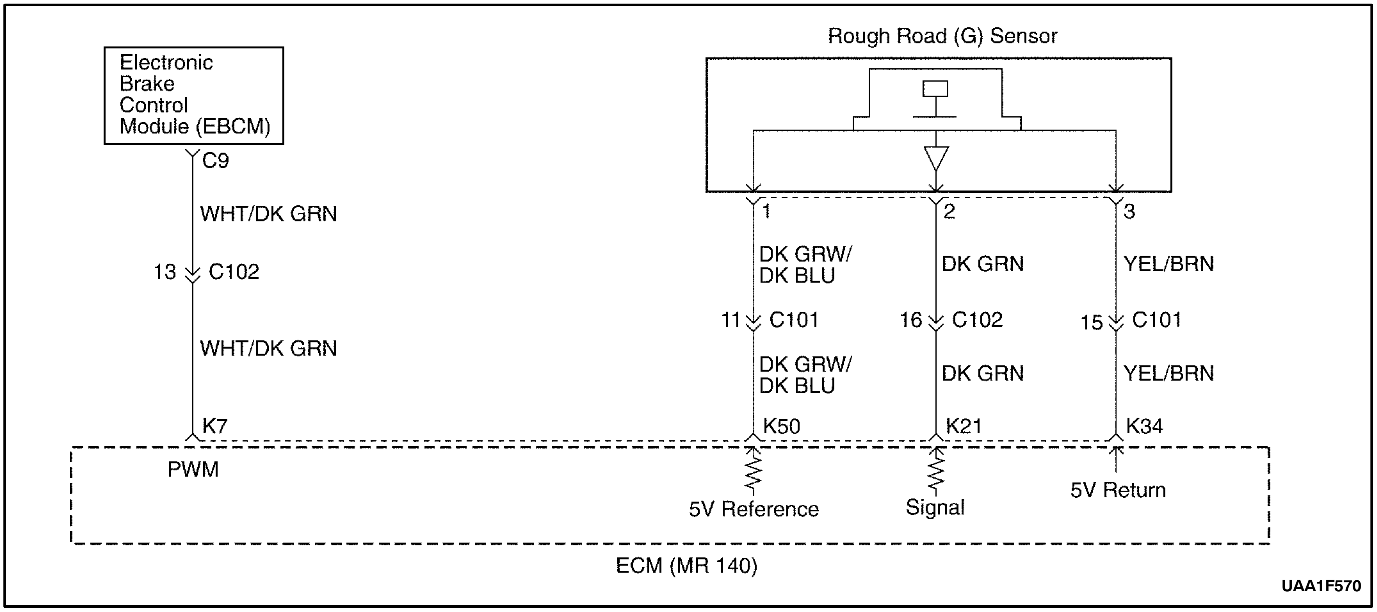
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTCs can be cleared by using a scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

The setting of this DTC indicates that a misfire was detected and that the ECM could not determine if the detected misfire was true or due to operating the vehicle on a rough surface. A misfire can be a true misfire with or without setting this DTC. Check the EBCM for poor connections at the PWM serial data terminals. Be sure no true misfire exists after repairing the cause of this DTC.

DTC P1380 – ABS PWM Rough Road Rough Road Data Invalid (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Install the scan tool to the Data Link Connector (DLC). 3. Turn the ignition ON, with engine OFF. 4. Check for any ABS Diagnostic Trouble Codes (DTCs). Are any ABS DTCs set?	–	Go to Applicable DTC table	Go to *Step 3*
3	1. Review the Failure data and note the parameters. 2. Operate the vehicle within the Conditions for Setting the DTC as noted when driving on a rough surface. Does the misfire set?	–	Go to *Step 4*	Go to *Step 8*
4	Check the scan tool. Does DTC P1380 set?	–	Go to *Step 5*	Go to *Step 6*
5	Check the scan tool Does an ABS DTC set?	–	Go to Applicable DTC table	Go to *Step 7*
6	Repair the condition causing the misfire. Is the repair complete?	–	Go to *Step 8*	–
7	Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 8*	–
8	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P1381
ABS PWM ROUGH ROAD SERIAL DATA FAULT (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) identifies engine misfire by detecting variations in crankshaft speed. Crankshaft speed variations can also occur when a vehicle is operated over a rough road. The Anti-Lock Brake System (ABS) can detect if the vehicle is on a rough surface based on wheel acceleration/deceleration data supplied by each wheel speed sensor. This information is sent to the ECM by the Electronic Brake Control Module (EBCM) through Pulse Width Modulation (PWM) serial data line. The ECM then uses this information to determine if the crankshaft variations are being caused by an actual engine misfire or from being driven on a rough surface.

If the ABS is found to be malfunctioning, the ECM will still continue to detect for misfire. However, if a misfire Diagnostic Trouble Code (DTC) is set, this additional DTC will also be set, indicating that rough surface data was not usable during the misfire detection due to the ABS malfunction.

Conditions for Setting the DTC

- Engine run time is greater than or equal to 10 seconds.
- PWM signal is less than 5 or greater than 98 %(ABS system fault).
- 15 test failures between 31 test samples.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

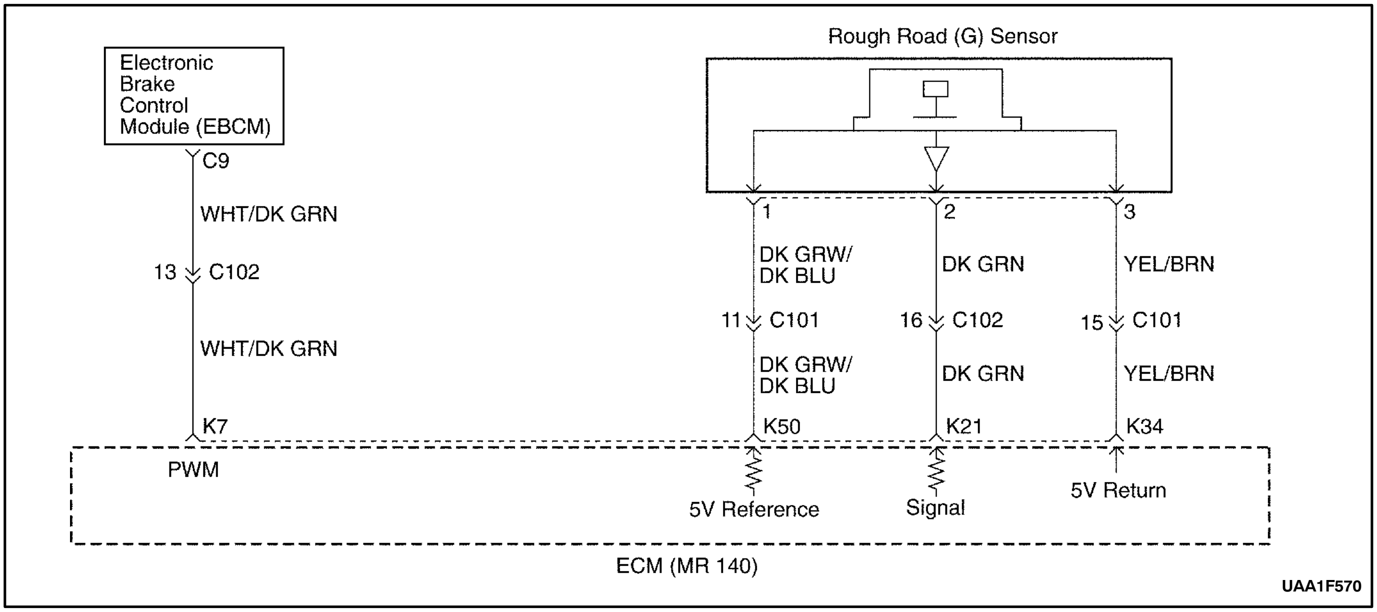
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTCs can be cleared by using a scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

The setting of this DTC indicates that a misfire was detected and that the ECM could not determine if the detected misfire was true or due to operating the vehicle on a rough surface. A misfire can be a true misfire with or without setting this DTC. Check the EBCM for poor connections at the PWM serial data terminals. Be sure no true misfire exists after repairing the cause of this DTC.

DTC P1381 – ABS PWM Rough Road Serial Data Fault (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition ON with engine OFF. 2. Install the scan tool to the Data Link Connector (DLC). 3. Check for any ABS Diagnostic Trouble Codes (DTCs). Are any ABS DTCs set?	–	Go to Applicable DTC table	Go to *Step 3*
3	1. Review the Failure data and note the parameters. 2. Operate the vehicle within the Conditions for Setting the DTC as noted when driving on a rough surface. Does the misfire set?	–	Go to *Step 4*	Go to *Step 8*
4	Check the scan tool. Does DTC P1381 set?	–	Go to *Step 5*	Go to *Step 6*
5	Check the scan tool Does an ABS DTC set?	–	Go to Applicable DTC table	Go to *Step 7*
6	Repair the condition causing the misfire. Is the repair complete?	–	Go to *Step 8*	–
7	Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 8*	–
8	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P1391 G SENSOR ROUGH ROAD RATIONALITY (2.0L DOHC)

Circuit Description

The Gravity Sensing Rough Road (G) sensor is a vertical low g-acceleration sensor. By sensing vertical acceleration caused by bumps or potholes in the road, the Engine Control Module (ECM) can determine if the changes in crankshaft speed are due to engine misfire or are driveline induced. If the G sensor detects a rough road condition, the ECM misfire detection diagnostic will be de-activated. The G sensor at rest output should be between 2.35–2.65 volts (+1G). During a rough road condition, the voltage output can vary between 0.5 (–1G) and 4.5 volts (+3G).

Conditions for Setting the DTC

- Engine is running more than 10 seconds and idle.
- Vehicle speed is less than or equal to 5 km/h (3.1 mph).
- G sensor output indicates below 1.1 volts or above 3.7 volts.

OR

- Engine is running more than 10 seconds and vehicle speed is between 30 mph (50 km/h) and 70 mph (112 km/h).
- G sensor signal changes less than 0.0002 volts while driving.

Action Taken When DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history Diagnostic Trouble Code (DTC) will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Check for the following conditions:

- Poor connection at the ECM – Inspect the harness connections for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the G sensor display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Since the G sensor shares the ECM 5 volt reference and ground terminals with the A/C Pressure Sensor, a damaged A/C Pressure Sensor harness or sensor could cause a G sensor DTC to set. Refer to “Multiple ECM Information Sensor DTCs Set” in this section.

The G sensor will give correct voltages only if it is level and mounted securely to its bracket.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P1391 – G Sensor Rough Road Rationality (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with engine OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Review and record the scan tool Failure Records data. 4. Operate the vehicle within Failure Records conditions as noted. 5. Using the scan tool, monitor specific Diagnostic Trouble Code (DTC) info for DTC P1391. Does the scan tool indicate that DTC P1391 failed?	–	Go to *Step 4*	Go to *Step 3*
3	Check for the following conditions and repair as needed: • G sensor seal missing or damaged. • G sensor mounting flanges cracked, missing, or incorrectly installed. Is the repair complete?	–	Go to *Step 14*	Go to “Diagnostic Aids”
4	1. Turn the ignition OFF. 2. Disconnect the G sensor electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. Observe the G sensor value displayed on the scan tool. Is the G sensor value near the specified value?	0 V	Go to *Step 5*	Go to *Step 12*
5	1. Jumper the 5 volt reference circuit, terminal 1 and the G sensor signal circuit, terminal 2 together at the G sensor harness connector. 2. Observe the G sensor value displayed on the scan tool. Is the G sensor value near the specified value?	4.95 v	Go to *Step 6*	Go to *Step 7*
6	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) and check the sensor ground circuit for high resistance, an open between the ECM and the G sensor, or for a poor connection at the terminal k34 of the ECM and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 10*
7	Check the 5 volt reference circuit for high resistance, an open between the ECM and the G sensor, or a poor connection at the terminal k50 of the ECM and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 8*
8	1. Turn the ignition OFF. 2. Disconnect the ECM and check the G sensor signal circuit for high resistance, an open, a short to ground, or a short to the sensor ground circuit and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 9*
9	Check the G sensor signal circuit for a poor connection at the ECM and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 13*

DTC P1391 – G Sensor Rough Road Rationality (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check for a poor connection at terminal 3 of the G sensor and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 11*
11	Replace the G sensor. Is the repair complete?	–	Go to *Step 14*	–
12	1. Turn the ignition OFF. 2. Disconnect the ECM. 3. Turn the ignition ON. 4. Check the G sensor signal circuit for a short to voltage or a short to the 5 volt reference circuit and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 13*
13	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 14*	–
14	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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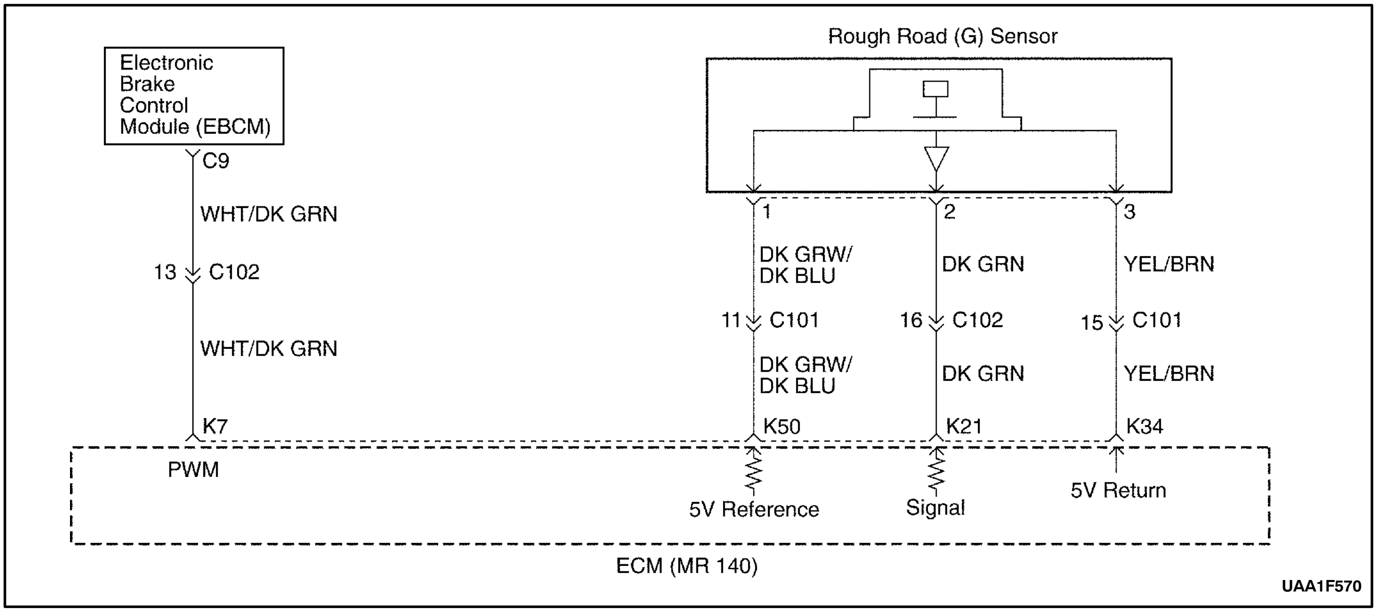

DIAGNOSTIC TROUBLE CODE (DTC) P1392
G SENSOR ROUGH ROAD LOW VOLTAGE (2.0L DOHC)

Circuit Description

The Gravity Sensing Rough Road (G) sensor is a vertical low g-acceleration sensor. By sensing vertical acceleration caused by bumps or potholes in the road, the Engine Control Module (ECM) can determine if the changes in crankshaft speed are due to engine misfire or are driveline induced. If the G sensor detects a rough road condition, the ECM misfire detection diagnostic will be de-activated. The G sensor at rest output should be between 2.35–2.65 volts (+1G). During a rough road condition, the voltage output can vary between 0.5 (–1G) and 4.5 volts (+3G).

Conditions for Setting the DTC

- Engine is running more than 10 seconds.
- G sensor output indicates below 0.1 volts.

Action Taken When DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history Diagnostic Trouble Code (DTC) will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Check for the following conditions:

- Poor connection at the ECM – Inspect the harness connections for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the G sensor display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Since the G sensor shares the ECM 5 volt reference and ground terminals with the A/C Pressure Sensor, a damaged A/C Pressure Sensor harness or sensor could cause a G sensor DTC to set. Refer to “Multiple ECM Information Sensor DTCs Set” in this section.

The G sensor will give correct voltages only if it is level and mounted securely to its bracket.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P1392 – G Sensor Rough Road Low Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Turn the ignition ON, with the engine OFF. 4. Observe the ROUGH ROAD value displayed on the scan tool. Is the ROUGH ROAD value near the specified value?	0 V	Go to *Step 4*	Go to *Step 3*
3	1. Review and record the scan tool Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using the scan tool, monitor specific Diagnostic Trouble Code (DTC) info for DTC P1392. Does the scan tool indicate that DTC P1392 failed?	–	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Disconnect the G sensor electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. Jumper the 5 volt reference circuit, terminal 1 and the G sensor signal circuit, terminal 2 together at the G sensor harness connector. 5. Observe the G sensor value displayed on the scan tool. Is the G sensor value near the specified value?	4.95 V	Go to *Step 9*	Go to *Step 5*
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) and check the 5 volt reference circuit for an open or short to ground and repair as needed. Is the repair complete?	–	Go to *Step 11*	Go to *Step 6*
6	Check the 5 volt reference circuit for poor connection at the ECM and repair or replace as needed. Is the repair complete?	–	Go to *Step 11*	Go to *Step 7*
7	1. Turn the ignition OFF. 2. Disconnect the ECM and check the G sensor signal circuit for an open, a short to ground, or a short to the sensor ground circuit and repair as needed. Is the repair complete?	–	Go to *Step 11*	Go to *Step 8*
8	Check the G sensor signal circuit for a poor connection at the ECM and repair as needed. Is the repair complete?	–	Go to *Step 11*	Go to *Step 10*
9	Replace the G sensor. Is the repair complete?	–	Go to *Step 11*	–
10	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 11*	–

DTC P1392 – G Sensor Rough Road Low Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 12*	Go to *Step 2*
12	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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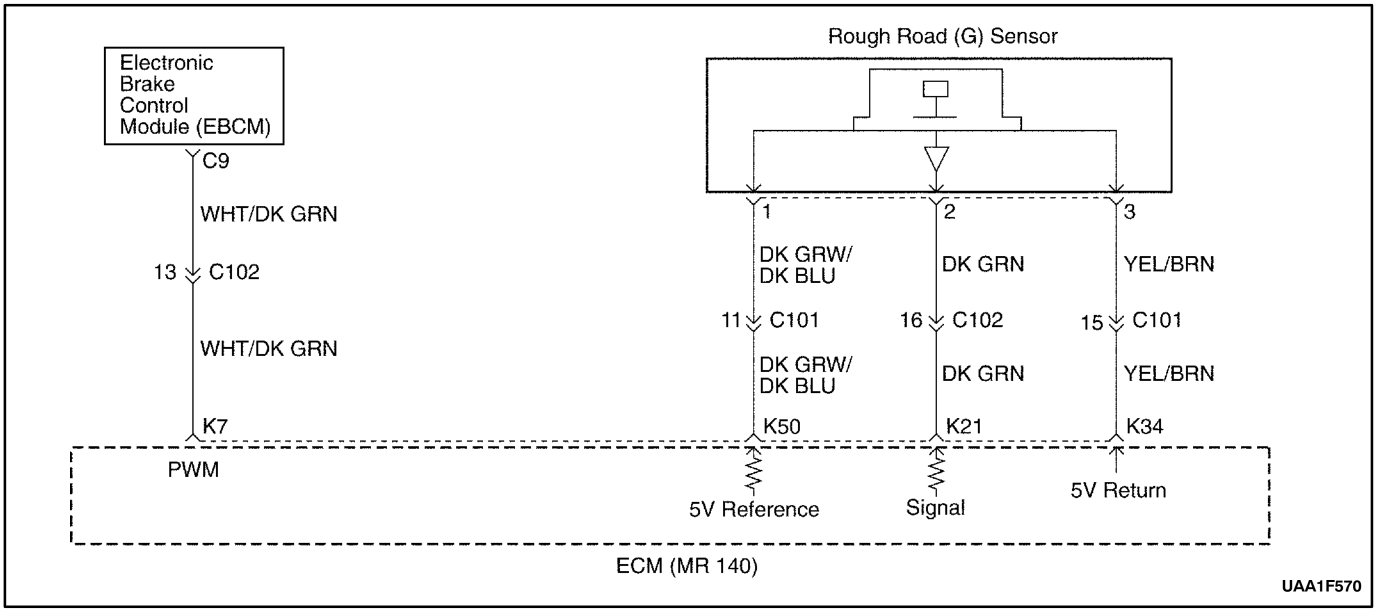

DIAGNOSTIC TROUBLE CODE (DTC) P1393 G SENSOR ROUGH ROAD HIGH VOLTAGE (2.0L DOHC)

Circuit Description

The Rough Road (G) sensor is a vertical low g-acceleration sensor. By sensing vertical acceleration caused by bumps or potholes in the road, the Engine Control Module (ECM) can determine if the changes in crankshaft speed are due to engine misfire or are driveline induced. If the G sensor detects a rough road condition, the ECM misfire detection diagnostic will be de-activated. The G sensor at rest output should be between 2.35–2.65 volts (+1G). During a rough road condition, the voltage output can vary between 0.5 (–1G) and 4.5 volts (+3G).

Conditions for Setting the DTC

- Engine is running more than 10 seconds.
- G sensor output indicates below 4.9 volts.

Action Taken When DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history Diagnostic Trouble Code (DTC) will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Check for the following conditions:

- Poor connection at the ECM – Inspect the harness connections for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the G sensor display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Since the G sensor shares the ECM 5 volt reference and ground terminals with the A/C Pressure Sensor, a damaged A/C Pressure Sensor harness or sensor could cause a G sensor DTC to set. Refer to “Multiple ECM Information Sensor DTCs Set” in this section.

The G sensor will give correct voltages only if it is level and mounted securely to its bracket.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P1393 – G Sensor Rough Road High Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Start and idle the engine. 4. Observe the ROUGH ROAD value displayed on the scan tool. Is the ROUGH ROAD value near the specified value?	4.5 V	Go to *Step 4*	Go to *Step 3*
3	1. Review and record the scan tool Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using the scan tool, monitor specific Diagnostic Trouble Code (DTC) info for DTC P1393. Does the scan tool indicate that DTC P1393 failed?	–	Go to *Step 4*	Go to “Diagnostic Aids”
4	1. Turn the ignition OFF. 2. Disconnect the G sensor electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. Note the G sensor value displayed on the scan tool. Is the G sensor value near the specified value?	0 V	Go to *Step 5*	Go to *Step 6*
5	Probe the sensor ground circuit terminal 3 with test light. Is the test light on?	–	Go to *Step 7*	Go to *Step 9*
6	Check the G sensor signal circuit for a short to voltage or a short to the 5 volt reference circuit and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 11*
7	Check for a poor sensor ground terminal connection at the G sensor and repair or replace as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 8*
8	Check for a poor sensor ground terminal connection at the Engine Control Module (ECM) and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 9*
9	Check the G sensor ground circuit for an open and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 10*
10	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 12*	–
11	Replace the G sensor. Is the repair complete?	–	Go to *Step 12*	Go to *Step 10*

DTC P1393 – G Sensor Rough Road High Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

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DIAGNOSTIC TROUBLE CODE (DTC) P0401 EXHAUST GAS RECIRCULATION INSUFFICIENT FLOW (2.0L DOHC)

Circuit Description

An Exhaust Gas Recirculation (EGR) system is used to lower Nitrogen Oxide (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with an Engine Control Module (ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and Manifold Absolute Pressure (MAP) sensors. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR Position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position.

This diagnostic will determine if there is a reduction in EGR flow.

Conditions for Setting the DTC

- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0125, P0201, P0202, P0203, P0204, P0351, P0352, P0402, P1404, P0405, P0406 and P0502 are not set.
- Test in Decel Fuel Cutoff (DFCO) mode.
  - Barometric pressure (BARO) is greater than 72 kPa (10.4 psi)
  - Vehicle speed is greater than 18 km/h (11.2 mph)
  - A/C clutch and transaxle status unchanged.
  - Rpm is between 1300 and 2900 for automatic transaxle.
  - Rpm is between 1400 and 3000 for manual transaxle.
  - Compensated MAP is within 10.3 to 32 kPa (1.5 to 4.6 psi) range.
- Start test
  - Throttle Position (TP) sensor is less than 1%.
  - EGR is less than 1 %.
  - Change in MAP is less than 1.0 kPa (0.15 psi).

Note: Test will be aborted when:

- Change in vehicle speed is greater than 4 km/h (2.5 mph).
- Rpm is increased more than 50.
- EGR opened less than 90% commanded position.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored in the Freeze Frame data.
- A history Diagnostic Trouble Code (DTC) is stored.
- EGR is disabled.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

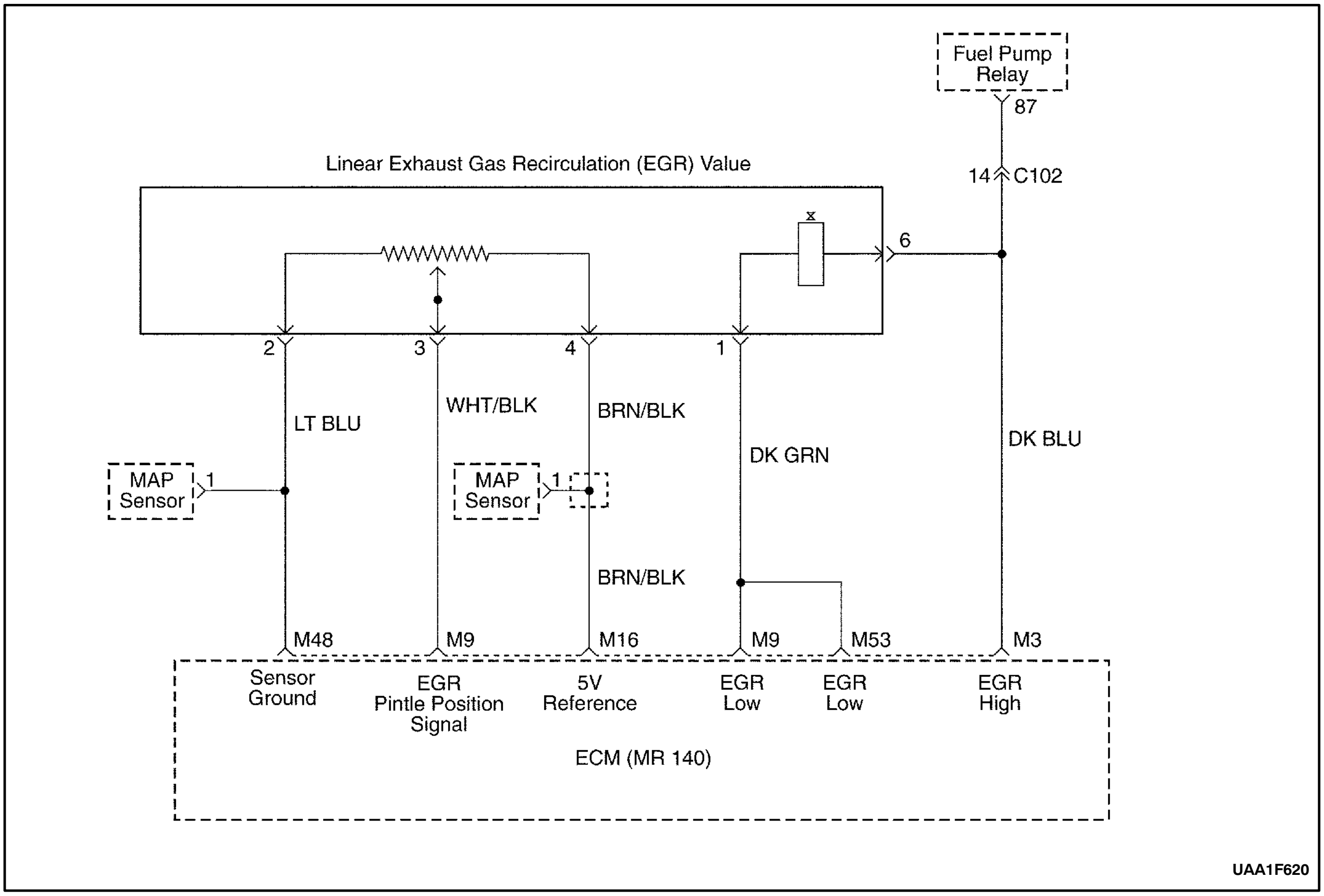
The EGR Decel Filter value can be a great aid in determining if a problem exists and to verify repairs. The EGR Decel Filter is an average of the difference in the expected MAP change and the actual MAP change caused by opening the EGR valve during a deceleration, and is used to determine when the MIL is illuminated. By driving the vehicle up to approximately 97 km/h (60 mph) and decelerating to 32 km/h (20 mph), it can be determined if the EGR system is OK, partially restricted, or fully restricted.

A more negative number (less than –3) indicates that the system is working normally, whereas a positive number indicates that the system is being restricted and that the expected amount of EGR flow is was not seen. A number that falls between negative 3 and positive 2 indicates that the system is partially restricted but not restricted enough to cause an emissions impact.

The EGR Decel Filter value should always be at –3 or lower. If the EGR Decel Filter number becomes more positive (towards 0 or more), then the EGR system is becoming restricted. Look for possible damage to the EGR pipe or for a restriction caused by carbon deposits in the EGR passages or on the EGR valve.

DTC P0401 Exhaust Gas Recirculation Insufficient Flow (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Start the engine and allow the engine to idle. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specific value. Does the engine stall or attempt to stall?	50 %	Go to *Step 5*	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the EGR valve connector and remove the EGR valve. 3. Inspect the EGR valve passages and pipe for a restriction or damages and repair as needed. Is the repair complete?	–	Go to *Step 5*	Go to *Step 4*
4	Replace the EGR valve. Is the repair complete?	–	Go to *Step 5*	–
5	1. Disconnect the battery for more than 10 seconds. 2. Drive the vehicle up to 97 km/h (60mph) 3. Release the throttle and allow the vehicle to decelerate to 32 km/h (20mph). Is the EGR Decel Filter value greater than specified value?	0	Go to *Step 3*	Go to *Step 6*
6	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 7*	Go to *Step 2*
7	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0402 EXHAUST GAS RECIRCULATION EXCESSIVE FLOW (2.0L DOHC)

Circuit Description

An Exhaust Gas Recirculation (EGR) system is used to lower Nitrogen Oxide (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with an Engine Control Module (ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and Manifold Absolute Pressure (MAP) sensors. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR Position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position.

This Diagnostic Trouble Code (DTC) will detect an EGR open to a large valve during crank. Crank time may be excessive with an open EGR valve.

Conditions for Setting the DTC

- Engine cranking (not running).
- Ignition voltage is between 11 and 16 volts.
- EGR position is greater than 70% for more than 3 seconds during cranking.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history Diagnostic Trouble Code (DTC) is stored.
- EGR is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turns off after four consecutive ignition cycles in which the diagnostic runs without a fault.

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and Desired EGR Positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the freeze frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

The EGR Decel Filter value should always be at –3 or lower. If the EGR Decel Filter number becomes more positive (towards 0 or more), then the EGR system is becoming restricted. Look for possible damage to the EGR pipe or for a restriction caused by carbon deposits in the EGR passages or on the EGR valve.

DTC P0402 Exhaust Gas Recirculation Excessive Flow (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data link Connector (DLC). 2. Turn the ignition ON. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specific values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to *Step 19*	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the EGR valve. 3. Turn the ignition ON. 4. With a test light connected to B+, probe the EGR valve wiring harness connector terminal 2. Does the test light illuminate?	–	Go to *Step 4*	Go to *Step 5*
4	1. Using a voltmeter, measure the voltage at the EGR valve wiring harness connector terminal 1. 2. Command the EGR valve open with the scan tool. After command is raised, is the voltage displayed on the voltmeter vary between specified value?	0 to ≈5 V	Go to *Step 6*	Go to *Step 7*
5	Repair the open or poor connection in the EGR ground circuit as needed. Is the repair complete?	–	Go to *Step 19*	–
6	With a test light connected to ground, probe the EGR valve wiring harness connector terminal 3. Dose the test light illuminate?	–	Go to *Step 8*	Go to *Step 9*
7	With a test light connected to ground, probe the EGR valve wiring harness connector terminal 1, without commanding the EGR valve with scan tool. Dose the test light illuminate?	–	Go to *Step 10*	Go to *Step 11*
8	Check the signal circuit for a short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 19*	Go to *Step 12*
9	With a voltmeter connected to the ground, probe the 5 volt reference circuit at terminal 4 of the EGR valve wiring harness connector. Is the voltage near the specified value?	5 V	Go to *Step 13*	Go to *Step 14*

DTC P0402 Exhaust Gas Recirculation Excessive Flow (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the control circuit for a short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 19*	Go to *Step 12*
11	With a test light connected to B+ and again probe the control circuit at terminal 1. Dose the test light illuminate?	–	Go to *Step 15*	Go to *Step 16*
12	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 19*	–
13	Check the EGR ground circuit for poor connection or proper terminal tension at the ECM and repair as needed. Is the repair complete?	–	Go to *Step 19*	Go to *Step 17*
14	Check the 5 volt reference circuit for a short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 19*	Go to *Step 12*
15	Check the control circuit 1 for short to ground and repair as needed. Is the repair complete?	–	Go to *Step 19*	Go to *Step 12*
16	Check the control circuit at terminal 1 for an open or poor connection at EGR valve connector and repair as needed. Is the repair complete?	–	Go to *Step 19*	Go to *Step 18*
17	1. Turn the ignition OFF. 2. Replace the EGR valve. Is the repair complete?	–	Go to *Step 19*	–
18	Check the ECM connector for a poor connection and repair as needed. Is the repair complete?	–	Go to *Step 19*	–
19	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 20*	Go to *Step 2*
20	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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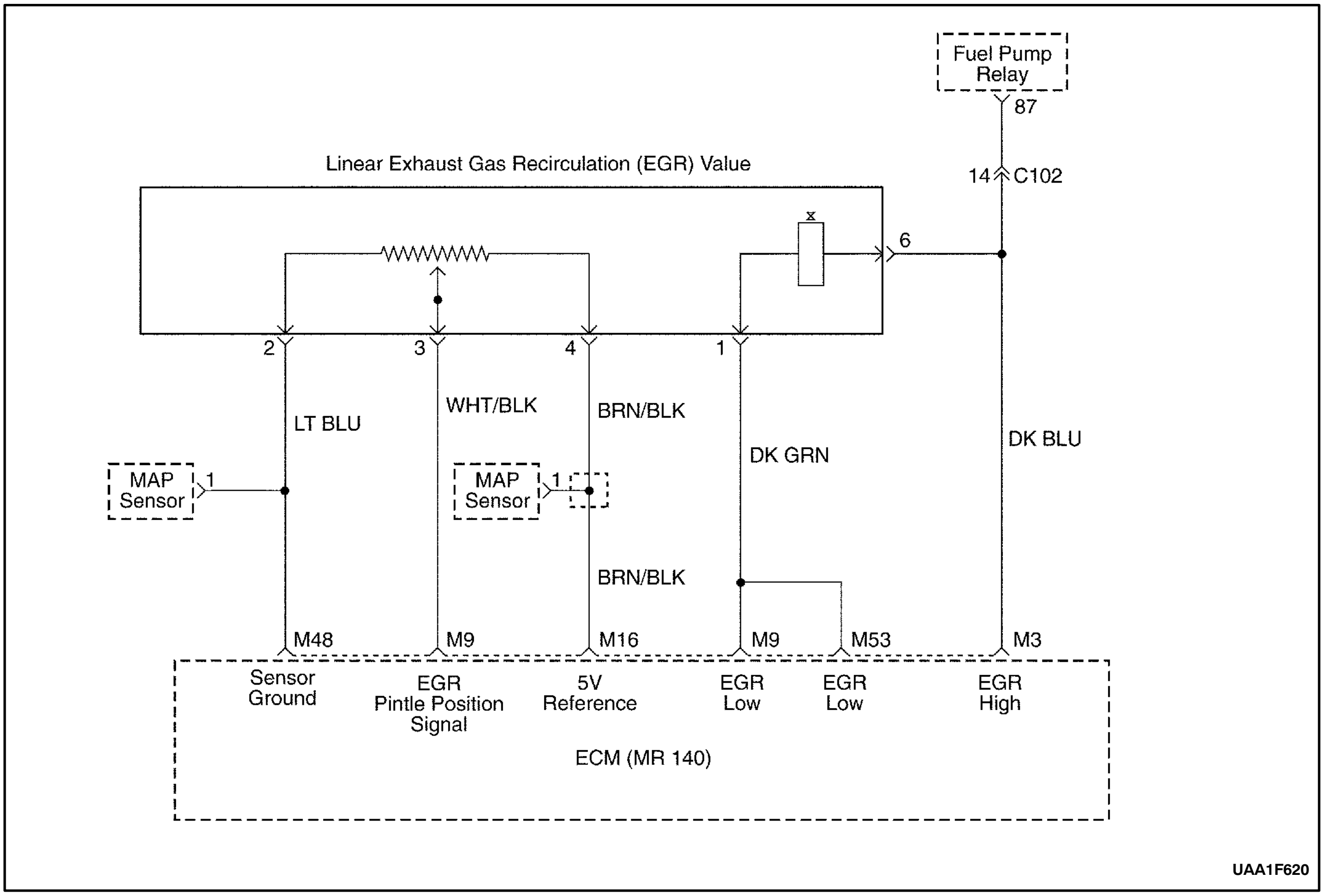

DIAGNOSTIC TROUBLE CODE (DTC) P0404 EXHAUST GAS RECIRCULATION OPENED (2.0L DOHC)

Circuit Description

An Exhaust Gas Recirculation (EGR) system is used to lower Nitrogen Oxide (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with an Engine Control Module (ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and Manifold Absolute Pressure (MAP) sensors. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR Position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position.

This Diagnostic Trouble Code (DTC) will detect an open valve position.

Conditions for Setting the DTC

- Desired EGR position is greater than 0.
- Change in Desired EGR is less than 3%.
- Engine is running.
- Intake Air Temperature (IAT) is greater than 3°C (37.4°F)
- Ignition voltage is between 11.7 and 16 volts
- DTCs P0112, P0113 P0405, P0406, and P0502 are not set.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history Diagnostic Trouble Code (DTC) is stored.
- EGR is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turns off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and Desired EGR Positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the freeze frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

DTC P0404 Exhaust Gas Recirculation Opened (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specific values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to *Step 19*	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the EGR valve. 3. Turn the ignition ON. 4. With a test light connected to B+, probe the EGR valve wiring harness connector terminal 2. Does the test light illuminate?	–	Go to *Step 4*	Go to *Step 5*
4	1. Using a voltmeter, measure the voltage at the EGR valve wiring harness connector terminal 1. 2. Command the EGR valve open with the scan tool. After command is raised, is the voltage displayed on the voltmeter vary between specified value?	0 to ≈5 V	Go to *Step 6*	Go to *Step 7*
5	Repair the open or poor connection in the EGR ground circuit as needed. Is the repair complete?	–	Go to *Step 19*	–
6	With a test light connected to ground, probe the EGR valve wiring harness connector terminal 3. Dose the test light illuminate?	–	Go to *Step 8*	Go to *Step 9*
7	With a test light connected to ground, probe the EGR valve wiring harness connector terminal 1, without commanding the EGR valve with scan tool. Dose the test light illuminate?	–	Go to *Step 10*	Go to *Step 11*
8	Check the signal circuit for a short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 19*	Go to *Step 12*
9	With a voltmeter connected to the ground, probe the 5 volt reference circuit at terminal 4 of the EGR valve wiring harness connector. Is the voltage near the specified value?	5 V	Go to *Step 13*	Go to *Step 14*
10	Check the control circuit for a short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 19*	Go to *Step 12*

DTC P0404 Exhaust Gas Recirculation Opened (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	With a test light connected to B+ and again probe the control circuit at terminal 1. Dose the test light illuminate?	–	Go to *Step 15*	Go to *Step 16*
12	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 19*	–
13	Check the EGR ground circuit for poor connection or proper terminal tension at the ECM and repair as needed. Is the repair complete?	–	Go to *Step 19*	Go to *Step 17*
14	Check the 5 volt reference circuit for a short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 19*	Go to *Step 12*
15	Check the control circuit at terminal 1 for short to ground and repair as needed. Is the repair complete?	–	Go to *Step 19*	Go to *Step 12*
16	Check the control circuit at terminal 1 for an open or poor connection at EGR valve connector and repair as needed. Is the repair complete?	–	Go to *Step 19*	Go to *Step 18*
17	1. Turn the ignition OFF. 2. Replace the EGR valve. Is the repair complete?	–	Go to *Step 19*	–
18	Check the ECM connector for a poor connection and repair as needed. Is the repair complete?	–	Go to *Step 19*	–
19	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 20*	Go to *Step 2*
20	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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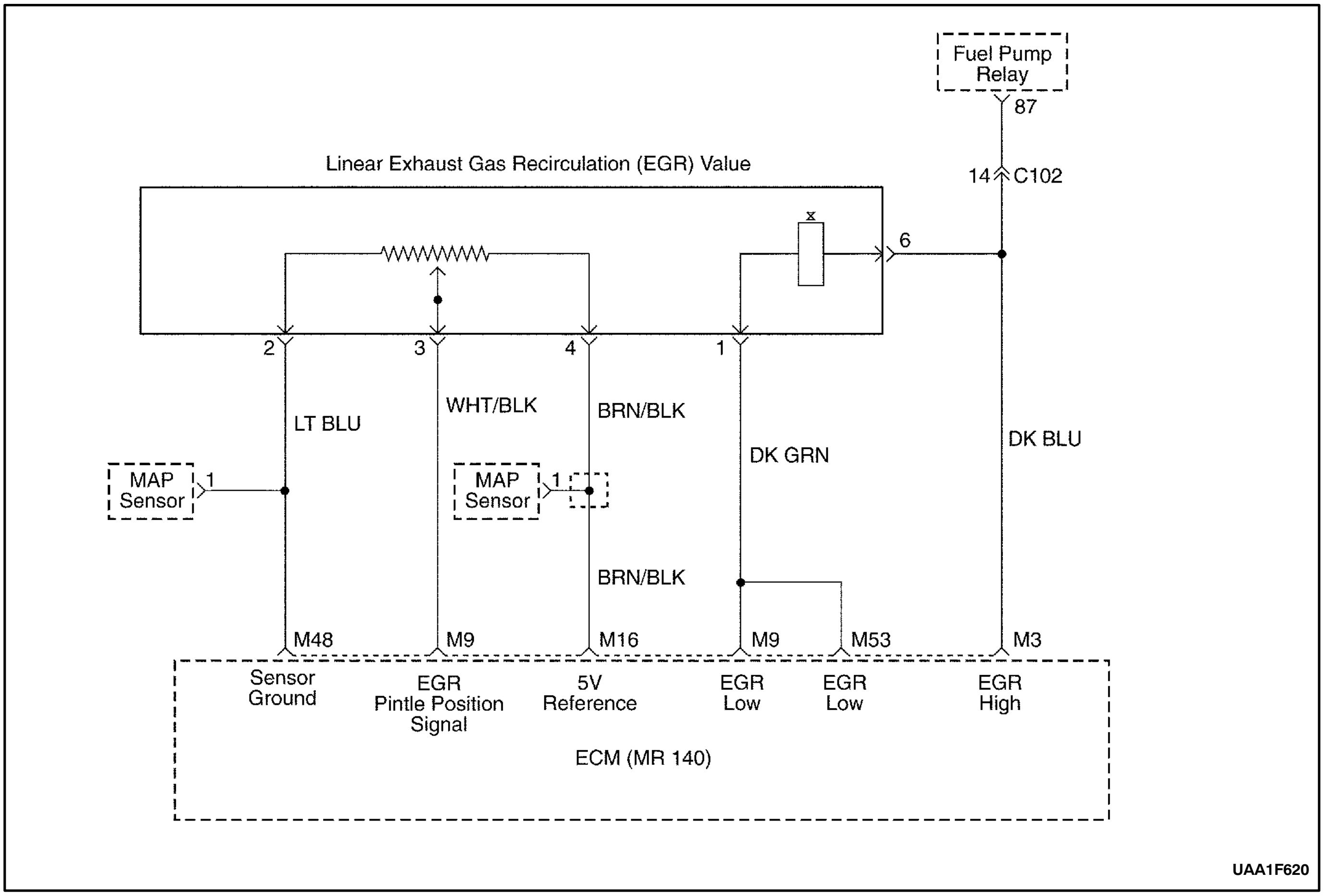

DIAGNOSTIC TROUBLE CODE (DTC) P1404 EXHAUST GAS RECIRCULATION CLOSED (2.0L DOHC)

Circuit Description

An Exhaust Gas Recirculation (EGR) system is used to lower Nitrogen Oxide (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with an Engine Control Module (ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and Manifold Absolute Pressure (MAP) sensors. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR Position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position.

Conditions for Setting the DTC

- Difference between current and learned low position is greater than 6.25%.
- Desired EGR position is equal to 0.
- Engine is running.
- Ignition voltage is between 11.7 and 16 volts.
- Intake Air Temperature (IAT) is greater than 3°C (37.4°F).
- DTCs P0112, P0113, P0405, P0406, and P0502 are not set.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history Diagnostic Trouble Code (DTC) is stored.
- EGR is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turns off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and Desired EGR Positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the freeze frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

DTC P1404 Exhaust Gas Recirculation Closed (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specific values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to *Step 13*	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the EGR valve. Is the Actual EGR Position near the specified value?	100%	Go to *Step 4*	Go to *Step 5*
4	Check the signal circuit terminal 3 at the EGR wiring harness connector for a short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 13*	Go to *Step 6*
5	With a voltmeter connected to the ground, probe the 5 volt reference circuit at terminal 4 of the EGR valve wiring harness connector. Is the voltage near the specified value?	5 V	Go to *Step 7*	Go to *Step 8*
6	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 13*	–
7	With a test light connected to ground, probe the EGR valve wiring harness connector terminal 1. Dose the test light illuminate?	–	Go to *Step 9*	Go to *Step 10*
8	Check the 5 volt reference circuit for a short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 13*	Go to *Step 6*
9	Check the control circuit for a short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 13*	Go to *Step 6*
10	Check the EGR ground circuit for an open or poor connection at the EGR valve harness connector and repair as needed. Is the repair complete?	–	Go to *Step 13*	Go to *Step 12*
11	1. Turn the ignition OFF. 2. Replace the EGR valve. Is the repair complete?	–	Go to *Step 13*	–

DTC P1404 Exhaust Gas Recirculation Closed (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check the ECM connector for a poor connection and repair as needed. Is the repair complete?	–	Go to *Step 13*	–
13	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 14*	Go to *Step 2*
14	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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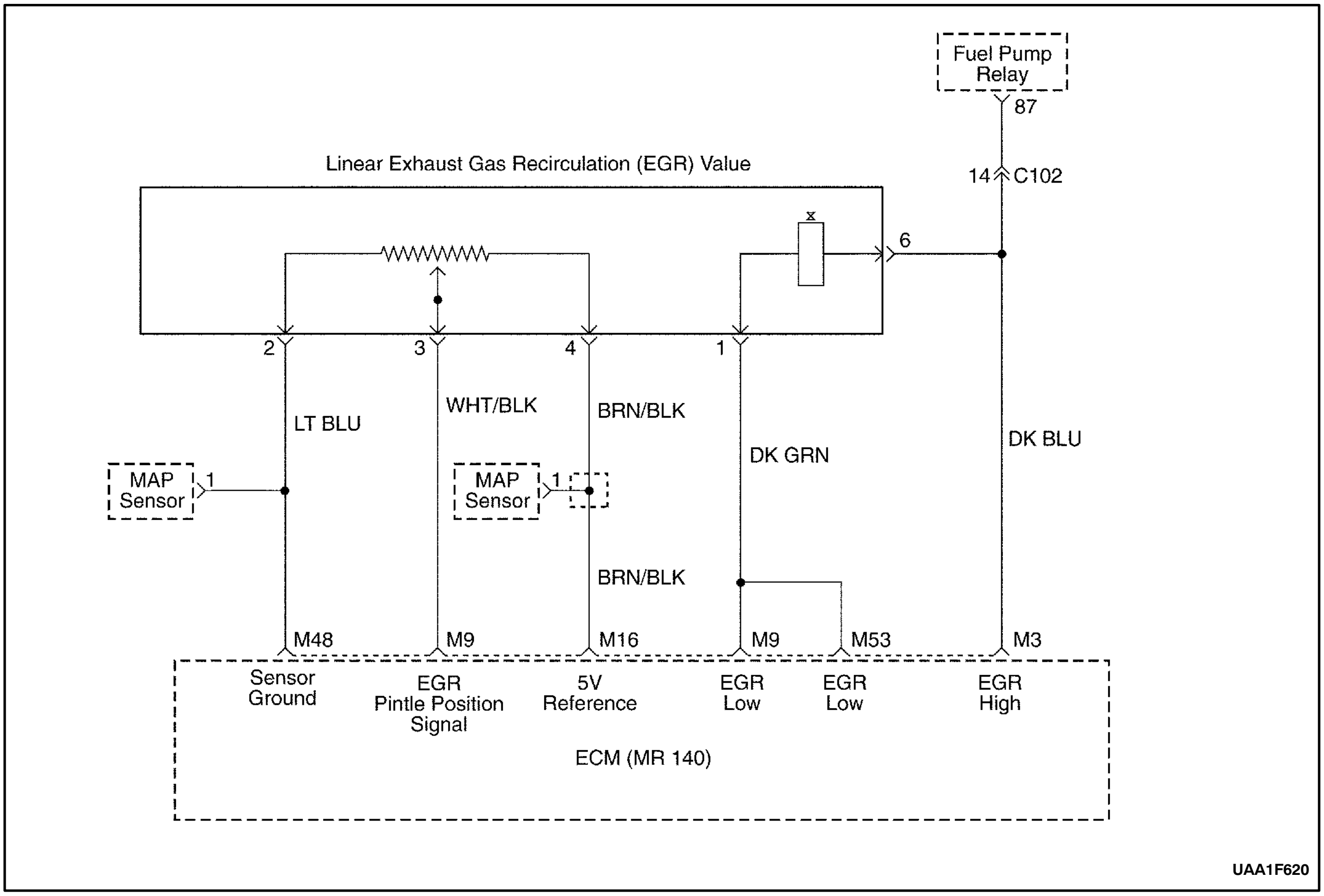

DIAGNOSTIC TROUBLE CODE (DTC) P0405 EXHAUST GAS RECIRCULATION PINTLE POSITION SENSOR CIRCUIT LOW VOLTAGE (2.0L DOHC)

Circuit Description

An Exhaust Gas Recirculation (EGR) system is used to lower Nitrogen Oxide (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with an Engine Control Module (ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and Manifold Absolute Pressure (MAP) sensors. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR Position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position. This diagnostic Trouble Code (DTC) will detect an open or short circuit.

Conditions for Setting the DTC

- EGR position signal is less than 2%.
- Ignition voltage is between 11.7 and 16 volts.
- Fail condition last more than 10 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history Diagnostic Trouble Code (DTC) is stored.
- EGR is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turns off after four consecutive ignition cycles in which the diagnostic runs without a fault.

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and Desired EGR Positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the freeze frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

DTC P0405 Exhaust Gas Recirculation Pintle Position Sensor Circuit Low Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specific values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to *Step 15*	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the EGR valve. 3. Turn the ignition ON. 4. With a voltmeter connected to the ground, probe the 5 volt reference circuit at terminal 4 of the EGR valve wiring harness connector. Is the voltage near the specified value?	5 V	Go to *Step 4*	Go to *Step 5*
4	Jumper the 5 volt reference circuit to the signal circuit at terminal 4 and 3 at the EGR valve wiring harness connector. Does the Actual EGR Position display the specific value?	100%	Go to *Step 6*	Go to *Step 7*
5	With a test light connected to B+, probe the 5 volt reference circuit at the EGR valve wiring harness connector terminal 4. Dose the test light illuminate?	–	Go to *Step 8*	Go to *Step 9*
6	Check the 5 volt reference and signal circuit for a poor connection or proper terminal tension and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 10*
7	With a test light connected to B+, probe the signal circuit at terminal 3 of the EGR valve wiring harness connector. Dose the test light illuminate?	–	Go to *Step 11*	Go to *Step 12*
8	Check for a short to ground in EGR valve 5 volt reference circuit and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 13*
9	Check for an open in EGR valve 5 volt reference circuit and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 14*

DTC P0405 Exhaust Gas Recirculation Pintle Position Sensor Circuit Low Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Turn the ignition OFF. 2. Replace the EGR valve. Is the repair complete?	–	Go to *Step 15*	–
11	Check for a short to ground in the EGR valve signal circuit and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 13*
12	Check for an open in the EGR valve signal circuit and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 14*
13	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 15*	–
14	Check the ECM connector for a poor connection and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 13*
15	1 Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2 Start the engine and idle at normal operating temperature. 3 Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 16*	Go to *Step 2*
16	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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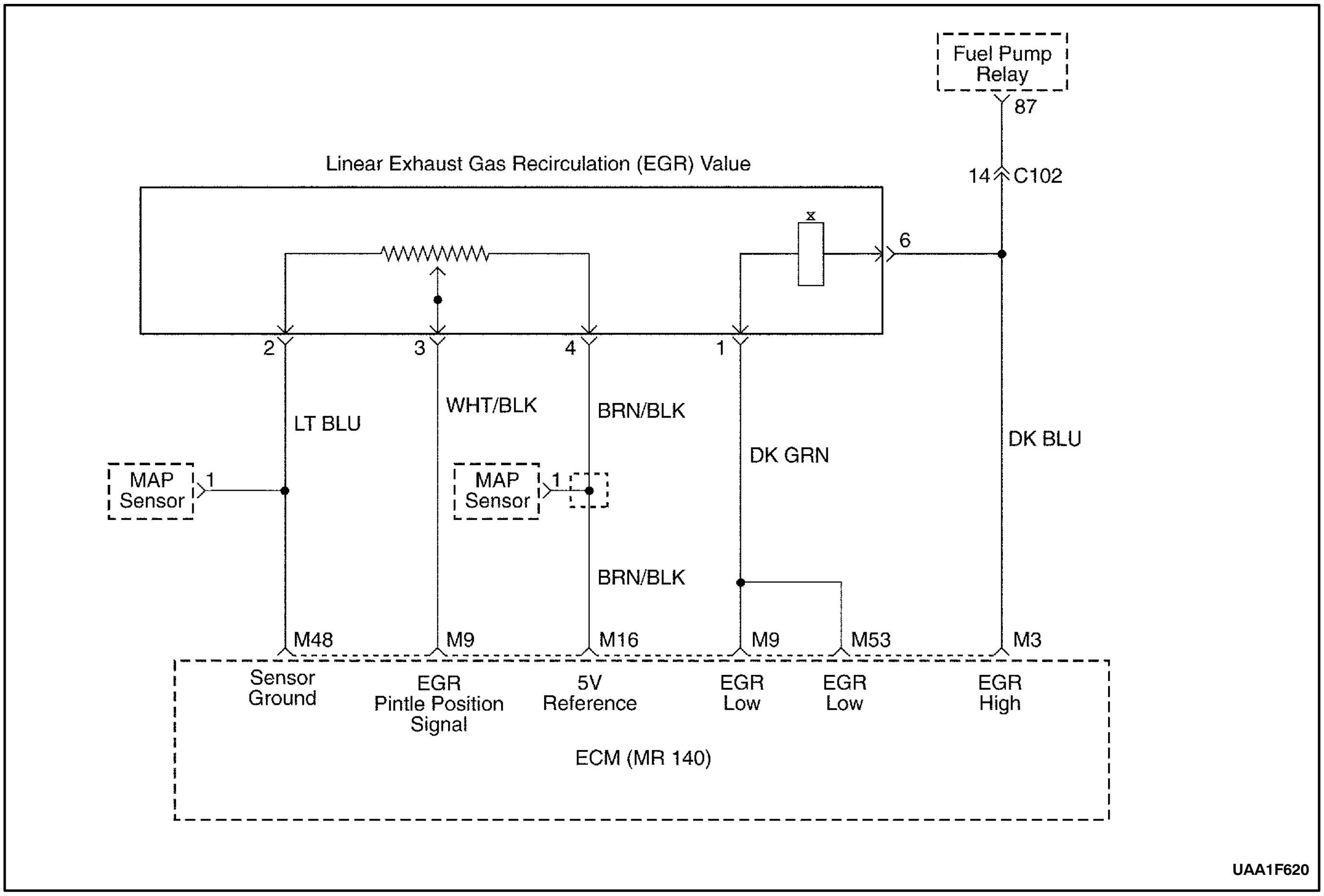

DIAGNOSTIC TROUBLE CODE (DTC) P0406 EXHAUST GAS RECIRCULATION PINTLE POSITION SENSOR CIRCUIT HIGH VOLTAGE (2.0L DOHC)

Circuit Description

An Exhaust Gas Recirculation (EGR) system is used to lower Nitrogen Oxide (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with an Engine Control Module (ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and Manifold Absolute Pressure (MAP) sensors. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR Position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position. This diagnostic Trouble Code (DTC) will detect short circuit.

Conditions for Setting the DTC

- EGR position signal is greater than 98%.
- Ignition voltage is between 11.7 and 16 volts.
- Fail condition last more than 10 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history Diagnostic Trouble Code (DTC) is stored.
- EGR is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turns off after four consecutive ignition cycles in which the diagnostic runs without a fault.

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and Desired EGR Positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the freeze frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

DTC P0406 Exhaust Gas Recirculation Pintle Position Sensor Circuit High Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specific values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to *Step 14*	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the EGR valve. 3. Turn the ignition ON. 4. With a voltmeter connected to the ground, probe the 5 volt reference circuit at terminal 4 of the EGR valve wiring harness connector. Is the voltage near the specified value?	5 V	Go to *Step 4*	Go to *Step 5*
4	Jumper the 5 volt reference circuit to the signal circuit at terminal 4 and 3 at the EGR valve wiring harness connector. Does the Actual EGR Position display the specific value?	100%	Go to *Step 6*	Go to *Step 7*
5	With a test light connected to B+, probe the 5 volt reference circuit at the EGR valve wiring harness connector terminal 4. Dose the test light illuminate?	–	Go to *Step 8*	Go to *Step 9*
6	Check the 5 volt reference and signal circuit for a poor connection or proper terminal tension and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 10*
7	With a test light connected to B+, probe the signal circuit at terminal 3 of the EGR valve wiring harness connector. Dose the test light illuminate?	–	Go to *Step 11*	Go to *Step 13*
8	Check for a short to ground in EGR valve 5 volt reference circuit and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 12*
9	Check for an open in EGR valve 5 volt reference circuit and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 13*

DTC P0406 Exhaust Gas Recirculation Pintle Position Sensor Circuit High Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Turn the ignition OFF. 2. Replace the EGR valve. Is the repair complete?	–	Go to *Step 14*	–
11	Check for a short to ground in the EGR valve signal circuit and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 12*
12	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 14*	–
13	Check the ECM connector for a poor connection and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 12*
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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DIAGNOSTIC TROUBLE CODE (DTC) P0420 CATALYST (OXYGEN SENSOR) LOW EFFICIENCY (2.0L DOHC)

Circuit Description

In order to control exhaust emissions of Hydrocarbons (HC), Carbon Monoxide (CO) and Nitrogen Oxide (NOx), a Three-Way Catalytic Converter (TWC) is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide, it also reduces NOx, converting it into nitrogen. The catalytic converter also has the ability to store oxygen. The Engine Control Module (ECM) has the capability to monitor this process using a Heated

Oxygen Sensor (HO2S) located in the exhaust stream past the TWC. The HO2S produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust emissions effectively. The ECM monitors the catalyst efficiency by first allowing the catalyst to heat up, waiting for a stabilization period while the engine is idling, and then adding and removing fuel while monitoring the reaction of the HO2S. When the catalyst is functioning properly, the HO2S response to the extra fuel is slow compared to the Oxygen Sensor (O2S). When the HO2S response is close to that of the O2S, the Oxygen storage capability or efficiency of the catalyst is considered to be bad, and the Malfunction Indicator Lamp (MIL) will illuminate.

Conditions for Setting the DTC

- Before idle test, the vehicle needs to be driven for at least:
  - 15 seconds at airflow is greater than 9.2 g/sec. for manual transaxle.
  - 11 seconds at airflow is greater than 12 g/sec. for automatic transaxle.
- Oxygen Sensor Capacity test condition:
- l At idle (D/R position for automatic transaxle).
- Closed loop stoichiometry.
- Purge concentration learned.
- Engine is running more than 300 seconds.
- Airflow is between 2.2 and 7.0 g/sec.
- Throttle Position (TP) sensor is less than 1.5%.
- Engine Coolant Temperature (ECT) is between 70°C (158°F) and 109°C (228.2°F).
- Intake Air Temperature (IAT) is between –7°C (19.4°F) and 105°C (221°F).
- Barometric pressure (BARO) is greater than 72 kPa (10.4psi).
- Catalyst temperature is between 600°C (1112°F) and 850°C (1562°F).
- Closed Loop integrator change is less than 0.03.
- Idle time is less than 1 minute.
- Vehicle speed is less than 3 km/h (1.9 mph).
- Block Learn Mode is learned.
- Above condition is stabilized for 5 seconds.

Note: Test is aborted for this idle if:

- Change in engine speed is greater than 80 rpm.
- A/C status changed.
- Cooling fan status changed.
- Insufficient air/fuel shift.

- DTC(s) P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0125, P0131, P0132, P0133, P1133, P0134, P1134, P0137, P0138, P0140, P0141, P1167, P1171, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0341, P0342, P0351, P0352, P0402, P0404, P0405, P0406, P0506, P0507, and P0562 are not set.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

The catalyst test may abort due to a change in the engine load. Do not change the engine load (i.e. A/C, coolant fan, heater motor) while a catalyst test is in progress.

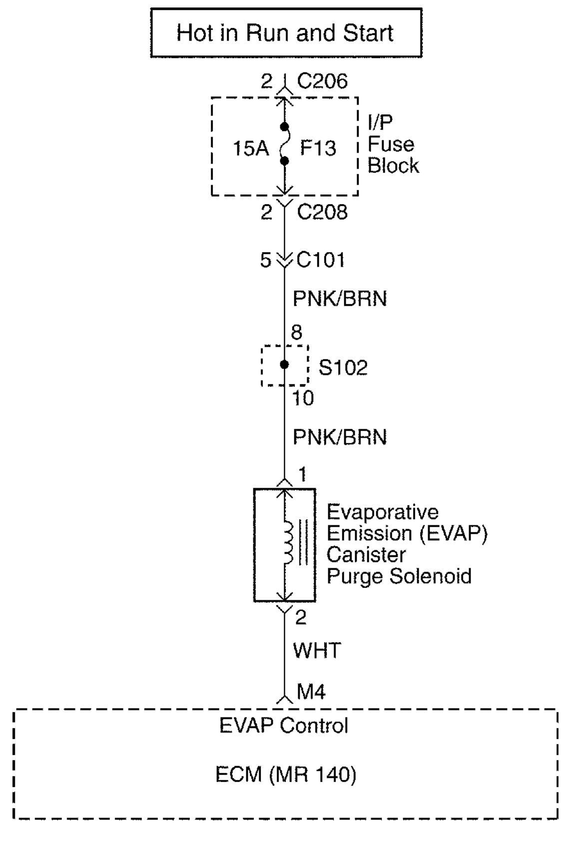
An intermittent problem may be caused by a poor connection, rubbed-through wire insulation, or a wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the intermittent complaint, should be thoroughly checked for the following conditions:

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection

DTC P0420 Oxygen Sensor Low Efficiency (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Are any component Diagnostic Trouble Codes (DTCs) set?	–	Go to Applicable DTC table	Go to *Step 3*
3	Visually/physically check the following: • Exhaust system for a leak. • Heated Oxygen Sensor (HO2S). Is a problem found?	–	Go to *Step 4*	Go to *Step 5*
4	Repair the exhaust system as needed. Is the repair complete?	–	Go to *Step 6*	–
5	Replace the Three Way Catalytic Converter (TWC). Is the repair complete?	–	Go to *Step 6*	–
6	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 7*	Go to *Step 2*
7	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0443
EVAPORATIVE EMISSION PURGE CONTROL CIRCUIT FAULT (2.0L DOHC)

System Description

The Evaporative Emission (EVAP) system includes the following components:

- Fuel tank.
- EVAP vent solenoid.
- Fuel tank pressure sensor.
- Fuel pipes and hoses.
- Fuel vapor lines.
- Fuel cap.
- EVAP canister.
- Purge lines.
- EVAP canister purge solenoid valve.
- EVAP service port.

The EVAP purge canister solenoid is controlled by the Engine Control Module (ECM). The ECM applies a ground to the EVAP purge canister solenoid. The ECM determines when to activate the EVAP canister purge solenoid depending on operating conditions, including Throttle Position (TP), engine speed, Engine Coolant Temperature (ECT) and ambient temperature.

The Diagnostic Trouble Code will detect an open or short circuit.

Conditions for Setting the DTC

- Ignition ON.
- Ignition voltage is greater than 11 v.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using a scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Using Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If the DTC cannot be duplicated, the information included in the Freeze

Frame and/or Failure Records data can be useful in determining how many miles since the DTC set. The Fail Counter and the Pass Counter can also be used to determine how many ignition cycles the diagnostic reported a pass and/or a fail. Operate the vehicle within the same freeze frame conditions (rpm, load, vehicle speed, temperature, etc.) that were noted. This will isolate when the DTC failed.

DTC P0443 Evaporative Emission Purge Control Circuit Fault (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. 3. Command the Evaporative Emission (EVAP) Purge Solenoid ON and OFF. Does the solenoid turn ON and OFF with each command.	ON–99% OFF–0%	Go to *Step 3*	Go to *Step 5*
3	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector. 3. Turn the ignition ON. 4. Using a ammeter on a 10 ampere scale, measure the current between the solenoid control circuit, terminal M4 at the ECM connect and ground for 2 minutes. Does the current draw measure less than the specified value?	0.75 A	Go to “Diagnostic Aids”	Go to *Step 4*
4	1. Disconnect the solenoid. 2. Using ohmmeter measure the resistance between the solenoid control circuit, terminal M4 of the ECM connector and ground. Does the ohmmeter display infinite resistance?	–	Go to *Step 12*	Go to *Step 10*
5	1. Turn the ignition OFF. 2. Disconnect the solenoid. 3. Connect a test light between the terminal 1 and 2 of the solenoid. 4. Turn the ignition ON.. 5. Using a scan tool, command the solenoid On and OFF. Does the test light turn ON and OFF with each command.	–	Go to *Step 8*	Go to *Step 6*
6	With a test light connected to ground, probe the ignition feed circuit, terminal 1 in the solenoid harness connector.	–	Go to *Step 7*	Go to *Step 11*
7	1. Turn the ignition OFF. 2. Reconnect the solenoid. 3. Disconnect the ECM connector. 4. Turn the ignition ON. 5. With a fused jumper wire connected to ground, probe the solenoid control circuit terminal M4 in the ECM connector. Does the solenoid operate?	–	Go to *Step 9*	Go to *Step 10*

DTC P0443 Evaporative Emission Purge Control Circuit Fault (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
8	Check the connection at the solenoid and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 12*
9	Check the connection at the ECM and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 13*
10	Repair the faulty solenoid control circuit. Is the repair complete?	–	Go to *Step 14*	–
11	Repair the faulty solenoid ignition feed circuit. Is the repair complete?	–	Go to *Step 14*	–
12	1. Turn the ignition OFF. 2. Replace the solenoid. Is the repair complete?	–	Go to *Step 14*	–
13	1. Turn the ignition OFF. 2. Disconnect the ECM. Is the repair complete?	–	Go to *Step 14*	–
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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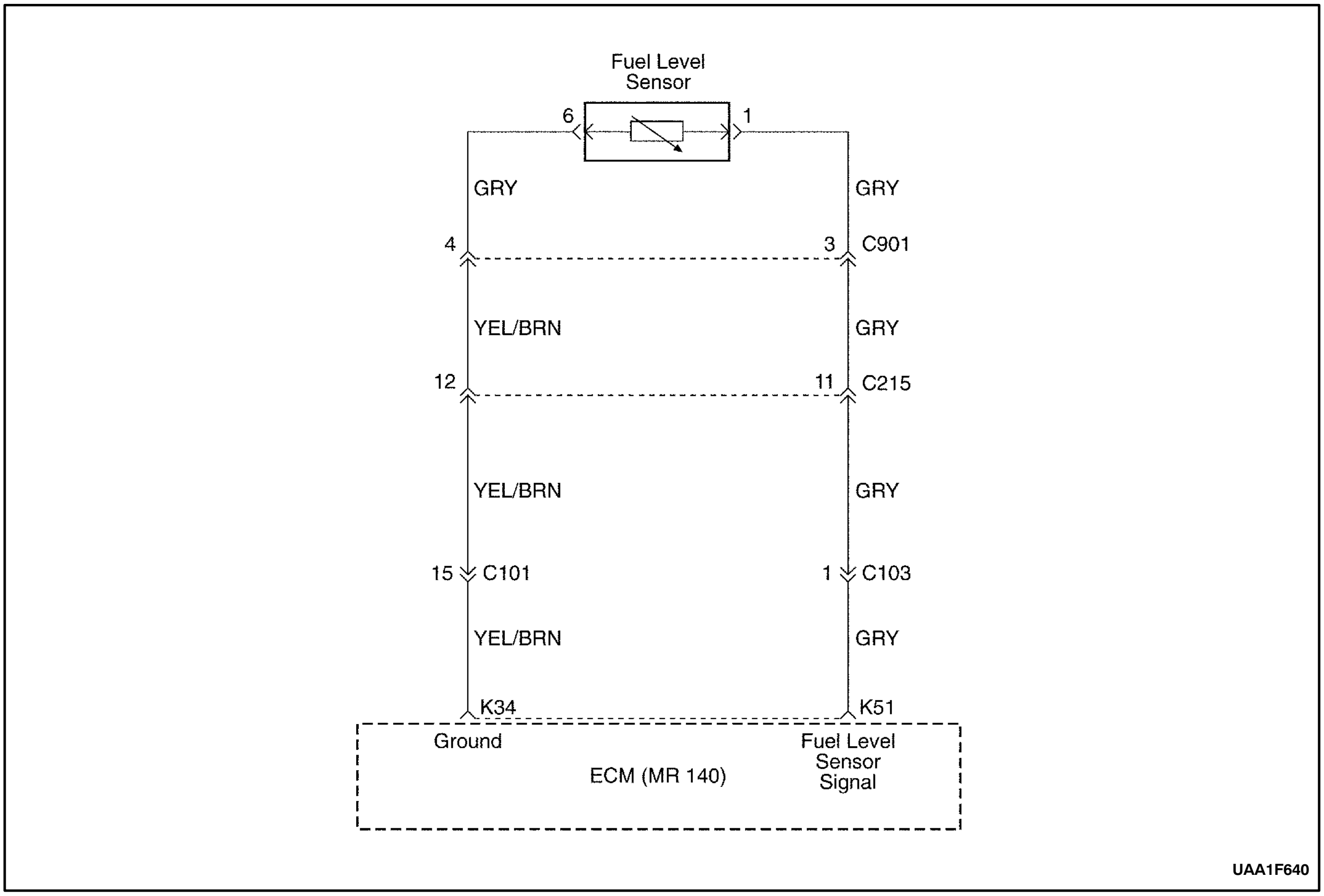

DIAGNOSTIC TROUBLE CODE (DTC) P0461 FUEL LEVEL STUCK (2.0L DOHC)

System Description

The Engine Control Module (ECM) uses the signal from the fuel level sensor to calculate expected vapor pressure within the fuel system. Vapor pressure varies as the fuel level changes. The fuel level signal also used to determine if the fuel level is too high or too low to be able to detect Evaporative Emission (EVAP) system faults. This Diagnostic Trouble Code (DTC) indicates the fuel level stuck.

Conditions for Setting the DTC

- Change in fuel level sensor output is less than 3.5% after 250 km (155 mile) driving.
- Ignition ON.
- DTCs P0462, P0463 and P0502 are not set.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using a scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the rubber.

Check for a poor connection or damaged ECM harness. Inspect the fuel level circuit terminal for the following conditions:

- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connection.
- Damaged harness.

DTC P0461 Fuel Level Stuck (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Start the engine and operate the vehicle over the specified mileage. Is any of the Diagnostic trouble Codes (DTCs) P0462, P0463 or P0502 set?	250 km (155 mile)	Go to Applicable DTC table	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the fuel pump connector. 3. Turn the ignition ON. 4. Using a voltmeter, measure the fuel level signal voltage at the fuel level sensor connector terminal 1. Is the voltage within the specified value?	4–5 V	Go to *Step 4*	Go to *Step 5*
4	1. Disconnect the Engine Control Module (ECM). 2. Check the fuel level sensor ground circuit for an open between terminal 6 of the fuel sensor connector and terminal K34 of the ECM and repair as needed. Is the repair complete?	–	Go to *Step 10*	Go to *Step 6*
5	Using a voltmeter, measure the voltage at the ECM connector terminal K34 by back-probing the ECM connector. Is the voltage within the specified value?	4–5 V	Go to *Step 8*	Go to *Step 9*
6	1. Remove the fuel pump from the fuel tank. 2. Reconnect the fuel pump connector. 3. Turn the ignition ON. 4. Monitor the fuel level sensor parameter on the scan tool while moving the fuel sensor float from empty position to full position. 5. Repeat procedure 4 several times. Does the fuel level sensor vale on the scan tool increase and then decrease steadily when the float is moved?	–	Go to "Diagnostic Aids"	Go to *Step 7*
7	1. Turn the ignition OFF. 2. Replace the fuel pump assembly. Is the repair complete?	–	Go to *Step 10*	–
8	1. Turn the ignition OFF. 2. Disconnect the ECM connector. 3. Check the fuel level signal circuit fir an open or short to ground between terminal K51 and fuel pump harness connector terminal 1 and repair as needed. Is the repair complete?	–	Go to *Step 10*	–
9	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 10*	–

DTC P0461 Fuel Level Stuck (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 11*	Go to *Step 2*
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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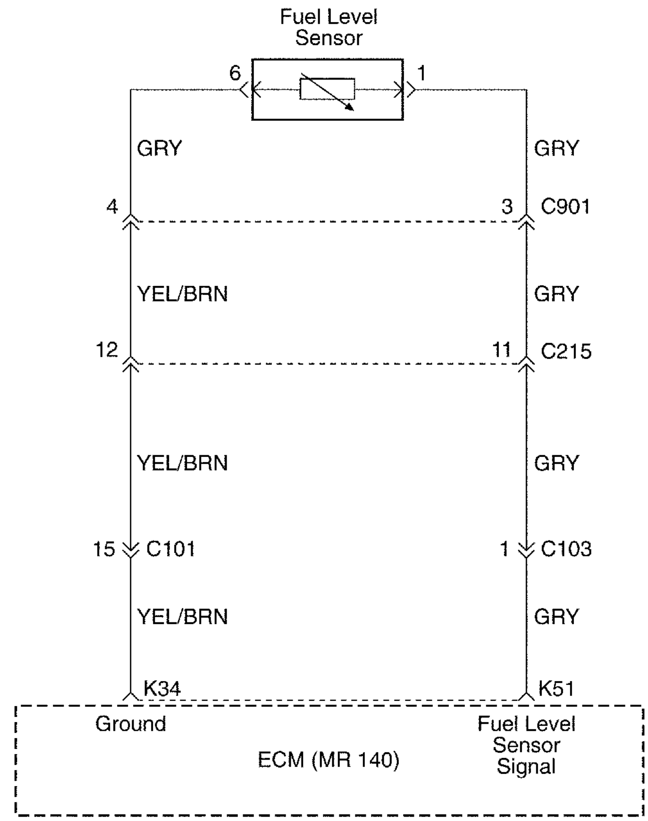

DIAGNOSTIC TROUBLE CODE (DTC) P0462
FUEL LEVEL SENSOR LOW VOLTAGE (2.0L DOHC)

System Description

The Engine Control Module (ECM) uses the signal from the fuel level sensor to calculate expected vapor pressure within the fuel system. Vapor pressure varies as the fuel level changes. The fuel level signal also used to determine if the fuel level is too high or too low to be able to detect Evaporative Emission (EVAP) system faults. This Diagnostic Trouble Code (DTC) detects a continuous short to low or open in either the signal circuit or the fuel level sensor..

Conditions for Setting the DTC

- Fuel level sensor output is less than 2%.
- Ignition ON.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using a scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Inspect harness connector for backed-out terminal, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.

Inspect wiring harness for damage.

A stuck fuel level sensor may cause the DTC set.

If the DTC P0462 cannot be duplicate, the information included on the Failure record data can be useful in determine vehicle conditions when the DTC was first set.

Resistance checks for fuel level sensor:

- Empty = 280 ohms or over.
- Half Full = about 90 ohms.
- Full = 38 ohms or less

DTC P0462 Fuel Level Sensor Low Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Start the engine and operate the vehicle within Failure Record condition as noted. Is Diagnostic trouble Codes (DTCs) P0462 set?	–	Go to *Step 3*	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the fuel pump connector. 3. Turn the ignition ON. 4. Using a voltmeter, measure the fuel level signal voltage at the fuel level sensor connector terminal 1. Is the voltage within the specified value?	0.4–4.5 V	Go to *Step 4*	Go to *Step 6*
4	Check for a proper ground connection at the fuel tank and repair as needed. Is the repair complete?	–	Go to *Step 11*	Go to *Step 5*
5	1. Remove the fuel pump from the fuel tank. 2. Reconnect the fuel pump connector. 3. Turn the ignition ON. 4. Monitor the fuel level sensor parameter on the scan tool while moving the fuel sensor float from empty position to full position. 5. Repeat procedure 4 several times. Does the fuel level sensor vale on the scan tool increase and then decrease steadily when the float is moved?	–	Go to "Diagnostic Aids"	Go to *Step 8*
6	Check for an open or short to ground in the fuel level sensor circuit and repair as needed. Is the repair complete?	–	Go to *Step 7*	Go to *Step 9*
7	Repair the open or short to ground in the fuel level sensor circuit between the fuel level sensor harness connector and fuel level sensor. Is the repair complete?	–	Go to *Step 11*	–
8	1. Turn the ignition OFF. 2. Replace the fuel pump assembly. Is the repair complete?	–	Go to *Step 11*	–
9	1. Turn the ignition OFF. 2. Connect the fuel pump connector. 3. Disconnect the engine Control Module (ECM) connector. 4. Turn the ignition ON. 5. Using a digital voltmeter, measure the voltage in the signal circuit at terminal K51. Is the voltage within the specified value?	0.4–4.5 V	Go to *Step 10*	Go to *Section 9E, Instrumentation/Driver Information*
10	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 11*	–

DTC P0462 Fuel Level Sensor Low Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 12*	Go to *Step 2*
12	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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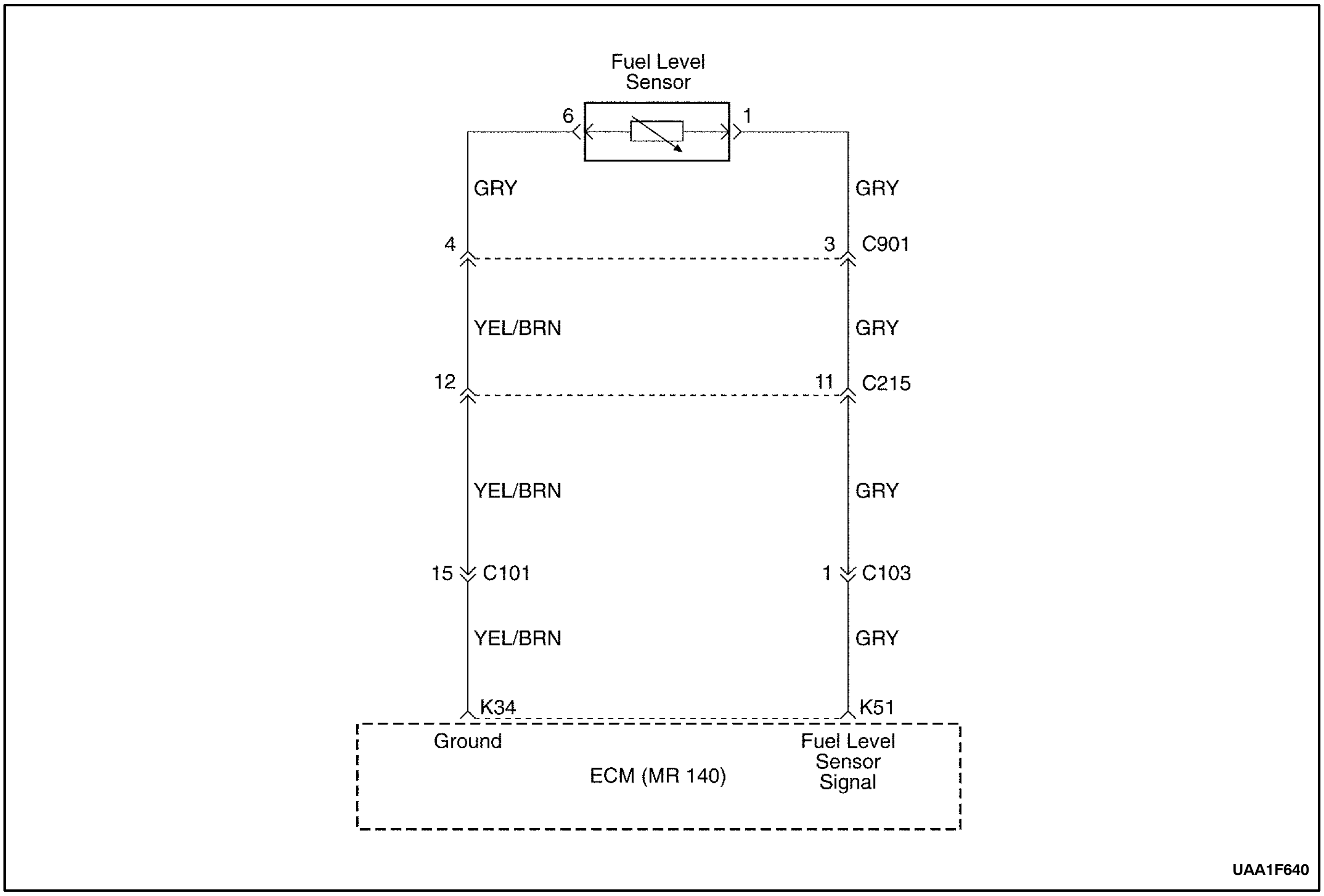

DIAGNOSTIC TROUBLE CODE (DTC) P0463
FUEL LEVEL SENSOR HIGH VOLTAGE (2.0L DOHC)

System Description

The Engine Control Module (ECM) uses the signal from the fuel level sensor to calculate expected vapor pressure within the fuel system. Vapor pressure varies as the fuel level changes. The fuel level signal also used to determine if the fuel level is too high or too low to be able to detect Evaporative Emission (EVAP) system faults. This Diagnostic Trouble Code (DTC) detects a continuous short to low or open in either the signal circuit or the fuel level sensor..

Conditions for Setting the DTC

- Fuel level sensor output is greater than 98%.
- Ignition ON.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using a scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Inspect harness connector for backed-out terminal, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

Inspect wiring harness for damage.

A stuck fuel level sensor may cause the DTC set.

If the DTC P0462 cannot be duplicate, the information included on the Failure record data can be useful in determine vehicle conditions when the DTC was first set.

Resistance checks for fuel level sensor:

- Empty = 280 ohms or over.
- Half Full = about 90 ohms.
- Full = 38 ohms or less.

DTC P0463 Fuel Level Sensor High Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Start the engine and operate the vehicle within Failure Record condition as noted. Is Diagnostic trouble Codes (DTCs) P0463 set?	–	Go to *Step 3*	Go to “Diagnostic Aids”
3	1. Turn the ignition OFF. 2. Disconnect the fuel pump connector. 3. Turn the ignition ON. 4. Using a voltmeter, measure the fuel level signal voltage at the fuel level sensor connector terminal 1. Is the voltage within the specified value?	0.4–4.5 V	Go to *Step 4*	Go to *Step 6*
4	Check for a proper ground connection at the fuel tank and repair as needed. Is the repair complete?	–	Go to *Step 11*	Go to *Step 5*
5	1. Remove the fuel pump from the fuel tank. 2. Reconnect the fuel pump connector. 3. Turn the ignition ON. 4. Monitor the fuel level sensor parameter on the scan tool while moving the fuel sensor float from empty position to full position. 5. Repeat procedure 4 several times. Does the fuel level sensor vale on the scan tool increase and then decrease steadily when the float is moved?	–	Go to “Diagnostic Aids”	Go to *Step 8*
6	Check for short to voltage in the fuel level sensor circuit and repair as needed. Is the repair complete?	–	Go to *Step 7*	Go to *Step 9*
7	Repair the short to voltage in the fuel level sensor circuit between the fuel level sensor harness connector and fuel level sensor. Is the repair complete?	–	Go to *Step 11*	–
8	1. Turn the ignition OFF. 2. Replace the fuel pump assembly. Is the repair complete?	–	Go to *Step 11*	–
9	1. Turn the ignition OFF. 2. Connect the fuel pump connector. 3. Disconnect the engine Control Module (ECM) connector. 4. Turn the ignition ON. 5. Using a digital voltmeter, measure the voltage in the signal circuit at terminal K51. Is the voltage within the specified value?	0.4–4.5 V	Go to *Step 10*	Go to *Section 9E, Instrumentatio n/Driver Information*
10	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 11*	–

DTC P0463 Fuel Level Sensor High Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 12*	Go to *Step 2*
12	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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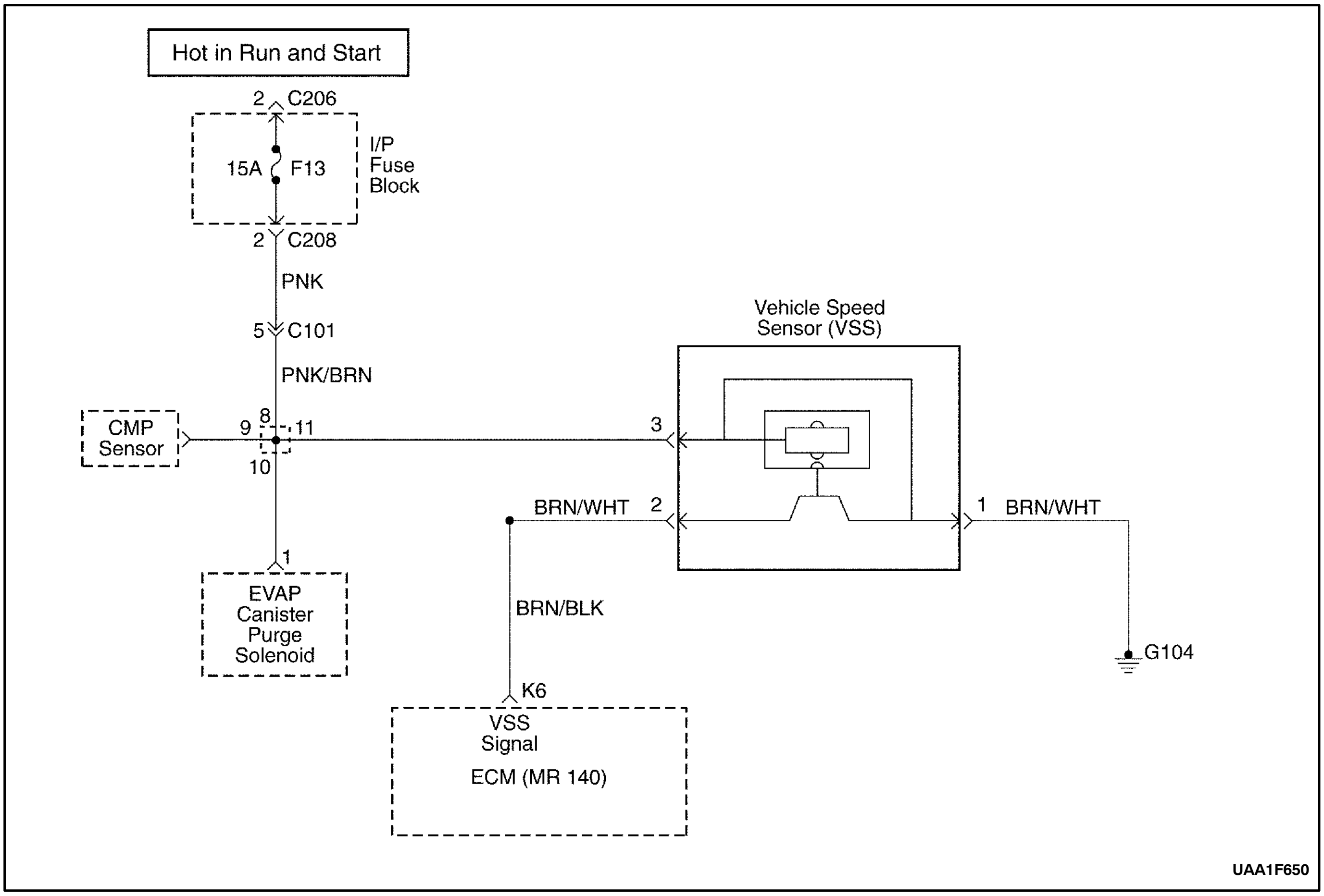

DIAGNOSTIC TROUBLE CODE (DTC) P0502
VEHICLE SPEED SENSOR NO SIGNAL (2.0L DOHC M/T ONLY)

Circuit Description

Vehicle speed information is provided to the Engine Control Module (ECM) by the Vehicle Speed Sensor (VSS). The VSS is a permanent magnet generator that is mounted in the transaxle and produces a pulsing voltage whenever vehicle speed is over 3 mph (5 km/h). The Alternating Current (AC) voltage level and the number of pulses increases with vehicle speed. The ECM converts the pulsing voltage into mph (km/h) and then supplies the necessary signal to the instrument panel for speedometer/ odometer operation and to the cruise control module and multi-function alarm module operation. This Diagnostic Trouble Code (DTC) will detect if vehicle speed is reasonable according to engine rpm and load.

Conditions for Setting the DTC

- Engine is running.
- Engine Coolant Temperature (ECT) is greater than 60°C (140°F).
- Ignition voltage is between 11–16 volts.
- Power Test
- The rpm is between 1200 and 4000.
- Throttle Position (TP) sensor is between 25 and 60%.
- Engine load is greater than 60 kPa (8.7 psi).
- Vehicle speed is less than 5 km/h (3.1 mph).
- Deceleration Test
- Generator compensated Manifold Absolute Pressure (MAP) is less than 30 kPa (4.4 psi)
- Change in rpm per cycle is less than 50 rpm/cycle.
- Throttle Position (TP) sensor is less than or equal to 0.8%.
- The rpm is between 1500 and 6000.
- Vehicle speed is less than 5 km/h (3.1 mph).
- DTC(s) P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0125 P0201, P0202, P0203, P0204, P0300, P0351, P0352, P0402, P0404, P1404, P0405, and P0406 are not set.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed-through wire insulation, or a wire that is broken inside the insulation.

VSS signal circuit should be thoroughly checked for the following conditions:

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection
- Physical damage to the wiring harness

Ensure the VSS is correctly tightened with proper torque to the transmission housing.

Refer to "Intermittent" in this section.

DTC P0502 Vehicle Speed Sensor No Signal (2.0L DOHC M/T Only)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	**Notice:** Running the vehicle in gear with the wheels hanging down at full travel will damage the drive axles. 1. Install a scan tool to the Data Link Connector (DLC). 2. Raise the drive wheels. 3. Support the lower control arms so that the drive axles are in a horizontal (straight) position. 4. Start the engine and allow to idle in gear. Does the scan tool display vehicle speed above the specific value?	0 km/h	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition ON. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting this DTC. Does the scan tool display vehicle speed above the specific value?	0 km/h	Go to *Step 12*	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the Vehicle Speed Sensor (VSS) connector. 3. Turn the ignition ON. 4. Using a voltmeter connected to ground, measure the voltage in VSS signal circuit, at terminal 2. Is the voltage near the specified value?	10.1 V	Go to *Step 5*	Go to *Step 7*
5	Using a voltmeter connected to ground, measure the voltage at terminal 3 of the VSS connector. Is the voltage near the specified value?	11–14 V	Go to *Step 6*	Go to *Step 8*
6	Using a ohmmeter connected to ground, measure the voltage at terminal 1 of the VSS connector. Is the voltage near the specified value?	≈400 Ω	Go to *Step 10*	Go to *Step 9*
7	Check the VSS signal circuit for an open or short to ground and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 11*

DTC P0502 Vehicle Speed Sensor No Signal (2.0L DOHC M/T Only) (Cont'd)

Step	Action	Value(s)	Yes	No
8	Check the ignition circuit for an open and repair as needed. Is the repair complete?	–	Go to *Step 12*	–
9	Check the VSS ground circuit for an open and repair as needed. Is the repair complete?	–	Go to *Step 12*	–
10	1. Turn the ignition OFF. 2. Replace the VSS. Is the repair complete?	–	Go to *Step 12*	–
11	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 12*	–
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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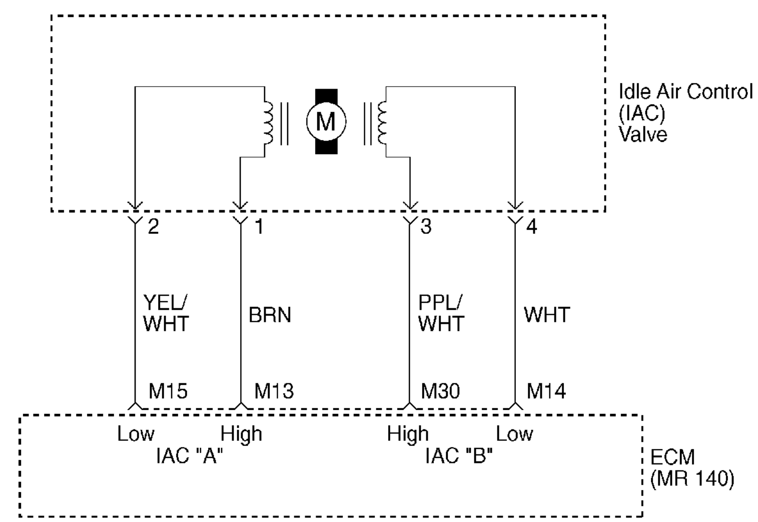

DIAGNOSTIC TROUBLE CODE (DTC) P0506
IDLE SPEED RPM LOWER THAN DESIRED IDLE SPEED (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) controls the air entering into the engine with an Idle Air Control (IAC) Valve. To increase the idle rpm, the ECM commands the pintle inside the IAC valve away from the throttle body seat. This allows more air to bypass through the throttle blade. To decrease the rpm the ECM commands the pintle towards the throttle body seat. This reduces the amount of air bypassing the throttle blade. A scan tool will read the IAC valve pintle position in counts. The higher the counts, the more air that is allowed to bypass the throttle blade. This Diagnostic Trouble Code (DTC) determines if a low idle condition exists as defined as 100 rpm below the desired idle rpm.

Conditions for Setting the DTC

- No intrusive tests are active.
- DTC(s) P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0131, P0132, P0133, P1133, P1134, P0171, P1171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0341, P0342, P0351, P0352, P0402, P0404, P1404, P0405, P0406, P0443, and P0502 are not set.
- Engine is running more than 60 seconds.
- Barometric Pressure (BARO) is greater than 72 kPa (10.4 psi).
- Engine Coolant Temperature (ECT) is greater than 60°C (140°F).
- Ignition voltage is between 11 and 16 volts.
- The Intake Air Temperature (IAT) is greater than –20°C (–4°F).
- Manifold Absolute Pressure is less than 60 kPa (8.7 psi).
- IAC valve is controlled fully opened.
- All of the above must be met for greater than 5 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Inspect the IAC valve electrical connection for proper mating.

Inspect the wiring harness for damage.

Inspect the throttle stop screw for signs of tampering.

Inspect the throttle linkage for signs of binding or excessive wear.

A slow or unstable idle may be caused by one of the following conditions:

- Fuel system too rich or too lean.
- Foreign material in the throttle body bore or in the air induction system.
- A leaking or restricted intake manifold.

- Excessive engine overloading. Check for seized pulleys, pumps, or motors on the accessory drive,
- Overweight engine oil.

DTC P0506 Idle Speed RPM Lower Than Desired Idle Speed (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Operate the engine to idle speed. 3. Transmission in park or neutral and the parking brake set. 4. A/C is off. 5. Using scan tool, command the Idle Air Control (IAC) valve up and down between the specified value. Does the rpm change smoothly when he commanded by the scan tool?	900–1200 rpm	Go to *Step 3*	Go to *Step 5*
3	1. Turn the ignition OFF. 2. Disconnect the IAC valve connector. 3. Measure the resistance between terminal 1 and 2 of the IAC valve. 4. Measure the resistance between terminal 3 and 4 of the IAC valve. Is the resistance within the specified value?	40–80 Ω	Go to *Step 4*	Go to *Step 13*
4	1. Measure the resistance between terminal 2 and 3 of the IAC valve. 2. Measure the resistance between terminal 1 and 4 of the IAC valve. Is the resistance equal to the specified value?	∞	Go to *Step 15*	Go to *Step 13*
5	1. Turn the ignition OFF. 2. Disconnect the IAC valve connector. 3. Turn the ignition ON. 4. With test light connected to ground, probe the IAC connector terminals. Does the test light illuminate on 2 terminals?	–	Go to *Step 6*	Go to *Step 7*
6	With test light connected to B+, probe the IAC connector terminals. Does the test light illuminate on 2 terminals?	–	Go to *Step 8*	Go to *Step 9*
7	Check for an open or short to ground in the IAC high and low circuits and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 10*
8	1. Idle the engine. 2. Connect a test light to ground, probe the IAC connector terminals. Does the test light flash On and OFF for all terminals?	–	Go to *Step 11*	Go to *Step 12*
9	Check for an open or a short to voltage in the IAC valve high and low circuits and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 10*
10	Check the Engine control Module (ECM) connector for poor connections and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 14*

DTC P0506 Idle Speed RPM Lower Than Desired Idle Speed (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	Inspect the IAC valve passages and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 13*
12	Check the test light. Does the test light remain on constantly for the terminals that did not blink?	–	Go to *Step 9*	Go to *Step 7*
13	1. Turn the ignition OFF. 2. Replace the IAC valve. Is the repair complete?	–	Go to *Step 15*	–
14	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 15*	–
15	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 16*	Go to *Step 2*
16	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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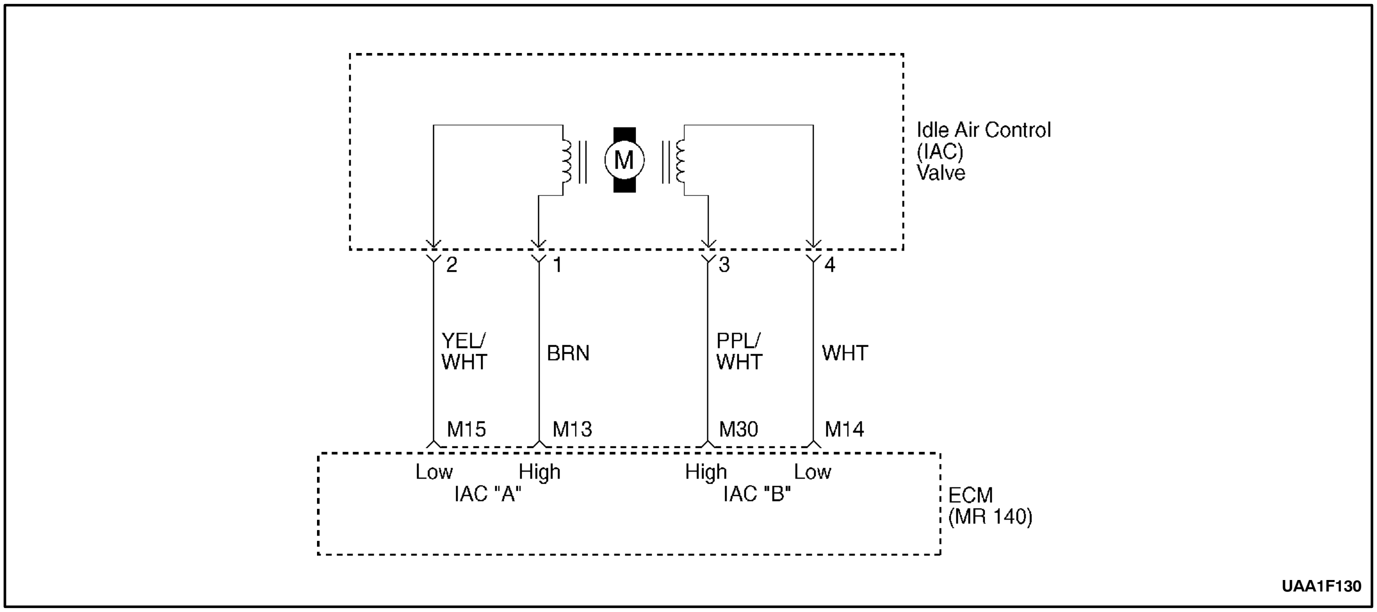

DIAGNOSTIC TROUBLE CODE (DTC) P0507 IDLE SPEED RPM HIGHER THAN DESIRED IDLE SPEED (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) controls the air entering into the engine with an Idle Air Control (IAC) Valve. To increase the idle rpm, the ECM commands the pintle inside the IAC valve away from the throttle body seat. This allows more air to bypass through the throttle blade. To decrease the rpm the ECM commands the pintle towards the throttle body seat. This reduces the amount of air bypassing the throttle blade. A scan tool will read the IAC valve pintle position in counts. The higher the counts, the more air that is allowed to bypass the throttle blade. This Diagnostic Trouble Code (DTC) determines if a high idle condition exists as defined as 200 rpm above the desired idle rpm.

Conditions for Setting the DTC

- No intrusive tests are active.
- DTC(s) P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0131, P0132, P0133, P1133, P1134, P0171, P1171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0341, P0342, P0351, P0352, P0402, P0404, P1404, P0405, P0406, P0443, and P0502 are not set.
- Engine is running more than 60 seconds.
- Barometric Pressure (BARO) is greater than 72 kPa (10.4 psi).
- Engine Coolant Temperature (ECT) is greater than 60°C (140°F).
- Ignition voltage is between 11 and 16 volts.
- The Intake Air Temperature (IAT) is greater than −20°C (−4°F).
- IAC valve is controlled fully closed.
- All of the above must be met for greater than 5 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Inspect the IAC valve electrical connection for proper mating.

Inspect the wiring harness for damage.

Inspect the throttle stop screw for signs of tampering.

Inspect the throttle linkage for signs of binding or excessive wear.

A slow or unstable idle may be caused by one of the following conditions:

- Fuel system too rich or too lean.
- Foreign material in the throttle body bore or in the air induction system.
- A leaking or restricted intake manifold.

- Excessive engine overloading. Check for seized pulleys, pumps, or motors on the accessory drive,
- Overweight engine oil.

DTC P0507 Idle Speed RPM Higher Than Desired Idle Speed (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Operate the engine to idle speed. 3. Transmission in park or neutral and the parking brake set. 4. A/C is off. 5. Using scan tool, command the Idle Air Control (IAC) valve up and down between the specified value. Does the rpm change smoothly when he commanded by the scan tool?	900–1200 rpm	Go to *Step 3*	Go to *Step 5*
3	1. Turn the ignition OFF. 2. Disconnect the IAC valve connector. 3. Measure the resistance between terminal 1 and 2 of the IAC valve. 4. Measure the resistance between terminal 3 and 4 of the IAC valve. Is the resistance within the specified value?	40–80 Ω	Go to *Step 4*	Go to *Step 13*
4	1. Measure the resistance between terminal 2 and 3 of the IAC valve. 2. Measure the resistance between terminal 1 and 4 of the IAC valve. Is the resistance equal to the specified value?	∞	Go to *Step 15*	Go to *Step 13*
5	1. Turn the ignition OFF. 2. Disconnect the IAC valve connector. 3. Turn the ignition ON. 4. With test light connected to ground, probe the IAC connector terminals. Does the test light illuminate on 2 terminals?	–	Go to *Step 6*	Go to *Step 7*
6	With test light connected to B+, probe the IAC connector terminals. Does the test light illuminate on 2 terminals?	–	Go to *Step 8*	Go to *Step 9*
7	Check for an open or short to ground in the IAC high and low circuits and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 10*
8	1. Idle the engine. 2. Connect a test light to ground, probe the IAC connector terminals. Does the test light flash On and OFF for all terminals?	–	Go to *Step 11*	Go to *Step 12*
9	Check for an open or a short to voltage in the IAC valve high and low circuits and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 10*
10	Check the Engine control Module (ECM) connector for poor connections and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 14*

DTC P0507 Idle Speed RPM Higher Than Desired Idle Speed (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	Inspect the IAC valve passages and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 13*
12	Check the test light. Does the test light remain on constantly for the terminals that did not blink?	–	Go to *Step 9*	Go to *Step 7*
13	1. Turn the ignition OFF. 2. Replace the IAC valve. Is the repair complete?	–	Go to *Step 15*	–
14	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 15*	–
15	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 16*	Go to *Step 2*
16	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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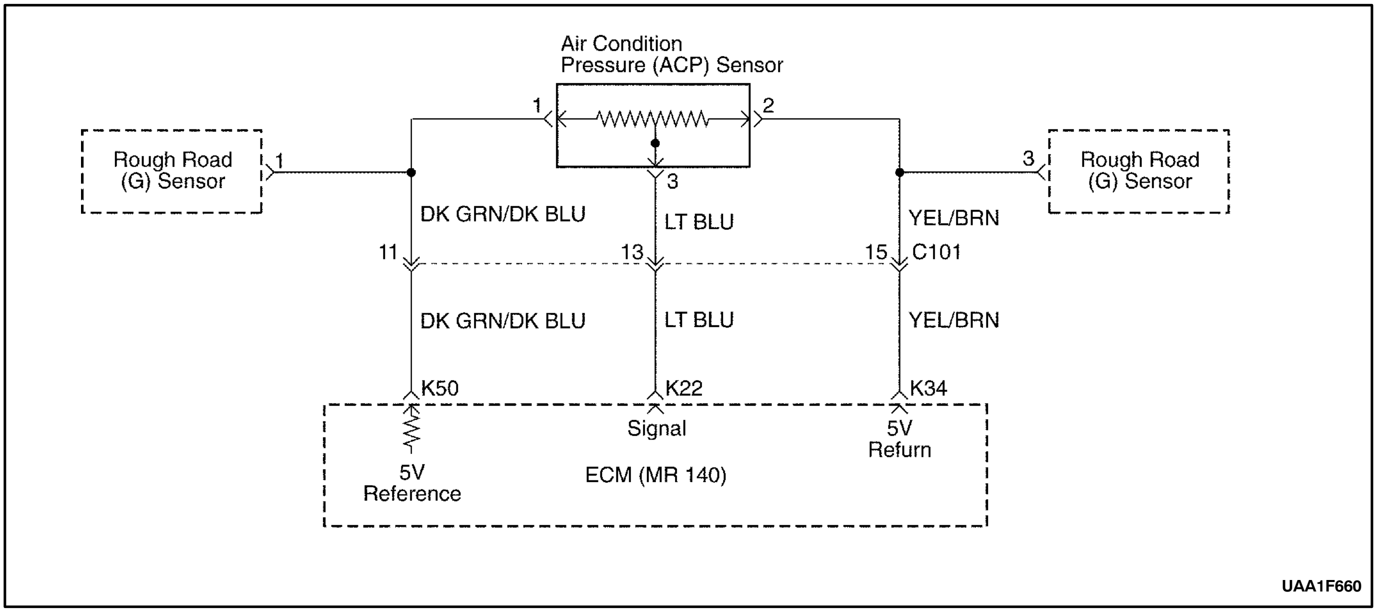

DIAGNOSTIC TROUBLE CODE (DTC) P0532 A/C PRESSURE SENSOR LOW VOLTAGE (2.0L DOHC)

Circuit Description

The Air Conditioning (A/C) system uses an A/C refrigerant pressure sensor mounted in the high pressure side of the A/C refrigerant system to monitor A/C refrigerant pressure. The Engine Control Module (ECM) uses this information to turn ON the engine coolant fans when the A/C refrigerant pressure is high and to keep the compressor disengaged when A/C refrigerant pressure is excessively high or low.

The Air Conditioning Pressure (ACP) sensor operates like other 3-wire sensors. The ECM applies a 5.0 volt reference and a sensor ground to the sensor. Changes in the A/C refrigerant pressure will cause the ACP sensor input to the ECM to vary. The ECM monitors the ACP sensor signal circuit and can determine when the signal is outside of the possible range of the sensor. When the signal is out of range for a prolonged period of time, the ECM will not allow the A/C compressor clutch to engage. This is done to protect the compressor.

Conditions for Setting the DTC

- Engine is running.
- A/C pressure is less than 1 % of the sensor reading scale.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffers.
- A history DTC is stored.
- The A/C compressor operation will be disabled while the low voltage indication exists.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection at the ECM.

Inspect the wiring harness for damage. If the harness appears to be OK, observe the A/C pressure display on the scan tool while moving the connectors and wiring harnesses related to the A/C Pressure sensor. A change in the A/C pressure display will indicate the location of the fault.

If DTC P0532 cannot be duplicated, reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to set occurs. This may assist in diagnosing the condition.

DTC P0532 A/C Pressure Sensor Low Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Idle the engine. Does the scan tool display Air Conditioning Pressure (ACP) sensor voltage below the specified value?	0.06 V	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition OFF. 2. Disconnect the ACP sensor connector. 3. Jumper the ACP signal circuit, terminal 2 to the 5 volt reference circuit, terminal 1. 4. Turn the ignition switch on. Does the ACP voltage read more than the specified value?	4.9 V	Go to *Step 5*	Go to *Step 6*
4	1. Turn the ignition ON, with the engine OFF. 2. Operate the vehicle within the Failure Record conditions and Conditions For Setting the DTC as noted. Does the scan tool display ACP voltage below the specified value?	0.06 V	Go to *Step 3*	Go to “Diagnostic Aids”
5	Inspect the ACP sensor harness connector terminals for the following conditions: ● Poor connections ● Proper contact tension ● Poor terminal-to-wire connection Is a problem found?	–	Go to *Step 8*	Go to *Step 9*
6	1. Turn the ignition OFF. 2. Remove the jumper wire. 3. Probe the ACP sensor signal circuit terminal 2 with a test light to B+. 4. Turn the ignition ON. Does the scan tool read over the specified value?	4 V	Go to *Step 7*	Go to *Step 11*
7	Check the ACP sensor 5 volt reference circuit for an open or short to ground and repair as needed. Is the repair complete?	–	Go to *Step 13*	Go to *Step 10*
8	Repair the connection terminals as necessary. Is the repair complete?	–	Go to *Step 13*	–
9	1. Turn the ignition OFF. 2. Replace the ACP sensor. Is the repair complete?	–	Go to *Step 13*	–
10	1. Turn the ignition OFF. 2. Replace the engine control module (ECM). Is the repair complete?	–	Go to *Step 13*	–
11	Check the ACP sensor signal circuit for the following conditions: ● Open ● Short to ground ● Short to sensor ground Is a problem found?	–	Go to *Step 12*	Go to *Step 10*

DTC P0532 A/C Pressure Sensor Low Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	Repair the A/C Pressure sensor signal circuit. Is the repair complete?	–	Go to *Step 13*	–
13	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 14*	Go to *Step 2*
14	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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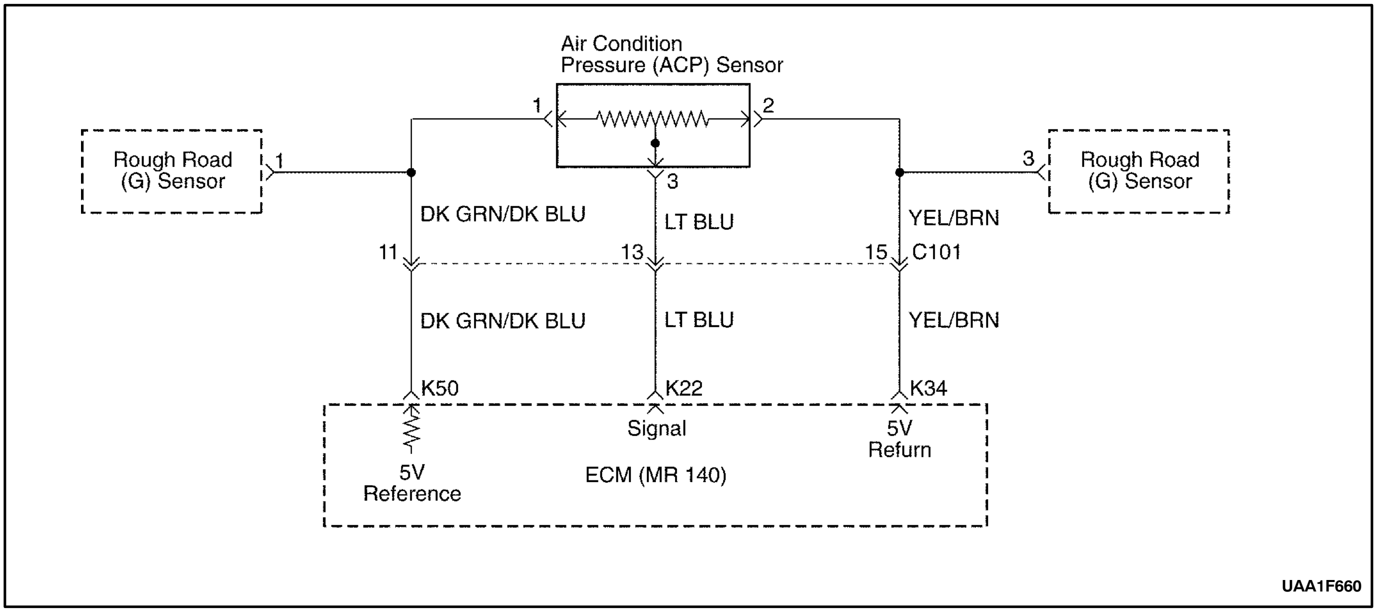

DIAGNOSTIC TROUBLE CODE (DTC) P0533
A/C PRESSURE SENSOR HIGH VOLTAGE (2.0L DOHC)

Circuit Description

The Air Conditioning (A/C) system uses an A/C refrigerant pressure sensor mounted in the high pressure side of the A/C refrigerant system to monitor A/C refrigerant pressure. The Engine Control Module (ECM) uses this information to turn ON the engine coolant fans when the A/C refrigerant pressure is high and to keep the compressor disengaged when A/C refrigerant pressure is excessively high or low.

The Air Conditioning Pressure (ACP) sensor operates like other 3-wire sensors. The ECM applies a 5.0 volt reference and a sensor ground to the sensor. Changes in the A/C refrigerant pressure will cause the ACP sensor input to the ECM to vary. The ECM monitors the ACP sensor signal circuit and can determine when the signal is outside of the possible range of the sensor. When the signal is out of range for a prolonged period of time, the ECM will not allow the A/C compressor clutch to engage. This is done to protect the compressor.

Conditions for Setting the DTC

- Engine is running.
- A/C pressure is greater than 99% of the sensor reading scale.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffers.
- A history DTC is stored.
- The A/C compressor operation will be disabled while the high voltage indication exists.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection at the ECM.

Inspect the wiring harness for damage. If the harness appears to be OK, observe the A/C pressure display on the scan tool while moving the connectors and wiring harnesses related to the ACP sensor. A change in the A/C pressure display will indicate the location of the fault.

If DTC P0533 cannot be duplicated, reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to set occurs. This may assist in diagnosing the condition.

DTC P0533 A/C Pressure Sensor High Voltage (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Idle the engine. Does the scan tool display Air Conditioning Pressure (ACP) sensor voltage below the specified value?	0.06 V	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition OFF. 2. Disconnect the ACP sensor connector. 3. Jumper the ACP signal circuit, terminal 2 to the 5 volt reference circuit, terminal 1. 4. Turn the ignition switch on. Does the ACP voltage read more than the specified value?	4.9 V	Go to *Step 5*	Go to *Step 6*
4	1. Turn the ignition ON, with the engine OFF. 2. Operate the vehicle within the Failure Record conditions and Conditions For Setting the DTC as noted. Does the scan tool display ACP voltage below the specified value?	0.06 V	Go to *Step 3*	Go to "Diagnostic Aids"
5	Inspect the ACP sensor harness connector terminals for the following conditions: • Poor connections • Proper contact tension • Poor terminal-to-wire connection Is a problem found?	–	Go to *Step 8*	Go to *Step 9*
6	1. Turn the ignition OFF. 2. Remove the jumper wire. 3. Probe the ACP sensor signal circuit terminal 2 with a test light to B+. 4. Turn the ignition ON. Does the scan tool read over the specified value?	4 V	Go to *Step 7*	Go to *Step 11*
7	Check the ACP sensor 5 volt reference circuit for an open or short to ground and repair as needed. Is the repair complete?	–	Go to *Step 13*	Go to *Step 10*
8	Repair the connection terminals as necessary. Is the repair complete?	–	Go to *Step 13*	–
9	1. Turn the ignition OFF. 2. Replace the ACP sensor. Is the repair complete?	–	Go to *Step 13*	–
10	1. Turn the ignition OFF. 2. Replace the engine control module (ECM). Is the repair complete?	–	Go to *Step 13*	–
11	Check the ACP sensor signal circuit for the following conditions: • Open • Short to ground • Short to sensor ground Is a problem found?	–	Go to *Step 12*	Go to *Step 10*

DTC P0533 A/C Pressure Sensor High Voltage (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	Repair the A/C Pressure sensor signal circuit. Is the repair complete?	–	Go to *Step 13*	–
13	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 14*	Go to *Step 2*
14	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

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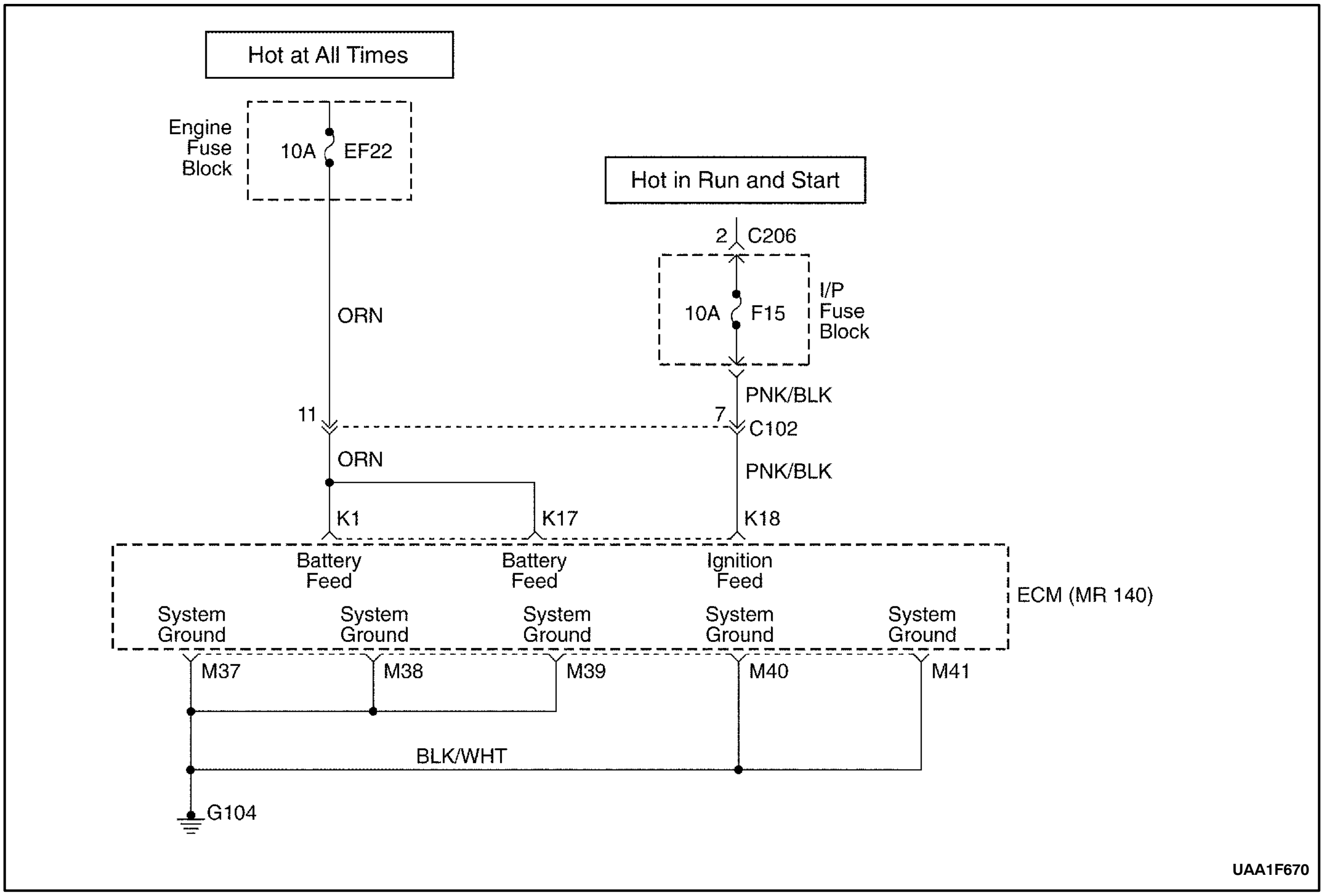


DIAGNOSTIC TROUBLE CODE (DTC) P0562 SYSTEM VOLTAGE TOO LOW (ENGINE SIDE) (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) monitors the ignition voltage on the ignition feed circuit to terminal K18 at the ECM. A system voltage Diagnostic Trouble Code (DTC) will set whenever the voltage is below a calibrated value.

Conditions for Setting the DTC

- Ignition switch is turned to ON.
- System voltage is less than 11 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

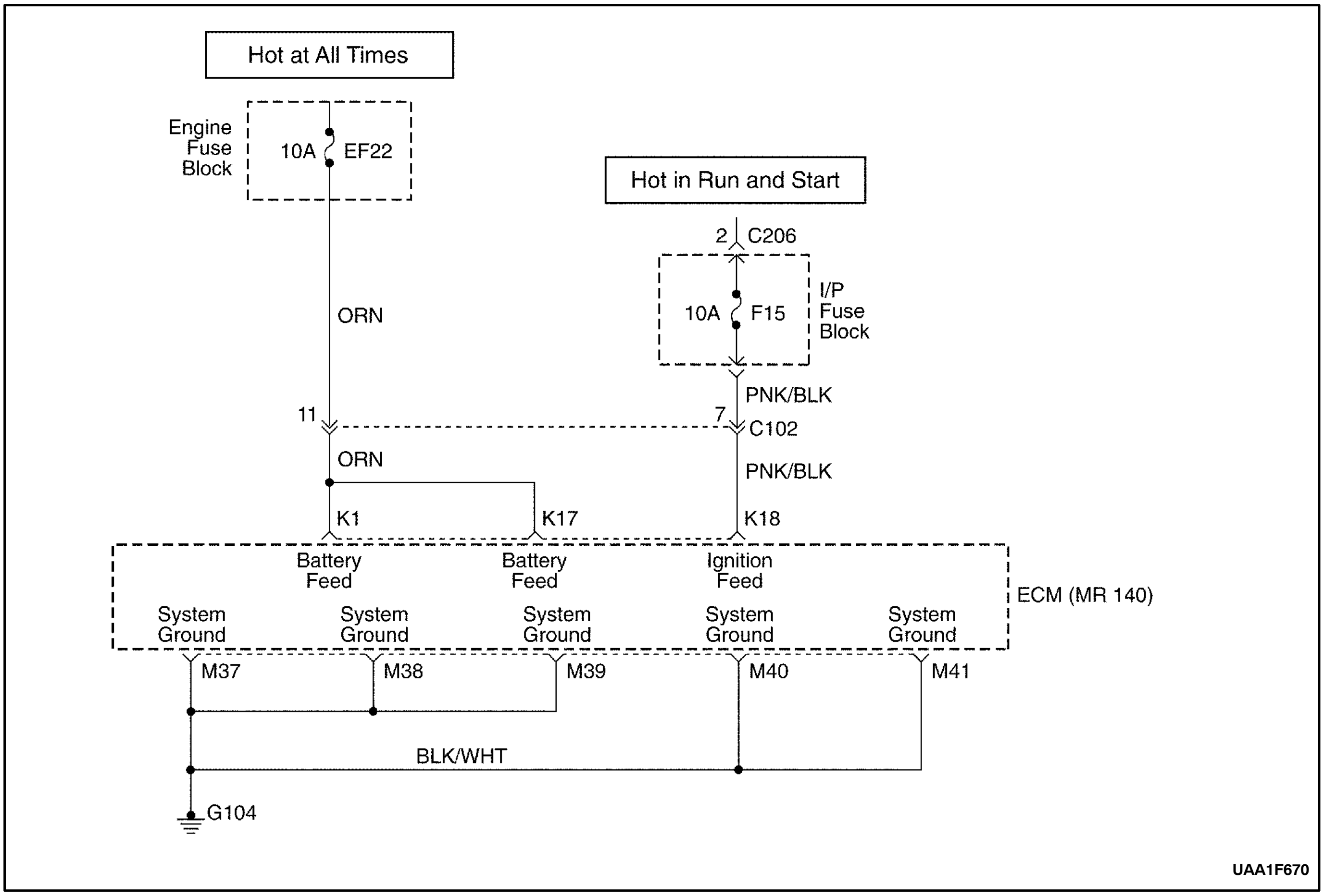
If the DTC sets when an accessory is operated, check for a poor connection or excessive current draw.

Any circuitry that is suspected as causing the intermittent complaint should be thoroughly checked for the following conditions:

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wiring connections
- Physical damage to the wiring harness

DTC P0562 System Voltage Too Low (Engine Side) (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC) and clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and raise the engine speed over 1400 rpm. 3. Load the electrical system by turning on the headlamps, high blower motor, etc. Is the ignition voltage less than the specified value	10 V	Go to *Step 3*	Go to *Step 8*
3	1. With the engine still running at 1400 rpm. 2. Using a voltmeter measure the battery voltage at the battery. Is the battery voltage greater than the specified value?	12 V	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector at the ECM. 3. Turn the ignition ON. 4. Using a voltmeter, measure the voltage at the ignition feed circuit, terminal K18. Is the ignition voltage greater than the specified value?	10 V	Go to *Step 5*	Go to *Step 6*
5	Check for a malfunctioning connector at the ECM harness terminals and repair as needed. Is the repair complete?	–	Go to *Step 8*	Go to *Step 7*
6	Repair the poor connection (high resistance) in the ignition feed circuit. Is the repair complete?	–	Go to *Step 8*	–
7	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 8*	–
8	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0563 SYSTEM VOLTAGE TOO HIGH (ENGINE SIDE) (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) monitors the ignition voltage on the ignition feed circuit to terminal K18 at the ECM. A system voltage Diagnostic Trouble Code (DTC) will set whenever the voltage is above a calibrated value.

Conditions for Setting the DTC

- Ignition switch is turned to ON.
- System voltage is greater than 16 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

If the DTC sets when an accessory is operated, check for a poor connection or excessive current draw.

Any circuitry that is suspected as causing the intermittent complaint should be thoroughly checked for the following conditions:

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wiring connections
- Physical damage to the wiring harness

DTC P0563 System Voltage Too High (Engine Side) (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC) and clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and raise the engine speed over 1400 rpm. 3. Load the electrical system by turning on the headlamps, high blower motor, etc. Is the ignition voltage less than the specified value	16 V	Go to *Step 3*	Go to *Step 5*
3	1. With the engine still running at 1400 rpm. 2. Using a voltmeter measure the battery voltage at the battery. Is the battery voltage less than the specified value?	16 V	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 5*	–
5	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 6*	Go to *Step 2*
6	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P0601 ECM CHECKSUM ERROR (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) is the control center of the fuel injection system. It constantly looks at the information from various sensors, and controls the systems that affect vehicle performance. The ECM also performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL) (Check Engine), and store a Diagnostic Trouble Code (DTC) or DTCs which identify the problem areas to aid the technician in making repairs. An Electrically Erasable Programmable Read Only Memory (EEPROM) is used to house the program information and the calibrations required for engine, transmission, and powertrain diagnostics operation. The ECM uses a value called a checksum for error detection of the software. The checksum is a value that is equal to all the numbers in the software added together. The ECM adds all the values in the software, and if that value does not equal the checksum value, a checksum error is indicated..

Conditions for Setting the DTC

- Program ID is not equal to the value in the software.
- Ignition switch is turned to ON.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will attempt to record operating conditions at the time the failure is detected. However, since this is the internal ECM fault, this information may be or may not be reliable. This information will be stored in the freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P0601 ECM Checksum Error (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 3*	–
3	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 4*	Go to *Step 2*
4	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P1601
SPI COMMUNICATIONS BETWEEN ECM AND TCM (2.0L DOHC)

Circuit Description

The Serial Peripheral Interface (SPI) communication is used internally by the Engine Control Module (ECM) to send message between the engine processor and the automatic transaxle processor. Included in each message sent between the two processor is a checksum of the message. Both the engine processor automatic transaxle processor will compare this checksum value with calculated checksum. If the checksum do not match, the processor will review the new data as being corrupted and ignore the value. The processor then use the previous message. The receiving processor will then send a message to the sending processor informing it that its last message was corrupted.

The ECM monitor periodic TCM status message and if message is not received fail counter incremented and Diagnostic trouble Code (DTC) will stored.

Conditions for Setting the DTC

- Ignition switch is turned to ON.
- Ignition voltage is greater than 11 volts.
- Engine is running more than 2 seconds.
- Device Control not active.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P1601 SPI Communications Between ECM and TCM (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 3*	–
3	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 4*	Go to *Step 2*
4	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P0607 LOWER POWER COUNT ERROR (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) is the control center of the fuel injection system. It constantly looks at the information from various sensors, and controls the systems that affect vehicle performance. The ECM also performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL) (Check Engine), and store a Diagnostic Trouble Code (DTC) or DTCs which identify the problem areas to aid the technician in making repairs. An Electrically Erasable Programmable Read Only Memory (EEPROM) is used to house the program information and the calibrations required for engine, transmission, and powertrain diagnostics operation. The ECM checks operation of Lower Power Counter Integrated Chip (I/C) and communication between main CPU and Lower Power Counter I/C.

Conditions for Setting the DTC

- Ignition switch is turned to ON.
- Ignition voltage is greater than 11 volts.
- Engine is running more than 10 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P0607 Lower Power Counter Error (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 3*	–
3	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 4*	Go to *Step 2*
4	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P1607 LOWER POWER COUNT RESET (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) is the control center of the fuel injection system. It constantly looks at the information from various sensors, and controls the systems that affect vehicle performance. The ECM also performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL) (Check Engine), and store a Diagnostic Trouble Code (DTC) or DTCs which identify the problem areas to aid the technician in making repairs. An Electrically Erasable Programmable Read Only Memory (EEPROM) is used to house the program information and the calibrations required for engine, transmission, and powertrain diagnostics operation. The ECM monitors EEPROM reset flag and Lower Power Counter I/C overflow bits. If the ECM detects if Lower Power Counter I/C has been reset due to battery disconnect or Lower Power Counter I/C malfunction, the Diagnostic Trouble Code (DTC) will stored.

Conditions for Setting the DTC

- Ignition switch is turned to ON.
- Engine is not running.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P1607 Lower Power Counter Reset (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 3*	–
3	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 4*	Go to *Step 2*
4	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P1626 IMMOBILIZER NO RESPONSE (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) is the control center of the fuel injection system. It constantly looks at the information from various sensors, and controls the systems that affect vehicle performance. The ECM also performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL) (Check Engine), and store a Diagnostic Trouble Code (DTC) or DTCs which identify the problem areas to aid the technician in making repairs. The ECM detects communication link failure with immobilizer control unit.

Conditions for Setting the DTC

- Ignition switch is turned to ON.
- No immobilizer message identification for ECM release time window (1.5 or 2.0 seconds).
- Vehicle Speed Sensor (VSS) is less than 512 km/h.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P1626 Immobilizer No Response (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 3*	–
3	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 4*	Go to *Step 2*
4	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P1631 IMMOBILIZER INCORRECT RESPONSE (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) is the control center of the fuel injection system. It constantly looks at the information from various sensors, and controls the systems that affect vehicle performance. The ECM also performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL) (Check Engine), and store a Diagnostic Trouble Code (DTC) or DTCs which identify the problem areas to aid the technician in making repairs. The ECM received incorrect message identification.

Conditions for Setting the DTC

- Ignition switch is turned to ON.
- Immobilizer option selected.
- ECM release time window expired.
- Vehicle Speed Sensor (VSS) is less than 512 km/h.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P1631 Immobilizer Incorrect Response (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 3*	–
3	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 4*	Go to *Step 2*
4	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P1650 SPI COMMUNICATION WITH SIDM CHIP (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) is the control center of the fuel injection system. It constantly looks at the information from various sensors, and controls the systems that affect vehicle performance. The ECM also performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL) (Check Engine), and store a Diagnostic Trouble Code (DTC) or DTCs which identify the problem areas to aid the technician in making repairs. An Electrically Erasable Programmable Read Only Memory (EEPROM) is used to house the program information and the calibrations required for engine, transmission, and powertrain diagnostics operation. The Diagnostic Trouble Code (DTC) will stored, when the ECM detects SPI communication between main CPU and output driver I/C is corrupted.

Conditions for Setting the DTC

- Ignition switch is turned to ON.
- Battery voltage is greater than 11 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P1650 SPI Communication With SIDM Chip (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 3*	–
3	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 4*	Go to *Step 2*
4	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P1655 SPI COMMUNICATION WITH PSVI CHIP (2.0L DOHC)

Circuit Description

The Engine Control Module (ECM) is the control center of the fuel injection system. It constantly looks at the information from various sensors, and controls the systems that affect vehicle performance. The ECM also performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL) (Check Engine), and store a Diagnostic Trouble Code (DTC) or DTCs which identify the problem areas to aid the technician in making repairs. An Electrically Erasable Programmable Read Only Memory (EEPROM) is used to house the program information and the calibrations required for engine, transmission, and powertrain diagnostics operation. The Diagnostic Trouble Code (DTC) will stored, when the ECM detects corrupted serial peripheral interface (SPI) comunication between main CPU and output driver I/C.

Conditions for Setting the DTC

- Ignition switch is turned to ON.
- Battery voltage is greater than 11 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DTC P1655 SPI Communication with PSVI Chip (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1 Turn the ignition OFF. 2 Replace the Engine Control Module (ECM). Is the repair complete?	–	Go to *Step 3*	–
3	1 Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2 Start the engine and idle at normal operating temperature. 3 Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 4*	Go to *Step 2*
4	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P0700 TRANSAXLE CONTROL MODULE MALFUNCTION (2.0L DOHC)

Circuit Description

The Transmission Control Module (TCM) and the Engine Control Module (ECM) are connected through the serial data link circuit. The TCM sends a Class–II P–code status message to the ECM every 100 milliseconds to confirm the transmission is functioning correctly.

If the TCM detects either an A– or B–type malfunction within the transmission, the TCM will send to the ECM a P–code status message to turn the Malfunction Indicator Lamp (MIL) ON and set DTC P0700.

Conditions for Setting the DTC

- Received message from the TCM indicating malfunction is detected in TCM.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate or will not illumanate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and/or Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation.

Check for a poor connection or damaged ECM/TCM harness. Inspect the serial data link circuit for the following conditions:

- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection
- Damaged harness

DTC P0700 Transaxle Control Module Malfunction (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. 3. Select Transmission Control Module (TCM) Diagnostic Trouble Code (DTC) with scan tool. Is a transmission DTC displayed?	–	Go to *Step 3*	Go to *Step 4*
3	1. Repair transmission malfunction. Refer to the applicable DTC table in the transmission repair section. 2. Using a scan tool, clear the TCM DTC. Is the repair complete?	–	Go to *Step 4*	–
4	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 5*	Go to *Step 2*
5	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

SYMPTOM DIAGNOSIS

IMPORTANT PRELIMINARY CHECKS

Important: Several symptom procedures call for a careful visual/physical inspection. Always perform the visual/physical test first. Visual inspections may lead to correcting a problem without further checks and can save valuable time.

Step	Action	Value(s)	Yes	No
1	Perform the On-Board Diagnostic (EOBD) System Check. Are any Diagnostic Trouble Code(s) (DTCs) stored in the Engine Control Module (ECM) memory?	–	Go to Appropriate DTC Table	Go to *Step 2*
2	1. Inspect all of the ECM ground connections. 2. Inspect all of the vacuum hoses for splits, kinks, and proper connections. 3. Check for air leaks at all of the mounting areas of the intake manifold sealing surfaces. 4. Inspect the ignition wires for cracking, hardness, proper routing, and carbon tracking. 5. Inspect the wiring for proper connections, pinches, and cuts. Are all checks complete?	–	Go to Appropriate Symptom Table	–

INTERMITTENT

Definition: The problem may or may not illuminate the Malfunction Indicator Lamp (MIL) or store a Diagnostic Trouble Code (DTC).

Important: Do not use the Diagnostic Trouble Code (DTC) tables for intermittent problems. A fault must be present in order to locate the problem. If a fault is intermittent, use of Diagnostic Trouble Code tables may result in the replacement of good parts.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	1. Perform a careful inspection of any suspect circuits. 2. Inspect for poor mating of the connector halves, or terminals not fully seated into the connector body. 3. Inspect for improperly formed or damaged terminals. 4. Inspect for poor terminal-to-wire connections. This requires removing the terminal from the connector body to inspect it. Are any problems present?	–	Go to *Step 3*	Go to *Step 4*
3	Repair the electrical connections as needed. Is the repair complete?	–	System OK	–
4	Road test the vehicle with a voltmeter connected to a suspected circuit or a scan tool connected to the Data Link Connector (DLC). Did the voltmeter or the scan tool indicate an abnormal voltage or scan reading?	–	Go to *Step 5*	Go to *Step 6*
5	Replace the sensor in the affected circuit, if a Diagnostic Trouble Code (DTC) was stored for this circuit (except for the DTCs P0171 and P0172). Is the repair complete?	–	System OK	–
6	Does an intermittent Malfunction Indicator Lamp (MIL) or DTC occur?	–	Go to *Step 7*	Go to *Step 8*
7	1. Check for a faulty relay, Engine Control Module (ECM) driven solenoid, or switch. 2. Check for improper installation of electrical devices, such as lights, two-way radios, electric motors, etc. 3. Inspect the ignition control wires for proper routing (away from ignition wires, ignition system components, and the generator). 4. Check for a short-to-ground in the MIL circuit or the DLC "test" terminal. 5. Inspect the ECM ground connections. 6. Correct or repair the affected circuits as needed. Is the repair complete?	–	System OK	–
8	1. Check for a loss of DTC memory. 2. Disconnect the throttle position (TP) sensor. 3. Run the engine at idle until the MIL comes on. 4. Turn the ignition OFF. Is DTC P0122 stored in memory?	–	Go to *Step 10*	Go to *Step 9*

Intermittent (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	System OK	–
10	Does the vehicle stall while driving?	–	Go to *Step 11*	Go to *Step 12*
11	Monitor the oxygen sensor and the injector base pulse width with the scan tool. Does the scan tool display a steady low voltage (about 0 millivolts) for the oxygen sensor with the control module commanding an injector base pulse width of the value specified?	8 ms	Go to *Step 9*	Go to *Step 12*
12	1. Check for an open diode across the A/C clutch and for other open diodes. 2. Repair or replace any components as needed. Is the repair complete?	–	System OK	–

HARD START

Definition: The engine cranks OK, but does not start for a long time. The engine eventually runs or may start and immediately die.

Important: Ensure that the driver is using the correct starting procedure. Before diagnosing, check service bulletins for updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to “Important Preliminary Checks”
2	1. Connect the scan tool to the Data Link Connector (DLC). 2. Check the Engine Coolant Temperature (ECT) sensor and the Intake Air Temperature (IAT) sensor using the scan tool. 3. Compare the coolant temperature and the IAT with the ambient temperature when the engine is cold. Do the ECT and the IAT readings differ from the ambient temperature by more than the value specified?	3°C (5°F)	Go to *Step 3*	Go to *Step 4*
3	1. Measure the resistance of the ECT sensor and the IAT sensor. 2. Compare the resistance value to specifications using the Temperature Vs. Resistance tables for DTCs P0118 and P0113. 3. If the resistance is not the same, replace the faulty sensor. Is the repair complete?	–	System OK	–
4	1. Check for a sticking throttle shaft or a binding linkage that may cause a high Throttle Position (TP) sensor voltage. Repair or replace as needed. 2. Check the TP sensor voltage reading with the throttle closed. Does the voltage measure within the value specified?	0.4–0.8 V	Go to *Step 5*	Go to *Step 26*
5	1. Check the Manifold Absolute Pressure (MAP) sensor response and accuracy. 2. Replace the MAP sensor as needed. Is the repair complete?	–	System OK	Go to *Step 6*
6	Check the fuel pump operation. Does the fuel pump operate for the specified time when the ignition switch is turned ON?	2 sec	Go to *Step 7*	Go to “Fuel Pump Relay Circuit Check”
7	Check the fuel system pressure. Is the fuel pressure within the specifications?	284–325 kPa (41–47 psi)	Go to *Step 8*	Go to *Step 27*
8	Check for water contamination in the fuel. Is fuel contaminated?	–	Go to *Step 9*	Go to *Step 10*
9	Replace the contaminated fuel. Is the repair complete?	–	System OK	–

Hard Start (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check the fuel injector driver circuit. 2. Disconnect all of the fuel injector harness connectors at the fuel injectors. 3. Connect an injector test light between the harness terminals of each fuel injector connector. 4. Note the test light while cranking the engine. Does the test light blink at all connectors?	–	Go to *Step 13*	Go to *Step 11*
11	Check the fuel injector driver wiring harness, the connectors, and the connector terminals for the proper connections. Is the problem found?	–	Go to *Step 12*	Go to *Step 28*
12	Repair the wiring harness, the connector, or the connector terminal as needed. Is the repair complete?	–	System OK	–
13	Measure the resistance of each fuel injector. Is the fuel injector resistance within the value specified at 20°C (68°F) **Note:** The resistance will increase slightly at higher temperatures)?	11.6–12.4 Ω	Go to *Step 15*	Go to *Step 14*
14	Replace any fuel injector with a resistance that is out of specifications. Is the repair complete?	–	System OK	–
15	Perform an injector diagnosis. Is the problem found?	–	Go to *Step 16*	Go to *Step 17*
16	Replace any restricted or leaking fuel injectors as needed. Is the repair complete?	–	System OK	–
17	1. Check for the proper ignition voltage output for each cylinder with a spark tester. 2. Inspect the spark plugs for cracks, wear, improper gap, burned electrodes, or heavy deposits. 3. Inspect the ignition wires for short conditions. 4. Inspect all of the ignition grounds for loose connections. 5. Inspect the Engine Control Module (ECM) for the proper operation. Is the problem found?	–	Go to *Step 18*	Go to *Step 19*
18	Correct or replace any faulty ignition components. Is the repair complete?	–	System OK	–
19	Does the engine misfire or cut out under load or at idle?	–	Go to "Ignition System Check"	Go to *Step 20*
20	Does the engine start, but then immediately stall?	–	Go to *Step 21*	Go to *Step 23*
21	1. Remove the Crankshaft Position (CKP) sensor. 2. Inspect for faulty connections and repair as needed. Is the problem found?	–	Go to *Step 22*	Go to *Step 25*
22	Repair the faulty connections as needed. Is the repair complete?	–	System OK	–

Hard Start (Cont'd)

Step	Action	Value(s)	Yes	No
23	1. Check for the proper valve timing. 2. Check the cylinder compression. 3. Inspect the pushrods, the rocker arms, the valve springs, and the camshaft lobes for excessive wear. 4. Inspect the intake manifold and the exhaust manifold passages for casting flash. Is the problem found?	–	Go to *Step 24*	Go to *Step 25*
24	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
25	Check the idle air control valve operation. Repair or replace components as needed. Is the repair complete?	–	System OK	–
26	Check the throttle position sensor circuit for proper operation. Repair or replace components as needed. Is the repair complete?	–	System OK	–
27	Repair the fuel system as needed. Is the repair complete?	–	System OK	–
28	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	System OK	–

SURGES OR CHUGGLES

Definition: Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal position.

Important: Make sure the driver understands A/C compressor operation as described in the owner's manual.

The speedometer reading and the speed reading on the scan tool should be equal.

Before diagnosing the symptom, check service bulletins for updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	Connect the scan tool to the Data Link Connector (DLC). Does the oxygen sensor (O2S) respond quickly to different throttle positions?	–	Go to *Step 4*	Go to *Step 3*
3	1. Check the O2S for silicone or other contaminants from fuel or use of improper Room Temperature Vulcanizing (RTV) sealant. 2. Replace the contaminated O2S. Is the repair complete?	–	System OK	–
4	1. Drive the vehicle at the speed of the complaint. 2. Monitor the long term fuel trim reading using the scan tool. Is the long term fuel trim reading within the value specified?	–20–25%	Go to *Step 7*	Go to *Step 5*
5	Is the long term fuel trim reading below the value specified?	–20%	Go to "Diagnostic Aids for DTC P0172"	Go to *Step 6*
6	Is the long term fuel trim reading above the value specified?	25%	Go to "Diagnostic Aids for DTC P0171"	–
7	Check the fuel system pressure while the condition exists. Is the fuel system pressure within specifications?	284–325 kPa (41–47 psi)	Go to *Step 8*	Go to *Step 17*
8	Check the in-line fuel filter. Is the filter dirty or plugged?	–	Go to *Step 18*	Go to *Step 9*
9	Perform an injector diagnosis. Did the injector diagnosis pinpoint the problem?	–	Go to *Step 19*	Go to *Step 10*
10	1. Check for proper ignition voltage output using a spark tester. 2. Inspect the spark plugs for cracks, wear, improper gap, burned electrodes, or heavy deposits. Is the problem found?	–	Go to *Step 11*	Go to *Step 12*
11	Repair or replace any ignition system components as needed. Is the repair complete?	–	System OK	–
12	1. Inspect the ECM grounds for being clean, tight, and in their proper locations. 2. Inspect the vacuum lines for kinks or leaks. Is the problem found?	–	Go to *Step 13*	Go to *Step 14*

Surges or Chuggles (Cont'd)

Step	Action	Value(s)	Yes	No
13	Repair the electrical connections or the vacuum lines as needed. Is the repair complete?	–	System OK	–
14	Check the generator output voltage. Is the generator voltage within the value specified?	12–16 V	Go to *Step 16*	Go to *Step 15*
15	Repair the generator. Is the repair complete?	–	System OK	–
16	1. Check for intermittent Exhaust Gas Recirculation (EGR) valve operation. 2. Repair or replace any components as needed. Is the repair complete?	–	System OK	–
17	Repair the fuel system as needed. Is the repair complete?	–	System OK	–
18	Replace the fuel filter. Is the repair complete?	–	System OK	–
19	Replace the leaking or restricted fuel injectors. Is the repair complete?	–	System OK	–

LACK OF POWER, SLUGGISHNESS, OR SPONGINESS

Definition: The engine delivers less than expected power. There is little or no increase in speed when the accelerator pedal is partially applied.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to “Important Preliminary Checks”
2	1. Verify the customer’s complaint. 2. Compare the performance of the customer’s vehicle with a similar unit. Does the problem exist?	–	Go to *Step 3*	System OK
3	1. Inspect the air filter for excessive contamination. 2. Replace the air filter as needed. 3. Check the transaxle shift pattern and down shift operation. Does the transaxle operate properly?	–	Go to *Step 4*	Go to *Step 5*
4	Check the fuel system pressure. Is the fuel system pressure within specifications?	284–325 kPa (41–47 psi)	Go to *Step 7*	Go to *Step 6*
5	Repair the transaxle as needed. Is the repair complete?	–	System OK	–
6	Repair the fuel system as needed. Is the repair complete?	–	System OK	–
7	Check for a restricted fuel filter or contaminated fuel. Is the problem found?	–	Go to *Step 8*	Go to *Step 9*
8	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
9	1. Check the ignition system output for all of the cylinders using a spark tester. 2. Check for proper ignition control operation. Is the ignition system operating properly?	–	Go to *Step 10*	Go to *Step 11*
10	1. With the engine at normal operating temperature, connect a vacuum gauge to a vacuum port on the intake manifold. 2. Operate the engine at 1000 rpm. 3. Record the vacuum reading. 4. Increase the engine speed to 2500 rpm. 5. Note the vacuum reading at a steady 2500 rpm. Does the vacuum decrease more than the value specified?	10 kPa (3 in Hg)	Go to *Step 12*	Go to *Step 15*
11	Repair or replace any ignition system components as needed. Is the repair complete?	–	System OK	–
12	Inspect the exhaust system for restrictions and damaged or collapsed pipes. Is the problem found?	–	Go to *Step 13*	Go to *Step 14*
13	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
14	1. Check the cylinder compression and valve timing. 2. Inspect the camshaft for excessive wear. Is the problem found?	–	Go to *Step 15*	Go to *Step 16*

Lack of Power, Sluggishness, or Sponginess (Cont'd)

Step	Action	Value(s)	Yes	No
15	Repair or replace any engine components as needed. Is the repair complete?	–	System OK	–
16	1. Check the Engine Control Module (ECM) grounds for being clean, tight, and in their proper location. 2. Check the exhaust recirculation valve for being open or partially open all the time. 3. Check the torque converter clutch operation. 4. Check the A/C system operation. 5. Check the generator output. 6. Repair the generator if the output is not within the specified range. Are all checks and repairs complete?	12–16 V	System OK	–

DETONATION/SPARK KNOCK

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	1. Fill the fuel tank with a known good grade of gasoline that has the octane rating of the value specified. 2. Reevaluate the vehicle's performance. Does the detonation problem still exist?	87–89 octane	Go to *Step 3*	System OK
3	1. Inspect for low engine coolant level. 2. Check for restricted airflow to the radiator or restricted coolant flow. 3. Check for a faulty thermostat. 4. Check for an incorrect coolant solution. Is the problem found?	–	Go to *Step 4*	Go to *Step 5*
4	Repair or replace any cooling system components as needed. Is the repair complete?	–	System OK	–
5	1. Check the engine coolant temperature using the scan tool. 2. Replace the Engine Coolant Temperature (ECT) sensor if the resistance is not within specifications as listed in the Diagnostic Aids for diagnostic trouble code P0118. Is the problem found?	–	Go to *Step 6*	Go to *Step 7*
6	Replace the ECT sensor or repair the circuit as needed. Is the repair complete?	–	System OK	–
7	1. Check the ignition system output with a spark tester. 2. Inspect the spark plugs for the proper heat range and gap. 3. Check for the proper operation of the ignition controls. Is the ignition system operating properly?	–	Go to *Step 9*	Go to *Step 8*
8	Repair or replace the ignition system components as needed. Is the repair complete?	–	System Ok	–
9	1. Connect the scan tool to the Data Link Connector (DLC). 2. Road test the vehicle at the speed of the complaint. 3. Monitor the long term fuel trim reading from the scanner data stream. Is the long term fuel trim reading above the value specified?	25%	Go to "Diagnostic Aids for DTC P0171"	Go to *Step 10*
10	Check the fuel system pressure. Is the problem found?	284–325 kPa (41–47 psi)	Go to *Step 11*	Go to *Step 12*
11	Repair or replace the fuel system components as needed. Is the repair complete?	–	System OK	–

Detonation/Spark Knock (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Inspect for carbon buildup inside the engine. 2. Remove the carbon with a top engine cleaner. Follow the instructions supplied with the product. 3. Check the basic engine parts such as the camshaft, the cylinder head, the pistons, etc. for excessive wear. 4. Replace any excessively worn parts. Is the procedure complete?	–	Go to *Step 13*	–
13	1. Check the exhaust gas recirculation valve for proper operation. 2. Check the air intake system for proper operation. 3. Check the torque converter clutch operation and transaxle shift points. 4. Check the service bulletins for Programmable Read Only Memory (PROM) updates. 5. Check the cylinder compression. 6. Repair or replace any faulty components. Are all checks and repairs complete?	–	System OK	–

HESITATION, SAG, STUMBLE

Definition: Momentary lack of response as the accelerator is pushed down. This can occur at any vehicle speed. It is usually the most severe when first trying to make the vehicle move, as from a stop. Hesitation, sag, or stumble may cause the engine to stall if severe enough.

Important: Before diagnosing this condition, check service bulletins for PROM updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	1. Check the fuel system pressure. If the pressure is not within the value specified, service the fuel system as needed. 2. Inspect the Throttle Position (TP) sensor for binding or sticking. The TP sensor voltage should increase at a steady rate as the throttle is moved toward Wide Open Throttle (WOT). Is the problem found?	284–325 kPa (41–47 psi)	Go to *Step 3*	Go to *Step 4*
3	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
4	1. Check the Manifold Absolute Pressure (MAP) sensor response and accuracy. 2. Inspect the fuel for water contamination. 3. Check the Evaporative Emission (EVAP) Canister Purge System for proper operation. Is the problem found?	–	Go to *Step 5*	Go to *Step 6*
5	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
6	1. Disconnect all of the fuel injector harness connectors. 2. Connect an injector test light between the harness terminals of each fuel injector. 3. Note the test light while cranking the engine. Does the test light blink on all connectors?	–	Go to *Step 8*	Go to *Step 7*
7	1. Repair or replace the faulty fuel injector drive harness, the connector, or the connector terminal. 2. If the connections and the harnesses are good, replace the Engine Control Module (ECM). Is the repair complete?	–	System OK	–
8	Measure the resistance of each fuel injector. Is the fuel injector resistance within the value specified (the resistance will increase slightly at higher temperatures)?	11.6–12.4 Ω	Go to *Step 10*	Go to *Step 9*
9	Replace any of the fuel injectors with a resistance that is out of specifications. Is the repair complete?	–	System OK	–
10	Perform an injector diagnosis. Is the problem found?	–	Go to *Step 11*	Go to *Step 12*
11	Replace any restricted or leaking fuel injectors. Is the repair complete?	–	System OK	–
12	Check the fuel system pressure after a cold start or during moderate or full throttle acceleration. Is the fuel pressure within specifications?	284–325 kPa (41–47 psi)	Go to *Step 14*	Go to *Step 13*

Hesitation, Sag, Stumble (Cont'd)

Step	Action	Value(s)	Yes	No
13	Repair the restriction in the fuel system or replace the faulty fuel pump. Is the repair complete?	–	System OK	–
14	1. Check for faulty ignition wires. 2. Inspect for fouled spark plugs. 3. Check the ignition system output on each cylinder with a spark tester. Is the problem found?	–	Go to *Step 15*	Go to *Step 16*
15	Repair or replace any ignition components as needed. Is the repair complete?	–	System OK	–
16	1. Check the generator output voltage. 2. Repair or replace the generator if the generator output is less than the value specified. 3. Check the Exhaust Gas Recirculation (EGR) valve operation. Are all checks and needed repairs complete?	–	System OK	–

CUTS OUT, MISSES

Definition: Steady pulsation or jerking that follows engine speed, usually more pronounced as engine load increases. The exhaust has a steady spitting sound at idle or low speed.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	Check the ignition system voltage output for all of the cylinders using a spark tester. Is spark present on all of the cylinders?	–	Go to *Step 3*	Go to "Ignition System Check"
3	1. Inspect the spark plugs for excessive wear, insulation cracks, improper gap, or heavy deposits. 2. Check the resistance of the ignition wires. Replace any ignition wires that have a resistance greater than the value specified. Is the problem found?	30000 Ω	Go to *Step 4*	Go to *Step 5*
4	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
5	With the engine running, spray the ignition wires with a fine water mist to check for arcing and shorting to ground. Is the problem found?	–	Go to *Step 6*	Go to *Step 7*
6	Replace the ignition wires. Is the repair complete?	–	System OK	–
7	1. Perform a cylinder compression test. 2. If the compression is low, repair the engine as needed. 3. Inspect for proper valve timing, bent pushrods, worn rocker arms, broken or weak valve springs, and worn camshaft lobes. 4. Inspect the intake manifold and the exhaust manifold passages for casting flash. Is the problem found?	–	Go to *Step 8*	Go to *Step 9*
8	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
9	1. Check the fuel system for a plugged in-line fuel filter. 2. Check the fuel system for low fuel pressure. If the fuel pressure is below the value specified, service the fuel system as needed. 3. Inspect for contaminated fuel. Is the problem found?	284–325 kPa (41–47 psi)	Go to *Step 10*	Go to *Step 11*
10	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
11	1. Disconnect all of the fuel injector harness connectors at the fuel injectors. 2. Connect an injector test light to the harness terminals of each fuel injector connector. 3. Note the test light while cranking the engine for each fuel injector. Does the test light blink for all of the fuel injectors?	–	Go to *Step 13*	Go to *Step 12*

Cuts Out, Misses (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Repair or replace the faulty injector drive circuit harness, the connector, or the connector terminal. 2. If the connections and the harnesses are good, replace the Engine Control Module (ECM). Is the repair complete?	–	System OK	–
13	Measure the resistance of each fuel injector. Is the injector resistance within the value specified (the resistance will increase slightly at higher temperatures)?	11.6–12.4 Ω	Go to *Step 15*	Go to *Step 14*
14	Replace any fuel injectors with a resistance that is out of specifications. Is the repair complete?	–	System OK	–
15	Perform an injector diagnosis. Is the problem found?	–	Go to *Step 16*	Go to *Step 17*
16	Replace any restricted or leaking fuel injectors. Is the repair complete?	–	System OK	–
17	1. Check for electromagnetic interference. 2. Monitor the engine rpm with a scan tool. Does the scan tool rpm change greatly with little change in actual engine rpm?	–	Go to *Step 18*	–
18	1. Inspect the routing of the ignition wires. 2. Inspect all of the ignition system grounds. 3. Correct the routing or repair the ground connections as needed. Are all checks and needed repairs complete?	–	System OK	–

POOR FUEL ECONOMY

Definition: Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, fuel economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test.

Important: Driving habits affect fuel economy. Check the owner's driving habits by asking the following questions:

1. Is the A/C system (i.e. defroster mode) turned on all the time?
2. Are the tires at the correct air pressure?
3. Have excessively heavy loads been carried?
4. Does the driver accelerate too much and too often? Suggest the driver read the section in the owner's manual about fuel economy.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	1. Inspect the air filter for excessive contamination. 2. Inspect for fuel system leaks. Are all needed checks complete?	–	Go to *Step 3*	–
3	1. Inspect the spark plugs for excessive wear, insulation cracks, improper gap, or heavy deposits. 2. Replace any faulty spark plugs. 3. Inspect the ignition wires for cracking, hardness, and proper connections. Are all needed checks and repairs complete?	–	Go to *Step 4*	–
4	1. Inspect the engine coolant level. 2. Check the thermostat for being always open or for an incorrect heat range. 3. Replace the thermostat as needed. Are all needed checks and repairs complete?	–	Go to *Step 4*	–
5	1. Check the transaxle shift pattern. Ensure all transaxle gears are functioning. 2. Check for proper calibration of the speedometer. 3. Check the brakes for dragging. 4. Check the cylinder compression. 5. Repair, replace, or adjust any components as needed. Are all checks and needed repairs complete?	–	System OK	–

ROUGH, UNSTABLE, OR INCORRECT IDLE, STALLING

Definition: The engine runs unevenly at idle. If the condition is bad enough, the vehicle may shake. Also, the idle varies in rpm (called “hunting”). Either condition may be severe enough to cause stalling. The engine idles at incorrect idle speed.

Important: Before diagnosing the symptom, check service bulletins for updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to Step 2	Go to “Important Preliminary Checks”
2	1. Connect the scan tool to the Data Link Connector (DLC). 2. Monitor the oxygen sensor (O2S) reading at different throttle positions. Does the O2S change quickly from rich to lean at the different throttle positions?	–	Go to *Step 5*	Go to *Step 3*
3	Check the O2S for contamination from fuel or improper use of room temperature vulcanizing sealant. Is the O2S contaminated?	–	Go to *Step 4*	Go to *Step 5*
4	Replace the contaminated O2S as needed. Is the repair complete?	–	System OK	–
5	1. Check for a sticking throttle shaft or binding throttle linkage that may cause incorrect Throttle Position (TP) sensor voltage. 2. Check the TP sensor voltage reading with the throttle closed. Is the TP sensor voltage within the value specified?	0.4–0.8 V	Go to *Step 6*	Go to “Diagnostic Aids for DTC P0123”
6	1. Check the Engine Coolant Temperature (ECT) sensor voltage reading using the scan tool. 2. Compare the ECT sensor reading with the ambient temperature when the engine is cold. Does the ECT sensor temperature reading differ from the ambient temperature by more than the value specified?	3°C (5°F)	Go to *Step 7*	Go to *Step 9*
7	Check for high resistance in the ECT sensor circuit or the sensor itself. Is the problem found?	–	Go to *Step 8*	Go to *Step 9*
8	Replace the ECT sensor or repair the circuit as needed. Is the repair complete?	–	System OK	–
9	Check the Manifold Absolute Pressure (MAP) sensor for response and accuracy. Is the problem found?	–	Go to *Step 10*	Go to *Step 11*
10	Replace the MAP sensor or repair the MAP sensor circuit as needed. Is the repair complete?	–	System OK	–
11	1. Road test the vehicle at the speed of the complaint. 2. Monitor the long term fuel trim reading using the scan tool. Is the long term fuel trim reading within the value specified?	–20–25%	Go to *Step 14*	Go to *Step 12*

Rough, Unstable, or Incorrect Idle, Stalling (Cont'd)

Step	Action	Value(s)	Yes	No
12	Is the long term fuel trim reading below the value specified?	–20%	Go to "Diagnostic Aids for DTC P0172"	Go to *Step 13*
13	Is the long term fuel trim reading above the value specified?	25%	Go to "Diagnostic Aids for DTC P0171"	–
14	1. Disconnect all of the fuel injector harness connectors at the fuel injectors. 2. Connect an injector test light between the harness terminals of each fuel injector connector. 3. Note the test light while cranking the engine. Does the test light blink for all of the fuel injectors?	–	Go to *Step 16*	Go to *Step 15*
15	1. Repair or replace the faulty injector drive circuit harness, the connector, or the connector terminals as needed. 2. If the harness, the connectors, and the terminals are OK, replace the Engine Control Module (ECM). Is the repair complete?	–	System OK	–
16	Measure the resistance of each of the fuel injectors. Is the resistance within the value specified (the resistance will increase slightly at higher temperatures)?	11.6–12.4 Ω	Go to *Step 18*	Go to *Step 17*
17	Replace any fuel injectors with a resistance that is out of specifications. Is the repair complete?	–	System OK	–
18	Perform an injector diagnosis. Is the problem found?	–	Go to *Step 19*	Go to *Step 20*
19	Replace any leaking or restricted fuel injectors. Is the repair complete?	–	System OK	–
20	1. With the engine OFF, disconnect the fuel pressure regulator vacuum hose. 2. Thoroughly inspect the fuel pressure regulator vacuum port and the fuel pressure regulator vacuum hose for the presence of fuel. Is the problem found?	–	Go to *Step 21*	Go to *Step 22*
21	Replace the fuel pressure regulator as needed. Is the repair complete?	–	System OK	–
22	1. Check the ignition system output voltage for all of the cylinders using a spark tester. 2. Inspect the spark plugs for excessive wear, insulation cracks, improper gap, or heavy deposits. 3. Inspect the ignition wires for cracking, hardness, or improper connections. 4. Replace any ignition wires with a resistance over the value specified. Is the problem found?	30000 Ω	Go to *Step 23*	Go to *Step 24*
23	Repair or replace any ignition system components as needed. Is the repair complete?	–	System OK	–

Rough, Unstable, or Incorrect Idle, Stalling (Cont'd)

Step	Action	Value(s)	Yes	No
24	1. Inspect for vacuum leaks. 2. Check for proper Positive Crankcase Ventilation (PCV) operation. 3. Check the Idle Air Control (IAC) valve operation. 4. Inspect the ECM ground connections. Is the problem found?	–	Go to *Step 25*	Go to *Step 26*
25	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
26	1. Check the Exhaust Gas Recirculation (EGR) valve for proper operation. 2. Inspect the battery cables and the ground straps for proper connections. 3. Check the generator voltage output. Repair or replace the generator if the voltage output is not within the value specified. Is the problem found?	12–16 V	Go to *Step 27*	Go to *Step 28*
27	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
28	1. Inspect for broken engine mounts. 2. Check for proper valve timing. 3. Perform a cylinder compression test. 4. Inspect for bent pushrods, worn rocker arms, broken or weak valve springs, and a worn camshaft. 5. Perform repairs as needed. Are all of the checks and needed repairs complete?	–	System OK	–

EXCESSIVE EXHAUST EMISSIONS OR ODORS

Definition: A vehicle fails an emission test. The vehicle has an excessive rotten egg smell. Excessive odors do not necessarily indicate excessive emissions.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	1. Run the engine until it reaches operating temperature. 2. Perform an emission test. Did the vehicle pass the emission test?	–	System OK	Go to *Step 3*
3	1. Connect the scan tool to the Data Link Connector (DLC). 2. Road test the vehicle. 3. Monitor the long term fuel trim memory. Is the long term fuel trim memory within the value specified?	–20 – 25 %	Go to *Step 6*	Go to *Step 4*
4	Is the long term fuel trim memory below the value specified?	–20 %	Go to "Diagnostic Aids for DTC P0172"	Go to *Step 5*
5	Is the long term fuel trim memory above the value specified?	25 %	Go to "Diagnostic Aids for DTC P0171"	–
6	1. Check for a properly installed fuel cap. 2. Check the fuel system pressure. 3. Perform an injector diagnosis. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair or replace any fuel system components as needed. 2. Perform an emission test. Did the vehicle pass the emission test?	–	System OK	–
8	1. Check the ignition system for proper operation. 2. Inspect the spark plugs for excessive wear, insulation cracks, improper gap, or heavy deposits. 3. Check the ignition wires for cracking, hardness, or improper connections. Is the problem found?	–	Go to *Step 9*	Go to *Step 10*
9	1. Repair or replace any ignition system components as needed. 2. Perform an emission test. Did the vehicle pass the emission test?	–	System OK	–

Excessive Exhaust Emissions or Odors (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Inspect for vacuum leaks. 2. Inspect the catalytic converter for contamination. 3. Inspect for carbon buildup on the throttle body and the throttle plate and inside the engine. Remove with a top engine cleaner. 4. Check the Exhaust Gas Recirculation (EGR) valve for not opening. 5. Check for proper Positive Crankcase Ventilation (PCV) operation. Are all checks and needed repairs complete?	–	System OK	–

DIESELING, RUN-ON

Definition: An engine continues to run after the ignition switch is turned OFF.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	Does the engine run smoothly after the ignition switch is turned OFF?	–	Go to *Step 3*	Go to *Step 4*
3	1. Check the ignition switch and the ignition switch adjustment. 2. Replace the ignition switch if needed. Is the repair complete?	–	System OK	–
4	1. Check the evaporative emission system. 2. Check for leaking fuel injectors. 3. Check the Idle Air Control (IAC) valve operation. 4. Inspect for vacuum leaks. 5. Check for the proper base idle setting. Are all checks and repairs complete?	–	System OK	–

BACKFIRE

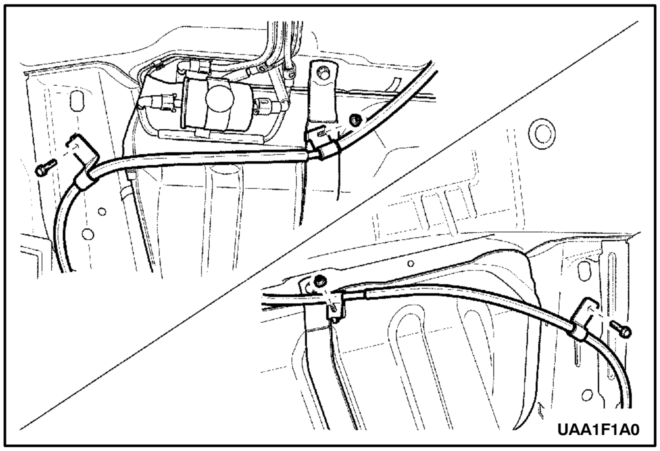
Definition: Fuel ignites in the intake manifold, or in the exhaust system, making a loud popping noise.

Important: Before diagnosing the symptom, check service bulletins for updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to “Important Preliminary Checks”
2	1. Inspect for crossed or crossfiring ignition wires. 2. Check the ignition system output voltage for all cylinders using a spark tester. 3. Inspect the spark plugs for excessive wear, burned electrodes, improper gap, or heavy deposits. Is the problem found?	–	Go to *Step 3*	Go to *Step 4*
3	Repair or replace any ignition system components as needed. Is the repair complete?	–	System OK	–
4	1. Check the fuel system operation. 2. Check the fuel injectors by performing an injector diagnosis. Is the problem found?	–	Go to *Step 5*	Go to *Step 6*
5	Repair or replace any fuel system components as needed. Is the repair complete?	–	System OK	–
6	1. Inspect the Exhaust Gas Recirculation (EGR) gasket for a leak or a loose fit. 2. Check the EGR valve for proper operation. 3. Inspect the intake manifold and the exhaust manifold for a casting flash. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
8	1. Inspect the timing belt for proper installation and tension. 2. Check the engine compression. 3. Inspect the intake manifold gasket and the exhaust manifold gasket for leaks. 4. Check for sticking or leaking valves. 5. Repair or replace any components as needed. Are all checks and corrections complete?	–	System OK	–

MAINTENANCE AND REPAIR

ON–VEHICLE SERVICE



FUEL TANK

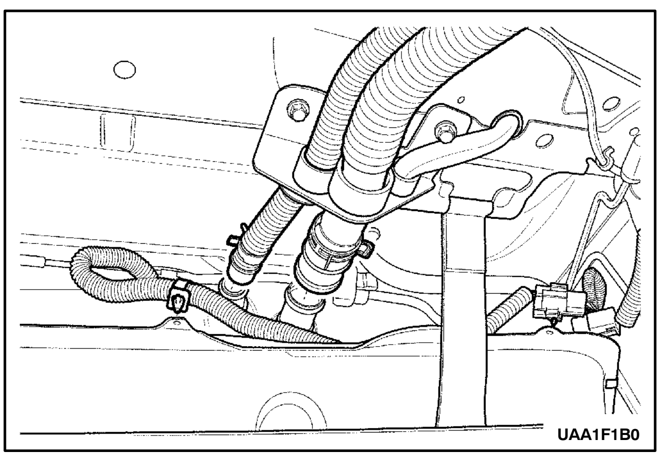
Removal and Installation Procedure

CAUTION : The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

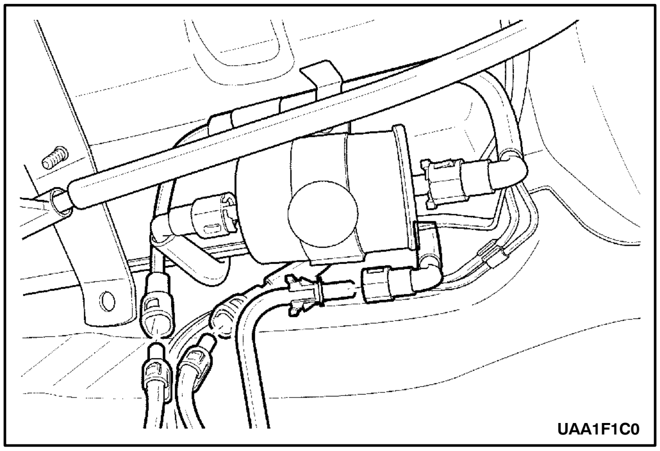
1. Relieve the fuel pressure. Refer to *"Fuel Pump"* in this section.
2. Disconnect the negative battery cable.
3. Drain the fuel from the fuel tank.
4. Remove the parking brake cable retaining bracket bolts/nuts.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)



5. Disconnect the fuel tank filter tube from the fuel tank.
6. Disconnect the fuel tank vent tube from the fuel tank.
7. Disconnect the wiring harness straps from the fuel tank.
8. Disconnect the fuel pump harness connector.



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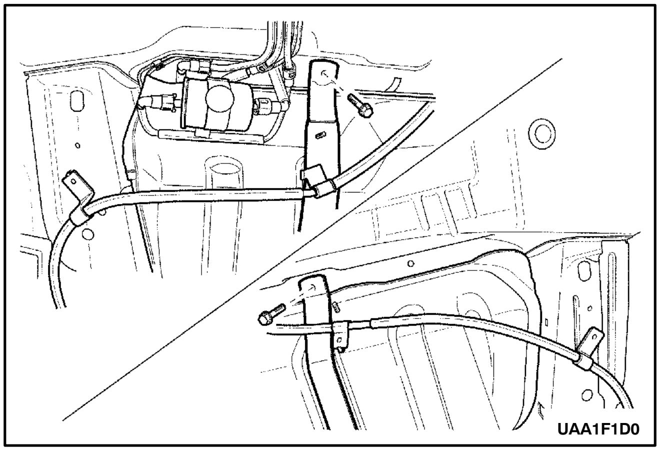
9. Disconnect the fuel inlet line.
10. Disconnect the fuel return line.
11. Disconnect the fuel CCP line.



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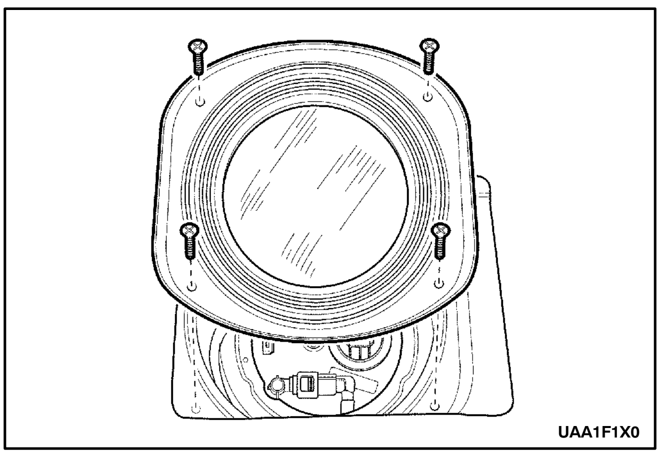
12. Support the fuel tank.
13. Remove the fuel tank strap retaining bolts.

Installation Notice

Tightening Torque	13 N·m (115 lb–in)

14. Remove the fuel tank straps.
15. Carefully lower the fuel tank.
16. Remove the fuel tank.
17. Transfer any parts as needed.
18. Installation should follow the removal procedure in the reverse order.



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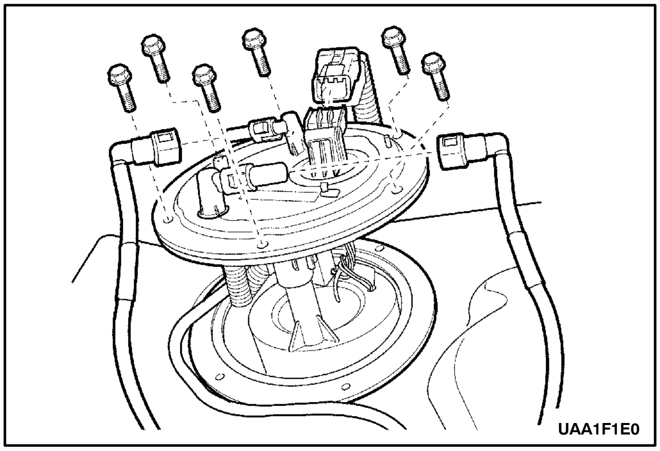
FUEL PUMP

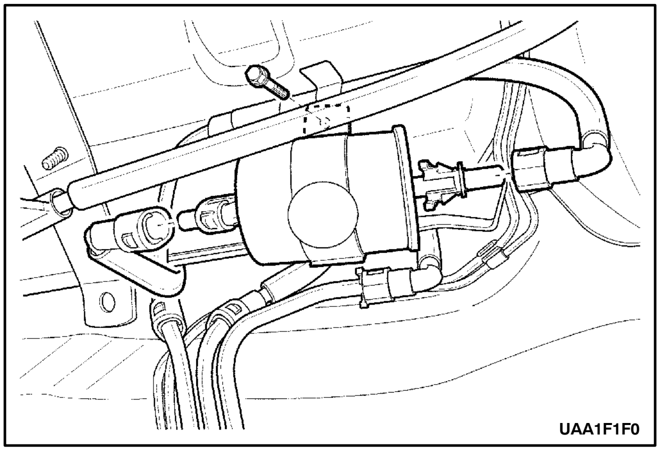
Removal and Installation Procedure

CAUTION: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

1. Relieve the fuel system pressure.
   1.1 Remove the fuel cap.
   1.2 Remove the fuel pump fuse Ef23 from the engine fuse box.
   1.3 Start the engine and allow the engine to stall.
   1.4 Crank the engine for an additional 10 seconds.
2. Disconnect the negative the battery cable.
3. Remove the rear seat. Refer to *Section 9H, Seats.*
4. Remove the fuel pump access cover screws.
5. Remove the fuel pump access cover



6. Disconnect the electrical connector at the fuel pump assembly.
7. Disconnect the fuel outlet line.
8. Disconnect the fuel return line.
9. Remove the locking ring bolts.
10. Remove the fuel pump assembly from the tank.
11. Installation should follow the removal procedure in the reverse order.



FUEL FILTER

Removal and Installation Procedure

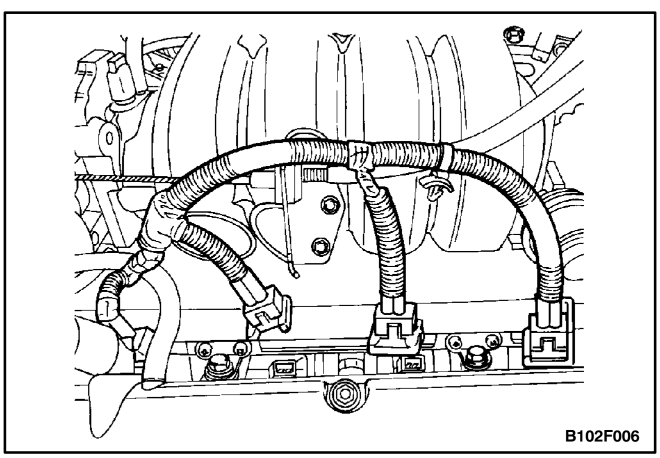
CAUTION : The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

1. Relieve the fuel system pressure. Refer to *"Fuel Pump"* in this section.
2. Disconnect the inlet/outlet fuel lines by moving the line connector lock forward and pulling the hose off of the fuel filter tube.
3. Remove the fuel filter mounting bracket bolt.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

4. Remove the fuel filter.
5. Installation should follow the removal procedure in the reverse order.

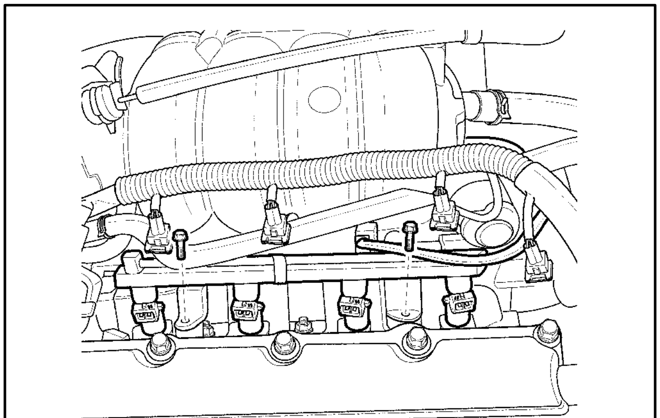


FUEL RAIL AND INJECTORS (1.6L DOHC)

Removal and Installation Procedure

CAUTION : The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

1. Relieve the fuel system pressure. Refer to "Fuel Pump" in this section.
2. Disconnect the negative battery cable.
3. Remove the spark plug cover.
4. Disconnect the fuel injector harness connectors.



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5. Remove the fuel pressure regulator vacuum hose.
6. Remove the fuel line.
7. Remove the fuel rail retaining bolts.

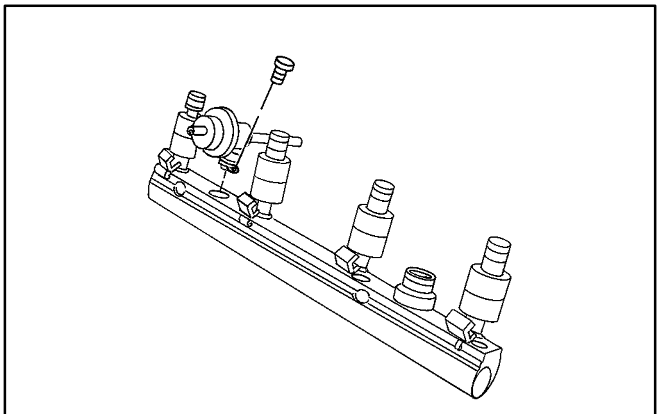
Installation Notice

Tightening Torque	25 N·m (18 lb–ft)

Notice: Before removal, the fuel rail assembly may be cleaned with a spray-type cleaner, following package instructions. Do not immerse the fuel rails in liquid cleaning solvent. Use care in removing the fuel rail assembly to prevent damage to the electrical connectors and the injector spray tips. Prevent dirt and other contaminants from entering open lines and passages. Fittings should be capped and holes plugged during service.

Important: If a fuel injector becomes separated from the fuel rail and remains in the cylinder head, replace the fuel injector O-ring seals and the retaining clip.

8. Remove the fuel rail with the fuel injectors attached.



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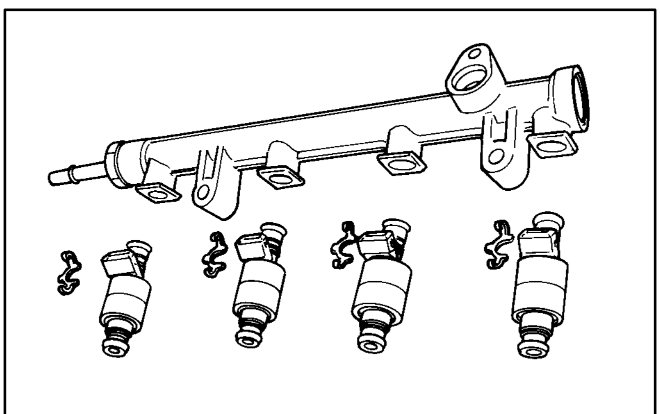

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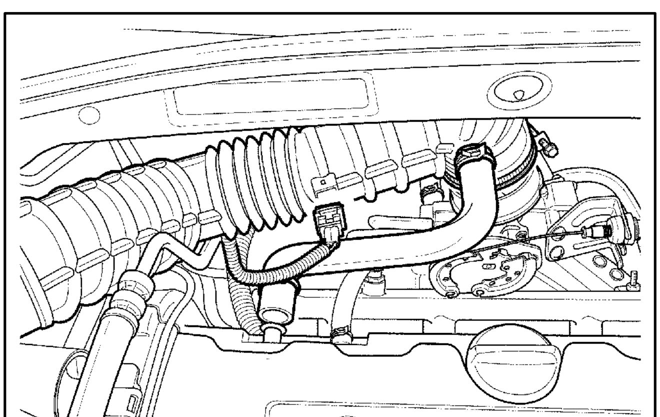
9. Remove the fuel pressure regulator. Refer to “Fuel Pressure Regulator” in this section.
10. Remove the fuel injector retainer clips.
11. Remove the fuel injectors by pulling them down and out.
12. Discard the fuel injector O-rings.



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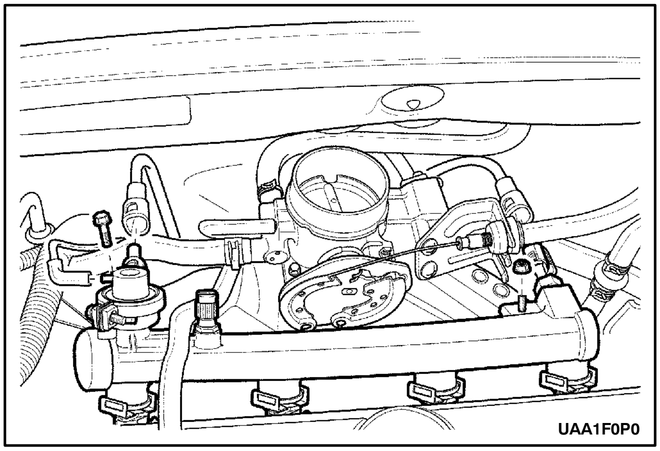
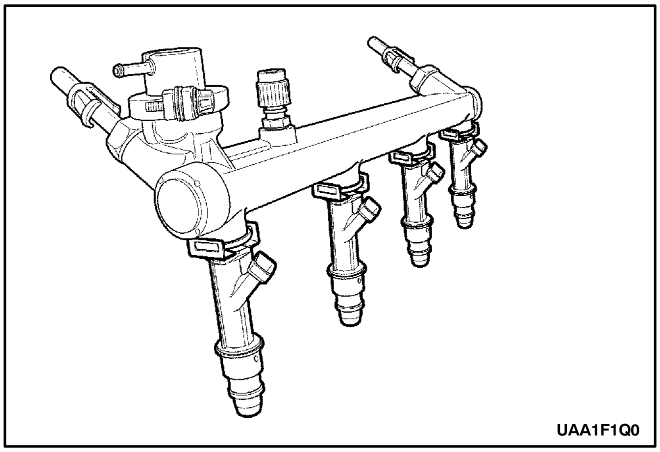
FUEL RAIL AND INJECTORS (2.0L DOHC)

Removal and Installation Procedure

CAUTION: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

1. Disconnect the negative battery cable.
2. Disconnect the intake air temperature (IAT) sensor connector.
3. Disconnect the breather hose from the valve cover.
4. Remove the air intake tube from the throttle body.





5. Relieve the fuel system pressure. Refer to *"Fuel Pump"* in this section.
6. Disconnect the vacuum hose from the fuel pressure regulator.
7. Disconnect the fuel return line at the fuel rail.
8. Disconnect the fuel inlet line at the fuel rail.
9. Disconnect the fuel injector connectors.
10. Remove the fuel rail retaining bolts.

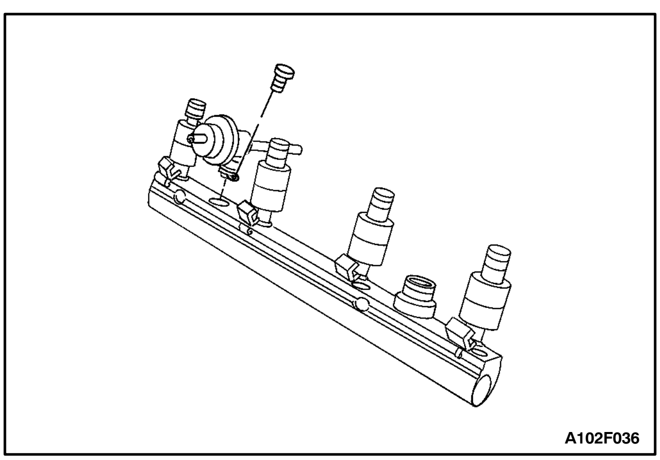
Installation Notice

Tightening Torque	12 N·m (106 lb–in)

Notice: Before removal, the fuel rail assembly may be cleaned with a spray-type cleaner, following package instructions. Do not immerse the fuel rails in liquid cleaning solvent. Use core in removing the fuel rail assembly to prevent damage to the electrical connectors and the injector spray tips. Prevent dirt and other contaminants from entering open lines and passages. Fittings should be capped and holes plugged during service.

Important: If an injector becomes separated from the rail and remains in the cylinder head, replace the injector O-ring seals and the retaining clip.

11. Remove the fuel injector retainer clips.
12. Remove the fuel injectors by pulling them down and out.
13. Discard the fuel injector O-rings.
14. Installation should follow the removal procedure in the reverse order.



FUEL PRESSURE REGULATOR (1.6L DOHC)

Removal and Installation Procedure

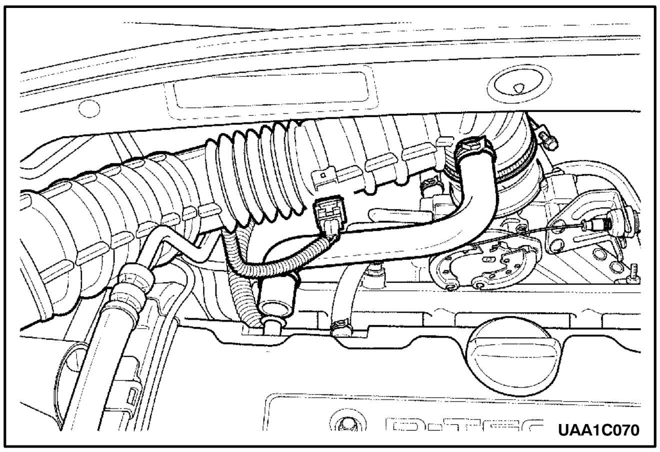
CAUTION: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

1. Relieve the fuel system pressure. Refer to *"Fuel Pump"* in this section.
2. Remove the fuel rail. Refer to *"Fuel Rail and Injectors"* in this section.
3. Remove the fuel pressure regulator screws.

Installation Notice

Tightening Torque	12 N·m (106 lb–in)

4. Remove the fuel pressure regulator.
5. Installation should follow the removal procedure in the reverse order.



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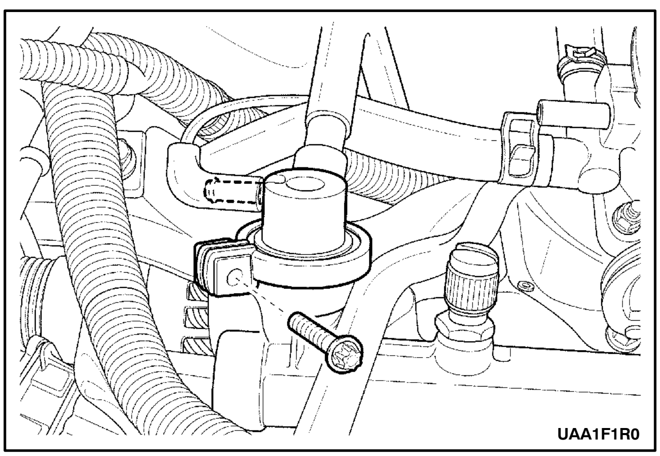
FUEL PRESSURE REGULATOR (2.0L DOHC)

Removal and Installation Procedure

CAUTION: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

1. Disconnect the negative battery cable.
2. Disconnect the intake air temperature (IAT) sensor connector.
3. Disconnect the breather hose from the valve cover.
4. Remove the air intake tube from the throttle body.



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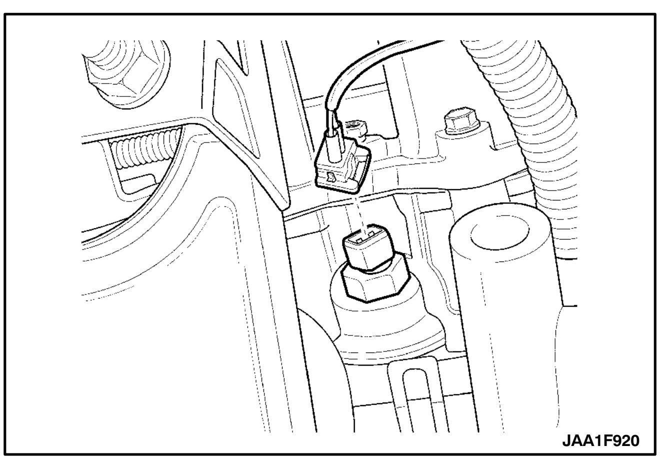
5. Relieve the fuel system pressure. Refer to *"Fuel Pump"* in this section.
6. Disconnect the vacuum hose from the fuel pressure regulator.
7. Remove the fuel pressure regulator retaining clamp.
8. Remove the fuel pressure regulator by turning it back and forth and then pulling it out.
9. Discard the O-ring.

Installation Notice

Tightening Torque	12 N·m (106 lb–in)

10. Installation should follow the removal procedure in the reverse order.



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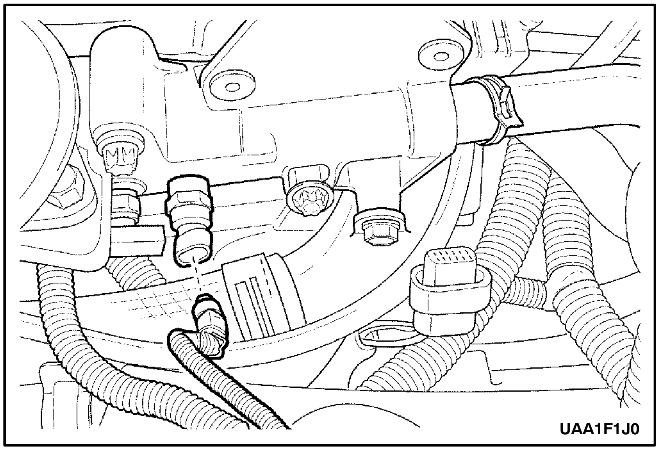
ENGINE COOLANT TEMPERATURE (ECT) SENSOR (1.6L DOHC)

Removal Procedure

1. Relieve the coolant system pressure.
2. Disconnect the negative battery cable.
3. Remove the Generator and the generator low support bracket. Refer to *Section 1E, Engine Electrical.*
4. Disconnect the ECT sensor connector.

Notice: Use care when handling the sensor. Damage will affect the proper operation of the fuel injection system.

5. Carefully remove the ECT sensor from the cylinder head underneath the intake manifold.



ENGINE COOLANT TEMPERATURE (ECT) SENSOR (2.0L DOHC)

Removal and Installation Procedure

1. Relieve the coolant system pressure.
2. Disconnect the negative battery cable.
3. Remove the EI system ignition coil. Refer to *"Electronic Ignition System Ignition Coil"* in this section.
4. Disconnect the engine coolant temperature (ECT) sensor connector.

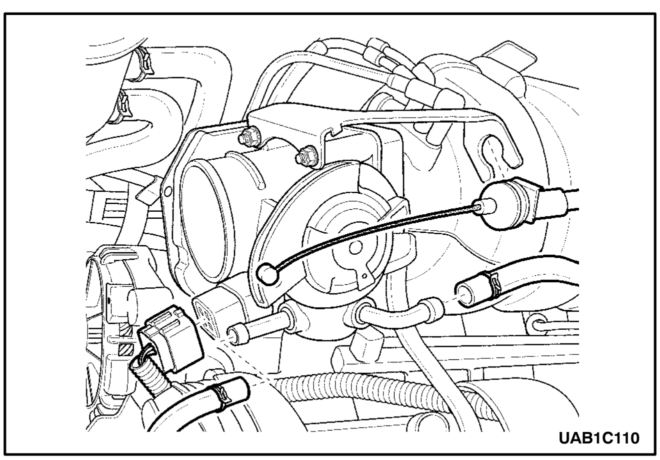
Notice: Use care when handing the ECT sensor. Damage to the sensor will affect the proper operation of the fuel injection system.

5. Carefully remove the ECT sensor from the cylinder head underneath the electronic ignition (EI) system ignition coil.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

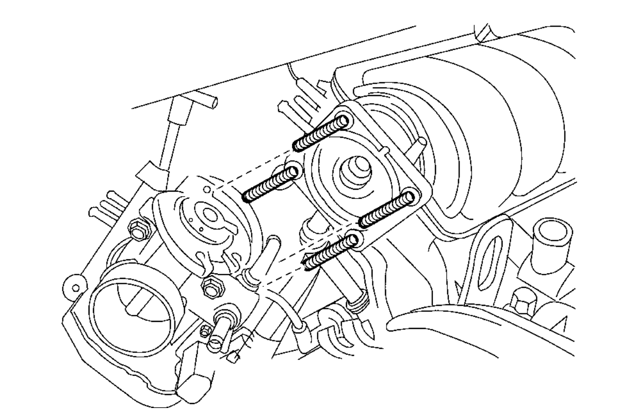
6. Installation should follow the removal procedure in the reverse order.



THROTTLE BODY (1.6L DOHC)

Removal and Installation Procedure

1. Disconnect the negative the battery cable.
2. Remove the air cleaner assembly and the air intake tube.
3. Disconnect the coolant hoses from the throttle body.
4. Disconnect Motorized Throttle Idle Actuator (MTIA) connector.
5. Disconnect the throttle cable from the throttle body and bracket.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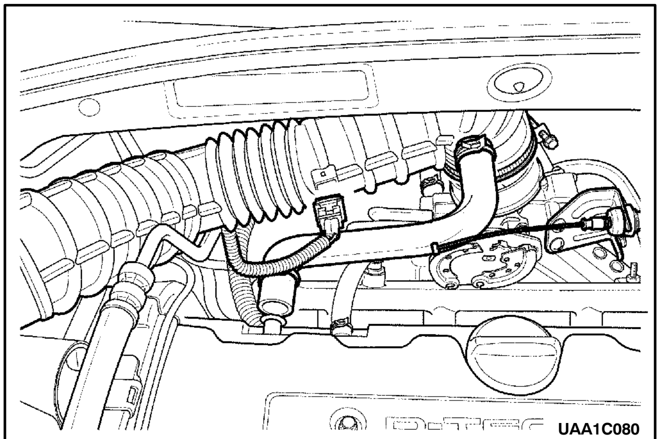
6. Remove the throttle body retaining nut and the throttle cable bracket.
7. Remove the throttle body retaining nut/bolt.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

8. Remove the throttle body and discard the gasket.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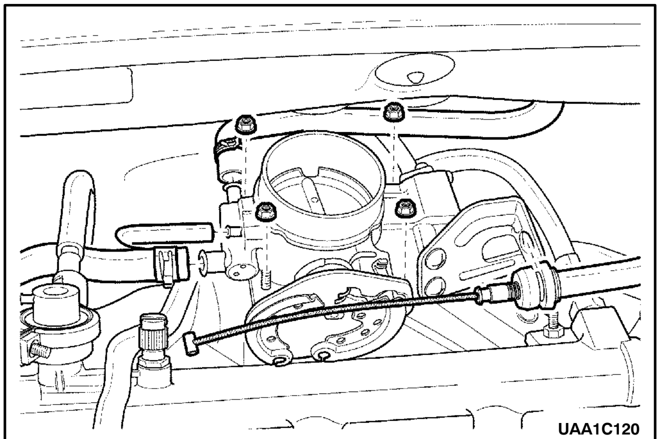
THROTTLE BODY (2.0L DOHC)

Removal and Installation Procedure

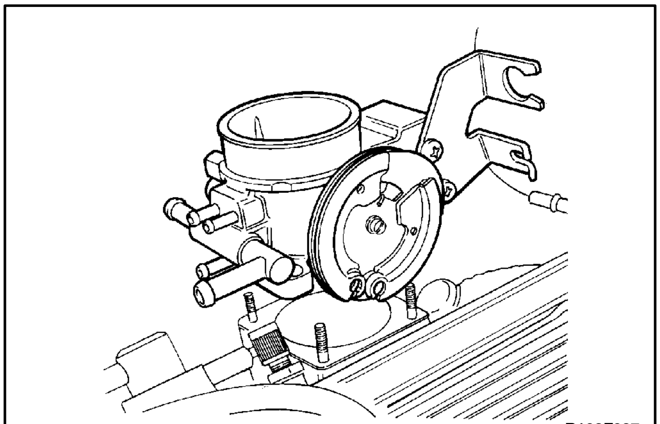
1. Disconnect the negative battery cable.
2. Disconnect the IAT sensor connector.
3. Disconnect the breather hose from the valve cover.
4. Remove the air intake tube from the throttle body.
5. Disconnect the throttle cable from the throttle body and bracket.


UAA1C120

6. Disconnect the coolant hoses from the throttle body.
7. Disconnect the vacuum hoses from the throttle body.
8. Disconnect the throttle position (TP) sensor connector and the idle air control (IAC) valve connectors.
9. Remove the throttle body retaining nuts.

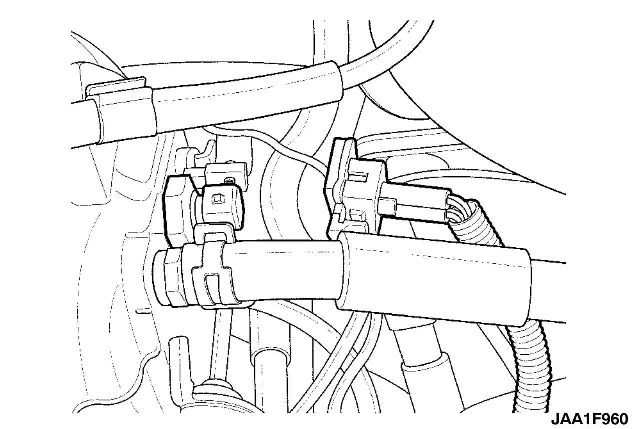
Installation Notice

Tightening Torque	10 N·m (89 lb–in)


B102F027

Notice: Cover the opening of the intake manifold after removing the throttle body assembly. This will prevent any objects or debris from entering the engine that may cause damage.

10. Remove the throttle body and discard the gasket.
11. Remove the TP sensor. Refer to *“Throttle Position Sensor”* in this section.
12. Remove the IAC valve. Refer to *“Idle Air Control Valve”* in this section.
13. Installation should follow the removal procedure in the reverse order.



JAA1F960

INTAKE AIR TEMPERATURE (IAT) SENSOR (1.6L DOHC)

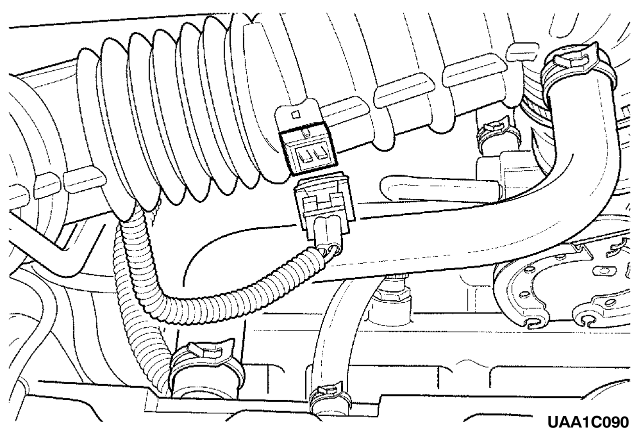
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the intake air temperature (IAT) sensor connector.
3. Remove the IAT sensor.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

4. Installation should follow the removal procedure in the reverse order.

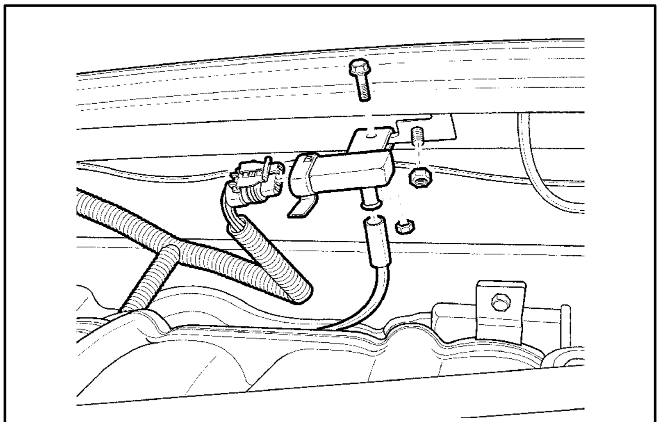


UAA1C090

INTAKE AIR TEMPERATURE (IAT) SENSOR (2.0L DOHC)

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the intake air temperature (IAT) sensor connector.
3. Remove the IAT sensor by pulling it out of the air intake tube.
4. Installation should follow the removal procedure in the reverse order.



JAA1F970

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR (1.6L DOHC)

Removal and Installation Procedure

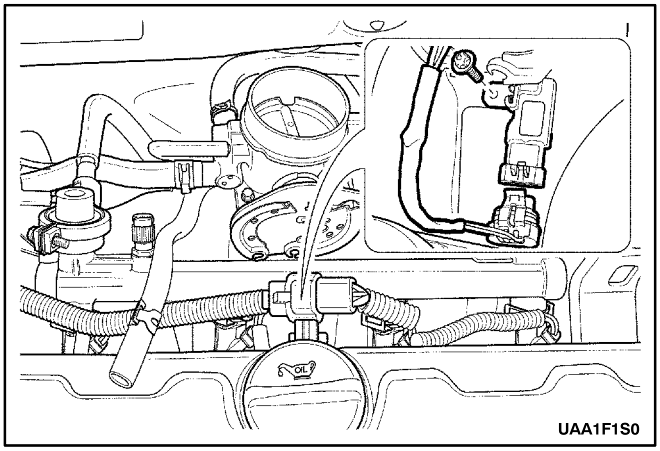
1. Disconnect the negative battery cable.
2. Disconnect the manifold absolute pressure (MAP) sensor connector.
3. Remove the MAP sensor retaining bolt

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

4. Remove the MAP sensor from the intake manifold.

5. Installation should follow the removal procedure in the reverse order.



MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR (2.0L DOHC)

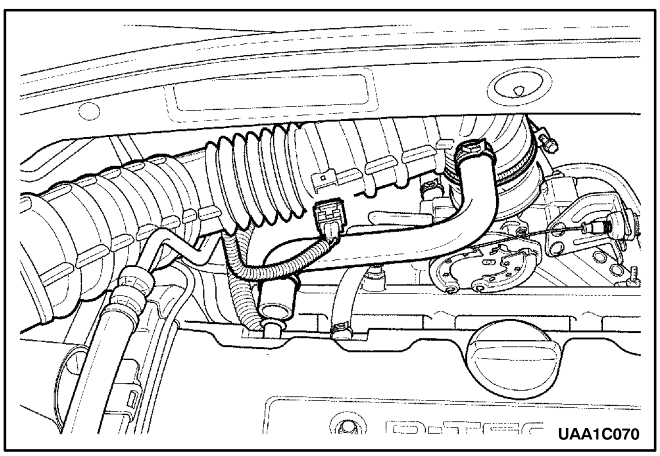
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the fuel rail. Refer to *"Fuel Rail and Injectors"* in this section.
3. Disconnect the manifold absolute pressure (MAP) sensor connector from the MAP sensor.
4. Remove the MAP sensor retaining bolt

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

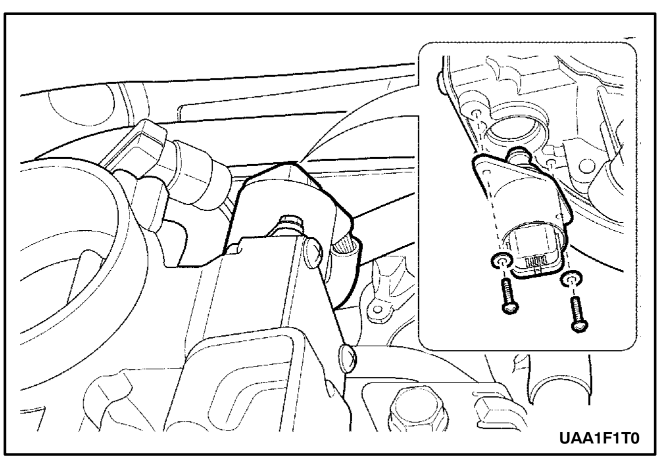
5. Remove the MAP sensor from the intake manifold.
6. Installation should follow the removal procedure in the reverse order.



IDLE AIR CONTROL (IAC) VALVE (2.0L DOHC)

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the IAT sensor connector.
3. Disconnect the breather hose from the valve cover.
4. Remove the air intake tube from the throttle body.



5. Disconnect the idle air control (IAC) valve connector.
6. Remove the IAC valve retaining screws.

Notice: On IAC valves that have been in service, do not push on the valve pintle. The force required moving the pintle may damage the threads on the worm drive.

7. Remove the IAC valve from the throttle body.

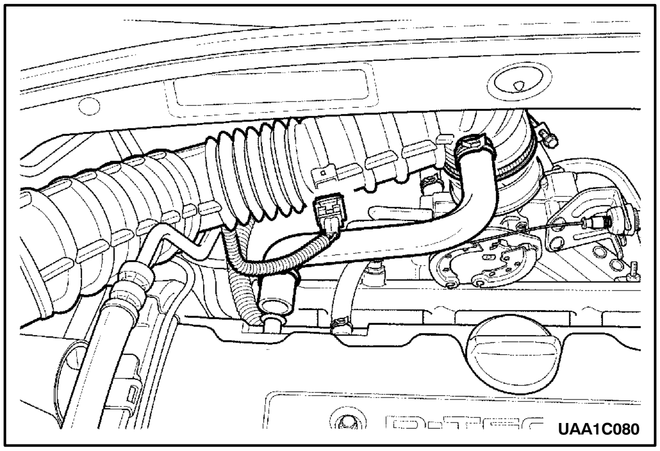
Notice: Do not use methyl ethyl ketone because it can damage the parts.

8. Clean the IAC valve O-ring seal area, the pintle valve seat and the air passage with a suitable fuel system cleaner.

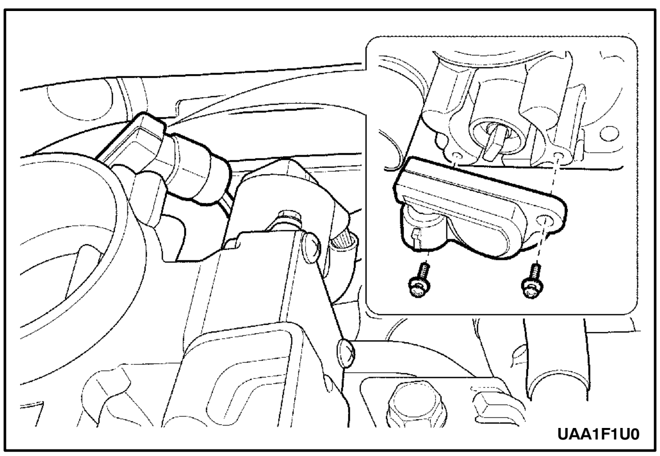
9. Installation should follow the removal procedure in the reverse order.

THROTTLE POSITION (TP) SENSOR (2.0L DOHC)

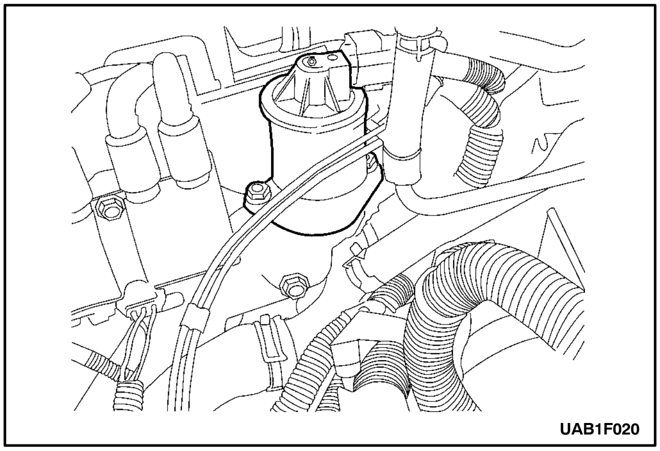
Removal and Installation Procedure


UAA1C080

1. Disconnect the negative battery cable.
2. Disconnect the IAT sensor connector.
3. Disconnect the breather hose from the valve cover.
4. Remove the air intake tube from the throttle body.


UAA1F1U0

5. Disconnect the throttle position (TP) sensor connector.
6. Remove the TP sensor retaining screws and the TP sensor.
7. Installation should follow the removal procedure in the reverse order



EXHAUST GAS RECIRCULATION (EGR) VALVE (1.6L DOHC)

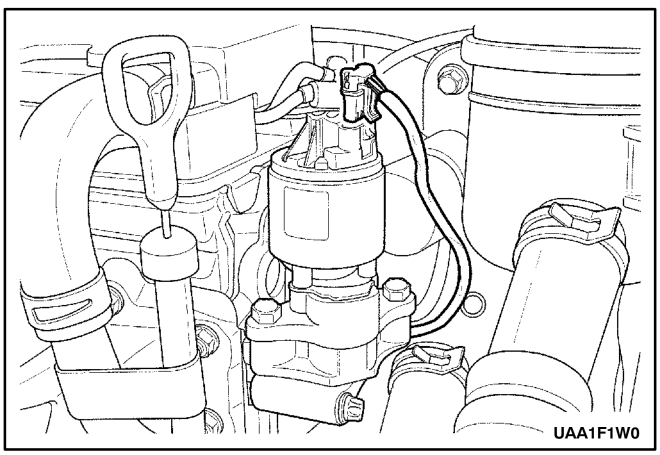
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the exhaust gas recirculation (EGR) valve connector.
3. Remove the EGR valve bolts.

Installation Notice

Tightening Torque	30 N·m (22 lb–ft)

4. Remove the EGR valve and gasket.
5. Installation should follow the removal procedure in the reverse order.



EXHAUST GAS RECIRCULATION VALVE (2.0L DOHC)

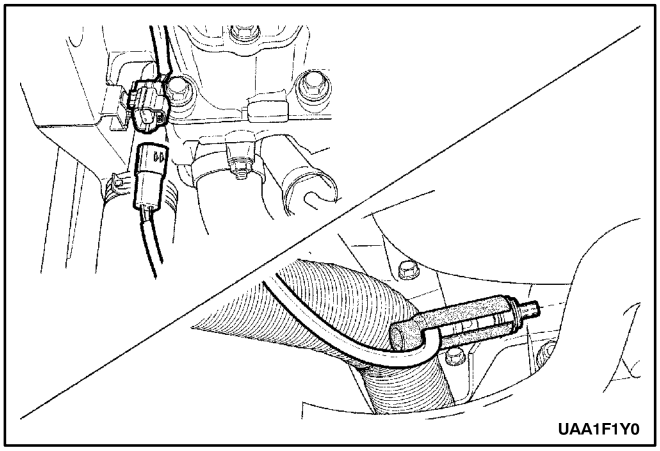
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the exhaust gas recirculation (EGR) valve connector.
3. Remove the EGR valve bolts.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

4. Remove the EGR valve and gasket.
5. Installation should follow the removal procedure in the reverse order.



OXYGEN SENSOR (O2S 1) (1.6L DOHC)

Removal and Installation Procedure

1. Disconnect the negative battery cable.

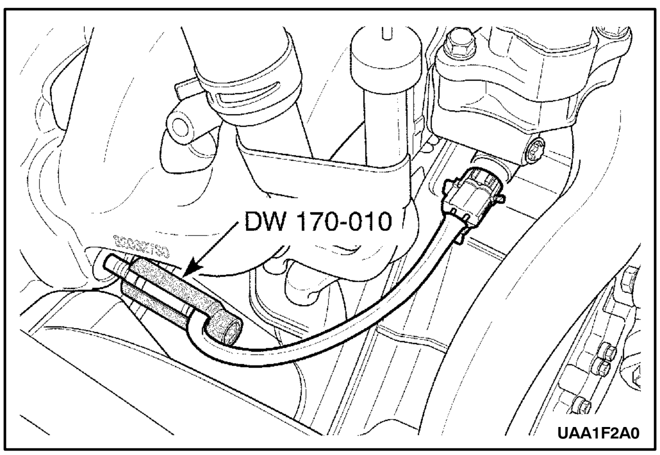
Notice: The oxygen sensor (O2S 1) uses a permanently attached pigtail and connector. This pigtail should not be removed from the O2S 1. Damage or removal of the pigtail or the connector could affect proper operation of the O2S 1. Take care when handling the O2S 1. Do not drop or damage the O2S 1.

2. Disconnect the O2S 1 connector.
3. Remove the exhaust manifold heat shield. Refer to *Section 1G, Engine Exhaust.*
4. Remove the O2S 1 from the exhaust manifold.

Installation Notice

Tightening Torque	41 N·m (30 lb–ft)

5. Installation should follow the removal procedure in the reverse order.



OXYGEN SENSOR (O2S 1) (2.0L DOHC)

Removal and Installation Procedure

1. Disconnect the negative battery cable.

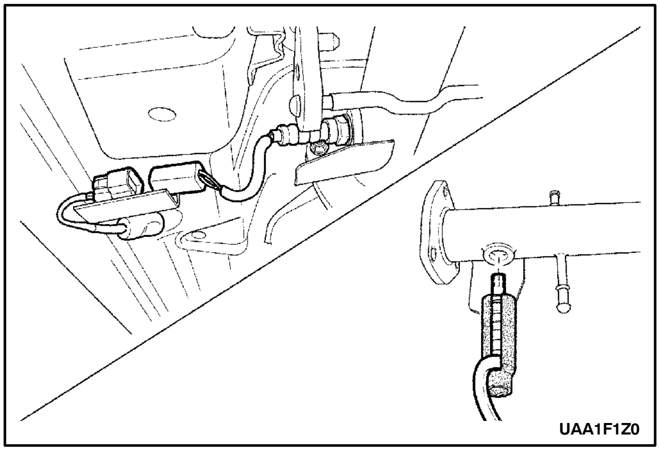
Notice: The oxygen sensor (O2S 1) uses a permanently attached pigtail and connector. This pigtail should not be removed from the O2S 1. Damage or removal of the pigtail or the connector could affect proper operation of the O2S 1. Take care when handling the O2S1. Do not drop or damage the O2S 1.

2. Disconnect the O2S 1 connector.
3. Remove the exhaust manifold heat shield. Refer to *Section 1G, Engine Exhaust.*
4. Remove the O2S 1 from the exhaust manifold.

Installation Notice

Tightening Torque	41 N·m (30 lb–ft)

5. Installation should follow the removal procedure in the reverse order.



HEATED OXYGEN SENSOR (HO2S 2) (TYPICAL)

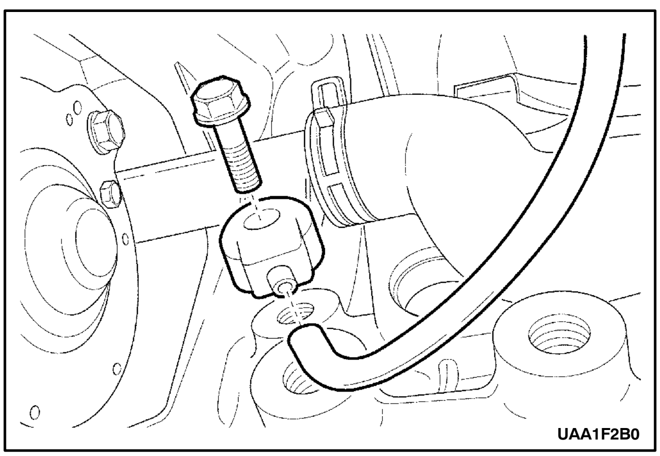
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the oxygen sensor 2 (HO2S 2) connector.
3. Remove the front exhaust pipe. Refer to *Section 1G, Engine Exhaust.*
4. Remove the HO2S 2 from the front exhaust pipe.

Installation Notice

Tightening Torque	41 N·m (30 lb–ft)

5. Installation should follow the removal procedure in the reverse order.



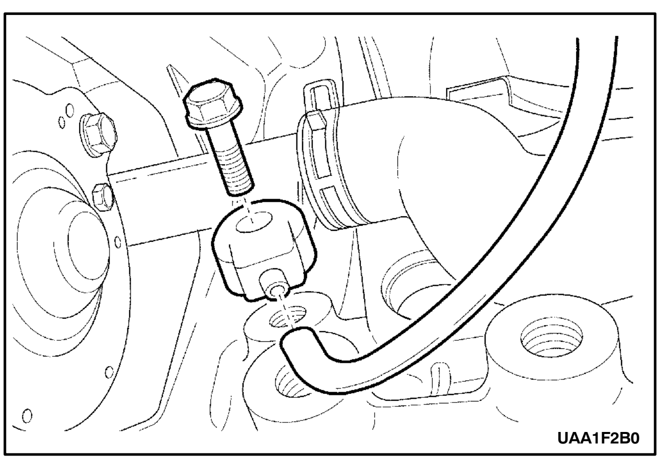
KNOCK SENSOR (1.6L DOHC)

Removal and Installation Procedure

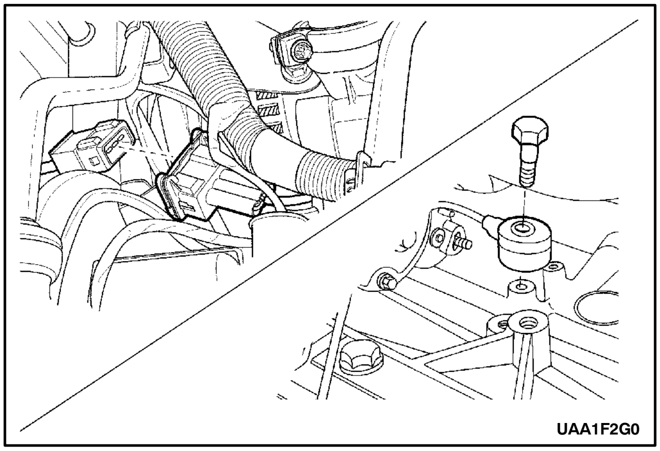
1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Remove the intake manifold bracket. Refer to *Section 1C, DOHC Engine Mechanical.*
4. Disconnect the knock sensor connector.
5. Remove the bolt and the knock sensor.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)



6. Installation should follow the removal procedure in the reverse order.



KNOCK SENSOR (2.0L DOHC)

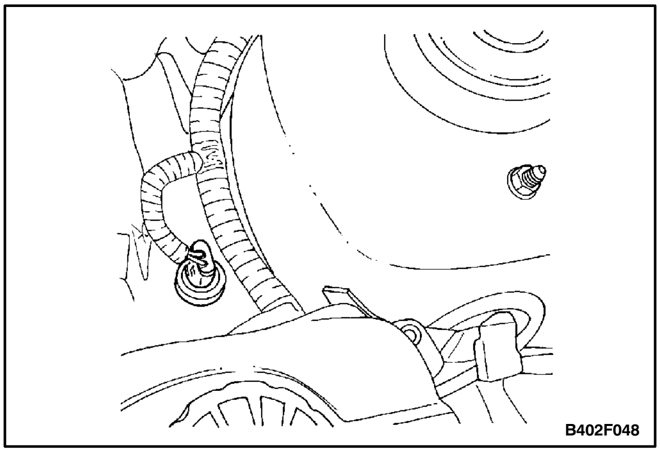
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the knock sensor connector.
3. Remove the bolt and the knock sensor.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

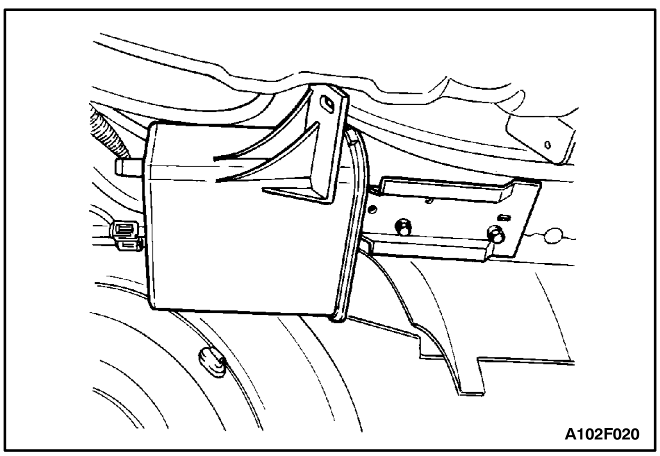
4. Installation should follow the removal procedure in the reverse order.



G SENSOR (2.0L DOHC)

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the G sensor electrical connector and remove the G sensor.
3. Installation should follow the removal procedure in the reverse order.



EVAPORATIVE EMISSION CANISTER

Removal and Installation Procedure

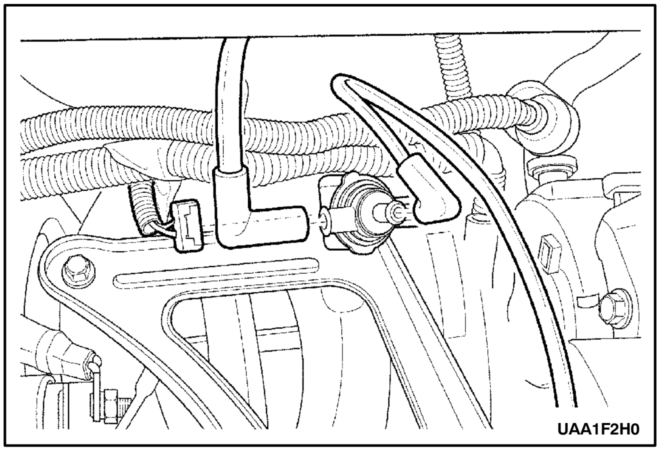
Caution: Canister and vacuum hoses contain fuel vapors. Do not smoke in the area or permit an open flame.

1. Disconnect the negative battery cable.
2. Disconnect the canister fuel vapor hoses.
3. Remove the bolt that secures the canister flange to the vehicle.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

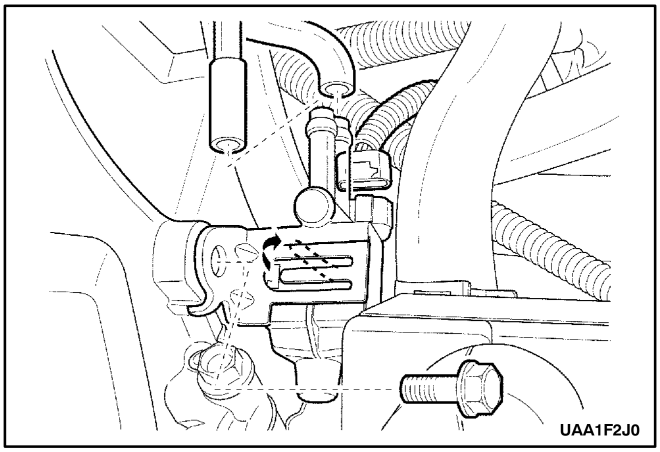
4. Slide the canister out of the track holder.
5. Remove the evaporative emission canister.
6. Installation should follow the removal procedure in the reverse order.



EVAPORATIVE EMISSION CANISTER PURGE SOLENOID (1.6L DOHC)

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the evaporative emission (EVAP) canister purge solenoid connector.
3. Disconnect the vacuum hoses from the EVAP canister purge solenoid.
4. Unclip the EVAP canister purge solenoid from the mounting bracket.
5. Installation should follow the removal procedure in the reverse order.



EVAPORATIVE EMISSION CANISTER PURGE SOLENOID (2.0L DOHC)

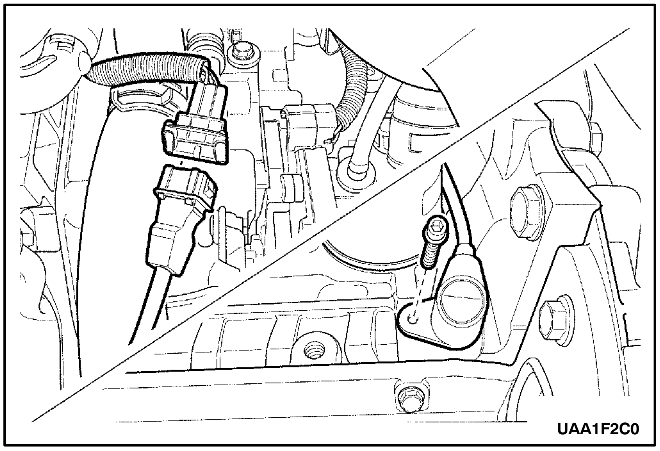
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the evaporative (EVAP) emission canister purge solenoid bracket bolt from the intake manifold.

Installation Notice

Tightening Torque	5 N·m (44 lb–in)

3. Disconnect the vacuum hoses form the EVAP emission canister purge solenoid.
4. Disconnect the EVAP emission canister purge solenoid connector.
5. Unclip the EVAP emission canister purge solenoid from the mounting bracket.
6. Installation should follow the removal procedure in the reverse order.



UAA1F2C0

CRANKSHAFT POSITION (CKP) SENSOR (1.6L DOHC)

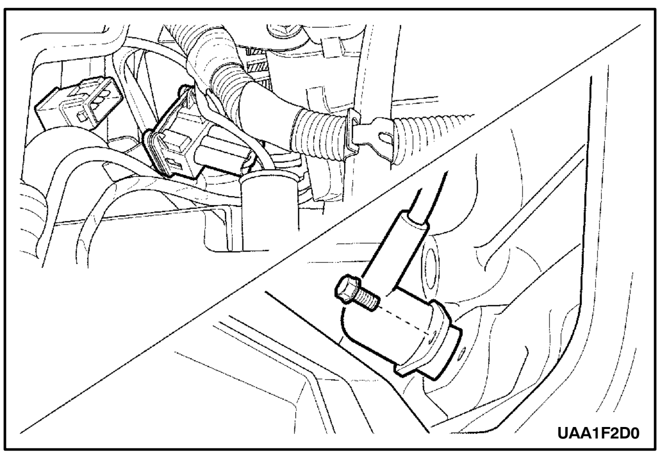
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the crankshaft position (CKP) sensor connector.
3. Remove the CKP sensor retaining bolt.

Installation Notice

Tightening Torque	7 N·m (62 lb–in)

4. Remove the CKP sensor.
5. Installation should follow the removal procedure in the reverse order.



UAA1F2D0

CRANKSHAFT POSITION (CKP) SENSOR (2.0L DOHC)

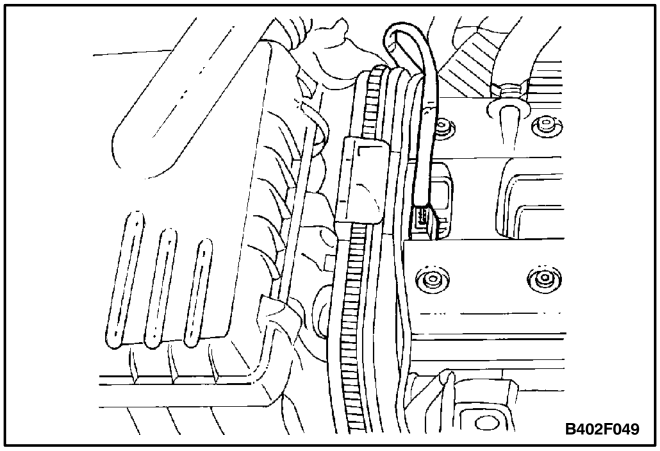
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the injector channel cover. Refer to *“Fuel Rail and Injectors”* in this section.
3. Disconnect the crankshaft position (CKP) sensor connector.
4. Remove the front exhaust pipe. Refer to *Section 1G, “Engine Exhaust”*
5. Remove the CKP sensor retaining bolt.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

6. Remove the CKP sensor.
7. Installation should follow the removal procedure in the reverse order.



CAMSHAFT POSITION (CMP) SENSOR (1.6L DOHC)

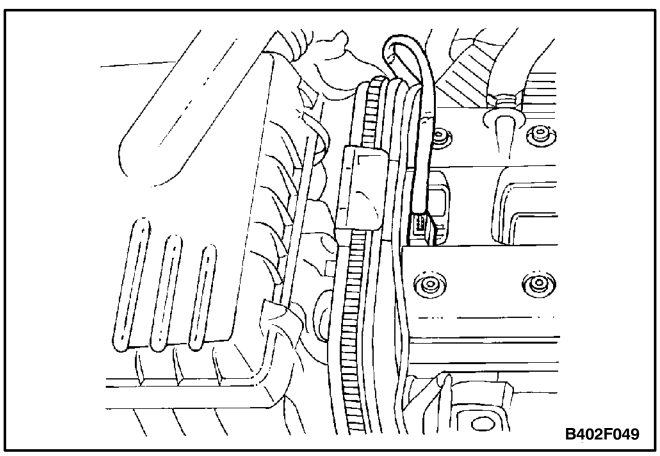
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the breather tube from the valve cover.
3. Disconnect the camshaft position (CMP) sensor connector.
4. Remove the CMP sensor retaining bolt.

Installation Notice

Tightening Torque	12 N·m (106 lb–in)

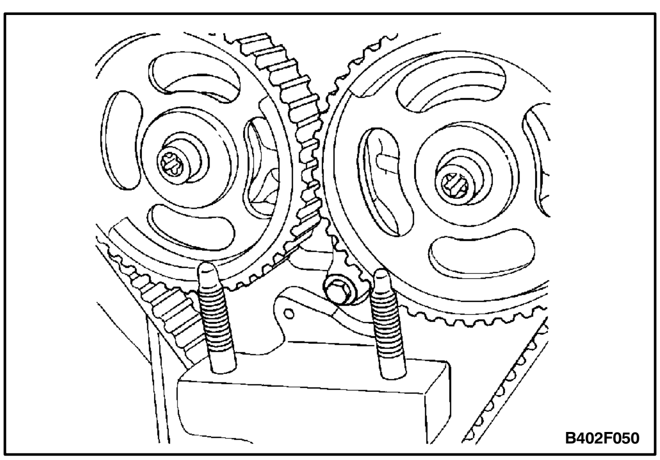
5. Remove the CMP sensor.
6. Installation should follow the removal procedure in the reverse order.



CAMSHAFT POSITION (CMP) SENSOR (2.0L DOHC)

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the engine cover.
3. Disconnect the camshaft position (CMP) sensor connector.

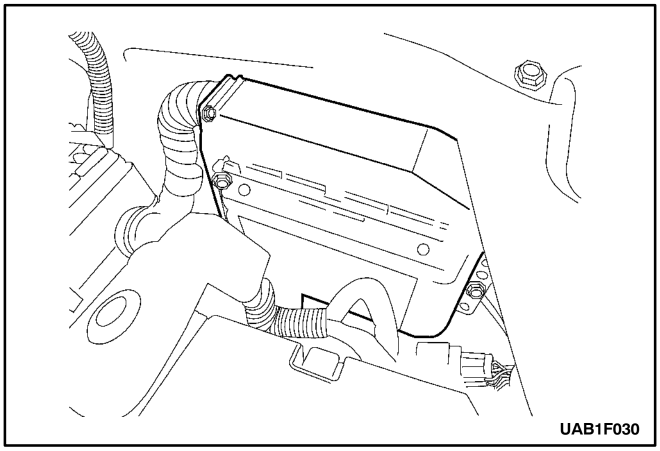


4. Remove the timing belt front cover. Refer to *Section 1C, DOHC Engine Mechanical.*
5. Remove the CMP sensor bolts.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

6. Remove the CMP sensor from the top.
7. Installation should follow the removal procedure in the reverse order.



ENGINE CONTROL MODULE (1.6L DOHC)

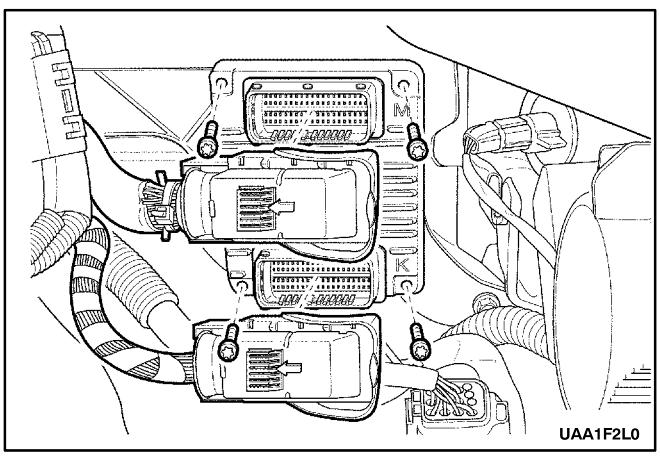
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the engine control module (ECM) connector from the ECM.
3. Remove the ECM retaining nuts.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

4. Remove the ECM from the ECM mounting bracket.
5. Installation should follow the removal procedure in the reverse order.



ENGINE CONTROL MODULE (2.0L DOHC)

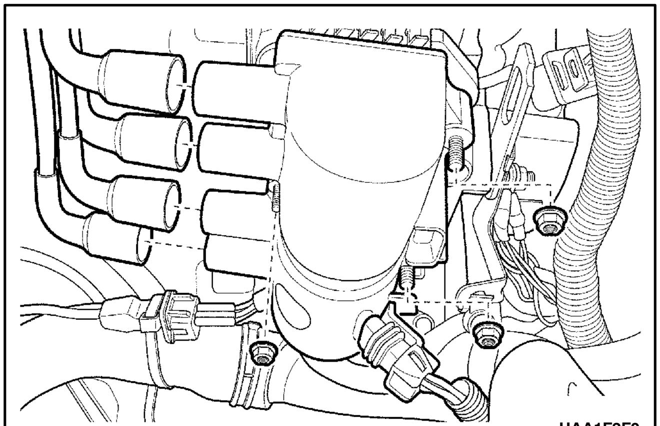
Removal and Installation Procedure

1. Remove the negative battery cable. Refer to *Section 1E, Engine Electrical.*
2. Disconnect the engine control module (ECM) connectors from the ECM.
3. Remove the ECM-to-bracket bolts.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

4. Remove the ECM from the ECM bracket.
5. Installation should follow the removal procedure in the reverse order.


UAA1F2F0

ELECTRONIC IGNITION (EI) SYSTEM IGNITION COIL (1.6L DOHC)

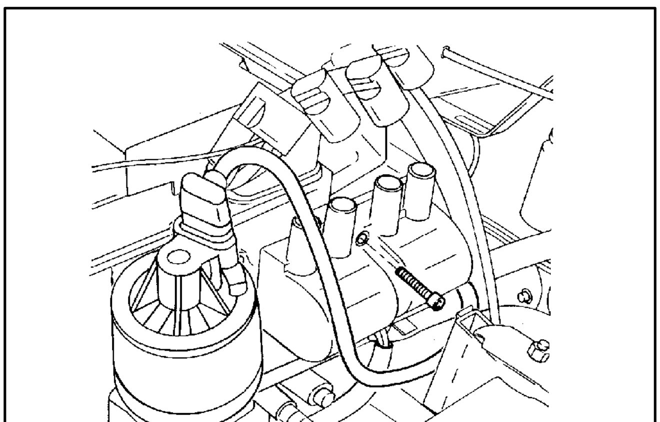
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the power steering fluid reservoir. Refer to *Section 6A, Power Steering System.*
3. Note the ignition wire location and disconnect the ignition wires from the EI system ignition coil.
4. Disconnect the EI system ignition coil connector.
5. Remove the EI system ignition coil retaining nuts.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

6. Remove the EI system ignition coil.
7. Installation should follow the removal procedure in the reverse order.


C402F047

ELECTRNIC IGNITION (EI) SYSTEM IGNITION COIL (2.0L DOHC)

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Note the ignition wire location and disconnect the ignition wires from the EI system ignition coil.
3. Remove the EI system ignition coil retaining bolts.
4. Disconnect the EI system ignition coil connector.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

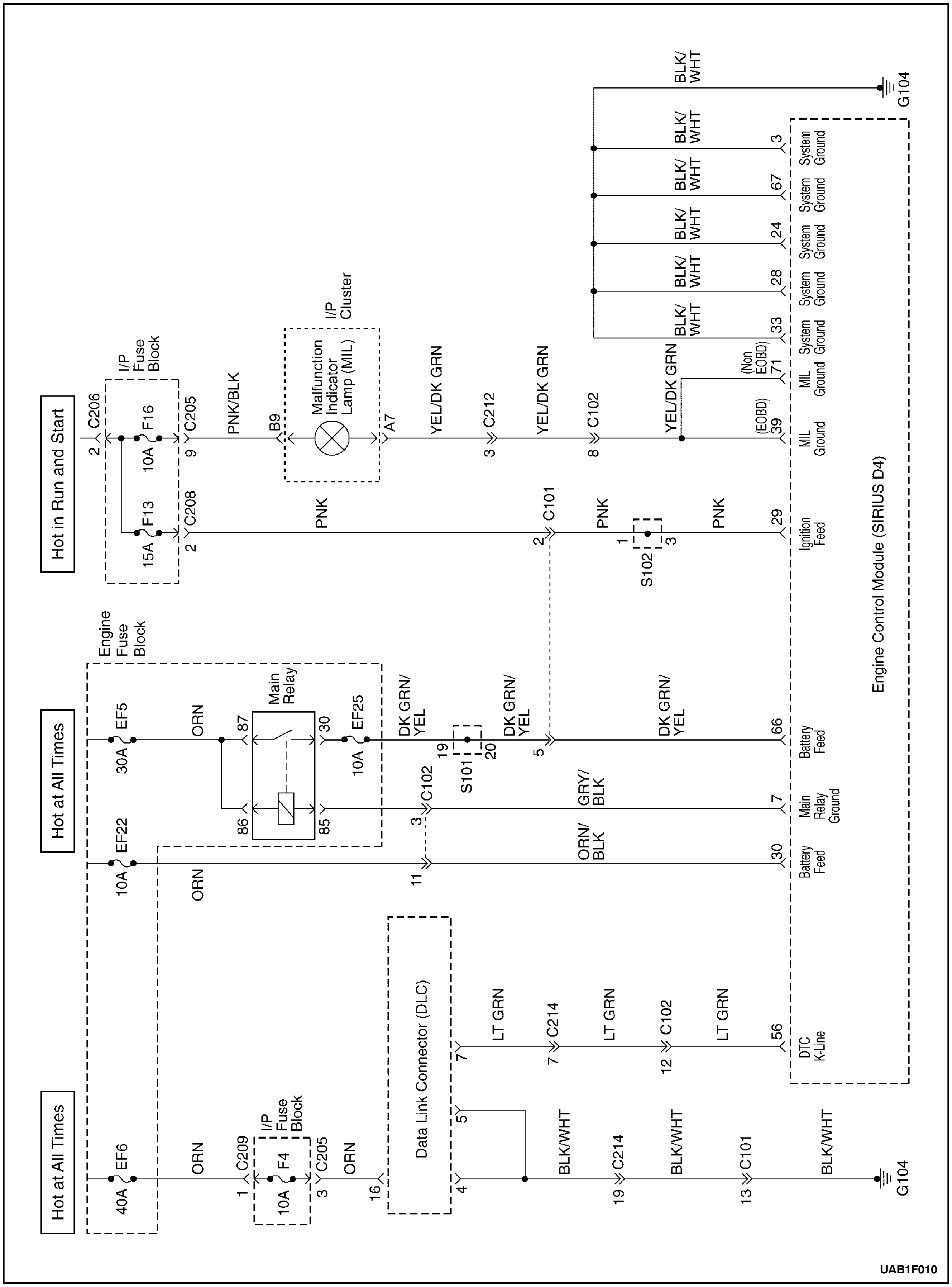
5. Remove the EI system ignition coil.
6. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

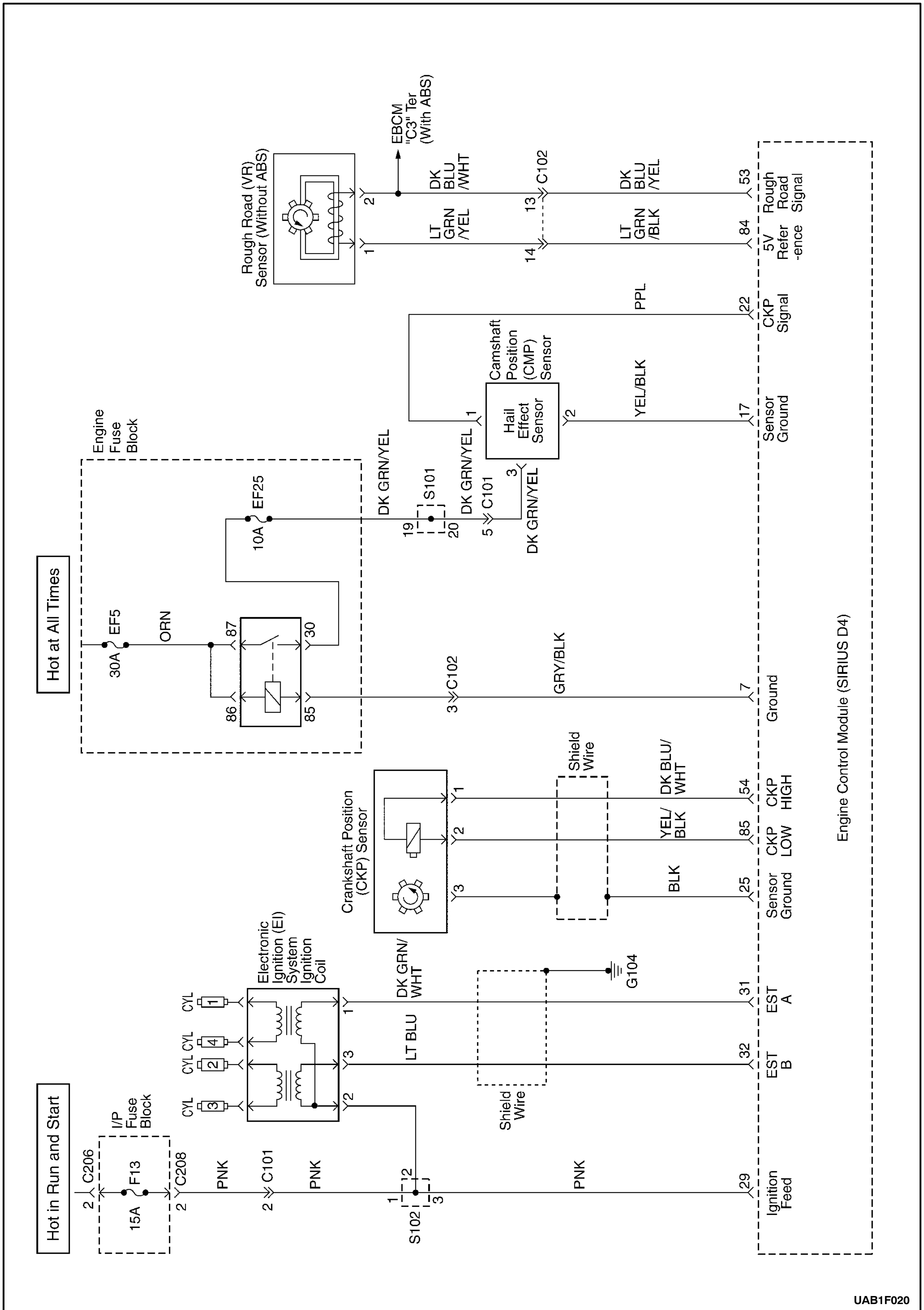
FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Accessory Mounting Bracket Bolts	35	26	–
Camshaft Position Sensor Bolts	12	–	106
Controlled Canister Purge Solenoid Bracket Bolt	5	–	44
Engine Coolant Temperature (ECT) Sensor	10	–	89
Crankshaft Position (CKP) Sensor Retaining Bolt	10	–	89
Electronic Ignition (EI) System Ignition Coil Retaining Bolts	10	–	89
Evaporative Emission Canister Flange Bolt	4	–	35
Evaporative Emission Canister Protective Cover	8	–	71
Evaporative Emission Canister Solenoid Bracket Bolts	5	–	44
Exhaust Gas Recirculation (EGR) Valve Retaining Bolts	20	15	–
Fuel Cutoff Switch Bolt	3	–	27
Fuel Pressure Regulator Retaining Bolt	10	–	89
Fuel Pressure Regulator Retaining Clamp	12	–	106
Fuel Rail Retaining Bolts	25	18	–
Fuel Tank Strap Retaining Nuts	22	16	–
Heated Oxygen Sensor	41	30	–
Main Throttle Idle Actuator (MTIA) Bolts	3	–	27
Knock Sensor Bolt	20	15	–
Intake Air Temperature (IAT) Sensor	20	15	–
Manifold Absolute Pressure (MAP) Sensor Retaining Bolt	10	–	89
Oxygen Sensor	41	30	–
Rear A/C Compressor Mounting Bracket Bolts	35	26	–
Throttle Body Retaining Nut (2.0L DOHC)	9	–	80
Throttle Body Retaining Nuts (1.6L DOHC)	15	11	–
Throttle Cable Bracket Bolts	10	–	89

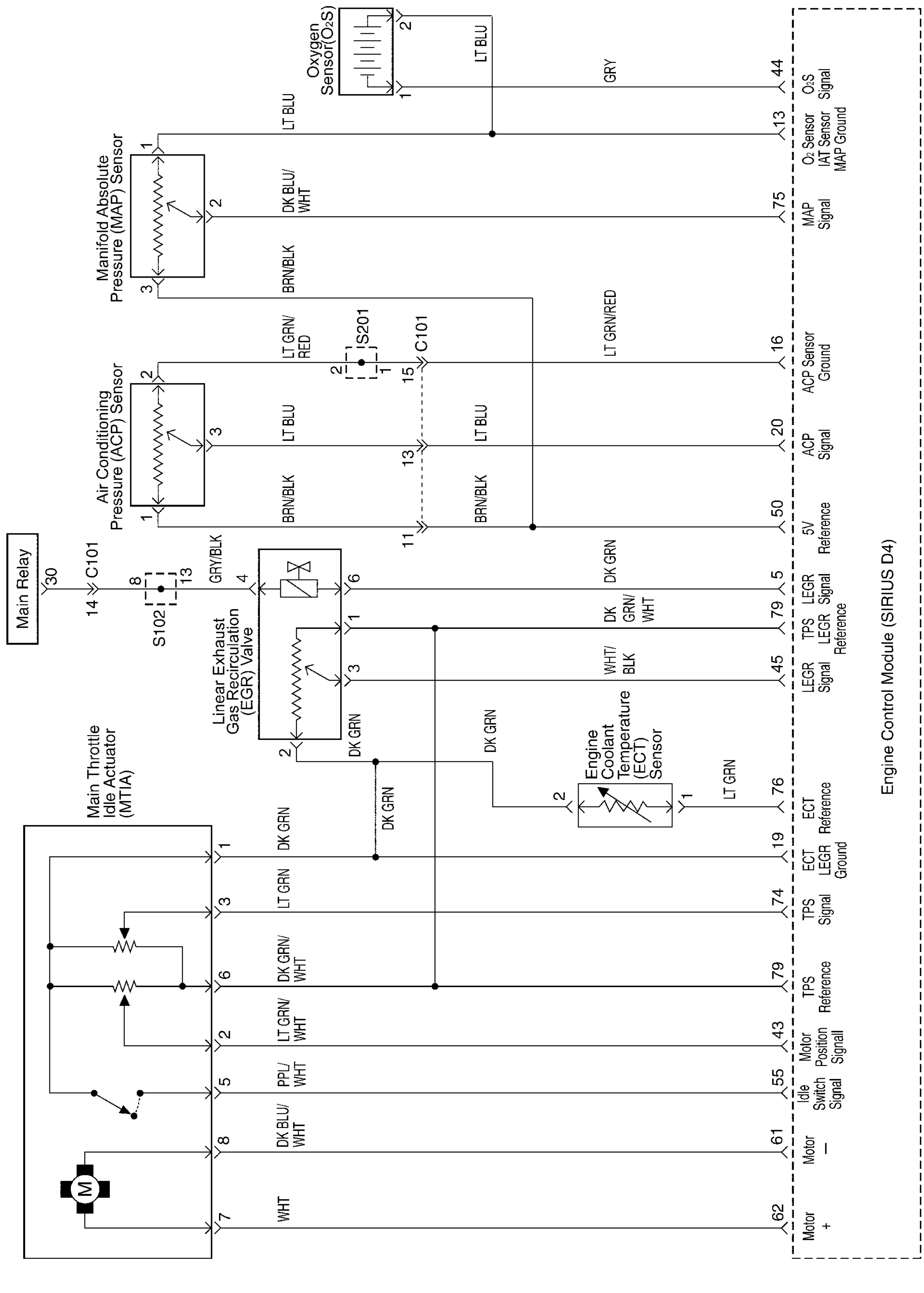
SCHEMETIC AND ROUTING DIAGRAMS



ECM WIRING DIAGRAM (1.6L DOHC, SIRIUS D4 – 2 OF 6)



ECM WIRING DIAGRAM (1.6L DOHC, SIRIUS D4 – 3 OF 6)



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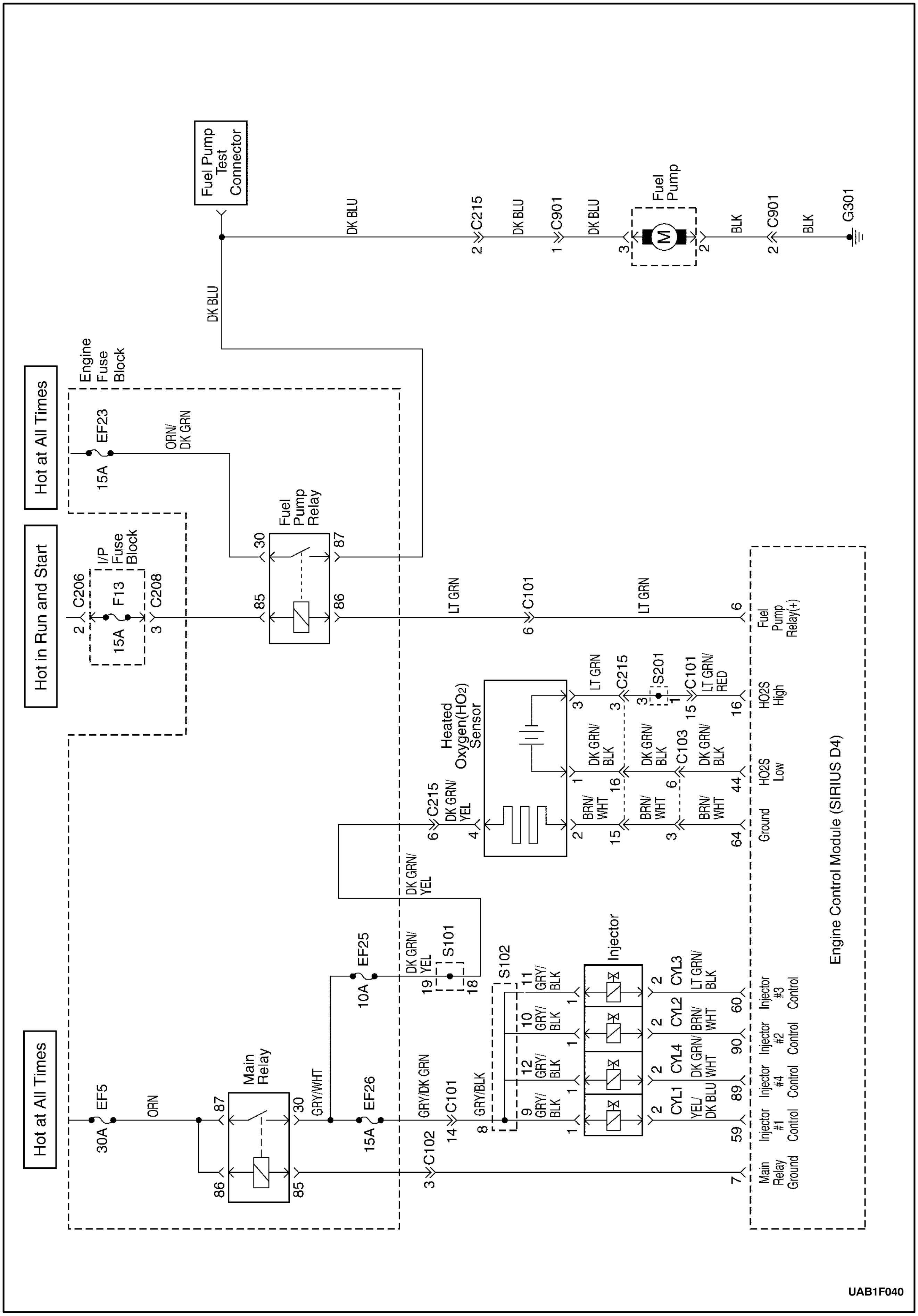
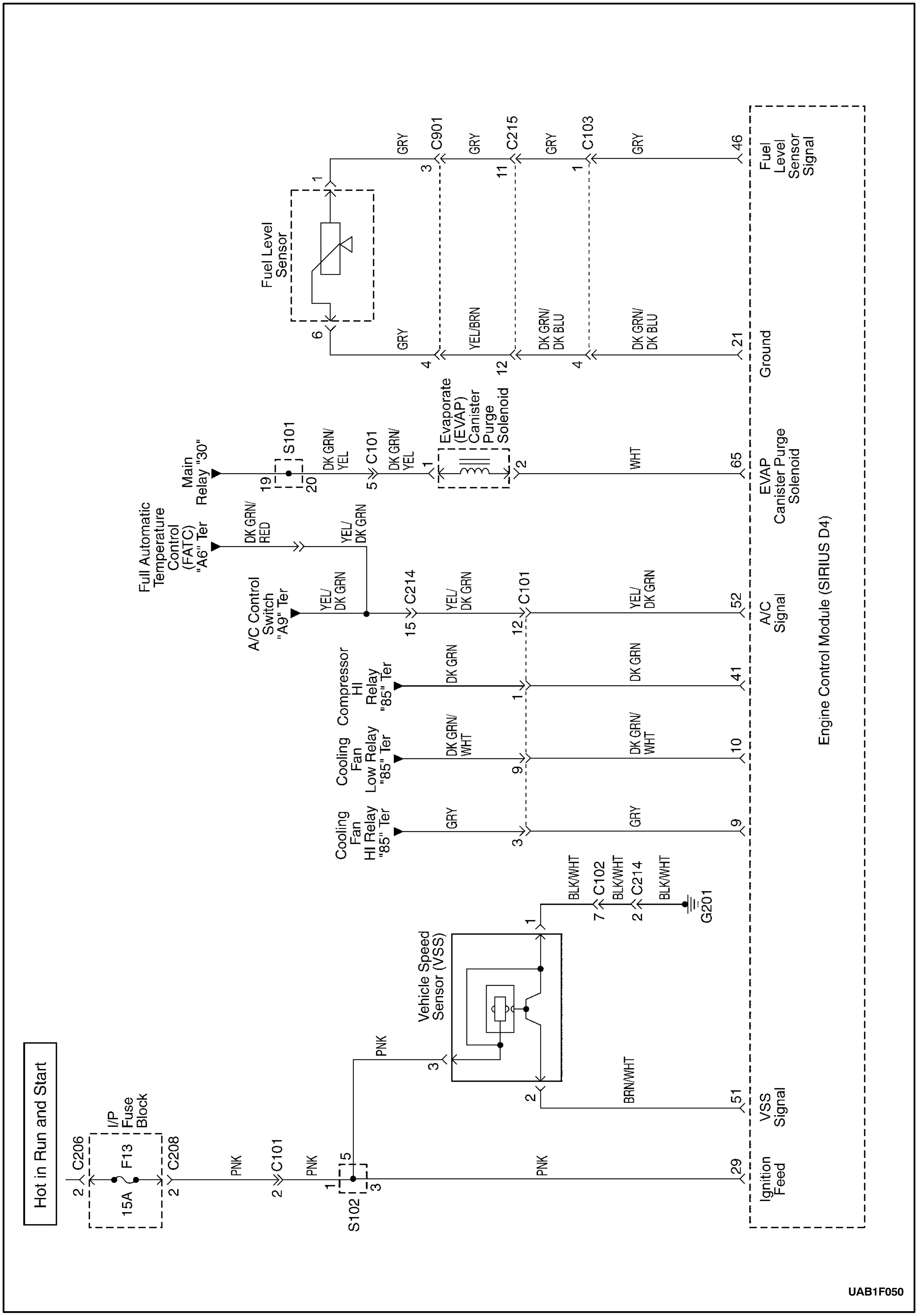
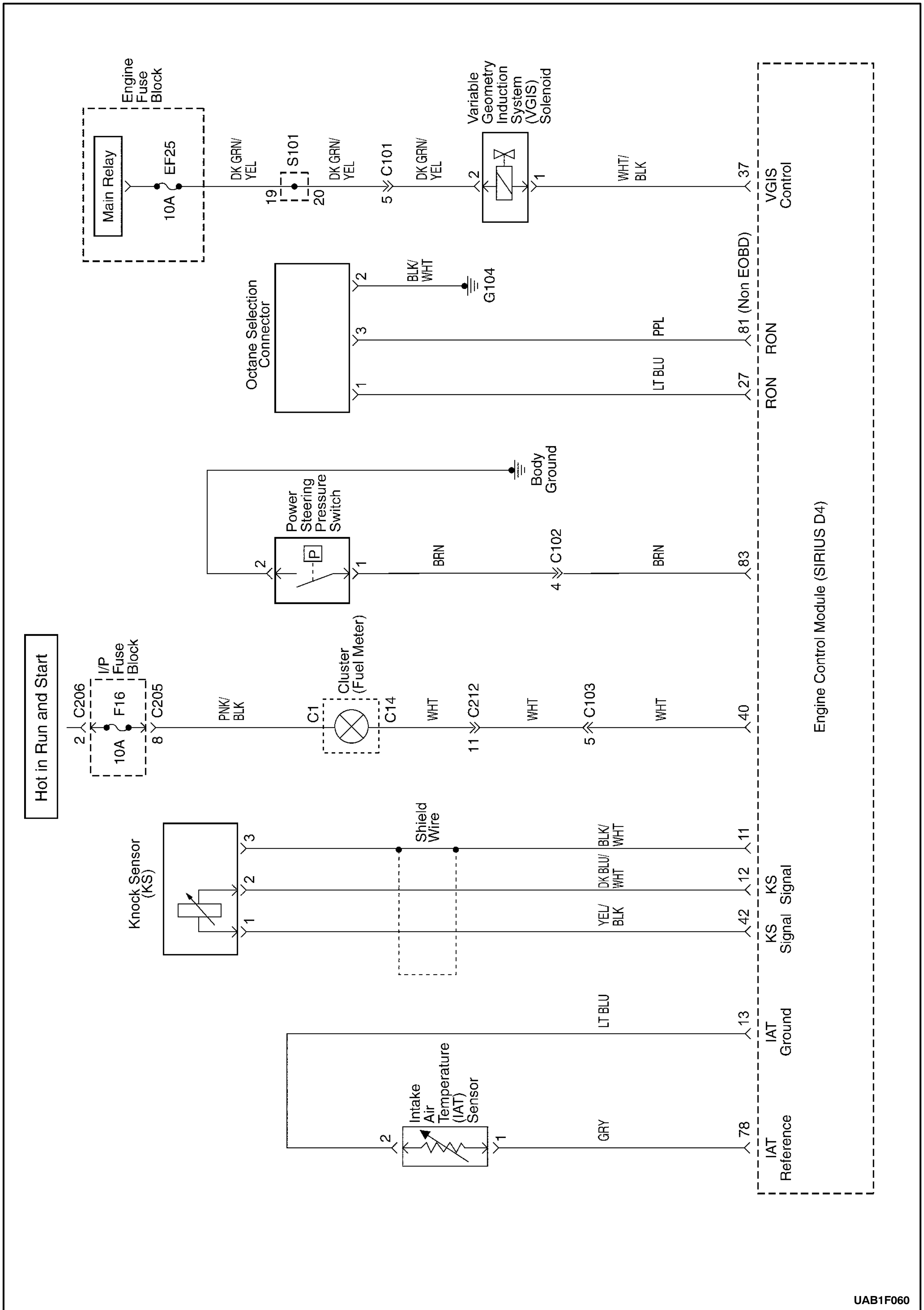
ECM WIRING DIAGRAM (1.6L DOHC, SIRIUS D4 – 4 OF 6)



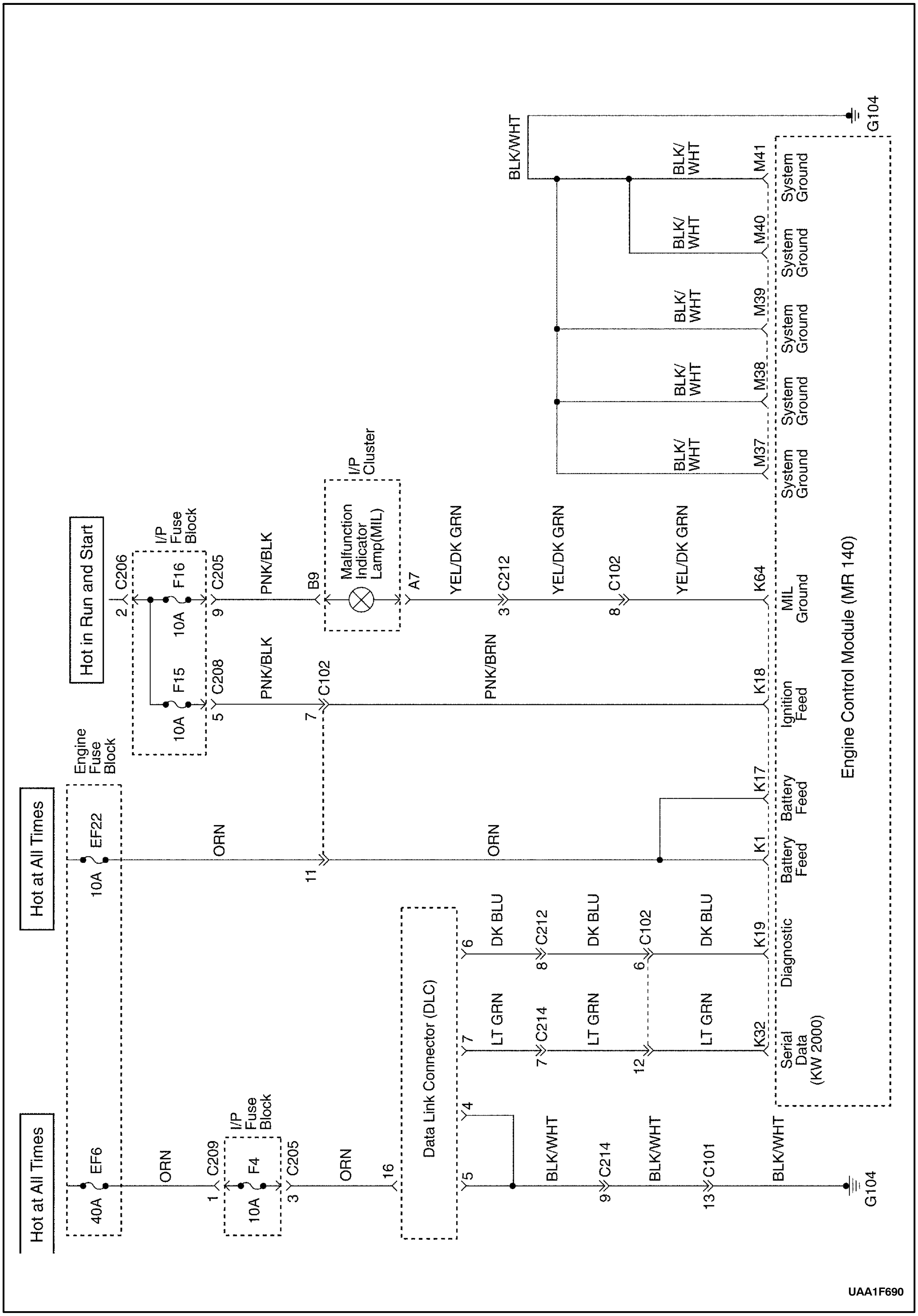
ECM WIRING DIAGRAM (1.6L DOHC, SIRIUS D4 – 5 OF 6)



ECM WIRING DIAGRAM (1.6L DOHC, SIRIUS D4 – 6 OF 6)



ECM WIRING DIAGRAM (2.0L DOHC, MR–140 – 1 OF 5)



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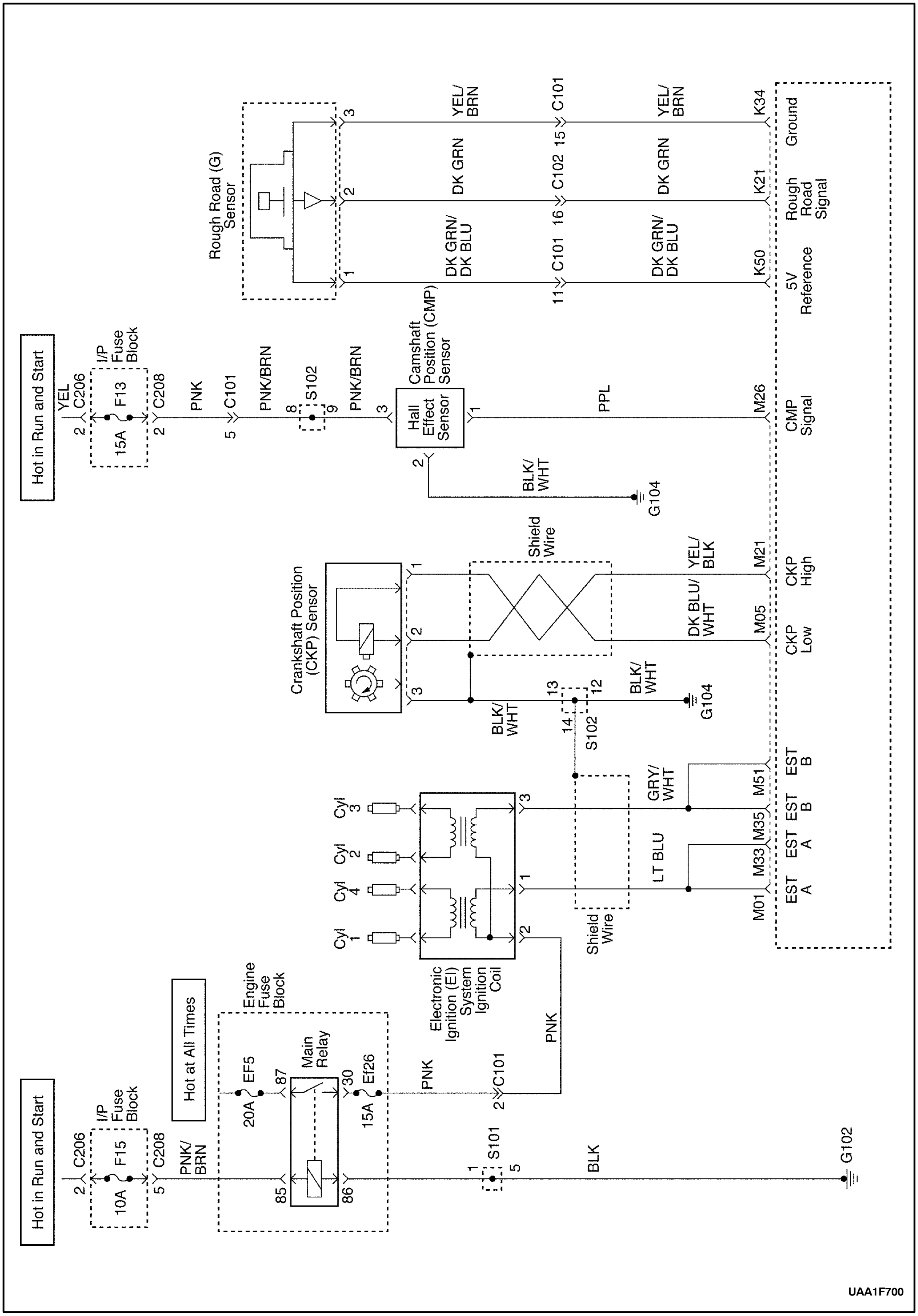

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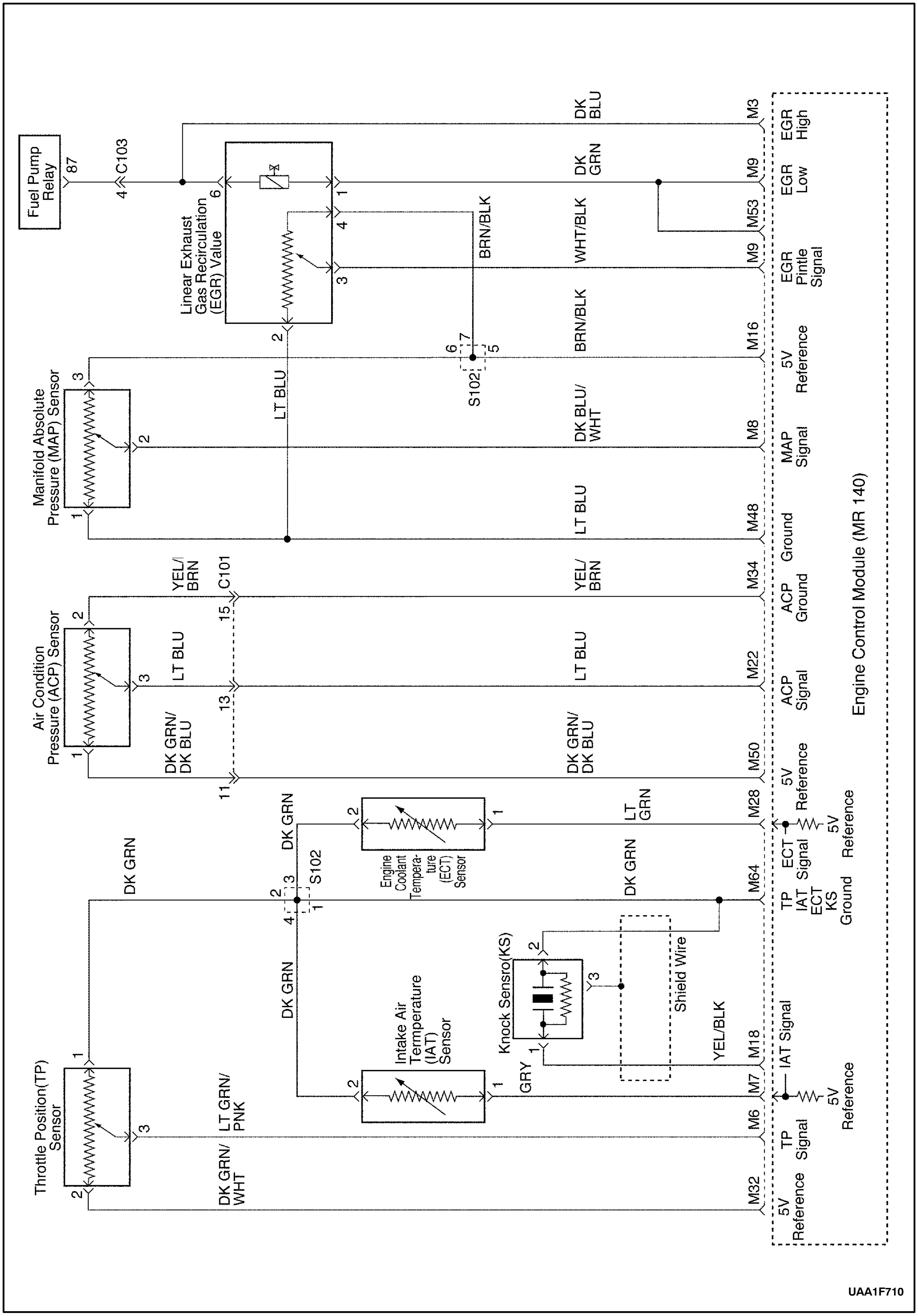
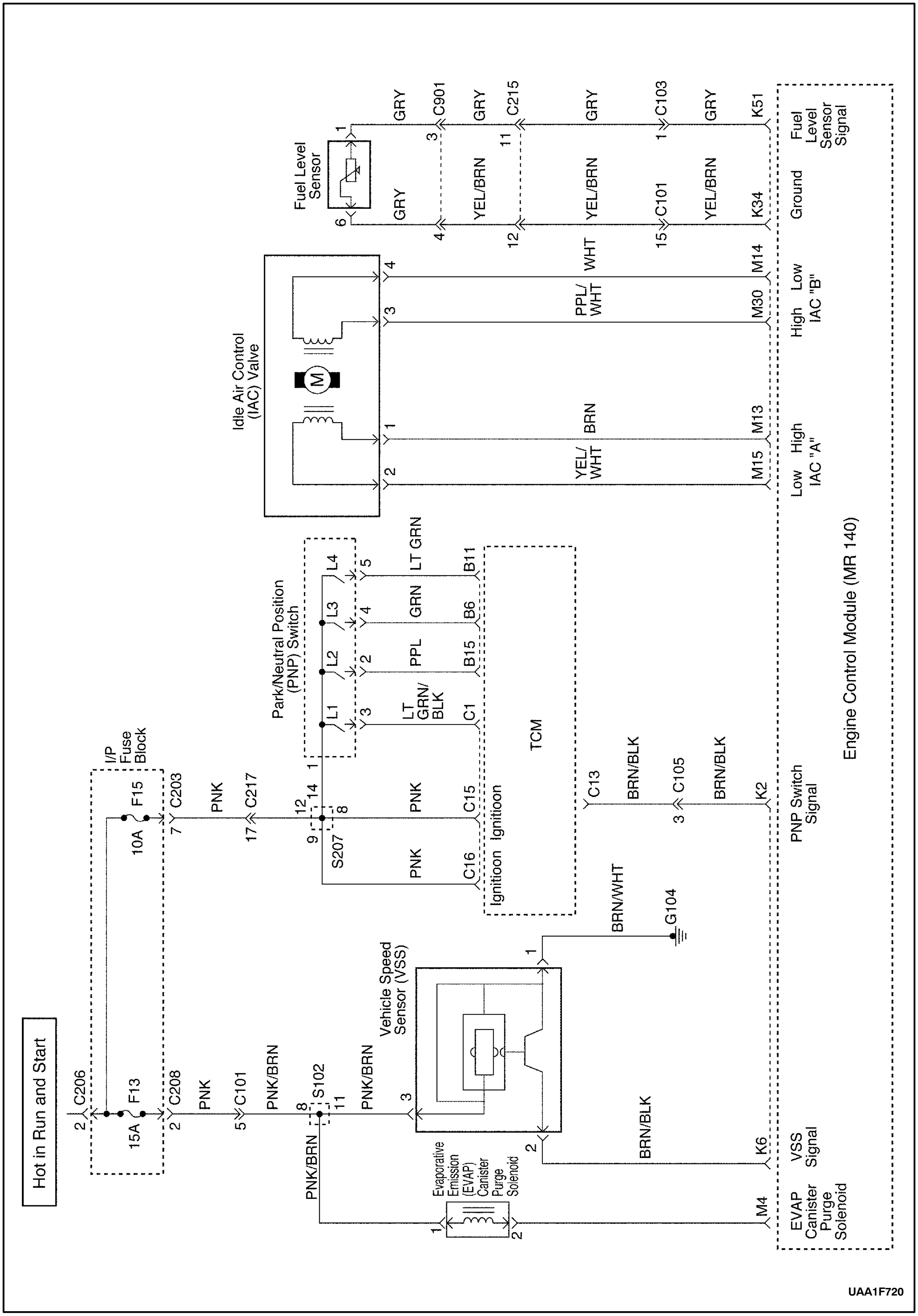
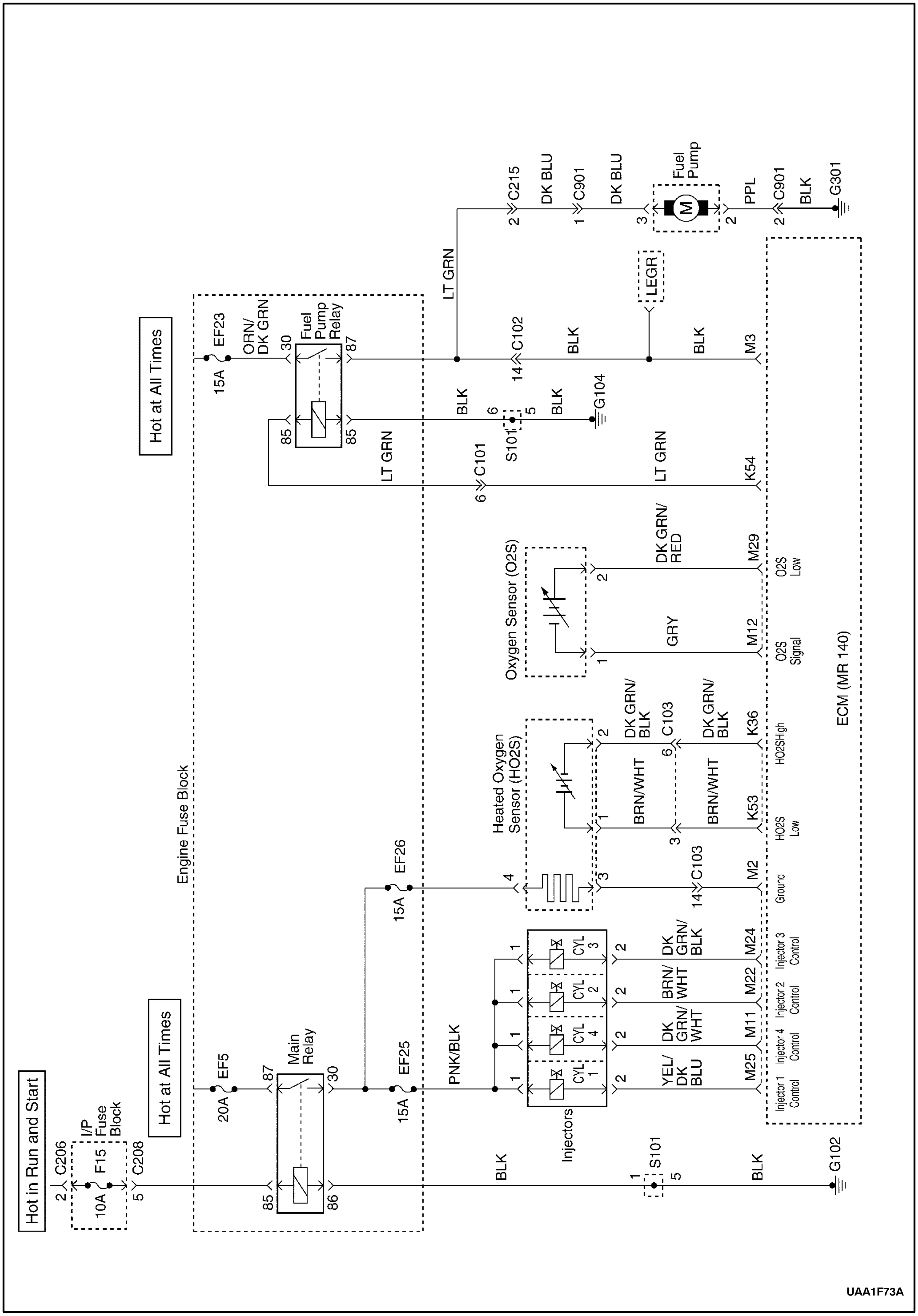


ECM WIRING DIAGRAM (2.0L DOHC, MR–140 – 4 OF 5)



ECM WIRING DIAGRAM (2.0L DOHC, MR–140 – 5 OF 5)



SECTION 1G

ENGINE EXHAUST

DESCRIPTION AND OPERATION

EXHAUST SYSTEM

Notice: When you are inspecting or replacing exhaust system components, make sure there is adequate clearance from all points on the underbody to avoid possible overheating of the floor pane and possible damage to the passenger compartment insulation and trim materials.

Check the complete exhaust system and the nearby body areas and trunk lid for broken, damaged, missing or mispositioned parts, open seams, holes, loose connections, or other deterioration which could permit exhaust fumes to seep into the trunk or passenger compartment. Dust or water in the trunk may be an indication of a problem in one of these areas. Any defects should be corrected immediately.

MUFFLER

The exhaust system uses a flange and gasket-sealing design rather than a slip joint coupling design with clamp and U-bolts. If holes, open seams, or any deterioration is discovered upon inspection of the front muffler and pipe assembly, the complete assembly should be replaced. The same procedure is applicable to the rear muffler assembly.

Heat shields for the front and rear muffler assembly and the catalytic converter protect the vehicle and the environment from the high temperatures that the exhaust system develops.

CATALYTIC CONVERTER

Notice: When jacking or lifting the vehicle from the body side rails, be certain that the lift pads do not contact the catalytic converter, as this could damage the catalytic converter.

Notice: Use of anything other than unleaded fuel will damage the catalyst in the catalytic converter.

The catalytic converter is an emission-control device added to the exhaust system to reduce pollutants from the exhaust gas.

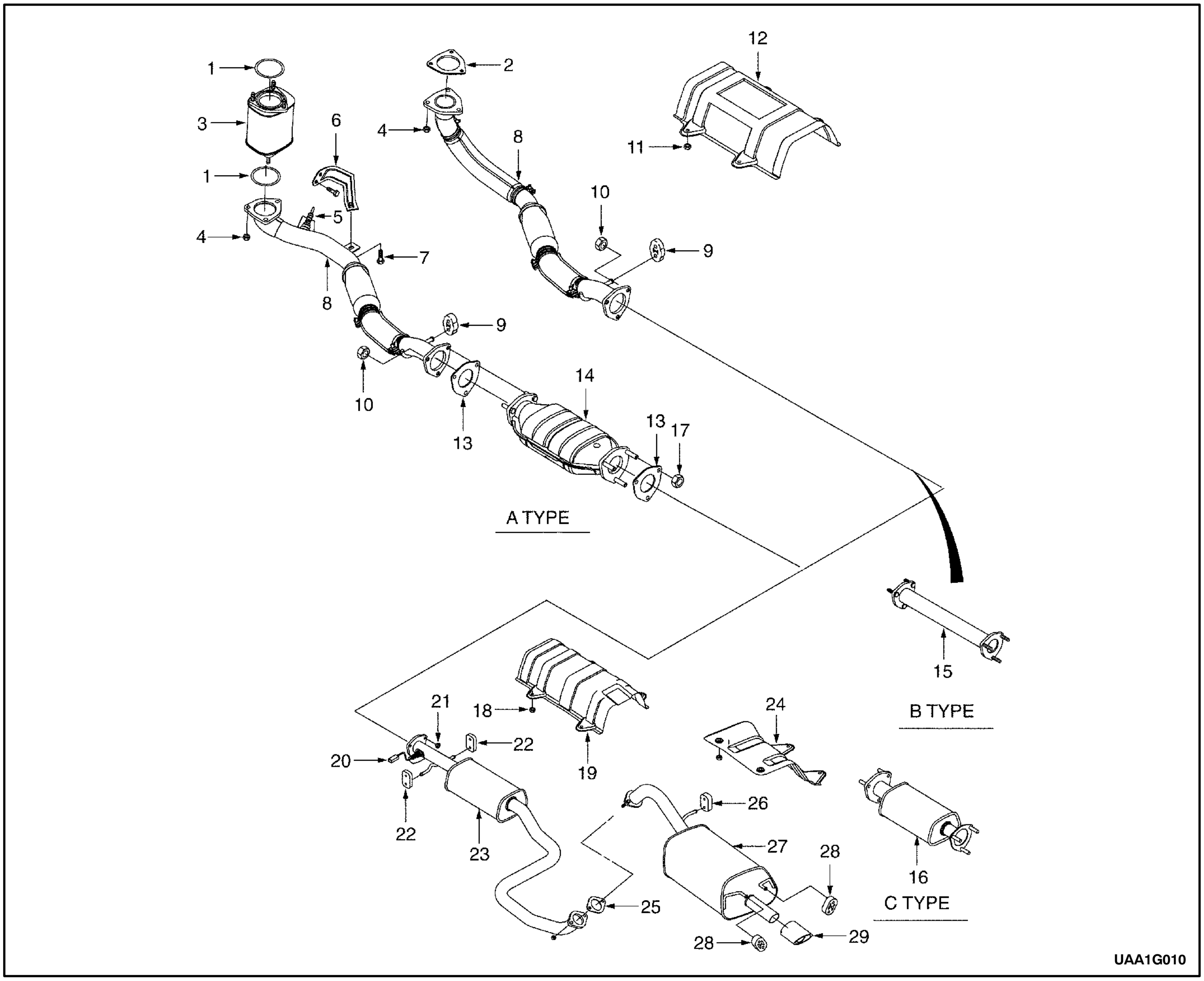
The oxidation catalyst is coated with a catalytic material containing platinum and palladium, which reduces levels of hydrocarbon (HC) and carbon monoxide (CO) from the exhaust gas. The three-way catalyst has coatings which contain platinum and rhodium, which additionally lower the levels of oxides of nitrogen (NOx).

THIRD MUFFLER

Third muffler is used in place of the catalytic converter for those vehicles using leaded fuel to reduce exhaust noise.

COMPONENT LOCATORZD

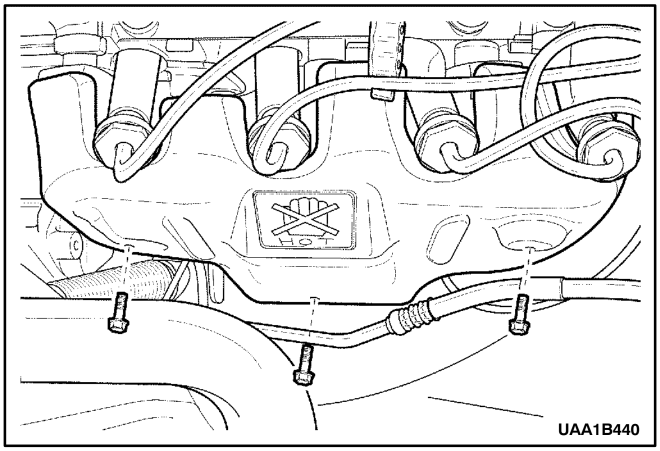
EXHAUST SYSTEM



1 Metal Gasket
2 Metal Gasket
3 Auxiliary Catalytic Converter
4 Nut
5 Heated Oxygen Sensor
6 Upper Bracket
7 Bolt
8 Exhaust Front Pipe
9 Hanger Rubber
10 Nut
11 Nut
12 Catalytic Converter Protective Shield
13 Catalytic Converter Gasket
14 Catalytic Converter
15 Exhaust Connecting Pipe
16 Exhaust Third Muffler
17 Nut
18 Nut
19 Front Muffler Protective Shield
20 Heated Lambda Sensor
21 Nut
22 Hanger Rubber
23 Exhaust Front Muffler
24 Rear Muffler Protective Shield
25 Muffler Rear Gasket
26 Hanger Rubber
27 Exhaust Rear Muffler
28 Hanger Rubber
29 Exhaust Trim Ring

MAINTENANCE AND REPAIR

ON–VEHICLE SERVICE



UAA1B440

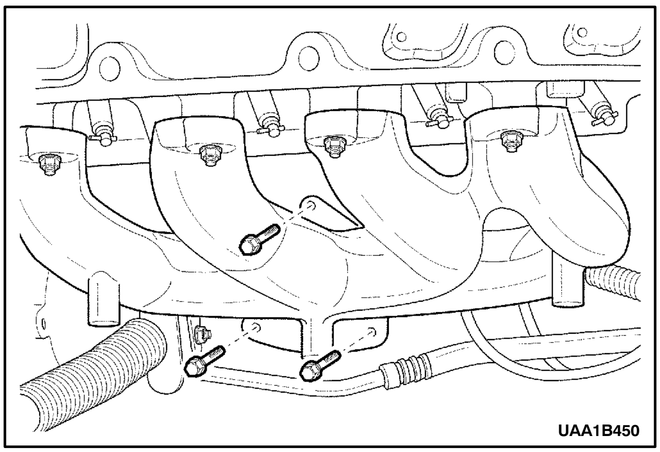
AUXILIARY CATALYTIC CONVERTER

Removal and Installation Procedure

1. Remove the exhaust manifold heat shield bolts and the heat shield.

Installation Notice

Tightening Torque	15 N·m (11 lb–ft)

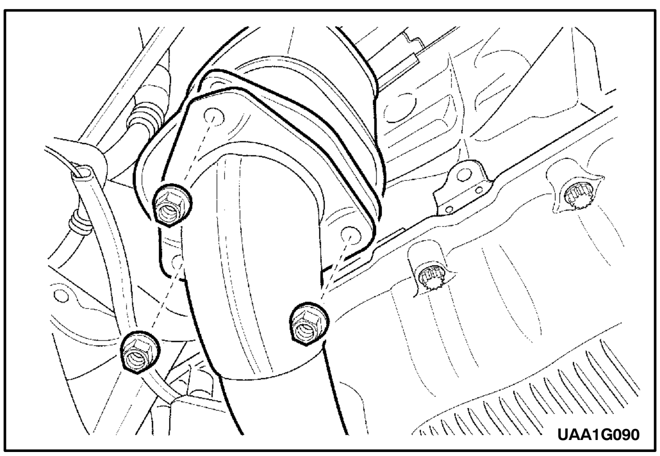


UAA1B450

2. Remove the auxiliary catalytic upper flange nuts.

Installation Notice

Tightening Torque	40 N·m (30 lb–ft)



UAA1G090

3. Raise and suitably support the vehicle.
4. Remove the auxiliary catalytic converter lower flange nuts and ring type from inlet/outlet flange of auxiliary catalytic converter gasket.

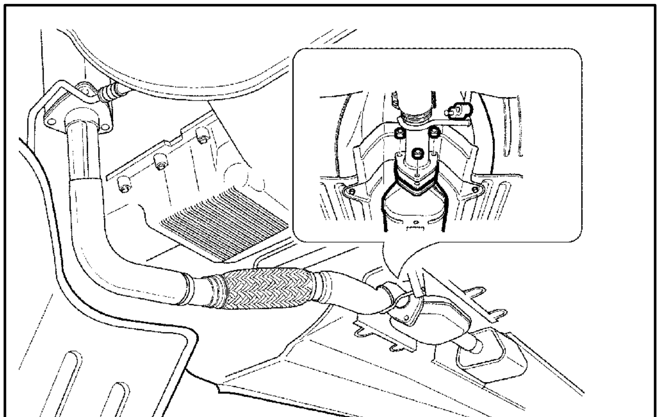
Installation Notice

Tightening Torque	40 N·m (30 lb–ft)

5. Remove the auxiliary catalytic converter.
6. Installation should follow the removal procedure in the reverse order.

MAIN CATALYTIC CONVERTER

Removal and Installation Procedure

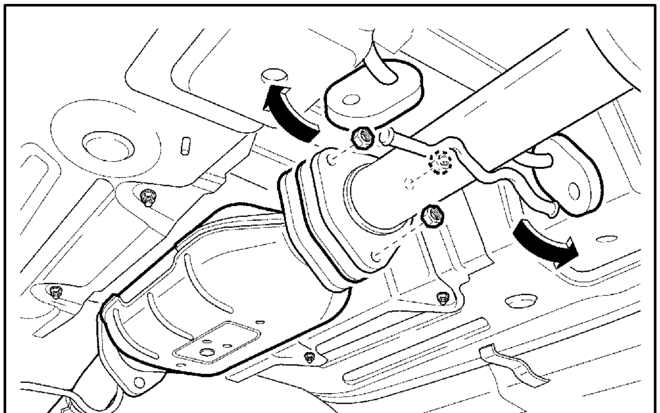

UAA1G030

1. Raise and suitably support the vehicle.
2. Remove the nuts that secure the exhaust front pipe flange to the main catalytic converter flange.

Installation Notice

Tightening Torque	30 N·m (22 lb–ft)

3. Remove the gasket.


UAA1G040

4. Remove the rubbers from hanger welded to front muffler pipe.
5. Remove the nuts that secure the exhaust front muffler flange to the main catalytic converter flange.

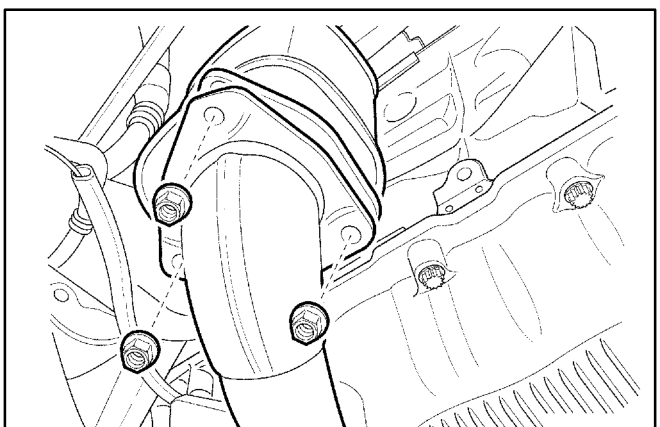
Installation Notice

Tightening Torque	30 N·m (22 lb–ft)

6. Remove the gasket.
7. Installation should follow the removal procedure in the reverse order.

EXHAUST FRONT PIPE

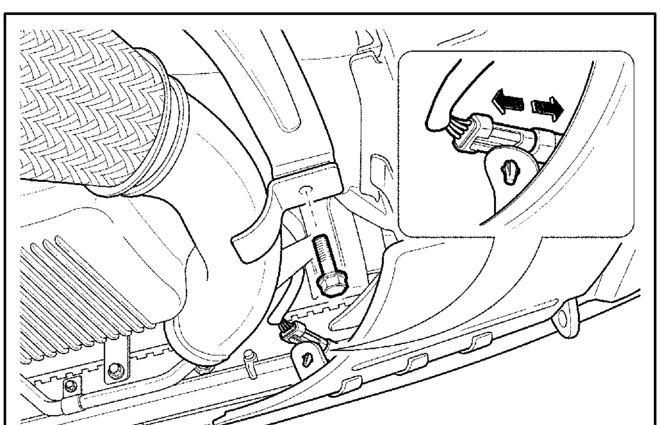
Removal and Installation Procedure


UAA1G090

1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Remove the auxiliary catalytic converter lower flange nuts and ring type gasket.

Installation Notice

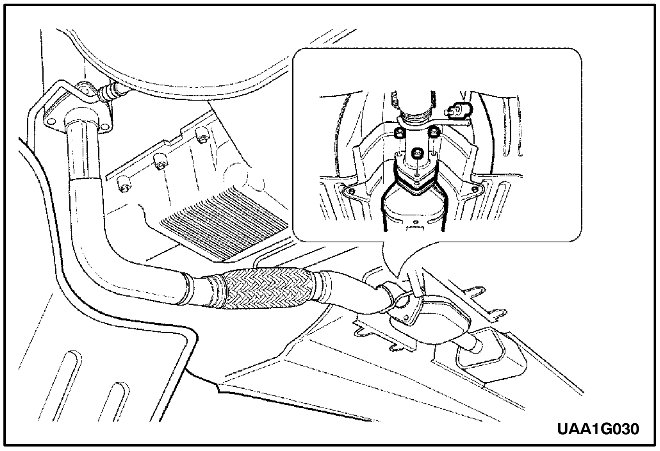
Tightening Torque	40 N·m (30 lb–ft)


UAA1G080

4. Disconnect the post converter heated oxygen sensor electrical connection. (if equiped)
5. Remove the exhaust front pipe bracket nut.

Installation Notice

Tightening Torque	25 N·m (18 lb–ft)

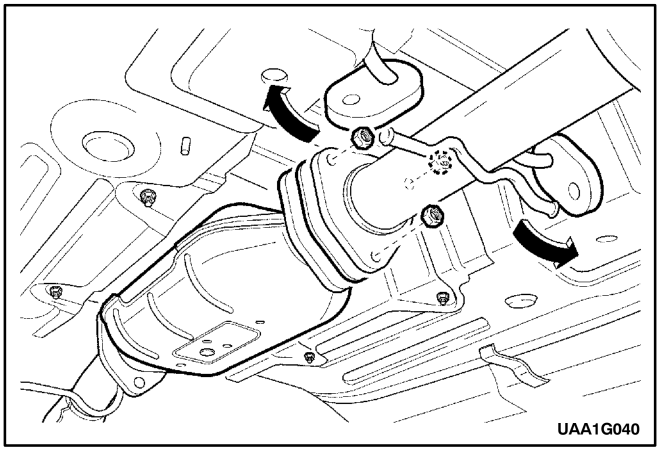


6. Remove the nuts that secure the exhaust front pipe flange to the main catalytic converter flange.

Installation Notice

Tightening Torque	30 N·m (22 lb–ft)

7. Remove the gasket from between the exhaust front pipe flange and the main catalytic converter flange.
8. Remove the exhaust front pipe.
9. Installation should follow the removal procedure in the reverse order.



MUFFLER – FRONT

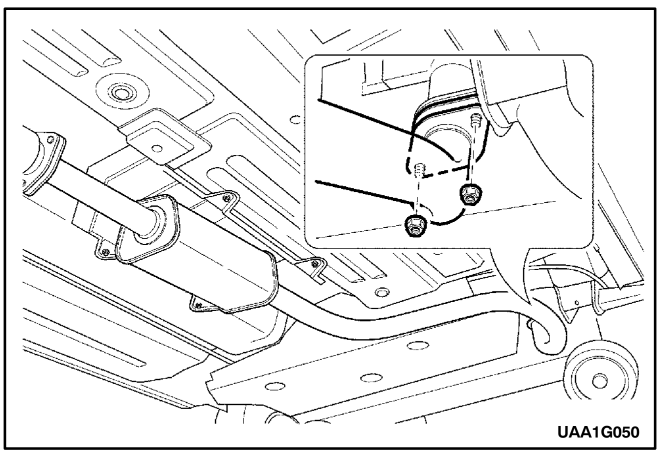
Removal and Installation Procedure

1. Disconnect the post converter heated oxygen sensor electrical connection. (if equiped)
2. Remove the nuts that secure the front muffler pipe to the main catalytic converter flange.

Installation Notice

Tightening Torque	30 N·m (22 lb–ft)

3. Remove the gasket.
4. Remove the rubber from hanger welded to front muffler pipe.

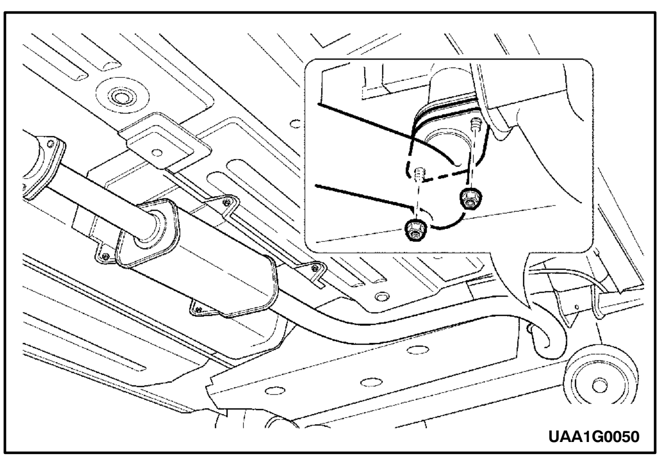


5. Remove the nuts that secure the front muffler pipe flange to the rear muffler pipe flange.

Installation Notice

Tightening Torque	30 N·m (22 lb–ft)

6. Remove the gasket.
7. Remove the front muffler pipe.
8. Installation should follow the removal procedure in the reverse order.
9. Check the exhaust pipe and the front muffler box for holes, damage, open seams, or other deterioration that could permit exhaust fumes to seep into the passenger compartment or the trunk.



MUFFLER – REAR

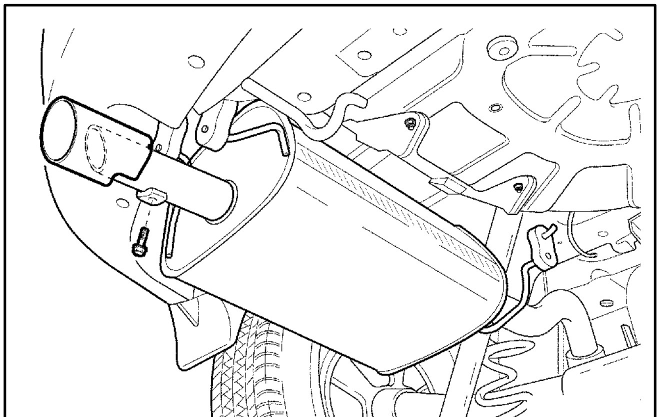
Removal and Installation Procedure

1. Remove the nuts that secure the rear muffler pipe flange to the front muffler pipe flange.

Installation Notice

Tightening Torque	30 N·m (22 lb–ft)

2. Remove the gasket.

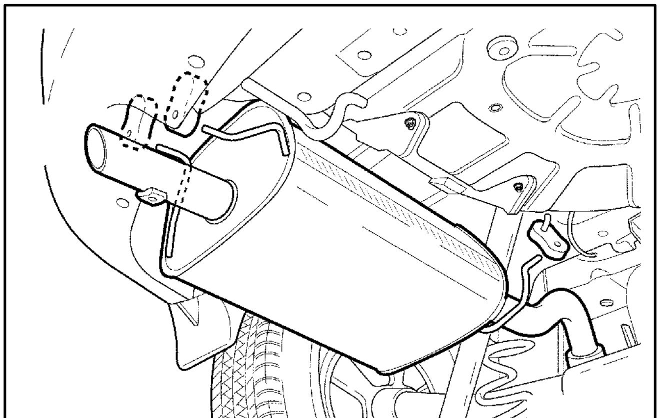

UAA1G060

3. Loosen the bolt that secures the trim ring to the rear muffler pipe.

Installation Notice

Tightening Torque	15 N·m (11 lb–ft)

4. Remove the trim ring.


UAA1G070

5. Detach the rear muffler from the rubber hangers.
6. Remove the rear exhaust muffler assembly.
7. Check the exhaust pipe and the rear muffler box for holes, damage, open seams, or other deterioration that could permit exhaust fumes to seep into the passenger compartment or the trunk.
8. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	NWm	Lb-Ft	Lb-In
Exhaust Manifold-to-Auxiliary Catalytic Converter Nuts	40	30	–
Auxiliary Catalytic Converter-to-Exhaust Front Pipe Nuts	40	30	–
Exhaust Front Pipe Bracket Bolt	25	18	–
Exhaust Front Pipe-to-Main Catalytic Converter Nuts	30	22	–
Main Catalytic Converter-to-Front Muffler Pipe Nuts	30	22	–
Front Muffler Pipe-to-Rear Muffler Pipe Nuts	30	22	–
Exhaust Manifold Heat Shield Bolts	15	11	–
Heated Oxygen Sensor	41	30	–

SECTION 2A

SUSPENSION DIAGNOSIS

TABLE OF CONTENTS

DIAGNOSTIC INFORMATION AND PROCEDURES

GENERAL DIAGNOSIS

Problems in the steering, the suspension, the tires, and the wheels involve several systems. Consider all systems when diagnosing a complaint. Some problems, such as abnormal or excessive tire wear and scuffed tires, may be the result of hard driving. Always road test the vehicle first. If possible, do this road test with the customer.

Proceed with the following preliminary checks. Correct any substandard conditions.

Preliminary Checks

Checks	Action
Inspect the tires for improper pressure and uneven wear.	Inflate the tires to the proper pressure.
Inspect the joint from the steering column to the Steering gear for loose connections or wear.	Tighten the intermediate shaft pinch bolts. Replace the Intermediate shaft as needed.
Inspect the front and the rear suspension, the steering gear, and the linkage for loose or damaged parts.	Tighten the front and rear suspension. Tight the steering gear mounting bracket bolts. Tighten the coupling flange pinch bolts. Replace the front and the rear suspension as needed. Replace the steering gear as needed. Replace the intermediate shaft as needed.
Inspect for out-of-round tires.	Perform a free runout test. Match-mount the tires.
Inspect for out-of-balance tires, bent wheels, and worn or loose wheel bearings.	Balance the wheels. Replace the wheels. Replace the Wheel bearing.
Check the power steering pump serpentine belt tension.	Tight the power steering pump serpentine belt.
Inspect for power steering system for leaks. Check the power steering fluid level.	Repair any leaks. Perform a power steering gear test. Add power steering fluid.

Car Lead/Pull

Checks	Action
Inspect for mismatched or uneven tires.	Replace the tires.
Inspect for a broken or a sagging spring.	Replace the spring.
Inspect for a radial tire lateral force.	Check the wheel alignment. Switch the wheels. Replace the tires as needed.
Check the front-wheel alignment.	Align the front wheels.
Inspect for an off-center steering gear.	Reseat the pinion valve assembly. Replace the pinion valve assembly as needed.
Inspect for front–brake dragging.	Adjust the front brakes.

A° normal or Excessive Tire Wear

Checks	Action
Check the front-wheel and the rear-wheel alignment.	Align the front and rear wheels.
Inspect for excessive toe on the front and the rear wheels.	Adjust the toe on the front and rear wheels.
Inspect for a broken or a sagging spring.	Replace the spring.
Inspect for out-of-balance tires.	Balance the tires.
Inspect for worn strut dampeners.	Replace the strut dampeners.
Check for a failure to rotate tires.	Rotate the tires. Replace the tires as needed.
Check for an overloaded vehicle.	Maintain the proper load weight.
Inspect for low tire inflation.	Inflate the tires to the proper pressure.

Scuffed Tires

Checks	Action
Inspect for incorrect toe on the front and the rear wheels.	Adjust the toe on the front and rear wheels.
Inspect for a twisted or a bent suspension arm.	Replace the suspension arm.

Wheel Tramp

Checks	Action
Inspect for an out-of-balance tire or wheel.	Balance the tire or wheel.
Inspect for improper strut dampener action.	Replace the strut dampeners.

Shimmy, Shake, or Vi°ration

Checks	Action
Inspect for an out-of-balance tire or wheel.	Balance the tire or wheel.
Inspect for excessive wheel hub runout.	Measure the hub flange runout. Replace the hub as needed.
Inspect for excessive brake drum or brake rotor Imbalance.	Adjust the brakes. Replace the brake rotor or the brake drum as needed.
Inspect for worn tie rod ends.	Replace the outer tie rods.
Inspect for wheel trim imbalance.	Balance the wheel.
Inspect for a worn lower ball joint.	Replace the lower ball joint.
Inspect for excessive wheel runout.	Measure the wheel runout. Replace the wheel as needed.
Inspect for excessive loaded radial runout on the tire and wheel assembly.	Match-mount the tire and wheel assembly.

Hard Steering

Checks	Action
Check the steering rear preload adjustment.	Perform a rack bearing preload adjustment.
Check the hydraulic system. Test the power steering system pressure with a gauge.	Replace the seals and the hoses as needed.
Inspect for binding or catching in the steering gear.	Lubricate the steering gear. Repair or replace the steering gear as needed.
Inspect for a loose steering gear mounting.	Tighten the steering gear mounting bracket bolts and nuts.

Too Much Play in Steering

Checks	Action
Inspect for worn or loose wheel bearings.	Tighten the drive axle nut. Replace the wheel bearings as needed.
Inspect for a loose steering gear mounting.	Tighten the steering gear mounting bracket bolts and nuts.
Inspect the joint from the column to the steering gear for loose connections or wear.	Tighten the intermediate shaft pinch bolts. Replace the intermediate shaft as needed.
Check the steering rear preload adjustment.	Perform a rack bearing preload adjustment.

Poor Returna°ility

Checks	Action
Inspect for lack of lubrication of the ball joints and the tie rod ends.	Replace the ball joints and the outer tie rods.
Inspect for binding in the ball joints.	Replace the ball joint.
Inspect for binding in the steering column.	Lubricate the steering column. Replace the steering column as needed.
Check the front-wheel alignment.	Align the front wheel.
Check the steering gear preload adjustment.	Perform a rack bearing preload adjustment.
Inspect for a sticking valve.	Lubricate the pinion valve assembly. Replace the pinion valve assembly as needed.
Inspect for binding in the intermediate shaft on the steering gear.	Replace the intermediate shaft.

A° normal Noise, Front Suspension

Checks	Action
Inspect for lack of lubrication of the ball joints and the tie rod ends.	Replace the ball joints and the outer tie rods.
Inspect for damaged suspension components.	Replace the damaged suspension components.
Inspect for worn control arm bushings or tie rod ends.	Replace the control arm bushings or the tie rods.
Inspect for a loose stabilizer shaft link.	Tight the stabilizer shaft link.
Inspect for loose wheel nuts.	Tight the wheel nuts.
Inspect for loose suspension bolts or nuts.	Tight the suspension bolts or nuts.
Inspect for loose wheel covers.	Tight the wheel covers.
Inspect for worn strut dampeners or strut mountings.	Replace the strut dampeners. Tight the strut mounting nuts.
Inspect for an improperly positioned strut spring.	Adjust the strut spring to the proper position.

Wander or Poor Steering A° ility

Checks	Action
Inspect for mismatched or uneven tires.	Replace the tires.
Inspect for lack of lubrication of the ball joints and the tie rod ends.	Replace the ball joints and the outer tie rods.
Inspect for worn strut.	Replace the strut dampeners.
Inspect for a loose stabilizer shaft link.	Tight the stabilizer shaft link.
Inspect for a broken or a sagging spring.	Replace the spring.
Check the steering gear preload adjustment.	Perform a rack bearing preload adjustment.
Check the front-wheel and the rear-wheel alignment.	Align the front and the rear wheels.

Erratic Steering when Braking

Checks	Action
Inspect for worn or loose wheel bearings.	Replace the wheel bearings.
Inspect for a broken or a sagging spring.	Replace the spring.
Inspect for a leaking wheel cylinder or caliper.	Replace the wheel cylinder or caliper.
Inspect for warped rotors.	Replace the rotors.
Inspect for an incorrect or an uneven caster.	If the caster is beyond specifications, check the frame and repair it as needed.

Low or Uneven Trim Height

Checks	Action
Inspect for a broken or a sagging spring.	Replace the spring.
Check for an overloaded vehicle.	Maintain the proper load weight.
Inspect for an incorrect or weak spring.	Replace the spring.

Ride Too Soft

Checks	Action
Inspect for worn strut dampeners.	Replace the strut dampeners.
Inspect for a broken or a sagging spring.	Replace the spring.

Ride Too Harsh

Checks	Action
Inspect for worn strut dampeners.	Replace the strut dampeners.
Inspect for a broken or a sagging spring.	Replace the spring.

Body Leans or Sways in Corners

Checks	Action
Inspect for a loose stabilizer shaft link.	Tighten the stabilizer shaft link.
Inspect for worn strut dampeners or strut mountings.	Replace the strut dampeners. Tighten the strut assembly mounting nuts.
Check for an overloaded vehicle.	Maintain the proper load weight.
Inspect for a broken or a sagging spring.	Replace the spring.

Suspension Bottoms

Checks	Action
Inspect for worn strut dampeners.	Replace the strut dampeners.
Check for an overloaded vehicle.	Maintain the proper load weight.
Inspect for a broken or a sagging spring.	Replace the spring.

Steering Wheel Kick°ack

Checks	Action
Inspect for air in the power steering system.	Replace the power steering system of air.
Inspect for a loose steering gear mounting.	Tighten the steering gear mounting bracket bolts and nuts.
Inspect for joint from the column to the steering gear for loose connections or wear.	Tighten the intermediate shaft pinch bolts. Replace the intermediate shaft as needed.
Inspect for loose tie rod ends.	Tighten the tie rod ends. Replace the outer tie rods as needed.
Inspect for loose or loose wheel bearings.	Tighten the drive axle nut. Replace the wheel bearings as needed.

Steering Wheel Surges or ●erks

Checks	Action
Check the hydraulic system. Test the power steering system pressure with a gauge.	Replace the seals and the hoses as needed.
Inspect for a sluggish steering gear valve.	Clean the pinion valve assembly. Replace the pinion valve assembly as needed.
Inspect for a loose power steering pump serpentine belt.	Adjust the power steering pump serpentine belt.

Cupped Tires

Checks	Action
Check the front-wheel and the rear-wheel alignment.	Align the front and the rear wheels.
Inspect for worn strut dampeners.	Replace the strut dampeners.
Inspect for worn or loose wheel bearings.	Tighten the drive axle nut. Replace the wheel bearings as needed.
Inspect for excessive tire or wheel runout.	Match-mount the tires. Replace the tires as needed. Replace the wheels as needed.
Inspect for a worn ball joint.	Replace the ball joint.
Check the steering gear preload adjustment.	Perform a rack bearing preload adjustment.

TORQUE STEER

A degree of torque steer to the right may normally be experienced during the use of heavy throttle on some front-wheel drive cars with drive axles of unequal length. This torque steer to the right results from the right drive axle being longer than the left drive axle, which creates a difference in the drive axle angle. Cars with intermediate shaft assemblies have axles of almost equal length.

A difference in the drive axle lengths results in more torque toe-in in the left front wheel. You will notice the torque toe-in when the vehicle accelerates from a standing start or at lower speeds.

Inspection Procedure

1. Place a small piece of tape at the top center of the steering wheel.
2. Note the inches of steering wheel deflection required to keep the vehicle straight during heavy acceleration.
3. Compare this finding with similar cars.

Factors that may cause torque steer to be more apparent on a particular vehicle include the following:

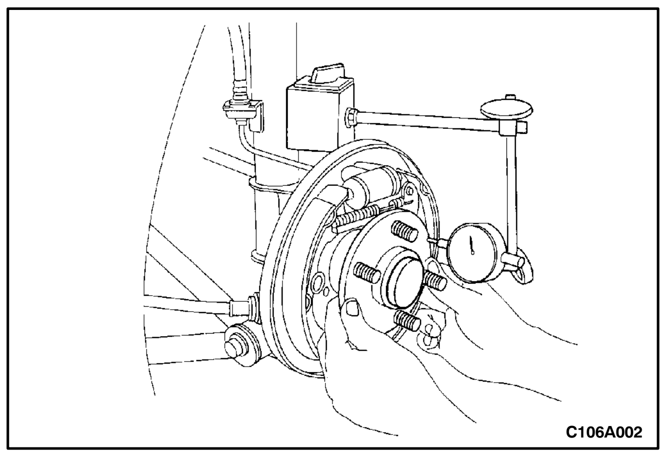
- Variations in the tire and wheel assemblies. This has the most significant effect on torque steer. A slightly smaller diameter on the right front tire will increase a right torque lead.
- Large differences in the right and the left front tire pressure.
- Looseness in the control arm bushings, the tie rod assemblies, or the steering gear mounting. This looseness permits a front wheel to pull forward and toe-in under a torque greater than the wheel on the opposite side. A loose suspension component may result in an opposite lead upon deceleration.
- A high front trim height. This height would increase the drive axle angle and could cause wobble at speeds between 24 to 48 km/h (15 to 30 mph).
- Binding or a tight drive axle joint. A tight drive axle joint or a high front trim height may also cause a wobble at speeds between 24 to 48 km/h (15 to 30 mph).
- Incorrect, worn, or loose engine mounts causing adverse drive angles.

Refer to *"**General Diagnosis**"* in this section for actions to remedy these problems.

Conditions that may produce an effect similar to torque steer include the following:

- Incorrect front or rear alignment.
- Frame misalignment or defect.
- Front suspension damage.
- Incorrectly mounted rear crossmember.

HUB AND BEARING



Perform the following test to check for looseness in the hub and bearing assembly:

1. Raise and suitably support the vehicle.
2. Remove the rear wheel. Refer to ***Section 2E, Tires and Wheels***.
3. Remove the brake disc caliper and the brake rotor. Refer to ***Section 4E, Rear Drum Brakes***.
4. Mount a dial indicator set with a magnetic base to a stationary part of the vehicle.
5. Push and pull the wheel hub by hand. If the wheel hub movement exceeds 0.1 mm (0.004 inch), replace the hub and bearing assembly. Refer to ***Section 2D, Rear Suspension.***

6. Install the brake disc caliper and the brake rotor. Refer to *Section 4E, **Rear Drum Brakes***.
7. Install the rear wheel. Refer to *Section 2E, **Tires and Wheels.***
8. Lower the vehicle.

SECTION 2B

WHEEL ALIGNMENT

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

FOUR WHEEL ALIGNMENT

The first responsibility of engineering is to design safe steering and suspension systems. Each component must be strong enough to withstand and absorb extreme punishment. Both the steering system and the front and the rear suspension must function geometrically with the body mass.

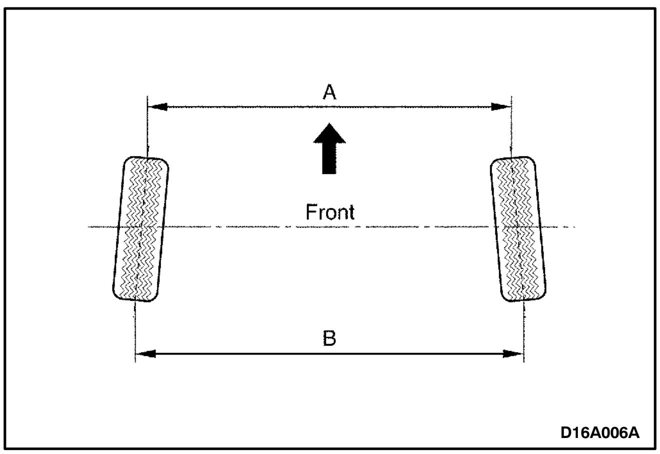
The steering and the suspension systems require that the front wheels self-return and that the tire rolling effort and the road friction be held to a negligible force in order to allow the customer to direct the vehicle with the least effort and the most comfort.

A complete wheel alignment check should include measurements of the rear toe and camber.

Four-wheel alignment assures that all four wheels will be running in precisely the same direction.

When the vehicle is geometrically aligned, fuel economy and tire life are at their peak, and steering and performance are maximized.

TOE



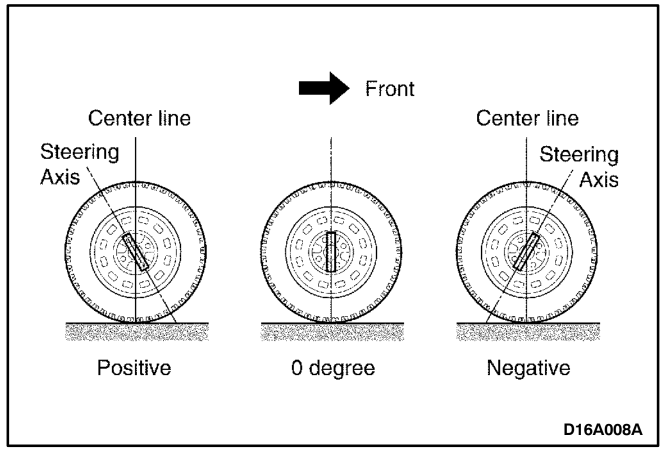
Toe–in is the turning in of the tires, while toe-out is the turning out of the tires from the geometric centerline or thrust line. The toe ensures parallel rolling of the wheels.

The toe serves to offset the small deflections of the wheel support system which occur when the vehicle is rolling forward. The specified toe angle is the setting which achieves 0 degrees of toe when the vehicle is moving.

Incorrect toe-in or toe-out will cause tire wear and reduced fuel economy. As the individual steering and suspension components wear from vehicle mileage, additional toe will be needed to compensate for the wear.

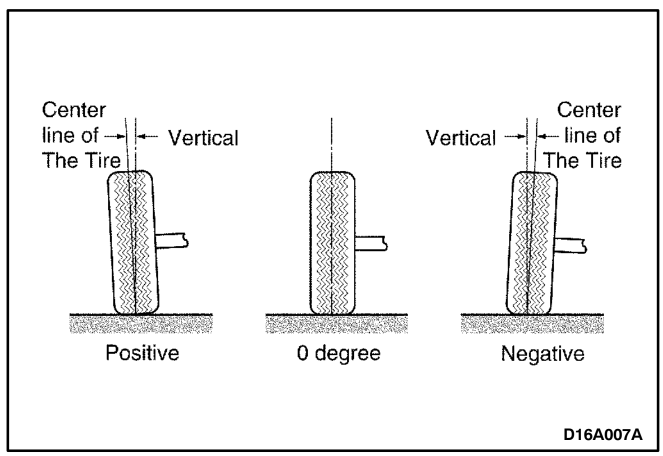
Always correct the toe dimension last.

CASTER



Caster is the tilting of the uppermost point of the steering axis either forward or backward from the vertical when viewed from the side of the vehicle. A backward tilt is positive, and a forward tilt is negative. Caster influences directional control of the steering but does not affect tire wear. Weak springs or overloading a vehicle will affect caster. One wheel with more positive caster will pull toward the center of the car. This condition will cause the car to move or lean toward the side with the least amount of positive caster. Caster is measured in degrees.

CAMBER



Camber is the tilting of the top of the tire from the vertical when viewed from the front of the vehicle. When the tires tilt outward, the camber is positive. When the tires tilt inward, the camber is negative. The camber angle is measured in degrees from the vertical. Camber influences both directional control and tire wear.

If the vehicle has too much positive camber, the outside shoulder of the tire will wear. If the vehicle has too much negative camber, the inside shoulder of the tire will wear.

DIAGNOSTIC INFORMATION AND PROCEDURES

TIRE DIAGNOSIS

Irregular and Premature Wear

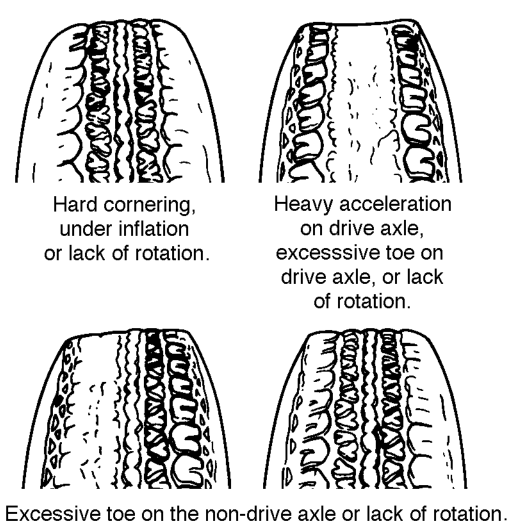
Irregular and premature tire wear has many causes. Some of them are incorrect inflation pressures, lack of regular rotation, poor driving habits, or improper wheel alignment. If the wheel alignment is reset because of tire wear, always reset the toe as close to zero degrees as the specification allows. Refer to *"Rear Toe Adjustment"* in this section.

Rotate the tires if:

- The front tire wear is different from the rear.
- The left and right front tire wear is unequal.
- The left and right rear tire wear is unequal.

Check wheel alignment if:

- The left and right front tire wear is unequal.
- The wear is uneven across the tread of either front tire.
- The front tire treads are scuffed with "feather" edges on the side of the tread ribs or blocks.



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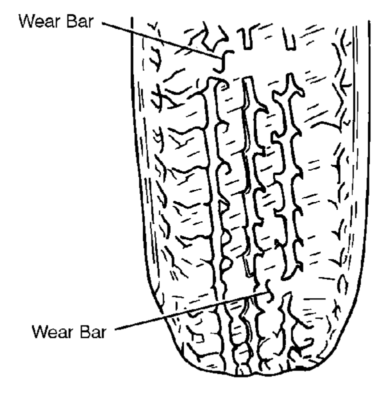
Tread Wear Indicators

The original equipment tires have built-in tread wear indicators to show when the tires need replacement. These indicators appear as bands when the tire tread depth becomes shallow. Tire replacement is recommended when the indicators appear in three or more grooves at six locations.



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Radial Tire Waddle

Waddle is side-to-side movement at the front or rear of the vehicle. It is caused by the steel belt not being straight within the tire, or by excessive lateral runout of the tire or wheel. It is most noticeable at low speeds, 8 to 48 km/h (5 to 30 mph), but may appear as ride roughness at 80 to 113km/h (50 to 70mph).

The vehicle must be road tested to determine which end of the vehicle has the faulty tire. The rear end of the vehicle will shake from side to side or "waddle" if the waddle tire is on the rear of the vehicle. From the drive's seat, it feels as though someone is pushing on the side of the vehicle. If the faulty tire is on the front of the vehicle, the waddle is more visual. The front sheet metal appears to be moving back and forth, and the drive's seat feels like the pivot point in the vehicle.

Waddle can be diagnosed using the method of substituting known good tire and wheel assemblies on the problem vehicle.

1. Road test the vehicle to determine if the waddle is coming from the front or the rear of the vehicle.
2. Install good tires and wheels from a similar vehicle in place of those on the offending end of the problem vehicle. If the source of the waddle is not obvious change the rear tires.
3. Road test the vehicle. If there is improvement, install the original tires to find the offending tire. If there is no improvement, install good tires in place of all four offending tires.
4. Install original tires one at a time to find the offending tire.

RADIAL TIRE LEAD/PULL

Lead/pull is the deviation of the vehicle from a straight path on a level road with no pressure on the steering wheel. Lead is usually caused by:

- Incorrect alignment.
- Uneven brake adjustment.
- Tire construction.

The way in which a tire is built can produce lead/pull in the vehicle. Off-center belts on radial tires can cause the tire to develop a side force while the vehicle rolls straight down the road. If one side of the tire has even a little larger diameter than the diameter of the other side, the tire will tend to roll to one side. Unequal diameters will cause the tire to develop a side force which can produce vehicle lead/pull.

The radial lead/pull diagnosis chart should be used to determine whether the problem originates from an alignment problem or from the tires. Part of the lead diagnosis procedure calls for tire rotation that is different from the proper tire rotation pattern. If a medium- to high-mileage tire is moved to the other side of the vehicle, be sure to check for ride roughness. Rear tires will not cause lead/pull.

Radial Tire Lead/Pull Diagnosis Chart

Step	Action	Value(s)	Yes	No
1	1. Perform wheel alignment preliminary inspection. 2. Check the brakes for dragging. 3. Road test the vehicle. Does the vehicle lead/pull?	–	Go to *Step 2*	System OK
2	1. Cross switch the front tire and wheel assemblies. 2. Road test the vehicle. Does the vehicle lead/pull?	–	Go to *Step 3*	System OK
3	Check the front wheel alignment. Is the alignment within specifications?	–	Go to *Step 4*	Adjust alignment
4	Compare the front camber and front caster to specifications. Are they within specifications?	–	Go to *Step 7*	Go to *Step 5*
5	Check the vehicle frame. Is the frame bent?	–	Go to *Step 6*	Go to *Step 1*
6	Straighten the frame. Is the repair complete?	–	Go to *Step 3*	–
7	1. The probable cause is the tires. 2. Switch the left front tire and wheel assembly with the left rear tire and wheel assembly. 3. Road test the vehicle. Does the vehicle still lead/pull?	–	Go to *Step 9*	Go to *Step 8*
8	Switch the left front tire and wheel assembly with the left rear tire and wheel assembly and replace the left front tire. Is the repair complete?	–	System OK	Go to *Step 1*
9	1. Switch the right front tire and wheel assembly with the right rear tire and wheel assembly. 2. Road test the vehicle. Does the vehicle still lead/pull?	–	Go to *Step 1*	Go to *Step 10*
10	Switch the right front tire and wheel assembly with the right rear tire and wheel assembly and replace the right front tire. Is the repair complete?	–	System OK	Go to *Step 1*

VIBRATION DIAGNOSIS

Wheel imbalance causes most highway speed vibration problems. A vibration can remain after dynamic balancing because:

- A tire is out of round
- A rim is out of round
- A tire stiffness variation exists

Measuring tire and wheel free runout will uncover only part of the problem. All three causes, known as loaded radial runout, must be checked using method of substituting known good tire and wheel assemblies on the problem vehicle.

Tire Balancing

Balance is the easiest procedure to perform and should be done first if the vibration occurs at high speeds. Do an off-vehicle, two-plane dynamic balance first to correct any imbalance in the tire and wheel assembly.

An on-vehicle finish balance will correct any brake drum, rotor, or wheel cover imbalance. If balancing does not correct the high-speed vibration, or if the vibration occurs at low speeds, runout is the probable cause.

Preliminary Checks

Prior to performing any work, always road test the car and perform a careful visual inspection for:

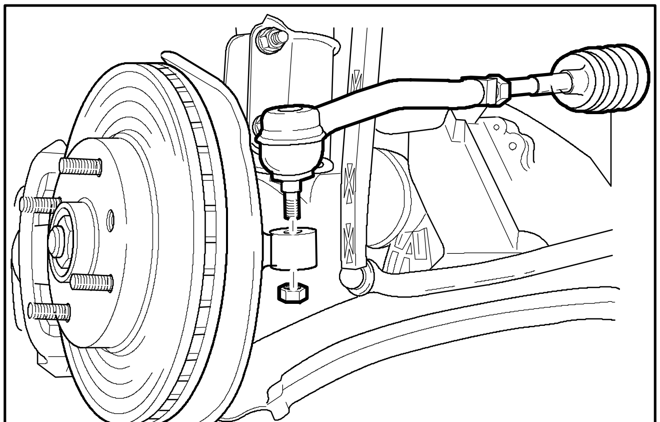
- Obvious tire and wheel runout.
- Obvious drive axle runout.
- Improper tire inflation.
- Incorrect trim height.
- Bent or damaged wheels.
- Debris build-up on the tire or the wheel.
- Irregular or excessive tire wear.
- Improper tire bead seating on the rim.
- Imperfections in the tires, including: tread deformations, separations, or bulges from impact damage. Slight sidewall indentations are normal and will not affect ride quality.

PRELIMINARY INSPECTION

Checks	Action
Check the tires for proper inflation pressures and normal tread wear.	Inflate the tires to the proper tire pressure. Replace the tires as needed.
Check the wheel bearings for looseness.	Tighten the axle nut to the proper specification. Replace the strut wheel bearing as needed.
Check for loose ball joints and tie rod ends.	Tighten the ball joints and the tie rods.
Check the runout of the wheels and the tires.	Measure and correct the tire runout.
Check the vehicle trim heights.	Correct the trim heights. Make the correction before adjusting the toe.
Check for loose rack and pinion mounting.	Tighten the mounting brackets for the rack and pinion assembly.
Check for improperly operating struts.	Replace the strut assembly.
Check for loose control arms.	Tighten the control arm attachment bolts. Replace the control arm bushings as needed.

FRONT TOE ADJUSTMENT

Adjustment Procedure



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1. Disconnect the outer tie rods from the knuckle assemblies. Refer to *Section 6C, Power Steering Gear.*
2. Loosen the front toe adjusting nut.

Notice : In this adjustment, the right and the left tie rods must be equal in length, or the tires will wear unevenly.

3. Turn the right and the left outer tie rods to align the toe to the proper specifications. Refer to *"General Specifications"* in this section.
4. Hold the outer tie rod and tighten the front toe adjusting nut.

Adjustment Notice

Tightening Torque	64 N·m (47 lb–ft)

Adjustment Notice

5. Reconnect the outer tie rods to the knuckle assemblies. Refer to *Section 6C, Power Steering Gear.*

FRONT CAMBER CHECK

The front camber and caster are not adjustable. Refer to *"Wheel Alignment Specifications"* in this section. Jounce the bumper three times before measuring the camber or the caster in order to prevent an incorrect reading. If the front camber or caster measurements deviate from the specifications, locate and replace or repair any damaged, loose, bent, dented, or worn suspension part. If the problem is body related, repair the body.

Adjustment Notice

Specification	–0°20′ ± 0°45′

REAR CAMBER CHECK

The rear camber is not adjustable. Refer to *"Wheel Alignment Specifications"* in this section. If the rear camber deviates from the specification, locate the cause and correct it. If damaged, loose, bent, dented, or worn suspension parts are found, they should be repaired or replaced. If the problem is body related, repair the body.

Adjustment Notice

Specification	–1°45′ ± 0°30′

SPECIFICATIONS

GENERAL SPECIFICATIONS

Front	Toe-in (No load)	0° ± 0°10′
	Caster	3°
	Camber	–0°20′ ± 0°45′
Rear	Toe-in (No load)	0°05′ ± 0°30′
	Camber (No load)	–1°45′ ± 0°30′

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Tie Rod Adjuster Nut	64	47	–

SECTION 2C

FRONT SUSPENSION

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

FRONT SUSPENSION

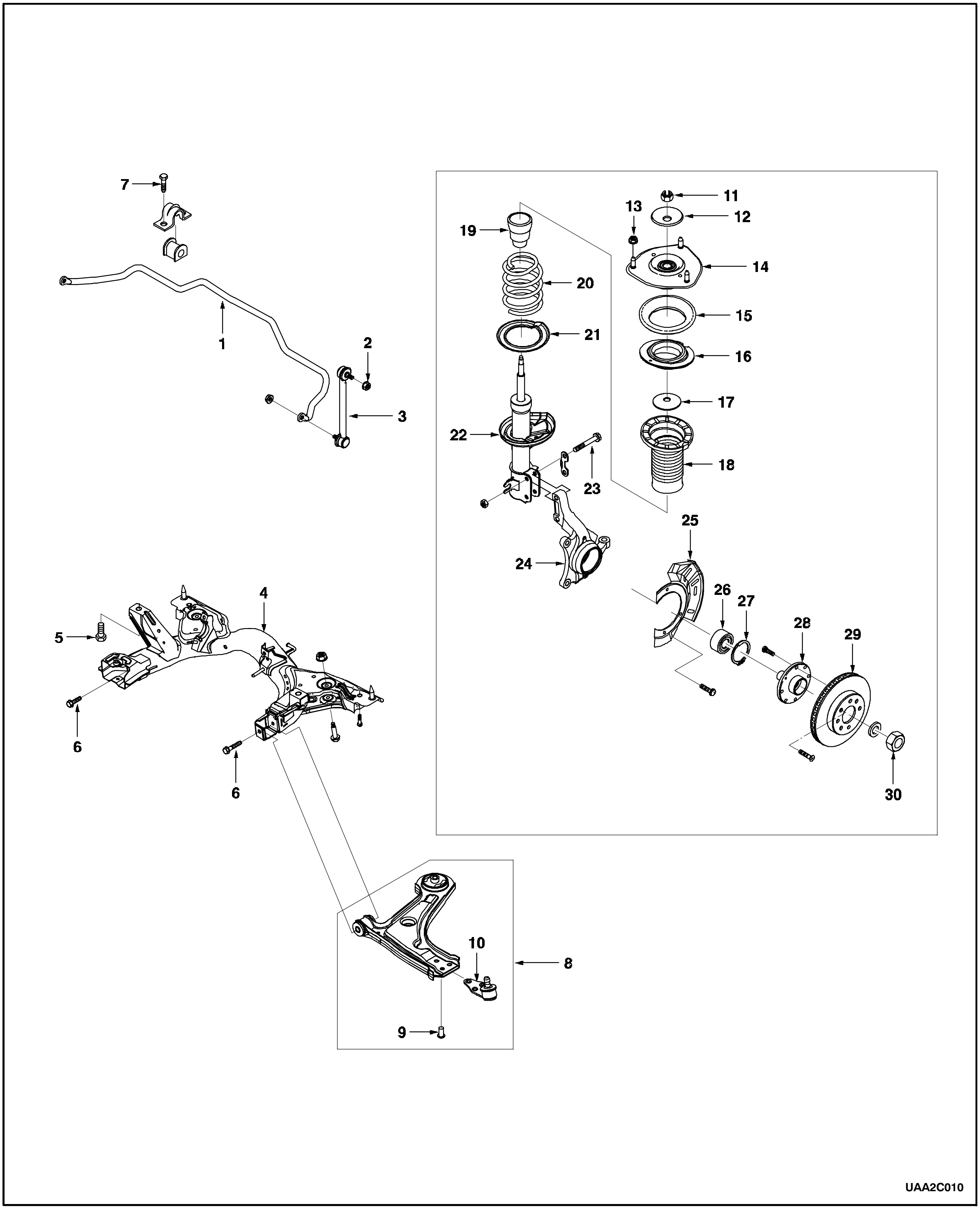
The front suspension for this vehicle is a combination of a strut assembly and a knuckle assembly. The strut assembly combines a strut dampener and a spring mounted to the body of the vehicle. The upper end of the strut is isolated by a rubber mount and contains a bearing to allow the strut to turn. The knuckle is attached to the strut assembly and pivots on a ball joint bolted to the control arm. The control arms pivot from the body using rubber bushings.

The ball joint is fastened to the steering knuckle with a pinch bolt and nut, and to the lower control arm withrivets. The stabilizer bar interconnects both strut assemblies of the vehicle through the stabilizer link and is attached to the front suspension crossmember. Jounce and rebound movements affecting one wheel are partially transmitted to the opposite wheel of the vehicle to stabilize body roll.

When servicing the control arm-to-body attachment and the stabilizer shaft-to-body insulators, make sure the attaching bolts are loose until the control arms are moved to the trim height, which is curb height. Trim height is the normal position to which the control arms move when the vehicle is sitting on the ground. Refer to *"General Specifications"* in this section.

COMPONENT LOCATOR

FRONT SUSPENSION



1 Stabilizer Shaft
2 Stabilizer Link Nut
3 Stabilizer Link
4 Crossmember
5 Crossmember-to-Body Front Bolt
6 Crossmember-to-Control Arm Front Bolt
7 Stabilizer Shaft-to-Crossmember Clamp Bolt
8 Control Arm
9 Ball Joint Rivet
10 Ball Joint
11 Piston Rod Nut
12 Washer
13 Body-to-Strut Assembly Nut
14 Strut Mount
15 Strut Mount Bearing
16 Upper Spring Seat
17 Washer
18 Upper Spring Insulator
19 Hollow Bumper
20 Coil Spring
21 Lower Spring Insulator
22 Strut
23 Strut Assembly-to-Steering Knuckle Bolt
24 Steering Knuckle
25 Splash Shield
26 Wheel Bearing
27 Snap Ring
28 Hub
29 Disc Brake Rotor
30 Caulking Nut

DIAGNOSTIC INFORMATION AND PROCEDURES

STRUT DAMPENER

A strut damper is basically a shock absorber. However, strut dampers are easier to extend and retract by hand than are shock absorbers.

Struts Seem Weak

Checks	Action
Check the tire pressures.	Adjust the tire pressures to the specifications on the tire placard.
Check the load conditions under which the vehicle is normally driven.	Consult with the owner to confirm the owner's understanding of normal load conditions.
Check the compression and rebound effectiveness of the strut dampener.	Quickly push down and then lift up on the corner of the bumper nearest the strut dampener being tested. Compare the compression and rebound with those of a similar vehicle that has an acceptable ride quality. Replace the strut dampener, if needed.

Struts Are Noisy

Checks	Action
Check the mountings for looseness or damage.	Tighten the strut dampener mounting nuts. Replace the strut dampener, if needed.
Check the compression and rebound effectiveness of the strut dampener.	Quickly push down and then lift up on the corner of the bumper nearest the strut dampener being tested. Compare the compression and rebound with those of a similar vehicle that has an acceptable ride quality. Replace the strut dampener, if needed.

BALL JOINT AND KNUCKLE

Ball Joint Inspection

1. Raise the front of the vehicle to allow the front suspension to hang free.
2. Grasp the tire at the top and the bottom.
3. Move the top of the tire in an in-and-out motion.
4. Look for any horizontal movement of the knuckle relative to the control arm.
5. Ball joints must be replaced under the following conditions:
   - The joint is loose.
   - The ball seal is cut.
   - The ball stud is disconnected from the knuckle.
   - The ball stud is loose at the knuckle.
   - The ball stud can be twisted in its socket with finger pressure.

Ball Stud Inspection

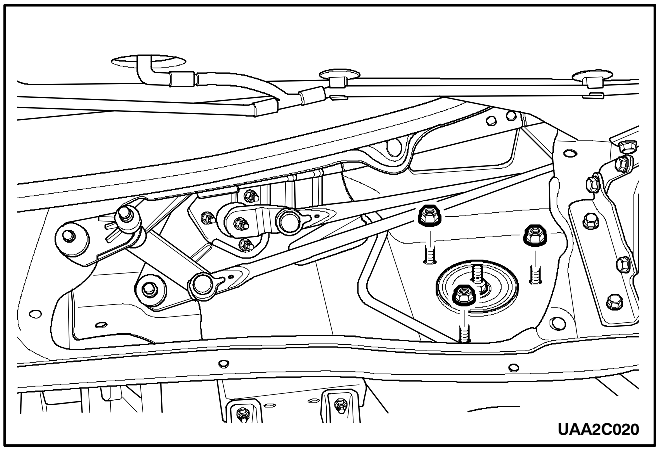
Make sure to check the tightness of the ball stud in the knuckle boss during each inspection of the ball joint. One way to inspect the ball stud for wear is to shake the wheel and feel for movement of the stud end at the knuckle boss.

Another way to inspect the ball stud for wear is to check the fastener torque at the pinch nut. A loose nut can indicate a stressed stud or a hole in the knuckle boss.

Worn of damaged ball joints and knuckles must be replaced.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



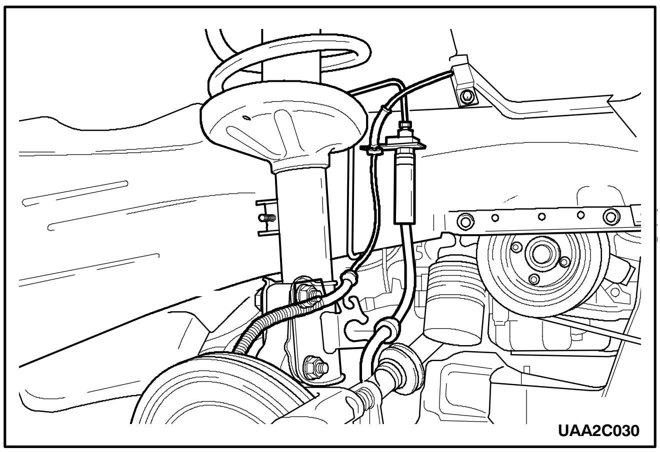
FRONT STRUT ASSEMBLY

Removal and Installation Procedure

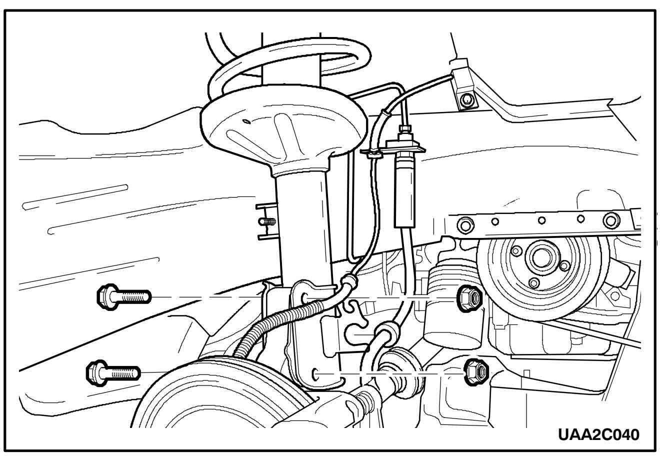
1. Remove the windshield wiper arm. Refer to *Section 9D,Wipers/Washer Systems.*
2. Remove the cowl vent grille. Refer to *Section 9R, Body Front End.*
3. Remove the nuts that secure the strut assembly to the body of the vehicle.

Installation Notice

Tightening Torque	35 N·m (26 lb–ft)



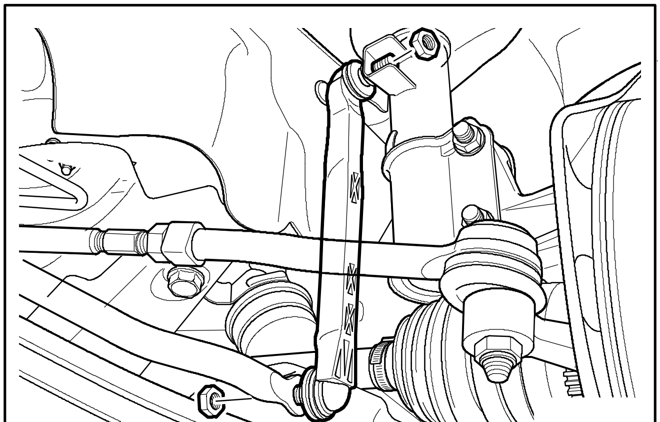
4. Raise and suitably support the vehicle.
5. Remove the front wheels. Refer to *Section 2E, Tires and Wheels*.
6. On vehicles equipped with an antilock braking system(ABS), remove the ABS sensor line from the securing bracket on the strut assembly.
7. Remove the brake line from the securing bracket on the strut assembly.



8. Disconnect the stabilizer shaft link by removing the stabilizer link-to-strut assembly upper nut. Refer to *“Stabilizer Link”* in this Section.
9. Disconnect the steering knuckle by removing the steering knuckle-to-strut assembly nuts and bolts.
10. Remove the strut assembly.

Installation Notice

Tightening Torque	100 N·m (74 lb–ft)


UAA2C050

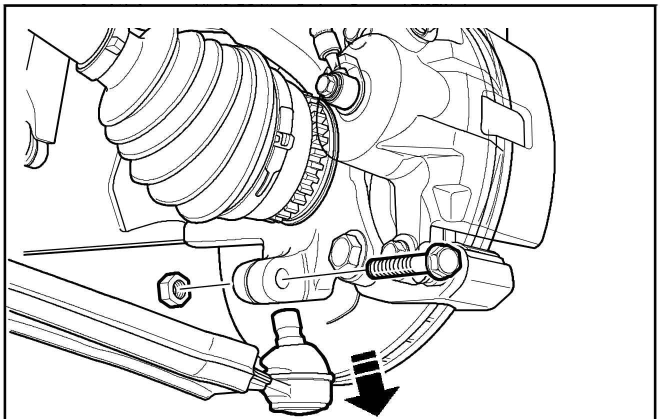
STABILIZER LINK

Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Remove the stabilizer shaft-to-stabilizer link nut.
3. Remove the stabilizer link-to-strut assembly nut.
4. Remove the stabilizer link.

Installation Notice

Tightening Torque	Stabilizer Shaft-to-Stabilizer Link Nuts	48 N·m (35 lb–ft)
Tightening Torque	Stabilizer Link-to-Strut Assembly Nuts	48 N·m (35 lb–ft)


UAA2C060

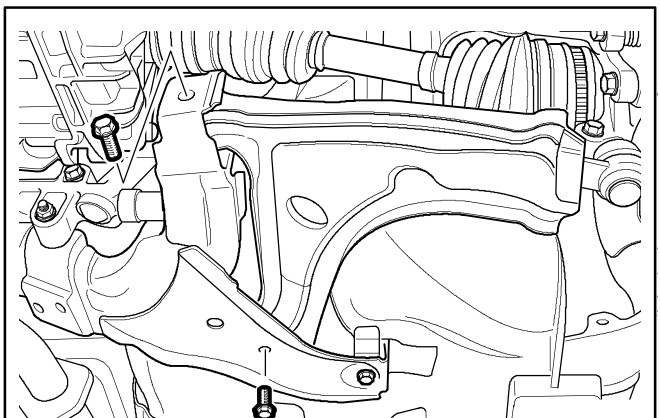
CONTROL ARM

Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Remove the front wheels. Refer to *Section 2E, Tires and Wheels.*
3. Remove the pinch bolt and the nut from the ball joint.
4. Disconnect the ball joint from the knuckle assembly.

Installation Notice

Tightening Torque	60 N·m(44 lb–ft)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5. Remove the crossmember-to-control arm front bolt.
6. Remove the crossmember-to-control arm rear bolt and the nut.
7. Remove the control arm from the vehicle.

Notice: For ease of removal of the front right control arm, remove the engine mounting reaction lower rod. Refer to *Section 1B, SOHC Engine Mechanical.*

Installation Notice

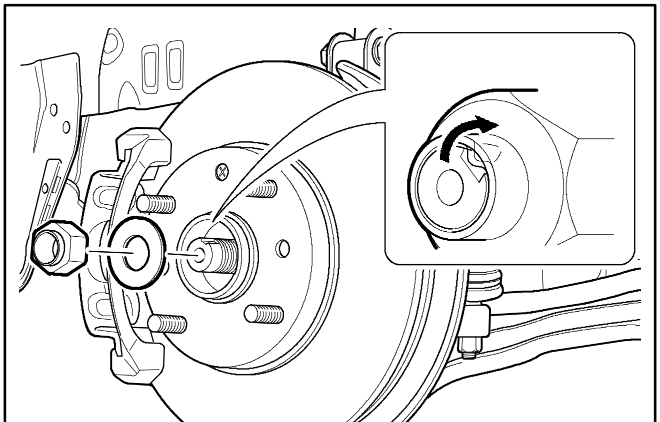
Tightening Torque	Crossmember-to-Control Arm Front Bolt	147 N·m (108 lb–ft)
Tightening Torque	Crossmember-to-Control Arm Rear Bolt and Nut	110 N·m (81 lb–ft)

KNUCKLE ASSEMBLY

Removal and Installation Procedure

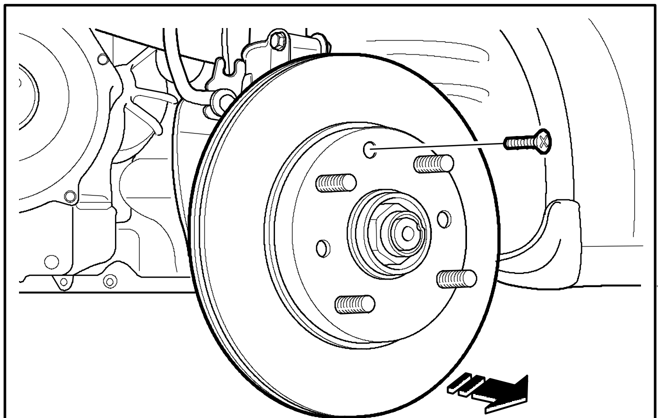
Tools Required

KM–507–B Outer Tie Rod Remover



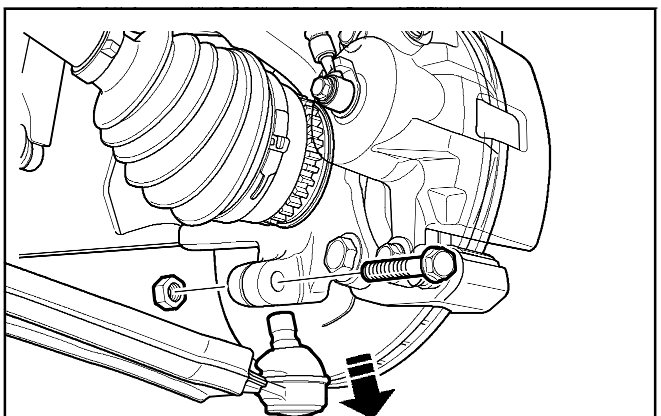
UAA2C080

1. Raise and suitably support the vehicle.
2. Remove the front wheels. Refer to *Section 2E, Tires and Wheels.*
3. Remove the caulking nut from the axle shaft.
4. Remove the outer tie rod from the knuckle assembly. Refer to *Section 6C, Power Steering Gear.*



UAA2C090

5. Remove the brake caliper from the rotor. Support the caliper so it dose not hang from the hydraulic brake hose. Refer to *Section 4D, Front Disc Brakes.*
6. On vehicles equipped with an antilock braking system(ABS), disconnect the ABS speed sensor electrical connection from the knuckle. Refer to *Section 4F, Antilock Brake System*.
7. Remove the rotor and splash shield. Refer to *Section 4D, Front Disc Brakes*.

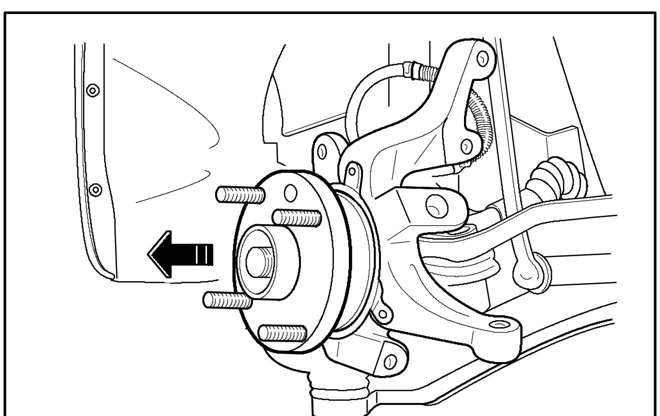


UAA2C060

8. Remove the ball joint pinch bolt and the nut.
9. Separate the knuckle from the ball joint.

Notice: Do not over extend the axle joints. When either end of the shaft is disconnected, overextension of the joint can result in separation of internal components and possible joint failure. Use drive axle joint seal protectors whenever performing service on or near the drive axles. Failure to do so can cause internal joint or seal damage and result in possible joint failure.

10. Separate the drive axle shaft from the wheel hub and support the drive axle.



UAA2C100

11. Remove the bolts and the nuts that connect the knuckle assembly to the strut assembly.
12. Remove knuckle assembly from the vehicle.

Installation Notice

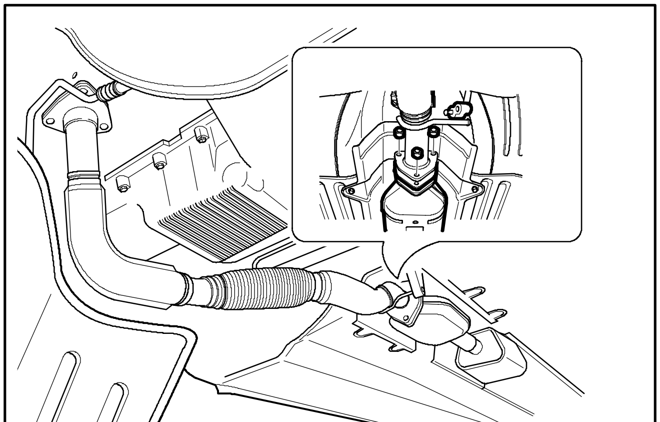
Tightening Torque	Steering Knuckle-to-Strut Assembly Bolts	100 N·m (74 lb–ft)
Tightening Torque	Front Hub Caulking Nut	280 N·m (206 lb–ft)

CROSSMEMBER ASSEMBLY

Removal and Installation Procedure

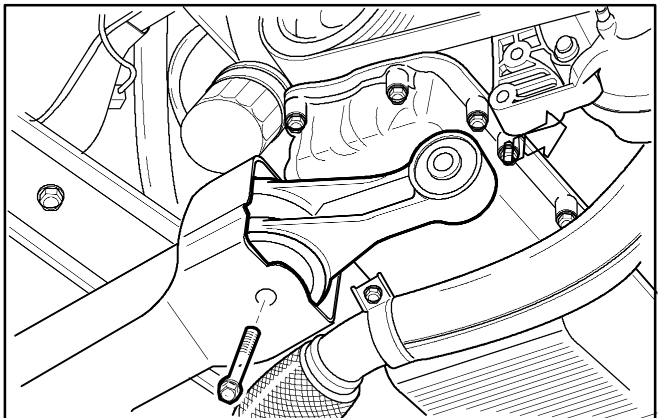
Tools Required

DW110–070 Crossmember Support Fixture



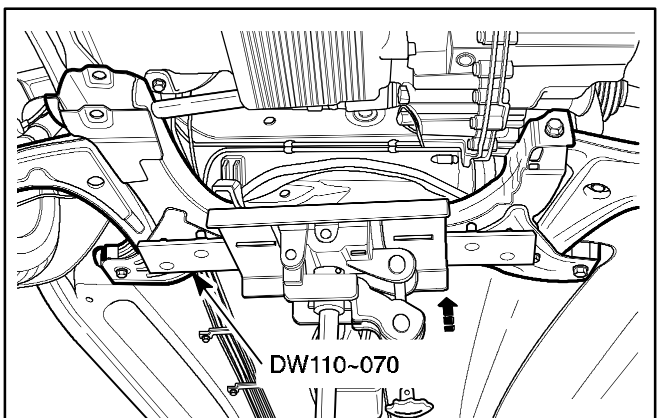
UAA2C110

1. Raise and suitably support the vehicle.
2. Remove the front wheels. Refer to *Section 2E, Tires and Wheels*.
3. Remove the exhaust pipe forward of the catalytic converter. Refer to *Section 1G, Engine Exhaust*.
4. Disconnect the stabilizer link from the stabilizer shaft. Refer to *“Stabilizer Link”* in this Section.



UAA2C120

5. Disconnect the ball joint from the knuckle Refer to *“Knuckle Assembly”* in this Section.
6. Remove the rack and pinion assembly. Refer to *Section 6C, Power Steering Gear*.
7. Remove the engine mounting reaction lower rod. Refer to *Section 1B, SOHC Engine Mechanical*.



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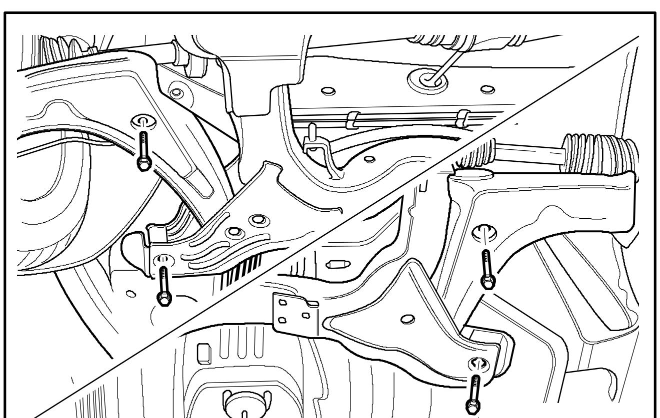
8. Attach the crossmemder support fixture DW110–070 on the transaxle jack.
9. Support the crossmember with the crossmemder support fixture DW110–070.

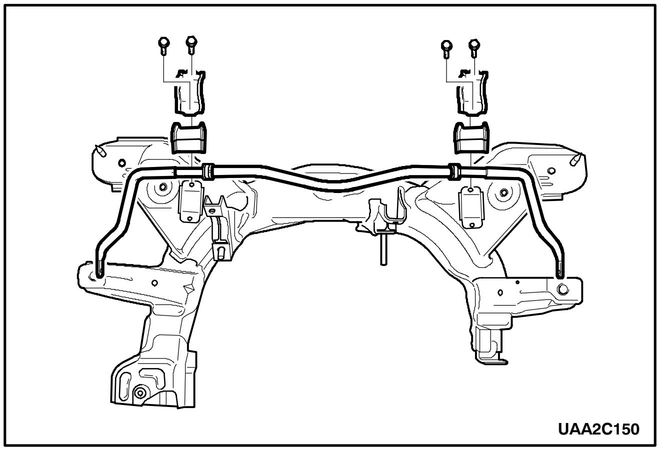


UAA2C140

10. Remove the crossmember-to-body front bolts.
11. Remove the crossmember-to-body rear bolts.
12. Remove the crossmember assembly from the vehicle.

Installation Notice

Tightening Torque	Crossmember-to-Body Front Bolt	196 N·m (145 lb–ft)
Tightening Torque	Crossmember-to-Body Rear Bolt	196 N·m (145 lb–ft)



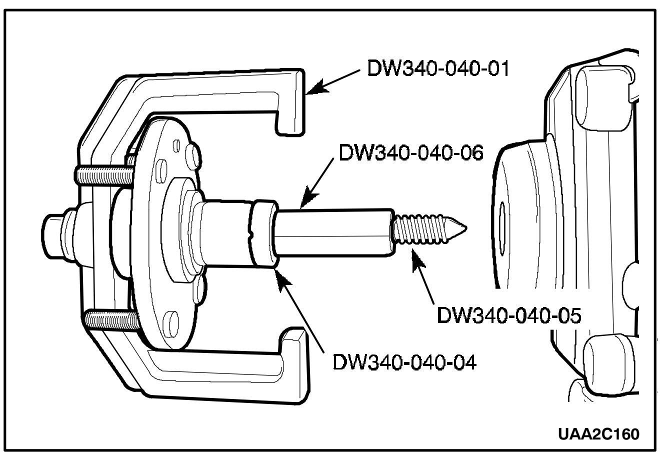
STABILIZER SHAFT AND INSULATORS

Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Remove the crossmember assembly from the vehicle. Refer to *"Crossmember Assembly"* in this Section.
3. Remove the stabilizer shaft-to-crossmember clamp bolts.
4. Remove the stabilizer shaft, the stabilizer shaft insulator clamp, and the insulators from the crossmember.

Installation Notice

Tightening Torque	45 N·m (33 lb–ft)



HUB AND BEARING ASSEMBLY

Removal Procedure

Tools Required

DW340–040–01 Support Bridge

DW340–040–02 Removal Bearing Adapter

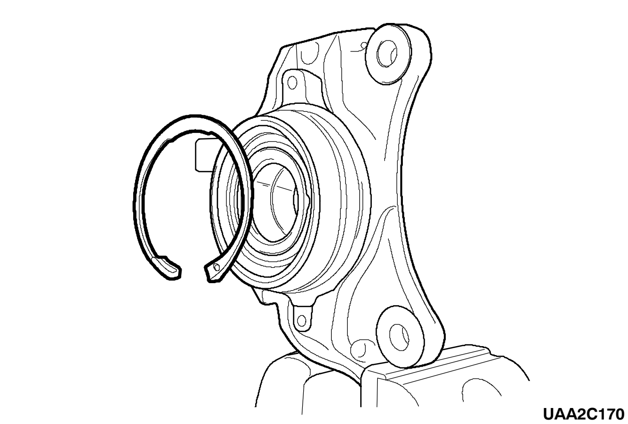
DW340–040–03 Installation Bearing Adapter

DW340–040–04 Hub Adapter

DW340–040–05 Forcing Bolt

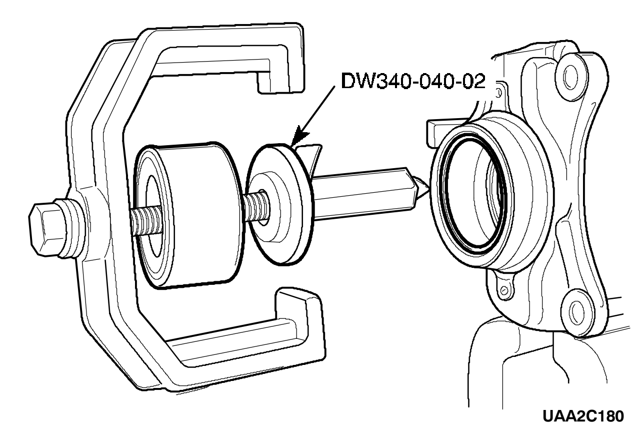
DW340–040–06 Hex Nut

1. Raise and suitably support the vehicle.
2. Remove the knuckle from the drive axle. Refer to *"Knuckle Assembly"* in this Section.
3. Remove the wheel hub with the support bridge DW340–040–01, the hub adapter DW340–040–04, the forcing bolt DW340–040–05, the hex nut DW340–040–06.



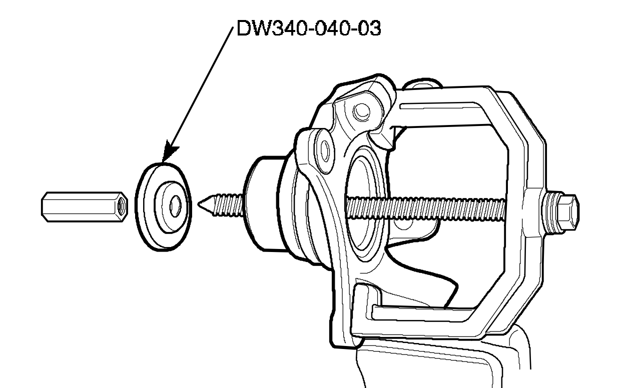
UAA2C170

4. Remove the inner snap ring.



UAA2C180

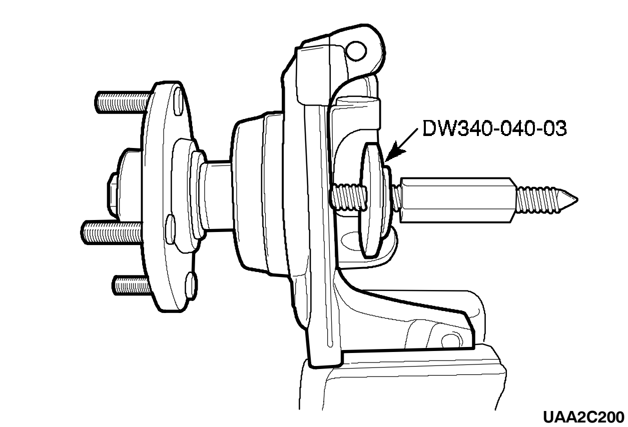
5. Remove the wheel bearing with the support bridge DW340–040–01, the removal bearing adapter DW340–040–02, the forcing bolt DW340–040–05, the hex nut DW340–040–06.
6. Remove the oil seal from the knuckle.



UAA2C190

Installation Procedure

1. Install the new oil seal into the knuckle.
2. Push the wheel bearing into place with the support bridge DW340–040–01, the installation bearing adapter DW340–040–03, the forcing bolt DW340–040–05, the hex nut DW340–040–06.
3. Install the inner snap ring.



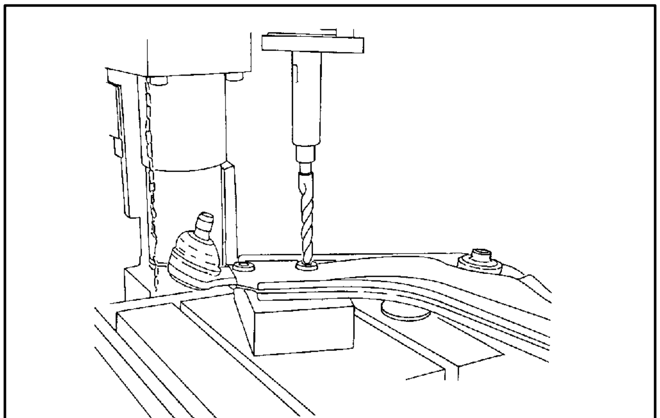
UAA2C200

4. Push the wheel hub into place with the installation bearing adapter DW340–040–03, the hub adapter DW340–040–04, the forcing bolt DW340–040–05, the hex nut DW340–040–06.
5. Install the knuckle into the drive axle.

Installation Notice

- The inner seal must be discard and replaced with new parts.

UNIT REPAIR



B306C007

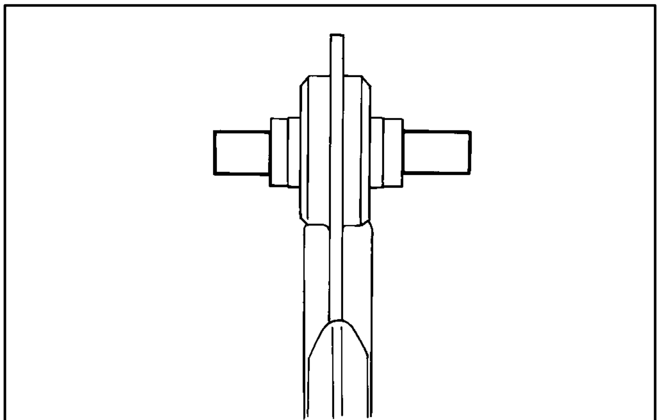
BALL JOINT

Disassembly and Assembly Procedure

1. Remove the control arm. Refer to *"Control Arm"* in this section.
2. Drill off the heads of the three rivets with a 12 mm (0.47 inch) drill bit.
3. Punch out the rivets with a drift.

Installation Notice

Tightening Torque	Ball Joint Pinch Bolt	60 N·m (44 lb–ft)



B106C019

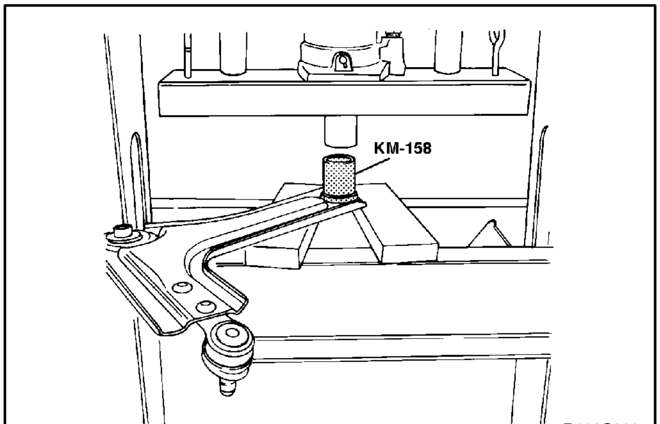
CONTROL ARM BUSHINGS

Disassembly and Assembly Procedure

Tools Required

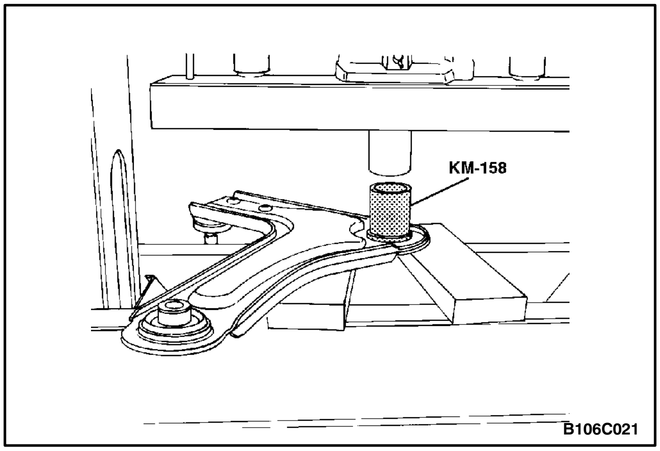
KM–158 Remover/Installer

1. Remove the control arm. Refer to *"Control Arm"* in this section.
2. Remove the split sleeves from the rear control arm bushing.

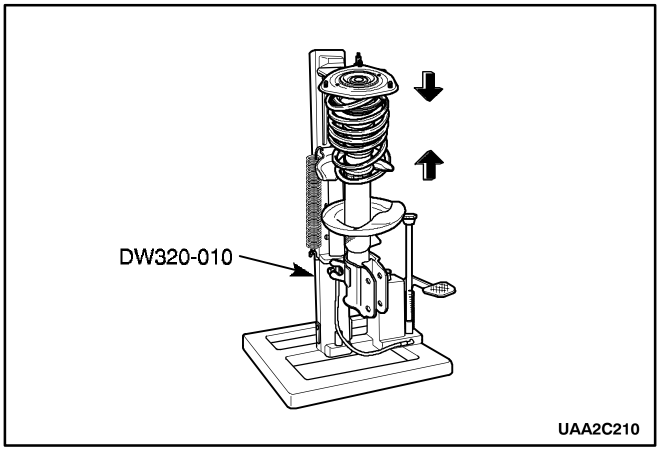


B106C020

3. Press off the control arm rear damping bushing using a press and the remover/installer KM–158.



4. Press out the control arm front damping bushing using a press and the remover/installer KM–158.



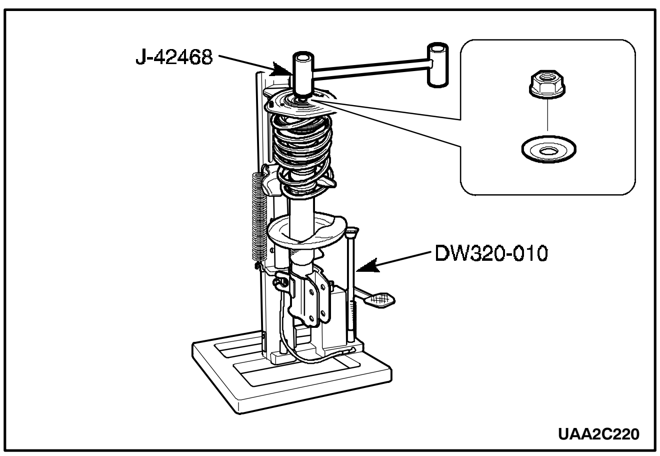
FRONT STRUT

Disassembly and Assembly Procedure

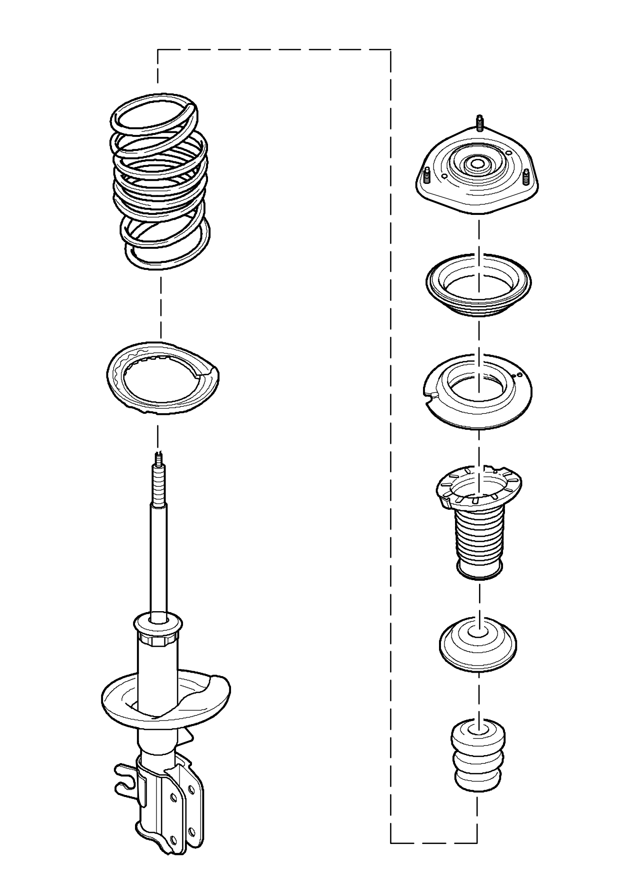
Tools Required

DW320–010 Suspension Compressor

1. Remove the strut assembly. Refer to *"Strut Assembly"* in this section.
2. Fasten the strut assembly to the suspension compressor DW320–010.
3. Compress the front spring with the suspension compressor DW320–010.



4. Use an open end wrench to hold the threaded piston rod while removing the piston rod nut and washer with a commercially available double ring spanner, sharply offset.



UAA2C230

Important : Record the position of the front spring locator relative to the strut assembly-to-knuckle bracket. Place the front spring locator back in the same position during assembly.

5. Remove the upper strut mount, the mount bearing, the upper spring seat, the upper sprig insulator, the washer, the hollow bumper, the coil spring, and the lower spring insulator.

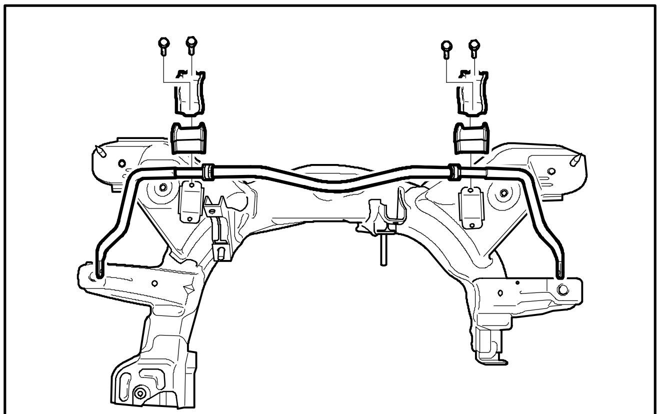
Installation Notice

Tightening Torque	Piston Rod Nut	80 N·m (59 lb–ft)

KNUCKLE

Disassembly and Assembly Procedure

1. Remove the knuckle assembly. Refer to *"Knuckle Assembly"* in this section.
2. Remove the rotor. Refer to *Section 4D, Front Disc Brakes.*
3. Remove the hub and bearing assembly. Refer to *"Hub and Bearing"* in this section.
4. Remove the brake splash shield. Refer to *Section 4D, Front Disc Brakes.*

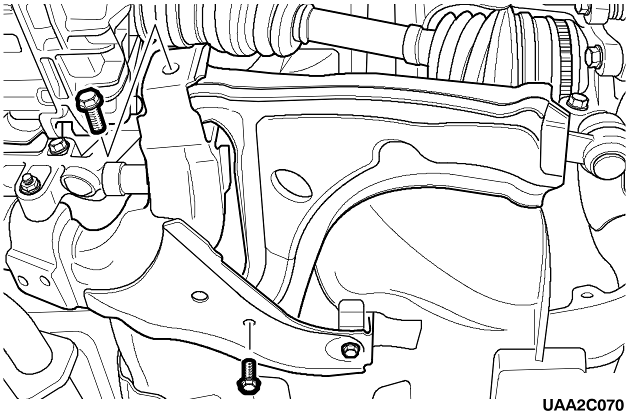


UAA2C150

CROSSMEMBER

Disassembly and Assembly Procedure

1. Remove the crossmember assembly from the vehicle. Refer to *"Crossmember Assembly"* in this section.
2. Remove the stabilizer shaft and insulators. Refer to *"Stabilizer Shaft and Insulators"* in this section.


UAA2C070

3. Remove the control arm. Refer to *“Control Arm”* in this section.

SPECIFICATIONS

GENERAL SPECIFICATIONS

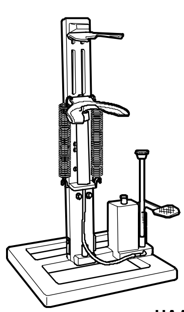
Application		Unit	Description
Suspension Type		–	Mcpherson (Strut)
Shock Absorber	Maximum Length	mm (inch)	499 (19.6)
	Minimum Length	mm (inch)	347 (13.7)
	Strock	mm (inch)	152 (6)
Stabilizer Shaft Diameter		mm (inch)	20 (0.8)
Coil Spring Height (No Load)		mm (inch)	439 (17.3)

FASTENER TIGHTENING SPECIFICATIONS

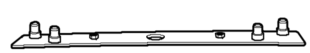
Application	N•m	Lb-Ft	Lb-In
Steering Knuckle-to-Strut Assembly Bolt	100	74	–
Body-to-Strut Assembly Nut	35	26	–
Stabilizer Shaft-to-Stabilizer Link Nut	48	35	–
Strut Assembly-to-Stabilizer Link Nut	48	35	–
Crossmember-to-Control Arm Front Bolt	147	108	–
Crossmember-to-Control Arm Rear Bolt and Nut	110	81	–
Ball Joint Pinch Bolt	60	44	–
Crossmember-to-Body Front Bolt	196	145	–
Crossmember-to-Body Rear Bolt	196	145	–
Stabilizer Shaft-to-Crossmember Clamp Bolt	45	33	–
Piston Rod Nut	80	59	–
Front Hub Caulking Nut	280	206	–

SPECIAL TOOLS AND EQUIPMENT

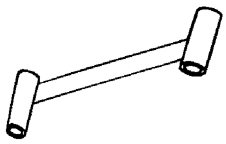
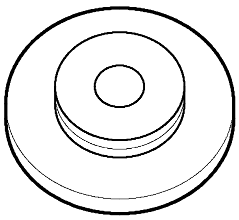
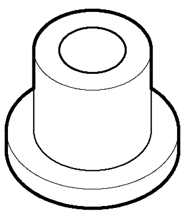
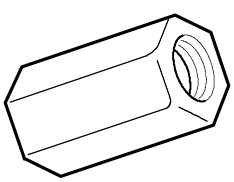
SPECIAL TOOLS TABLE

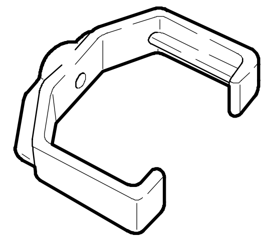
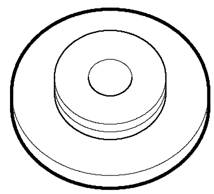
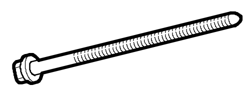
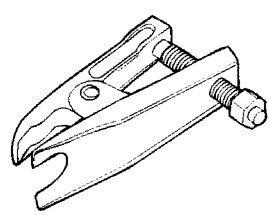

UAA2C240

DW320–010 Suspension Compressor


UAA2C250

DW110–070 Crossmember Remover / Installer

 UAA2C260	**J–42468 Strut Piston Rod Nut Wrench**
 UAA2C280	**DW340–040–02 Wheel Bearing Remove Adapter**
 UAA2C300	**DW340–040–04 Hub Remove Adapter**
 UAA2C320	**DW340–040–06 Hex Nut**

 UAA2C270	**DW340–040–01 Support Bridge**
 UAA2C290	**DW340–040–03 Wheel Bearing Install Adapter**
 UAA2C310	**DW340–040–05 Forcing Bolt**
 UAA2C330	**KM–507–B Ball Joint Remover**

SECTION 2D

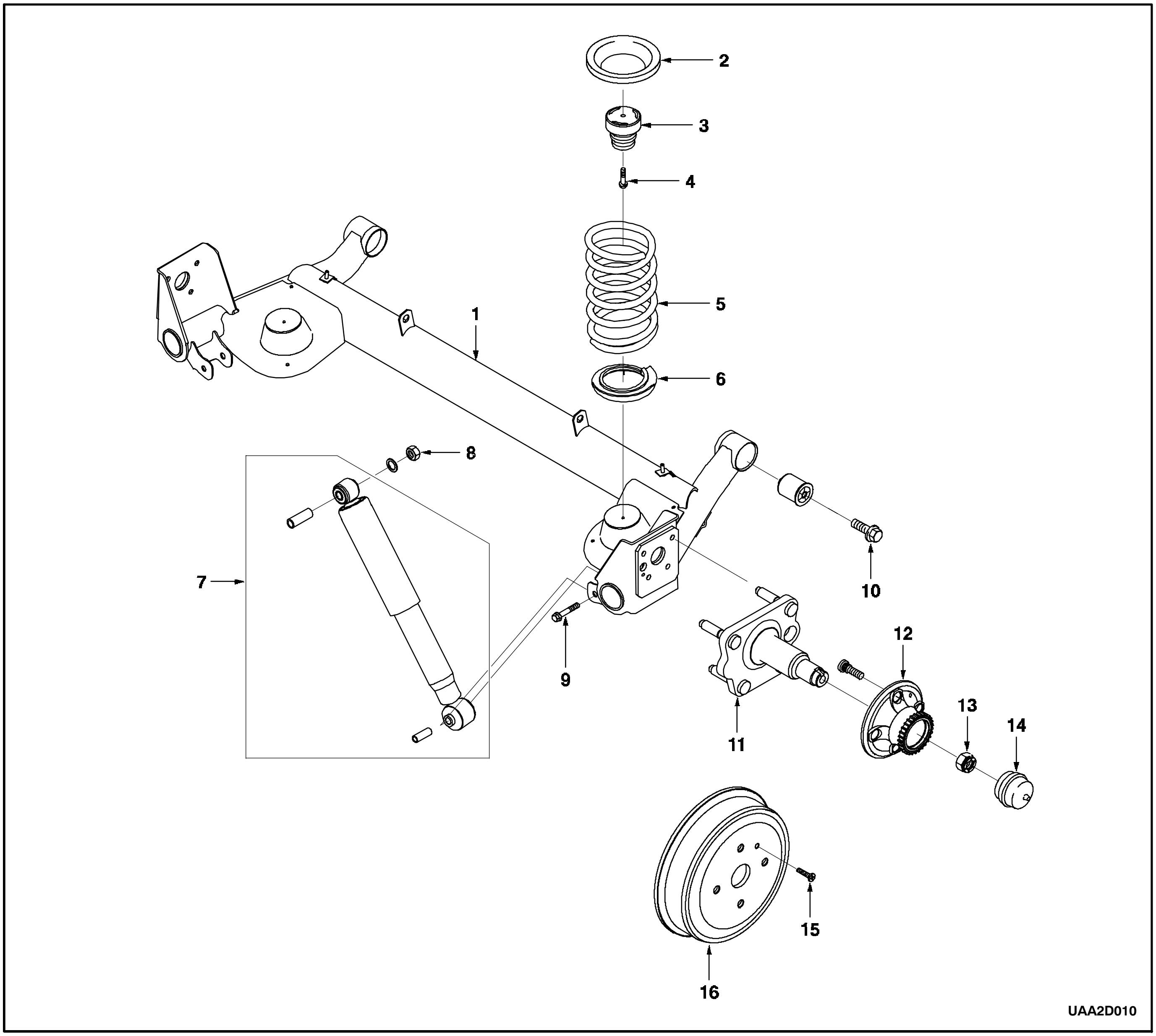
REAR SUSPENSION

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

COMPONENT LOCATOR

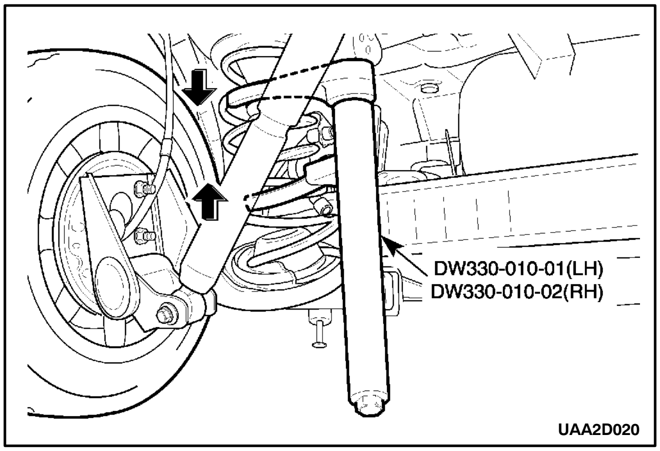
REAR SUSPENSION



1 Rear Axle
2 Upper Spring Insulator
3 Hollow Bumper
4 Hollow Bumper Bolt
5 Coil Spring
6 Lower Spring Insulator
7 Shock Absorber
8 Shock Absorber Upper Mounting Nut
9 Shock Absorber Lower Mounting Bolt
10 Rear Axle Support Bolt
11 Wheel Bearing Spindle
12 Hub
13 Caulking Nut
14 Spindle Cap
15 Brake Drum Screw
16 Brake Drum

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



REAR SHOCK ABSORBER

Removal and Installation Procedure

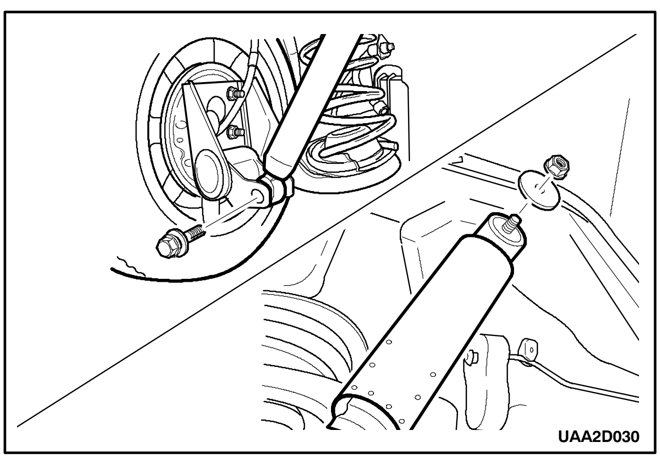
Notice: Remove only one shock at a time when both shocks are being replaced. Suspending the rear axle at full length can result in damage to brake lines and hoses. For ease of removal of the rear left shock absorber, remove the rear muffler. Refer to *Section 1G, Engine Exhaust*.

Tools Required

DW330–010–01 Rear coil spring Compressor (LH)

DW330–010–02 Rear coil spring Compressor (RH)

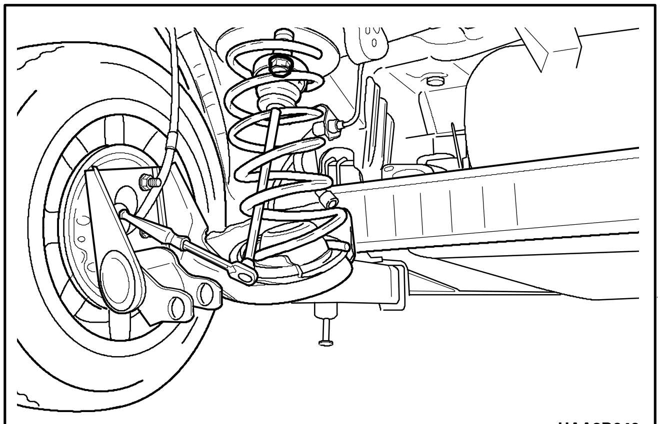
1. Raise and suitably support the vehicle. When lifting the vehicle with a body hoist, it will be necessary to support the rear axle with adjustable jack stands.
2. Compress the spring with the rear coil spring compressor DW330–010–01(LH), and DW330–010–02 (RH).



3. Remove the rear shock absorber lower mounting bolt.
4. Remove the rear shock absorber upper mounting nut and washer.
5. Remove the rear shock absorber from the vehicle.

Installation Notice

Tightening Torque	Rear Shock Absorber Lower Mounting Bolt	80 N·m (59 lb–ft)
Tightening Torque	Rear Shock Absorber Upper Mounting Nut	70 N·m (52 lb–ft)



UAA2D040

COIL SPRING AND INSULATOR

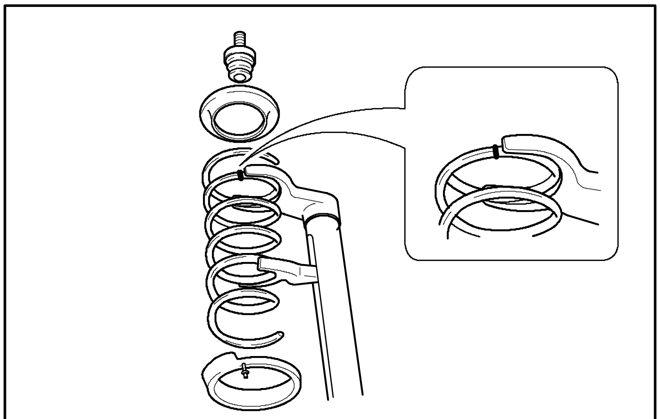
Removal and Installation Procedure

Tools Required

DW330–010–01 Rear coil spring Compressor (LH)

DW330–010–02 Rear coil spring Compressor (RH)

1. Raise and suitably support the vehicle. Use a frame contact hoist if possible and support the rear control arms with jack stands. If it becomes necessary to lift the vehicle with a twin-post hoist, lift the body and support the control arms with jack stands.
2. Remove the rear shock absorber. Refer to "Rear Shock Absorber" in this section.
3. Remove the hollow bumper bolt.



UAA2D050

Important : Record the position of the coil spring locator relative to the coil spring-to-rear coil spring compressor DW330–010–01(LH), and DW330–010–02(RH). For ease of installation of the coil spring.

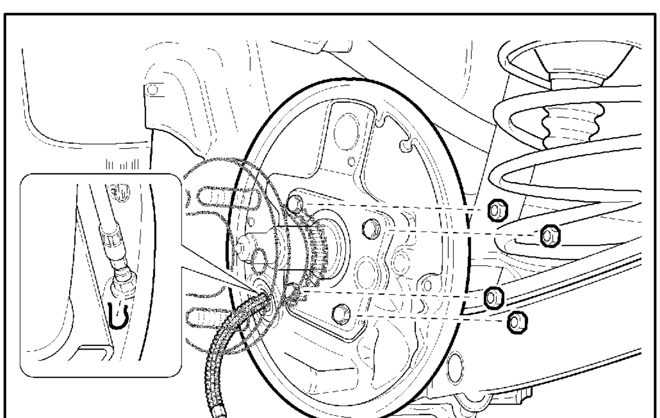
4. Compress the coil spring with the rear coil spring compressor DW330–010–01(LH), and DW330–010 –02(RH).
5. Remove the coil spring.
6. Record the position of the coil spring locator.
7. Remove the hollow bumper, the upper spring insulator, and the lower spring insulator.

Notice: For ease of removal of the rear left shock absorber, remove the rear muffler. Refer to *Section 1G, Engine Exhaust*.

Installation Notice

Tightening Torque	Hollow Bumper Bolt	22 N·m (16 lb–ft)

- Prior to installing the spring, it will be necessary to install the upper insulator and the lower insulator to the body with adhesive to keep them in position while raising the axle assembly and the spring.

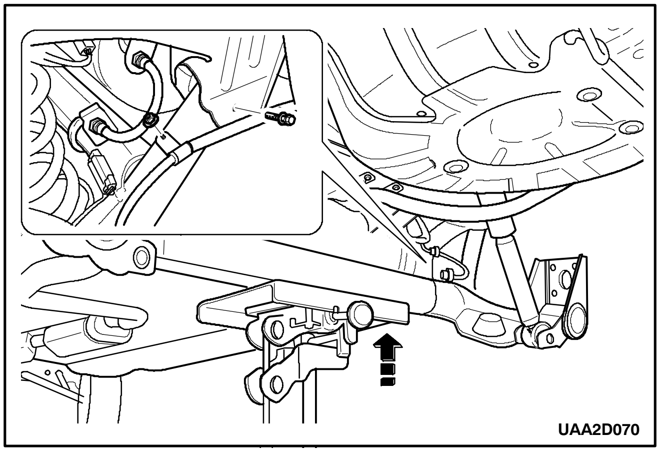


UAA2D060

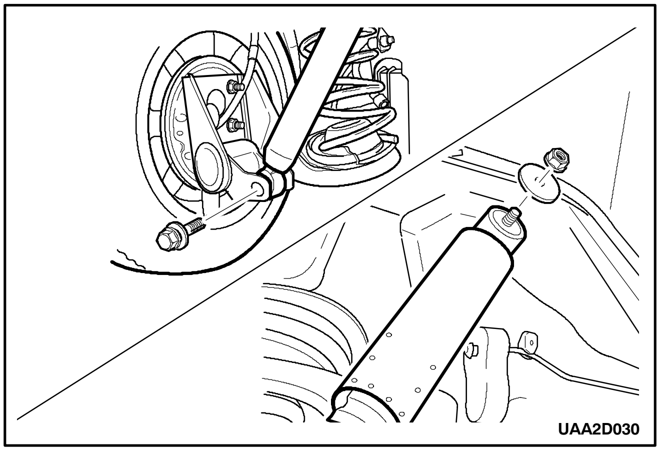
REAR AXLE ASSEMBLY

Removal and Installation Procedure

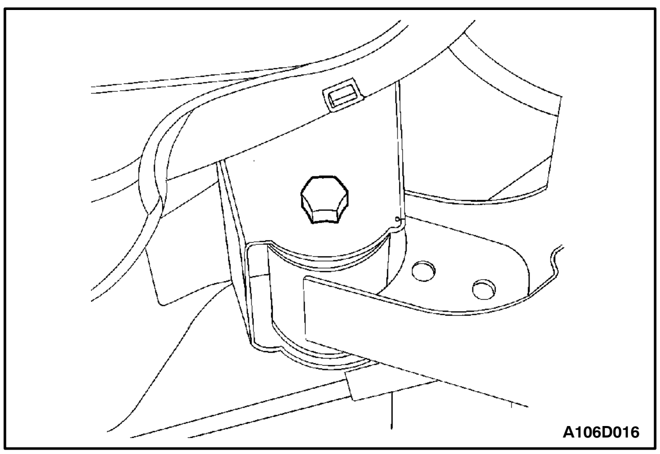
1. Raise and suitably support the vehicle.
2. Remove the rear wheels. Refer to *Section 2E, Tires and Wheels*.
3. Remove the backing plate. Refer to *Section 4E, Rear Drum Brakes*.
4. On vehicles equipped with an antilock braking system(ABS), remove the ABS speed sensor and disconnect the ABS sensor line. Refer to *Section 4F, Antilock Brake System*.



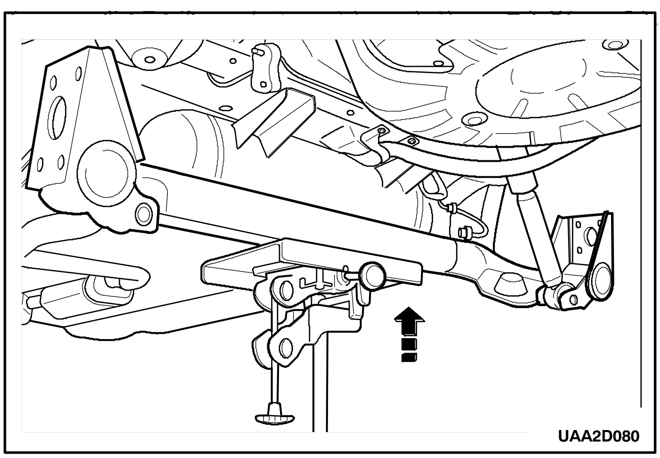
5. Remove the parking brake cable bracket nuts and disconnect the parking brake. Refer to *Section 4G, Parking Brake.*
6. Disconnect the brake pipes from the brake hoses at the rear axle brackets by removing the retaining clip. Cap or tape the brake hose openings to prevent entry of foreign matter. Unclip the brake hose from the rear axle brackets. Refer to *Section 4A, Hydraulic Brakes.*



7. Place support jacks under the arms of the rear axle and raise the rear axle arms slightly.
8. Remove the coil springs and insulators. Refer to “Coil Spring and Insulator” in this section.
9. Remove the rear shock absorbers. Refer to “Rear Shock Absorber” in this section.



10. Remove the rear axle support bolts and nuts from the underbody.



Caution : Two technicians and jack stands must hold the rear axle during removal of the rear axle support bolts and nuts. Failure to support the rear axle properly can result in personal injury.

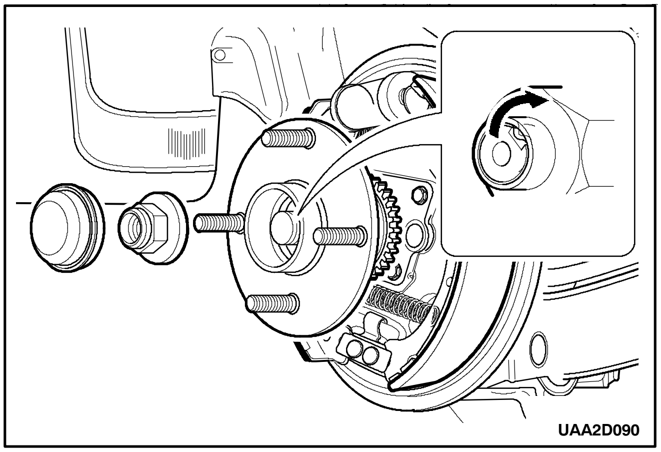
11. Lower the support jacks and remove the rear axle.

Installation Notice

Tightening Torque	Rear Axle Support Bolts and Nuts	110 N·m (81 lb–ft)

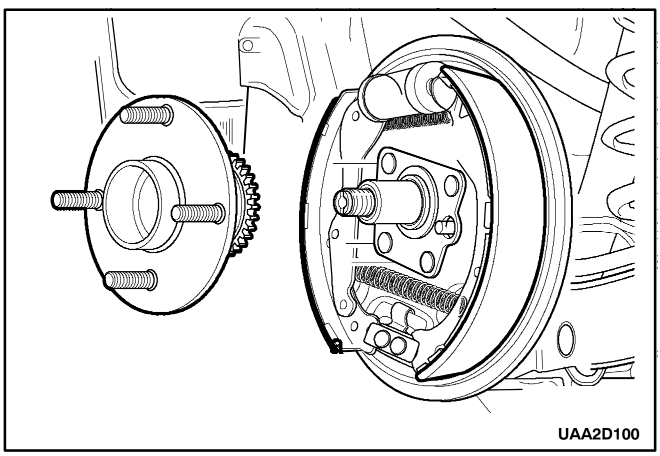
- Tighten the underbody-to-rear axle support bolts and nuts, when adjust the distance between the wheel arch and the wheel center to be 367±15mm.

- Bleed the brake system and check for leaks. Refer to *Section 4A, Hydraulic Brakes.*
- Adjust the rear wheel brakes. Refer to *Section 4E, Rear Drum Brakes.*



HUB AND BEARING ASSEMBLY

1. Raise and suitably support the vehicle.
2. Remove the rear wheels. Refer to *Section 2E, Tires and Wheels*.
3. Remove the rear brake drum. Refer to *Section 4E, Rear Drum Brakes*.
4. Remove the dust cap and straighten the indent in the caulking nut with a drift and hammer.
5. Remove the caulking nut.

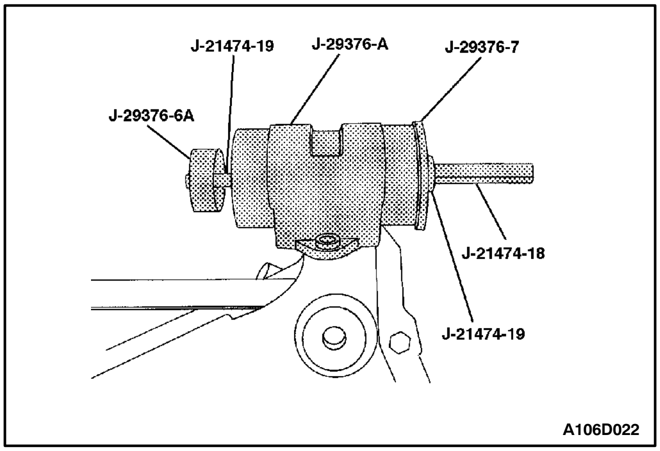


6. Remove the hub and bearing assembly.

Installation Notice

Tightening Torque	Caulking Nut	235 N·m (173 lb–ft)

UNIT REPAIR



CONTROL ARM BUSHINGS

Disassembly Procedure

Tools Required

KM–266–A Remover

J–21474–18 Nut

J–21474–19 Puller Bolt/ Trust Washer

J–29376–A Control Arm Bushing Housing

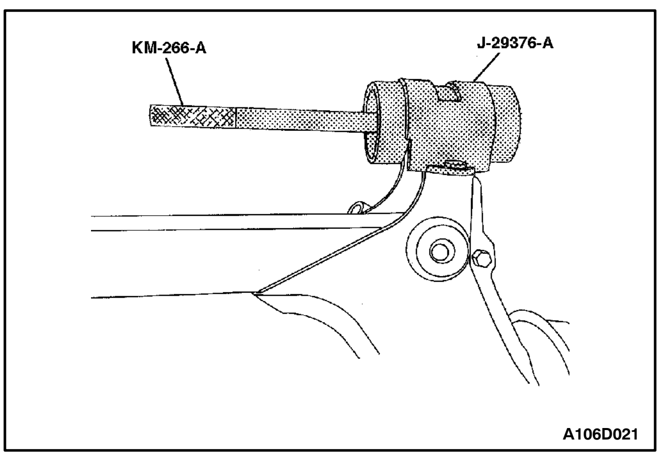
J–29376–6A Control Arm Bushing Remover/Installer

J–29376–7 Control Arm Bushing Plate

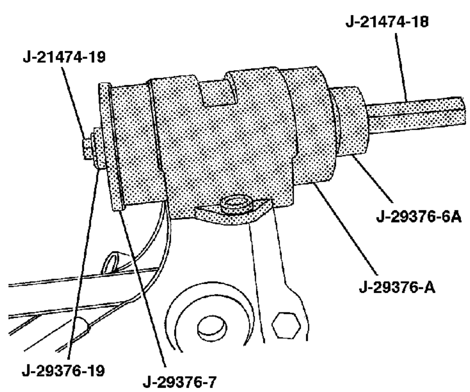
1. Raise and suitably support the vehicle.
2. Remove the rear axle and secure it to a workbench. Refer to “Rear Axle Assembly” in this section.

Notice: To facilitate removal of damping bushings, warm the rear axle in the area of the bushings to approximately 50 to 75°C(122 to 158°F) using an industrial hot air dryer.

3. Place the control arm bushing housing J–29376–A on the rear axle. Slide the puller bolt/thrust washer J–21474–19 through the control arm bushing remover/installer J–29376–6A, the rear control arm bushing, the control arm bushing plate J–29376–7 and into the nut J–21474–18.
4. Partially remove the rear axle bushing by turning the nut J–21474–18 and counterholding the puller bolt J–21474–19.



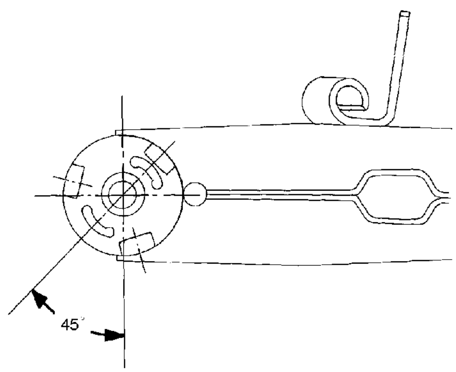
5. Remove the rear axle busing completely by striking the control arm bushing remover/installer J–29376–6A with the remover KM–266–A.



A106D010

Assembly Procedure

1. Place the control arm bushing housing J–29376–A on the rear axle. Slide the puller bolt J–21474–19 through the trust washer J–21474–19, the control arm bushing, the control arm bushing remover/installer J–29376–6A, and into the nut J–21474–18.
2. Install the rear axle bushing by turning the nut J–21474–18 and counterholding the puller bolt J–21474–19.



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3. Be sure the bushing angle is 40 to 50 degrees to the axis of the rear axle.
4. Install the rear axle. Refer to “Rear Axle Assembly” in this section.
5. Lower the vehicle.

SPECIFICATIONS

GENERAL SPECIFICATIONS

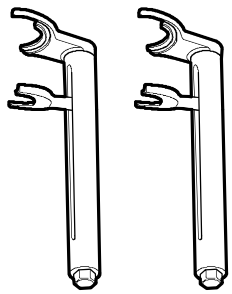
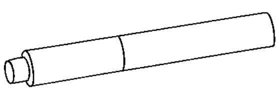
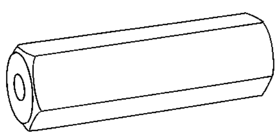
Application		Unit	Description
Suspension Type		–	Torsion Beam Axle
Shock Absorber	Maximum Length	mm (inch)	493 (19.4)
	Minimum Length	mm (inch)	317 (12.5)
	Strock	mm (inch)	176 (6.9)
Coil Spring Height (No Load)		mm (inch)	328 (12.9)

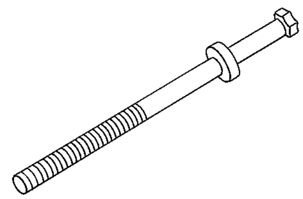
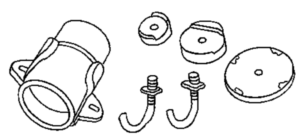
FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Hollow Bumper Bolt	22	16	–
Rear Shock Absorber Upper Mounting Nut	70	52	–
Rear Shock Absorber Lower Mounting Bolt	80	59	–
Rear Axle Support Bolt and Nut	110	81	–
Caulking Nut	235	173	–

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 UAA2D110	**DW330–010–01 (LH) DW330–010–02 (RH) Rear Coil Spring Compressor**
 A106D020	**KM–266–A Remover**
 A106D029	**J–21474–18 Nut**

 A106D030	**J–21474–19 Puller Bolt & Thrust Washer**
 A106D031	**• J-29376-A Rear Control Arm Bushing Housing • J-29376-6A Rear Control Arm Bushing Remover/Installer • J-29376-7 Rear Control Arm Bushing Plate**

SECTION 2E

TIRES AND WHEELS

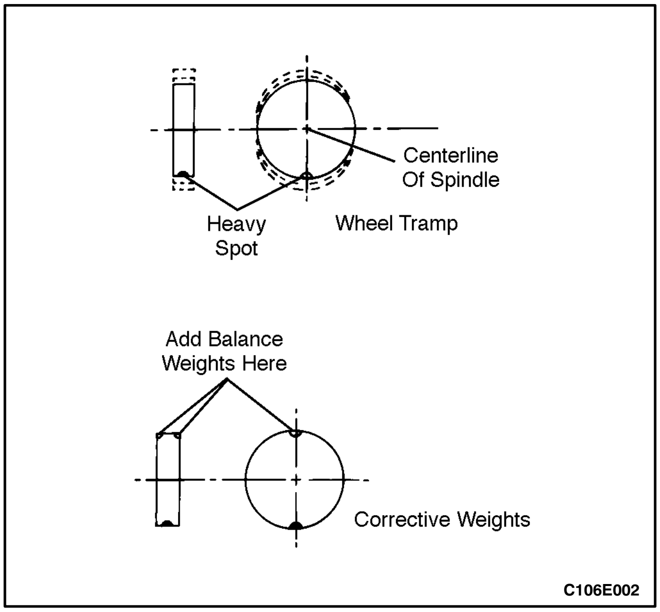
TABLE OF CONTENTS

DESCRIPTION AND OPERATION

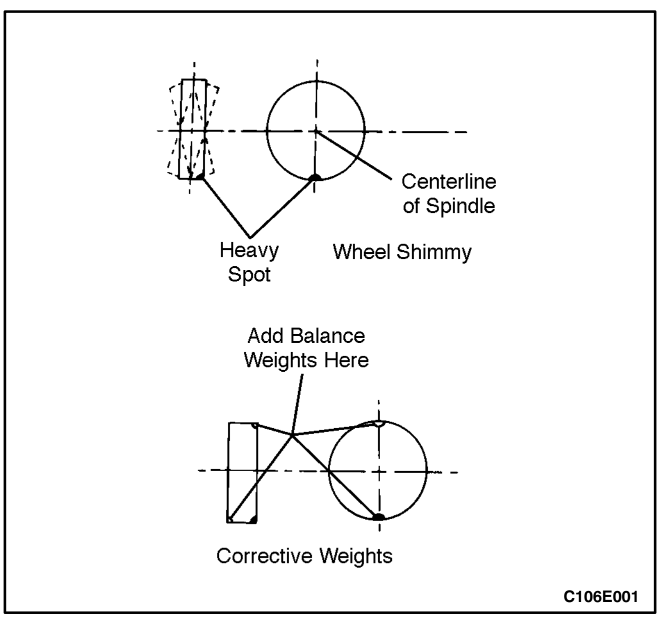
TIRE AND WHEEL BALANCING

There are two types of tire and wheel balancing: static and dynamic.

Static balance is the equal distribution of weight around the wheel. Assemblies that are statically unbalanced cause a bouncing action called wheel tramp. This condition may eventually cause uneven tire wear.



Dynamic balance is the equal distribution of weight on each side of the centerline so that when the assembly spins there is no tendency for it to move from side to side. Assemblies that are dynamically unbalanced may cause wheel shimmy.



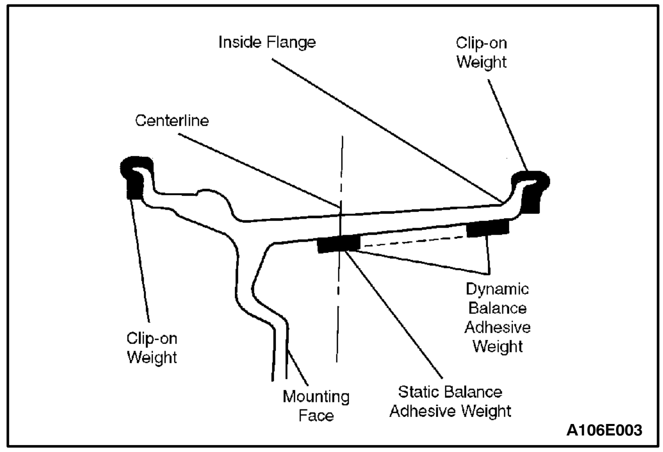
General Balance Precautions

Remove all deposits of foreign material from the inside of the wheel.

Caution: Remove stones from the tread in order to avoid operator injury during spin balancing.

Inspect the tire for any damage. Balance the tire according to the equipment manufacturer's recommendations.

Wheel Weights



If more than 85 grams (3.0 ounces) are needed to static balance the wheel, split the wheel weights as equally as possible between the inboard and the outboard flanges.

Balancing the assemblies with factory alloy wheels requires the use of special nylon-coated, clip-on wheel weights.

These weights are designed to fit over the thicker rim flange of the alloy wheel. Install these weights with a plastic-tipped hammer.

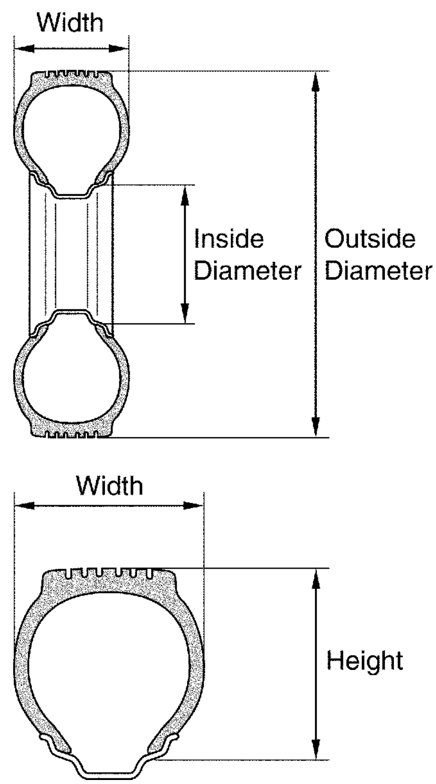
Adhesive wheel weights are also available. Use the following procedure to install adhesive wheel weights.

Adhesive Wheel Weight Installation

1. Clean the wheel by sanding it to bare alloy where the wheel weight will be installed.
2. Use a clean cloth or paper towel saturated with a mixture of half isopropyl alcohol and half water to wipe the place where the wheel weight will be installed.
3. Dry the area with hot air. The surface of the wheel should be warm to the touch.
4. Warm the adhesive backing on the wheel weights to room temperature.
5. Remove the tape from the back of the weights. Do not touch the adhesive surface.
6. Apply the wheel weight and press it on with hand pressure.

7. Secure the wheel weight with a 70–110 N (16–25 lb) force applied with a roller.

TIRE NOMENCLATURE



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195/60R15 87H	195	Width (mm)
	/60	Flatness ratio 60% (Height/Width)X100
	R	Radial
	15	Rim diameter (= Tire I.D, Inch)
	87	Max. load index
	H	Max. speed symbol

TIRE CHAIN USAGE

Due to limited tire-to-body clearance on certain vehicles, recommendations for tire chain use are published in the Owner's Manual. When tire chains need to be used, most current Daewoo vehicles require SAE Class "S" tire chains. These may also be designated as 1100 Series, type PL tire chains. These chains are specifically designed to limit the "fly off" effect which occurs when the wheel rotates.

Be sure that only fine-link chains are used which do not add more than 15 mm (0.590 inch), including the lock, to the tread surface and the inner sides of the tires. Manufacturers of tire chains have a specific chain size for each tire size to ensure a proper fit when the chain is installed. Be sure to purchase the correct chains for the tires on which they are to be used. Use rubber adjusters to take up any slack or clearance in loose chains.

Use of chains may adversely affect vehicle handling.

When tire chains are installed, follow these precautions:

- Adjust speed to road conditions.
- Avoid sharp turns.
- Avoid locked-wheel braking.

To prevent chain damage to the vehicle, install the chains on the front tires as tightly as possible. Tighten them again after driving 0.4 to 0.8 kilometer (0.3 to 0.5 mile). The use of chains on the rear tires is not recommended because they may contact the vehicle and possibly damage it. If chains must be used on the rear tires, be sure there is sufficient clearance between the chains and the body. Do not exceed 70 km/h (45 mph) or the chain manufacturer's speed limit, if lower. Avoid large bumps, potholes, severe turns and any other maneuvers which could cause the tires to bounce. Follow any other instructions of the chain manufacturer which do not disagree with the above instructions.

REPLACEMENT TIRES

A tire performance criteria (TPC) specification number is molded in the sidewall near the tire size of all original equipment tires. This specification number assures that the tire meets performance standards for traction, endurance, dimensions, noise, handling and rolling resistance. Usually a specific TPC number is assigned to each tire size.

Caution: Do not mix different types of tires on the same vehicle such as radial, bias and bias-belted tires except in emergencies, because vehicle handling may be seriously affected and may result in loss of control.

Use only replacement tires with the same size, load range, and construction as the original. The use of any other tire size or construction type may seriously affect ride, handling, speedometer/odometer calibration, vehicle ground clearance, and tire clearance to the body and the chassis. This does not apply to the spare tire furnished with the vehicle.

It is recommended that new tires be installed in pairs on the same axle.

If it is necessary to replace only one tire, pair it with the tire having the most tread to equalize the braking action.

Although they may appear different in tread design, tires built by different manufacturers with identical TPC specifications may be used on the same vehicle.

ALL SEASON TIRES

Most vehicles are now equipped with steel-belted all season radial tires as standard equipment. These tires qualify as snow tires, with a 37 percent higher average rating for snow traction than the non-all season radial tires previously used. Other performance areas, such as wet traction, rolling resistance, tread life, and air retention, have also been improved. This was done by improvements in both tread design and tread compounds. These tires are identified by an "M + S" molded in the tire sidewall following the size number. The suffix "MS" is also molded in the sidewall after the TPC specification number.

The optional handling tires used on some vehicles are not all season tires. These will not have the "MS" marking after the tire size or the TPC specification number.

TIRE LABEL

The tire label is permanently located on the rear face of the driver's door and should be referred to for tire information. It lists the maximum vehicle load, the tire size (including the spare tire), and the cold inflation pressure (including the spare tire).

SPARE TIRE

This vehicle comes equipped with a full-sized spare tire and wheel.

INFLATION OF TIRES

The pressure recommended for any vehicle line is carefully calculated to give a satisfactory ride, handling, tread life, and load-carrying capacity.

Tire pressure should be checked monthly or before any extended trip. Check the tires when they are cold, after the vehicle has sat for 3 hours or more or has been driven less than 1 mile. Set the tire pressure to the specifications on the tire label located on the rear face of the driver's door. Tire inflation pressure is also given under *"Tire Size and Pressure Specifications"* in this section.

Valve caps or extensions should be on the valves to keep dust and water out.

For sustained driving at speeds up to 140 km/h (85 mph), inflate the tires to the pressure recommended on thetire. Sustained driving at speeds faster than 140 km/h (85 mph), even if permitted by law, is not advised unless the vehicle has special high-speed tires available from many tire dealers. Tire pressures may increase as much as 41 kPa (6 psi) when the tires are hot.

Higher than recommended tire pressure can cause

- Hard ride.
- Tire bruising or damage.
- Rapid tread wear at the center of the tire.

Lower than recommended pressure can cause

- Tire squeal on turns.
- Hard steering.
- Rapid and uneven wear on the edges of the tread.
- Tire rim bruises and rupture.
- Tire cord breakage.
- High tire temperatures.

Unequal tire pressures on same axle can cause

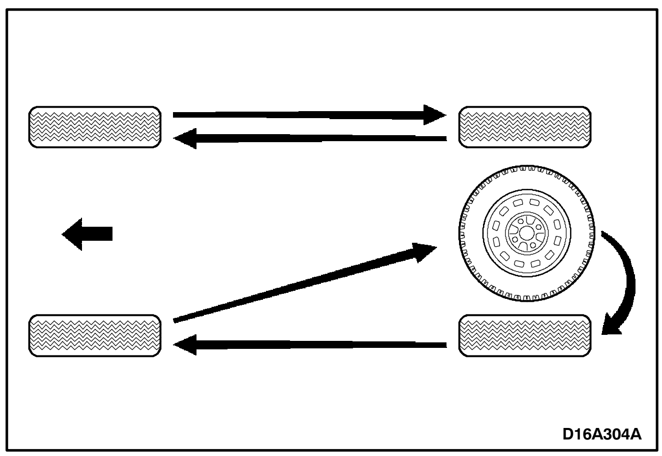
- Uneven braking.
- Steering lead.
- Reduced handling.
- Swerve on acceleration.
- Torque steer.

ROTATION TIRES

Front and rear tires perform different jobs and can wear differently depending on the tires of road driven, driving habit, etc.

The front tires will wear faster than the rear tires.

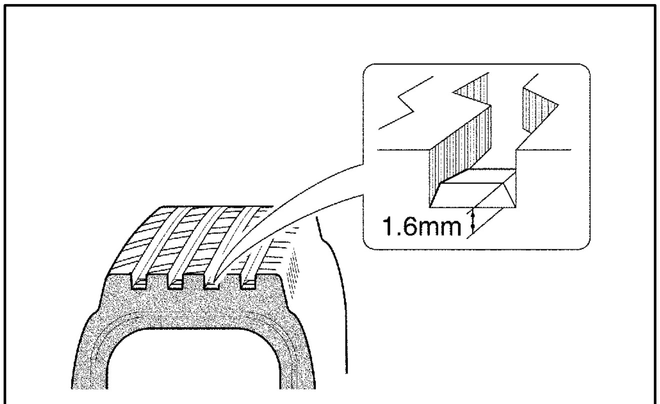
To avoid uneven wear of tires and to prolong tire life, inspect and rotate the tires every 5,000 km (3,100 miles). After rotating the tires, adjust the tire inflation pressures and be sure to check wheel nuts tightness.



DIAGNOSTIC INFORMATION AND PROCEDURES

TIRE WEAR

1. Measure the depth of the tire tread.
2. If the depth of the tread is below the specified value, replace the tire.



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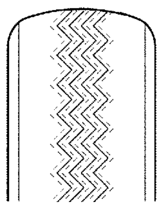
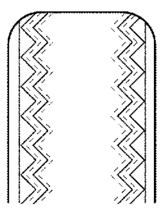
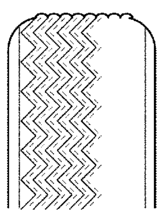
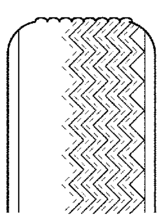
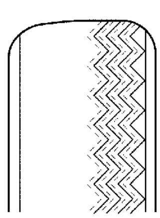
Limit of The Tread Wear	1.6mm (0.06 in.)

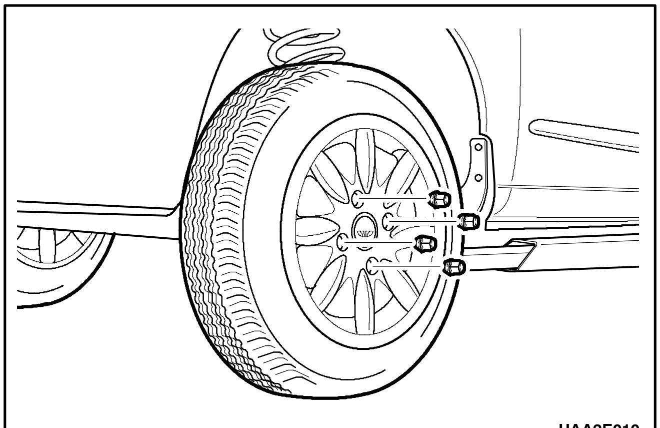
3. Indicators appear when the tire tread depth becomes shallow (less than 1.6mm (0.06 in.)).

IRREGULAR OR EXCESSIVE TIRES WEAR

Condition	Probable Cause	Correction
 D16A305A	• Low tire inflation pressures. • Improper the tire rotation.	• Adjust tire inflation pressures. • Rotate the tires.
 D16A305B	• Excessive tire inflation pressures. • Improper the tire rotation.	• Adjust tire inflation pressures. • Rotate the tires.
 D16A305C	• Poor toe-in.	• Adjust the toe-in.
 D16A305D	• Toe-out.	• Adjust the toe-in.
 D16A305E	• Poor camber or caster. • Faulty suspensions. • Poor wheel balancing. • Improper the tire rotation.	• Check the steering knuckle, control arm, drive axle, and suspensions. Repair or replace them, as needed. • Adjust the wheel balancing. • Rotate the tires.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



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WHEEL

Removal and Installation Procedure

1. Loosen the wheel nuts.
2. Raise and suitably support the vehicle.
3. Remove the wheel nuts.

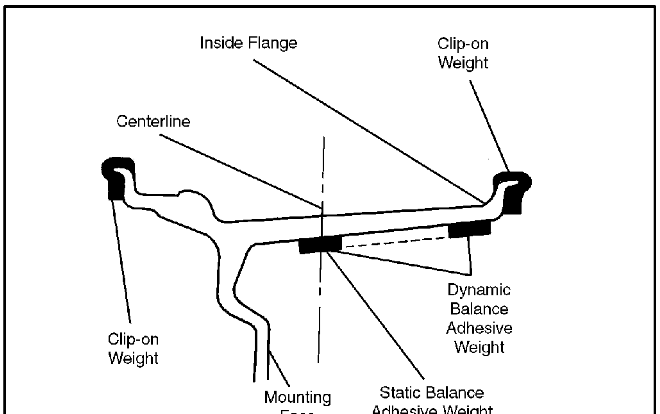
Notice: Never use heat to loosen a tight wheel. It can shorten the lift of the wheel, the wheel nuts and the wheel bearings. Excessive force, such as hammering the wheel or tire, can also cause damage and is not recommemded. Slight tapping of the wheel sidewall with one's hand or with a mallet is acceptable.

4. Remove the wheel.

Installation Notice

Tightening Torque	Wheel Nuts	108 N·m (80 lb–ft)

- Before installing the wheels, remove any build up of corrosion on the wheel mounting surface and the brake drum or the rotor mounting surface by scraping and brushing then with a wire brush. Installing the wheels without good metal-to-metal contact at the mounting surface can cause the wheel nuts to loosen, which can later allow a wheel to come off wheel while the vehicle is moving. Wheel nuts must be tightened in sequence and to the proper torque to avoid bending the wheel, the brake drum or the rotor.



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ON-VEHICLE BALANCING

On-vehicle balancing will help correct vibrations due to brake drum, rotor, and wheel cover imbalances.

Notice: Do not allow the front suspension to hang free. When the drive axle is run at an extreme angle, extra vibrations can occur, as well as damage to seals and joints.

1. During on-vehicle balancing, do not remove the balance weights from the off-vehicle dynamic balance.
2. If more than 1 ounce of additional weight is required, split the weight between the inner and the outer rim flanges.

Caution: Do not spin the drive wheels faster than 55 km/h (35 mph) as indicated by the speedometer. This limit is necessary because the speedometer indicates only one-half of the actual wheel speed when one drive wheel is spinning and the other drive wheel is stopped. Personal injury and damage may result from high-speed spinning.

3. Spin the driven tire and wheel assemblies using the engine.

UNIT REPAIR

ALLOY WHEEL POROSITY

Wheel repairs that use welding, heating or peening are not approved.

1. Raise and suitably support the vehicle.
2. Remove the tire and wheel assembly. Refer to “Wheel” in this section.

Caution: To avoid serious injury, do not stand over the tire when inflating, because the bead may break when it snaps over the safety hump. Do not exceed 275 kPa (40 psi) of air pressure in any tire if the beads are not seated. If 275 kPa (40 psi) of air pressure will not seat the beads, deflate the tire. Relubricate the beads. Reinflate the tire. Overinflation may cause the bead to break and cause serious injury.

3. Locate leaking areas by inflating the tire to 345 kPa (50 psi) and dipping the tire and wheel assembly into a water bath.
4. Mark the leak areas and remove the tire from the wheel.
5. Scuff the inside wheel surface at the leak area with 80-grit sandpaper. Clean the leak area with a general-purpose cleaner.
6. Apply a 3.3 mm (0.13 inch) thick layer of adhesive/sealant to the leak area. Allow it to dry for 12 hours.
7. Install the tire on the wheel. Inflate the tire to 345 kPa (50 psi) and check for leaks as in step 3.
8. Adjust the tire pressure to meet specifications. Refer to “Tire Size and Pressure Specifications” in this section.
9. Balance the tire and wheel assembly. Refer to “Tire and Wheel Balancing” in this section.
10. Install the tire and wheel assembly. Refer to “Wheel” in this section.
11. Lower the vehicle.

ALLOY WHEEL REFINISHING

A protective clear or color coating is applied to the surface of the original equipment cast alloy wheels. Surface degradation can develop if this clear coating is damaged or removed. This can happen at some automatic car wash facilities that use silicone carbide-tipped tire brushes to clean white walls and tires. Once the protective coating is damaged, exposure to caustic cleaners or road salt causes further surface degradation. The following procedure details how to strip, clean and recoat alloy wheels.

Caution: To avoid serious personal injury, follow the manufacturer’s recommendations and cautions when using these materials.

Required materials

Amchem Alumi Prep No. 33 – Stock No. DX533 or equivalent cleaning and conditioning chemical for alloys.

Amchem Alodine No. 1001 – Stock No. DX50T or equivalent coating chemical for alloys.

Ditzler Delclear Acrylic Urethane Clear – Stock No. DAU-75 or equivalent.

Ditzler Delthane Ultra-Urethane Additive – Stock No. DXR-80 or equivalent.

Before repairing the alloy damage or the clear coat damage, prepare the wheels and tires.

1. Remove the wheel from the vehicle. Refer to "Wheel" in this section.
2. Mark the location of the outboard weights and remove them.
3. Wash the wheel inside and out with a water-based all-purpose cleaner. Remove the grease and oil with a solvent cleaner.
4. Mask the tire prior to painting.
5. Using a 400-grit wet or dry sandpaper, sand over the painted areas that will not require recoloring. Sanding will promote the adhesion of the clear coat.

OFF-VEHICLE BALANCING

Perform wheel balancing with an electronic off-vehicle balancer. The balancer is easy to use and gives both a static and a dynamic balance. Unlike on-vehicle balancing, the off-vehicle balancer does not correct for drum or rotor imbalance. This drawback is overcome by its accuracy (usually to within 1/8 ounce). Secure the wheel on the balancer with a cone through the back side of the centerhole, not through the wheel bolt holes.

CORRECTING NON-UNIFORM TIRES

There are two ways to correct properly balanced tires which still vibrate. One method uses an automatic machine which loads the tire and buffs small amounts of rubber from high spots on the outer two tread rows. Correction by this method is usually permanent and, if it is done properly, does not significantly affect the appearance or the tread life of the tire. Tire truing with a blade-type machine is not recommended because it substantially reduces the tread life and often does not correct the problem permanently.

Another method is to dismount the tire and rotate it 180 degrees on the rim. Do this only on the tire and wheel assemblies which are known to be causing a vibration because this method is just as likely to cause good assemblies to vibrate.

TIRE AND WHEEL MATCH-MOUNTING

The tires and wheels are match-mounted at the assembly plant. Match-mounting aligns the radially stiffest part of the tire, or high spot, to the smallest radius, or low spot, of the wheel.

The high spot of the tire is originally marked by a red paint mark or an adhesive label on the outboard sidewall.

The low spot of the wheel will be at the location of the valve stem.

Before dismounting a tire from its wheel, scribe a line on the tire at the valve stem to assure that it is remounted in the same position.

Replacement tires that are of original equipment quality will have their high and low spot marked in the same manner.

TIRE MOUNTING AND DISMOUNTING

Notice: Use a tire-changing machine to mount or dismount the tires. Follow the equipment manufacturer's instructions. Do not use hand tools or tire irons to change tires. These tools may damage the beads or the wheel rim.

1. Clean the rim bead seats with a wire brush or coarse steel wool to remove lubricants, old rubber, and light rust. Before mounting or dismounting a tire, lubricate the bead area well with an approved tire lubricant.

Caution: To avoid serious injury, do not stand over the tire when inflating it, because the bead may break when it snaps over the safety hump. Do not exceed 275 kPa (40 psi) of air pressure in any tire if the beads are not seated. If 275 kPa (40 psi) of air pressure will not seat the beads, deflate the tire. Relubricate the bead and reinflate the tire. Overinflation may cause the bead to break and cause serious injury.

2. After mounting the tire, inflate it until the beads are seated. Never exceed 275 kPa (40 psi) to seat the beads.
3. Install the valve core and inflate the tire to the proper pressure. Make sure the locating ring outside of the bead of the tire shows around the rim flanges of the wheel on both sides. This positioning of the tire will insure that the bead of the tire is seated.

SPECIFICATIONS

TIRE SIZE AND PRESSURE SPECIFICATIONS

Inflation Pressure at Full Load (General)

Engine	Tires	Wheel	Front		Rear	
–	–	–	kPa	psi	kPa	psi
1.6 DOHC	185/70R14	5.5Jx14 (Steel)	220	32	220	32
2.0 DOHC	195/60R15	6.0Jx15 (Steel)	220	32	220	32
1.6 DOHC	185/70R14	5.5Jx14 (Alloy)	220	32	220	32
2.0 DOHC	195/60R15	6.0Jx15 (Alloy)	220	32	220	32

Inflation Pressure at Full Load (Western Europe)

Engine	Tires	Wheel	Front		Rear	
–	–	–	kPa	psi	kPa	psi
1.6 DOHC	185/70R14	5.5Jx14 (Steel)	220	32	220	32
2.0 DOHC	195/60R15	6.0Jx15 (Steel)	220	32	220	32
1.6 DOHC	185/70R14	5.5Jx14 (Alloy)	220	32	220	32
2.0 DOHC	195/60R15	6.0Jx15 (Alloy)	220	32	220	32

INFLATION PRESSURE CONVERSION SPECIFICATIONS

kPa	psi	kPa	psi	kPa	psi
140	20	185	27	235	34
145	21	190	28	240	35
155	22	200	29	250	36
160	23	205	30	275	40
165	24	215	31	310	45
170	25	220	32	345	50
180	26	230	33	380	55

FASTENER TIGHTENING SPECIFICATIONS

Application	NVm	Lb-Ft	Lb-In
Wheel Bolts (Alloy Wheel)	108	80	–
Wheel Bolts (Steel Wheel)	108	80	–

SECTION 3A

AUTOMATIC TRANSAXLE DRIVE AXLE

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

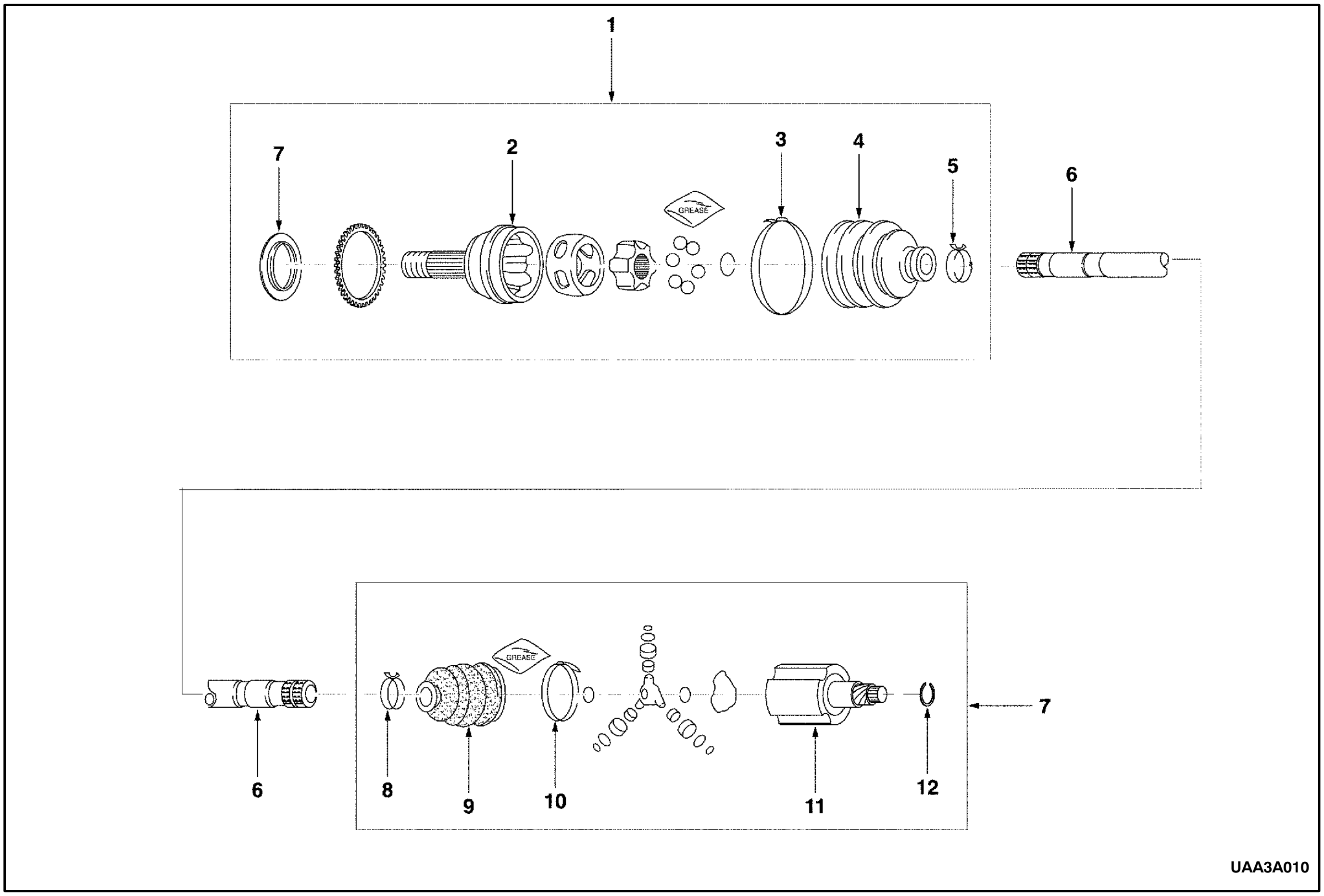
GENERAL DESCRIPTION

Drive axles are flexible shaft assemblies that transmit rotational force from the transaxle to the front-wheel assemblies. Each axle assembly consists of an inner and an outer constant-velocity joint connected to an axle shaft. The inner joint is completely flexible and has the ability to move in and out. The outer joint is also flexible, but it cannot move it and out.

The drive axles use one type of outboard joint and one type of inboard joint. The inboard ends of both drive axles incorporate a female's spline that installs over a stub shaft protruding from the transaxle.

COMPONENT LOCATOR

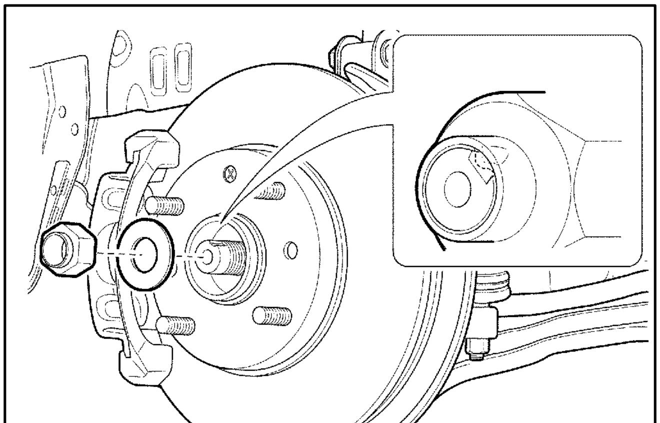
DRIVE AXLE ASSEMBLY



1 C/V Joint Assembly
2 C/V Joint
3 Seal Retaining Clamp
4 Drive Axle Outboard Seal
5 Seal Retaining Clamp
6 Axle Shaft (Left-hand Drive Shown, Right-hand Drive Similar)
7 Tripot Joint Assembly
8 Seal Retaining Clamp
9 Drive Axle Inboard Seal
10 Seal Retaining Clamp
11 Tripot Housing
12 Snap Ring

REPAIR INSTRUCTIONS

ON VEHICLE SERVICE



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DRIVE AXLE ASSEMBLY

Tools Required

KM–507–B Ball Joint Separator

KM–406–A Axle Shaft Remover

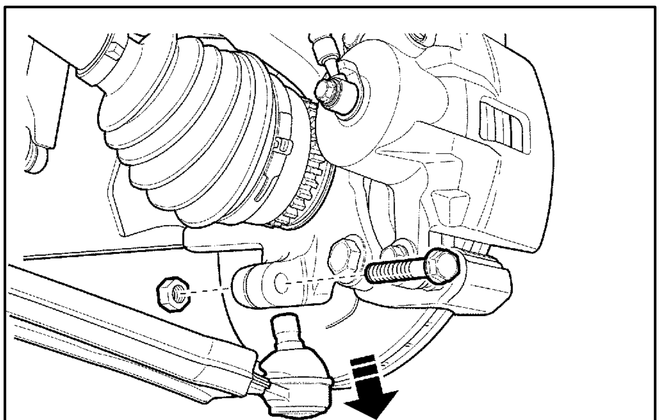
Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Remove the wheels. Refer to *Section 2E. Tires and Wheels.*
3. Remove the engine under covers. Refer to *Section 9N. "Frame and Underbody".*
4. Remove the axle shaft-caulking nut. Discard the nut.

Installation Notice

Tightening Torque	Wheel Bolt	90N·m(66lb–ft)
Tightening Torque	Caulking nut	280N·m(207lb–ft)

- Tighten to axle shaft caulking nut to 180N·m (133lb–ft). loosen the nut and re-tighten the nut to 50N·m(37lb–ft). Then tighten the nut further by 60 degrees. The final torque has to be 220–340N·m (162–251lb–ft).
- Refill the transaxle fluid to the proper level. Refer to *Section 5E. "4HP 16 Automatic transaxle"*.



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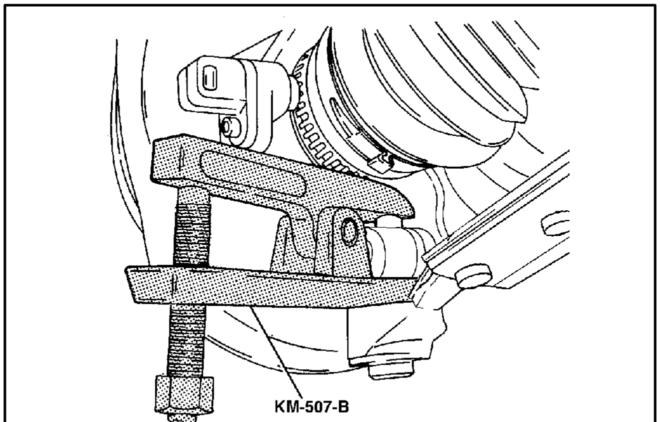
5. Remove the lower ball joint nut and bolt.



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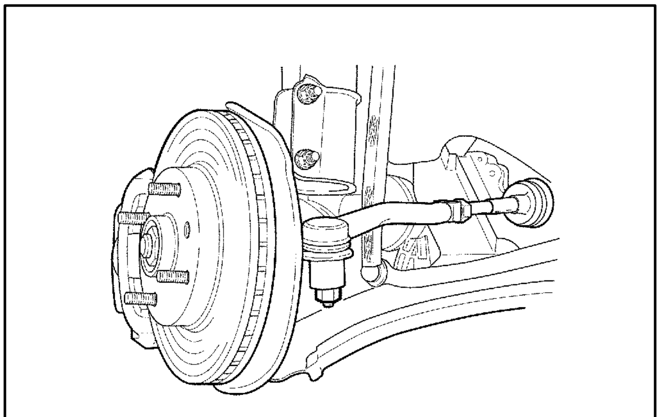
6. Separate the steering knuckle from the lower ball joint using the ball joint separator KM–507–B.

Removal Notice: Use only the recommended tool for separating the lower ball joint. Failure to use the recommended tool may cause damage to the ball joint and the seal.



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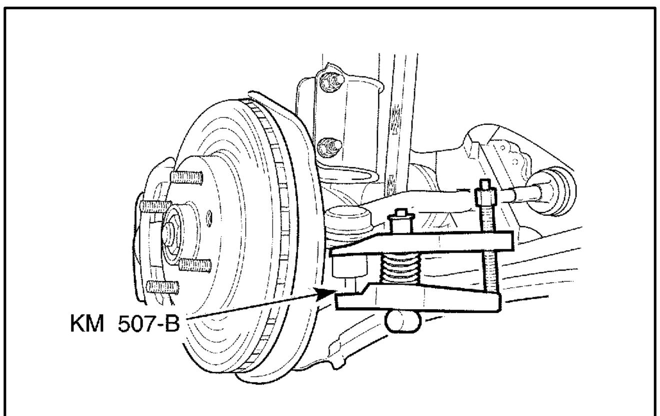
7. Remove the tie rod nut.

Installation Notice

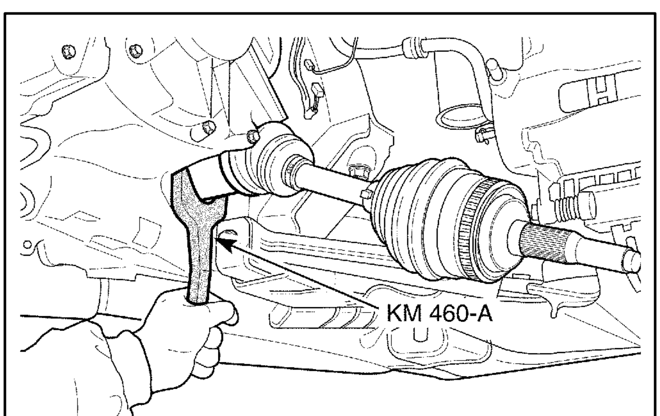
Tightening Torque	60N·m(44lb–ft)



UAA3A050

8. Separate the tie rod end using the ball joint separator Km–507–B

Removal Notice: Use only the recommended tool for separating the lower ball joint. Failure to use the recommended tool may cause damage to the ball joint and the seal.



UAA3A060

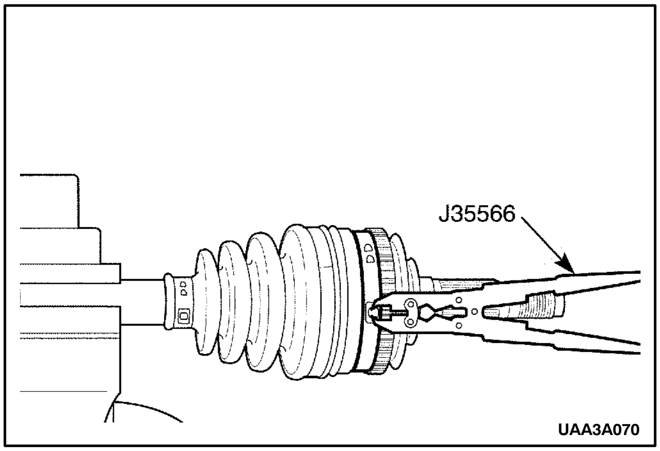
9. Push the drive axle shaft from the wheel hub.

Important: support the unfastened end of the drive axle. Do not allow the drive axle to dangle freely from the transaxle for any length of time after it has been removed from the wheel hub.

Important: place a drain pan below the transaxle to catch the escaping fluid. Cap the transaxle drive opening after the drive axle has been removed to keep the fluid in and any contamination out.

10. Remove the drive axle from the transaxle using the axle shaft remover KM–460–A.
11. Installation should follow the removal procedure in the reverse order.

UNIT REPAIR



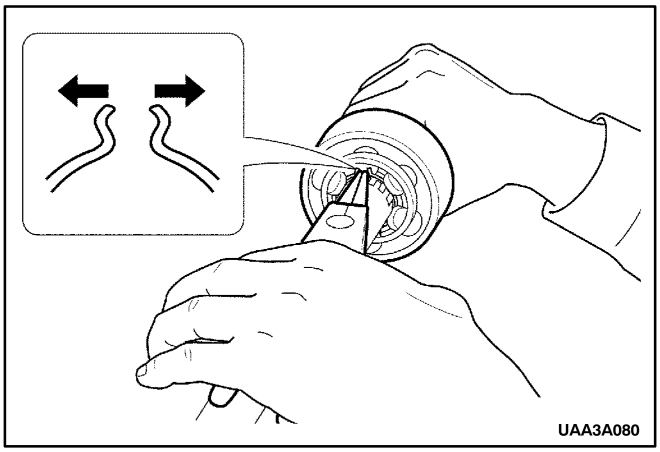
OUTER JOINT

Tools Required

J–35566 Snap Ring Pliers

Disassembly and Assembly Procedure

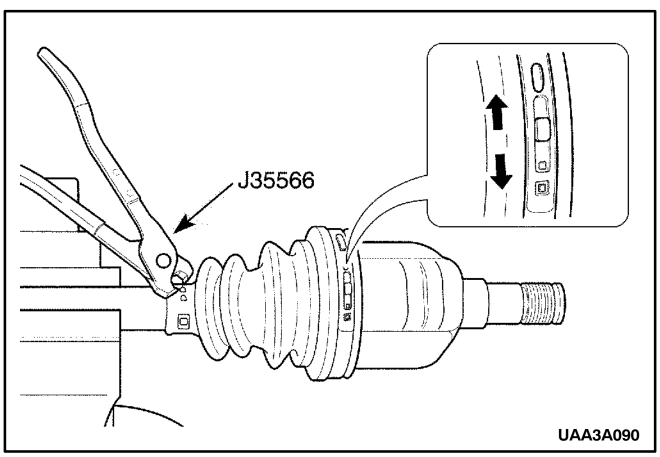
1. Remove the drive axle from the vehicle. Refer to *"Drive Axle"* in this Section.
2. Remove the large seal retaining clamp. Discard the clamp.
3. Remove the small seal retaining clamp. Discard the clamp.



4. Degrease the joint.
5. Spread the snap ring using the snap ring pliers J–35566 and remove the outer joint from the axle shaft.

Installation Notice

- Fill the joint seal with 175 to 195g (6.2 to 6.9 ounces) of the recommended grease. Repack the joint with 175 to 195g (6.2 to 6.9 ounces) of the recommended grease.
- 2.0DOHC: 200–220g(7.1–7.8 ounces)
- Clamp and retaining ring are can't be reused.



INNER TRIPOT SEAL

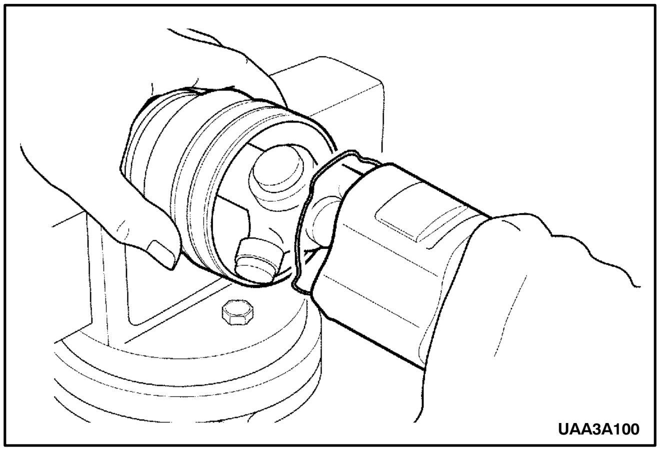
Tools Required

J–35566 Snap Ring Pliers

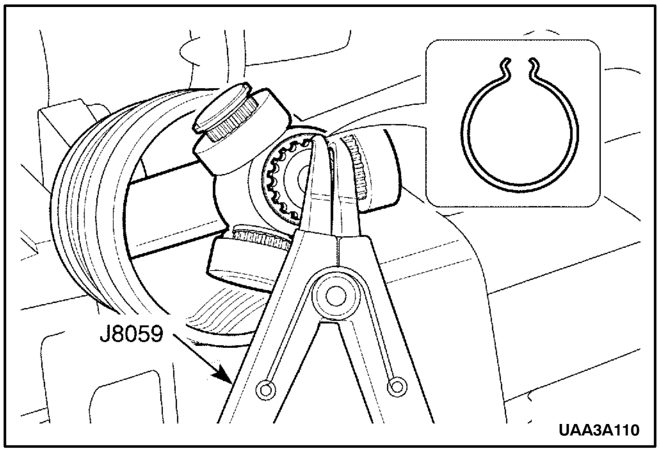
J–8059 Snap Ring Pliers

Disassembly and Assembly Procedure

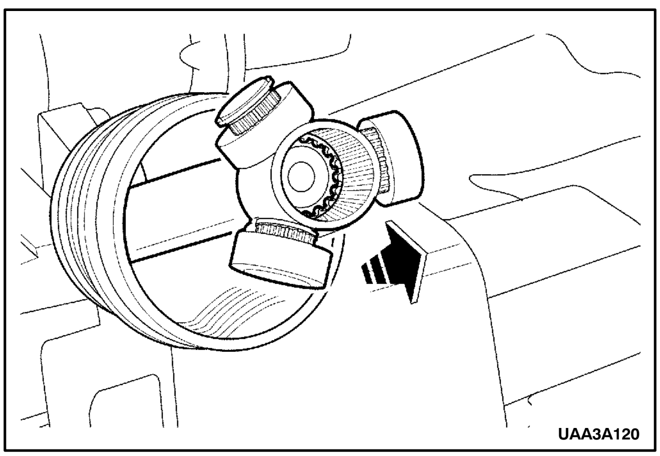
1. Remove the drive axle from the vehicle. Refer to *"Drive Axle"* in this Section.
2. Remove the large seal retaining clamp. Discard the clamp.
3. Remove the small seal retaining clamp. Discard the clamp.



4. Pry the tripot joint retaining ring from the tripot housing.



5. Degrease the tripot assembly.
6. Remove the shaft retaining ring using the snap ring plier J 8059.



7. Remove the tripot and the tripot joint retaining ring from the axle shaft.
8. Remove the tripot joint seal from the axle shaft.

Installation Notice

- Fill the joint seal with 195 to 215g (6.9 to 7.6 ounces) of the recommended grease. Repack the joint with 195 to 215g (6.9 to 7.6 ounces) of the recommended grease.
- 2.0DOHC: 150–170g(6.9–7.6 ounces)
- Clamp and retaining ring are can’t be reused.

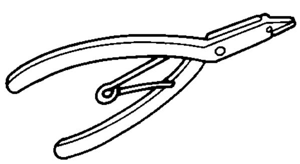
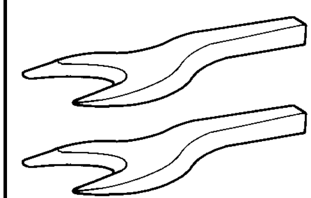
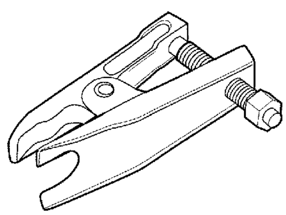
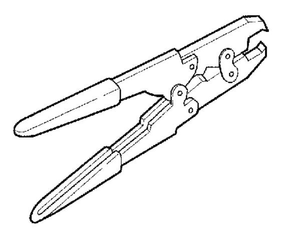
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Axle Shaft Caulking Nut Initial Torque	180	133	–
Axle Shaft Caulking Nut Final Torque	50+60°	37+60°	–
Lower Ball Joint Nut And Bolt	60	44	–
Tie Rod Nut	60	44	–
Wheel Nut	90	66	–

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 A104A001	**J-8059** **Snap Ring Pliers**
 A106C032	**KM-460-A** **Axle Shaft Remover**
 UAA3A130	**KM-507-B** **Ball Joint Separator**
 UAA3A140	**J-35566** **Seal Clamp Pliers**

SECTION 3B

MANUAL TRANSAXLE DRIVE AXLE

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

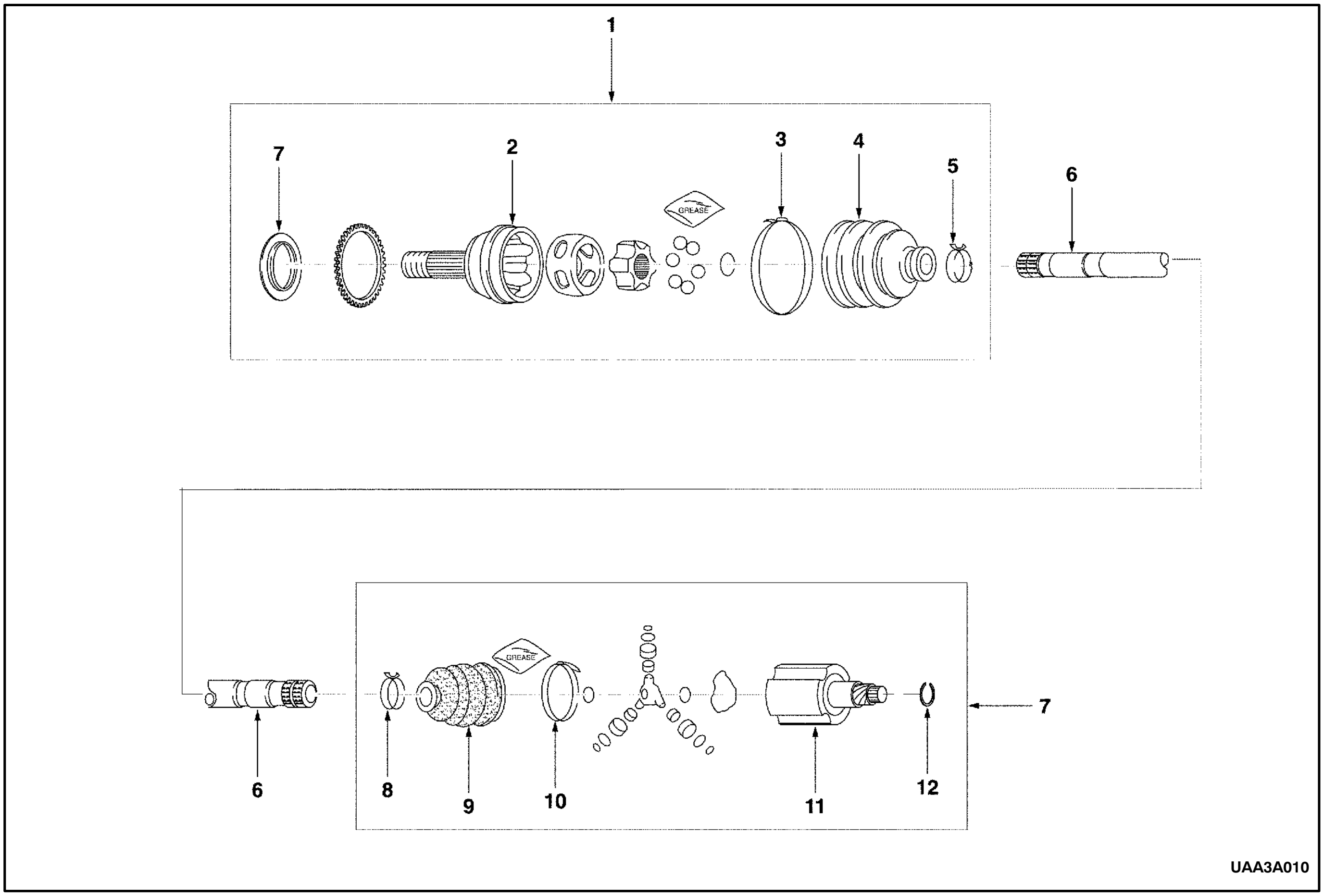
GENERAL DESCRIPTION

Drive axles are flexible shaft assemblies that transmit rotational force from the transaxle to the front–wheel assemblies. Each axle assembly consists of an inner and an outer constant–velocity joint connected to an axle shaft. The inner joint is completely flexible and has the ability to move in and out. The outer joint is also flexible, but it cannot move it and out.

The drive axles use one type of outboard joint and one type of inboard joint. The inboard ends of both drive axles incorporate a female's spline that installs over a stub shaft protruding from the transaxle.

COMPONENT LOCATOR

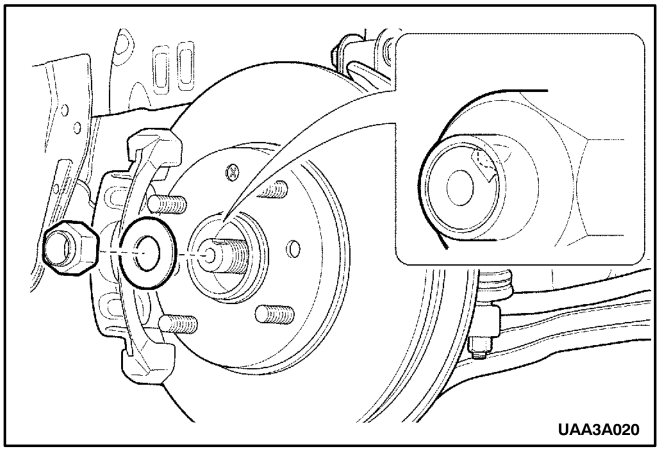
FRONT AXLE ASSEMBLY



1 C/V Joint Assembly
2 C/V Joint
3 Seal Retaining Clamp
4 Drive Axle Outboard Seal
5 Seal Retaining Clamp
6 Axle Shaft (Left-hand Drive Shown, Right-hand Drive Similar)
7 Tripot Joint Assembly
8 Seal Retaining Clamp
9 Drive Axle Inboard Seal
10 Seal Retaining Clamp
11 Tripot Housing
12 Snap Ring

REPAIR INSTRUCTIONS

ON VEHICLE SERVICE



DRIVE AXLE ASSEMBLY

Tools Required

KM–507–B Ball Joint Separator

KM–406–A Axle Shaft Remover

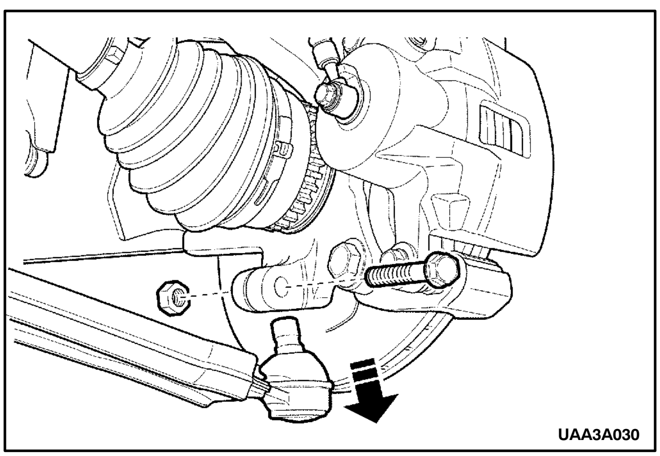
Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Remove the wheels. Refer to ***Section 2E. Tires and Wheels***.
3. Remove the engine under covers. Refer to ***Section 9N. "Frame and Underbody".***
4. Remove the axle shaft-caulking nut. Discard the nut.

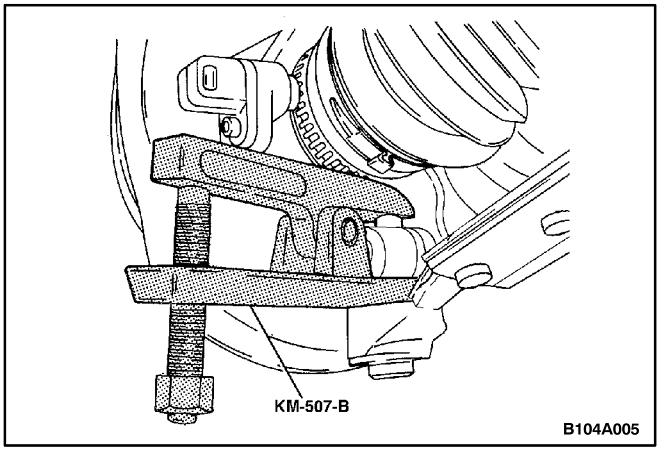
Installation Notice

Tightening Torque	Wheel Bolt	90N·m(66lb–ft)
Tightening Torque	Caulking nut	280N·m(207lb–ft)

- Tighten to axle shaft caulking nut to 180N·m (133lb–ft). loosen the nut and re-tighten the nut to 50N·m(37lb–ft). Then tighten the nut further by 60 degrees. The final torque has to be 220–340N·m (162–251lb–ft).
- Refill the transaxle fluid to the proper level. Refer to ***Section 5B. "Manual transaxle".***

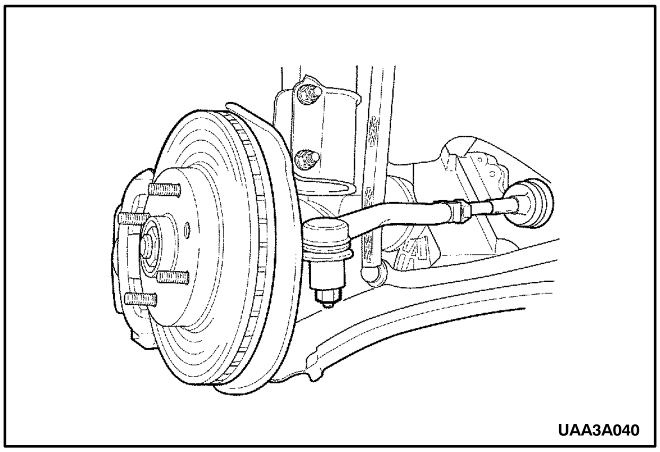


5. Remove the lower ball joint nut and bolt.



6. Separate the steering knuckle from the lower ball joint using the ball joint separator KM–507–B.

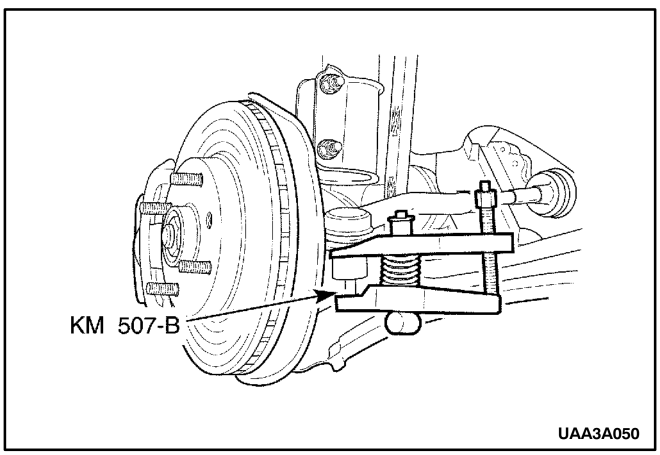
Removal Notice: Use only the recommended tool for separating the lower ball joint. Failure to use the recommended tool may cause damage to the ball joint and the seal.



7. Remove the tie rod nut.

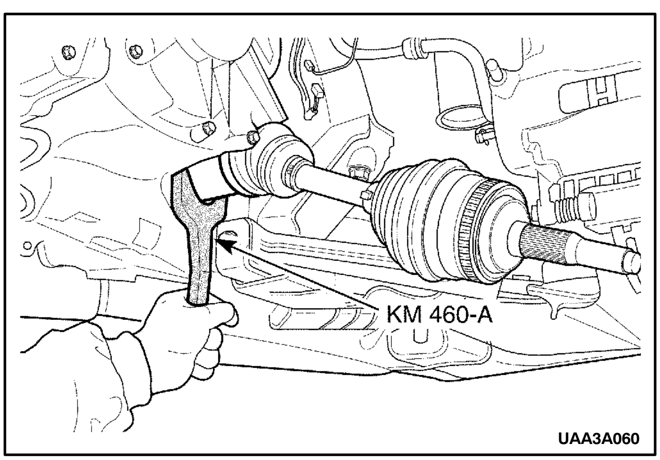
Installation Notice

Tightening Torque	60N·m(44lb–ft)



8. Separate the tie rod end using the ball joint separator Km–507–B

Removal Notice: Use only the recommended tool for separating the lower ball joint. Failure to use the recommended tool may cause damage to the ball joint and the seal.



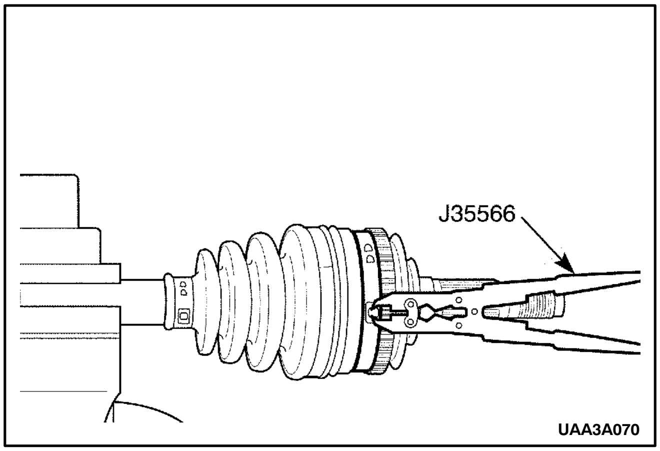
9. Push the drive axle shaft from the wheel hub.

Important: support the unfastened end of the drive axle. Do not allow the drive axle to dangle freely from the transaxle for any length of time after it has been removed from the wheel hub.

Important: place a drain pan below the transaxle to catch the escaping fluid. Cap the transaxle drive opening after the drive axle has been removed to keep the fluid in and any contamination out.

10. Remove the drive axle from the transaxle using the axle shaft remover KM–460–A.
11. Installation should follow the removal procedure in the reverse order.

UNIT REPAIR



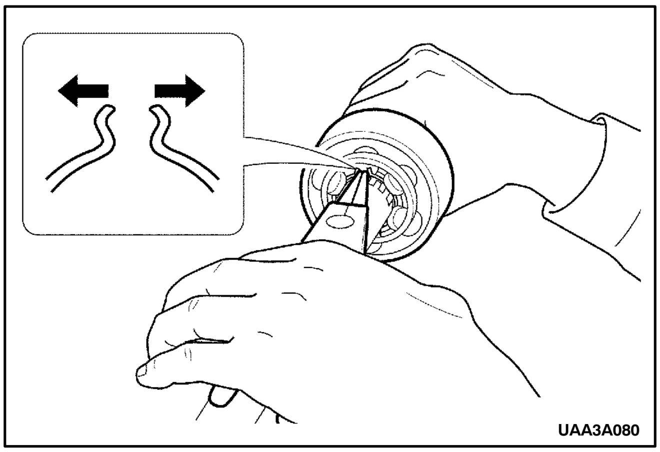
OUTER JOINT

Tools Required

J–35566 Snap Ring Pliers

Disassembly and Assembly Procedure

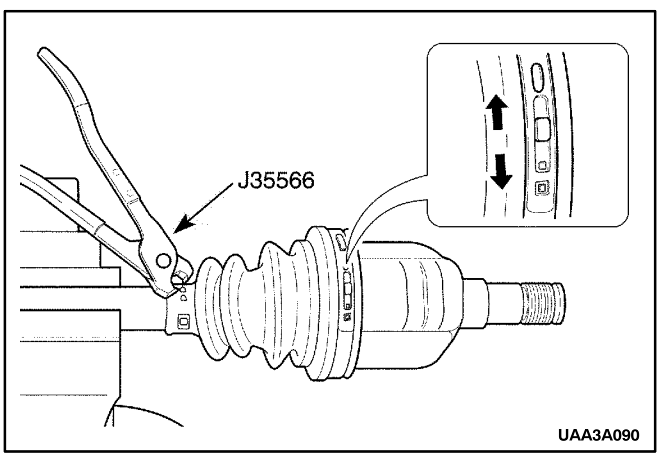
1. Remove the drive axle from the vehicle. Refer to "***Drive Axle***" in this Section.
2. Remove the large seal retaining clamp. Discard the clamp.
3. Remove the small seal retaining clamp. Discard the clamp.



4. Degrease the joint.
5. Spread the snap ring using the snap ring pliers J–35566 and remove the outer joint from the axle shaft.

Installation Notice

- Fill the joint seal with 175 to 195g (6.2 to 6.9 ounces) of the recommended grease. Repack the joint with 175 to 195g (6.2 to 6.9 ounces) of the recommended grease.
- 2.0DOHC: 200–220g(7.1–7.8 ounces)
- Clamp and retaining ring are can't be reused.



INNER TRIPOT SEAL

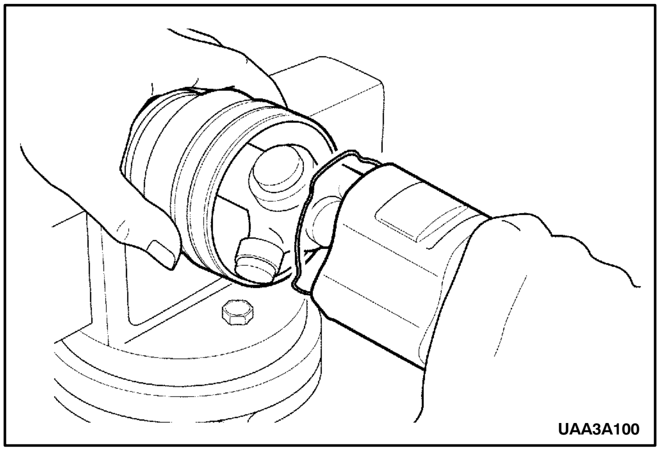
Tools Required

J–35566 Snap Ring Pliers

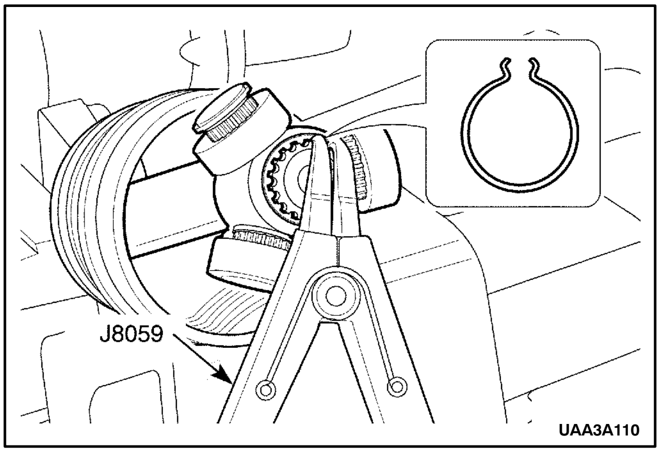
J–8059 Snap Ring Pliers

Disassembly and Assembly Procedure

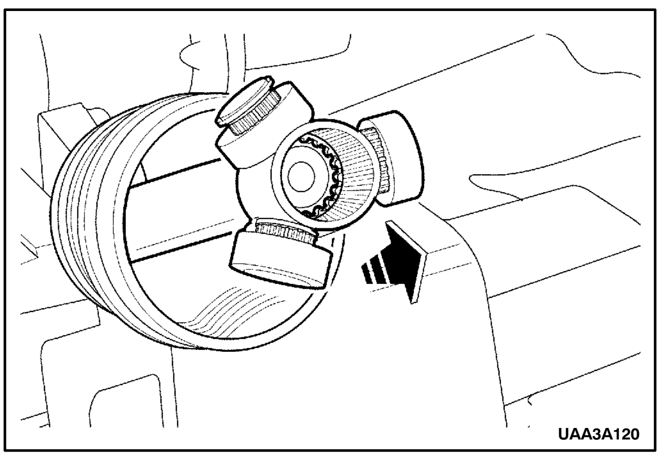
1. Remove the drive axle from the vehicle. Refer to "***Drive Axle***" in this Section.
2. Remove the large seal retaining clamp. Discard the clamp.
3. Remove the small seal retaining clamp. Discard the clamp.



4. Pry the tripot joint retaining ring from the tripot housing.



5. Degrease the tripot assembly.
6. Remove the shaft retaining ring using the snap ring plier J 8059.



7. Remove the tripot and the tripot joint retaining ring from the axle shaft.
8. Remove the tripot joint seal from the axle shaft.

Installation Notice

- Fill the joint seal with 195 to 215g (6.9 to 7.6 ounces) of the recommended grease. Repack the joint with 195 to 215g (6.9 to 7.6 ounces) of the recommended grease.
- 2.0DOHC: 150–170g(6.9–7.6 ounces)
- Clamp and retaining ring are can't be reused.

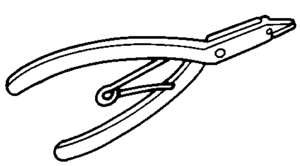
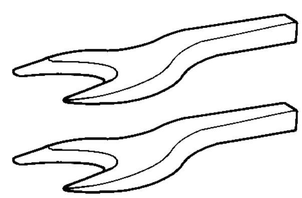
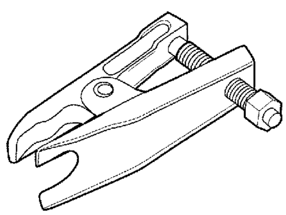
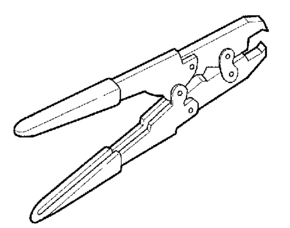
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Axle Shaft Caulking Nut Initial Torque	180	133	–
Axle Shaft Caulking Nut Final Torque	50+60°	37+60°	–
Lower Ball Joint Nut And Bolt	60	44	–
Tie Rod Nut	60	44	–
Wheel Nut	90	66	–

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 A104A001	**J-8059 Snap Ring Pliers**	 A106C032	**KM-460-A Axle Shaft Remover**
 UAA3A130	**KM-507-B Ball Joint Separator**	 UAA3A140	**J-35566 Seal Clamp Pliers**

SECTION 4A

HYDRAULIC BRAKES

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION

Brake fluid should meet the DOT–3 specification. Use only clear fluid from a sealed container.

Fluid that is exposed to the air will absorb moisture. Water in the brake fluid will cause the fluid to boil and the rubber components to deteriorate.

Thoroughly clean the master cylinder reservoir cap before removing it. Do not let any dirt or foreign material fall into the fluid reservoir.

There is a brake fluid level sensor under the master cylinder reservoir. This brake system uses a BRAKE warning lamp in the instrument panel cluster. When the ignition switch is in the START position, the BRAKE warning lamp should go off when the ignition switch returns to the ON position.

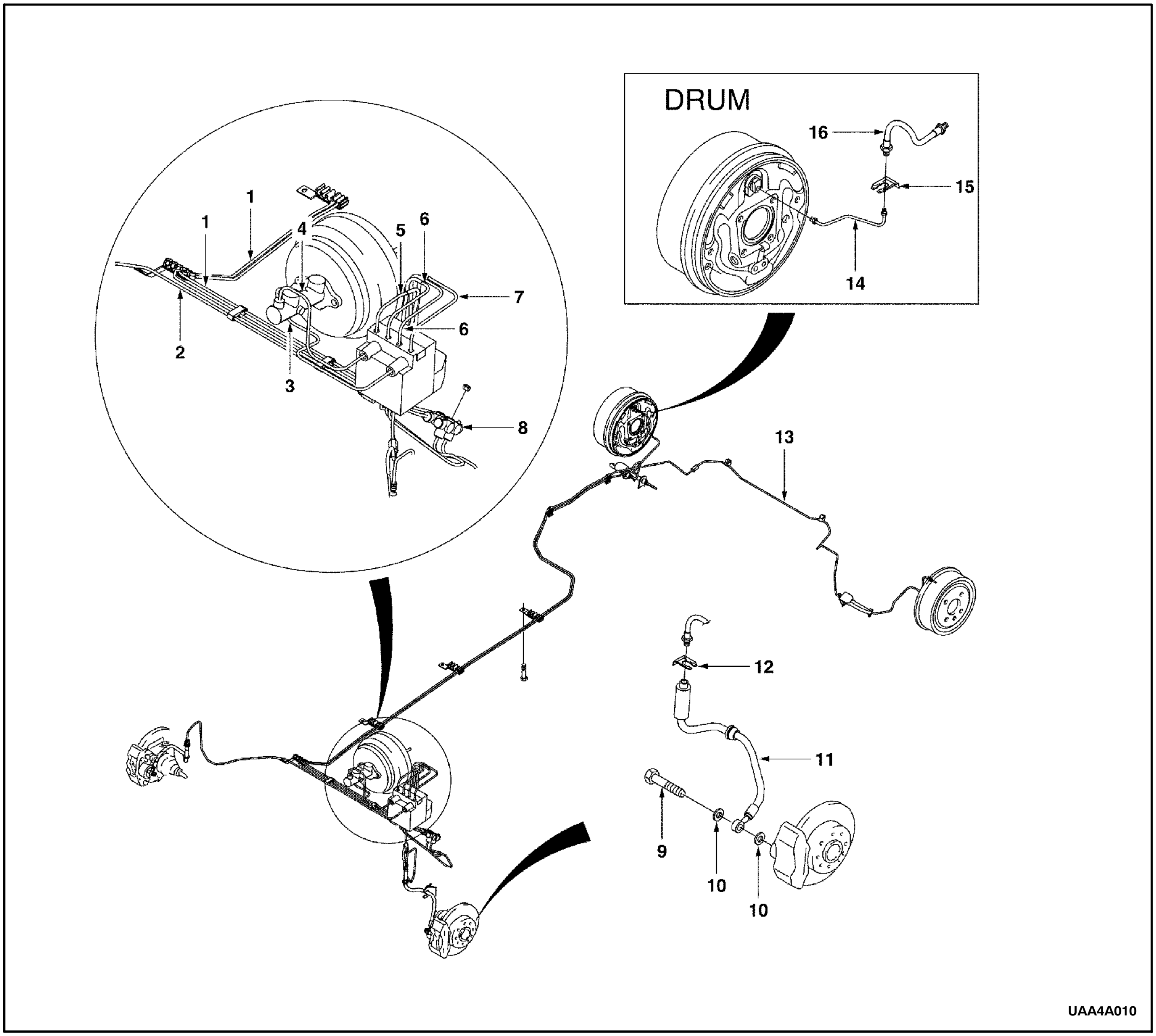
The following conditions will active the BRAKE warning lamp:

- The lamp should be on whenever the parking brake is applied and the ignition switch is in the ON position.
- A low fluid level in the master cylinder will turn the BRAKE lamp on.

The correct brake fluid level is marked on the both side of the brake fluid reservoir. If the fluid level is below the MIN indicator mark, check the hydraulic brake system for leaks. Fix any leaks. Then refill the reservoir to the MAX indicator mark.

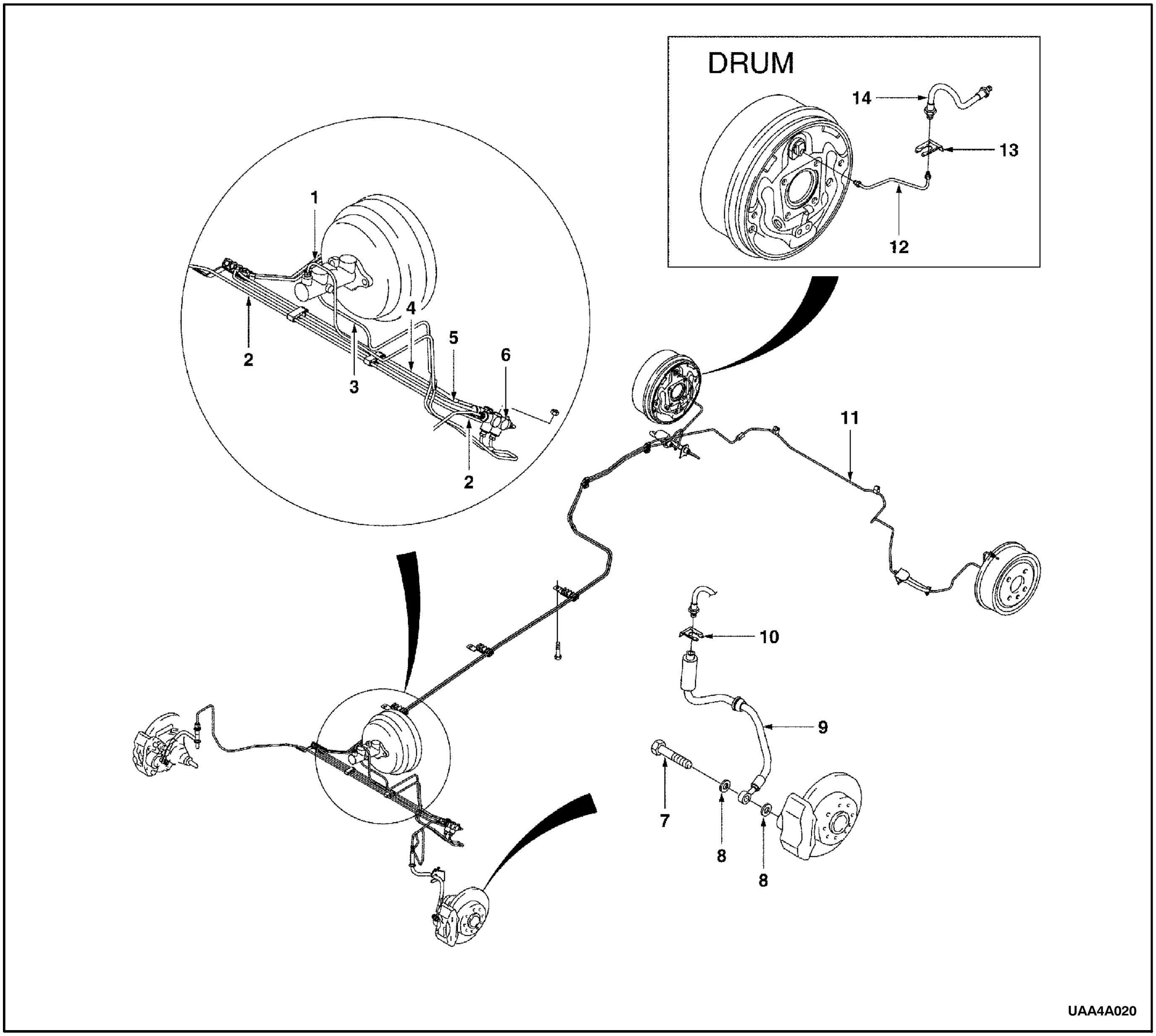
COMPONENT LOCATOR

BRAKE SYSTEM (ABS)



1 Rear 2nd Brake Pipe
2 Front 2nd Brake Pipe
3 Primary Brake Pipe
4 Hydraulic Unit 2nd Brake Pipe
5 Rear 1st Brake Pipe
6 Front 1st Brake Pipe
7 Rear 1st Brake Pipe
8 4 Port Connector Assembly
9 Brake hose-to-Caliper Bolt
10 Washer
11 Front Brake Hose
12 E-ring
13 Rear 3rd Brake Pipe
14 Rear Short Brake Pipe
15 E-ring
16 Rear Short Brake Hose

BRAKE SYSTEM (NON-ABS)



1 Secondary Brake Pipe	8 Washer
2 Front Brake Pipe	9 Front Brake Hose
3 Primary Brake Pipe	10 E-ring
4 Rear 2nd Brake Pipe	11 Rear 3rd Brake Pipe
5 Rear 2nd Brake Pipe	12 Rear Short Brake Pipe
6 Proportioning Valve Assembly	13 E-ring
7 Brake Hose-to-Caliper Bolt	14 Rear Short Brake Pipe

DIAGNOSTIC INFORMATION AND PROCEDURES

BRAKE SYSTEM TESTING

Brakes should be tested on a dry, clean, reasonably smooth and level roadway. A true test of brake performance cannot be made if the roadway is wet, greasy, or covered with loose dirt which can cause tires not to grip the road unequally. Testing also will be inaccurate on a crowned roadway because the wheels tend to bounce.

Test the brakes at different vehicle speeds with both light– and heavy–pedal pressure; however, avoid locking the brakes and sliding the tires. Locked brakes and sliding tires do not indicate brake efficiency since heavily braked but turning wheels will stop the vehicle in less distance than locked brakes. More tire-to-road friction is present with a heavily braked, turning tire than with a sliding tire.

Because of the high deceleration capability, a firmer pedal may be felt at higher deceleration levels.

There are three major external conditions that affect brake performance:

- Tires having unequal contact and grip of the road will cause unequal braking. Tires must be equally inflated, and the tread pattern of the right and the left tires must be approximately equal.
- Unequal loading of the vehicle can affect the brake performance since the most heavily loaded wheels require more braking power, and thus more braking effort, than the others.
- Misalignment of the wheels, particularly conditions of excessive camber and caster, will cause the brakes to pull to one side.

To check for brake fluid leaks, hold constant foot pressure on the pedal with the engine running at idle and the shift lever in NEUTRAL. If the pedal gradually falls away with the constant pressure, the hydraulic system may be leaking. Perform a visual check to confirm any suspected leaks.

Check the master cylinder fluid level. While a slight drop in the reservoir level results from normal lining wear, an abnormally low level indicates a leak in the system. The hydraulic system may be leaking either internally or externally. Refer to the procedure below to check the master cylinder. The system may appear to pass this test while still having a slight leak. If the fluid level is normal, check the vacuum booster pushrod length. If an incorrect pushrod length is found, adjust or replace the rod.

Check the master cylinder using the following procedure:

- Check for a cracked master cylinder casting or a brake fluid leak around the master cylinder. Leaks are indicated only if there is at least one drop of fluid. A damp condition is not abnormal.
- Check for a binding pedal linkage and for an incorrect pushrod length. If both of these parts are in satisfactory condition, disassemble the master cylinder and check for an elongated or swollen primary cylinder or piston seals. If swollen seals are found, substandard or contaminated brake fluid should be suspected. If contaminated brake fluid is found, all the components should be disassembled and cleaned, and all the rubber components should be replaced. All of the pipes must also be flushed.

Improper brake fluid, or mineral oil or water in the fluid, may cause the brake fluid to boil or cause deterioration of the rubber components. If the primary piston cups in the master cylinder are swollen, the rubber parts have deteriorated.

If deterioration of the rubber is evident, disassemble all the hydraulic parts and wash the parts with alcohol. Dry these parts with compressed air before reassembly to keep the alcohol out of the system. Replace all the rubber parts in the system, including the hoses. When working on the brake mechanisms, check for fluid on the linings. If excessive fluid is found, replace the linings.

If the master cylinder piston seals are in satisfactory condition, check for leaks or excessive heat conditions. If these conditions are not found, drain the fluid, flush the master cylinder with brake fluid, refill the master cylinder, and bleed the system.

BRAKE HOSE INSPECTION

The hydraulic brake hoses should be inspected at least twice a year. The brake hose assembly should be checked for road hazard damage, cracks, chafing of the outer cover, and for leaks or blisters. Inspect the hoses for proper routing and mounting. A brake hose that rubs on a suspension component will wear and eventually fail. A light and a mirror may be needed for an adequate inspection. If any of the above conditions are observed on the brake hose, adjust or replace the hose as necessary.

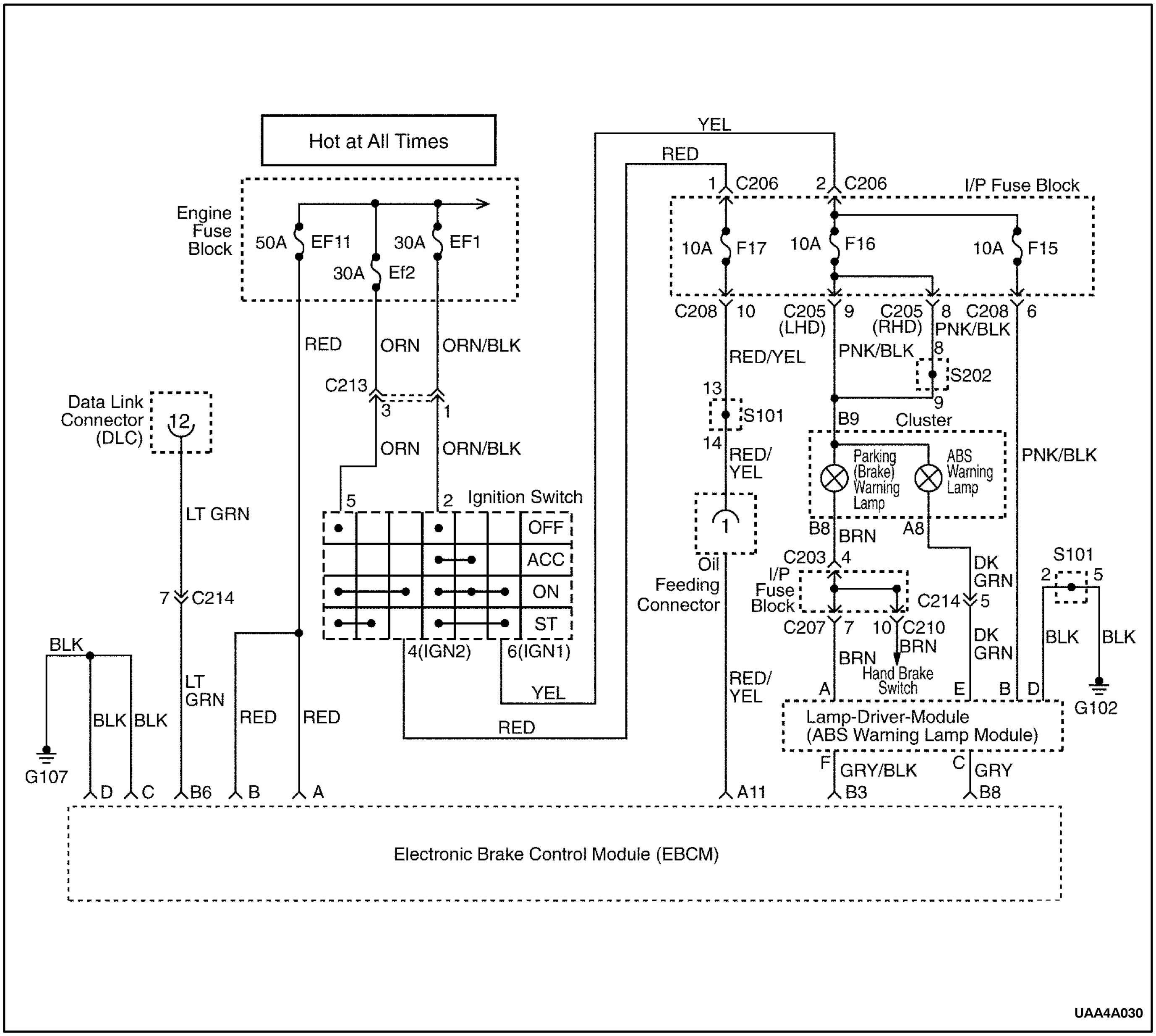
WARNING LAMP OPERATION

This brake system uses a BRAKE warning lamp in the instrument panel cluster. When the ignition switch is in the START position, the BRAKE warning lamp should glow and go OFF when the ignition switch returns to the START position.

The following conditions will active the BRAKE warning lamp:

- Parking brake applied. The light should be ON whenever the parking brake is applied and the ignition switch is in the ON position.
- Low fluid level. A low fluid in the master cylinder will turn the BRAKE lamp ON.
- DDRP system is disabled. The light should be ON when the DDRP system is malfunctioning.

BRAKE LAMP WARNING CIRCUIT DIAGNOSIS



Test Description

The numbers below refer to steps on the diagnostic table.

1. When the ignition is turned ON, the brake lamp should initially illuminate and then dim for ABS equipped vehicles. This is done as a bulb check. On vehicles that are not equipped with ABS, the brake warming lamp should only illuminate when either the brake fluid reservoir is low or the parking is applied.
7. The brake fluid level switch is a normally open switch. If the BRAKE warning lamp is OFF after disconnecting the switch, the brake fluid level switch is stuck closed.
9. If the BRAKE warning lamp is still on after disconnecting the parking brake switch, there is a short to ground in the wire to the parking brake switch.
12. If the other checks have been properly performed and the BRAKE warning lamp is OFF after disconnecting the electronic brake control module (EBCM) connector, the EBCM is faulty.
19. If the BRAKE warning lamp dose not operate while performing any of the functions, the fault should be in the ignition feed to the circuit.
24. This step determines if the problem is in the ignition feed to the circuit or in the instrument cluster.
30. The BRAKE warning lamp should illuminate when jumper the parking brake connector to ground.
32. If the BRAKE warning lamp is on after jumper the brake fluid level switch terminals, the switch is faulty.

Brake Lamp Warning Circuit

Step	Action	Value(s)	Yes	No
1	Start the engine and leave it running. Is the BRAKE warning lamp always on?	–	Go to *Step 2*	Go to *Step 18*
2	Check the ABS warning lamp. Is the ABS warning lamp also on?	–	Go to *Step 3*	Go to *Step 4*
3	Use a scan tool to check for diagnostic trouble codes(DTCs) and follow the procedures for any DTCs found. Were any DTC(s) stored current or history?	–	Go to the table for the (DTCs)	Go to *Step 4*
4	Release the parking brake fully. Is the BRAKE warning lamp off?	–	System OK	Go to *Step 5*
5	Check the brake fluid level. Is the fluid level OK?	–	Go to *Step 7*	Go to *Step 6*
6	1. Fill the brake fluid reservoir with clean DOT–3 hydraulic fluid. 2. Check the cap on the fluid reservoir. 3. Start the engine and leave it running. Is the BRAKE warning lamp on?	–	Go to *Step 7*	System OK
7	Disconnect the wiring harness connector from the brake fluid level switch. Is the BRAKE warning lamp on?	–	Go to *Step 9*	Go to *Step 8*
8	Replace the brake fluid lever switch. Is the repair complete?	–	System OK	–
9	1. Connect the brake fluid level switch. 2. Disconnect the parking brake switch. 3. Start the engine and leave it running. Is the BRAKE warning lamp on?	–	Go to *Step 11*	Go to *Step 10*
10	Replace the parking brake switch. Is the repair complete?	–	System OK	–
11	Connect the parking brake switch. Is the vehicle equipped with ABS?	–	Go to *Step 12*	Go to *Step 14*
12	1. Turn the ignition OFF. 2. Disconnect the electronic brake control module (EBCM) connector. 3. Turn the ignition ON. Is the BRAKE warning lamp on?	–	Go to *Step 14*	Go to *Step 13*
13	Replace the EBCM. Is the repair complete?	–	System OK	–
14	1. Turn the ignition OFF. 2. Connect the EBCM connector. 3. Check for a short to ground in the wiring between the instrument cluster terminal B9 and the brake fluid level switch. Is the problem found?	–	Go to *Step 17*	Go to *Step 15*
15	Check for a short to ground in the wiring between the instrument cluster terminal B9 and the parking brake switch. Is the problem found?	–	Go to *Step 17*	Go to *Step 16*
16	Check for a short to ground in the wiring between the instrument cluster terminal B9 and the EBCM connector terminal B3. Is the problem found?	–	Go to *Step 17*	Go to *Step 18*

Brake Lamp Warning Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
17	Repair the wiring harness as needed. Is the repair complete?	–	System OK	–
18	Check the brake lamp after doing each of the following functions: ● Apply the parking brake ● Remove the cap from the brake fluid reservoir. ● On vehicles equipped with ABS, command the lamp on using a scan tool. Does the BRAKE warning lamp operate for all of these conditions?	–	System OK	Go to *Step 19*
19	When the operations listed in step 18 were performed, the brake warning lamp did not function. Did the BRAKE warning lamp fail to light for all of the operations listed in step18?	–	Go to *Step 20*	Go to *Step 27*
20	1. Turn the ignition OFF. 2. Inspect the fuse F16. Is the fuse OK?	–	Go to *Step 22*	Go to *Step 21*
21	Replace the fuse F16. Is the repair complete?	–	System OK	–
22	Inspect the BRAKE warning lamp bulb. Is the bulb OK?	–	Go to *Step 24*	Go to *Step 23*
23	Replace the bulb. Is the repair complete?	–	System OK	–
24	1. Disconnect the instrument cluster connector. 2. Turn the ignition ON. 3. Measure the voltage at the instrument cluster connector terminal B9. Dose the voltage measure within the value specified?	11-14 V	Go to *Step 25*	Go to *Step 26*
25	1. Turn the ignition OFF. 2. Repair the open in the instrument cluster. Is the repair complete?	–	System OK	–
26	1. Turn the ignition OFF. 2. Repair the open in the wiring between the instrument cluster connector terminal B9 and the ignition switch. Is the repair complete?	–	System OK	–
27	Apply the parking brake again. Dose the parking brake warning lamp operate with the parking brake applied?	–	Go to *Step 28*	Go to *Step 30*
28	Remove the brake fluid reservoir cap. Dose the parking brake warning lamp operate with the cap from the brake fluid reservoir removed?	–	Go to *Step 29*	Go to *Step 30*
29	Check for an open between the instrument cluster connector terminal B8 and the EBCM connector terminal B3. Is the problem found?	–	Go to *Step 17*	Go to *Step 13*
30	1. Turn the ignition ON. 2. Disconnect the parking brake switch. 3. Jumper the parking brake switch connector terminal to ground. Is the BRAKE warning lamp on?	–	Go to *Step 10*	Go to *Step 31*

Brake Lamp Warning Circuit (Cont'd)

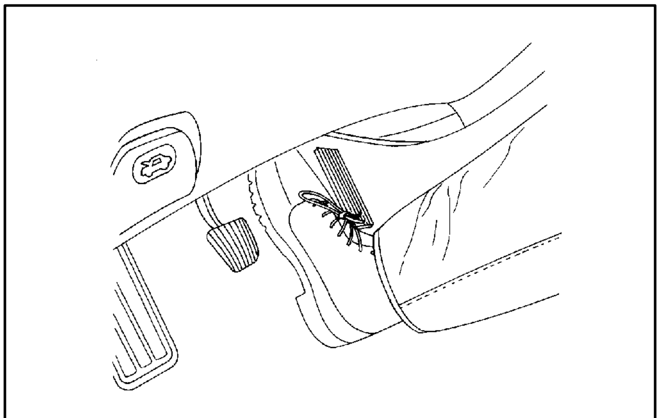
Step	Action	Value(s)	Yes	No
31	1. Turn the ignition OFF. 2. Repair the open in the wiring between the instrument cluster connector terminal B8 and the parking brake switch connector terminal. Is the repair complete?	–	System OK	–
32	1. Disconnect the brake fluid level switch. 2. Turn the ignition ON. 3. Jumper the brake fluid level switch connector terminal. Is the BRAKE warning lamp on?	–	Go to *Step 8*	Go to *Step 33*
33	1. Turn the ignition OFF. 2. Connect a test light between battery positive and the wiring harness terminal of the brake fluid level switch. Is the BRAKE warning lamp on?	–	Go to *Step 34*	Go to *Step 35*
34	Repair the open in the wiring between ground and the brake fluid level switch. Is the repair complete?	–	System OK	–
35	Repair the open in the wiring between the instrument cluster connector terminal B8 and brake fluid level switch. Is the repair complete?	–	System OK	–

REPAIR INSTRUCTIONS

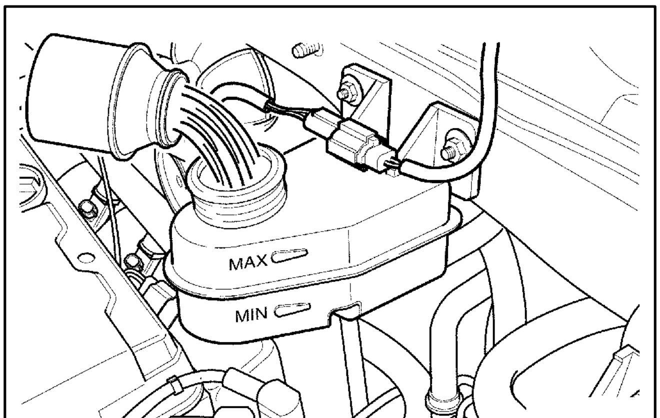
ON–VEHICLE SERVICE

MANUAL BLEEDING THE BRAKES

Removal and Installation Procedure


C107A015

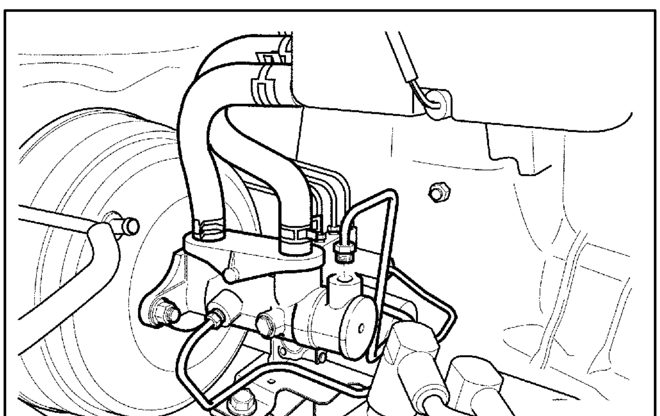
1. Remove the booster reserve by applying the brakes several times with the engine off until all the reserve is depleted.



UAA4A040

Important : If the master cylinder is known or suspected to have air in the bore, then it must be bend before any wheel cylinder or caliper is bend.

2. Fill the master cylinder reservoir with brake fluid. Keep the master cylinder reservoir at least one-half full during the bleeding operation.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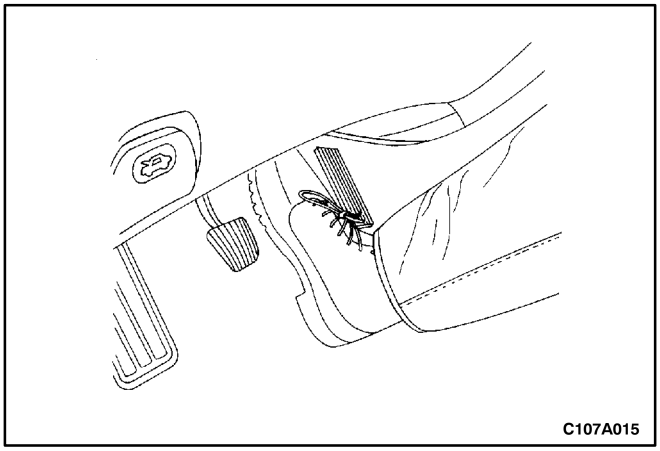
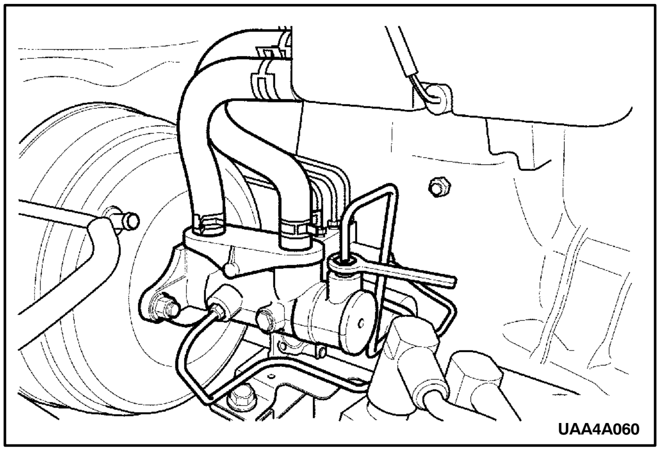
3. Disconnect the brake line at the top of the master cylinder.
4. Allow the brake fluid to fill the master cylinder until it begins to flow from the port.
5. Connect the brake line at the top of the master cylinder.



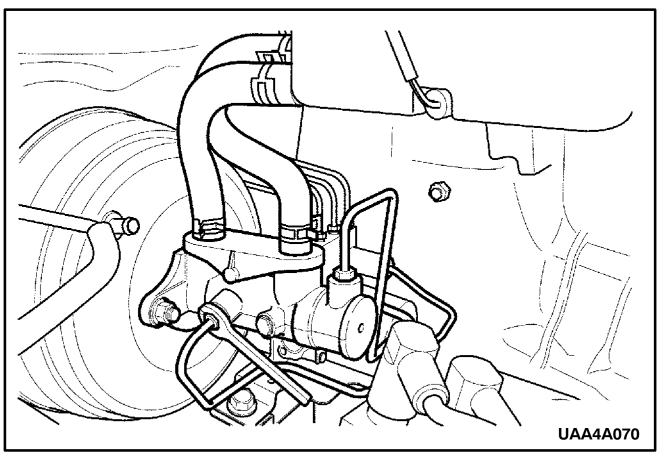
6. Slowly push and hold the brake pedal



7. Loosen the brake line at the top of the master cylinder to purge the air from the cylinder.
8. Tight the brake line, as in Step 5, and then release the brake pedal slowly. Wait 15 seconds before proceeding to the next step.
9. Repeat Steps 6–8, including the 15 seconds wait, until all the air is removed from the master cylinder bore.
10. Tighten the brake line fitting.

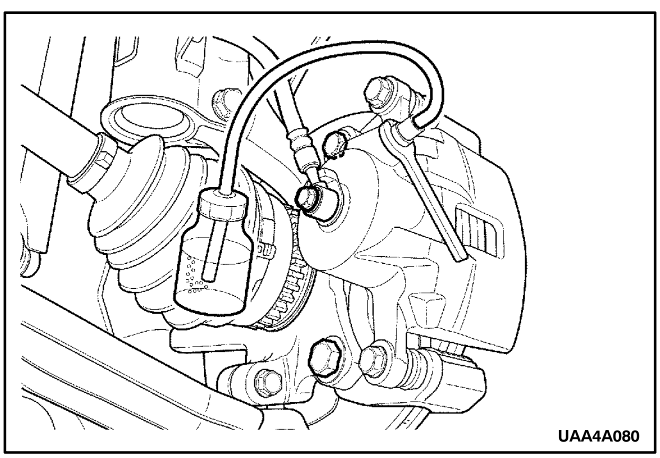
Installation Notice

Tightening Torque	16 N·m (12 lb–ft)



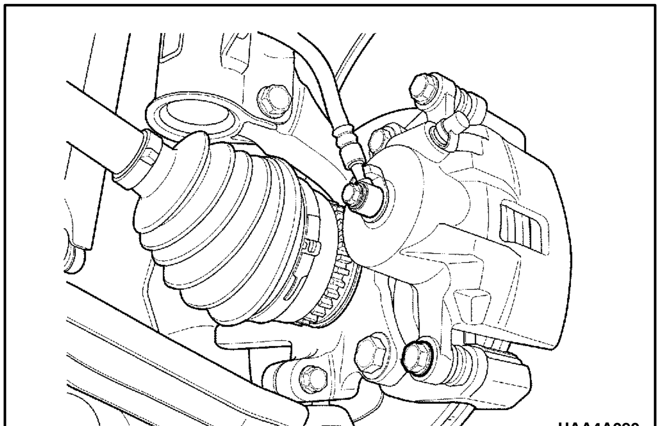
Notice : Care must be taken to prevent the brake fluid from contacting any painted surface to prevent damage to the paint finish

11. After the air has been removed at the top connection, bleed the master cylinder at the side connection in the same manner as with the top connection.



Important : For vehicles equipped with a non-antilock braking system, the bleeding sequence is as follows: right rear, left front, left rear, and right front. For ABS vehicles, refer to *Section 4F, Antilock Brake System* for the correct sequence and bleeding procedure.

12. Attach a transparent tube over the bleeder valve. Allow the tube to hang submerged in the brake fluid in a transparent container


UAA4A090

13. Slowly push and hold the brake pedal one time. Avoid rapid pumping of the brake pedal.
14. Remove the bleeder valve dust cover and loosen the bleeder screw to purge the air from the cylinder.
15. Tighten the bleeder screw.

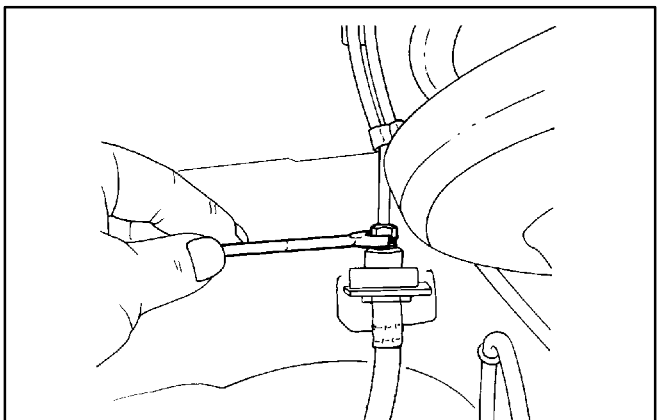
Installation Notice

Tightening Torque	9 N·m (6 lb–ft)

16. Slowly release the brake pedal. Wait 15 seconds before proceeding with the next step.

Important : Rapid pumping of the brake pedal pushes the master cylinder secondary piston down the bore in a manner that makes it difficult to bleed the system.

17. Repeat Steps 13–16, including the 15 seconds wait, until all the air is removed. It may be necessary to repeat the sequence 10 or more times to remove all the air.
18. Locate the front bleeder caps.
19. Proceed to bleed the front brakes following the appropriate sequence, beginning with step 13.
20. Check the brake pedal for sponginess. Repeat the entire bleeding procedure to correct this condition.
21. Replace the bleeder valve dust cover.


C107A009

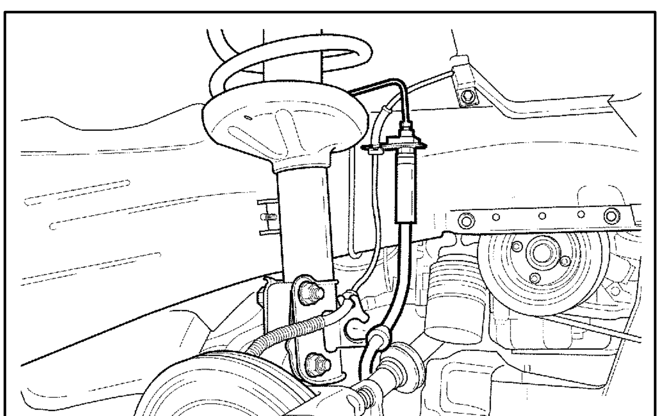
FRONT BRAKE HOSE

Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Disconnect the brake line fitting nut from the brake hose support bracket on the wheel housing on each side of the vehicle.
3. Remove the E-ring retainer.

Installation Notice

Tightening Torque	16 N·m (12 lb–ft)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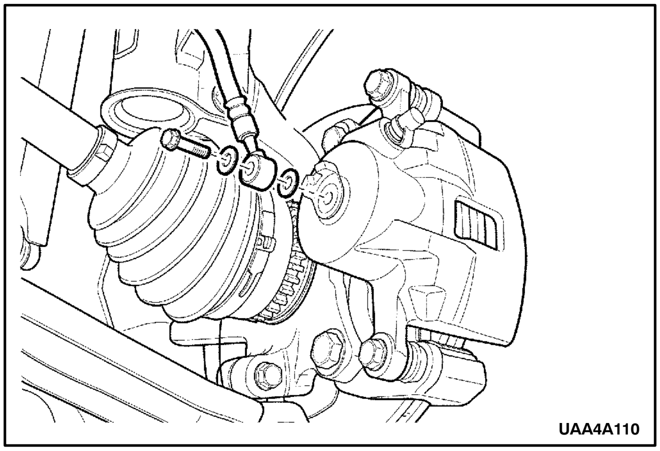
4. Disconnect the brake hose from the “C” bracket on the strut assembly.

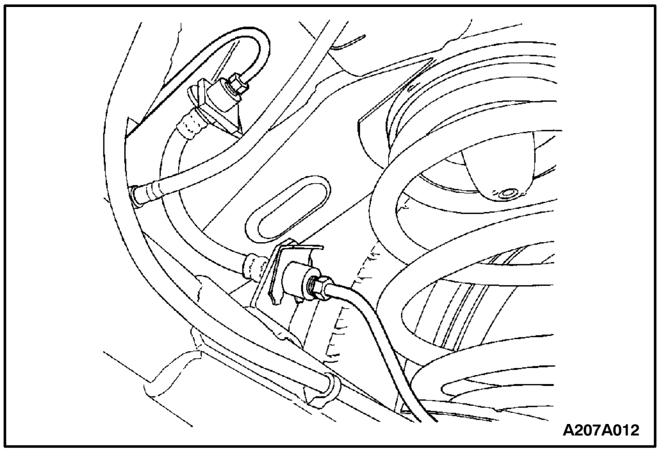


5. Remove the bolt from the brake caliper.
6. Remove the seal rings and the brake hose.

Installation Notice

Tightening Torque	40 N·m (30 lb–ft)

- Bleed the brake system. Refer to “Manual Bleeding the Brakes” in this section.
- Check the brake system for leaks.



REAR BRAKE HOSE

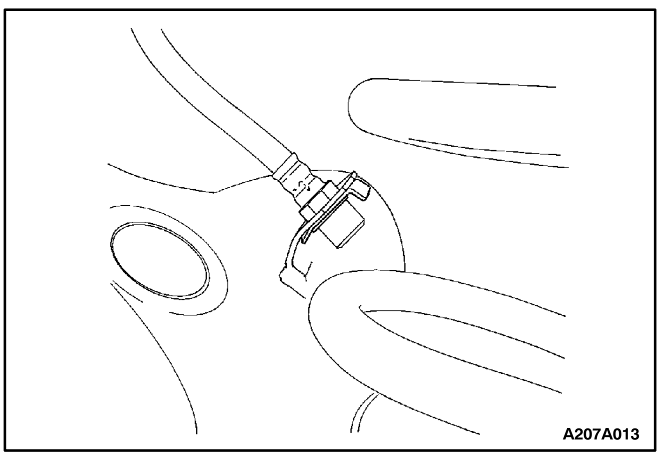
Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Disconnect the brake line fitting nuts from the brake hoses at the body and the rear axle brackets.

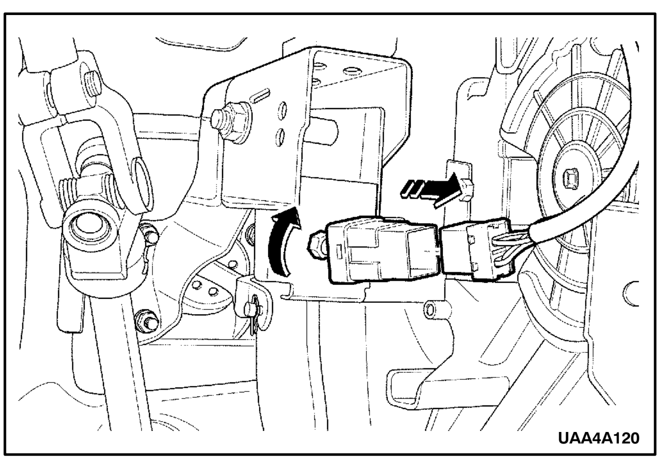
Installation Notice

Tightening Torque	16 N·m (12 lb–ft)

- Bleed the brake system. Refer to “Manual Bleeding the Brakes” in this section.
- Check the brake system for leaks.



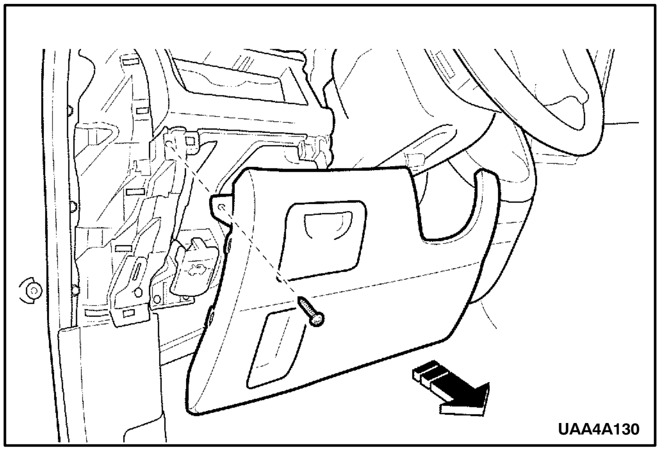
3. Remove both brake hose E-ring retainers.
4. Remove the brake hoses from the brackets.



STOPLAMP SWITCH

Removal and Installation Procedure

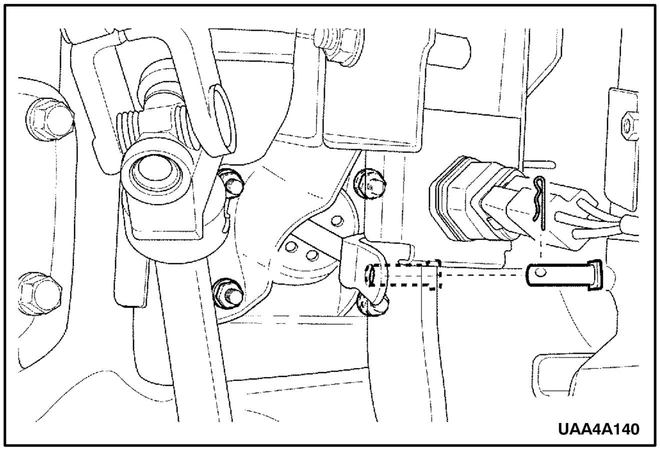
1. Disconnect the negative battery cable.
2. Separate the stoplamp switch from the connector.
3. Remove the stoplamp switch nut.
4. Turn the stoplamp switch connector assembly counterclockwise and remove it from the brake pedal bracket.



BRAKE PEDAL

Removal and Installation Procedure

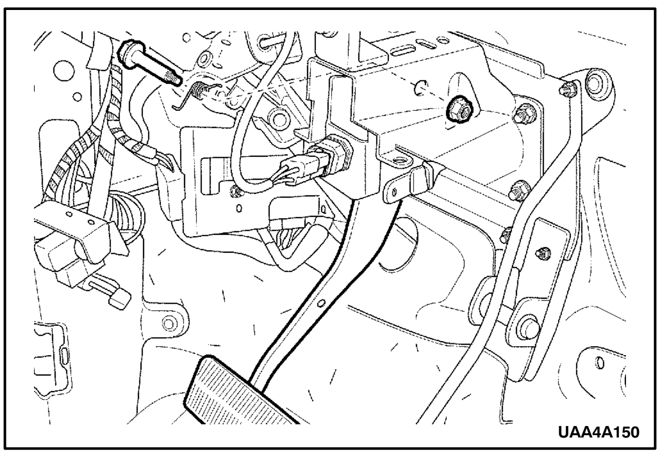
1. Remove the lower instrument trim panel. Refer to *Section 9E, Instrumentation/Driver Information*.
2. Remove the stoplamp switch. Refer to “Stoplamp Switch” in this section.



3. Disconnect the spring retaining clip and the pin from the brake booster pushrod clevis.

Installation Notice

- Apply the grease around the hold of clevis pin.

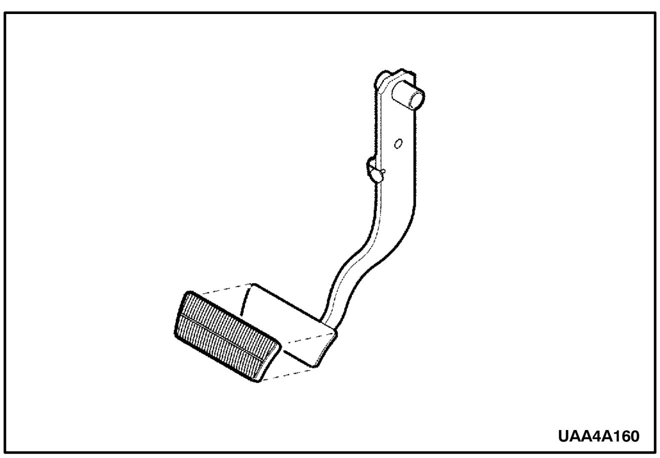


4. Remove the brake pedal-to-dash panel bracket nut and the bolt.
5. Remove the brake pedal from the dash panel bracket.
6. Remove the spring from the brake pedal.

Installation Notice

Tightening Torque	18 N·m (13 lb–ft)

- Apply the grease around the hold of brake pedal shaft.



7. Remove the brake pedal cover.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	Description
Capacity	0.5 Liter (0.53 qt)
Lubricant	DOT–3

Application	Millimeters	Inches
Front Disc Brake Rotor:		
Diameter	256.00	10.08
Thickness(New)	24.00	0.95
Discard Thickness	22.00	0.87
Lateral Runout(Installed)	0.03	0.0012
Rear Drum Brake:		
Inside Diameter	230.00	9.06
Maximum Rebore Diameter	231.00	9.09
Out-of-Round	0.1	0.0039
Booster:		
Diameter	180 + 205	7 + 8
Servo Force Ratio	6 : 1	–
The Distance From The Booster To Fork Bin	162.4	6.39
Master Cylinder:		
Bore Diameter	23.81	0.9374
Caliper:		
Minimum Piston Diameter (Front)	57.0	2.2441
Wheel Cylinder:		
Diameter	20.64	0.8126
Brake Pedal		
Free Play	MAX. 10	MAX. 0.3937
Height	162 ± 10	6.3779 ± 0.3937
Stroke	MIN. 120	MIN. 4.7244

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Brake Line Fitting Nut (Master Cylinder)	16	12	–
Bleeder Screw	9	6	80
Brake Hose-to-Caliper Bolt	40	30	–
Brake Pedal-to-Dash Panel Bracket Bolt and Nut	18	13	–
Brake Line Fitting Nut (Brake Hose)	16	12	–

SECTION 4B

MASTER CYLINDER

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION

The master cylinder is designed for use in a diagonally split system. One front and one diagonally opposite rear brakes are served by the primary piston. The opposite front and rear brakes are served by the secondary piston.

The master cylinder incorporates the functions of the standard dual master cylinder, plus a low fluid level indicator and the proportioning valves in the non-antilock braking system. The proportioning valves limit the outlet pressure to the rear brakes after a predetermined master cylinder pressure has been reached. The brake master cylinder sensor is attached under the body of the plastic brake master cylinder reservoir.

Notice: Do not use lubricated shop air on the brake parts, as this may damage the rubber components.

Important:

- Replace all the components included in the repair kits used to service the master cylinder.
- Lubricate the rubber parts with clean brake fluid to ease assembly.
- If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system. Refer to *Section 4A, Hydraulic Brakes.*
- The torque values specified are for dry, unlubricated fasteners.
- Perform all service operations on a clean bench, free from all traces of mineral oil.

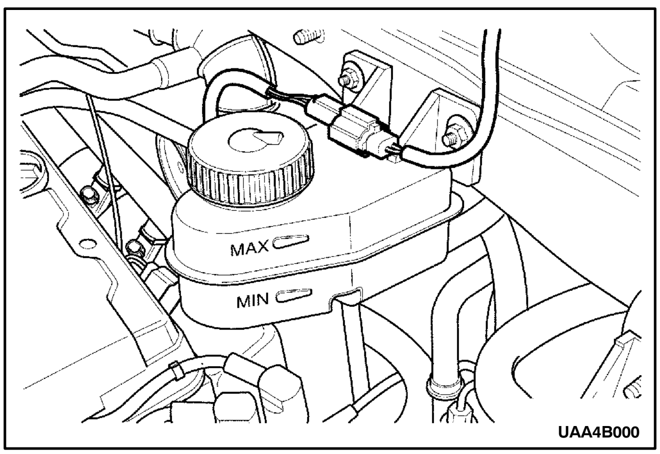
FLUID LEVEL SENSOR

The master cylinder is equipped with a fluid level sensor. This sensor will activate the BRAKE light if a low fluid level condition is detected. Once the fluid level is corrected, the BRAKE light will go out.

DIAGNOSTIC INFORMATION AND PROCEDURES

CHECKING THE BRAKE FLUID LEVEL

1. Check the fluid level.
2. If the fluid level is below MAX, refill the fluid to MAX.



CHECKING BRAKE PROPORTIONING VALVE

Use two brake pressure gauges to check the brake proportioning valves that are attached to the front under body on non-ABS braking systems. These valves limit the outlet pressure to the rear brakes after a predetermined master cylinder pressure has been reached.

When checking the brake proportioning valves, be sure that the hydraulic line pressure is measured simultaneously and diagonally on the front and the rear axle.

To measure the pressure, use the following steps:

Remove the bleeder valve and install a pressure gauge to one of the rear brake cylinders.

1. Remove the bleeder valve and install a pressure gauge to one of the rear brake cylinders.
2. Install another bleeder valve and install another pressure gauge to the diagonally opposite front brake.
3. Build pressure by pressing firmly on the brake pedal several times. The pressure indicated on the gauge is not regulated and represents the actual brake system hydraulic pressure.
4. Build pressure until the test values in the following proportioning valve test chart are achieved.

Important : If the pressure exceeds 10,000kPa (1,450 psi), the pressure reading on the rear gauge will not be accurate.

5. Remove the gauges from the tested brake circuit and repeat the test on the remaining circuit.

Engine	Reference Number for Gradient and Switching Pressure on the Valve Housing
All	25 bar/0.25

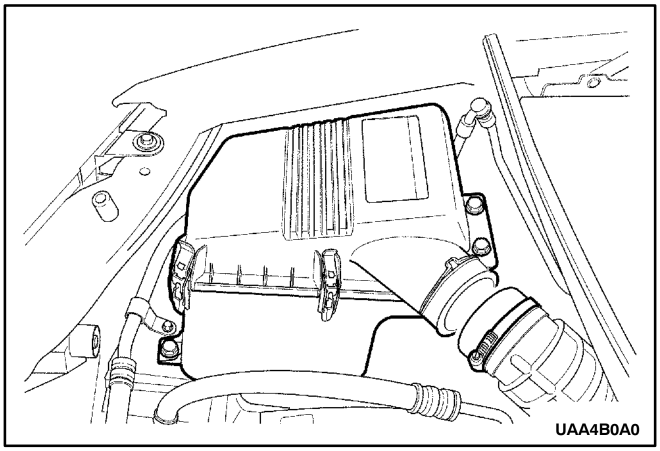
REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

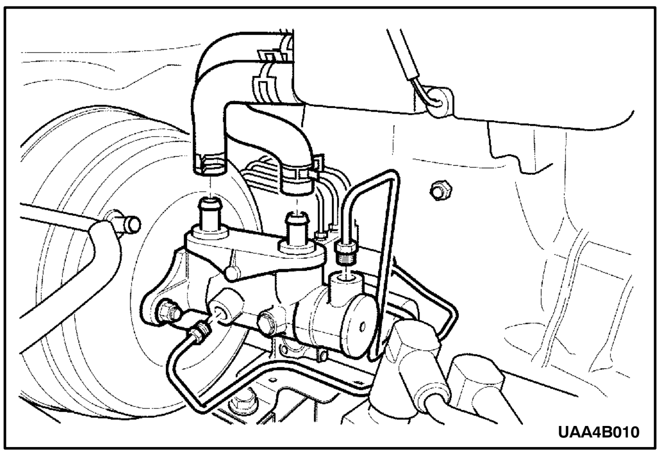
MASTER CYLINDER ASSEMBLY

(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal and Installation Procedure



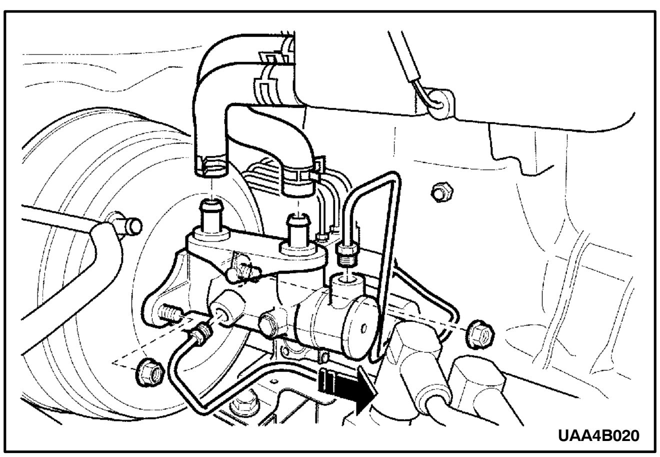
1. Remove the air intake tube from the air filter housing. (Right-Hand Drive Only)



2. Remove the brake line fitting nuts from the master cylinder body.
3. Disconnect the brake hoses from the master cylinder body. It is not necessary to drain the reservoir. Plug the opening to the brake lines to prevent the loss or contamination of the fluid.

Installation Notice

Tightening Torque	16 N·m (12 lb–ft)



4. Remove the master cylinder mounting nuts.

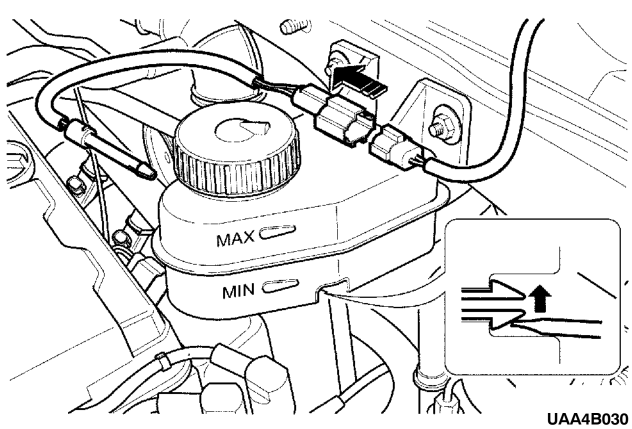
Installation Notice

Tightening Torque	13 N·m (10 lb–ft)

5. Remove the master cylinder assembly.
6. Drain the brake fluid.

Installation Notice

- After the installation, bleed the brake system. Refer to *Section 4A, Hydraulic Brakes*.
- Check the brake system for leaks.
- Care must be taken to prevent the brake fluid from contacting any painted surface to prevent damage to the paint finish.



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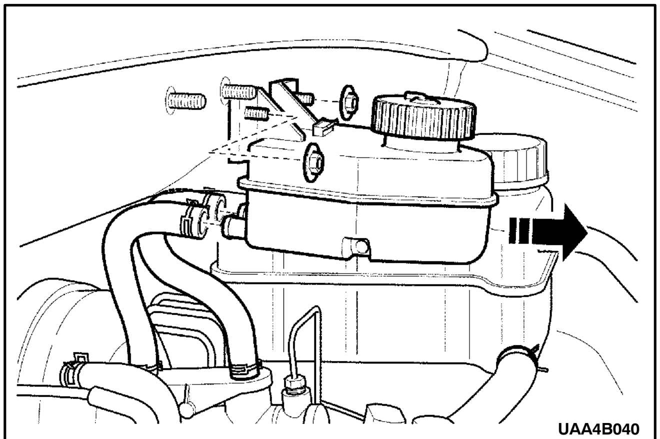
BRAKE FLUID RESERVOIR

Removal and Installation Procedure

Important : Remove the brake fluid reservoir only when it must be replaced because of damage or leaks.

1. Disconnect the brake fluid level sensor connector.
2. Drain the brake fluid.
3. Disconnect the brake hoses from the brake fluid reservoir.



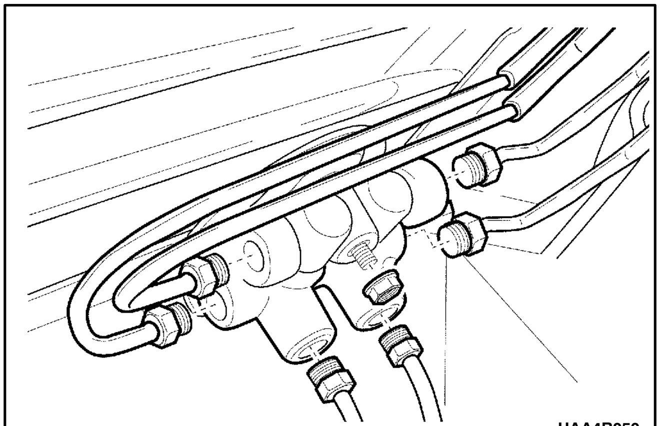
UAA4B040

4. Remove the brake fluid reservoir mounting nuts.
5. Remove the brake fluid reservoir.

Installation Notice

Tightening Torque	6 N·m (4 lb–ft)

- Add new brake fluid.
- After the installation, bleed the brake system. Refer to *Section 4A, Hydraulic Brakes*.



UAA4B050

PROPORTIONING VALVE

Removal and Installation Procedure

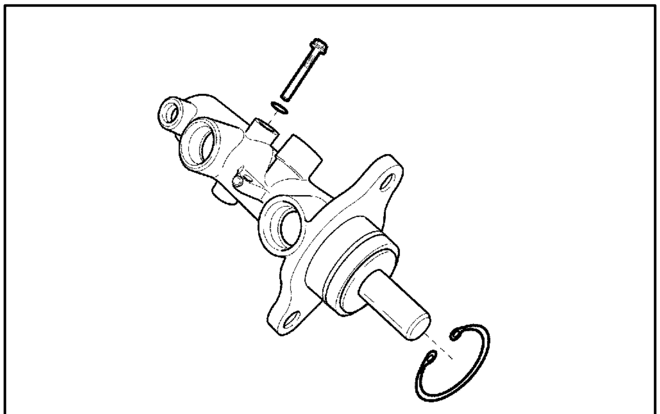
1. Raise and suitably support the vehicle.
2. Disconnect the brake line fitting nuts from the proportioning valve.
3. Remove the proportioning valve mounting nut.
4. Remove the proportioning valve.

Installation Notice

Tightening Torque	Brake Line Fitting Nuts	16 N·m (12 lb–ft)
Tightening Torque	Proportioning Valve Mounting Nuts	7 N·m (5 lb–ft)

- Add new brake fluid.
- After the installation, bleed the brake system. Refer to *Section 4A, Hydraulic Brakes*.

UNIT REPAIR



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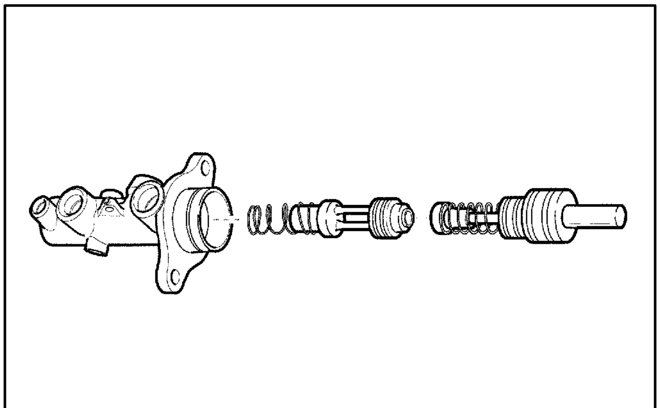

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MASTER CYLINDER OVERHAUL

(Left-Hand Drive)

Disassembly and Assembly Procedure

1. Remove the master cylinder. Refer to *"Master Cylinder Assembly"* in this section.
2. Remove the retaining bolt and the seal from the cylinder.

Notice: When removing the retaining ring, avoid damaging the piston or the cylinder wall.

3. Remove and discard the retaining ring from the cylinder body.
4. Remove the primary piston assembly.
5. Carefully remove the secondary piston assembly, including the spring, from the master cylinder bore.

Installation Notice

- Do not use abrasives in the master cylinder bore. Abrasives can damage the bore.
- Rubber parts and retaining ring must be discarded and replaced with new parts.
- When installing the new retaining ring, take care not to damage the cylinder bore.
- Lubricate the master cylinder bore with clean brake fluid.
- Add new brake fluid. After the installation, bleed the brake system. Refer to *Section 4A, Hydraulic Brakes*.

MASTER CYLINDER OVERHAUL

(Right-Hand Drive)

The master cylinder overhaul in this vehicle is not serviceable.

If the master cylinder is defective, you must replace the master cylinder assembly.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	NVm	Lb-Ft	Lb-In
Brake Line Fitting Nut (Master Cylinder)	16	12	–
Master Cylinder Mounting Nut	13	10	115
Brake Fluid Reservoir Mounting Nut	6	4	53
Brake Line Fitting Nut (Proportioning Valve)	16	12	–
Proportioning Valve Mounting Nut	7	5	62

SECTION 4C

POWER BOOSTER

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION

The power booster is a single-diaphragm, vacuum-suspended unit. In normal operating mode, with the service brakes in the release position, a vacuum-suspended booster operates with a vacuum on both sides of its diaphragm. When the brakes are applied, air at atmospheric pressure is admitted to one side of the diaphragm to provide the power assist. When the brakes are released, atmospheric air is shut off from that side of the diaphragm.

The air is then drawn from the booster through the vacuum check valve by the vacuum source.

Important: If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system. Refer to ***Section 4F, Antilock Brake System and Traction Control System***.

DIAGNOSTIC INFORMATION AND PROCEDURES

POWER BOOSTER FUNCTIONAL CHECK

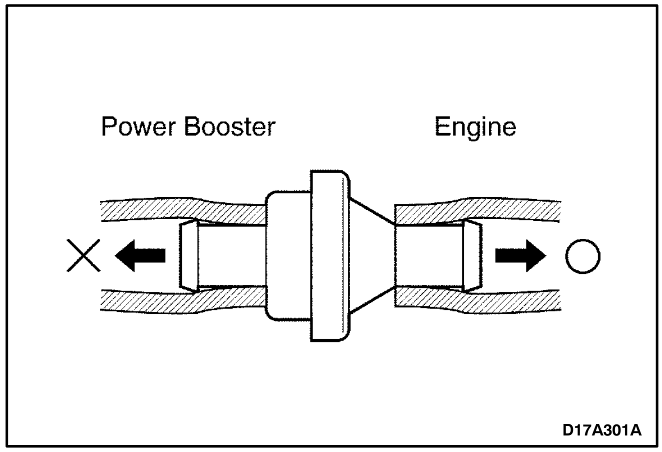
1. With the engine stopped, eliminate vacuum in the booster by pumping the brake pedal several times.
2. Push the pedal down and hold in this position.
3. Start the engine.
4. The booster is OK if the pedal drops further because of extra force produced.

If the brake pedal does not drop, the vacuum system (vacuum hoses, check valve, etc.) is probably defective and should be checked.

If no defect is revealed by checking the vacuum system, the defect is in the booster itself.

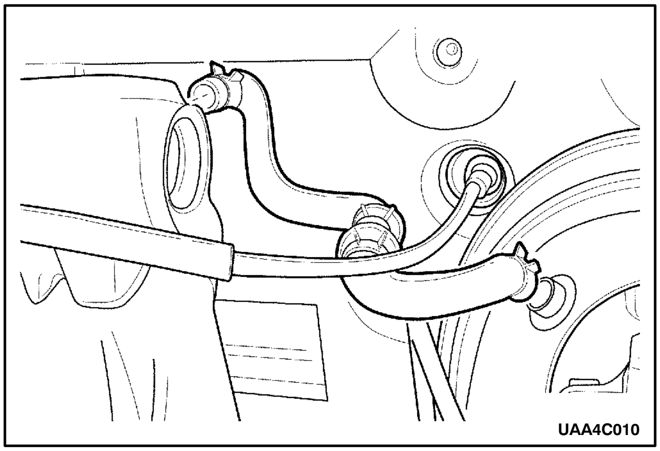
CHECK VALVE FUNCTIONAL CHECK

1. Remove the vacuum hose.
2. Suck the vacuum hose to power booster. And also, suck the vacuum hose to engine.
3. If the air pass through the check valve or not, replace the check valve. And if the vacuum hose to engine is only sucked, the check valve OK.



REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



UAA4C010

VACUUM HOSE

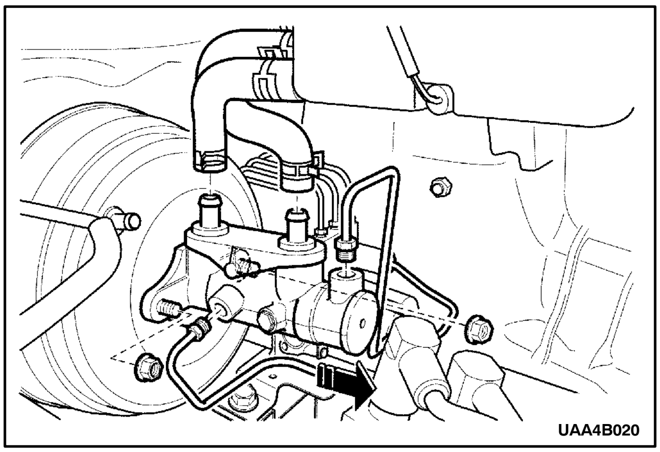
(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal and Installation Procedure

1. Remove the air intake tube from the air filter housing. (Right-Hand Drive Only)
2. Remove the clips on the vacuum hose connection to the intake manifold and the brake booster.
3. Remove the vacuum hose.

Installation Notice

- Check the function of the booster. Refer to the "Power Booster Function Check" in this section.



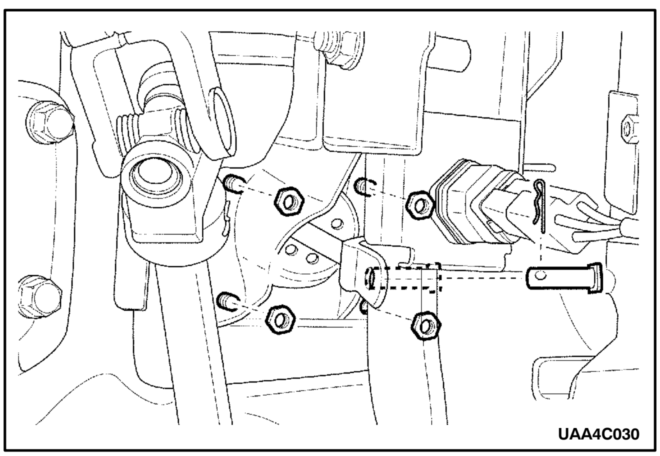
UAA4B020

POWER BOOSTER ASSEMBLY

(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal and Installation Procedure

1. Remove the engine. Refer to ***Section 1C, DOHC Engine Mechanical.*** (Right-Hand Drive Only).
2. Remove the master cylinder. Refer to ***Section 4B, Master Cylinder***.
3. Remove the vacuum hose from the brake booster. Refer to the "Vacuum Hose" in this section.



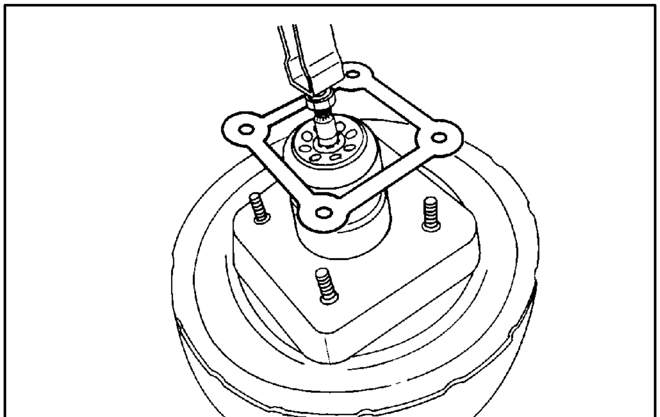
UAA4C030

4. Remove the clevis pin and disconnect the pedal and brake booster push rod.
5. Disconnect the retaining clip and the pin from the brake booster pushrod clevis.
6. Remove the brake booster mounting nuts from studs protruding from dash panel and remove the brake booster.

Installation Notice

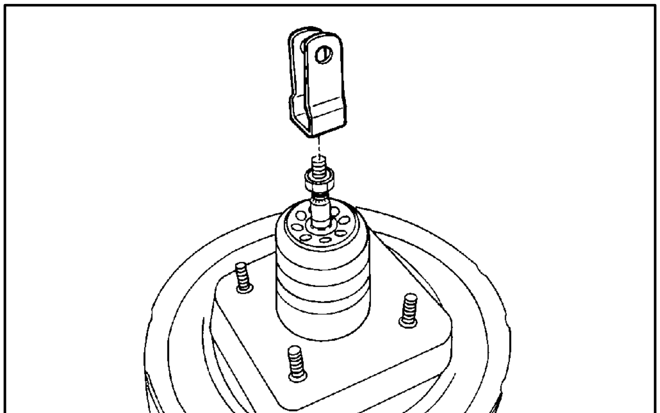
Tightening Torque	25 N·m (18 lb–ft)

- Apply the grease around the hole of pushrod clevis pin.



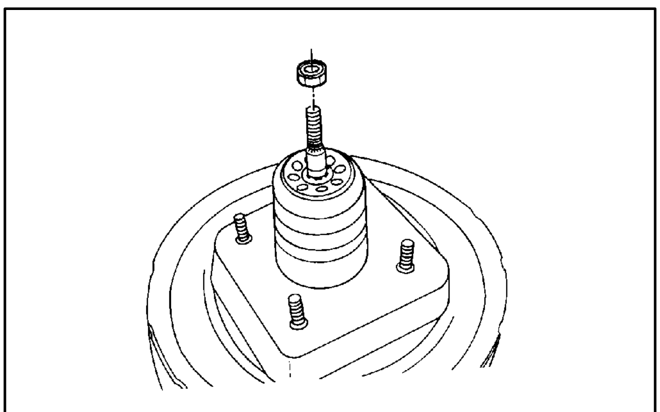
C107C004

7. Remove and discard the gasket.



C107C005

8. Remove the pushrod clevis.



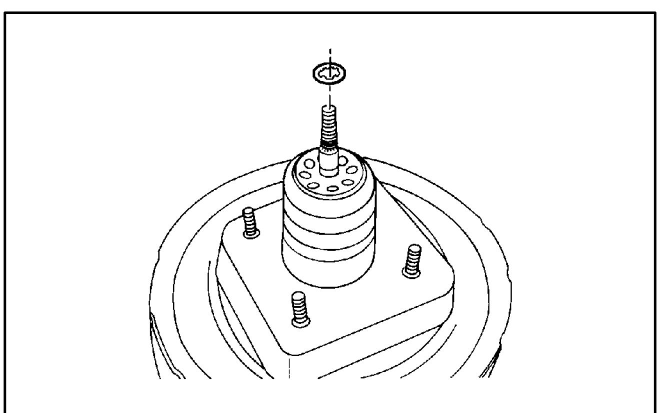
C107C006

9. Remove the hex nut from the pushrod.

Installation Notice

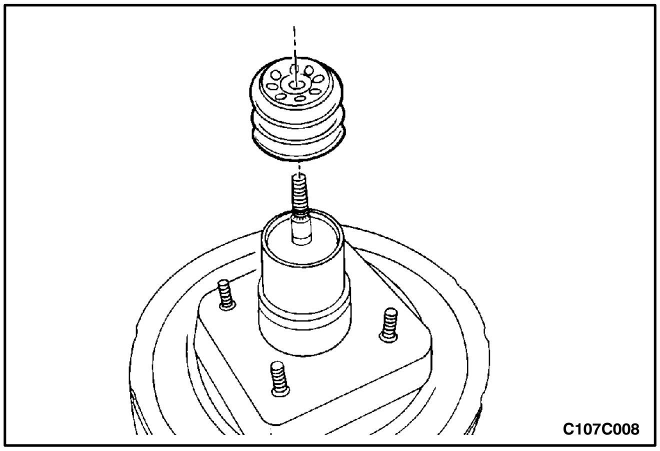
Tightening Torque	18 N·m (13 lb–ft)

- Install the new gasket.



C107C007

10. Remove the spring clip.


C107C008

11. Remove the rubber boot.
    - Measure the distance from the booster to the center of the fork bin bore. This measurement should be 162.4 mm(6.39 inches).
    - Right-Hand Drive: 127.4mm(5.02 inches)
    - Check the function of the booster. Refer to the "Power Booster Function Check" in this section.
    - After the installation, bleed the brake system. Refer to ***Section 4A, Hydraulic Brakes***.
    - Check the brake system for leaks.
    - Care must be taken to prevent the brake fluid from contacting any painted surface to prevent damage to the paint finish.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Application		Unit	Description
Power Booster	Type	–	Vacuum–Suspended
	Diameter	mm (inch)	180 (7) + 205 (8)
	Servo Force Ratio	–	5 : 1
	The Distance From The Booster To Fork Bin	mm (inch)	LHD: 162.4 (6.39) RHD: 127.4 (5.02)

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Dash Panel-to-Brake Booster Mounting Nut	25	18	–
Pushrod Clevis Nut	18	13	–

SECTION 4D

FRONT DISC BRAKES

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

BRAKE CALIPER

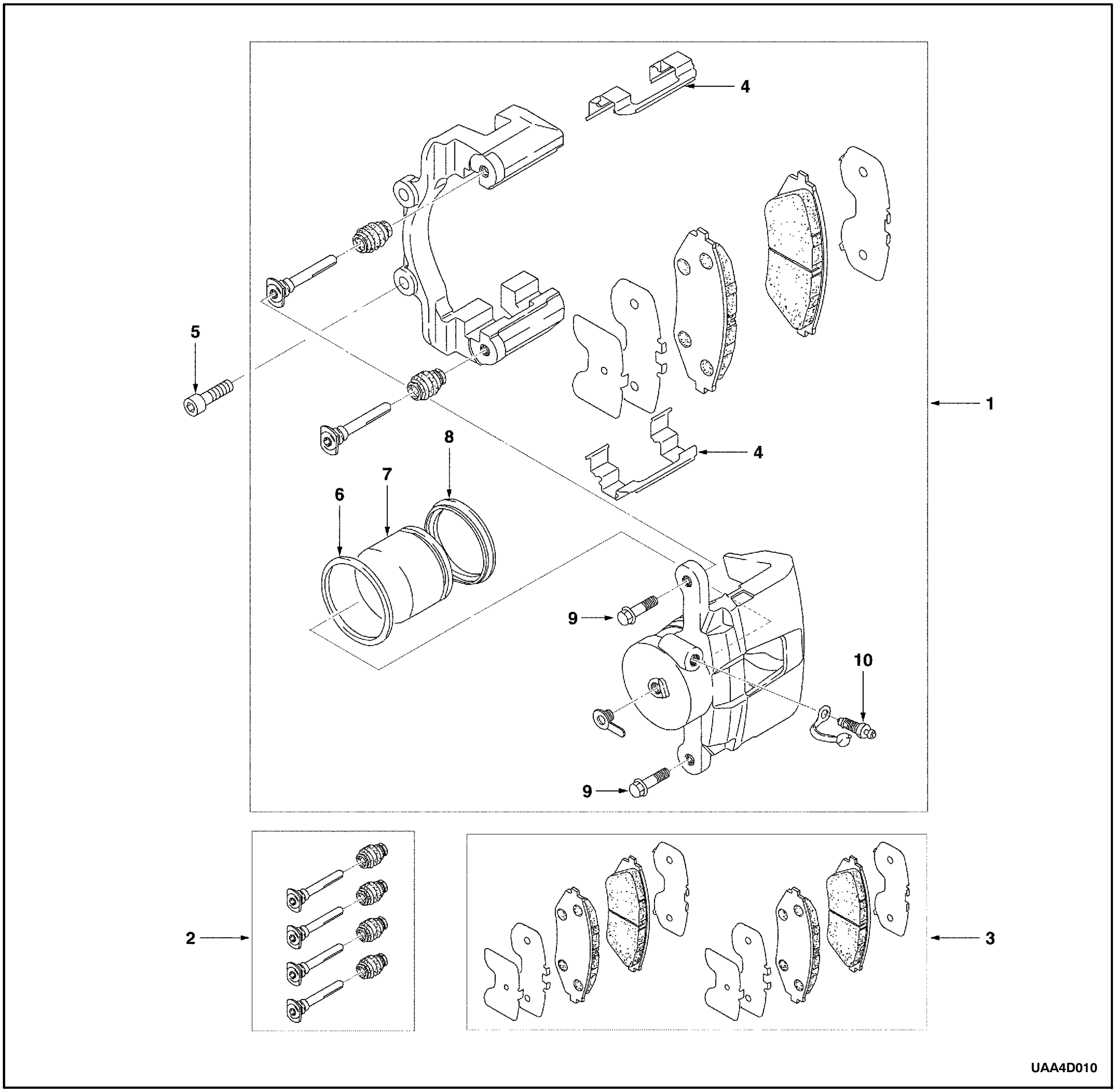
The caliper has a single bore and is mounted to the steering knuckle with two mounting bolts. Hydraulic pressure, created by applying the brake pedal, is converted by the caliper to a stopping force. This force acts equally against the piston and the bottom of the caliper bore to move the piston outward and to slide the caliper inward, resulting in a clamping action on the rotor. This clamping action forces the linings against the rotor, creating friction to stop the vehicle.

Important:

- Replace all components included in the repair kits used to service the caliper.
- Lubricate the rubber parts with clean brake fluid to ease assembly.
- Do not use lubricated shop air on brake parts, as damage to the rubber components may result.
- If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system. Refer to *Section 4A, Hydraulic Brakes*.
- Replace the pads in axle sets only.
- The torque values specified are for dry, unlubricated fasteners.
- Perform the service operations on a clean bench, free from all oily material.

COMPONENT LOCATOR

FRONT CALIPER BRAKE

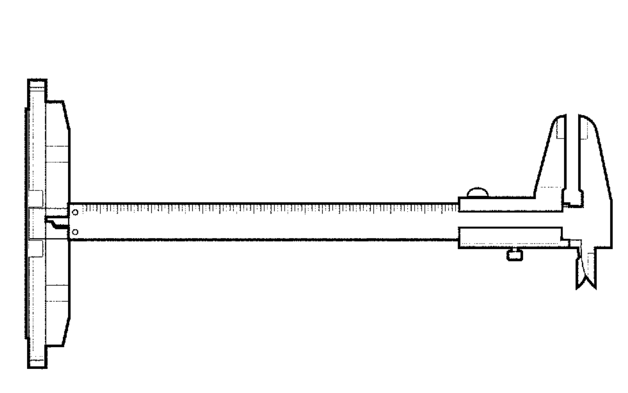


1 Front Brake Caliper Assembly
2 Front & Grease Pin Set
3 Brake Pad
4 Brake Pad Spring
5 Pin Bolt
6 Piston Boot
7 Piston
8 Piston Seal
9 Caliper Bolt
10 Bleeder Screw

DIAGNOSTIC INFORMATION AND PROCEDURES

LINING INSPECTION

1. Raise and suitably support the vehicle.
2. Remove the front wheel. Refer to *Section 2E, Tires and Wheels*.
3. Visually check the linings for minimum thickness and wear.



UAA4D020

4. Measure the thickness.

Important : The minimum thickness to the inner or outer pad is 2 mm(0.0787 inch).

5. Install the pads in axle sets only.
6. Install the front wheels. Refer to *Section 2E, Tires and Wheels*.
7. Lower the vehicle.

FRONT DISC BRAKE ROTOR INSPECTION

Thickness variation can be checked by measuring the thickness of the rotor at four or more points around the circumference of the rotor. All measurements must be made at the same distance in from the edge of the rotor.

A rotor that varies by more than 0.03 mm(0.0012 inch) can cause pedal pulsations and/or front end vibration during brake applications. A rotor that does not meet these specifications should be refinished to specifications or replaced.

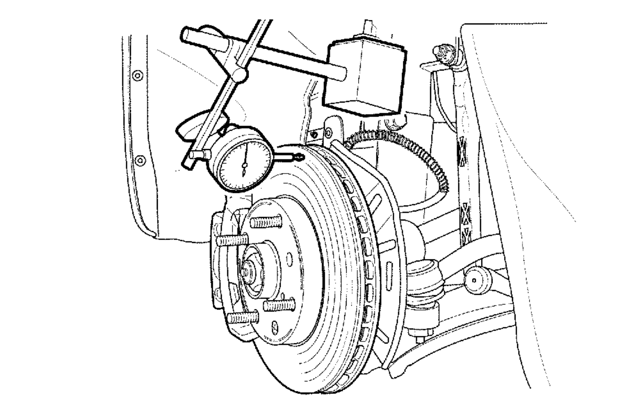
During manufacturing, the brake rotor and the tolerances of the braking surface regarding flatness, thickness variation, and lateral runout are held very close. The maintenance of close tolerances on the shape of the braking surfaces is necessary to prevent brake roughness.

In addition to these tolerances, the surface finish must be held to a specified range. The control of the braking surface finish is necessary to avoid pulls and erratic performance and to extend lining life.

Using a commercially available dial indicator, check lateral runout as follows:

Notice : permissible lateral runout is a maximum 0.03 mm(0.0012 inch). If lateral runout exceeds the specification, ensure that there is no dirt between the rotor and the hub and that contact surfaces are smooth and free from burrs.

1. Position the transaxle in NEUTRAL.
2. Remove the front wheel. Refer to *Section 2E, Tires and Wheels*.
3. Fasten the brake rotor to the wheel hub with two wheel nuts.



UAA4D030

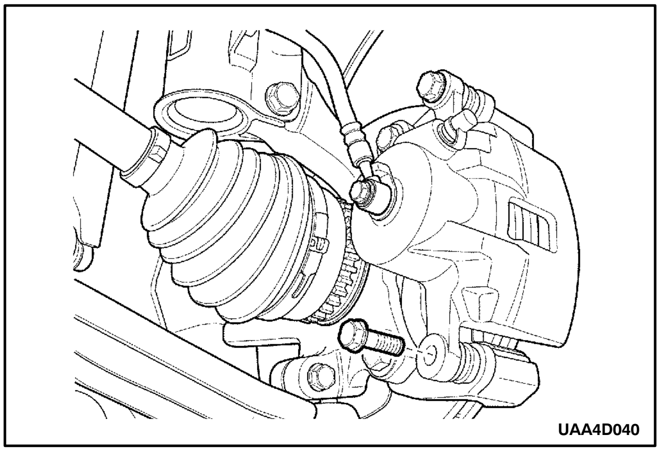
4. Fasten a dial indicator to the brake caliper.
5. Set the gauge probe tip to approximately 10 mm (0.39 inch) from the outer edge of the brake rotor, perpendicular to the disc and under slight preload.
6. Remove the dial indicator and the wheel nuts that connect the rotor to the hub.

Important : Since accurate control of the rotor tolerances is necessary for proper performance of the disc brakes, refinishing of the rotor should be done only with precision equipment.

7. Refinish the rotor, if required, with precision equipment. Discard the rotor if it fails to meet the above specifications after refinishing.
8. Install the front wheel. Refer to *Section 2E, Tires and Wheels*.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



SHOE AND LINING (BRAKE PADS)

Removal and Installation Procedure

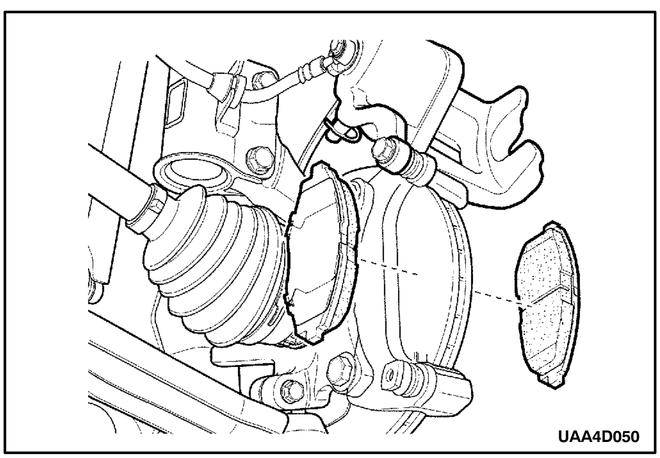
1. Raise and suitably support the vehicle.
2. Remove the front wheels. Refer to *Section 2E, Tires and Wheels*.
3. Remove the lower guide pin bolt of the caliper assembly.

Important : Caliper assembly removal is not necessary to service the brake pads.

Installation Notice

Tightening Torque	27 N·m (20 lb–ft)

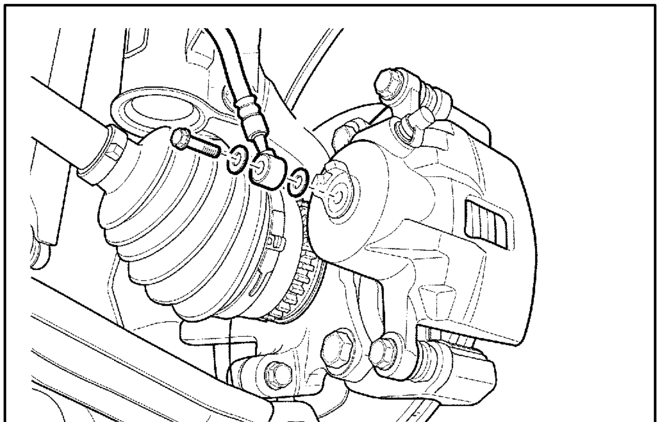
- Take care not to damage the piston seal when the retaining frame is pulled down.



4. Pull the caliper piston housing up.
5. Remove the brake pads.

Installation Notice

- Measure the minimum brake pad thickness. Refer to “Lining Inspection” in this section.
- Always change the all pads on one wheel at a time.



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CALIPER ASSEMBLY

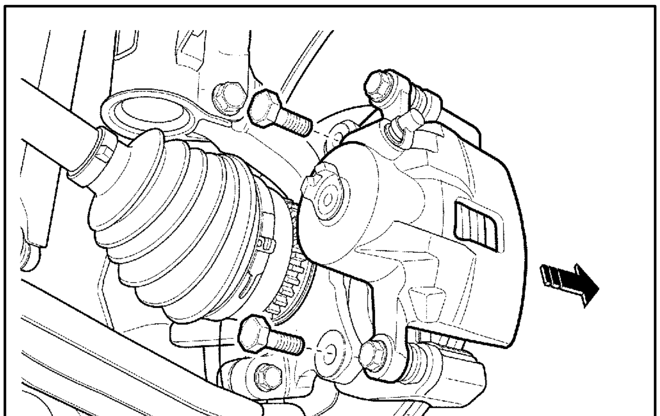
Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Remove the front wheels. Refer to *Section 2E, Tires and Wheels*.
3. Remove the nut and seal rings attaching brake hose to the caliper.
4. Disconnect the brake hose and plug the openings in the caliper and the brake hose to prevent fluid loss and contamination.

Installation Notice

Tightening Torque	40 N·m (30 lb–ft)

- Bleed the brake system. Refer to *Section 4A, Hydraulic Brakes*.
- Check the brake system for leaks.



UAA4D060

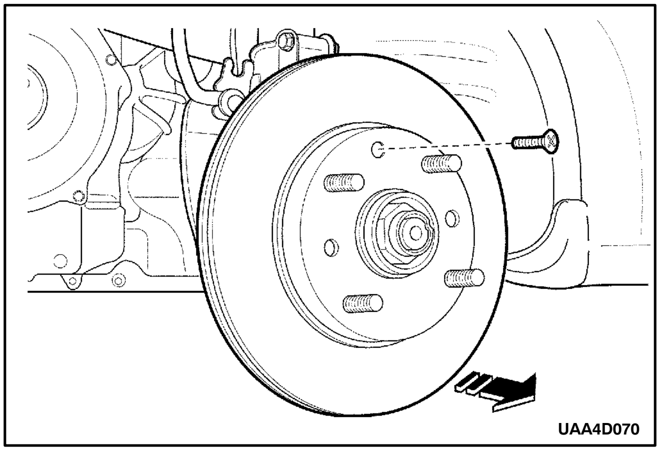
5. Remove the caliper mounting bolts from the steering knuckle, and remove the caliper assembly.

Installation Notice

Tightening Torque	95 N·m (70 lb–ft)

Notice :

- Do not move the vehicle until a firm pedal is obtained or improper braking action will result.
- Repeatedly press the brake pedal to bring the pads in contact with the rotor.



FRONT DISC BRAKE ROTOR

Removal and Installation Procedure

Notice : Do not hang the caliper assembly from the brake hose. Any resulting internal hose restriction will impede uniform braking action.

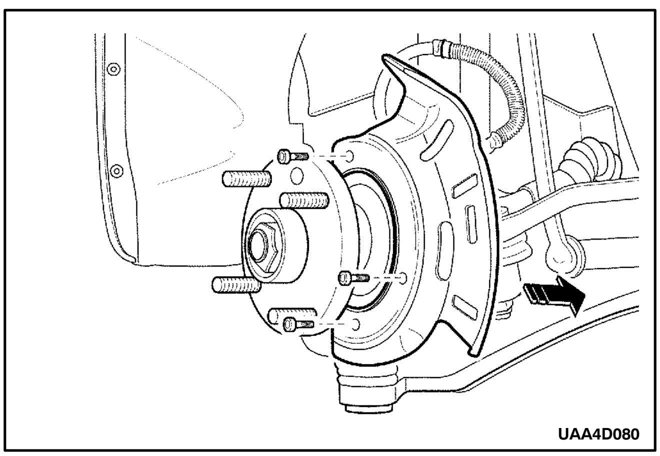
Important : To guarantee uniform braking on both sides, both rotors must have identical surfaces regarding smoothness and scoring depth. For this reason always replace both rotors.

1. Remove the caliper assembly without disconnecting the brake hoses. Refer to “Caliper Assembly” in this section.
2. Remove the rotor-to-front wheel hub detent screw.
3. Remove the front disc brake rotor.

Installation Notice

Tightening Torque	4 N·m (3 lb–ft)

- Inspect the rotor Refer to “Rotor Inspection” in this section.



SPLASH SHIELD

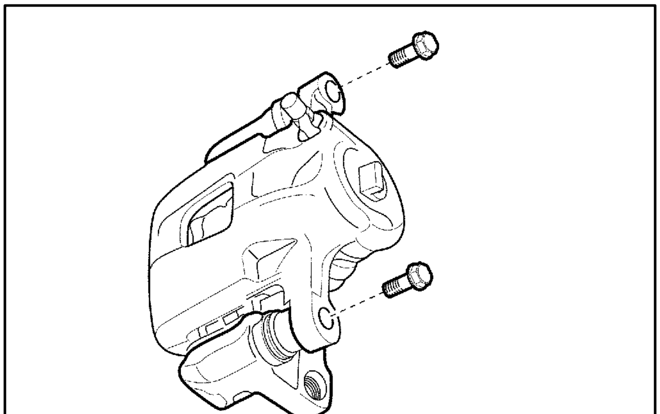
Removal and Installation Procedure

1. Remove the front disc brake rotor. Refer to “Front Disc Brake Rotor” in this section.
2. Remove the bolts for splash shield from the steering knuckle.
3. Remove the splash shield.

Installation Notice

Tightening Torque	5 N·m (4 lb–ft)

UNIT REPAIR



UAA4D090

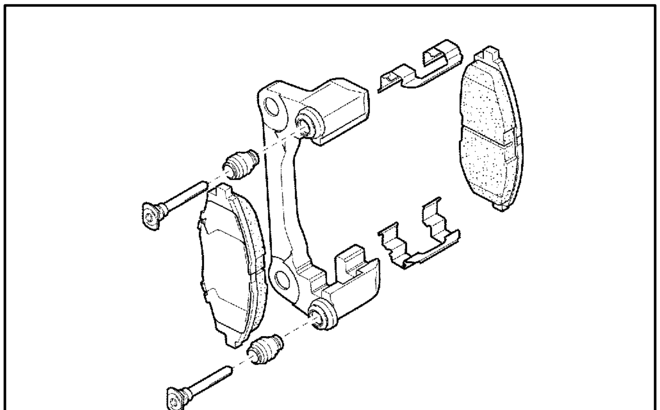
CALIPER OVERHAUL

Disassembly and Assembly Procedure

1. Remove the caliper assembly. Refer to “Caliper Assembly” in this section.
2. Remove the guide pin bolts, connecting the caliper piston housing to the retaining frame.

Installation Notice

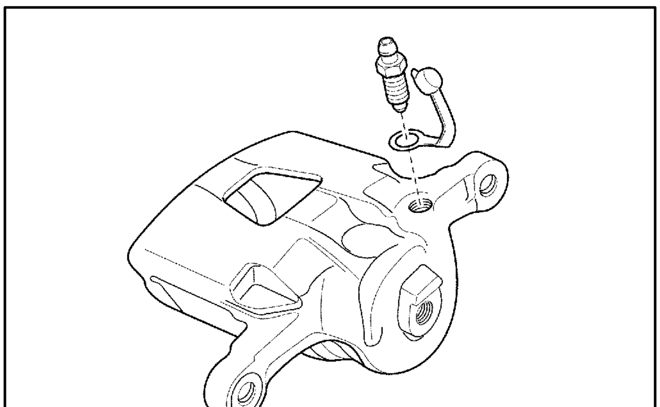
Tightening Torque	27 N·m (20 lb–ft)



UAA4D100

3. Remove the front pad brake set, including the pad springs, from the caliper. Refer to “Shoe and Lining (Brake Pads)” in this section.
4. Pull out the guide pins and the rubber boots.

Important : Make sure the pad springs are properly installed.

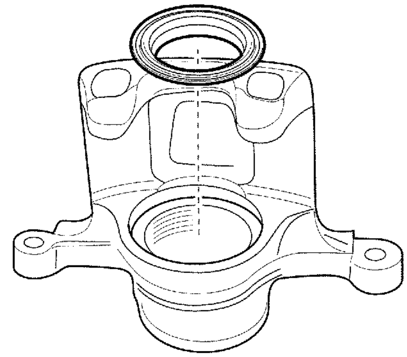


UAA4D110

5. Remove the bleeder valve protector and the bleeder valve.

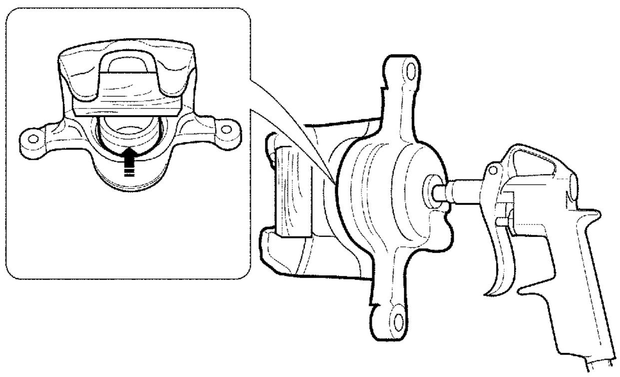
Installation Notice

Tightening Torque	9 N·m (6 lb–ft)



UAA4D120

6. Remove the outer seal.

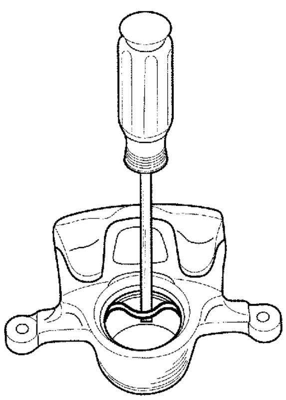


UAA4D130

Caution : Do not place fingers in front of the piston inan attempt to catch or protect it when applying compressed air. This could result in serious injury.

Important : Insert a piece of hardwood into the caliper housing interior when removing the piston.

7. Using compressed air, blow out the piston from housing.



UAA4D140

8. Remove the inner seal from the caliper piston bore.

Installation Notice

- Clean all the parts in denatured alcohol or brake fluid. Dry the parts with unlubricated compressed air and blow out all the passages in the housing and the bleeder valve.
- Inspect the piston and the caliper for scoring, nicks and corrosion. Replace the components if these elements are found.
- Lubricate a new piston inner seal.
- Rubber parts and retaining ring must be discarded and replaced with new parts.
- Lubricate the piston with clean brake fluid.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Application		Unit	Description
Rotor	Outer Diameter	mm (inch)	256 (10.08)
	Thickness	mm (inch)	24 (0.95)
	Discard Thickness	mm (inch)	22 (0.87)
	Runout	mm (inch)	0.03 (0.0012)
Caliper	Pad Thickness	mm (inch)	11 (0.4331)
	Pad Discard Thickness	mm (inch)	2 (0.0787)
	Diameter of the Piston	mm (inch)	57 (2.2441)

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Caliper Guide Pin Bolt	27	20	–
Brake Hose-to-Caliper Bolt	40	30	–
Steering knockle-to-Caliper Mounting Bolt	95	70	–
Rotor-to-Front Wheel Hub Detent Screw	4	3	35
Splash Shield Bolt	5	4	44
Bleeder Valve	9	6	80

SECTION 4E

REAR DRUM BRAKES

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION

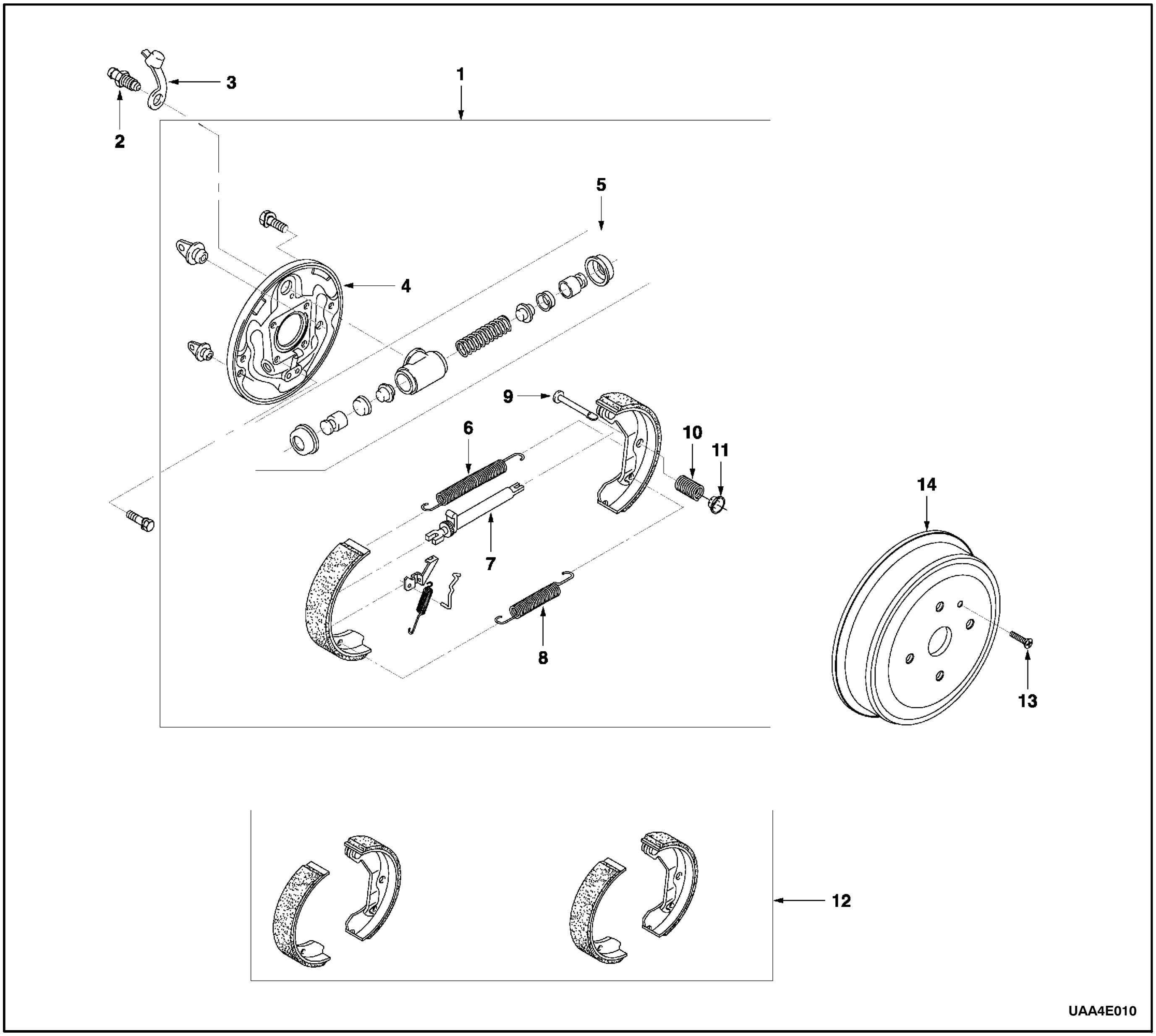
This drum brake assembly is a leading/trailing shoe design. Both brake shoes are held against the wheel cylinder pistons by the lower return spring and the fixed anchor plate near the lower return spring. When the brakes are applied, the wheel cylinder pistons move both shoes out to contact the drum. With forward wheel rotation, the forward brake shoe will wrap into the drum and become self-energized. With reverse wheel retation, brake shoes is transferred to the anchor plate through the braking plate to the axle flange. Adjustment is automatic and occurs on any service brake application. Do not switch the position of shoes that have been in service, as this may render the self-adjustment feature inoperative and result in increased pedal travel.

Notice:

- Replace all the components included in the repair kits used to service this drum brake.
- Do not use lubricated shop air on the brake parts, as damage to the rubber components may result.
- If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the braking system.
- Replace the shoe and linings in axle sets only.
- The torque values specified are for dry, unlubricated fasteners.
- Perform service operations on a clean bench that is free from all mineral oil materials.

COMPONENT LOCATOR

REAR DRUM BRAKE

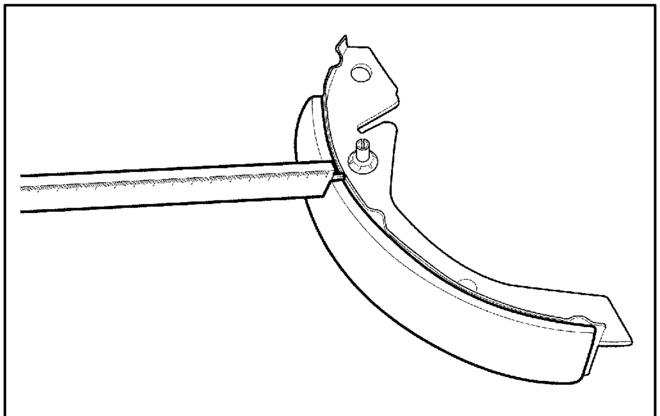


1 Rear Brake Drum Assembly
2 Bleeder Screw
3 Bleeder Screw Cap
4 Backing Plate
5 Wheel Cylinder
6 Upper Return Spring
7 Adjuster
8 Lower Return Spring
9 Retain Spring Pin
10 Retain Spring
11 Retain Spring Plate
12 Brake Lining
13 Brake Drum Screw
14 Brake Drum

DIAGNOSTIC INFORMATION AND PROCEDURES

LINING INSPECTION

1. Raise and suitably support the vehicle.
2. Remove the rear wheel. Refer to *Section 2E, Tires and Wheels*.
3. Release the parking brake.
4. Remove the drum. Refer to “Drum” in this section.



UAA4E020

5. Inspect the lining for wear or stain with oil
6. Measure the lining thickness.

Lining Wear Limit Value	0.5 mm (0.02 inch)

Caution : To avoid injury when servicing brake parts, do not create dust by grinding or sanding the brake linings or by cleaning the wheel brake parts with a dry brush or with compressed air.

Important : Replace the shoe and lining assembly in axle sets only.

7. If the measured value is within the limit value, or if the defect is found, replace the lining.
8. Install the drum. Refer to “Drum” in this section.
9. Install the rear wheels. Refer to *Section 2E, Tires and Wheels*.
10. Lower the vehicle.

REAR DRUMS

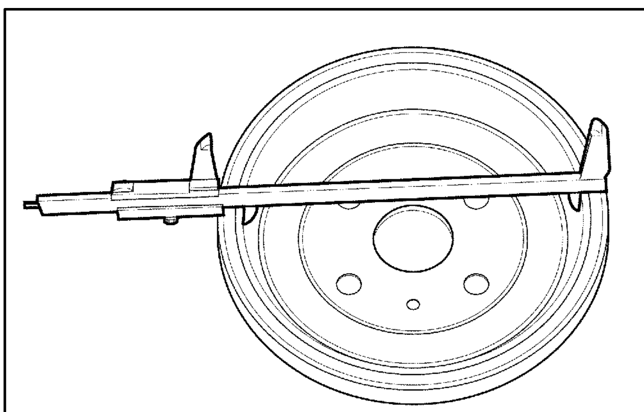
Whenever brake drums are removed, they should be thoroughly cleaned and inspected to see if the drums are cracked, scored, deeply grooved, or beyond the specified out-of-round limit.

- A cracked drum is unsafe for further service and must be replaced. Do not attempt to weld a cracked drum. Smooth out any slight scores.
- Heavy or extensive scoring will cause excessive brake lining wear and may require refinishing the drum braking surface.
- If the brake linings are slightly worn but are still reusable and the drum is grooved, polish the drum with a fine emery cloth but do not refinish it. Eliminating all grooves in the drum and smoothing the ridges on the lining removes too much metal and lining. If left alone, the grooves and ridges match, and satisfactory service can be obtained. If the brake linings need to be replace, refinish a grooved drum. A grooved drum, used with a new lining, will not only wear the lining, but also will make it difficult, if not impossible, to obtain proper brake performance.
- An out-of-round drum makes accurate brake shoe adjustment impossible and is likely cause excessive wear of other parts of the brake mechanism. An out-of-round drum can also cause service and irregular tire tread wear, as well as a pulsating brake pedal.
- The extent to which a drum is worn or out-of-round can be measured accurately with an inside micrometer fitted with the proper extension rods. When measuring a drum for wear or the extent to which it is out-of-round, take measurements from the inside edge to the outside edge of the machined surface at 90-degree intervals around the circumference of the drum.
  When the drum exceeds the specified out-of-round limit, refinish the drum.

Inspect the brake drum as follow;

1. Inspect the drum for crack or damage.
2. Measure the inside diameter.

Inside Diameter Wear Limit Value	231 mm (9.1 inch)



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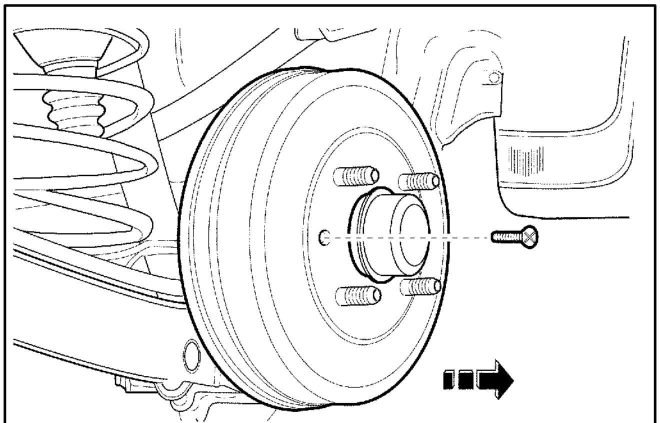
3. If the measured valve is over the limit value, or if the defect is found, replace the drum.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



UAA4E040

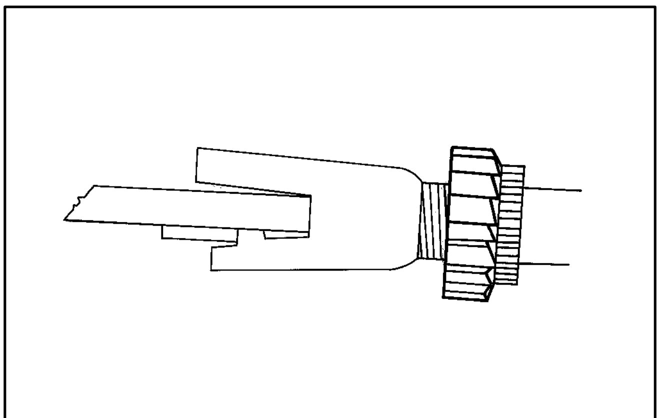
BRAKE ADJUSTMENT

Removal and Installation Procedure

1. Release the parking brake.
2. Operate the brake at least 10 times until the jumping of the adjustment spring on the adjustment nut can no longer be heard on either brake drum.
3. Raise and suitably support the vehicle.
4. Remove the rear wheels. Refer to *Section 2E, Tires and Wheels.*
5. Remove the detent screw from the brake drum.
6. Remove the brake drum.

Installation Notice

Tightening Torque	5 N·m (4 lb–ft)



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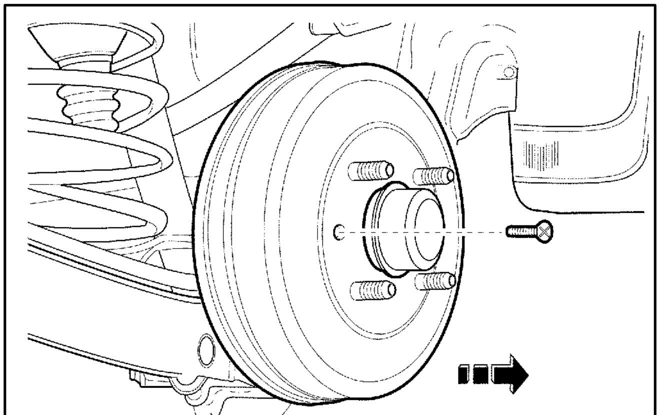
7. Using the rear brake adjuster nut, turn the adjuster assembly in until drag is felt on the brake drum.
8. Make sure that the parking brake level stops are against the edge of the shoe web. If they are not, loosen the parking brake cable at the equalizer.

Installation Notice

- The brake pedal must be operated more than 10 times. When the clicking can no longer be heard, the clearance between the brake shoe and drum is adjusted.
- Adjust the parking brake. Refer to *Section 4G, Parking Brake*.



UAA4E040

DRUM

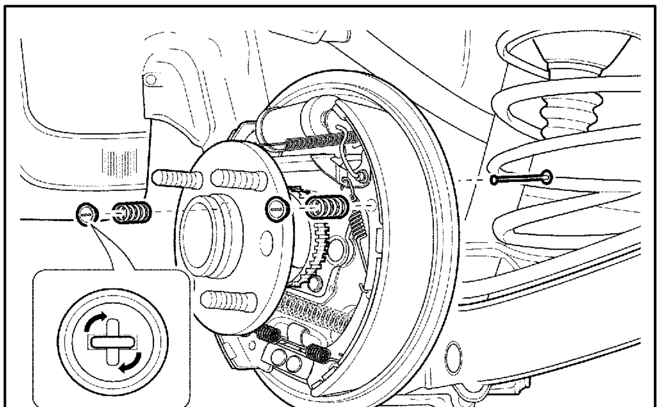
Removal and Installation Procedure

1. Release the parking brake.
2. Raise and suitably support the vehicle.
3. Remove the rear wheels. Refer to *Section 2E, Tires and Wheels*.
4. Remove the detent screw from the brake drum.
5. Remove the brake drum.

Installation Notice

Tightening Torque	5 N·m (4 lb–ft)

- Inspect the brake drum. Refer to “Drums” in this section.

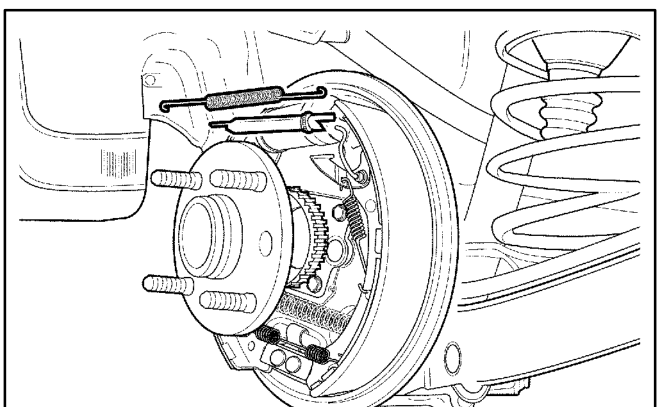


UAA4E050

SHOE AND LINING

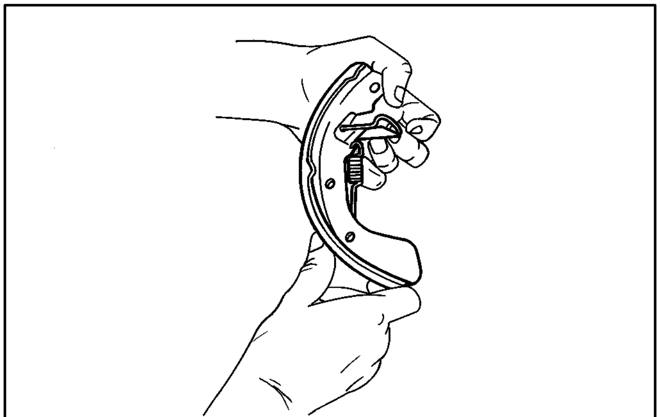
Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Remove the brake drum. Refer to “Drum” in this section.
3. Remove the retaining spring plate, the retaining spring, and the retaining spring pin.



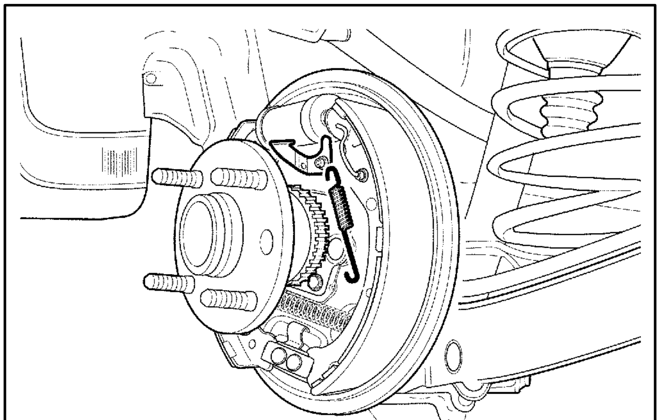
UAA4E060

4. Disconnect the upper link of the connecting link spring of the leading shoe. This relieves tension on the upper return spring.
5. Remove the upper return spring and the adjuster.



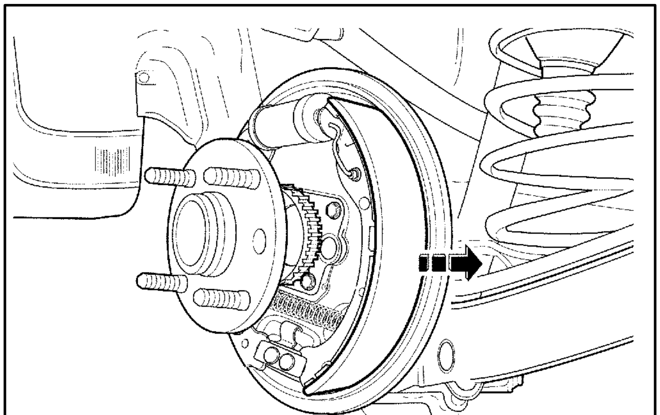
A107E005

6. Remove the leading shoe by unlatching it from the lower return spring.
7. Remove the lower return spring.



UAA4E070

8. Remove the middle spring and the adjuster lever.

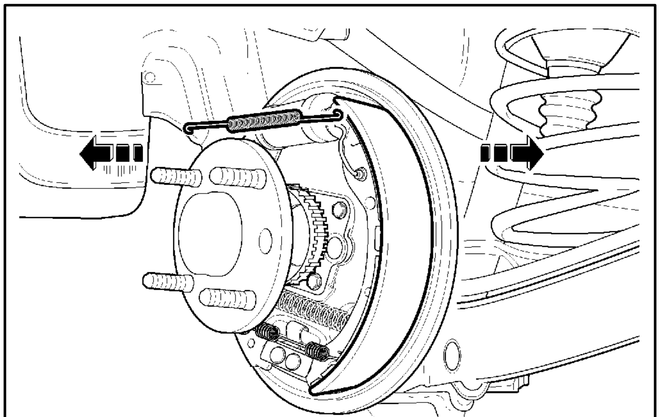


UAA4E080

9. Disconnect the trailing shoe and lining assembly.

Installation Notice

- Measure the minimum brake lining thickness. Refer to "Lining Inspection" in this section.
- Clean the adjuster assembly and apply grease.
- If any parts are of questionable strength or quality because of heat discoloration, excessive stress, or wear, the shoes, the springs, or the adjuster assembly should be replaced.
- Inspect the threads of the adjuster assembly for smooth rotation.
- Do not overstretch the lower return spring and the upper return spring.
- Before installing the brake drum, make sure the adjuster assembly nut is drawn all the way to the stop. The nut must not lock firmly at the end of the adjustment assembly.
- Adjust the parking brake. Refer to *Section 4G, Parking Brake*.

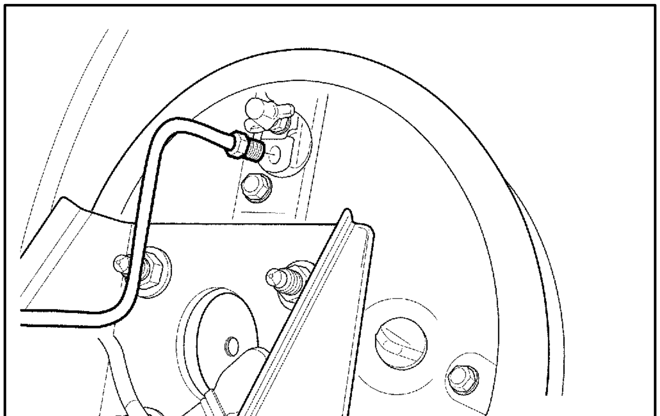


UAA4E090

WHEEL CYLINDER ASSEMBLY

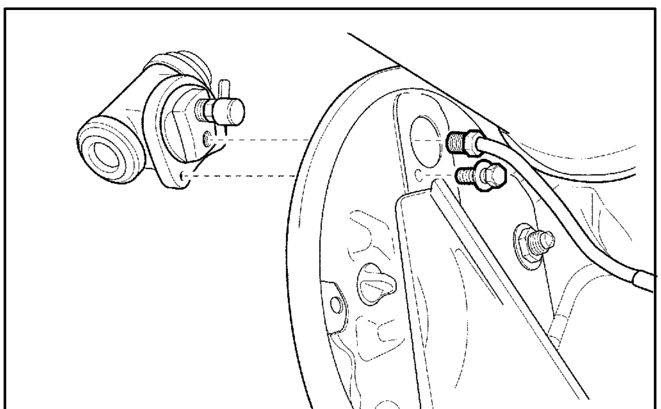
Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Remove the brake drum. Refer to "Drum" in this section.
3. Remove the shoe and lining. Refer to "Shoe and Lining" in this section.



UAA4E100

4. Clean dirt and foreign material from around the wheel cylinder brake line inlet, the pilot, and the bolt.
5. Remove the brake fitting nut from the wheel cylinder.
6. Plug the opening in the brake line to prevent fluid loss or contamination.



UAA4E110

7. Remove the wheel cylinder-to-backing plate bolt.
8. Gently tap out the wheel cylinder from the backing plate, using care not to damage the bleeder valve or its cap.

Installation Notice

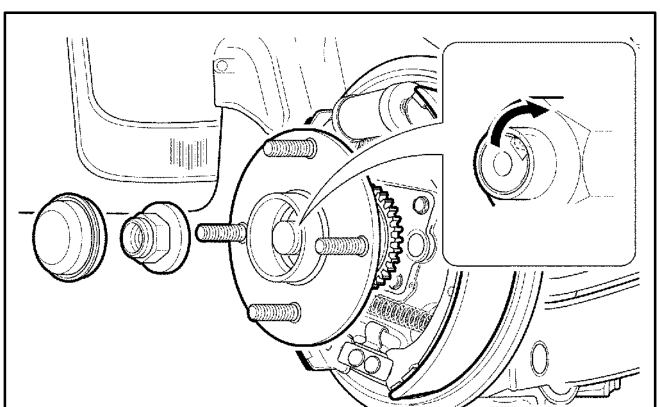
Tightening Torque	Brake Fitting Nut	16 N·m (12 lb–ft)
Tightening Torque	Wheel Cylinder-to-Backing Plate Bolt	10 N·m (7 lb–ft)

- After the installation, bleed the brake system. Refer to *Section 4A, Hydraulic Brakes*.

HUB AND BEARING ASSEMBLY

Removal and Installation Procedure

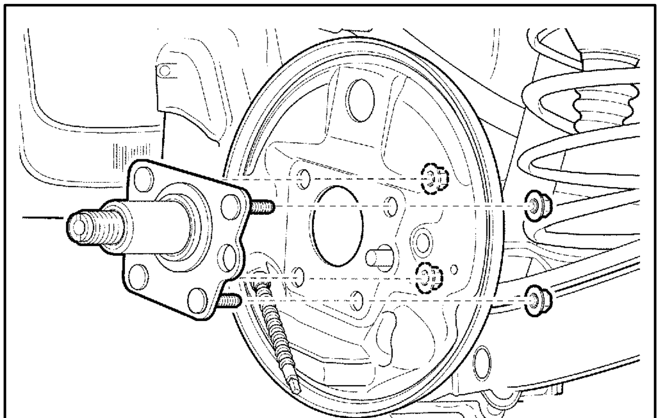
1. Raise and suitably support the vehicle.
2. Remove the brake drum. Refer to *"Drum"* in this section.
3. Remove the wheel hub cap (dust cap) and the caulking nut from the spindle shaft.
4. Remove the hub and bearing assembly.



UAA4E120

Installation Notice

Tightening Torque	235 N·m (173 lb–ft)



UAA4E130

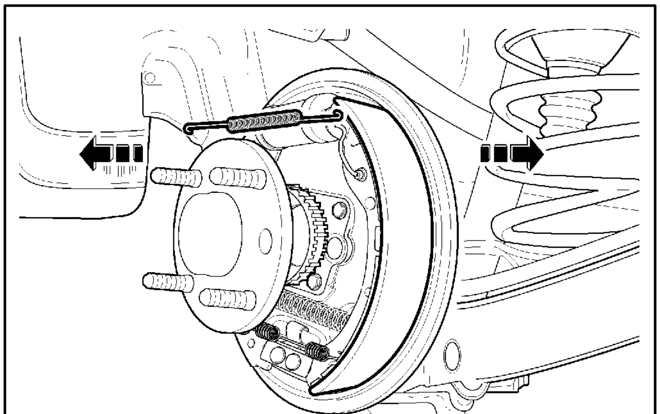
SPINDLE SHAFT

Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Remove the shoe and lining. Refer to *“Shoe and Lining”* in this section.
3. Remove the hub and bearing assembly. Refer to “Hub and Bearing Assembly” in this section.
4. Remove the backing plate-to-spindle shaft nuts.
5. Remove the spindle shaft.

Installation Notice

Tightening Torque	90 N·m (67 lb–ft)

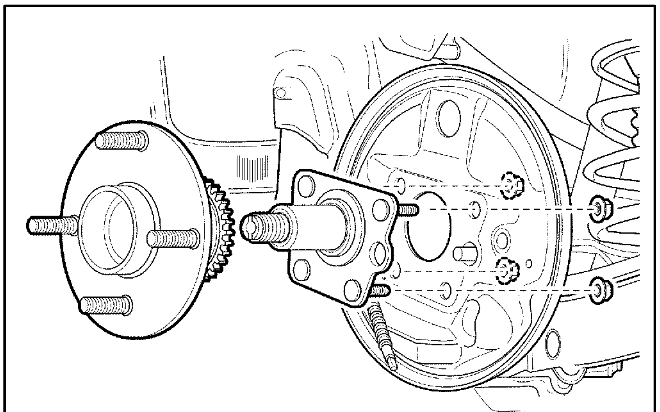


UAA4E090

BACKING PLATE

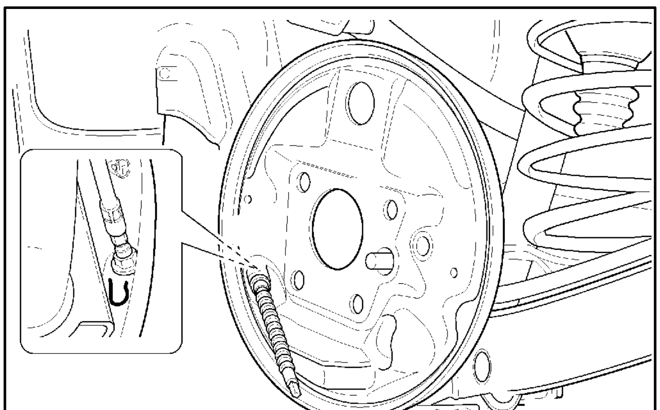
Removal and Installation Procedure

6. Raise and suitably support the vehicle.
7. Remove the shoe and lining. Refer to “Shoe and Lining” in this section.
8. Remove the wheel cylinder. Refer to “Wheel Cylinder Assembly” in this section.
9. Plug the opening in the brake line to prevent fluid loss or contamination.



UAA4E140

10. Remove the hub and bearing assembly. Refer to “Hub and Bearing Assembly” in this section.
11. Remove the spindle shaft. Refer to “Spindle Shaft” in this section.



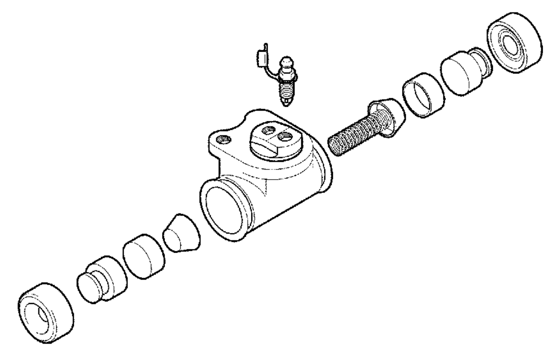
UAA4E150

12. Remove the parking brake retaining clip from the backing plate.
13. Separate the backing plate and the gasket.

Installation Notice

- Install the new gasket on the backing plate.
- After the installation, bleed the brake system. Refer to *Section 4A, Hydraulic Brakes*.
- Adjust the parking brake. Refer to *Section 4G, Parking Brake*.

UNIT REPAIR


UAA4E160

WHEEL CYLINDER

Disassembly and Assembly Procedure

1. Remove the wheel cylinder assembly from the backing plate. Refer to "Wheel Cylinder Assembly" in this section.
2. Twist off the boots, the pistons, and the seals from each end of the wheel cylinder.
3. Remove the spring assembly.
4. Remove the bleeder cap and the bleeder valve.

Installation Notice

Tightening Torque	6 N·m (4 lb–ft)

- Inspect the wheel cylinder bore and the pistons for scoring, nicks, corrosion, and wear.
- Use a crocus cloth to polish out light corrosion in the wheel cylinder bore.
- If the bore will not clean up with a crocus cloth, replace the wheel assembly.
- Clean all the parts in clean denatured alcohol or brake fluid. Dry all the parts with unlubricated compressed air and lubricate the new seals, the pistons, and the wheel cylinder bore with clean brake fluid before assembly.
- Thinly coat all the parts except the dust caps with brake fluid.
- Inspect the pistons for free movement.
- After the installation, bleed the brake system. Refer to *Section 4A, Hydraulic Brakes*.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Application		Unit	Description
Drum	Inside Diameter	mm (inch)	230 (9.06)
	Wear Limit	mm (inch)	231 (9.09)
	Out of Round	mm (inch)	0.1 (0.0039)
Brake Lining	Thickness	mm (inch)	MIN. 4.7 (0.185)
	Wear Limit	mm (inch)	0.5 (0.02)
	Distance Between Lining and Drum	mm (inch)	0.2~0.45 (0.0079~0.0177)
Wheel Cylinder	Diameter of the Piston	mm (inch)	20.64 (0.8126)

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Brake Drum Detent Screw	5	4	44
Brake Fitting Nut (Wheel Cylinder)	16	12	–
Wheel Cylinder-to-Backing Plate Bolt	10	7	89
Caulking Nut	235	173	–
Backing Plate-to-Spindle Shaft Nut	90	67	–
Bleeder Valve Screw	6	4	53

SECTION 4F

ANTILOCK BRAKE SYSTEM

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

GENERAL SYSTEM DESCRIPTION

The purpose of the DBC 7 Antilock Brake System (ABS) is to minimize wheel slip during heavy braking. DBC 7 performs this function by monitoring the speed of each wheel and controlling the brake fluid pressure to each wheel independently during a braking event. This allows the driver to retain directional stability and better steering capability.

BASIC KNOWLEDGE REQUIRED

Before using this section, it is important that you have a basic knowledge of the following items. Without this basic knowledge, it will be difficult to use the diagnostic procedures contained in this section.

- Basic Electrical Circuits : You should understand the basic theory of electricity and know the meaning of potential (voltage), current (amperes) and resistance (ohms). You should understand what happens in a circuit with open or shorted wire. You should be able to read and understand a wiring diagram.
- Use of Circuit Test Tools : You should be familiar with a Digital Multimeter (DMM), and be familiar with the meter controls and how to use them correctly. You should be able to measure voltage, resistance and current. You should know how to use jumper wire to bypass components for testing circuits.

ABS SYSTEM COMPONENTS

The DBC 7 Antilock Brake System (ABS) consists of a conventional hydraulic brake system plus antilock components. The conventional brake system includes a vacuum booster, master cylinder, front disc brakes, rear drum brakes, interconnecting hydraulic brake pipes and hoses, brake fluid level sensor and the brake warning lamp indicator.

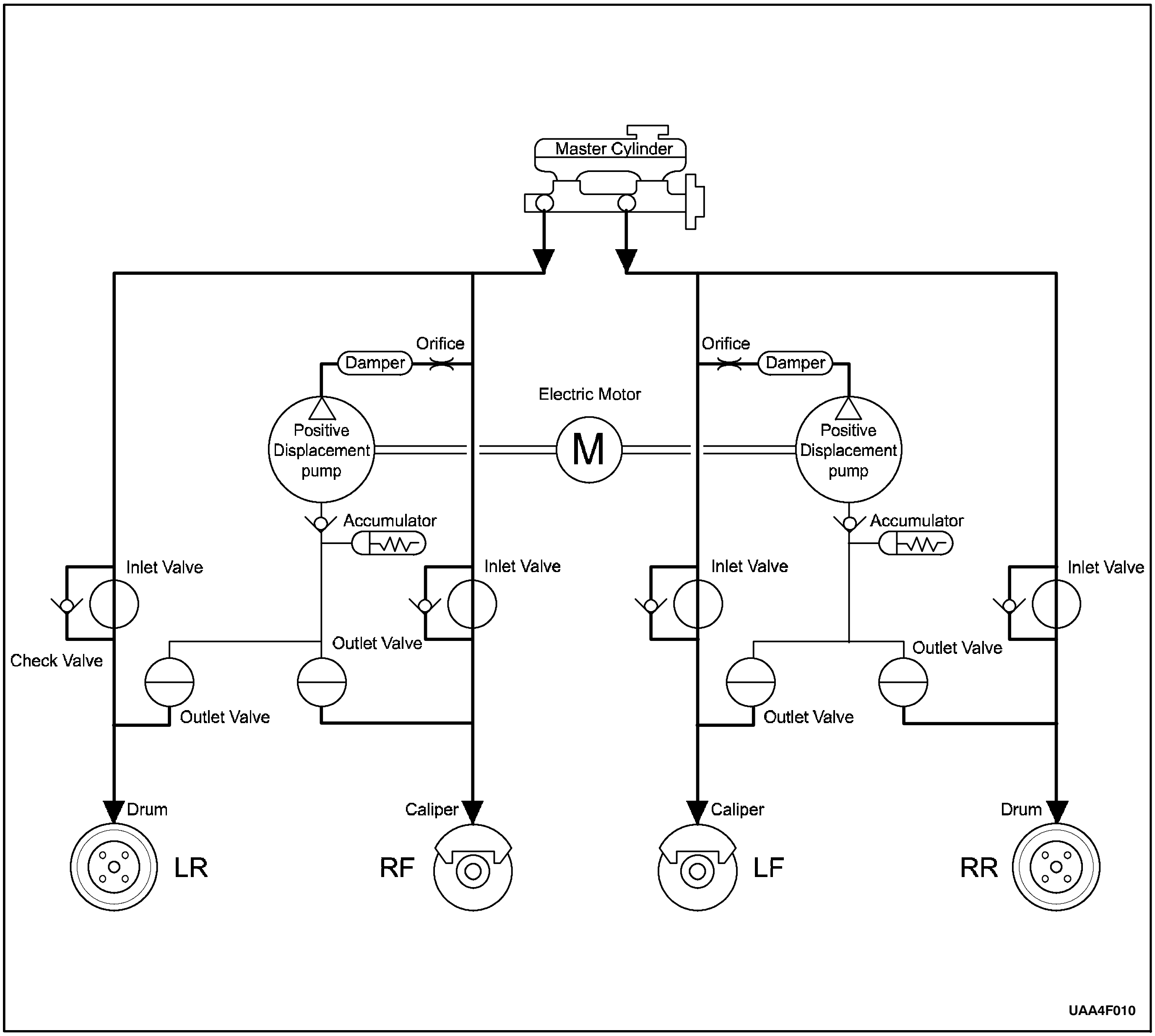
The ABS components include a hydraulic unit, an EBCM (Electronic Brake Control Module), system fuse, four wheel speed sensor (one at each wheel), interconnecting wiring, ABS indicator, the DDRP (De-coupled Dynamic Rear Proportioning) indicator (which is connected to the parking lamp) and the rear drum brakes. See "ABS Component Locator" in this section for the general layout of this system.

The hydraulic unit with the attached EBCM is located between the surge tank and the fire wall on the left side of the vehicle.

The basic hydraulic unit configuration consists of hydraulic check valves, two solenoid valves for each wheel, a hydraulic pump, two accumulators, and two dampers. The hydraulic unit controls hydraulic pressure to the front calipers and the rear wheel cylinders by modulating hydraulic pressure to prevent wheel lockup.

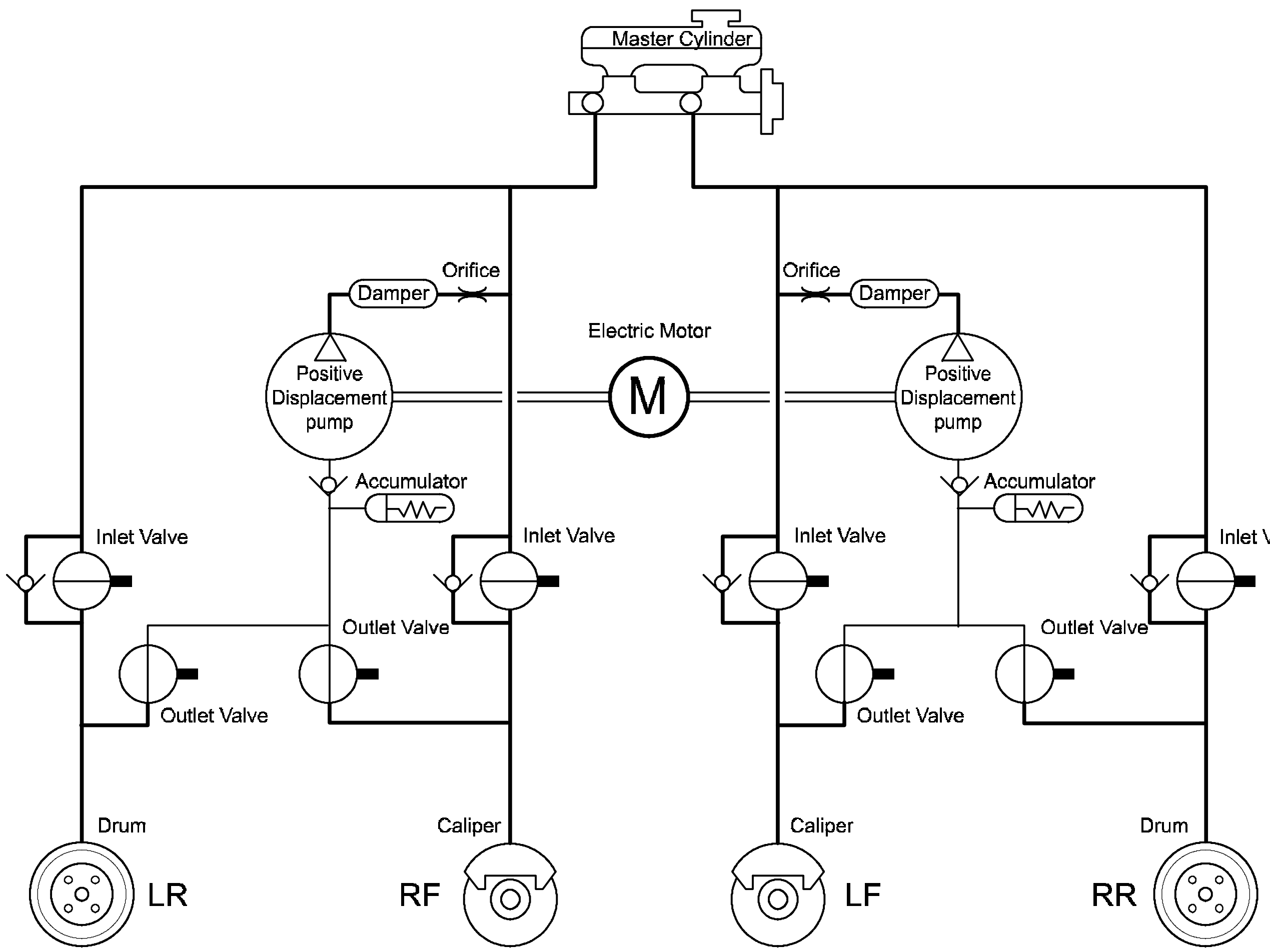
BASE BRAKING MODE

The baseline braking mode of the DBC 7 Antilock Braking System (ABS) system used in this vehicle is a diagonal split system. In this system, one master cylinder circuit supplies pressure to the right front and the left rear brakes; the other circuit supplies pressure to the left front and the right rear brakes. All valves in the hydraulic modulator are in their normal, non-energized positions as shown in the drawings found in “ABS System Components” in this section.



ANTILOCK BRAKING MODE – RELEASE

If during the pressure hold mode the EBCM (Electronic Brake Control Module) still senses wheel slip, the EBCM will decrease the pressure to the affected wheel(s). The inlet valve is left closed and the outlet valve is opened. The excess fluid/pressure is temporary stored into an accumulator within the brake pressure modulator valve, until the pump can return the fluid to the master cylinder reservoir.



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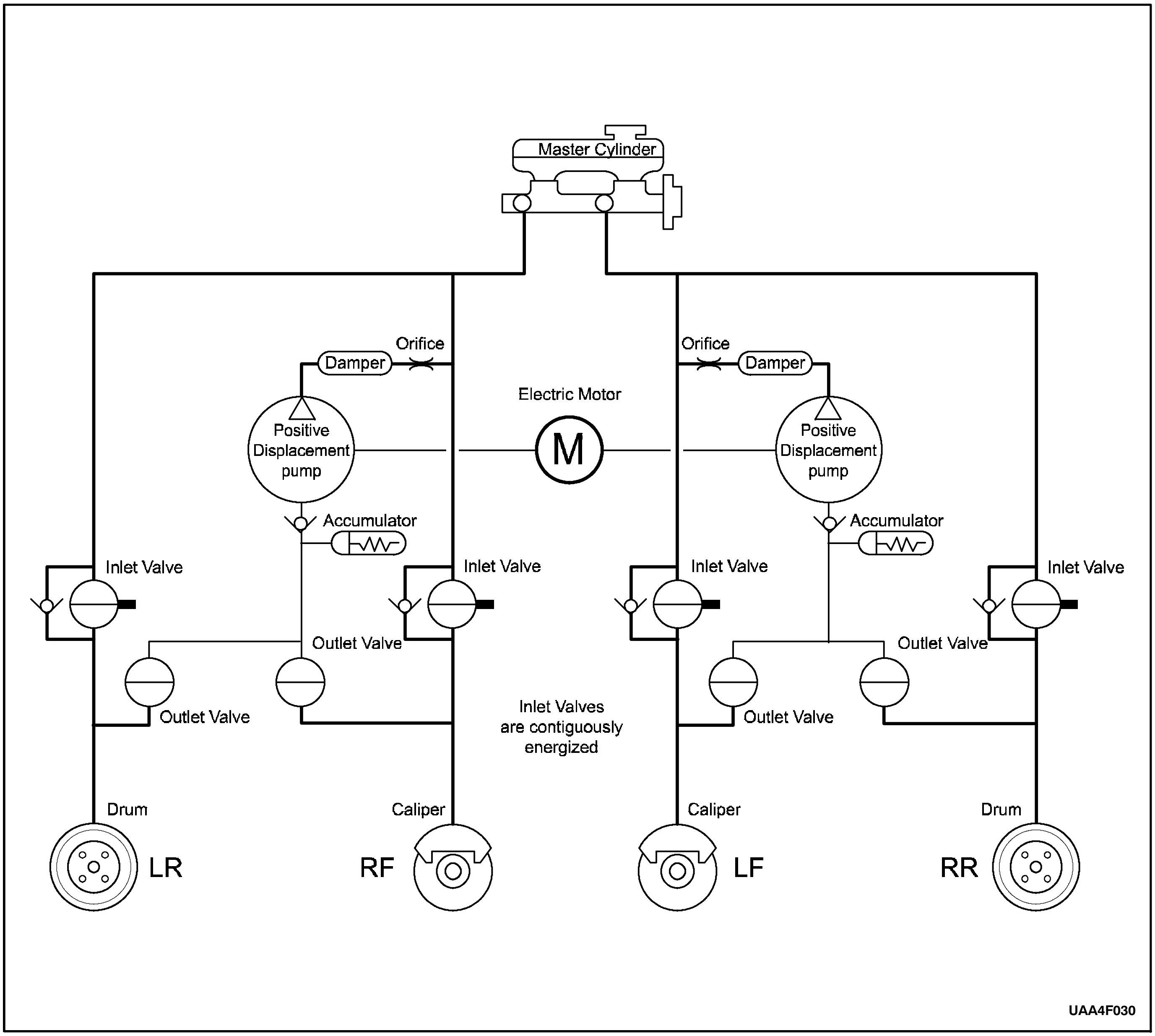
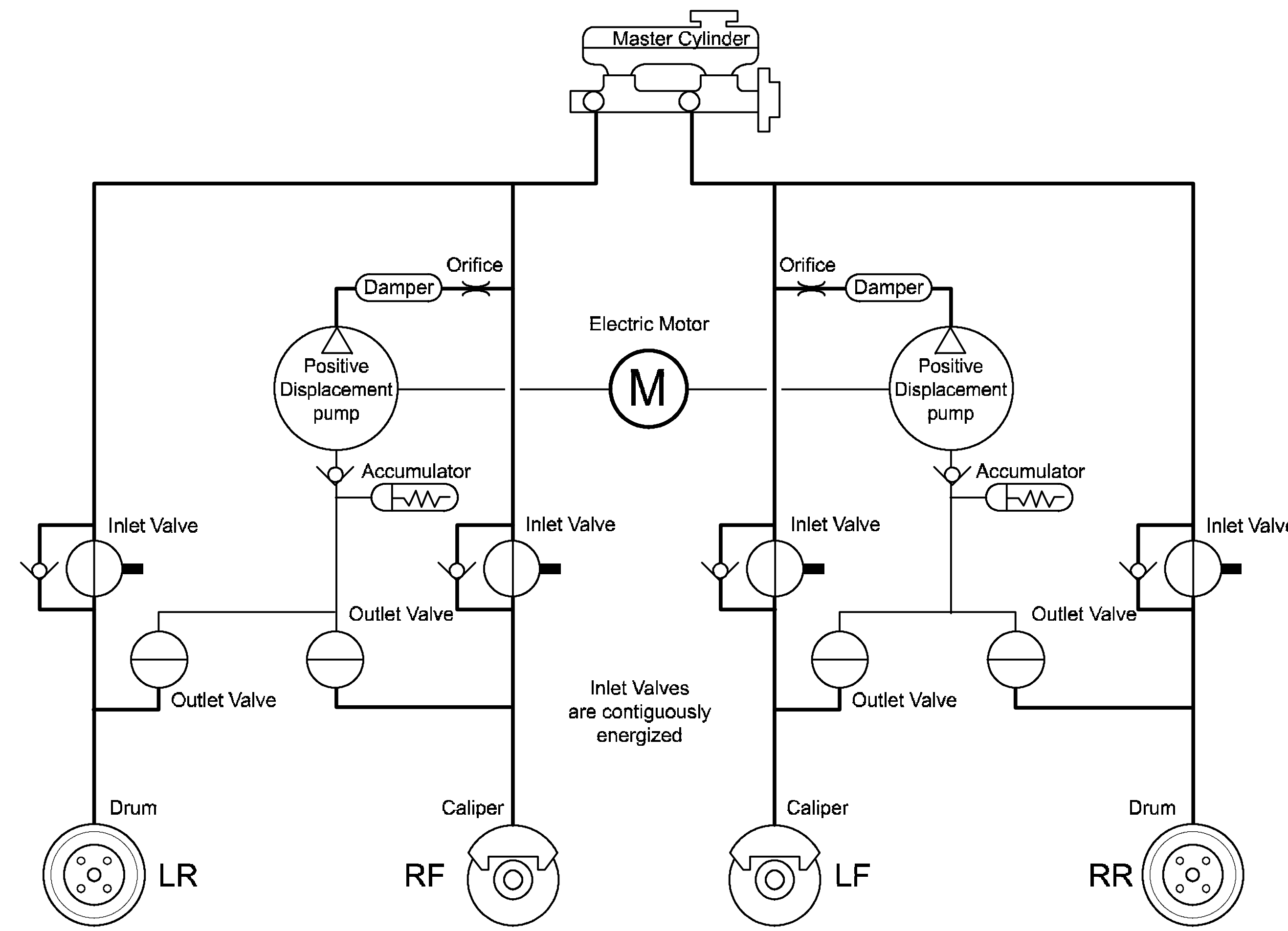
ANTILOCK BRAKING MODE– HOLD

When the EBCM (Electronic Brake Control Module) senses the wheel slip, the EBCM closes the inlet valve and keeps the outlet valve closed in the brake pressure modulator valve in order to isolate the system. This holds the pressure steady on the brake so that the hydraulic pressure does not increase or decrease.



ANTILOCK BRAKING MODE – APPLY

If during the pressure hold or pressure decrease mode the EBCM (Electronic Brake Control Module) senses that wheel slip has reduced, the EBCM will increase the pressure to the affected wheel(s) by applying master cylinder pressure. The inlet valve is opened and the outlet valve is closed, now base brake master cylinder pressure can be applied to the wheel.



UAA4F040

DDRP (DE-COUPLED DYNAMIC REAR PROPORTIONING)

DDRP (De-coupled Dynamic Rear Proportioning) is proportioning system to maintain vehicle stability during braking. In normal braking condition, equal wheel speed should be maintained for efficient and balanced braking. In hard braking condition, a vehicle requires relatively less brake force at rear wheel due to vehicle's weight transfer to the front. DDRP maintains desired brake pressure to the rear wheel by using the ABS rear inlet and outlet valve in order to provide efficient braking and vehicle stability. In DDRP system, Power to the Rear Hold Valve Solenoid is provided from Ignition. If the following fault conditions are existing, The Red Brake Warning Lamp will be illuminated.

- Two Wheel Speed Sensors inoperative on same axle.
- Rear inlet solenoid inoperative.
- Battery 2 (Motor Input) short to ground.
- Battery 1 (EBCM Input) open or short to the ground.
- Motor ground open or short to battery.
- EBCM ground open or short to battery.
- Ignition open or short to ground.

DDRP (DE–COUPLED DYNAMIC REAR PROPORTIONING) FAILURE MODES

Part	Hypothesized Failure	De–coupled DRP		
		Amber ABS	Red Brake	D-DRP Status
Sensor RF	Short or Open			Degraded
Sensor LF	Short or Open			Degraded
Sensor RR	Short or Open			Degraded
Sensor LR	Short or Open			Degraded
Two Sensors, Same Axle	Short or Open			Disabled
One Front & One Rear Sensor	Short or Open			Degraded
Motor	Short to Ground – LOW Side			Degraded
	Short to Ground – HI Side			Degraded
	Short to Battery – LOW Side			Degraded
	Short to Battery – HI Side			None
	Motor Circuit Open			Degraded
	Motor Stalled			Degraded
Front Apply Solenoids	Short or Open			Degraded
Front Release Solenoids	Short or Open			Degraded
Rear Apply Solenoids	Short or Open			Disabled
Rear Release Solenoids	Short or Open			Degraded
System Relay	Open (Unable to turn on)			Degraded
	Shorted On (Unable to turn off)			None
Battery 2 (Motor)	Short to GND			Disabled
	Open			Low Voltage
Ground (Motor)	Open or Short To Batt			Enabled
Battery 1 (ECU, Solenoids)	Open or Short To GND			Disabled
Ground (ECU, Solenoids)	Open or Short To Batt			Disabled
Ignition	Open or Short To GND			Disabled
Brake Switch	Not Applicable			Enabled
Serial Communication	Open or Short			Enabled

EBCM (ELECTRONIC BRAKE CONTROL MODULE)

The EBCM performs the following primary functions;

order to provide efficient braking and vehicle stability. In DDRP system, Power to the Rear Hold Valve Solenoid is provided from Ignition. If the following fault conditions are existing, The Red Brake Warning Lamp will be illuminated.

- Monitor wheel speed sensor inputs.
- Detect wheel slip tendencies.
- Control the brake system while in the antilock control mode.
- Monitor the system for proper electrical operation.

The EBCM continuously checks the speed of each wheel to determine if any wheel is beginning to slip. If any wheel slip tendency is detected, the EBCM commands appropriate valve positions to modulate brake fluid pressure in some or all of the hydraulic circuits to prevent wheel slip and provide optimum braking. The EBCM continues to control pressure in individual hydraulic circuits until a slipping tendency is no longer present. Also the EBCM continuously monitors the ABS for proper operation. If the EBCM detects an error, it can disable the ABS function and turn on the ABS Warning Lamp in the instrument cluster. The EBCM also controls the display of the ABS DTCs (Diagnostic Trouble Codes) while in diagnostic mode.

SOLENOID RELAY

The solenoid relay, provides power to the pump motor and solenoids. The switch in the relay is normally open, but is commanded to close during initialization. The relay switch will remain closed for the remainder of the drive cycle as long as no DTCs (Diagnostic Trouble Codes) set which required the switch to open. If a DTC sets which requires the relay to be commanded off, battery voltage will be removed from the pump motor and solenoids for the remainder of the current drive cycle and ABS cannot function. The relay is an integral part of the EBCM and cannot be serviced separately.

WHEEL SPEED SENSORS AND RINGS

A wheel speed sensor is present at each wheel. The sensors transmit wheel speed information to the EBCM by means of a small AC voltage. This voltage is generated by magnetic induction caused by passing a thoothed sensor ring past a stationary sensor. The magnitude and frequency of the AC voltage are proportional to the speed of the wheel and both will increase with increasing speed. The signal is transmitted to the EBCM through interface that can cause false or noisy wheel speed sensor input to the EBCM. Two different types of wheel speed sensors are used for DBC 7 system.

ABS WARNING LAMP (AMBER)

The ABS warning lamp is located in the instrument cluster and will illuminate if a malfunction in the ABS is detected by the EBCM. The ABS warning lamp informs the driver that a condition exists which results in turning off the antilock brake function. If only the ABS is warning lamp is on, normal braking with full power assist is available.

Conditions for the ABS warning lamp to turn on are as follows.

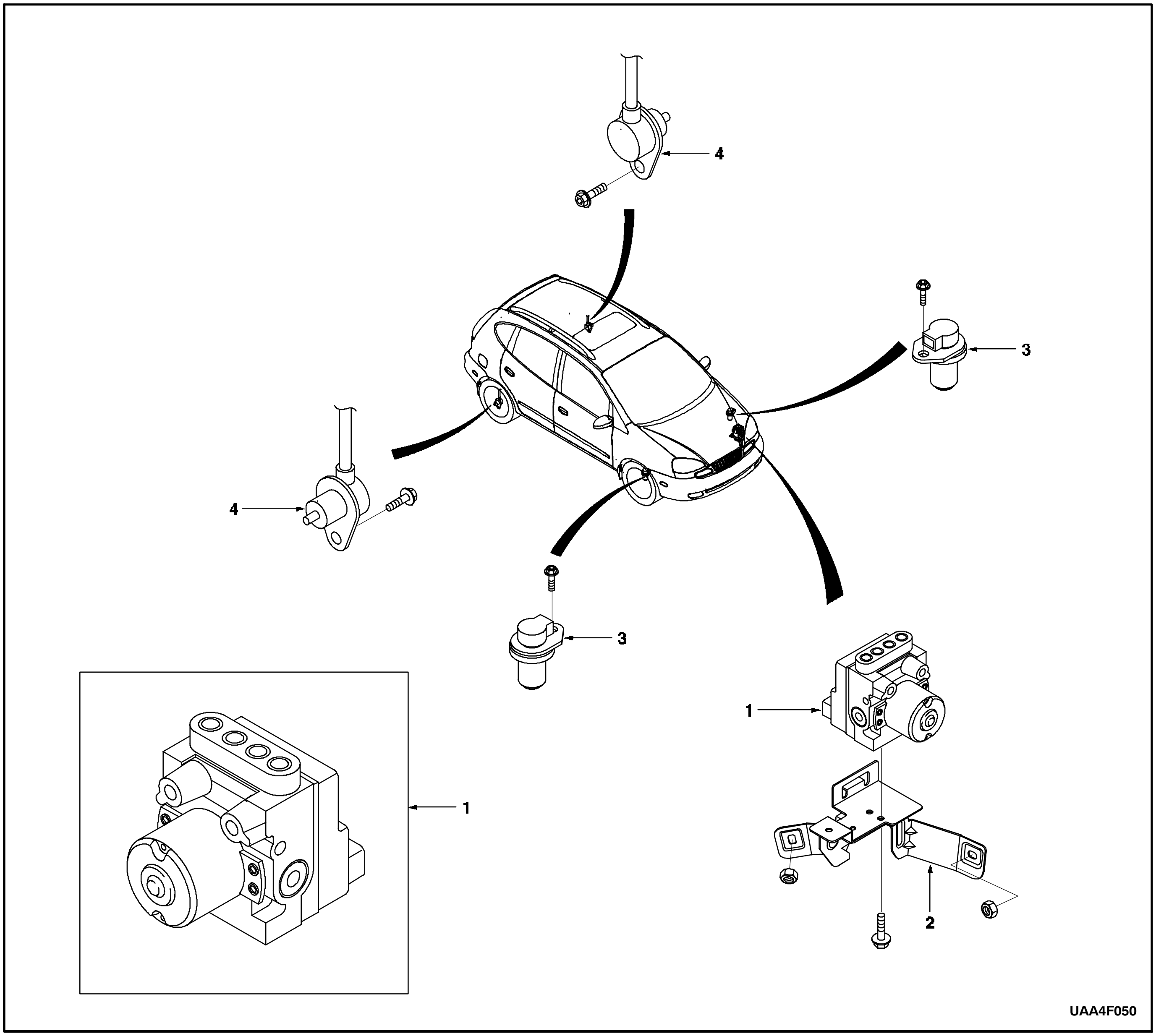
- ABS malfunction detected. As previously described, the ABS warning lamp turns on when a problem has been found in the ABS.
- Instrument panel cluster bulb check. When the ignition is turned to ON, the ABS warning lamp will turn on for approximately three seconds and then turn off.

BRAKE WARNING LAMP (RED)

The red brake warning lamp in the in the instrument cluster and will illuminate to warn the driver of condition in the brake system, which may result in reduced braking ability. The lamp will illuminate when the parking brake is applied or not fully released, or if the brake fluid level switch is closed (closed is when the brake fluid is low in the master cylinder reservoir). When the brake fluid level switch is closed (low condition) a brake warning lamp will stay illuminated until the condition has been repaired. Also some failure modes in DBC 7 system will illuminate the lamp to let the drivers know DDRP (Decoupled Dynamic Rear Proportioning) is disabled.

COMPONENT LOCATOR

ABS SYSTEM



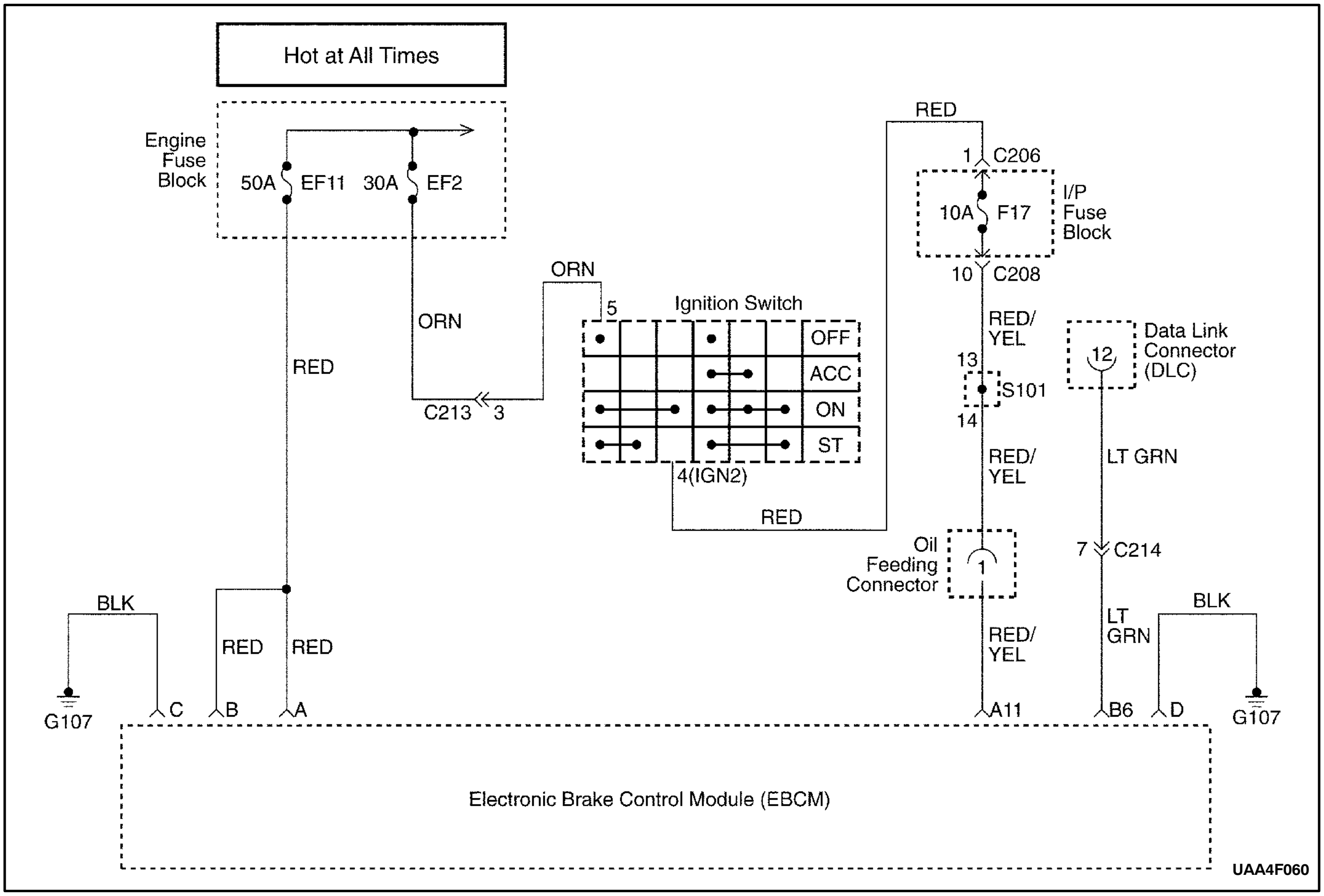
1 Hydraulic Modulator Unit
2 Mounting Bracket
3 Front Wheel Speed Sensor
4 Rear Wheel Speed Sensor

DIAGNOSTIC INFORMATION AND PROCEDURES

SYMPTOM AND DIAGNOSTIC TROUBLE CODE

Test No.	Description	Shutdown Action
C0014	System Relay Contacts or Coil Circuit Open	ABS
C0017	Pump Motor Short to Ground	ABS
C0018	Pump Motor Short to Battery or Motor Ground Open/High Resistance	ABS
C0021*	Left front wheel speed = 0 kph	ABS
C0022*	Right front wheel speed = 0 kph	ABS
C0023*	Left rear wheel speed = 0 kph	ABS
C0024*	Right rear wheel speed = 0 kph	ABS
C0025	Left front excessive wheel speed variation	ABS
C0026	Right front excessive wheel speed variation	ABS
C0027	Left rear excessive wheel speed variation	ABS
C0028	Right rear excessive wheel speed variation	ABS
C0032*	Left front wheel speed circuit open or shorted to ground/battery	ABS
C0033*	Right front wheel speed circuit open or shorted to ground/battery	ABS
C0034*	Left rear wheel speed circuit open or shorted to ground/battery	ABS
C0035*	Right rear wheel speed circuit open or shorted to ground/battery	ABS
C0036*	Low Voltage Condition	ABS
C0037*	High Voltage Condition	ABS
C0042*	Pump Motor Circuit Open	ABS
C0043	Pump Motor Stalled	ABS
C0054	Abnormal Shutdown Detected	ABS/DDRP
C0055	EBCM Internal Fault	ABS or ABS/DDRP
C0056	System Relay Stuck On	None
C0061	Left front apply solenoid fault	ABS
C0062	Left front release solenoid fault	ABS
C0063	Right front apply solenoid fault	ABS
C0064	Right front release solenoid fault	ABS
C0065	Left rear apply solenoid fault	ABS/DDRP
C0066	Left rear release solenoid fault	ABS
C0067	Right rear apply solenoid fault	ABS/DDRP
C0068	Right rear release solenoid fault	ABS
C0095*	Brake Switch Circuit Open	None

DIAGNOSTIC CIRCUIT CHECK



System Description

The Diagnostic Circuit Check is an organized method of identifying any problems caused by a malfunction in the ABS/DDRP system.

A service technician should begin diagnosis of any ABS/DDRP complaint with the Diagnostic Circuit Check. The Diagnostic Circuit Check directs a service technician to the next logical step when diagnosing a complaint.

Serial Data is transmitted/received by the EBCM through terminal B6. The EBCM is supplied with constant battery feed voltage through terminals A and B, and switched ignition voltage through terminal A11. The EBCM ground is provided through terminal C.

Diagnostic Process

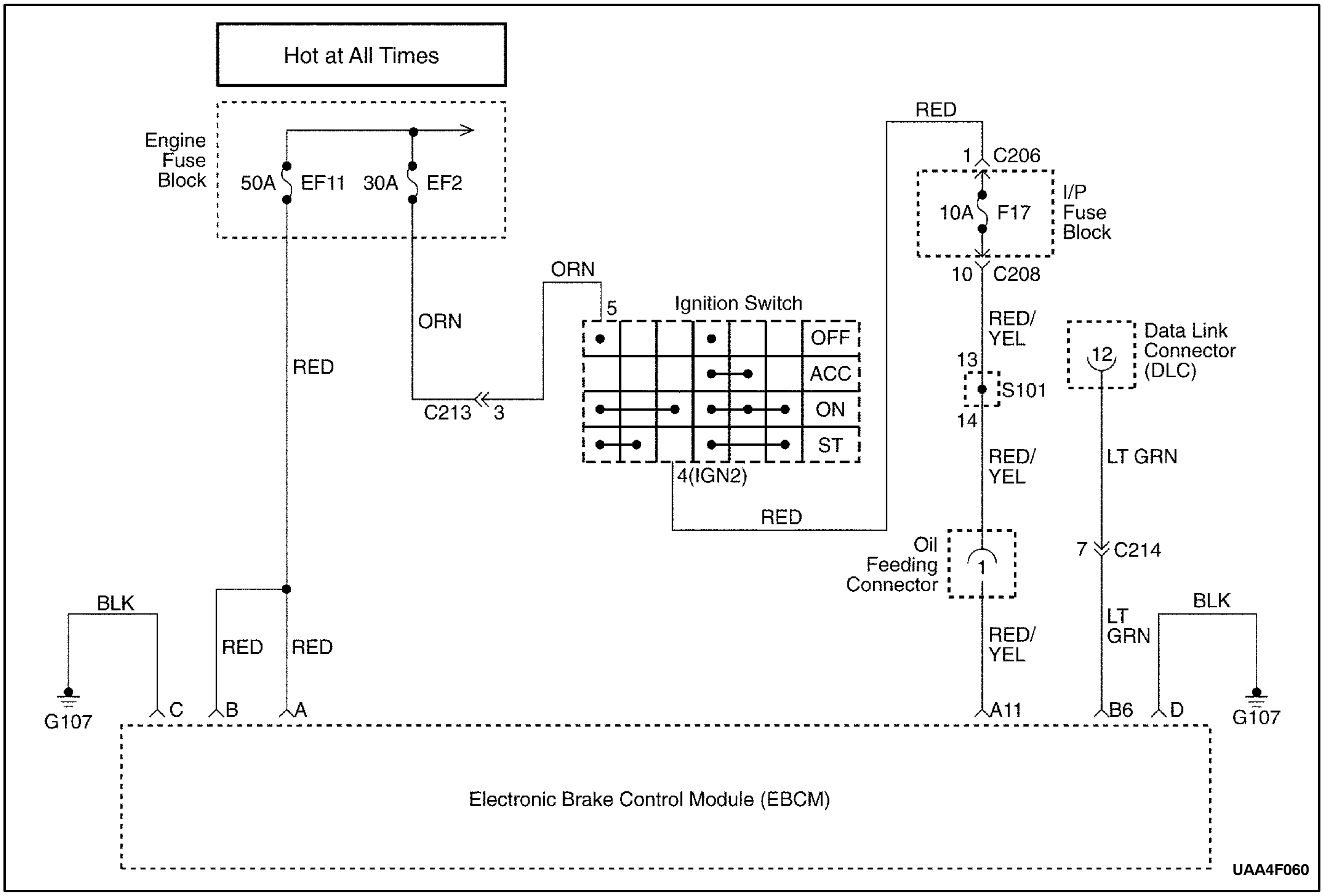
Use the following ordered procedure when servicing the ABS/DDRP system.

1. Inspect the vehicle for any mechanical conditions related the brake system.
   - Brake reservoir fluid level correct.
   - Inspect master for fluid for contamination.
   - Inspect brake master/modulator for leaks.
   - Inspect brake components at all wheels.
   - Verify no brake drag exists (brake switch adjustment).
   - Verify even brake apply (no pull or lead).
   - Inspect for worn/damaged brake pads.
   - Inspect for worn/damaged wheel bearings.
   - Inspect wheel speed sensors/wiring.
   - Inspect exciter rings for damage.
   - Inspect tires for tread depth/wear.
   - Road test the vehicle to verify the complaint.
2. Perform the Diagnostic Circuit Check and proceed to the applicable Diagnostic Trouble Chart as necessary.
3. Clear the ABS DTCs (Diagnostic Trouble Codes) after all of the system malfunctions have been corrected.

Diagnostic Circuit Check

Step	Action	Value	Yes	No
1	1. Connect or install all previously disconnected or removed components if applicable. 2. Key on, engine off. 3. Install the applicable Scan Tool into the DLC and attempt to communicate with the EBCM. Does the Scan Tool communicate with the EBCM?	–	Go to *Step 2*	Go to *Step 4*
2	Were any DTC(s) stored current or history?	–	Go to *Step 3*	Go to *Step 7*
3	1. Document Current DTC(s). 2. Document History DTC(s). 3. Document Enhanced History Data such as ● number of times each DTC set. ● number of times since each DTC first set. ● number of times since each DTC last set. ● speed when each DTC set. ● other Enhanced Data which may assist with diagnosis. 4. DO NOT CLEAR DTC(s) PRIOR TO FULLY DOCUMENTING THE INFORMATION FROM THE SCAN TOOL. 5. Refer to the applicable Diagnostic Trouble Code(s).	–	Go to the table for the DTC(s)	–
4	Does the Scan Tool communicate with other Modules on the data line?	–	Go to *Step 5*	Go to *Step 6*
5	Go to the NO COMMUNICATION WITH EBCM with EBCM trouble chart.	–	Go to “No Communication with EBCM”	System OK
6	Repair the DLC harness. Replace the DLC harness as needed.	–	System OK	–
7	1. Key off. 2. Wait 10 seconds. 3. Key on, engine off. 4. Observe the amber ABS lamp when the key is turned on. Did the ABS Warning Lamp and Brake Warning Lamp turn on for 3 seconds and then turn off? (bulb test)	-	Go to *Step 8*	Go to *Step 9*
8	System functioning as designed.	–	System OK	–
9	Did the any lamp stay on?	–	Go to *Step 10*	Go to *Step 11*
10	Go to appropriate lamp “ON” trouble chart.	–	–	–
11	Go to appropriate lamp “INOPERATIVE” trouble chart.	–	–	–

NO COMMUNICATION WITH EBCM



Circuit Description

Serial Data is transmitted/received by the EBCM through terminal B6. The EBCM is supplied with constant battery feed voltage through terminals A and B, and switched ignition voltage through terminal A11. The EBCM ground is provided through terminal C.

Diagnostic Aids

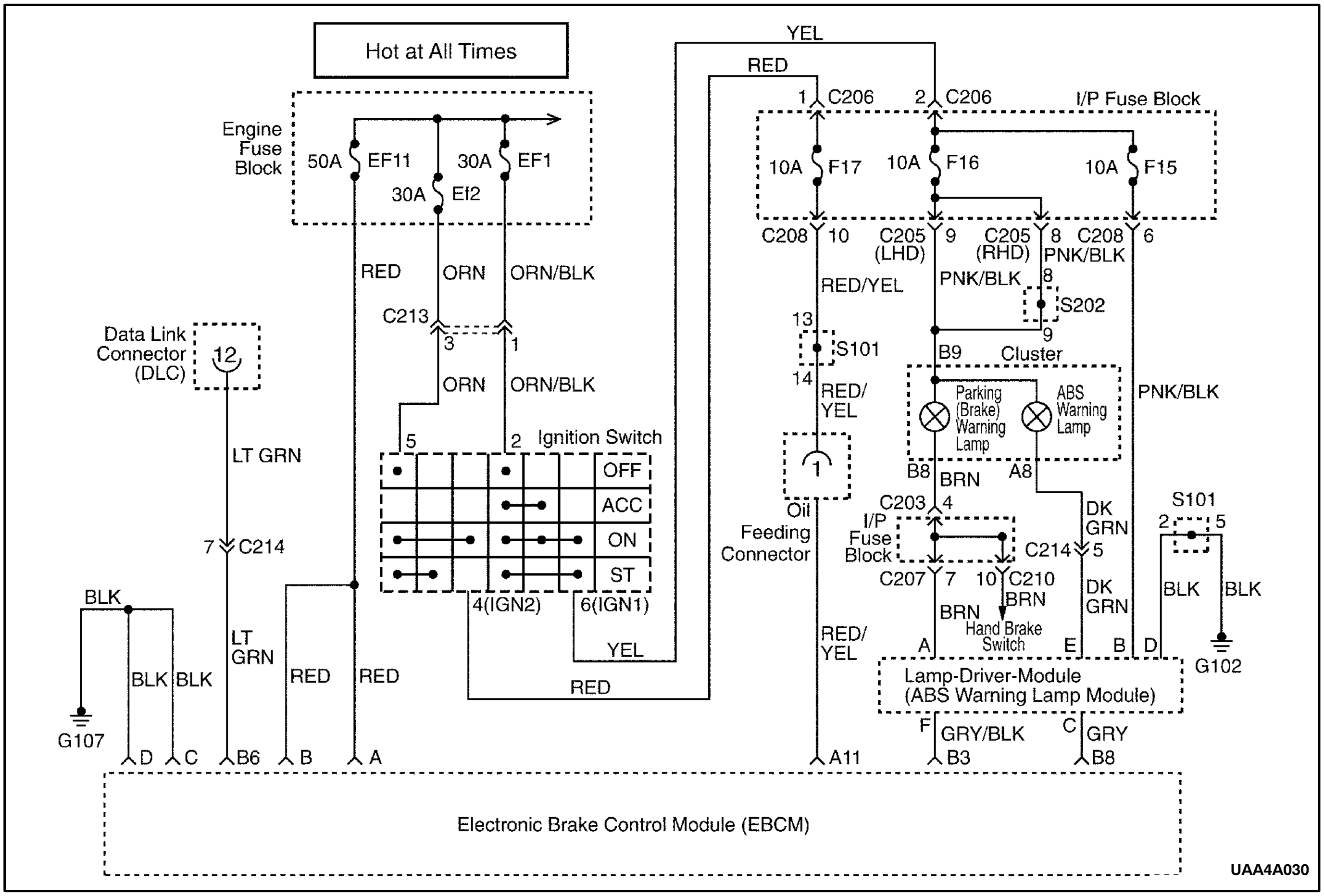
Typical causes of no communication with the EBCM.

1. Poor terminal contact at the EBCM.
2. Loss of EBCM ground to terminal C .
3. Loss of battery voltage at EBCM terminals A and or B.
4. Loss of ignition voltage at EBCM A11.
5. Open/grounded data line.
6. Data line with high resistance.

No Communication with EBCM

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Performed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Key off. 2. Disconnect the EBCM harness. 3. Connect a voltmeter to EBCM harness terminal A and then to body ground. Was the voltage within the specified range?	Battery Voltage	Go to *Step 5*	Go to *Step 4*
4	Repair the source of low voltage to terminal A. Inspect for an open fuse, poor terminal contact, or a grounded wire.	–	System OK	–
5	Connect a voltmeter to EBCM harness terminal B and then to body ground. Was the voltage within the specified range?	Battery Voltage	Go to *Step 7*	Go to *Step 6*
6	Repair the source of low voltage to terminal B. Inspect for an open fuse, poor terminal contact, or a grounded wire.	–	System OK	–
7	1. Key on. 2. Connect a voltmeter to EBCM harness terminal A11 and then to body ground. Was the voltage within the specified range?	Battery Voltage	Go to *Step 9*	Go to *Step 8*
8	Repair the source of low voltage to terminal A11. Inspect for an open fuse, poor terminal contact, a grounded wire, or an ignition switch condition.	–	System OK	–
9	1. Key off. 2. Connect a ohmmeter to EBCM harness terminal C and then to body ground. Was the voltage within the specified range?	Less than 2 ohms	Go to *Step 11*	Go to *Step 10*
10	Repair the source of high resistance between terminal C and body ground. Find and check the ground location where the circuit is secured to body ground.	–	System OK	–
11	1. Key off. 2. EBCM harness still disconnected from the EBCM. 3. Connect an ohmmeter to EBCM harness terminal B6 and DLC terminal 12. Was the resistance within the specified range?	Less than 2 ohms	Go to *Step 13*	Go to *Step 12*
12	Repair the source of high resistance between terminal B6 and DLC terminal 12.	–	System OK	–
13	1. Key off. 2. EBCM harness still disconnected. 3. Connect an ohmmeter to EBCM harness terminal B6 and then to body ground. Was the resistance within the specified range?	OL (open circuit)	Go to *Step 15*	Go to *Step 14*
14	Find and repair the short to ground on the data line.	–	System OK	–
15	Replace the EBCM.	–	System OK	–

ABS WARNING LAMP INOPERATIVE/NO DTC SET



Circuit Description

The Electronic Brake Control Module (EBCM) controls the operation of the amber ABS Warning Lamp by means of a lamp driver module contained within the Cluster.

Battery voltage is supplied to the I/P Cluster terminal B9, and Electronic Brake Control Module terminal A11 when the ignition switch is turned on. EBCM terminals A and B are 'hot at all times'.

The default state is for the Lamp Driver Module to turn ON the amber ABS Warning Lamp, by supplying a ground path through the Lamp Driver Module.

When the EBCM commands the ABS lamp off, the EBCM will ground the ABS Warning Lamp control circuit. This causes the Lamp Driver Module to open the path to ground for the bulb.

When the ignition switch is turned to the ON position, the EBCM turns ON the ABS Warning Lamp for 3 seconds for a bulb check.

Whenever a malfunction is detected within the ABS system, the EBCM turns ON the ABS Warning Lamp, notifying the driver that ABS needs to be serviced.

Diagnostic Aids

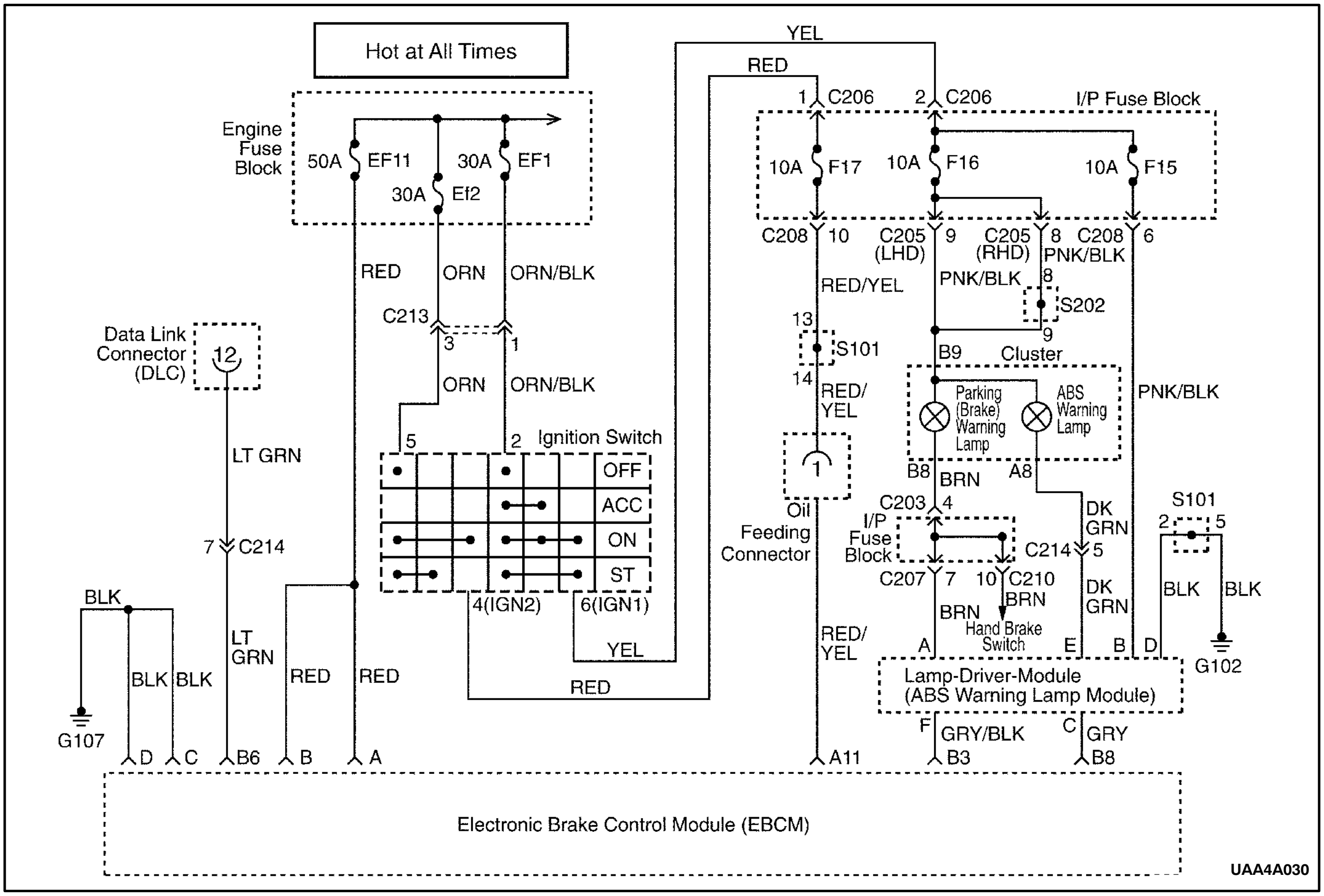
Typical causes of the ABS warning lamp inoperative with no DTC(s) set.

1. Faulty ABS bulb/ loose socket.
2. I/P fuse open.
3. Faulty Cluster/Lamp Driver Module.
4. Faulty EBCM.
5. Grounded circuit between the EBCM and the Cluster.

ABS Warning Lamp Inoperative/No DTC Set

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check performed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Disconnect the EBCM harness from the EBCM. 2. Key on. Did the amber ABS lamp turn on?	–	Go to *Step 4*	Go to *Step 5*
4	Replace the EBCM.	–	System OK	–
5	Check the Cluster fuse. Is the fuse and terminal contact ok?	–	Go to *Step 7*	Go to *Step 6*
6	Replace the open fuse and/or repair the loose terminals. Find the short, which caused the fuse to open, if applicable.	–	System OK	–
7	Remove the amber ABS bulb from the Cluster and inspect for an open bulb filament or poor socket contact? Was the socket and bulb ok?	–	Go to *Step 9*	Go to *Step 8*
8	Replace the Bulb/Socket as needed.	–	System OK	–
9	1. Key off. 2. EBCM harness still disconnected. 3. Remove the Cluster Assembly from the Instrument Panel. 4. Disconnect the white Cluster harness connector from the Cluster Assembly. 5. Key on. 6. Connect a voltmeter to terminal B9 of the white Cluster harness and then to body ground. Was the voltage within the specified range?	Battery Voltage	Go to *Step 11*	Go to *Step 10*
10	Find and repair the source of low voltage on the cluster voltage supply terminal.	–	System OK	–
11	1. Key off. 2. Disconnect the White Cluster harness connector from the Cluster Assembly. 3. Connect an ohmmeter between white Cluster harness terminal A8 and LDM(Lamp Driver Module) harness terminal E. Was the resistance within the specified range?	Less than 2 ohms	Go to *Step 13*	Go to *Step 12*
12	Repair the open or high resistance between the cluster and the LDM.	–	System OK	–
13	1. Key off. 2. LDM harness and EBCM harness still disconnected. 3. Connect an ohmmeter to EBCM harness terminal B8 and then to body ground. Was the resistance within the specified range?	OL (open circuit)	Go to *Step 15*	Go to *Step 14*
14	Find the repair the short to ground between the Cluster harness and the EBCM harness.	–	System OK	–
15	Replace the LDM. Is the repair complete?	–	System OK	Go to *Step 16*
16	Replace the Cluster Assembly.	–	System OK	–

ABS WARNING LAMP ON/NO DTC SET



Circuit Description

The Electronic Brake Control Module (EBCM) controls the operation of the amber ABS Warning Lamp by means of a lamp driver module contained within the Cluster.

Battery voltage is supplied to the I/P Cluster terminal B9, and Electronic Brake Control Module terminal A11 when the ignition switch is turned on. EBCM terminals A and B are 'hot at all times'.

The default state is for the Lamp Driver Module to turn ON the amber ABS lamp, by supplying a ground path through the Lamp Driver Module.

When the EBCM commands the ABS lamp off, the EBCM will ground the ABS Warning Lamp control circuit. This causes the Lamp Driver Module to open the path to ground for the bulb.

When the ignition switch is turned to the ON position, the EBCM turns ON the ABS Warning Lamp for 3 seconds for a bulb check.

Whenever a malfunction is detected within the ABS system, the EBCM turns ON the ABS Warning Lamp, notifying the driver that ABS needs to be serviced.

Diagnostic Aids

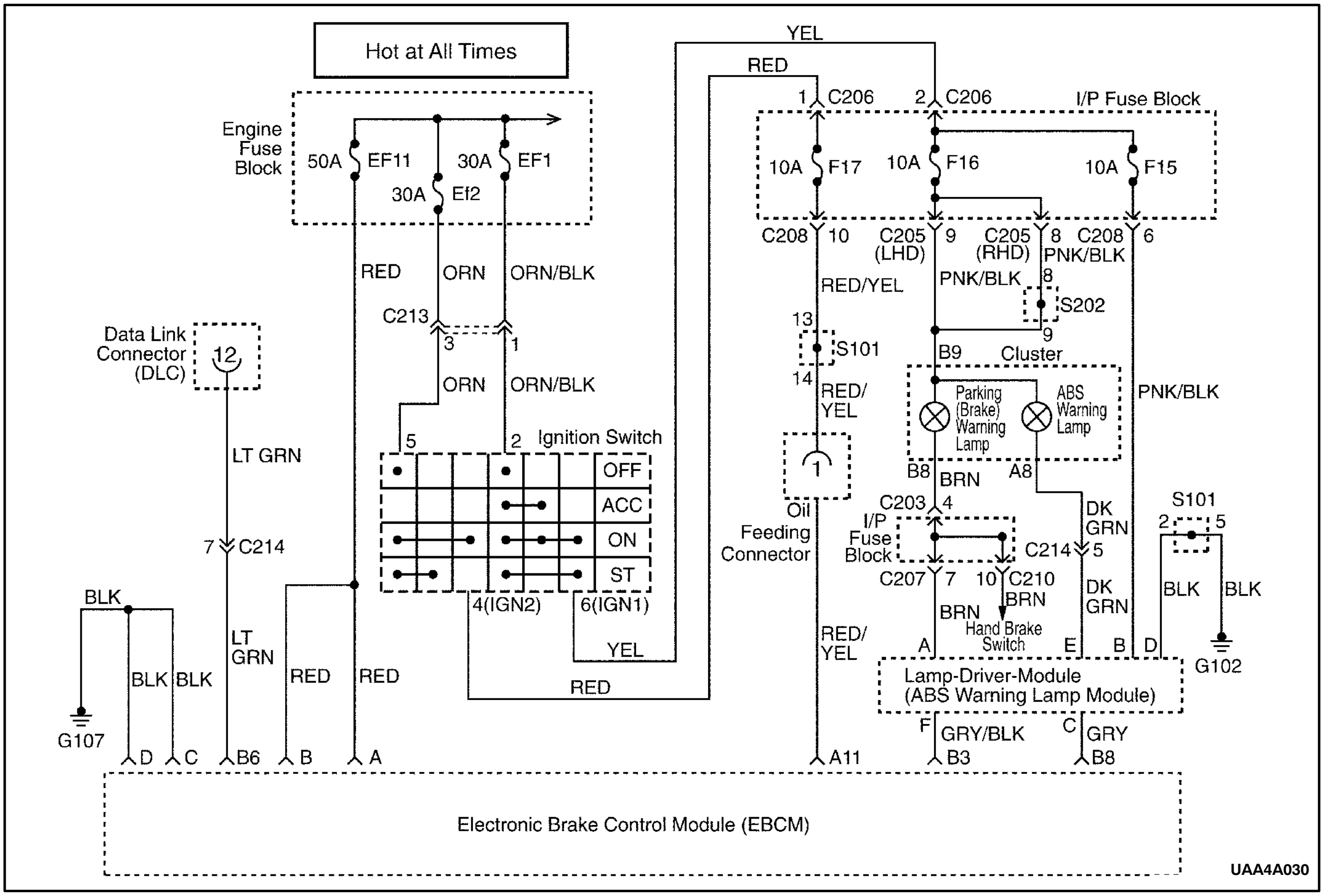
Typical causes of the ABS warning lamp on with no DTC(s) set.

1. Grounded circuit between the Cluster and the EBCM.
2. Faulty Cluster/Lamp Driver Module.
3. Faulty EBCM.

ABS Warning Lamp On/No DTC Set

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check performed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Key off. 2. Disconnect the EBCM harness from the EBCM. 3. Key on. 4. Connect a fused jumper wire between terminal B8 of the EBCM harness and body ground. Did the amber ABS lamp turn off?	–	Go to *Step 4*	Go to *Step 5*
4	Replace the EBCM.	–	System OK	–
5	1. Key off. 2. Remove the Cluster Assembly from the I/P. 3. Disconnect the white Cluster harness connector from the Cluster Assembly. 4. Disconnect the LDM harness connector from the LDM. 5. Connect an ohmmeter to cluster harness A8 and then to body ground. Was the resistance within the specific range?	OL (open circuit)	Go to *Step 7*	Go to *Step 6*
6	Find the repair the short to ground between the Cluster harness and the LDM harness.	–	System OK	–
7	1. Key off. 2. Disconnect the EBCM harness from the EBCM. 3. Disconnect the LDM harness from the LDM. 4. Connect an ohmmeter to terminal C of the LDM harness and then to EBCM harness terminal B8. Was the resistance within the specific range?	Less than 2 ohms	Go to *Step 9*	Go to *Step 8*
8	Repair the open or high resistance between the LDM and the EBCM.	–	System OK	–
9	Replace the LDM. Is the repair complete?	–	System OK	Go to *Step 10*
10	Replace the Cluster Assembly.	–	System OK	–

BRAKE WARNING LAMP ON



Circuit Description

The Electronic Brake Control Module (EBCM) controls the operation of the Brake Warning Lamp by means of a lamp driver module contained within the Cluster.

Battery voltage is supplied to the I/P Cluster terminal B9, and Electronic Brake Control Module terminal A11 when the ignition switch is turned on EBCM terminals A and B are 'hot at all times'.

The default state is for the Lamp Driver Module to turn ON the Brake Warning Lamp, by supplying a ground path through the Lamp Driver Module.

When the EBCM commands the Brake Warning Lamp off, the EBCM will ground the ABS Warning Lamp control circuit. This causes the Lamp Driver Module to open the path to ground for the bulb.

When the ignition switch is turned to the ON position, the EBCM turns ON the Brake Warning Lamp for 3 seconds for a bulb check.

Whenever a malfunction is detected within the general brake system or DBC7 ABS system, the EBCM may turn ON the Brake Warning Lamp, notifying the driver that either Brake System or DBC7 needs to be serviced.

Diagnostic Aids

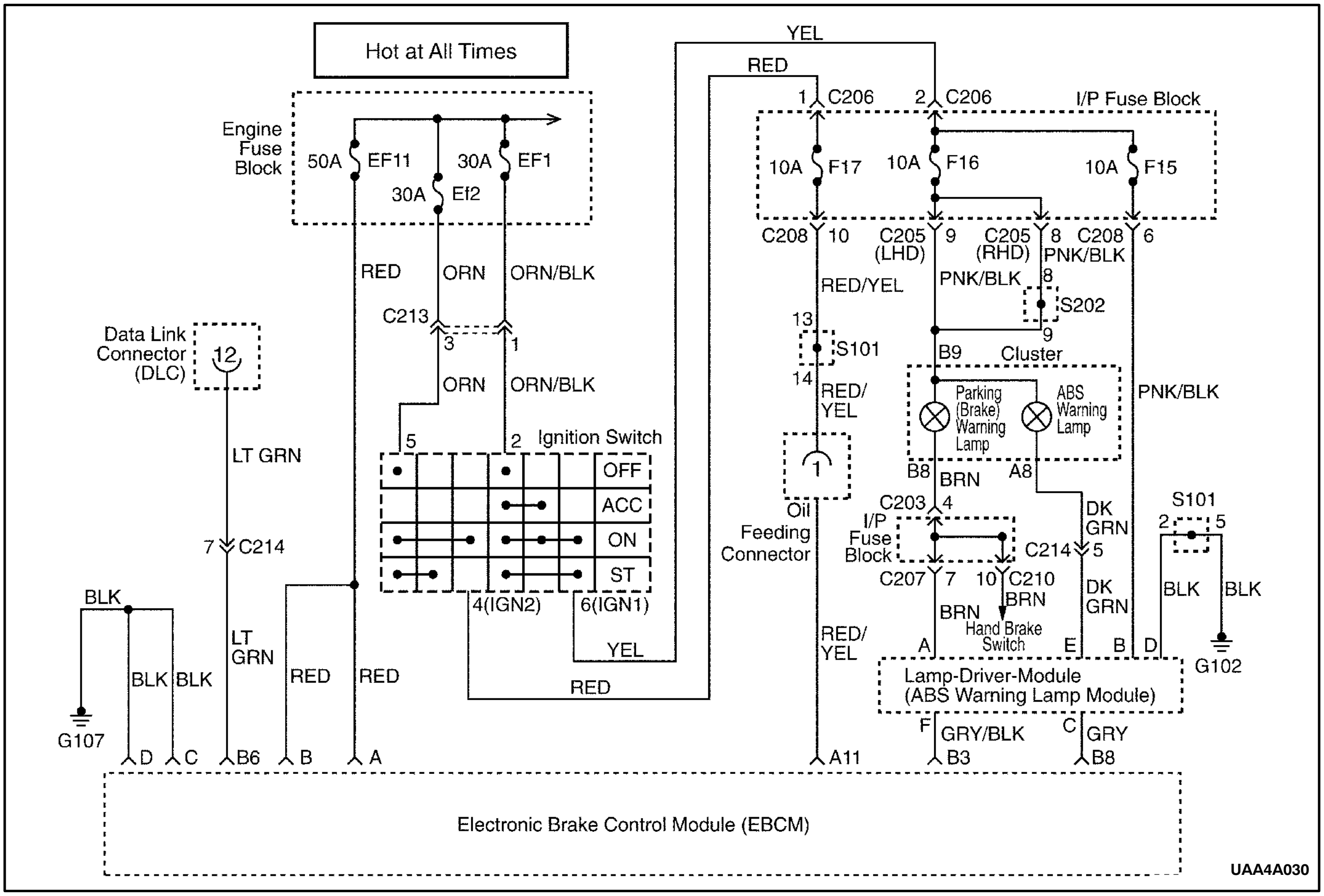
Typical causes of the Brake Warning Lamp on with no DTC(s) set.

1. Faulty Emergency brake switches.
2. Low brakes fluid level or faulty brake fluid switch.
3. DTC C0054, C0055, C0065 or C0067 fault conditions exist.
4. DDPR is disabled due to the following fault conditions in DBC7ABS system.
   - Two Wheel Speed Sensors inoperative on same axle.
   - Battery 2(Motor Input) short to ground.
   - Battery 1(ECU Input) Open or short to ground.
   - Motor ground open or short to battery.
   - ECU ground open or short to battery.
   - Ignition open or short to ground.
5. Grounded circuit between the Cluster and the EBCM.
6. Faulty Cluster/Lamp Driver Module.
7. Faulty EBCM.

Brake Warning Lamp On

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check performed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Observe ABS Warning Lamp. Does ABS Warning Lamp ON also?	–	Go to *Step 5*	Go to *Step 4*
4	Possibility of general brake system failure. Repair the brake system.	–	System OK	–
5	1. Connect Scan Tool and retrieve DTC. Did DTC exist?	–	Go to *Step 6*	Go to *Step 7*
6	Go to appropriate DTC diagnostic section.	–	System OK	–
7	1. Key off. 2. Disconnect the EBCM harness from the EBCM. 3. Key on. 4. Connect a fused jumper wire between terminal B3 of the EBCM harness and body ground. Did the Brake Warning Lamp turn off?	–	Go to *Step 8*	Go to *Step 9*
8	Replace the EBCM.	–	System OK	–
9	1. Key off. 2. Remove the Cluster Assembly from the I/P. 3. Disconnect the white Cluster harness connector from the Cluster Assembly. 4. Disconnect the LDM harness connector from the LDM. 5. Connect an ohmmeter to cluster harness B8 and then to body ground. Was the resistance within the specific range?	OL (open circuit)	Go to *Step 11*	Go to *Step 10*
10	Find the repair the short to ground between the Cluster harness and the LDM harness.	–	System OK	–
11	1. Key off. 2. LDM harness and EBCM harness still disconnected. 3. Connect an ohmmeter to terminal F of the LDM harness and then to EBCM harness terminal B3. Was the resistance within the specific range?	Less than 2 ohms	Go to *Step 13*	Go to *Step 12*
12	Repair the open or high resistance between the LDM and the EBCM	–	System OK	–
13	Replace the LDM. Is the repair complete?	–	System OK	Go to *Step 14*
14	Replace the Cluster Assembly.	–	System OK	–

BRAKE WARNING LAMP INOPERATIVE/NO DTC SET



Circuit Description

The Electronic Brake Control Module (EBCM) controls the operation of the red Brake Warning Lamp by means of a lamp driver module contained within the Cluster.

Battery voltage is supplied to the I/P Cluster terminal B9, and Electronic Brake Control Module terminal A11 when the ignition switch is turned on. EBCM terminals A and B are 'hot at all times'.The default state is for the Lamp Driver Module to turn ON the Brake Warning Lamp, by supplying a ground path through the Lamp Driver Module.

When the EBCM commands the Brake Warning lamp off, the EBCM will ground the Brake Warning Lamp control circuit. This causes the Lamp Driver Module to open the path to ground for the bulb.

When the ignition switch is turned to the ON position, the EBCM turns ON the Brake Warning Lamp for 3 seconds for a bulb check.

Whenever a malfunction is detected within the General Brake system or DDRP, the EBCM turns ON the Brake Warning Lamp, notifying the driver that Brake System or DDRP needs to be serviced.

Diagnostic Aids

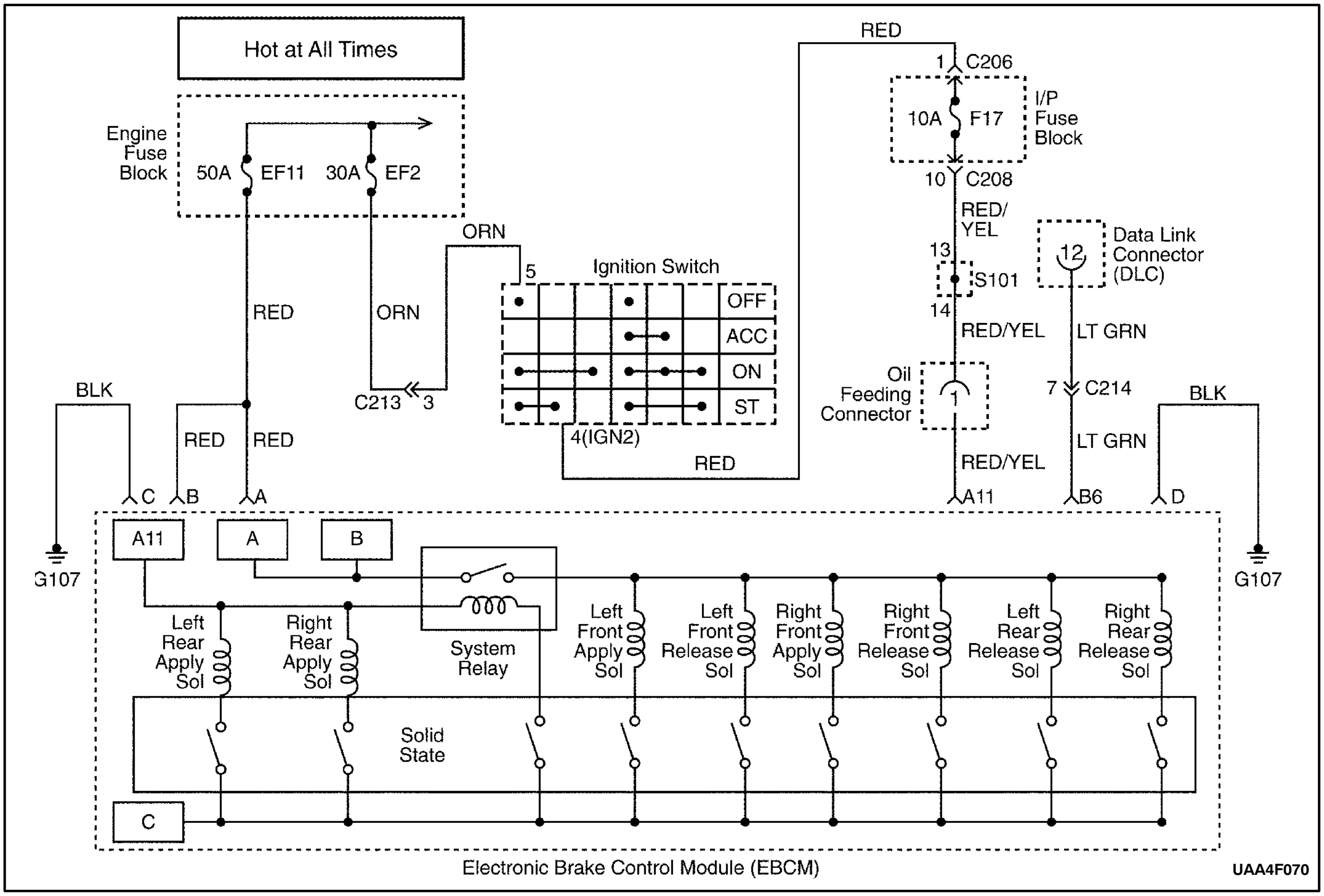
Typical causes of the Brake Warning Lamp inoperative with no DTC(s) set.

1. Faulty bulb/ loose socket.
2. I/P fuse open.
3. Faulty Cluster/Lamp Driver Module.
4. Faulty EBCM.
5. Grounded circuit between the EBCM and the Cluster.

Brake Warning Lamp Inoperative/No DTC Set

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check performed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Disconnect the EBCM harness from the EBCM. 2. Key on. Did the Brake Warning Lamp turn on?	–	Go to *Step 4*	Go to *Step 5*
4	Replace the EBCM.	–	System OK	–
5	Check the Cluster fuse. Is the fuse and terminal contact ok?	–	Go to *Step 7*	Go to *Step 6*
6	Replace the open fuse and/or repair the loose terminals. Find the short, which caused the fuse to open, if applicable.	–	System OK	–
7	Remove the Brake Warning Lamp bulb from the Cluster and inspect for an open bulb filament or poor socket contact? Was the socket and bulb ok?	–	Go to *Step 9*	Go to *Step 8*
8	Replace the Bulb/Socket as needed.	–	System OK	–
9	1. Key off. 2. EBCM harness still disconnected. 3. Remove the Cluster Assembly from the Instrument Panel. 4. Disconnect the white Cluster harness connector from the Cluster Assembly. 5. Key on. 6. Connect a voltmeter to terminal B9 of the white Cluster harness and then to body ground. Was the voltage within the specified range?	Battery Voltage	Go to *Step 11*	Go to *Step 10*
10	Find and repair the source of low voltage on the cluster voltage supply terminal.	–	System OK	–
11	1. Key off. 2. Disconnect the White Cluster harness connector from the Cluster Assembly. 3. Connect an ohmmeter between white Cluster harness terminal B8 and LDM(Lamp Driver Module) harness terminal A. Was the resistance within the specified range?	Less than 2 ohms	Go to *Step 13*	Go to *Step 12*
12	Repair the open or high resistance between the cluster and the LDM.	–	System OK	–
13	1. Key off. 2. LDM harness and EBCM harness still disconnected. 3. Connect an ohmmeter to EBCM harness terminal B3 and then to body ground. Was the resistance within the specified range?	OL (open circuit)	Go to *Step 15*	Go to *Step 14*
14	Find the repair the short to ground between the LDM harness and the EBCM harness.	–	System OK	–
15	Replace the LDM. Is the repair complete?	–	System OK	Go to *Step 16*
16	Replace the Cluster Assembly.	–	System OK	–

C0014 SOLENOID RELAY CONTACTS OR COIL CIRCUIT OPEN



Circuit Description

The solenoid relay is internal part of the EBCM.

Battery voltage is supplied from terminals A and B for the relay switch at all times. When the ignition switch is turned ON, battery voltage from terminal A11 is supplied to the relay coil.

The EBCM will then ground the relay coil circuit to switch the relay on, this supplies the solenoids and motor with battery voltage. The relay will remain in the on position as long as the ignition switch remains on, or a DTC set which turns off the relay.

Conditions for Setting the DTC

DTC C0014 will set after the ignition switch is ON, and the EBCM commands the relay on, if the ignition voltage is greater than 10.5 volts and the switched relay voltage drops less than 8.0 volts for 1/4 of a second.

Action Taken When the DTC Sets

- The solenoid relay is commanded off, removing battery voltage from the all the solenoids and the pump motor.
- ABS disabled, ABS Warning Lamp is turned on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0014 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

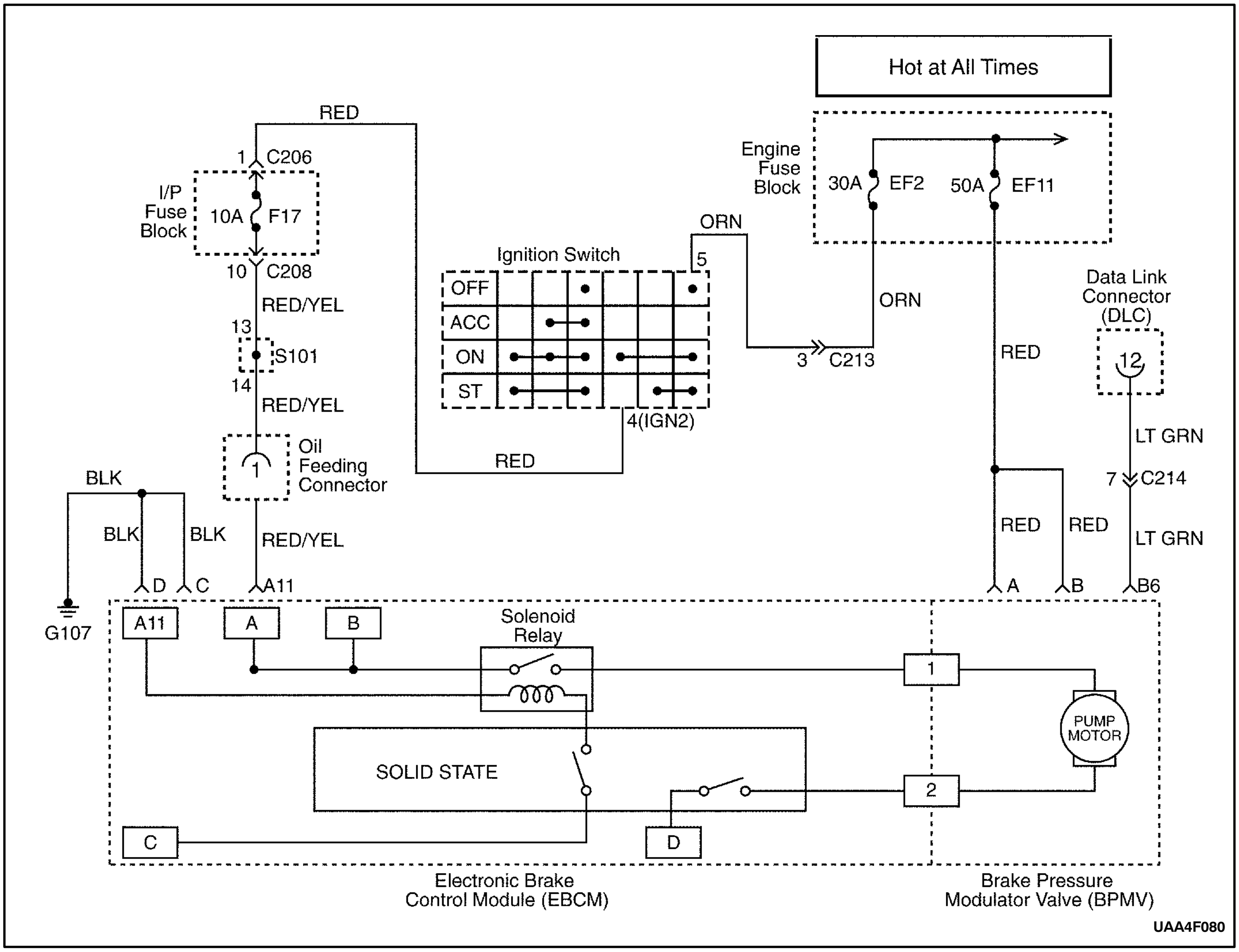
Typical Causes of DTC C0014.

1. Weak or discharged battery.
2. Loose or corroded battery terminals.
3. Engine block ground from battery poor.
4. Poor or loose ABS fuse contacts.
5. Poor EBCM terminals A11, A, B, C.
6. Low voltage to EBCM terminals A and/or B.
7. Internal EBCM failure.

C0014 Solenoid Relay Contacts or Coil Circuit Open

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Load tests the battery. Refer to battery in the service manual. 2. Inspect the charging system. Refer to starter and charging system in the service manual. 3. Perform a parasitic load test. Did the battery, charging system, and parasitic load test pass?	Battery must hold above 9.6 volts for 10 seconds No greater than 30 milli amps of draw	Go to *Step 5*	Go to *Step 4*
4	Repair the charging system and/or Recharge/ Replace the battery and/or Find and repair the source of the excessive parasitic draw.	–	System OK	–
5	1. Key off. 2. Disconnect the battery positive and negative terminals. 3. Disconnect the harness from the EBCM. 4. Inspect the following for a poor connection. • battery terminal cables. • negative cable to block and/or chassis. • positive cable to starter solenoid and/or junction block. • EBCM terminals A11, A , B, C. • EBCM ground wire to chassis ground. Were all the above connections satisfactory?	–	Go to *Step 7*	Go to *Step 6*
6	Repair the terminal and/or connections as needed.	–	System OK	–
7	1. EBCM still disconnected. 2. Battery cables still disconnected. 3. Connect an ohmmeter to terminal C of the EBCM harness and the negative battery cable. Was the resistance within the specified range?	Less than 2 ohms	Go to *Step 9*	Go to *Step 8*
8	Find and repair the source of high resistance between the negative battery cable and the EBCM harness connector.	–	System OK	–
9	1. Reconnect the battery cables. 2. EBCM still disconnected. 3. Key on. 4. Using a voltmeter, measure the voltage on the EBCM harness terminals, A11, A ,B. Was the voltage on all 3 terminals above the specified range?	Battery Voltage	Go to *Step 11*	Go to *Step 10*
10	Find and repair the source of low voltage to the EBCM terminals.	–	System OK	–
11	Replace the EBCM.	–	System OK	–

C0017 PUMP MOTOR SHORT TO GROUND



Circuit Description

The pump motor is contained within the Brake Pressure Modulator Valve (BPMV). The pump motor ground is supplied though terminal D of the EBCM.

Conditions for Setting the DTC

C0017 can only be set with the key in the on position, pump motor is off, and the EBCM detected a short to ground on the pump motor circuit.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power from the pump motor and solenoids.
- DTC C0017 is stored.
- ABS disabled, ABS Warning Lamp is turned on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0017 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

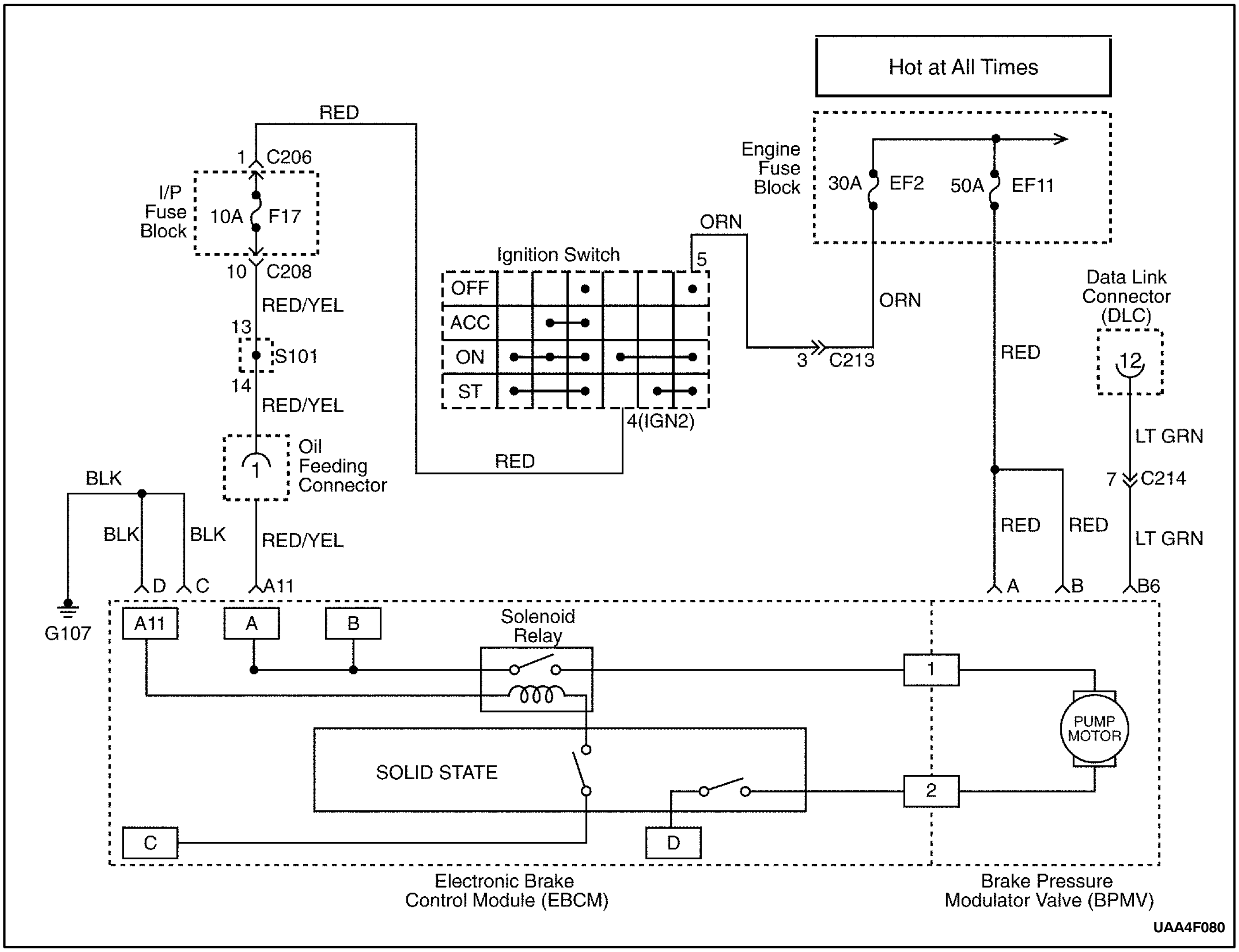
Typical Causes of DTC C0017.

1. Faulty BPMV.
2. Faulty EBCM.

C0017 Pump Motor Short to Ground

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Key off. 2. Disconnect the EBCM harness from the EBCM. 3. Remove the EBCM from the BPMV. 4. Inspect the EBCM to BPMV connector for conditions such as damage, corrosion, poor terminal contact, or the presence of brake fluid. Were the terminals and connector OK, and the cavity free of brake fluid, damage and corrosion?	–	Go to *Step 5*	Go to *Step 4*
4	1. If damage and/or corrosion is present, replace the EBCM and/or the BPMV as necessary. 2. If the brake fluid is present, replace both the EBCM and the BPMV.	–	System OK	–
5	1. Connect an ohmmeter to terminal 1 of the BPMV and then to body ground, note the resistance value. 2. Connect an ohmmeter to terminal 2 of the BPMV and then to body ground, note the resistance value. Were both readings within the specified range?	OL (open circuit)	Go to *Step 7*	Go to *Step 6*
6	Replace the Brake Pressure Modulator Valve.	–	System OK	–
7	Replace the EBCM.	–	System OK	–

C0018 PUMP MOTOR SHORT TO BATTERY OR MOTOR GROUND OPEN/HIGH RESISTANCE



Circuit Description

The pump motor is contained within the Brake Pressure Modulator Valve (BPMV). The pump motor ground is supplied though terminal D of the EBCM.

Conditions for Setting the DTC

C0018 can only be set with the key in the ON position, pump motor is commanded on, and the EBCM detected a short to power or high resistance in the pump ground circuit.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power from the pump motor and solenoids.
- DTC C0018 is stored.
- ABS disabled, ABS Warning Lamp turns on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0018 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be deleted from history data.

Diagnostic Aids

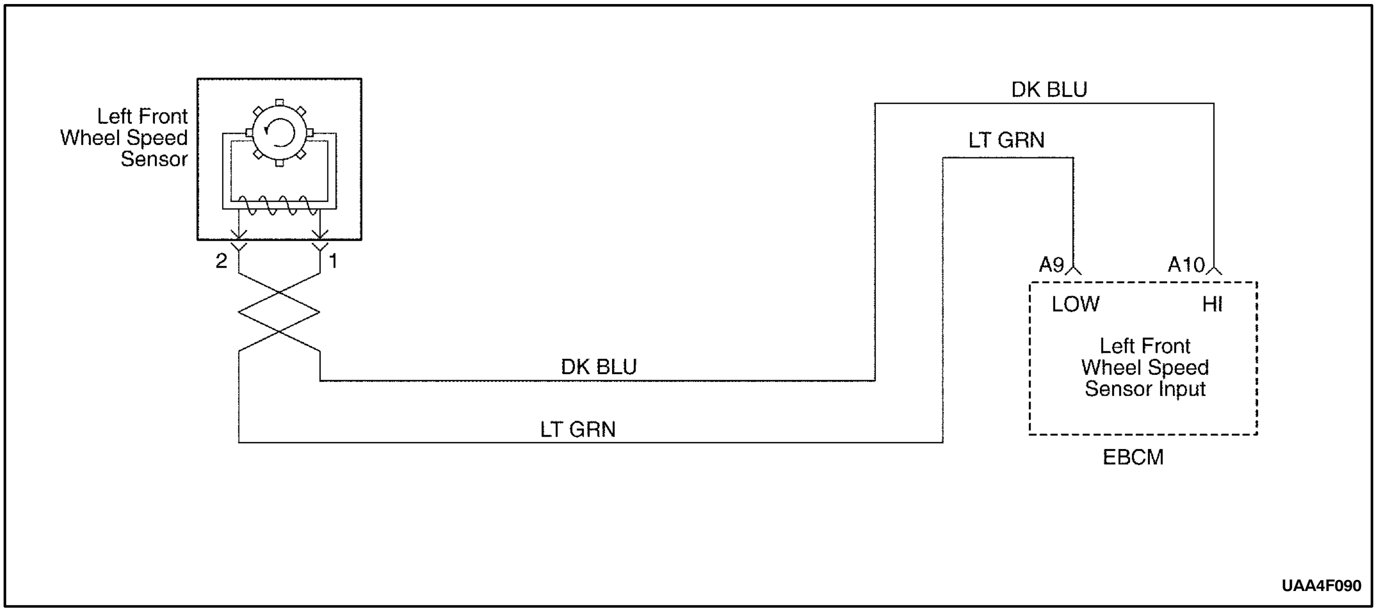
Typical causes of DTC C0018.

1. Poor terminal contact at terminal D.
2. Terminal D ground circuit shorted to voltage.
3. Terminal D ground circuit open.
4. Terminal D ground circuit high resistance to ground.
5. Faulty EBCM.

C0017 Pump Motor Short to Battery or Motor Ground Open/High Resistance

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Key off. 2. Disconnect the EBCM harness from the EBCM. 3. Key on. 4. Connect a voltmeter to terminal D of the EBCM harness and then to body ground. Was the voltage within the specified range?	Less than 1 volts	Go to *Step 5*	Go to *Step 4*
4	Find and repair the source of the short to voltage on the terminal D ground circuit.	–	System OK	–
5	1. Key off. 2. Disconnect the negative battery cable. 3. EBCM harness still disconnected from the EBCM. 4. Connect an ohmmeter to the negative battery cable and then to terminal D of the EBCM harness. Was the resistance reading within the specified range?	Less than 2 ohms	Go to *Step 7*	Go to *Step 6*
6	Find and repair the source of high resistance between the EBCM terminal D ground circuit and body ground.	–	System OK	–
7	1. Follow the negative battery cable to the engine block and/or chassis ground connection and inspect for a good clean and tight connection. 2. From terminal D of the EBCM harness follow the circuit and find the location where the circuit grounds to the chassis. Inspect for a good clean and tight connection. Were both connections clean and tight?	–	Go to *Step 9*	Go to *Step 8*
8	Repair the poor ground connection as necessary.	–	System OK	–
9	1. EBCM harness still disconnected from the EBCM. 2. Remove the EBCM from the BPMV. 3. Inspect the EBCM to BPMV connector for conditions such as damage, corrosion, poor terminal contact, or the presence of brake fluid. Were the terminals and connector OK, and the cavity free of brake fluid, damage and corrosion?	–	Go to *Step 11*	Go to *Step 10*
10	1. If damage and/or corrosion are present, replace the EBCM and/or the BPMV as necessary. 2. If the brake fluid is present, replace both the EBCM and the BPMV.	–	System OK	–
11	Connect an ohmmeter to terminal 1 and then terminal 2 of the BPMV. Was the pump motor resistance reading within the specified range?	Less than 2 ohms	Go to *Step 13*	Go to *Step 12*
12	Replace the Brake Pressure Modulator Valve.	–	System OK	–
13	Replace EBCM.	–	System OK	–

C0021 LEFT FRONT WHEEL SPEED SENSOR INPUT SIGNAL=0



Circuit Description

As the wheel is rotated, the speed sensor produces an AC voltage that increases with wheel speed. The EBCM uses the frequency of the AC signal to calculate wheel speed. The speed sensor is connected to the EBCM by a “twisted pair” of wires. Twisting reduces noise susceptibility that may cause a DTC to set.

Conditions for Setting the DTC

All of the following must be true for C0021 to set.

- C0032 or C0033 or C000034 or C0035 not current.
- ABS not active.
- Brake switch off.

The left front wheel speed equals 0, and all of the remaining Wheel Speed Sensors are greater than 8 km/hr (5 mph) for at least 2.5 seconds.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power from the pump motor and solenoids.
- DTC C0021 is stored.
- ABS disabled, ABS Warning Lamp turns on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0021 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

Thoroughly inspect the wiring and connectors when diagnosing intermittent DTC(s). This will include the following.

- Removal of the protective conduit and inspection of wiring for damage, shorts and contamination.
- Inspection for improperly formed and/or damaged terminals.
- Checking terminal contact (retention force) by using a spare male/female terminal.
- Removal of the terminals from the connectors to check for proper terminal to wire crimp.

If the drivers comments reflect that the ABS warning lamp is on only during moist environmental changes (rain, snow, vehicle wash), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. If the DTC is not current, simulate the effects of water intrusion. Use the following procedure. Spray the suspected area with a 5 percent salt-water solution. Then test-drive the vehicle over various road surfaces such as (bumps, turns, etc) above 24 kph (15 mph). If the DTC sets then replace the suspected harness and/or sensor.

When measuring wheel speed sensor resistance insures the vehicle is at room temperature, since resistance will increase with temperature.

Failure to perform the previous steps carefully and fully can result in misdiagnosis, unnecessary component replacement and reoccurrence of DTC C0021.

C0021 Left Front Wheel Speed Sensor Input Signal=0

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check prior to performing this trouble tree. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Key off. 2. Inspect the left front wheel speed sensor, jumper harness and toothed ring for physical damage. Is any physical damage noted?	–	Go to *Step 4*	Go to *Step 5*
4	Repair the damage to the left front wheel speed sensor, jumper harness and/or toothed ring.	–	System OK	–
5	Was DTC C0032 set as a current or history code?	–	Go to *Step 6*	Go to *Step 7*
6	Perform diagnostics for DTC C0032 prior to performing this table.	–	System OK	–
7	1. Connect a Scan Tool and select data list. 2. Monitor the wheel speed sensors. 3. Test-drives vehicle above 24 kph (15 mph) and slowly decelerates to zero, do this several times. Did C0021 reset or did the left front wheel speed suddenly drop to zero prior to the vehicle coming to a complete stop?	–	Go to *Step 9*	Go to *Step 8*
8	DTC C0021 is intermittent. Refer to diagnostic aids.	–	System OK	–
9	1. Key off. 2. Raise and suitably support the vehicle. 3. Disconnect the EBCM harness from the EBCM. 4. Connect a voltmeter to EBCM harness terminals A09 and A10. 5. Select the AC mill volt scale. 6. Spin the left front wheel while observing the voltmeter. (voltage should increase as wheel speed increases) Is the AC voltage within the specified range?	At least 100mV	Go to *Step 10*	Go to *Step 11*
10	Replace the EBCM.	–	System OK	–
11	1. Disconnect the left front jumper harness from the Left Front Wheel Speed Sensor. 2. Connect an ohmmeter to terminals 2 and 1 of the Left Front Wheel Speed Sensor. Is the resistance within the specified range?	800–1600 Ohms (Resistance will vary with temperature)	Go to *Step 13*	Go to *Step 12*
12	Replace the left front wheel speed sensor.	–	System OK	–
13	1. Left front jumper harness still disconnected from the left front speed sensor. 2. Connect a voltmeter to terminals 2 and 1 of the left front wheel speed sensor. 3. Select the AC mill volt scale. 4. Spin the left front wheel while observing the voltmeter. (voltage should increase as wheel speed increases) Is the AC voltage within the specified range?	At least 100mV	Go to *Step 14*	Go to *Step 12*

C0021 Left Front Wheel Speed Sensor Input Signal=0 (Cont'd)

Step	Action	Value	Yes	No
14	1. Disconnect the left front jumper harness from the ABS body harness. 2. EBCM harness still disconnected from the EBCM. 3. Connect an ohmmeter to EBCM harness terminals A09 and A10. Is the Resistance within the specified range?	OL (open circuit)	Go to *Step 16*	Go to *Step 15*
15	Find and repair the short between the 2 circuits.	–	System OK	–
16	1. EBCM harness still disconnected from the EBCM. 2. Left front jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A09 and then to ABS body harness terminal 2. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 18*	Go to *Step 17*
17	Repair the open or high resistance between terminals A09 and 2.	–	System OK	–
18	1. EBCM harness still disconnected from the EBCM. 2. Left front jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A10 and then to ABS body harness terminal 1. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 20*	Go to *Step 19*
19	Repair the open or high resistance between terminal A10 and 1.	–	System OK	–
20	1. Replace the left front wheel speed jumper harness. 2. Test-drive the vehicle at various speeds and road surfaces Did C0032 reset?	–	Go to *Step 10*	System OK

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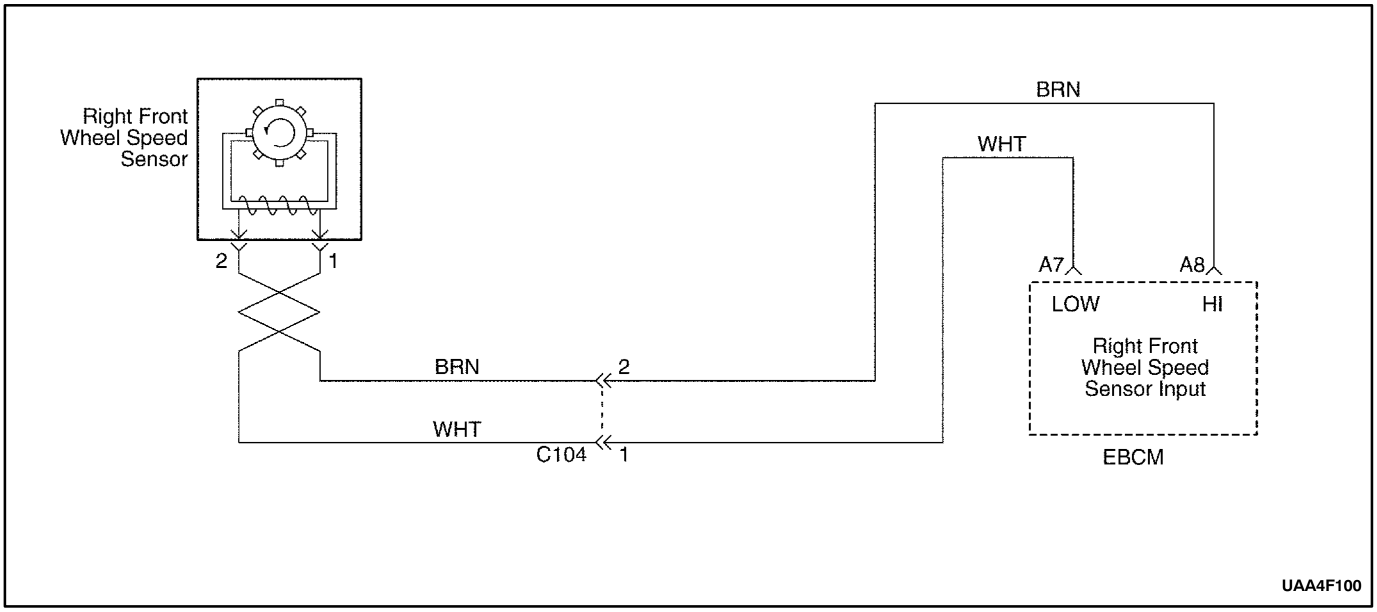
C0022 RIGHT FRONT WHEEL SPEED SENSOR INPUT SIGNAL=0



Circuit Description

As the wheel is rotated, the speed sensor produces an AC voltage that increases with wheel speed. The EBCM uses the frequency of the AC signal to calculate wheel speed. The speed sensor is connected to the EBCM by a "twisted pair" of wires. Twisting reduces noise susceptibility that may cause a DTC to set.

Conditions for Setting the DTC

All of the following must be true for C0022 to set.

- C0032 or C0033 or C0034 or C0035 not current.
- ABS not active.
- Brake switch off.
- The right front wheel speed equals 0, and all of the remaining Wheel Speed Sensors are greater than 8 km/hr (5 mph) for at least 2.5 seconds.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power from the pump motor and solenoids.
- DTC C0022 is stored.
- ABS disabled, ABS Warning Lamp turns on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0022 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

Thoroughly inspect the wiring and connectors when diagnosing intermittent DTC(s). This will include the following.

- Removal of the protective conduit and inspection of wiring for damage, shorts and contamination.
- Inspection for improperly formed and/or damaged terminals.
- Checking terminal contact (retention force) by using a spare male/female terminal.
- Removal of the terminals from the connectors to check for proper terminal to wire crimp.

If the drivers comments reflect that the ABS Warning Lamp is on only during moist environmental changes (rain, snow, vehicle wash), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. If the DTC is not current, simulate the effects of water intrusion. Use the following procedure. Spray the suspected area with a 5 percent salt-water solution. Then test-drive the vehicle over various road surfaces such as (bumps, turns, etc) above 24 kph (15 mph). If the DTC sets then replace the suspected harness and/ or sensor.

When measuring wheel speed sensor resistance insures the vehicle is at room temperature, since resistance will increase with temperature.

Failure to perform the previous steps carefully and fully can result in misdiagnosis, unnecessary component replacement and reoccurrence of DTC C0022.

C0022 Right Front Wheel Speed Sensor Input Signal=0

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check prior to performing this trouble tree. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Key off. 2. Inspect the right front wheel speed sensor, jumper harness and toothed ring for physical damage. Is any physical damage noted?	–	Go to *Step 4*	Go to *Step 5*
4	Repair the damage to the right front wheel speed sensor, jumper harness and/or toothed ring.	–	System OK	–
5	Was DTC C0033 set as a current or history code?	–	Go to *Step 6*	Go to *Step 7*
6	Perform diagnostics for DTC C0033 prior to performing this table.	–	System OK	–
7	1. Connect a Scan Tool and select data list. 2. Monitor the wheel speed sensors. 3. Test-drives vehicle above 24 kph (15 mph) and slowly decelerates to zero, do this several times. Did C0022 reset or did the right front wheel speed suddenly drop to zero prior to the vehicle coming to a complete stop?	–	Go to *Step 9*	Go to *Step 8*
8	DTC C0022 is intermittent. Refer to diagnostic aids.	–	System OK	–
9	1. Key off. 2. Raise and suitably support the vehicle. 3. Disconnect the EBCM harness from the EBCM. 4. Connect a voltmeter to EBCM harness terminals A07 and A8. 5. Select the AC mill volt scale. 6. Spin the right front wheel while observing the voltmeter. (voltage should increase as wheel speed increases) Is the AC voltage within the specified range?	At least 100mV	Go to *Step 10*	Go to *Step 11*
10	Replace the EBCM.	–	System OK	–
11	1. Disconnect the left front jumper harness from the Right Front Wheel Speed Sensor. 2. Connect an ohmmeter to terminals 2 and 1 of the Right Front Wheel Speed Sensor. Is the resistance within the specified range?	800–1600 Ohms (Resistance will vary with temperature)	Go to *Step 13*	Go to *Step 12*
12	Replace the right front wheel speed sensor.	–	System OK	–
13	1. Right front jumper harness still disconnected from the right front speed sensor. 2. Connect a voltmeter to terminals 2 and 1 of the right front wheel speed sensor. 3. Select the AC mill volt scale. 4. Spin the right front wheel while observing the voltmeter. (voltage should increase as wheel speed increases) Is the AC voltage within the specified range?	At least 100mV	Go to *Step 14*	Go to *Step 12*

C0022 Right Front Wheel Speed Sensor Input Signal=0 (Cont'd)

Step	Action	Value	Yes	No
14	1. Disconnect the right front jumper harness from the ABS body harness. 2. EBCM harness still disconnected from the EBCM. 3. Connect an ohmmeter to EBCM harness terminals A07 and A8. Is the Resistance within the specified range?	OL (open circuit)	Go to *Step 16*	Go to *Step 15*
15	Find and repair the short between the 2 circuits.	–	System OK	–
16	1. EBCM harness still disconnected from the EBCM. 2. Right front jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A07 and then to ABS body harness terminal 2. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 18*	Go to *Step 17*
17	Repair the open or high resistance between terminals A07 and 2.	–	System OK	–
18	1. EBCM harness still disconnected from the EBCM. 2. Right front jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A08 and then to ABS body harness terminal 1. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 20*	Go to *Step 19*
19	Repair the open or high resistance between terminal A08 and 1.	–	System OK	–
20	1. Replace the right front wheel speed jumper harness. 2. Test-drive the vehicle at various speeds and road surfaces Did C0033 reset?	–	Go to *Step 10*	System OK

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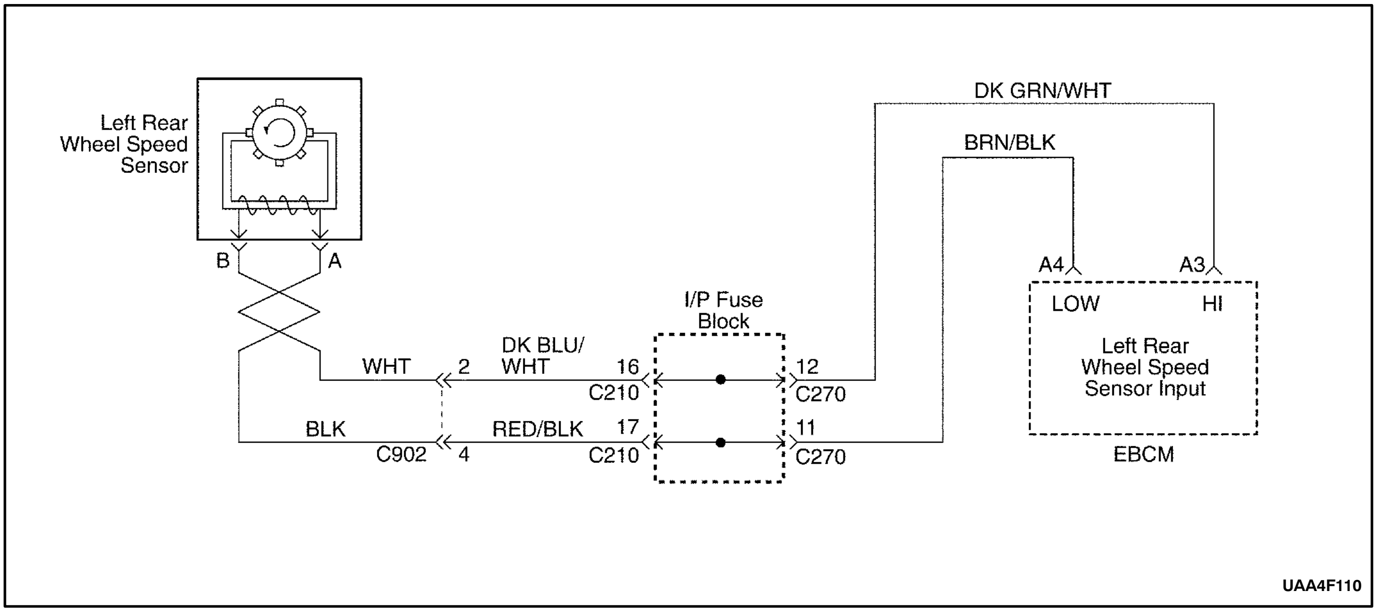
C0023 LEFT REAR WHEEL SPEED SENSOR INPUT SIGNAL=0



Circuit Description

As the wheel is rotated, the speed sensor produces an AC voltage that increases with wheel speed. The EBCM uses the frequency of the AC signal to calculate wheel speed. The speed sensor is connected to the EBCM by a "twisted pair" of wires. Twisting reduces noise susceptibility that may cause a DTC to set.

Conditions for Setting the DTC

All of the following must be true for C0023 to set.

- C0032 or C0033 or C0034 or C0035 not current.
- ABS not active.
- Brake switch off.
- The left rear wheel speed equals 0, and all of the remaining Wheel Speed Sensors are greater than 8 km/hr (5 mph) for at least 2.5 seconds.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power from the pump motor and solenoids.
- DTC C0023 is stored.
- ABS disabled, ABS Warning Lamp turns on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0023 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

Thoroughly inspect the wiring and connectors when diagnosing intermittent DTC(s). This will include the following.

- Removal of the protective conduit and inspection of wiring for damage, shorts and contamination.
- Inspection for improperly formed and/or damaged terminals.
- Checking terminal contact (retention force) by using a spare male/female terminal.
- Removal of the terminals from the connectors to check for proper terminal to wire crimp.

If the drivers comments reflect that the ABS Warning Lamp is on only during moist environmental changes (rain, snow, vehicle wash), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. If the DTC is not current, simulate the effects of water intrusion. Use the following procedure. Spray the suspected area with a 5 percent salt-water solution. Then test-drive the vehicle over various road surfaces such as (bumps, turns, etc) above 24 kph (15 mph). If the DTC sets then replace the suspected harness and/or sensor.

When measuring wheel speed sensor resistance insures the vehicle is at room temperature, since resistance will increase with temperature.

Failure to perform the previous steps carefully and fully can result in misdiagnosis, unnecessary component replacement and reoccurrence of DTC C0023.

C0023 Left Rear Wheel Speed Sensor Input Signal=0

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check prior to performing this trouble tree. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Key off. 2. Inspect the left rear wheel speed sensor, jumper harness and toothed ring for physical damage. Is any physical damage noted?	–	Go to *Step 4*	Go to *Step 5*
4	Repair the damage to the left rear wheel speed sensor, jumper harness and/or toothed ring.	–	System OK	–
5	Was DTC C0034 set as a current or history code?	–	Go to *Step 6*	Go to *Step 7*
6	Perform diagnostics for DTC C0034 prior to performing this table.	–	System OK	–
7	1. Connect a Scan Tool and select data list. 2. Monitor the wheel speed sensors. 3. Test-drives vehicle above 24 kph (15 mph) and slowly decelerates to zero, do this several times. Did C0023 reset or did the left rear wheel speed suddenly drop to zero prior to the vehicle coming to a complete stop?	–	Go to *Step 9*	Go to *Step 8*
8	DTC C0023 is intermittent. Refer to diagnostic aids.	–	System OK	–
9	1. Key off. 2. Raise and suitably support the vehicle. 3. Disconnect the EBCM harness from the EBCM. 4. Connect a voltmeter to EBCM harness terminals A03 and A04. 5. Select the AC mill volt scale. 6. Spin the left rear wheel while observing the voltmeter. (voltage should increase as wheel speed increases) Is the AC voltage within the specified range?	At least 100mV	Go to *Step 10*	Go to *Step 11*
10	Replace the EBCM.	–	System OK	–
11	1. Disconnect the left rear jumper harness from the Left Rear Wheel Speed Sensor. 2. Connect an ohmmeter to terminals A and B of the Left Rear Wheel Speed Sensor. Is the resistance within the specified range?	800–1600 Ohms (Resistance will vary with temperature)	Go to *Step 13*	Go to *Step 12*
12	Replace the left rear wheel speed sensor.	–	System OK	–
13	1. Left Rear jumper harness still disconnected from the left rear speed sensor. 2. Connect a voltmeter to terminals A and B of the left rear wheel speed sensor. 3. Select the AC mill volt scale. 4. Spin the left rear wheel while observing the voltmeter. (voltage should increase as wheel speed increases) Is the AC voltage within the specified range?	At least 100mV	Go to *Step 14*	Go to *Step 12*

C0023 Left Rear Wheel Speed Sensor Input Signal=0 (Cont'd)

Step	Action	Value	Yes	No
14	1. Disconnect the left rear jumper harness from the ABS body harness. 2. EBCM harness still disconnected from the EBCM. 3. Connect an ohmmeter to EBCM harness terminals A03 and A04. Is the Resistance within the specified range?	OL (open circuit)	Go to *Step 16*	Go to *Step 15*
15	Find and repair the short between the 2 circuits.	–	System OK	–
16	1. EBCM harness still disconnected from the EBCM. 2. Left rear jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A03 and then to ABS body harness terminal A. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 18*	Go to *Step 17*
17	Repair the open or high resistance between terminals A03 and A.	–	System OK	–
18	1. EBCM harness still disconnected from the EBCM. 2. Left rear jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A04 and then to ABS body harness terminal B. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 20*	Go to *Step 19*
19	Repair the open or high resistance between terminal A04 and B.	–	System OK	–
20	1. Replace the left rear wheel speed jumper harness. 2. Test-drive the vehicle at various speeds and road surfaces Did C0034 reset?	–	Go to *Step 10*	System OK

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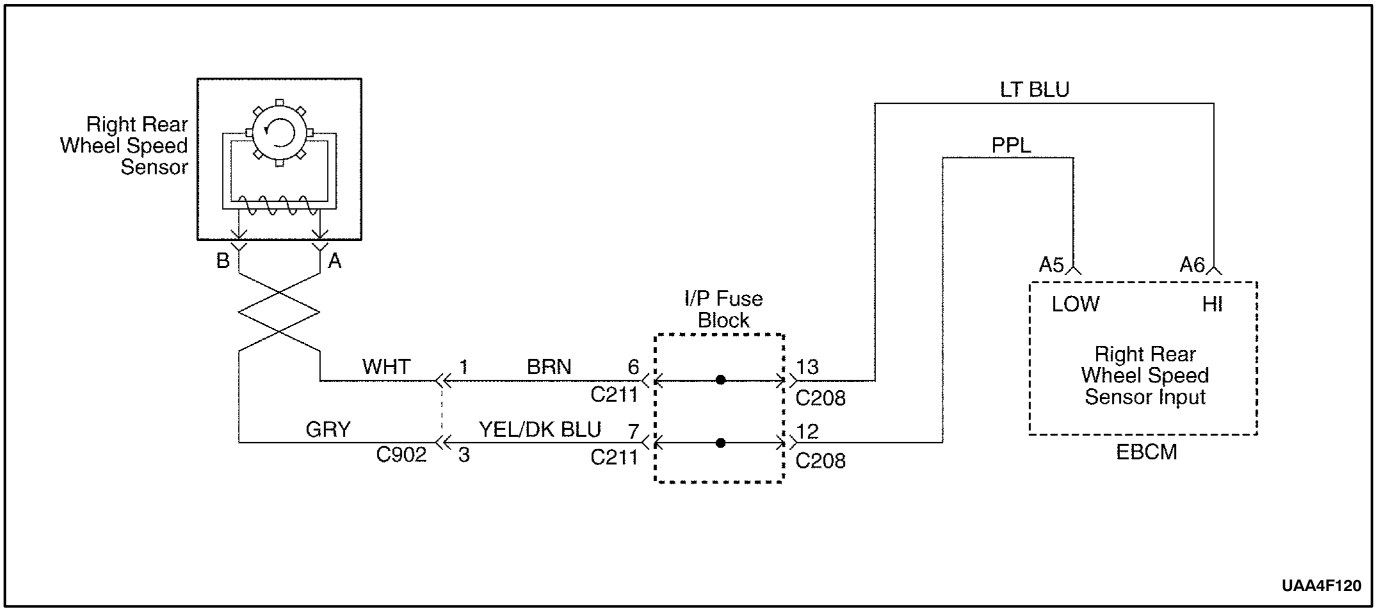
C0024 RIGHT REAR WHEEL SPEED SENSOR INPUT SIGNAL=0



Circuit Description

As the wheel is rotated, the speed sensor produces an AC voltage that increases with wheel speed. The EBCM uses the frequency of the AC signal to calculate wheel speed. The speed sensor is connected to the EBCM by a “twisted pair” of wires. Twisting reduces noise susceptibility that may cause a DTC to set.

Conditions for Setting the DTC

All of the following must be true for C0024 to set.

- C0032 or C0033 or C0034 or C0035 not current.
- ABS not active.
- Brake switch off.
- The right rear wheel speed equals 0, and all of the remaining Wheel Speed Sensors are greater than 8 km/hr (5 mph) for at least 2.5 seconds.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power from the pump motor and solenoids.
- DTC C0024 is stored.
- ABS disabled, ABS Warning Lamp turns on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0024 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

- Thoroughly inspect the wiring and connectors when diagnosing intermittent DTC(s). This will include the following.
- Removal of the protective conduit and inspection of wiring for damage, shorts and contamination.
- Inspection for improperly formed and/or damaged terminals.
- Checking terminal contact (retention force) by using a spare male/female terminal.
- Removal of the terminals from the connectors to check for proper terminal to wire crimp.

If the drivers comments reflect that the ABS Warning Lamp is on only during moist environmental changes (rain, snow, vehicle wash), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. If the DTC is not current, simulate the effects of water intrusion. Use the following procedure. Spray the suspected area with a 5 percent salt-water solution. Then test-drive the vehicle over various road surfaces such as (bumps, turns, etc) above 24 kph (15 mph). If the DTC sets then replace the suspected harness and/or sensor.

When measuring wheel speed sensor resistance insures the vehicle is at room temperature, since resistance will increase with temperature.

Failure to perform the previous steps carefully and fully can result in misdiagnosis, unnecessary component replacement and reoccurrence of DTC C0024.

C0024 Right Rear Wheel Speed Sensor Input Signal=0

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check prior to performing this trouble tree. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Key off. 2. Inspect the right rear wheel speed sensor, jumper harness and toothed ring for physical damage. Is any physical damage noted?	–	Go to *Step 4*	Go to *Step 5*
4	Repair the damage to the right rear wheel speed sensor, jumper harness and/or toothed ring.	–	System OK	–
5	Was DTC C0035 set as a current or history code?	–	Go to *Step 6*	Go to *Step 7*
6	Perform diagnostics for DTC C0035 prior to performing this table.	–	System OK	–
7	1. Connect a Scan Tool and select data list. 2. Monitor the wheel speed sensors. 3. Test-drives vehicle above 24 kph (15 mph) and slowly decelerates to zero, do this several times. Did C0024 reset or did the right rear wheel speed suddenly drop to zero prior to the vehicle coming to a complete stop?	–	Go to *Step 9*	Go to *Step 8*
8	DTC C0024 is intermittent. Refer to diagnostic aids.	–	System OK	–
9	1. Key off. 2. Raise and suitably support the vehicle. 3. Disconnect the EBCM harness from the EBCM. 4. Connect a voltmeter to EBCM harness terminals A05 and A06. 5. Select the AC mill volt scale. 6. Spin the right rear wheel while observing the voltmeter. (voltage should increase as wheel speed increases) Is the AC voltage within the specified range?	At least 100mV	Go to *Step 10*	Go to *Step 11*
10	Replace the EBCM.	–	System OK	–
11	1. Disconnect the right rear jumper harness from the Right Rear Wheel Speed Sensor. 2. Connect an ohmmeter to terminals B and A of the Right Rear Wheel Speed Sensor. Is the resistance within the specified range?	800–1600 Ohms (Resistance will vary with temperature)	Go to *Step 13*	Go to *Step 12*
12	Replace the right rear wheel speed sensor.	–	System OK	–
13	1. Right Rear jumper harness still disconnected from the left rear speed sensor. 2. Connect a voltmeter to terminals B and A of the right rear wheel speed sensor. 3. Select the AC mill volt scale. 4. Spin the right rear wheel while observing the voltmeter. (voltage should increase as wheel speed increases) Is the AC voltage within the specified range?	At least 100mV	Go to *Step 14*	Go to *Step 12*

C0024 Right Rear Wheel Speed Sensor Input Signal=0 (Cont'd)

Step	Action	Value	Yes	No
14	1. Disconnect the right rear jumper harness from the ABS body harness. 2. EBCM harness still disconnected from the EBCM. 3. Connect an ohmmeter to EBCM harness terminals A05 and A06. Is the Resistance within the specified range?	OL (open circuit)	Go to *Step 16*	Go to *Step 15*
15	Find and repair the short between the 2 circuits.	–	System OK	–
16	1. EBCM harness still disconnected from the EBCM. 2. Right rear jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A05 and then to ABS body harness terminal B. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 18*	Go to *Step 17*
17	Repair the open or high resistance between terminals A05 and B.	–	System OK	–
18	1. EBCM harness still disconnected from the EBCM. 2. Right rear jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A06 and then to ABS body harness terminal A. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 20*	Go to *Step 19*
19	Repair the open or high resistance between terminal A06 and A.	–	System OK	–
20	1. Replace the right rear wheel speed jumper harness. 2. Test-drive the vehicle at various speeds and road surfaces Did C0035 reset?	–	Go to *Step 10*	System OK

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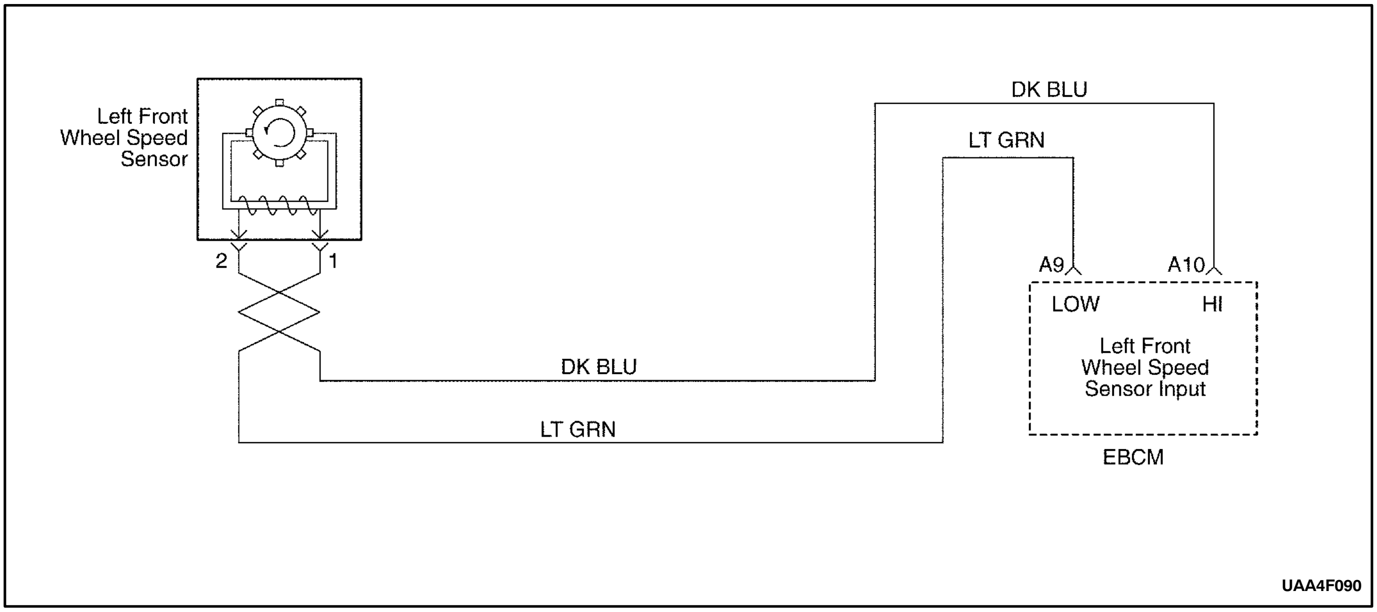
C0025 LEFT FRONT WHEEL SPEED EXCESSIVE VARIATION



Circuit Description

As the wheel is rotated, the speed sensor produces an AC voltage that increases with wheel speed. The EBCM uses the frequency of the AC signal to calculate wheel speed. The speed sensor is connected to the EBCM by a "twisted pair" of wires. Twisting reduces noise susceptibility that may cause a DTC to set.

Conditions for Setting the DTC

All of the following must be true for C0025 to set.

- C0032 or C0033 or C0034 or C0035 not current.
- Brake switch off.
- The left front wheel speed is accelerating or decelerating beyond reasonable limits.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power from the pump motor and solenoids.
- DTC C0025 is stored.
- ABS disabled, ABS Warning Lamp turns on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0025 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

Thoroughly inspect the wiring and connectors when diagnosing intermittent DTC(s). This will include the following.

- Removal of the protective conduit and inspection for wiring for damage, shorts and contamination.
- Inspection for improperly formed and/or damaged terminals.
- Checking terminal contact (retention force) by using a spare male/female terminal.
- Removal of the terminals from the connectors to check for proper terminal to wire crimp.

If the drivers comments reflect that the ABS Warning Lamp is on only during moist environmental changes (rain, snow, vehicle wash), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. If the DTC is not current, simulate the effects of water intrusion. Use the following procedure. Spray the suspected area with a 5 percent salt-water solution. Then test-drive the vehicle over various road surfaces such as (bumps, turns, etc) above 24 kph (15 mph). If the DTC sets then replace the suspected harness and/ or sensor.

A careful visual inspection of the toothed ring for damaged such as cracks and tooth damage should be performed. If the DTC sets at the same speed every drive cycle, the toothed ring is most likely damaged.

Failure to perform the previous steps carefully and fully can result in misdiagnosis, unnecessary component replacement and reoccurrence of DTC C0025.

C0025 Left Front Wheel Speed Excessive Variation

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check prior to performing DTC C0025 trouble chart. Did you find problem?	–	Go to *Step 3*	System OK
3	Was C0032 set as a current or history DTC?	–	Go to *Step 4*	Go to *Step 5*
4	Perform C0032 diagnostic chart prior to performing DTC C0025 trouble chart.	–	System OK	–
5	1. Key off. 2. Inspect the left front wheel speed sensor and the jumper harness for damage. 3. Perform a complete and thorough inspection of the left front toothed ring for damage. (cracks, missing teeth, looseness) Is any physical damage noted?	–	Go to *Step 6*	Go to *Step 7*
6	Repair the damage to the left front wheel speed sensor, jumper harness and/or the toothed ring.	–	System OK	–
7	1. Vehicle in park. 2. Connect a Scan Tool and select data list. 3. Monitor the wheel speed sensors. 4. Start the vehicle, and monitor wheel speed sensors with engine running but vehicle not moving. 5. Lightly depress the accelerator pedal to increase engine idle speed. Did C0025 reset or did the left front wheel speed read above 0 mph when the vehicle was in park with the engine running.	–	Go to *Step 8*	Go to *Step 9*
8	The cause of C0025 is ignition noise coupled onto the Left Front Speed Sensor circuits. Inspect the routing of the left front ABS body harness and/or jumper harness for potential ignition noise sources such as spark plug wires. Reroute wiring as needed.	–	System OK	–
9	1. Scan tool still connected. 2. Monitor the wheel speed sensors. 3. Test-drives the vehicle up to the maximum-posted speed limit, and slowly decelerates to zero. Do this several times. Did C0025 reset or did the left front wheel speed vary more than 5 kph (3 mph) when compared to any one of the other wheels during the drive?	–	Go to *Step 11*	Go to *Step 10*
10	DTC C0025 is intermittent, refer to Diagnostic Aids.	–	System OK	–
11	1. Vehicle in park, key off. 2. Raise and suitably support the vehicle. 3. Disconnect the left front jumper harness from the Left Front Wheel Speed sensor. 4. Connect an ohmmeter to terminals 2 and 1 of the Left Front Wheel Speed sensor. Is the resistance within the specified range?	800–1600 Ohms (Resistance will vary with temperature)	Go to *Step 13*	Go to *Step 12*
12	Replace the left front wheel speed sensor.	–	System OK	–

C0025 Left Front Wheel Speed Excessive Variation (Cont'd)

Step	Action	Value	Yes	No
13	1. Speed sensor still disconnected from the jumper harness. 2. Connect a voltmeter to terminals 2 and 1 of the left front speed sensor. 3. Select the AC milli-volt scale. 4. Spin the left front wheel while observing the voltage on the meter. Is the AC voltage within the specified range?	At least 100mV	Go to *Step 14*	Go to *Step 12*
14	1. Disconnect the EBCM harness from the EBCM. 2. Disconnect the left front jumper harness from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A09 and then to ABS body harness terminal 2. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 16*	Go to *Step 15*
15	Repair the source open or high resistance between terminals A09 and 2.	–	System OK	–
16	1. EBCM harness still disconnected from the EBCM. 2. Jumper harness still disconnected from the body harness. 3. Connect an ohmmeter to EBCM harness terminal A10 and then to ABS body harness terminal 1. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 18*	Go to *Step 17*
17	Repair the open or high resistance between terminals A10 and 1.	–	System OK	–
18	1. EBCM harness still disconnected from the EBCM. 2. Jumper harness still disconnected from the body harness. 3. Connect an ohmmeter between EBCM harness terminals A09 and A10. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 20*	Go to *Step 19*
19	Repair the short between the 2 wires.	–	System OK	–
20	1. Replace the left front jumper harness. 2. Test-drive the vehicle at various speeds and road surfaces. Did C0025 reset?	–	Go to *Step 21*	System OK
21	Replace the EBCM.	–	System OK	–

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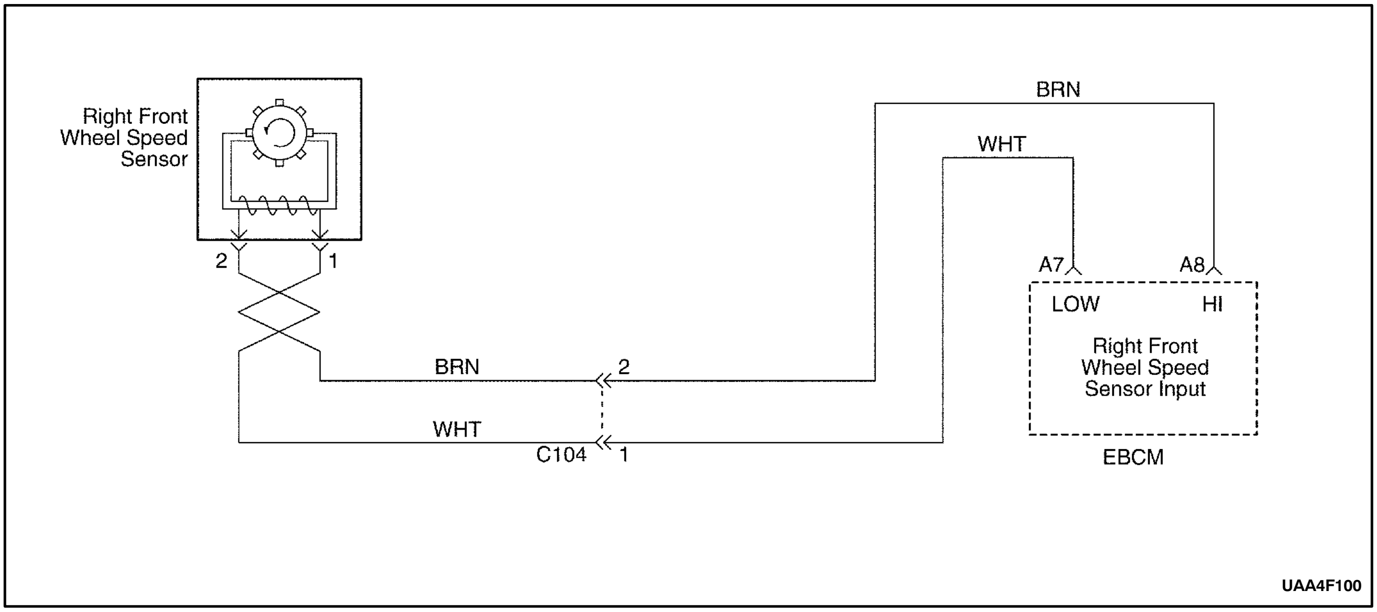
C0026 RIGHT FRONT WHEEL SPEED EXCESSIVE VARIATION



Circuit Description

As the wheel is rotated, the speed sensor produces an AC voltage that increases with wheel speed. The EBCM uses the frequency of the AC signal to calculate wheel speed. The speed sensor is connected to the EBCM by a "twisted pair" of wires. Twisting reduces noise susceptibility that may cause a DTC to set.

Conditions for Setting the DTC

All of the following must be true for C0026 to set.

- C0032 or C0033 or C0034 or C0035 not current.
- Brake switch off.
- The right front wheel speed is accelerating or decelerating beyond reasonable limits.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power from the pump motor and solenoids.
- DTC C0026 is stored.
- ABS disabled, ABS Warning Lamp turns on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0026 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

Thoroughly inspect the wiring and connectors when diagnosing intermittent DTC(s). This will include the following.

- Removal of the protective conduit and inspection for wiring for damage, shorts and contamination.
- Inspection for improperly formed and/or damaged terminals.
- Checking terminal contact (retention force) by using a spare male/female terminal.
- Removal of the terminals from the connectors to check for proper terminal to wire crimp.

If the drivers comments reflect that the ABS Warning Lamp is on only during moist environmental changes (rain, snow, vehicle wash), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. If the DTC is not current, simulate the effects of water intrusion. Use the following procedure. Spray the suspected area with a 5 percent salt-water solution. Then test-drive the vehicle over various road surfaces such as (bumps, turns, etc) above 24 kph (15 mph). If the DTC sets then replace the suspected harness and/ or sensor.

A careful visual inspection of the toothed ring for damaged such as cracks and tooth damage should be performed. If the DTC sets at the same speed every drive cycle, the toothed ring is most likely damaged.

Failure to perform the previous steps carefully and fully can result in misdiagnosis, unnecessary component replacement and reoccurrence of DTC C0026.

C0026 Right Front Wheel Speed Excessive Variation

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check prior to performing DTC C0026 trouble chart. Did you find problem?	–	Go to *Step 3*	System OK
3	Was C0033 set as a current or history DTC?	–	Go to *Step 4*	Go to *Step 5*
4	Perform C0033 diagnostic chart prior to performing DTC C0026 trouble chart.	–	System OK	–
5	1. Key off. 2. Inspect the right front wheel speed sensor and the jumper harness for damage. 3. Perform a complete and thorough inspection of the right front toothed ring for damage. (cracks, missing teeth, looseness) Is any physical damage noted?	–	Go to *Step 6*	Go to *Step 7*
6	Repair the damage to the right front wheel speed sensor, jumper harness and/or the toothed ring.	–	System OK	–
7	1. Vehicle in park. 2. Connect a Scan Tool and select data list. 3. Monitor the wheel speed sensors. 4. Start the vehicle, and monitor wheel speed sensors with engine running but vehicle not moving. 5. Lightly depress the accelerator pedal to increase engine idle speed. Did C0026 reset or did the right front wheel speed read above 0 mph when the vehicle was in park with the engine running.	–	Go to *Step 8*	Go to *Step 9*
8	The cause of C0026 is ignition noise coupled onto the Right Front Speed Sensor circuits. Inspect the routing of the right front ABS body harness and/or jumper harness for potential ignition noise sources such as spark plug wires. Reroute wiring as needed.	–	System OK	–
9	1. Scan tool still connected. 2. Monitor the wheel speed sensors. 3. Test-drives the vehicle up to the maximum-posted speed limit, and slowly decelerates to zero. Do this several times. Did C0026 reset or did the right front wheel speed vary more than 5 kph (3 mph) when compared to any one of the other wheels during the drive?	–	Go to *Step 11*	Go to *Step 10*
10	DTC C0026 is intermittent, refer to Diagnostic Aids.	–	System OK	–
11	1. Vehicle in park, key off. 2. Raise and suitably support the vehicle. 3. Disconnect the right front jumper harness from the Right Front Wheel Speed sensor. 4. Connect an ohmmeter to terminals 2 and 1 of the Right Front Wheel Speed sensor. Is the resistance within the specified range?	800–1600 Ohms (Resistance will vary with temperature)	Go to *Step 13*	Go to *Step 12*
12	Replace the right front wheel speed sensor.	–	System OK	–

C0026 Right Front Wheel Speed Excessive Variation (Cont'd)

Step	Action	Value	Yes	No
13	1. Speed sensor still disconnected from the jumper harness. 2. Connect a voltmeter to terminals 2 and 1 of the right front speed sensor. 3. Select the AC milli-volt scale. 4. Spin the right front wheel while observing the voltage on the meter. Is the AC voltage within the specified range?	At least 100mV	Go to *Step 14*	Go to *Step 12*
14	1. Disconnect the EBCM harness from the EBCM. 2. Disconnect the right front jumper harness from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A07 and then to ABS body harness terminal 2. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 16*	Go to *Step 15*
15	Repair the source open or high resistance between terminals A07 and 2.	–	System OK	–
16	1. EBCM harness still disconnected from the EBCM. 2. Jumper harness still disconnected from the body harness. 3. Connect an ohmmeter to EBCM harness terminal A08 and then to ABS body harness terminal 1. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 18*	Go to *Step 17*
17	Repair the open or high resistance between terminals A08 and 1.	–	System OK	–
18	1. EBCM harness still disconnected from the EBCM. 2. Jumper harness still disconnected from the body harness. 3. Connect an ohmmeter between EBCM harness terminals A07 and A08. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 20*	Go to *Step 19*
19	Repair the short between the 2 wires.	–	System OK	–
20	1. Replace the right front jumper harness. 2. Test-drive the vehicle at various speeds and road surfaces. Did C0026 reset?	–	Go to *Step 21*	System OK
21	Replace the EBCM.	–	System OK	–

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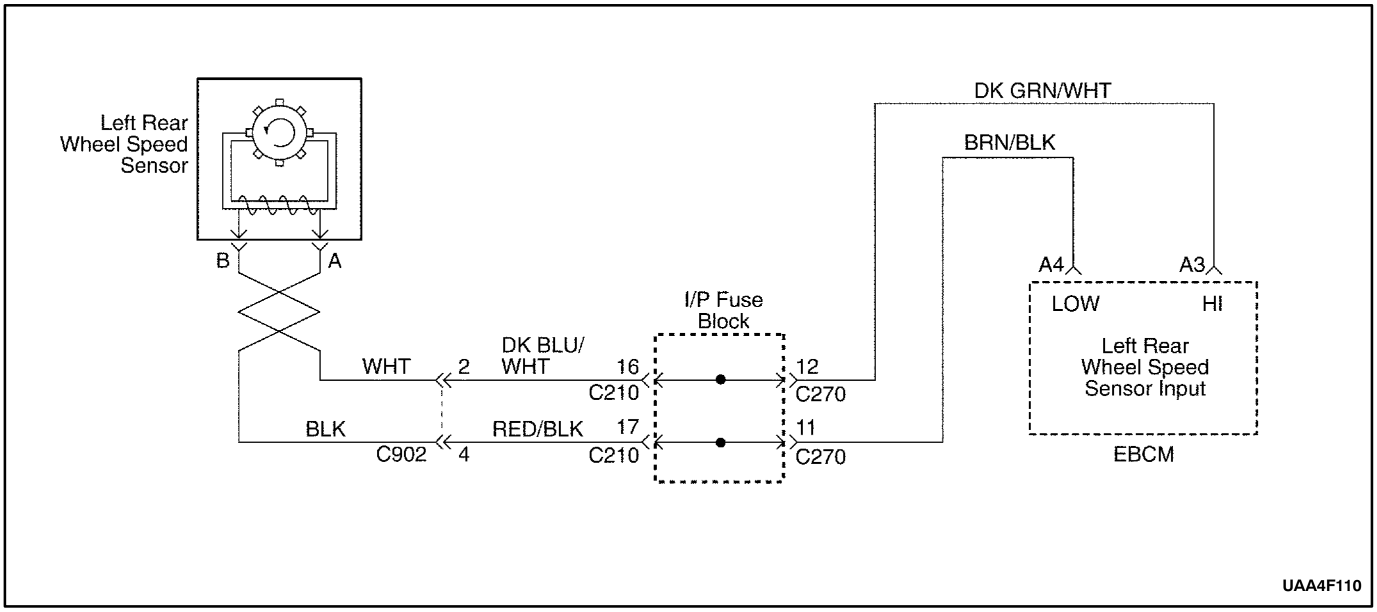
C0027 LEFT REAR WHEEL SPEED EXCESSIVE VARIATION



Circuit Description

As the wheel is rotated, the speed sensor produces an AC voltage that increases with wheel speed. The EBCM uses the frequency of the AC signal to calculate wheel speed. The speed sensor is connected to the EBCM by a “twisted pair” of wires. Twisting reduces noise susceptibility that may cause a DTC to set.

Conditions for Setting the DTC

All of the following must be true for C0027 to set.

- C0032 or C0033 or C0034 or C0035 not current.
- Brake switch off.
- The left rear wheel speed is accelerating or decelerating beyond reasonable limits.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power from the pump motor and solenoids.
- DTC C0027 is stored.
- ABS disabled, ABS Warning Lamp turns on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0027 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

Thoroughly inspect the wiring and connectors when diagnosing intermittent DTC(s). This will include the following.

- Removal of the protective conduit and inspection for wiring for damage, shorts and contamination.
- Inspection for improperly formed and/or damaged terminals.
- Checking terminal contact (retention force) by using a spare male/female terminal.
- Removal of the terminals from the connectors to check for proper terminal to wire crimp.

If the drivers comments reflect that the ABS Warning Lamp is on only during moist environmental changes (rain, snow, vehicle wash), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. If the DTC is not current, simulate the effects of water intrusion. Use the following procedure. Spray the suspected area with a 5 percent salt-water solution. Then test-drive the vehicle over various road surfaces such as (bumps, turns, etc) above 24 kph (15 mph). If the DTC sets then replace the suspected harness and/or sensor.

A careful visual inspection of the toothed ring for damaged such as cracks and tooth damage should be performed. If the DTC sets at the same speed every drive cycle, the toothed ring is most likely damaged.

Failure to perform the previous steps carefully and fully can result in misdiagnosis, unnecessary component replacement and reoccurrence of DTC C0027.

C0027 Left Rear Wheel Speed Excessive Variation

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check prior to performing DTC C0027 trouble chart. Did you find problem?	–	Go to *Step 3*	System OK
3	Was C0034 set as a current or history DTC?	–	Go to *Step 4*	Go to *Step 5*
4	Perform C0034 diagnostic chart prior to performing DTC C0027 trouble chart.	–	System OK	–
5	1. Key off. 2. Inspect the left rear wheel speed sensor and the jumper harness for damage. 3. Perform a complete and thorough inspection of the left rear toothed ring for damage. (cracks, missing teeth, looseness) Is any physical damage noted?	–	Go to *Step 6*	Go to *Step 7*
6	Repair the damage to the left rear wheel speed sensor, jumper harness and/or the toothed ring.	–	System OK	–
7	1. Vehicle in park. 2. Connect a Scan Tool and select data list. 3. Monitor the wheel speed sensors. 4. Start the vehicle, and monitor wheel speed sensors with engine running but vehicle not moving. 5. Lightly depress the accelerator pedal to increase engine idle speed. Did C0027 reset or did the left rear wheel speed read above 0 mph when the vehicle was in park with the engine running.	–	Go to *Step 8*	Go to *Step 9*
8	The cause of C0027 is ignition noise coupled onto the Left Rear Speed Sensor circuits. Inspect the routing of the left rear ABS body harness and/or jumper harness for potential ignition noise sources such as spark plug wires. Reroute wiring as needed.	–	System OK	–
9	1. Scan tool still connected. 2. Monitor the wheel speed sensors. 3. Test-drives the vehicle up to the maximum-posted speed limit, and slowly decelerates to zero. Do this several times. Did C0027 reset or did the left rear wheel speed vary more than 5 kph (3 mph) when compared to any one of the other wheels during the drive?	–	Go to *Step 11*	Go to *Step 10*
10	DTC C0027 is intermittent, refer to Diagnostic Aids.	–	System OK	–
11	1. Vehicle in park, key off. 2. Raise and suitably support the vehicle. 3. Disconnect the left rear jumper harness from the Left Rear Wheel Speed sensor. 4. Connect an ohmmeter to terminals A and B of the Left Rear Wheel Speed sensor. Is the resistance within the specified range?	800–1600 Ohms (Resistance will vary with temperature)	Go to *Step 13*	Go to *Step 12*
12	Replace the left rear wheel speed sensor.	–	System OK	–

C0027 Left Rear Wheel Speed Excessive Variation (Cont'd)

Step	Action	Value	Yes	No
13	1. Speed sensor still disconnected from the jumper harness. 2. Connect a voltmeter to terminals A and B of the left rear speed sensor. 3. Select the AC milli-volt scale. 4. Spin the left rear wheel while observing the voltage on the meter. Is the AC voltage within the specified range?	At least 100mV	Go to *Step 14*	Go to *Step 12*
14	1. Disconnect the EBCM harness from the EBCM. 2. Disconnect the left rear jumper harness from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A03 and then to ABS body harness terminal A. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 16*	Go to *Step 15*
15	Repair the source open or high resistance between terminals A03 and A.	–	System OK	–
16	1. EBCM harness still disconnected from the EBCM. 2. Jumper harness still disconnected from the body harness. 3. Connect an ohmmeter to EBCM harness terminal A04 and then to ABS body harness terminal B. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 18*	Go to *Step 17*
17	Repair the open or high resistance between terminals A04 and B.	–	System OK	–
18	1. EBCM harness still disconnected from the EBCM. 2. Jumper harness still disconnected from the body harness. 3. Connect an ohmmeter between EBCM harness terminals A03 and A04. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 20*	Go to *Step 19*
19	Repair the short between the 2 wires.	–	System OK	–
20	1. Replace the left rear jumper harness. 2. Test-drive the vehicle at various speeds and road surfaces. Did C0027 reset?	–	Go to *Step 21*	System OK
21	Replace the EBCM.	–	System OK	–

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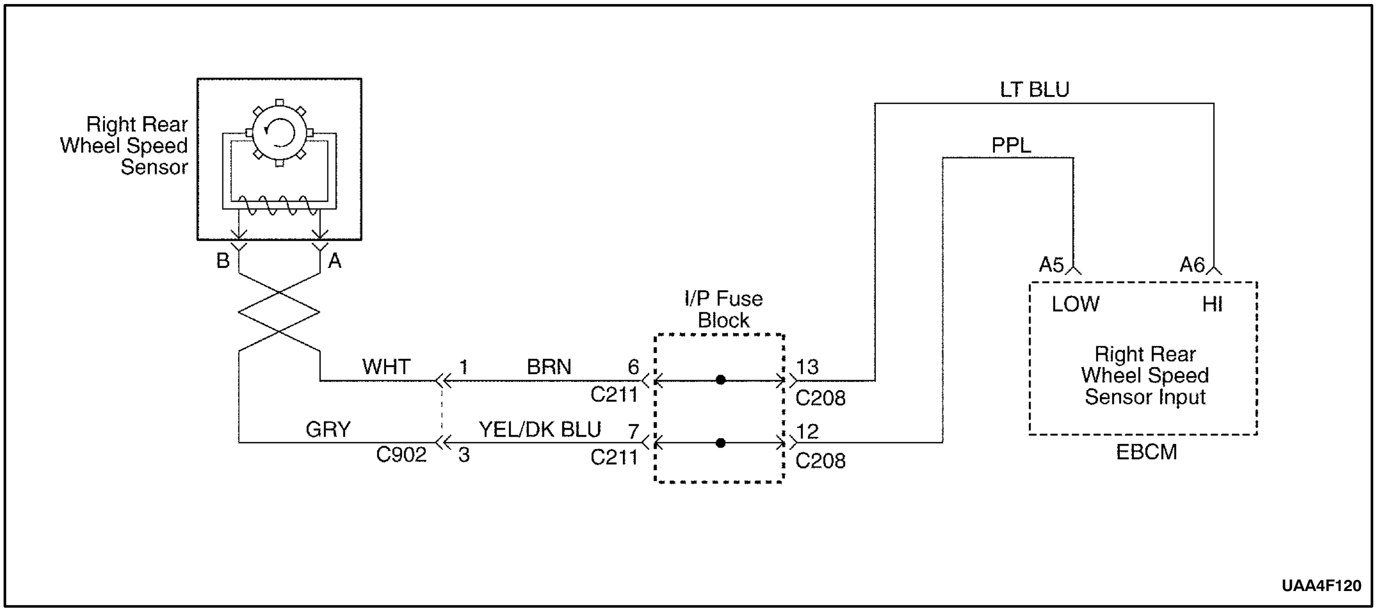
C0028 RIGHT REAR WHEEL SPEED EXCESSIVE VARIATION



Circuit Description

As the wheel is rotated, the speed sensor produces an AC voltage that increases with wheel speed. The EBCM uses the frequency of the AC signal to calculate wheel speed. The speed sensor is connected to the EBCM by a "twisted pair" of wires. Twisting reduces noise susceptibility that may cause a DTC to set.

Conditions for Setting the DTC

All of the following must be true for C0028 to set.

- C0032 or C0033 or C0034 or C0035 not current.
- Brake switch off.
- The right rear wheel speed is accelerating or decelerating beyond reasonable limits.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power from the pump motor and solenoids.
- DTC C0028 is stored.
- ABS disabled, ABS Warning Lamp turns on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0028 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

Thoroughly inspect the wiring and connectors when diagnosing intermittent DTC(s). This will include the following.

- Removal of the protective conduit and inspection for wiring for damage, shorts and contamination.
- Inspection for improperly formed and/or damaged terminals.
- Checking terminal contact (retention force) by using a spare male/female terminal.
- Removal of the terminals from the connectors to check for proper terminal to wire crimp.

If the drivers comments reflect that the ABS Warning Lamp is on only during moist environmental changes (rain, snow, vehicle wash), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. If the DTC is not current, simulate the effects of water intrusion. Use the following procedure. Spray the suspected area with a 5 percent salt-water solution. Then test-drive the vehicle over various road surfaces such as (bumps, turns, etc) above 24 kph (15 mph). If the DTC sets then replace the suspected harness and/or sensor.

A careful visual inspection of the toothed ring for damaged such as cracks and tooth damage should be performed. If the DTC sets at the same speed every drive cycle, the toothed ring is most likely damaged.

Failure to perform the previous steps carefully and fully can result in misdiagnosis, unnecessary component replacement and reoccurrence of DTC C0028.

C0028 Right Rear Wheel Speed Excessive Variation

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check prior to performing DTC C0028 trouble chart. Did you find problem?	–	Go to *Step 3*	System OK
3	Was C0035 set as a current or history DTC?	–	Go to *Step 4*	Go to *Step 5*
4	Perform C0035 diagnostic chart prior to performing DTC C0028 trouble chart.	–	System OK	–
5	1. Key off. 2. Inspect the right rear wheel speed sensor and the jumper harness for damage. 3. Perform a complete and thorough inspection of the right rear toothed ring for damage. (cracks, missing teeth, looseness) Is any physical damage noted?	–	Go to *Step 6*	Go to *Step 7*
6	Repair the damage to the right rear wheel speed sensor, jumper harness and/or the toothed ring.	–	System OK	–
7	1. Vehicle in park. 2. Connect a Scan Tool and select data list. 3. Monitor the wheel speed sensors. 4. Start the vehicle, and monitor wheel speed sensors with engine running but vehicle not moving. 5. Lightly depress the accelerator pedal to increase engine idle speed. Did C0028 reset or did the right rear wheel speed read above 0 mph when the vehicle was in park with the engine running.	–	Go to *Step 8*	Go to *Step 9*
8	The cause of C0028 is ignition noise coupled onto the Right Rear Speed Sensor circuits. Inspect the routing of the right rear ABS body harness and/or jumper harness for potential ignition noise sources such as spark plug wires. Reroute wiring as needed.	–	System OK	–
9	1. Scan tool still connected. 2. Monitor the wheel speed sensors. 3. Test-drives the vehicle up to the maximum-posted speed limit, and slowly decelerates to zero. Do this several times. Did C0028 reset or did the right rear wheel speed vary more than 5 kph (3 mph) when compared to any one of the other wheels during the drive?	–	Go to *Step 11*	Go to *Step 10*
10	DTC C0028 is intermittent, refer to Diagnostic Aids.	–	System OK	–
11	1. Vehicle in park, key off. 2. Raise and suitably support the vehicle. 3. Disconnect the right rear jumper harness from the Right Rear Wheel Speed sensor. 4. Connect an ohmmeter to terminals B and A of the Right Rear Wheel Speed sensor. Is the resistance within the specified range?	800–1600 Ohms (Resistance will vary with temperature)	Go to *Step 13*	Go to *Step 12*
12	Replace the right rear wheel speed sensor.	–	System OK	–

C0028 Right Rear Wheel Speed Excessive Variation (Cont'd)

Step	Action	Value	Yes	No
13	1. Speed sensor still disconnected from the jumper harness. 2. Connect a voltmeter to terminals B and A of the right rear speed sensor. 3. Select the AC milli-volt scale. 4. Spin the right rear wheel while observing the voltage on the meter. Is the AC voltage within the specified range?	At least 100mV	Go to *Step 14*	Go to *Step 12*
14	1. Disconnect the EBCM harness from the EBCM. 2. Disconnect the right rear jumper harness from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A05 and then to ABS body harness terminal B. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 16*	Go to *Step 15*
15	Repair the source open or high resistance between terminals A05 and B.	–	System OK	–
16	1. EBCM harness still disconnected from the EBCM. 2. Jumper harness still disconnected from the body harness. 3. Connect an ohmmeter to EBCM harness terminal A06 and then to ABS body harness terminal A. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 18*	Go to *Step 17*
17	Repair the open or high resistance between terminals A06 and A.	–	System OK	–
18	1. EBCM harness still disconnected from the EBCM. 2. Jumper harness still disconnected from the body harness. 3. Connect an ohmmeter between EBCM harness terminals A05 and A06. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 20*	Go to *Step 19*
19	Repair the short between the 2 wires.	–	System OK	–
20	1. Replace the right rear jumper harness. 2. Test-drive the vehicle at various speeds and road surfaces. Did C0028 reset?	–	Go to *Step 21*	System OK
21	Replace the EBCM.	–	System OK	–

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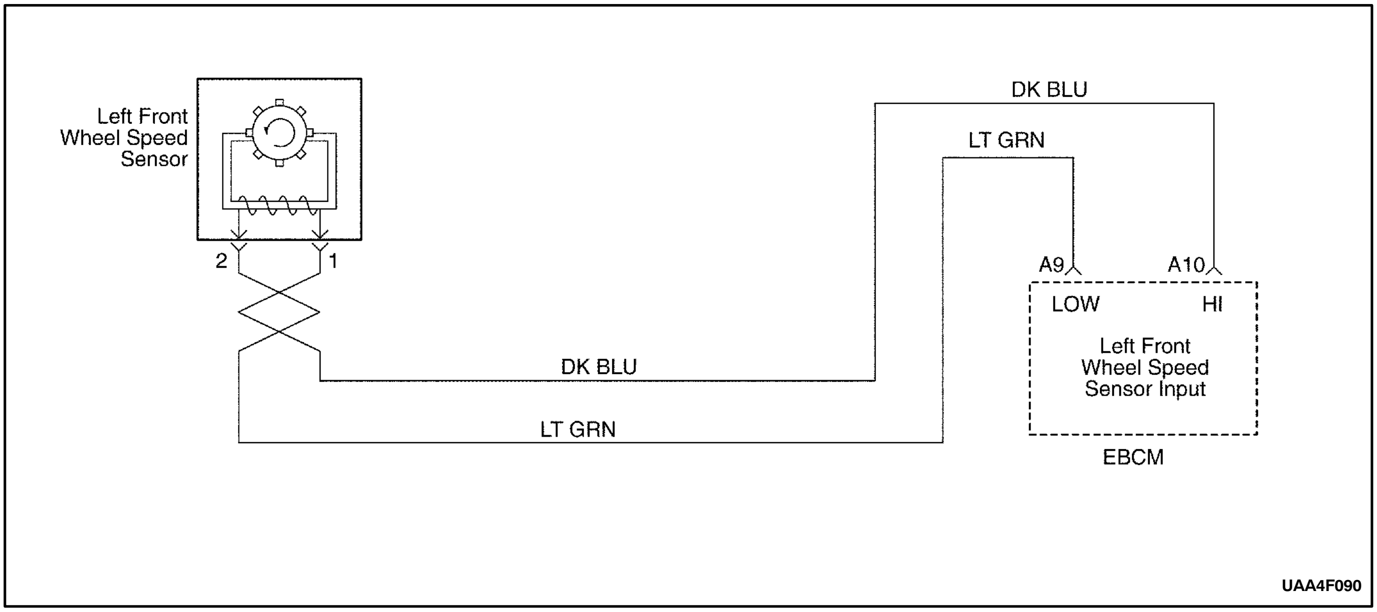
C0032 LEFT FRONT WHEEL SPEED SENSOR CIRCUIT OPEN OR SHORTED



Circuit Description

As the wheel is rotated, the speed sensor produces an AC voltage that increases with wheel speed. The EBCM uses the frequency of the AC signal to calculate wheel speed. The speed sensor is connected to the EBCM by a "twisted pair" of wires. Twisting reduces noise susceptibility that may cause a DTC to set.

Conditions for Setting the DTC

DTC C0032 can be set anytime the key is on and the EBCM has detected an open, short to ground or a short to battery on the left front wheel speed circuit.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power to the pump motor and solenoids.
- DTC C0032 is stored.
- ABS disabled, ABS Warning Lamp turns on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0032 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

Thoroughly inspect the wiring and connectors when diagnosing intermittent DTC(s). This will include the following.

- Removal of the protective conduit and inspection to wiring for damage, shorts and contamination.
- Inspection for improperly formed and/or damaged terminals.
- Checking terminal contact (retention force) by using a spare male/female terminal.
- Removal of the terminals from the connectors to check for proper terminal to wire crimp.

If the drivers comments reflect that the ABS Warning Lamp is on only during moist environmental changes (rain, snow, vehicle wash), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. If the DTC is not current, simulate the effects of water intrusion. Use the following procedure. Spray the suspected area with a 5 percent salt-water solution. Then test-drive the vehicle over various road surfaces such as (bumps, turns, etc) above 24 kph (15 mph). If the DTC sets then replace the suspected harness and or sensor.

When measuring wheel speed sensor resistance insure the vehicle is at room temperature, since resistance will increase with temperature

Failure to perform the previous steps carefully and fully can result in misdiagnosis, unnecessary component replacement and reoccurrence of DTC C0032.

C0032 Left Front Wheel Speed Sensor Circuit Open or Shorted

Step	Action	Value	Yes	No
1	Was the diagnostic circuit check performed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Key off. 2. Inspect the left front wheel speed sensor, jumper harness and the toothed ring for physical damage. Is any physical damage noted?	–	Go to *Step 4*	Go to *Step 5*
4	Repair the damage to the left front wheel speed sensor, jumper harness and/or toothed ring.	–	System OK	–
5	Test–drive vehicle at various speeds and over various road surfaces. Did C0032 reset?	–	Go to *Step 7*	Go to *Step 6*
6	DTC C0032 is intermittent. Refer to Diagnostic Aids.	–	System OK	–
7	1. Key off, vehicle in park. 2. Raise and suitably support the vehicle. 3. Disconnect the left front jumper harness from the Left Front Wheel Speed Sensor. 4. Connect an ohmmeter to terminals 2 and 1 of the Left Front Wheel Speed Sensor. Is the resistance with in specified range?	800–1600 Ohms (Resistance will vary with temperature)	Go to *Step 9*	Go to *Step 8*
8	Replace the left front wheel speed sensor.	–	System OK	–
9	1. Left front jumper harness still disconnected from the speed sensor. 2. Connect an ohmmeter to terminal 2 of the left front wheel speed sensor and then to body ground. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 10*	Go to *Step 8*
10	1. Disconnect the EBCM harness from the EBCM. 2. Disconnect the left front jumper harness from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A09 and then the ABS body harness terminal 2. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 12*	Go to *Step 11*
11	Repair the open or high resistance between terminals A09 and 2.	–	System OK	–
12	1. EBCM harness still disconnected from the EBCM. 2. Left front jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A10 and then to ABS body harness terminal 1. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 4*	Go to *Step 13*
13	Repair the open or high resistance between terminals A10 and 1.	–	System OK	–
14	1. EBCM harness still disconnected from the EBCM. 2. Left front jumper harness still disconnected from the ABS body harness. 3. Connect a voltmeter to EBCM harness terminal A09 and then to body ground. Is the voltage within the specified range?	Less than 1 volt	Go to *Step 16*	Go to *Step 15*

C0032 Left Front Wheel Speed Sensor Circuit Open or Shorted (Cont'd)

Step	Action	Value	Yes	No
15	Repair the short to voltage between terminals A09 and 2.	–	System OK	–
16	1. EBCM harness still disconnected from the EBCM. 2. Left front jumper harness still disconnected from the ABS body harness. 3. Connect a voltmeter to EBCM harness terminal A10 and then to body ground. Is the voltage within the specified range?	Less than 1 volt	Go to *Step 18*	Go to *Step 17*
17	Repair the short to voltage between terminals A10 and 1.	–	System OK	–
18	1. EBCM harness still disconnected from the EBCM. 2. Left front jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A09 and then to body ground. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 20*	Go to *Step 19*
19	Repair the short to ground between terminals A09 and 2.	–	System OK	–
20	1. EBCM harness still disconnected from the EBCM. 2. Left front jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A10 and then to body ground. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 22*	Go to *Step 21*
21	Repair the short to ground between terminals A10 and 1.	–	System OK	–
22	1. EBCM harness still disconnected from the EBCM. 2. Left front jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A09 and A10. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 24*	Go to *Step 23*
23	Repair the short between the 2 circuits.	–	System OK	–
24	1. Replace the Left Front Wheel Speed Sensor Jumper Harness. 2. Test-drive the vehicle at various speeds and various road surfaces. Did C0032 reset?	–	Go to *Step 25*	System OK
25	Replace the EBCM.	–	System OK	–

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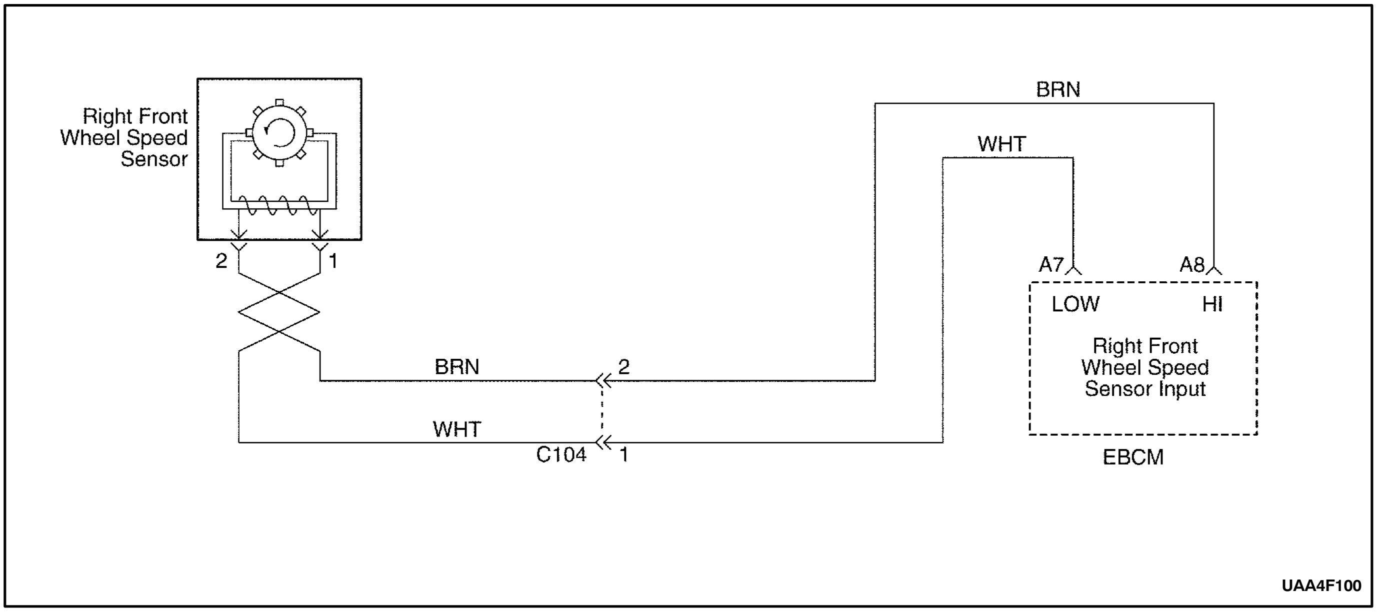
C0033 RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT OPEN OR SHORTED



Circuit Description

As the wheel is rotated, the speed sensor produces an AC voltage that increases with wheel speed. The EBCM uses the frequency of the AC signal to calculate wheel speed. The speed sensor is connected to the EBCM by a "twisted pair" of wires. Twisting reduces noise susceptibility that may cause a DTC to set.

Conditions for Setting the DTC

DTC C0033 can be set anytime the key is on and the EBCM has detected an open, short to ground or a short to battery on the right front wheel speed circuit.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power to the pump motor and solenoids.
- DTC C0033 is stored.
- ABS disabled, ABS Warning Lamp turns on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0033 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

Thoroughly inspect the wiring and connectors when diagnosing intermittent DTC(s). This will include the following.

- Removal of the protective conduit and inspection to wiring for damage, shorts and contamination.
- Inspection for improperly formed and/or damaged terminals.
- Checking terminal contact (retention force) by using a spare male/female terminal.
- Removal of the terminals from the connectors to check for proper terminal to wire crimp.

If the drivers comments reflect that the ABS Warning Lamp is on only during moist environmental changes (rain, snow, vehicle wash), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. If the DTC is not current, simulate the effects of water intrusion. Use the following procedure. Spray the suspected area with a 5 percent salt-water solution. Then test-drive the vehicle over various road surfaces such as (bumps, turns, etc) above 24 kph (15 mph). If the DTC sets then replace the suspected harness and or sensor.

When measuring wheel speed sensor resistance insure the vehicle is at room temperature, since resistance will increase with temperature

Failure to perform the previous steps carefully and fully can result in misdiagnosis, unnecessary component replacement and reoccurrence of DTC C0033.

C0033 Right Front Wheel Speed Sensor Circuit Open or Shorted

Step	Action	Value	Yes	No
1	Was the diagnostic circuit check performed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Key off. 2. Inspect the right front wheel speed sensor, jumper harness and the toothed ring for physical damage. Is any physical damage noted?	–	Go to *Step 4*	Go to *Step 5*
4	Repair the damage to the right front wheel speed sensor, jumper harness and/or toothed ring.	–	System OK	–
5	Test-drive vehicle at various speeds and over various road surfaces. Did C0033 reset?	–	Go to *Step 7*	Go to *Step 6*
6	DTC C0033 is intermittent. Refer to Diagnostic Aids.	–	System OK	–
7	1. Key off, vehicle in park. 2. Raise and suitably support the vehicle. 3. Disconnect the right front jumper harness from the Right Front Wheel Speed Sensor. 4. Connect an ohmmeter to terminals 2 and 1 of the Right Front Wheel Speed Sensor. Is the resistance with in specified range?	800–1600 Ohms (Resistance will vary with temperature)	Go to *Step 9*	Go to *Step 8*
8	Replace the right front wheel speed sensor.	–	System OK	–
9	1. Right front jumper harness still disconnected from the speed sensor. 2. Connect an ohmmeter to terminal 2 of the right front wheel speed sensor and then to body ground. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 10*	Go to *Step 8*
10	1. Disconnect the EBCM harness from the EBCM. 2. Disconnect the right front jumper harness from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A07 and then the ABS body harness terminal 2. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 12*	Go to *Step 11*
11	Repair the open or high resistance between terminals A07 and 2.	–	System OK	–
12	1. EBCM harness still disconnected from the EBCM. 2. Right front jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A08 and then to ABS body harness terminal 1. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 4*	Go to *Step 13*
13	Repair the open or high resistance between terminals A08 and 1.	–	System OK	–
14	1. EBCM harness still disconnected from the EBCM. 2. Right front jumper harness still disconnected from the ABS body harness. 3. Connect a voltmeter to EBCM harness terminal A07 and then to body ground. Is the voltage within the specified range?	Less than 1 volt	Go to *Step 16*	Go to *Step 15*

C0033 Right Front Wheel Speed Sensor Circuit Open or Shorted (Cont'd)

Step	Action	Value	Yes	No
15	Repair the short to voltage between terminals A07 and 2.	–	System OK	–
16	1. EBCM harness still disconnected from the EBCM. 2. Right front jumper harness still disconnected from the ABS body harness. 3. Connect a voltmeter to EBCM harness terminal A08 and then to body ground. Is the voltage within the specified range?	Less than 1 volt	Go to *Step 18*	Go to *Step 17*
17	Repair the short to voltage between terminals A08 and 1.	–	System OK	–
18	1. EBCM harness still disconnected from the EBCM. 2. Right front jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A07 and then to body ground. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 20*	Go to *Step 19*
19	Repair the short to ground between terminals A07 and 2.	–	System OK	–
20	1. EBCM harness still disconnected from the EBCM. 2. Right front jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A08 and then to body ground. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 22*	Go to *Step 21*
21	Repair the short to ground between terminals A08 and 1.	–	System OK	–
22	1. EBCM harness still disconnected from the EBCM. 2. Right front jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A07 and A08. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 24*	Go to *Step 23*
23	Repair the short between the 2 circuits.	–	System OK	–
24	1. Replace the Right Front Wheel Speed Sensor Jumper Harness. 2. Test-drive the vehicle at various speeds and various road surfaces. Did C0033 reset?	–	Go to *Step 25*	System OK
25	Replace the EBCM.	–	System OK	–

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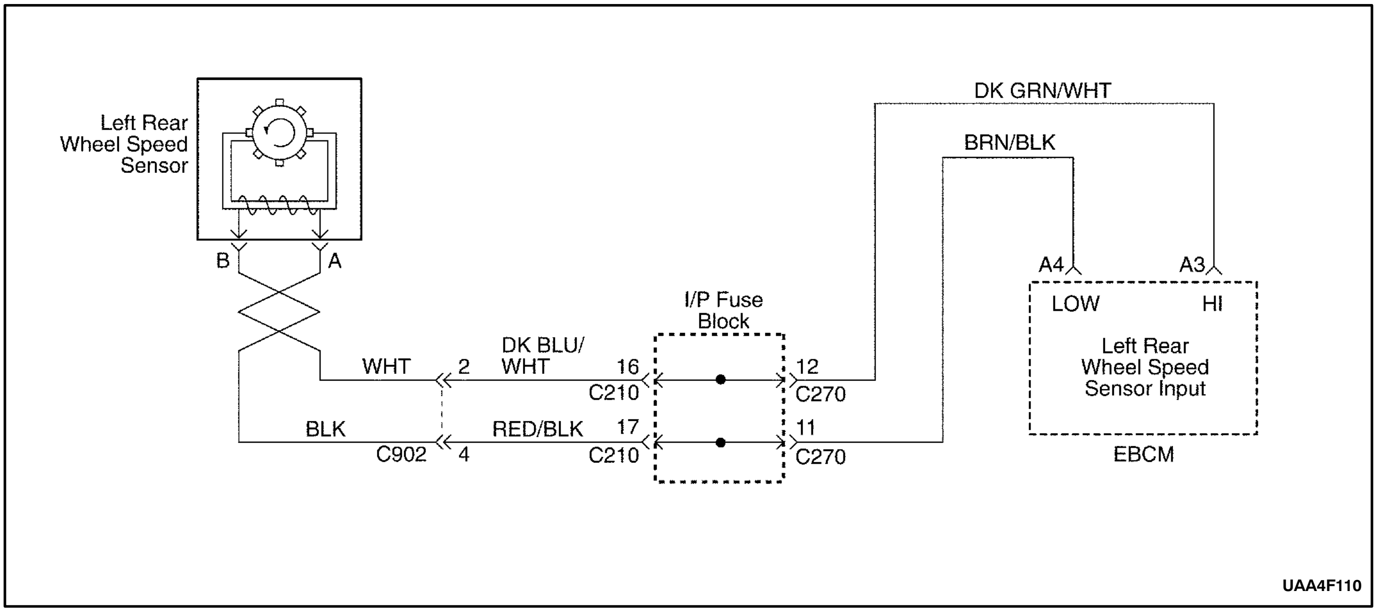
C0034 LEFT REAR WHEEL SPEED SENSOR CIRCUIT OPEN OR SHORTED



Circuit Description

As the wheel is rotated, the speed sensor produces an AC voltage that increases with wheel speed. The EBCM uses the frequency of the AC signal to calculate wheel speed. The speed sensor is connected to the EBCM by a "twisted pair" of wires. Twisting reduces noise susceptibility that may cause a DTC to set.

Conditions for Setting the DTC

DTC C0034 can be set anytime the key is on and the EBCM has detected an open, short to ground or a short to battery on the left rear wheel speed circuit.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power to the pump motor and solenoids.
- DTC C0034 is stored.
- ABS disabled, ABS Warning Lamp turns on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0034 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

Thoroughly inspect the wiring and connectors when diagnosing intermittent DTC(s). This will include the following.

- Removal of the protective conduit and inspection to wiring for damage, shorts and contamination.
- Inspection for improperly formed and/or damaged terminals.
- Checking terminal contact (retention force) by using a spare male/female terminal.
- Removal of the terminals from the connectors to check for proper terminal to wire crimp.

If the drivers comments reflect that the ABS Warning Lamp is on only during moist environmental changes (rain, snow, vehicle wash), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. If the DTC is not current, simulate the effects of water intrusion. Use the following procedure. Spray the suspected area with a 5 percent salt-water solution. Then test-drive the vehicle over various road surfaces such as (bumps, turns, etc) above 24 kph (15 mph). If the DTC sets then replace the suspected harness and or sensor.

When measuring wheel speed sensor resistance insure the vehicle is at room temperature, since resistance will increase with temperature

Failure to perform the previous steps carefully and fully can result in misdiagnosis, unnecessary component replacement and reoccurrence of DTC C0034.

C0034 Left Rear Wheel Speed Sensor Circuit Open or Shorted

Step	Action	Value	Yes	No
1	Was the diagnostic circuit check performed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Key off. 2. Inspect the left rear wheel speed sensor, jumper harness and the toothed ring for physical damage. Is any physical damage noted?	–	Go to *Step 4*	Go to *Step 5*
4	Repair the damage to the left rear wheel speed sensor, jumper harness and/or toothed ring.	–	System OK	–
5	Test-drive vehicle at various speeds and over various road surfaces. Did C0034 reset?	–	Go to *Step 7*	Go to *Step 6*
6	DTC C0034 is intermittent. Refer to Diagnostic Aids.	–	System OK	–
7	1. Key off, vehicle in park. 2. Raise and suitably support the vehicle. 3. Disconnect the left rear jumper harness from the Left Rear Wheel Speed Sensor. 4. Connect an ohmmeter to terminals A and B of the Left Rear Wheel Speed Sensor. Is the resistance with in specified range?	800–1600 Ohms (Resistance will vary with temperature)	Go to *Step 9*	Go to *Step 8*
8	Replace the left rear wheel speed sensor.	–	System OK	–
9	1. Left Rear jumper harness still disconnected from the speed sensor. 2. Connect an ohmmeter to terminal A of the left rear wheel speed sensor and then to body ground. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 10*	Go to *Step 8*
10	1. Disconnect the EBCM harness from the EBCM. 2. Disconnect the left rear jumper harness from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A03 and then the ABS body harness terminal A. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 12*	Go to *Step 11*
11	Repair the open or high resistance between terminals A03 and A.	–	System OK	–
12	1. EBCM harness still disconnected from the EBCM. 2. Left Rear jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A04 and then to ABS body harness terminal B. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 4*	Go to *Step 13*
13	Repair the open or high resistance between terminals A04 and B.	–	System OK	–
14	1. EBCM harness still disconnected from the EBCM. 2. Left Rear jumper harness still disconnected from the ABS body harness. 3. Connect a voltmeter to EBCM harness terminal A03 and then to body ground. Is the voltage within the specified range?	Less than 1 volt	Go to *Step 16*	Go to *Step 15*

C0034 Left Rear Wheel Speed Sensor Circuit Open or Shorted (Cont'd)

Step	Action	Value	Yes	No
15	Repair the short to voltage between terminals A03 and A.	–	System OK	–
16	1. EBCM harness still disconnected from the EBCM. 2. Left Rear jumper harness still disconnected from the ABS body harness. 3. Connect a voltmeter to EBCM harness terminal A04 and then to body ground. Is the voltage within the specified range?	Less than 1 volt	Go to *Step 18*	Go to *Step 17*
17	Repair the short to voltage between terminals A04 and B.	–	System OK	–
18	1. EBCM harness still disconnected from the EBCM. 2. Left Rear jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A03 and then to body ground. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 20*	Go to *Step 19*
19	Repair the short to ground between terminals A03 and A.	–	System OK	–
20	1. EBCM harness still disconnected from the EBCM. 2. Left Rear jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A04 and then to body ground. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 22*	Go to *Step 21*
21	Repair the short to ground between terminals A04 and B.	–	System OK	–
22	1. EBCM harness still disconnected from the EBCM. 2. Left Rear jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A03 and A04. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 24*	Go to *Step 23*
23	Repair the short between the 2 circuits.	–	System OK	–
24	1. Replace the Left Rear Wheel Speed Sensor Jumper Harness. 2. Test-drive the vehicle at various speeds and various road surfaces. Did C0034 reset?	–	Go to *Step 25*	System OK
25	Replace the EBCM.	–	System OK	–

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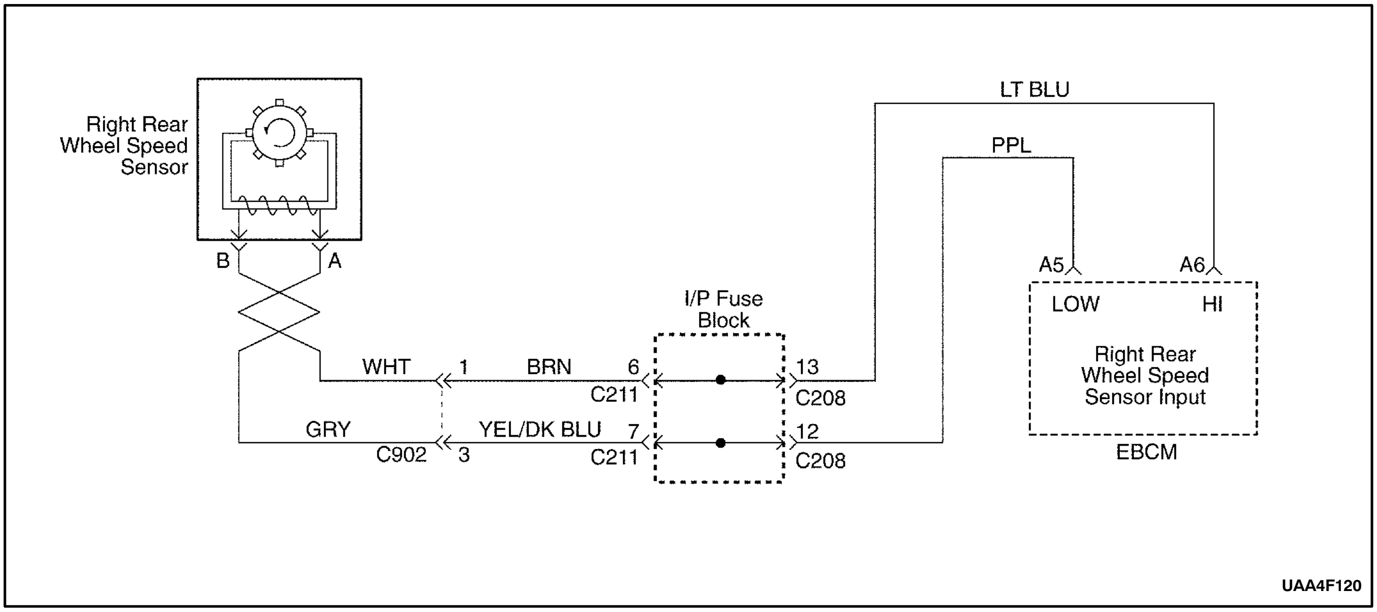
C0035 RIGHT REAR WHEEL SPEED SENSOR CIRCUIT OPEN OR SHORTED



Circuit Description

As the wheel is rotated, the speed sensor produces an AC voltage that increases with wheel speed. The EBCM uses the frequency of the AC signal to calculate wheel speed. The speed sensor is connected to the EBCM by a "twisted pair" of wires. Twisting reduces noise susceptibility that may cause a DTC to set.

Conditions for Setting the DTC

DTC C0035 can be set anytime the key is on and the EBCM has detected an open, short to ground or a short to battery on the right rear wheel speed circuit.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power to the pump motor and solenoids.
- DTC C0035 is stored.
- ABS disabled, ABS Warning Lamp turns on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0035 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

Thoroughly inspect the wiring and connectors when diagnosing intermittent DTC(s). This will include the following.

- Removal of the protective conduit and inspection to wiring for damage, shorts and contamination.
- Inspection for improperly formed and/or damaged terminals.
- Checking terminal contact (retention force) by using a spare male/female terminal.
- Removal of the terminals from the connectors to check for proper terminal to wire crimp.

If the drivers comments reflect that the ABS Warning Lamp is on only during moist environmental changes (rain, snow, vehicle wash), all wheel speed sensor circuitry should be thoroughly inspected for signs of water intrusion. If the DTC is not current, simulate the effects of water intrusion. Use the following procedure. Spray the suspected area with a 5 percent salt-water solution. Then test-drive the vehicle over various road surfaces such as (bumps, turns, etc) above 24 kph (15 mph). If the DTC sets then replace the suspected harness and or sensor.

When measuring wheel speed sensor resistance insure the vehicle is at room temperature, since resistance will increase with temperature

Failure to perform the previous steps carefully and fully can result in misdiagnosis, unnecessary component replacement and reoccurrence of DTC C0035.

C0035 Right Rear Wheel Speed Sensor Circuit Open or Shorted

Step	Action	Value	Yes	No
1	Was the diagnostic circuit check performed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Key off. 2. Inspect the right rear wheel speed sensor, jumper harness and the toothed ring for physical damage. Is any physical damage noted?	–	Go to *Step 4*	Go to *Step 5*
4	Repair the damage to the right rear wheel speed sensor, jumper harness and/or toothed ring.	–	System OK	–
5	Test-drive vehicle at various speeds and over various road surfaces. Did C0035 reset?	–	Go to *Step 7*	Go to *Step 6*
6	DTC C0035 is intermittent. Refer to Diagnostic Aids.	–	System OK	–
7	1. Key off, vehicle in park. 2. Raise and suitably support the vehicle. 3. Disconnect the right rear jumper harness from the Right Rear Wheel Speed Sensor. 4. Connect an ohmmeter to terminals B and A of the Right Rear Wheel Speed Sensor. Is the resistance with in specified range?	800–1600 Ohms (Resistance will vary with temperature)	Go to *Step 9*	Go to *Step 8*
8	Replace the right rear wheel speed sensor.	–	System OK	–
9	1. Right Rear jumper harness still disconnected from the speed sensor. 2. Connect an ohmmeter to terminal B of the right rear wheel speed sensor and then to body ground. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 10*	Go to *Step 8*
10	1. Disconnect the EBCM harness from the EBCM. 2. Disconnect the right rear jumper harness from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A05 and then the ABS body harness terminal B. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 12*	Go to *Step 11*
11	Repair the open or high resistance between terminals A05 and B.	–	System OK	–
12	1. EBCM harness still disconnected from the EBCM. 2. Right Rear jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A06 and then to ABS body harness terminal A. Is the resistance within the specified range?	Less than 2 ohms	Go to *Step 4*	Go to *Step 13*
13	Repair the open or high resistance between terminals A06 and A.	–	System OK	–
14	1. EBCM harness still disconnected from the EBCM. 2. Right Rear jumper harness still disconnected from the ABS body harness. 3. Connect a voltmeter to EBCM harness terminal A05 and then to body ground. Is the voltage within the specified range?	Less than 1 volt	Go to *Step 16*	Go to *Step 15*

C0035 Right Rear Wheel Speed Sensor Circuit Open or Shorted (Cont'd)

Step	Action	Value	Yes	No
15	Repair the short to voltage between terminals A05 and B.	–	System OK	–
16	1. EBCM harness still disconnected from the EBCM. 2. Right Rear jumper harness still disconnected from the ABS body harness. 3. Connect a voltmeter to EBCM harness terminal A06 and then to body ground. Is the voltage within the specified range?	Less than 1 volt	Go to *Step 18*	Go to *Step 17*
17	Repair the short to voltage between terminals A06 and A.	–	System OK	–
18	1. EBCM harness still disconnected from the EBCM. 2. Right Rear jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A05 and then to body ground. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 20*	Go to *Step 19*
19	Repair the short to ground between terminals A05 and B.	–	System OK	–
20	1. EBCM harness still disconnected from the EBCM. 2. Right Rear jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A06 and then to body ground. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 22*	Go to *Step 21*
21	Repair the short to ground between terminals A06 and A.	–	System OK	–
22	1. EBCM harness still disconnected from the EBCM. 2. Right Rear jumper harness still disconnected from the ABS body harness. 3. Connect an ohmmeter to EBCM harness terminal A05 and A06. Is the resistance within the specified range?	OL (open circuit)	Go to *Step 24*	Go to *Step 23*
23	Repair the short between the 2 circuits.	–	System OK	–
24	1. Replace the Right Rear Wheel Speed Sensor Jumper Harness. 2. Test-drive the vehicle at various speeds and various road surfaces. Did C0035 reset?	–	Go to *Step 25*	System OK
25	Replace the EBCM.	–	System OK	–

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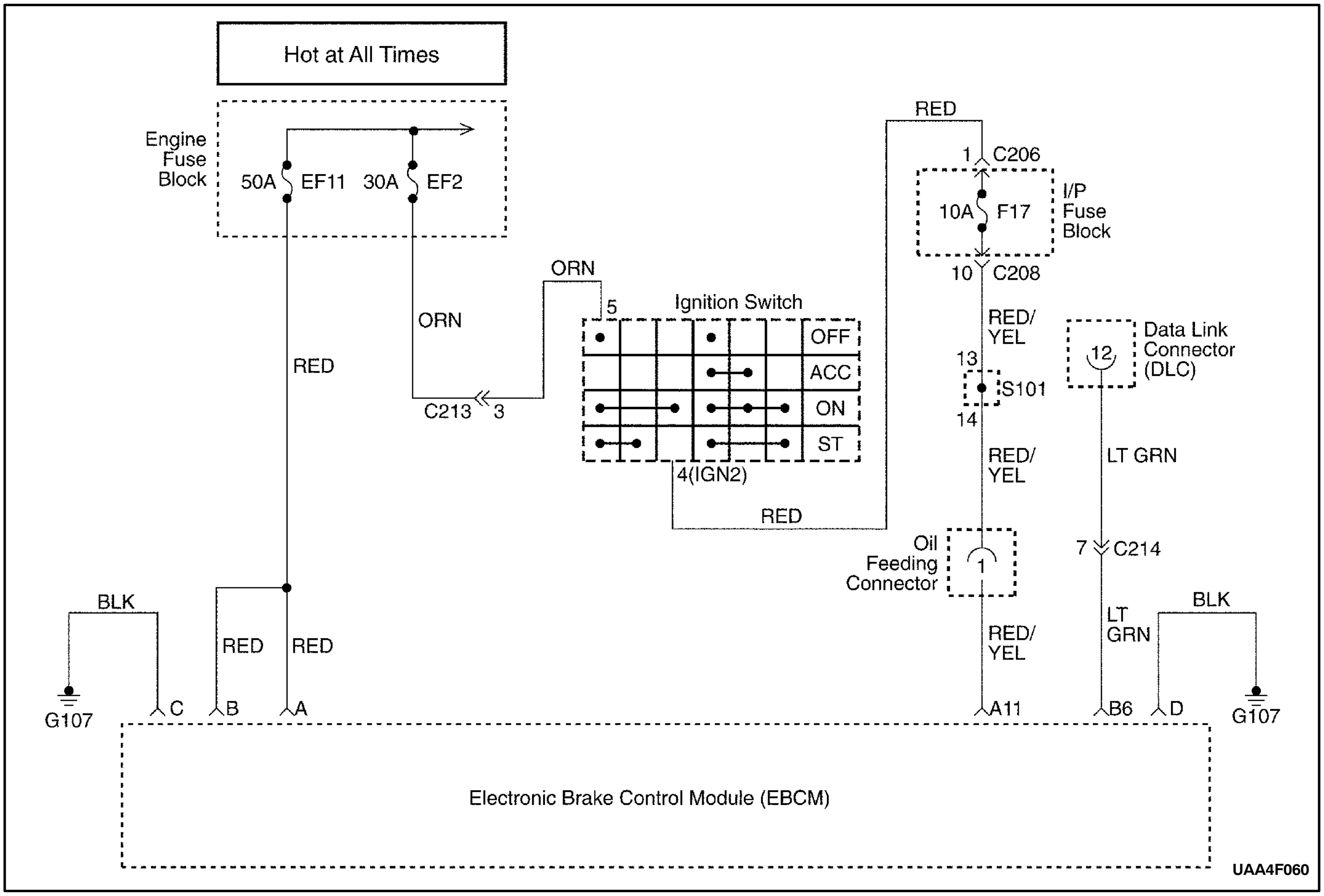
C0036 LOW SYSTEM VOLTAGE



Circuit Description

This circuit is used to monitor the voltage level available to the EBCM. If the voltage drops below a certain level, full performance of the system cannot be guaranteed. During ABS operation, there are several current requirements that will cause battery voltage to drop. Because of this, voltage is monitored prior to ABS operation to indicate good charging system condition and also during ABS operation when voltage may drop significantly.

Conditions for Setting the DTC

C0036 can only be set if the vehicles speed is greater than 8kph (5mph), if the ignition voltage to terminal A11 and battery voltage to terminal A and B are less than 10.5 volts during non ABS or initialization. The DTC will also set if the ignition voltage is below 10.5 volts and the battery voltage is below 9.0 volts during ABS.

Action Taken When the DTC Sets

- The solenoid relay opens, removing voltage from the solenoids and pump motor.
- DTC C0036 is stored.
- ABS disabled, ABS Warning Lamp turns on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0036 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

Typical causes for DTC C0036 to set.

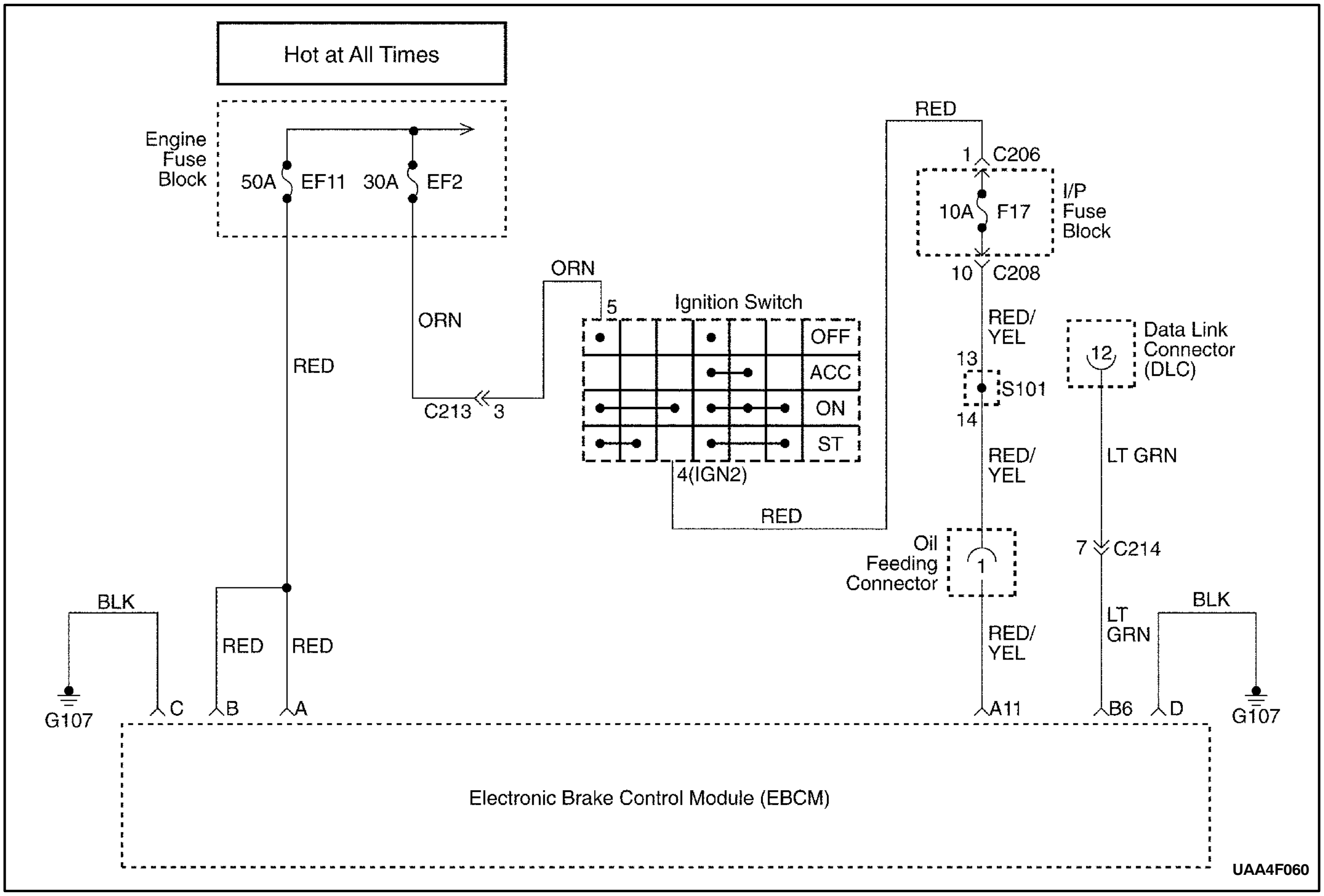
1. Weak or discharged battery.
2. Poor battery terminal contact.
3. Excessive battery draws from factory or after-market equipment (parasitic load).
4. Poor battery ground at block or chassis.
5. Poor terminal contact at EBCM.
6. Poor EBCM ground connection.
7. Charging system malfunction (generator).

- Thoroughly inspect the wiring and the connectors. Failure to inspect the wiring and the connectors carefully and fully can cause replacement of parts without repairing the malfunction.

C0036 Low System Voltage

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Load tests the battery. 2. Inspect the charging system. 3. Perform a parasitic load test. Did the battery, charging system, and parasitic load test pass?	Battery must hold above 9.6 volts for 10 seconds No greater than 30 mA of draw	Go to *Step 5*	Go to *Step 4*
4	Repair the charging system and/or Recharge/Replace the battery and/or Find and repair the source of the excessive parasitic draw.	–	System OK	–
5	1. Key off. 2. Disconnect the battery positive and negative terminals. 3. Disconnect the harness from the EBCM. 4. Inspect the following for a poor connection. • battery terminal cables. • negative cable to block and/or chassis. • positive cable to starter solenoid and/or junction block. • EBCM terminals A11, A , B, C. • EBCM ground wire to chassis ground. Were all the above connections satisfactory?	–	Go to *Step 7*	Go to *Step 6*
6	Repair the terminal and/or connections as needed.	–	System OK	–
7	1. EBCM still disconnected. 2. Battery cables still disconnected. 3. Connect an ohmmeter to terminal C of the EBCM harness and the negative battery cable. Was the resistance within the specified range?	Less than 2 ohms	Go to *Step 9*	Go to *Step 8*
8	Find and repair the source of high resistance between the negative battery cable and the EBCM harness connector.	–	System OK	–
9	1. Reconnect the battery cables. 2. EBCM still disconnected. 3. Key on. 4. Using a volt meter, measure the voltage on the EBCM harness terminals, A11, A ,B. Was the voltage on all 3 terminals above the specified range?	Battery Voltage	Go to *Step 11*	Go to *Step 10*
10	Find and repair the source of low voltage to the EBCM terminals.	–	System OK	–
11	Replace the EBCM.	–	System OK	–

C0037 HIGH SYSTEM VOLTAGE



Circuit Description

This circuit is used to monitor the voltage level available to the EBCM. If the voltage rises above a certain level, damage to the system may occur.

Conditions for Setting the DTC

DTC C0037 can only be set if the vehicles speed is greater than 8kph (5mph), if the voltage supplied to terminals A and/or B is greater than 17 volts for 1 second.

Action Taken When the DTC Sets

- The solenoid relay opens, removing voltage from the solenoids and pump motor.
- DTC C0037 is stored.
- ABS disabled, ABS Warning Lamp turns on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0037 is no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

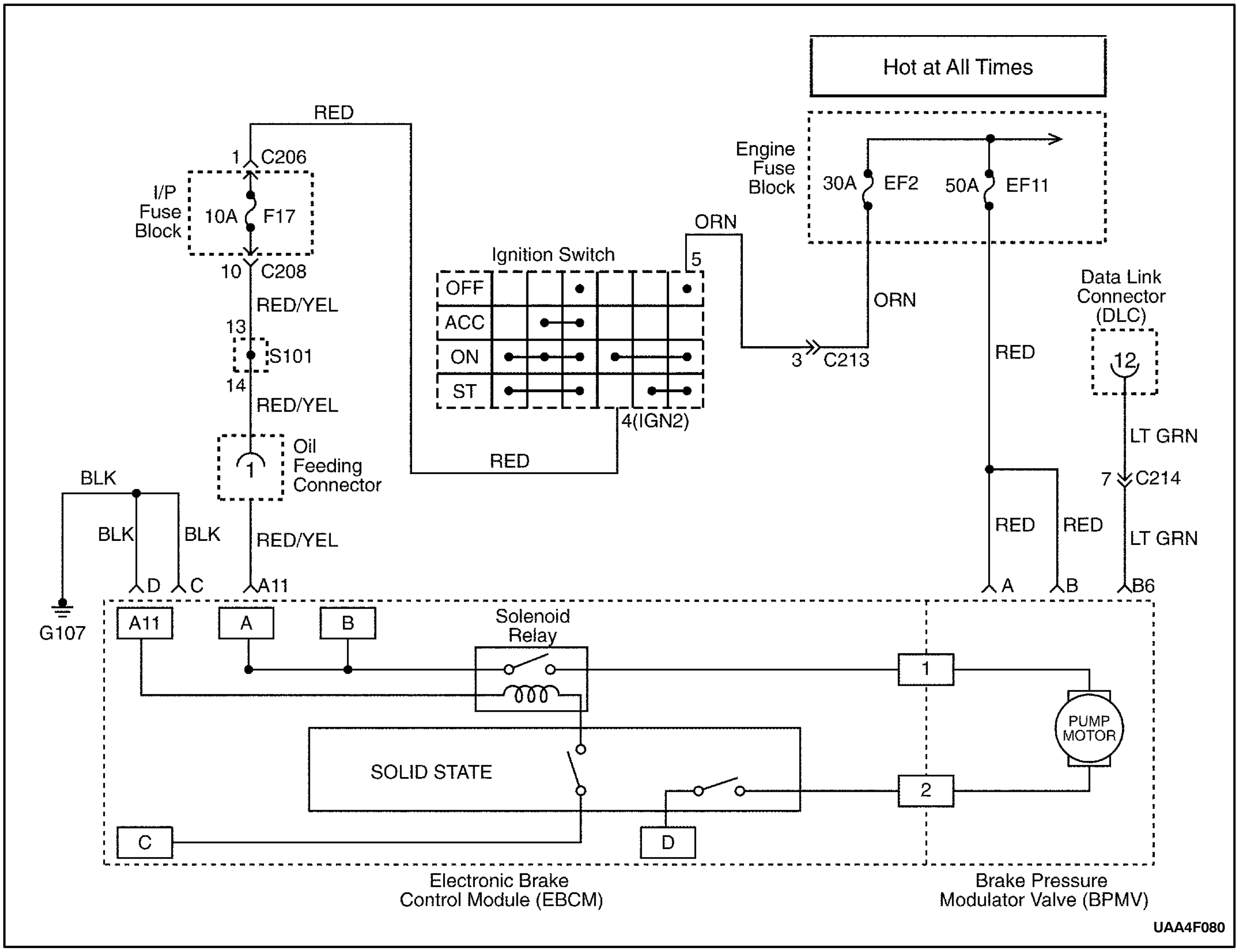
Typical causes for DTC C0037 to set.

1. Charging system malfunction.
2. Poor connection.
3. EBCM malfunction.

C0037 High System Voltage

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Connect a voltmeter to the positive and negative terminals of the battery. 2. Turn off all accessories. 3. Start the engine. 4. Monitor the voltage on the meter with the engine running at 2000 rpm for several seconds. Is the voltage within the specified range?	Less than 17.0 volts	Go to *Step 5*	Go to *Step 4*
4	Repair the Starter and Charging system. Replace the Starter and Charging system as needed.	–	System OK	–
5	1. Connect a scan tool and select ABS data list. 2. Monitor battery voltage on the ABS data list while running the engine at 2000 rpm for several seconds. Is the voltage within the specified range?	Less than 17.0 volts	Go to *Step 7*	Go to *Step 6*
6	Replace the EBCM.	–	System OK	–
7	Condition is intermittent, Refer to diagnostic aids.	–	System OK	–

C0042 PUMP MOTOR CIRCUIT OPEN



Circuit Description

The pump motor is contained within the Brake Pressure Modulator Valve (BPMV). The pump motor ground is supplied though terminal D of the EBCM.

Conditions for Setting the DTC

C0042 can only be set with the key in the ON position, pump motor is off, and the EBCM detected high resistance or an open circuit across the motor.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power from the pump motor and solenoids.
- The DTC C0042 is stored.
- ABS disabled and the ABS warning lamp illuminates.

Conditions for Clearing the DTC

- If the conditions that set DTC C0042 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

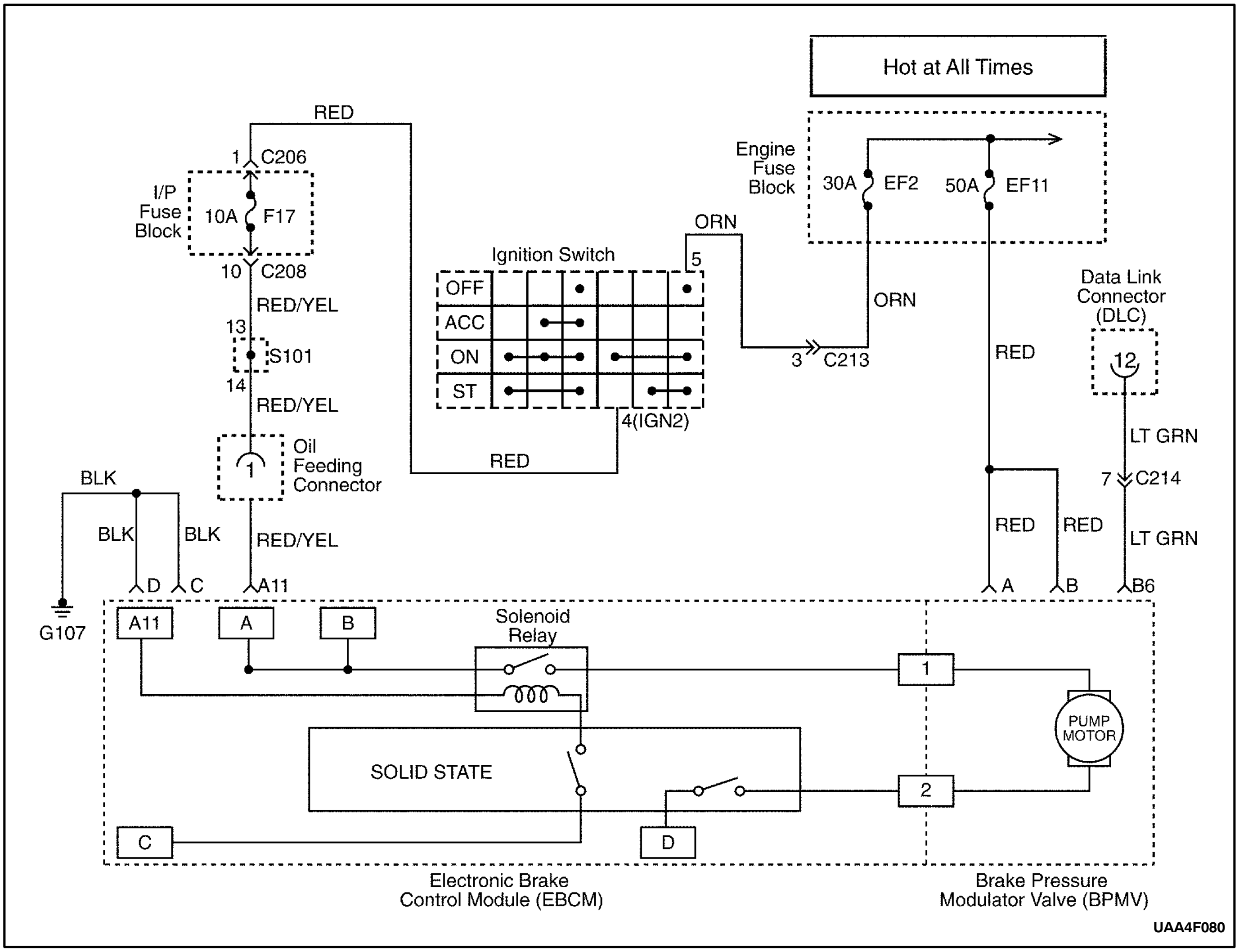
Typical causes of DTC C0042.

1. BPMV pump motor open or high resistance.
2. EBCM malfunction.

C0042 Pump Motor Circuit Open

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Key off. 2. Disconnect the EBCM. 3. Remove the EBCM from the BPMV. 4. Inspect the EBCM to BPMV connector for conditions such as damage, corrosion, poor terminal contact, or the presence of brake fluid. Were the terminals and connector OK, and the cavity free of brake fluid, damage and corrosion?	–	Go to *Step 5*	Go to *Step 4*
4	1. If damage and/or corrosion are present, replace the EBCM and/or the BPMV as necessary. 2. If the brake fluid is present, replace both the EBCM and the BPMV.	–	System OK	–
5	Connect an ohmmeter to terminal 1 and terminal 2 of the BPMV. Was the pump motor resistance reading within the specified range?	Less than 2 ohms	Go to *Step 7*	Go to *Step 6*
6	Replace the Brake Pressure Modulator Valve.	–	System OK	–
7	Replace the EBCM.	–	System OK	–

C0043 PUMP MOTOR STALLED



Circuit Description

The pump motor is contained within the Brake Pressure Modulator Valve (BPMV). The pump motor ground is supplied though terminal D of the EBCM.

Conditions for Setting the DTC

C0043 can only be set with the key in the ON position, pump motor is commanded off just after a run command, and the EBCM detected a seized or slowly moving pump motor.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power from the pump motor and solenoids.
- The DTC C0043 is stored.
- ABS disabled and the ABS Warning Lamp illuminates.

Conditions for Clearing the DTC

- If the conditions that set DTC C0043 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

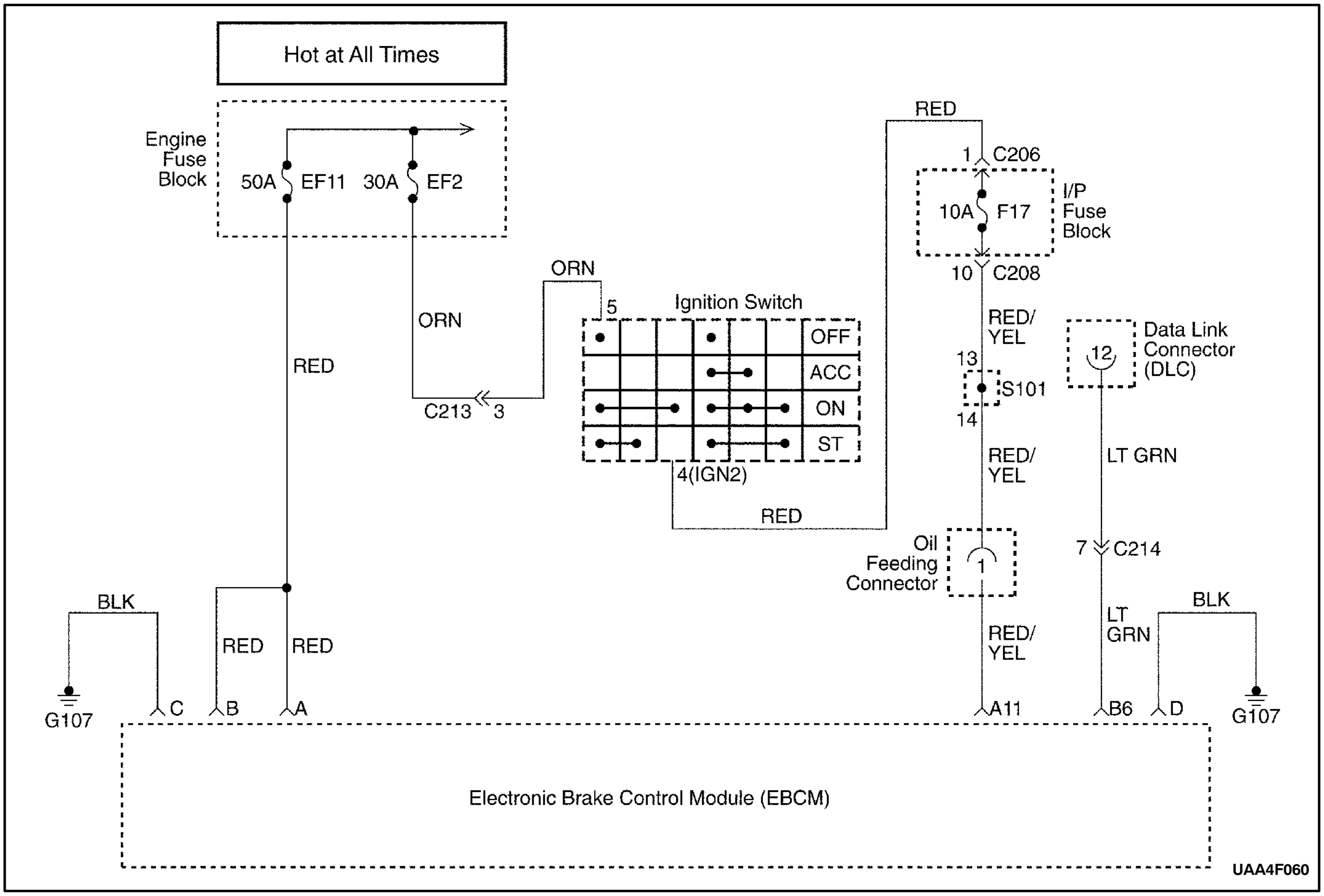
Typical causes of DTC C0043.

1. Poor terminal contact at terminal D.
2. Terminal D ground circuit high resistance.
3. Terminal D ground circuit open.
4. BPVM pump motor malfunction.
5. EBCM malfunction.

C0043 Pump Motor Stalled

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Key off. 2. Disconnect the negative battery cable. 3. Disconnect EBCM harness from the EBCM. 4. Connect an ohmmeter to the negative battery cable and terminal D of the EBCM harness. Was the resistance reading within the specified range?	Less than 2 ohms	Go to *Step 5*	Go to *Step 4*
4	Find and repair the source of high resistance between the EBCM ground circuit and chassis ground.	–	System OK	–
5	1. Follow the negative battery cable to the engine block and/or chassis ground connection and inspect for a good clean and tight connection. 2. From terminal D of the EBCM harness follow the wire and find the location where the circuit grounds to the chassis. Inspect for a good clean and tight connection. Were both connections clean and tight?	–	Go to *Step 7*	Go to *Step 6*
6	Repair the poor ground connection.	–	System OK	–
7	1. EBCM harness still disconnected. 2. Remove the EBCM from the BPMV. 3. Inspect the EBCM to BPMV connector for conditions such as damage, corrosion, poor terminal contact, or the presence of brake fluid. Were the terminals and connector OK, and the cavity free of brake fluid, damage and corrosion?	–	Go to *Step 9*	Go to *Step 8*
8	1. If damage and/or corrosion are present, replace the EBCM and/or the BPMV as necessary. 2. If the brake fluid is present, replace both the EBCM and the BPMV.	–	System OK	–
9	Connect an ohmmeter to terminal 1 and terminal 2 of the BPMV. Was the pump motor resistance reading within the specified range?	Less than 2 ohms	Go to *Step 11*	Go to *Step 10*
10	Replace the Brake Pressure Modulator Valve.	–	System OK	–
11	Replace the EBCM.	–	System OK	–

C0054 ABNORMAL SHUTDOWN DETECTED



Circuit Description

This DTC is used to detect a sudden loss of voltage or ground to the EBCM. Battery voltage is applied to terminals A and B. Switched ignition voltage is applied to terminal A11.

Ground is supplied to terminal C.

Conditions for Setting the DTC

DTC C0054 will set when the EBCM has detected power or ground had been lost and then regained within short period of time.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power from the pump motor and the solenoids.
- C0054 is stored.
- ABS disabled, ABS Warning Lamp turns on.
- DDRP disabled, Brake Warning Lamp turns on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0054 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

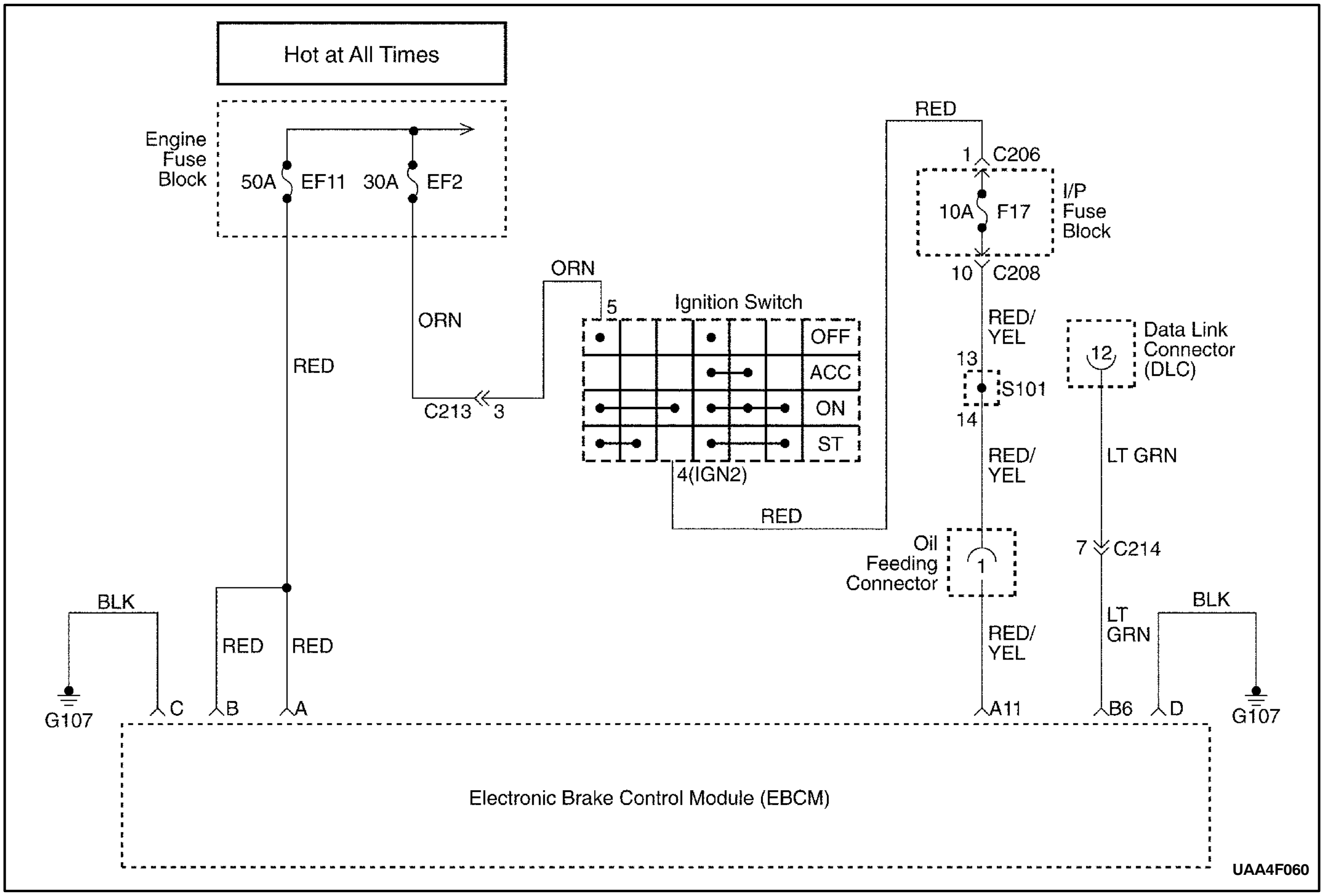
Typical causes of C0054.

1. Weak or Discharged battery.
2. Loose or poor battery terminals.
3. Battery disconnected.
4. Loose or poor ground cables.
5. Poor EBCM terminal contact.
6. Excessive parasitic draws.
7. Charging system malfunction.

C0054 Abnormal Shutdown Detected

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Load tests the battery. 2. Inspect the charging system. 3. Perform a parasitic load test. Did the battery, charging system, and parasitic load test pass?	Battery must hold above 9.6 volts for 10 seconds No greater than 30 mA of draw	Go to *Step 5*	Go to *Step 4*
4	Repair the charging system and/or Recharge/Replace the battery and/or Find and repair the source of the excessive parasitic draw.	–	System OK	–
5	1. Key off. 2. Disconnect the battery positive and negative terminals. 3. Disconnect the harness from the EBCM. 4. Inspect the following for a poor connection. • battery terminal cables. • negative cable to block and/or chassis. • positive cable to starter solenoid and/or junction block. • EBCM terminals A11, A , B, C. • EBCM ground wire to chassis ground. Were all the above connections satisfactory?	–	Go to *Step 7*	Go to *Step 6*
6	Repair the terminal and/or connections as needed.	–	System OK	–
7	1. EBCM still disconnected. 2. Battery cables still disconnected. 3. Connect an ohmmeter to terminal C of the EBCM harness and the negative battery cable. Was the resistance within the specified range?	Less than 2 ohms	Go to *Step 9*	Go to *Step 8*
8	Find and repair the source of high resistance between the negative battery cable and the EBCM harness connector.	–	System OK	–
9	1. Reconnect the battery cables. 2. EBCM still disconnected. 3. Key on. 4. Using a volt meter, measure the voltage on the EBCM harness terminals, A11, A ,B. Was the voltage on all 3 terminals above the specified range?	Battery Voltage	Go to *Step 11*	Go to *Step 10*
10	Find and repair the source of low voltage to the EBCM terminals.	–	System OK	–
11	Replace the EBCM.	–	System OK	–

C0055 EBCM INTERNAL FAULT



Circuit Description

This DTC identifies a possible malfunction within the EBCM.

Conditions for Setting the DTC

- DTC C0055 will set when a possible internal component/microprocessor problem may exist.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power from the pump motor and the solenoids.

The ABS and DDRP are disabled.

- DTC C0055 is stored.
- ABS Warning Lamp and Brake Warning Lamp are turned on.

Conditions for Clearing the DTC

- If the conditions that set DTC C0055 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

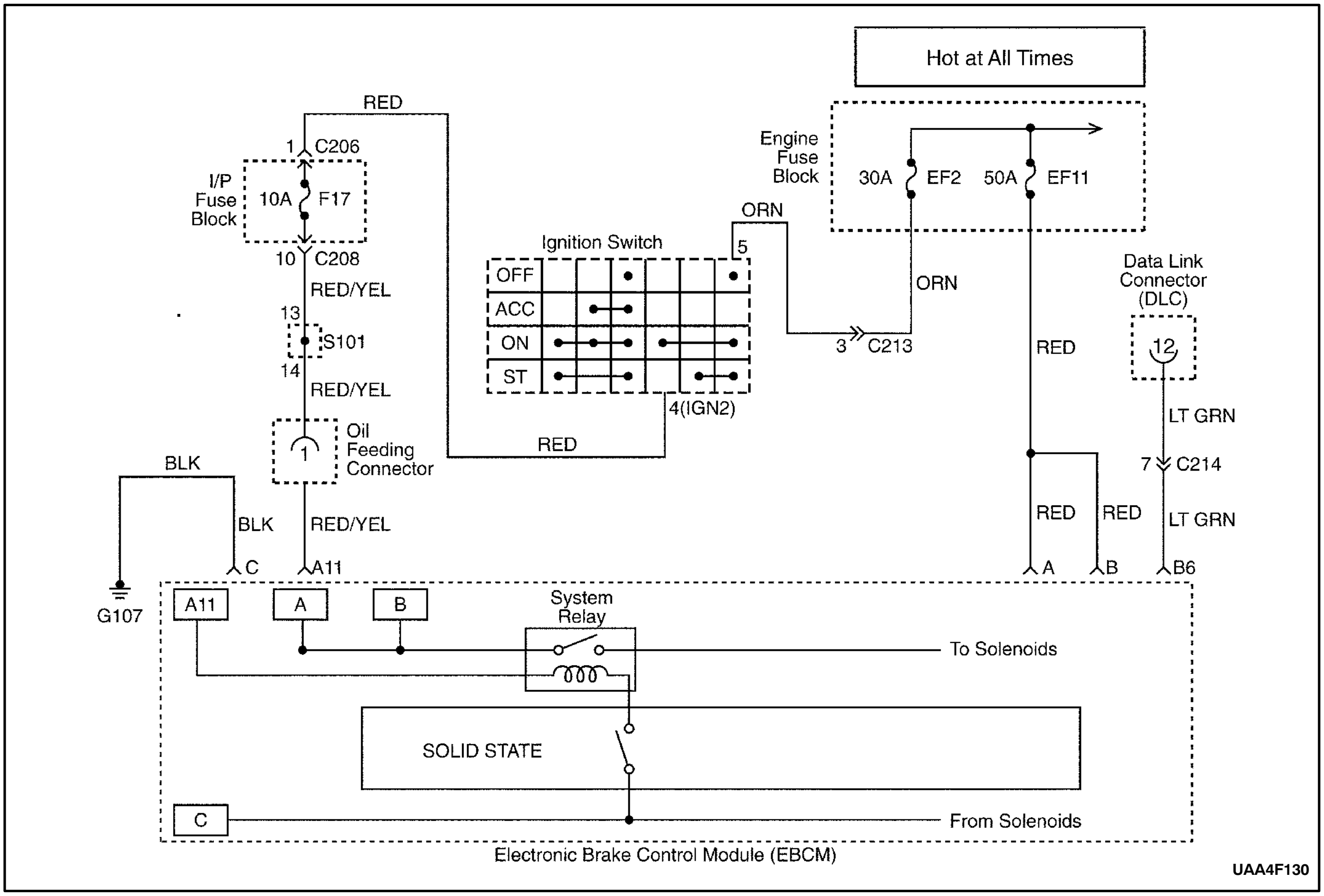
Diagnostic Aids

- When C0055 is displayed on the scan tool, it should be followed by two additional numbers (xx) which should be documented along with any other OTC(s) that may be displayed.
- Repair low voltage, driveability, or other electrical complaints first, prior to performing C0055 trouble tree.
- Make sure the integrity of the connection between the EBCM and the BPMV is secure, tight and free of corrosion, leaks and/or damage.

C0055 EBCM Internal Fault

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Install scan tool. 2. Turn ignition ON, with engine OFF. 3. Using scan tool, observe DTC information. Dose any DTC(s) set in Current or History Data other than C0055 XX ?	–	Go to *Step 4*	Go to *Step 5*
4	Perform the applicable DTC diagnostic for the other DTC(s).	–	System OK	–
5	1. Key off. 2. Disconnect the EBCM harness from the EBCM. 3. Check the connectors for damage, corrosion, and terminal contact. Were any problems found?	–	Go to *Step 6*	Go to *Step 7*
6	Repair as needed.	–	System OK	–
7	Replace the EBCM.	–	System OK	–

C0056 SYSTEM RELAY STUCK ON



Circuit Description

This DTC identifies a possible malfunction within the EBCM. When the EBCM relay is activated (turned on), voltages is supplied to the valve solenoids and pump motor.

Conditions for Setting the DTC

- DTC C0056 will set when possible internal malfunctions exist.

Action Taken When the DTC Sets

- ABS Warning Lamp is not turned on.
- DTC 0056 is stored.
- ABS remains functional.

Conditions for Clearing the DTC

- If the conditions that set DTC C0056 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

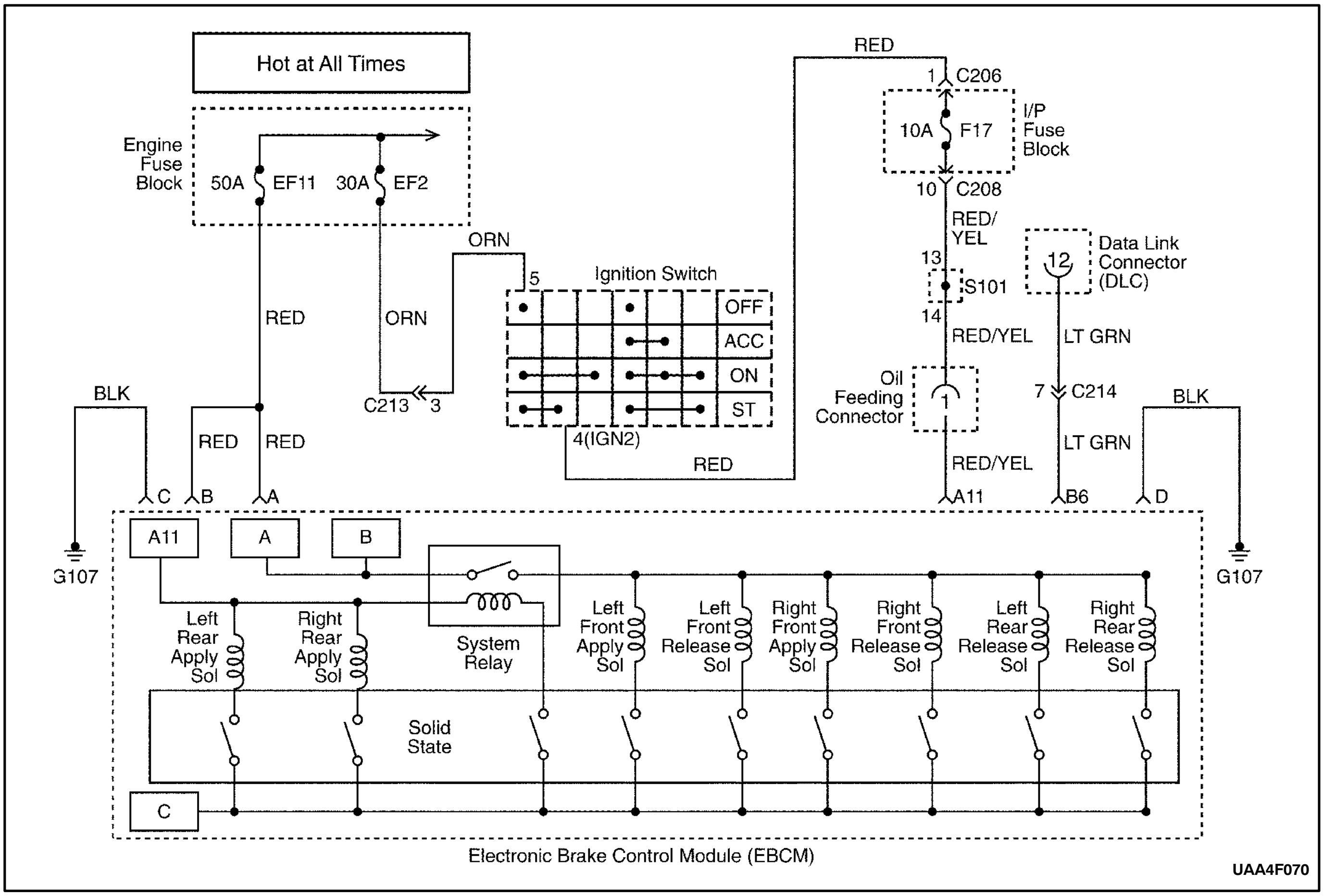
Diagnostic Aids

- Repair low voltage, driveability, or other electrical complaints first, prior to performing C0056 trouble tree.
- Make sure the integrity of the connection between the EBCM and the BPMV is secure, tight and free of corrosion, leaks and/or damage.
- Possible cause for DTC C0056 to set is an internal relay problem within EBCM.

C0056 System Relay Stuck On

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Install scan tool. 2. Turn ignition ON, with engine OFF. 3. Using scan tool, observe DTC information. Does scan tool display any DTC(s) set in Current or History Data other than C0056?	–	Go to *Step 4*	Go to *Step 5*
4	Perform the applicable diagnostic for the other DTC(s).	–	System OK	–
5	1. Key off. 2. Disconnect the EBCM harness from the EBCM. 3. Check the connectors for damage, corrosion, and terminal contact. Were any problems found?	–	Go to *Step 6*	Go to *Step 7*
6	Repair as needed.	–	System OK	–
7	Replace the EBCM.	–	System OK	–

C0061, C0062, C0063, C0064, C0065, C0066, C0067, C0068 APPLY OR RELEASE SOLENOID SHORTED OR OPEN



Circuit Description

Apply and release coils are an integral part of the EBCM. The coils are supplied with battery power when the ignition is in the ON position and the solenoid relay is closed. The EBCM controls the solenoids by grounding the respective coil circuit when necessary.

Conditions for Setting the DTC

When the EBCM senses an open, short to ground or a short to power on any one of the apply or release coils, the respective DTC will set.

Action Taken When the DTC Sets

- The solenoid relay opens, removing power from the solenoids.
- The respective DTC is stored.
- ABS disabled, ABS Warning Lamp turns on.
- DDRP disabled, Brake Warning Lamp turned on (For C0065 and C0067 only).

Conditions for Clearing the DTC

- If the conditions that set DTC C0061 through C0068 are no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

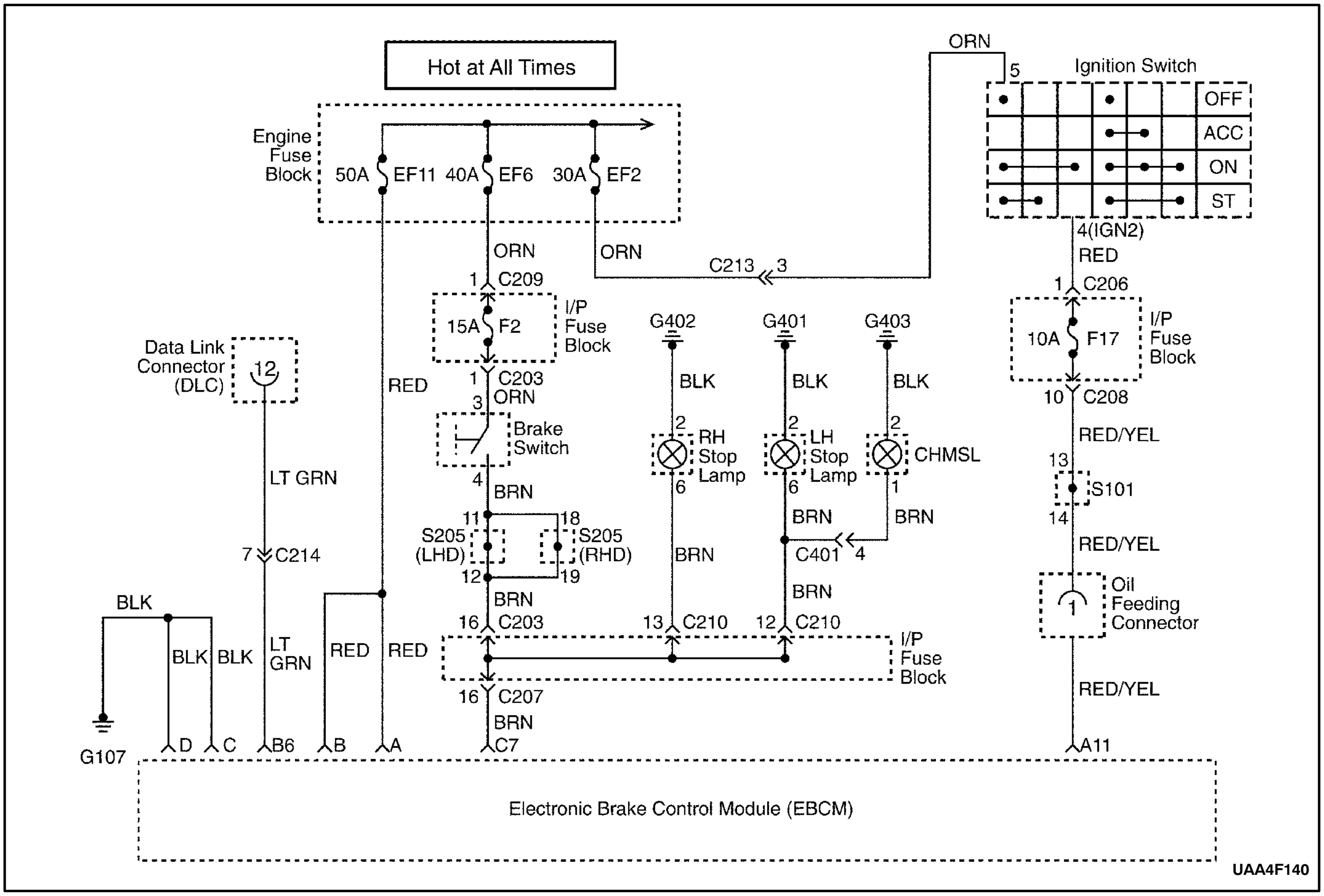
Make sure the integrity of the connection between the EBCM and the BPMV is secure, tight and free from corrosion.

Since the solenoid coils are an integral part of the EBCM, any one of the DTC(s) settings will usually indicate an internal fault to the EBCM.

C0061, C0062, C0063, C0064, C0065, C0066, C0067, C0068 Apply or Release Solenoid Shorted or Open

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check Completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	1. Key off. 2. Inspect the EBCM and BPMV for physical damage. Is any physical damage noted?	–	Go to *Step 4*	Go to *Step 5*
4	Replace the damaged components.	–	System OK	–
5	1. Disconnect the EBCM harness from the EBCM. 2. Remove the EBCM from the BPMV. 3. Inspect the EBCM and the BPMV cavity for fluid leaks, corrosion and/or damage. Was the cavity free from any fluid leaks, damage or corrosion?	–	Go to *Step 6*	Go to *Step 7*
6	Replace both the EBCM and the BPMV.	–	System OK	–
7	1. Install Scan Tool. 2. Turn ignition to ON position, with engine OFF. 3. Clear DTC using scan tool. 4. Operate vehicle within condition for running the DTC. 5. Does the DTC reset as current DTC?	–	Go to *Step 6*	Intermittent Problem Go to *Step 2*

C0095 BRAKE SWITCH CIRCUIT OPEN (STOP LAMP CIRCUIT OPEN)



Circuit Description

This DTC is used to identify open stop lamp switch circuitry that prevents the stop lamp switch input to the EBCM from changing states when the brake is applied. The EBCM sends a low current 5volt sense voltage on brake switch input line to the rear brake light bulbs. If the rear brake light circuit is intact, this voltage will be pulled low (under 1 volt) to ground through the rear brake light bulbs. When the brake light switch is depressed, battery voltage will be supplied to the rear brake lights and to the EBCM, indicating brake lights are on. If the voltage is either low (under 1 volt) or high (battery voltage), the EBCM cannot determine brake switch state and DTC C0095 will set.

Conditions for Setting the DTC

C0095 can be set after initialization. If the voltage on the brake switch input line voltage is between 2 to 5 volts for 2 seconds, the DTC will set.

Action Taken When the DTC Sets

- ABS remains functional

Conditions for Clearing the DTC

- If the condition that set DTC 0095 is no longer present, the DTC may be cleared by using the proper scan tool.
- The DTC that has not occurred in 100 drive cycles will be cleared from history data.

Diagnostic Aids

The following are typical causes of DTC C0095.

1. One or more stop lamp bulb filaments open.
2. One or more stop lamp bulb and/or socket connections loose.
3. One or more stop lamp grounds loose or open.
4. Terminal C7 brake switch input terminal connection poor or open.
5. Terminal C7 brake switch input circuit open.

C0095 Brake Switch Circuit Open (Stop Lamp Circuit Open)

Step	Action	Value	Yes	No
1	Was the Diagnostic Circuit Check completed?	–	Go to *Step 3*	Go to *Step 2*
2	Perform the Diagnostic Circuit Check. Did you find problem?	–	Go to *Step 3*	System OK
3	Depress the brake pedal. Are any brake light bulbs inoperative, including the CHMSL (3rd or center high brake light) ?	–	Go to *Step 4*	Go to *Step 5*
4	Remove and inspect bulbs/sockets that do not illuminate when brake pedal is depressed. Replace bulbs/sockets/and repair grounds as necessary.	–	System OK	–
5	1. Key off. 2. Disconnect the EBCM harness from the EBCM. 3. Install the universal breakout box inline between the EBCM and the EBCM harness using the applicable adapter cable. 4. Connect a voltmeter to terminal C7 of the universal breakout box and then to either terminal C of the universal breakout box or to body ground. Is the voltage within the specified range?	Less than 2 volts	Go to *Step 7*	Go to *Step 6*
6	Inspect all rear brake light grounds/bulbs/socks for poor connections/high resistance which would not allow the 5 volt reference signal from the EBCM to be pulled low (under 2 volts).	–	System OK	–
7	Replace the EBCM.	–	System OK	–

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

SERVICE PRECAUTIONS

Caution : Brake fluid may irritate eyes and skin. In case of contact, take the following actions:

- Eye contact – rinse thoroughly with water.
- Skin contact – wash with soap and water.
- Ingestion – consult a physician immediately.

Notice : When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused and those requiring thread–locking compound will be called out. The correct torque values must be used when installing fasteners that require them. If the above procedures are not followed parts or system damage could result.

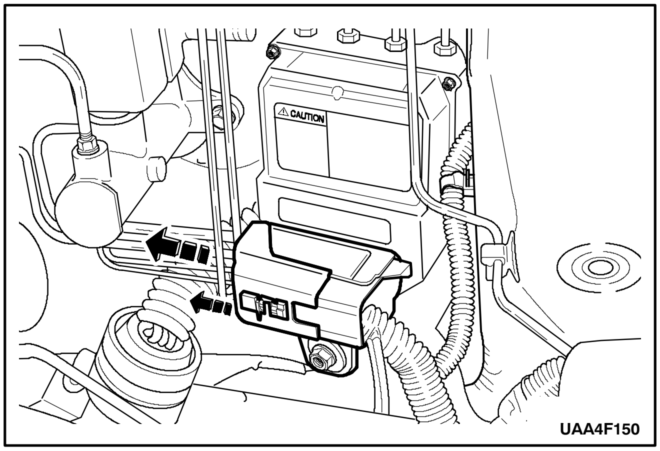
Notice : Use only DOT 3 hydraulic brake fluid. The use of DOT 5 (silicone) brake fluid is not recommended. Reduced brake performance or durability may result.

Notice : Avoid spilling brake fluid on any of the vehicle's painted surface, wiring cables, or electrical connectors. Brake fluid will damage paint and electrical connectors. If any fluid is spilling on the vehicle, flush the area with water to lessen the damage.

BLEEDING SYSTEM

Replacement modulators are shipped already filled and bled. In normal procedures requiring removal of the modulator, such as to replace the EBCM, air will not enter the modulator, and normal bleeding will be all that is needed. For this procedure, refer to *Section 4A, Hydraulic Brakes.*

If air enters the hydraulic modulator, or if an unfilled modulator is installed, use the brake bleeding program in the scan tool to bleed the modulator. Manual bleeding of the hydraulic modulator is not possible.



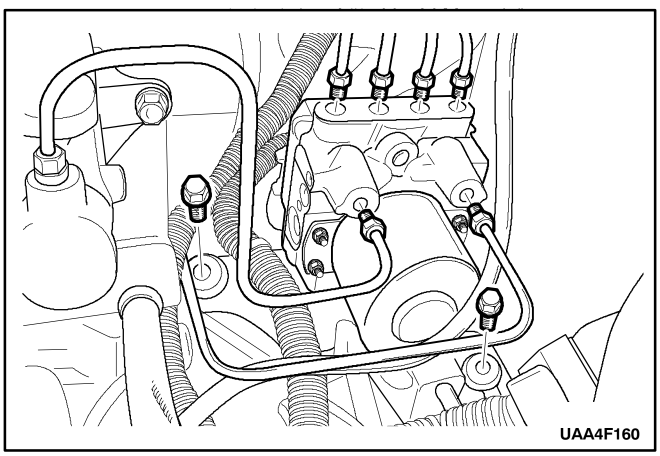
DBC 7 ABS ASSEMBLY

Removal and Installation Procedure

Notice : Do not hang the caliper assembly from the brake hose. Any resulting internal hose restriction will impede uniform braking action.

Important : To guarantee uniform braking on both sides, both rotors must have identical surfaces regarding smoothness and scoring depth. For this reason always replace both rotors.

1. Disconnect the negative battery cable.
2. Removed the cooling surge tank. Refer to Section *1D, Engine Cooling.*
3. Disconnect the ABS wiring harness connector from its socket on the EBCM.
4. Cover the connector and the socket with shop cloths to protect them from brake fluid.



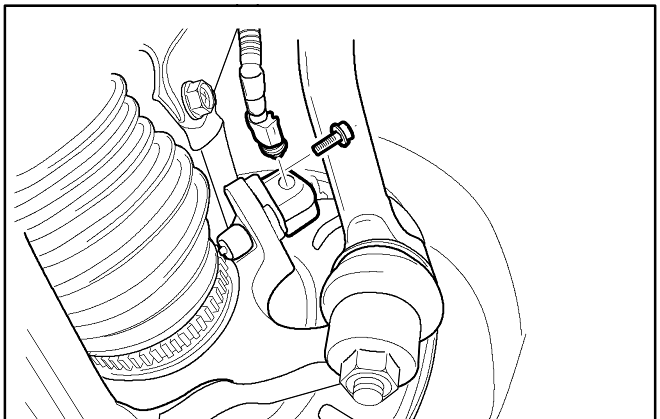
Notice : Take care not to allow air into the hydraulic unit or into the brake pipes from the master cylinder. If air gets into the hydraulic unit, it will require a bleeding procedure using a scan tool programmed for the DBC 7 ABS system. As long as no air enters the hydraulic unit, a simple bleeding procedure is all the system will require.

5. Remove the brake pipes fitting nuts from the hydraulic unit.
6. Remove the mounting bracket bolts on the hydraulic unit.
7. Remove the DBC 7 ABS assembly.

Installation Notice

Tightening Torque	Brake Pipe Fitting Nuts	16 N·m (12 lb–ft)
Tightening Torque	ABS Mounting Bracket Bolts	22 N·m (16 lb–ft)

- Add new brake fluid.
- After the installation, bleed the brake system. Refer to *Section 4A, Hydraulic Brakes.*
- Check the brake system for leaks.
- Care must be taken to prevent the brake fluid from contacting any painted surface to prevent damage to the paint finish.



UAA4F170

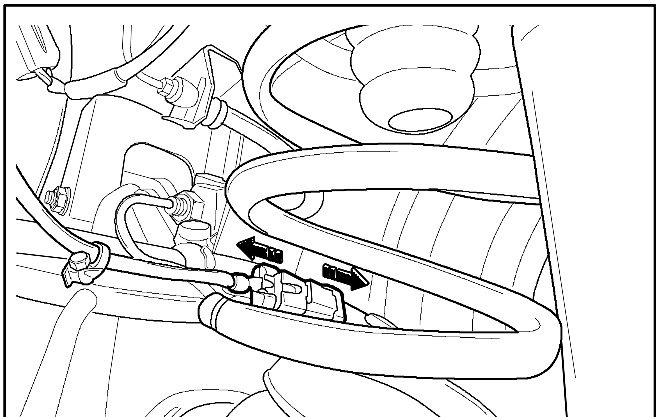
FRONT WHEEL SPEED SENSOR

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Disconnect the front wheel speed sensor electrical connector.
4. Remove the bolt and front wheel speed sensor from the steering knuckle.

Installation Notice

Tightening Torque	9 N·m (6 lb–ft)



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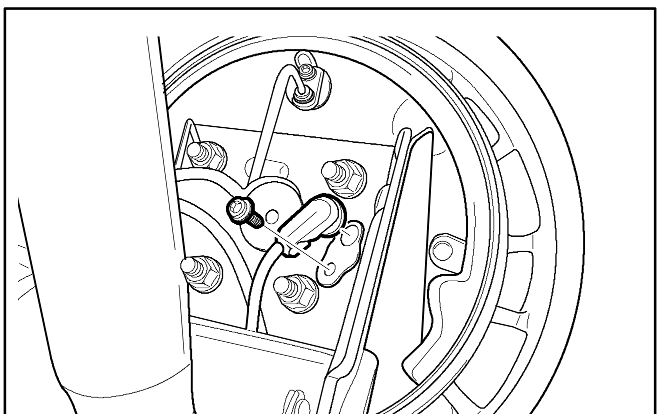
REAR WHEEL SPEED SENSOR

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Disconnect the rear wheel speed sensor electrical connector from the rear axle.
4. Remove the rear wheel speed sensor cable grommets.

Installation Notice

Tightening Torque	9 N·m (6 lb–ft)



UAA4F190

SPECIFICATIONS

GENERAL SPECIFICATIONS

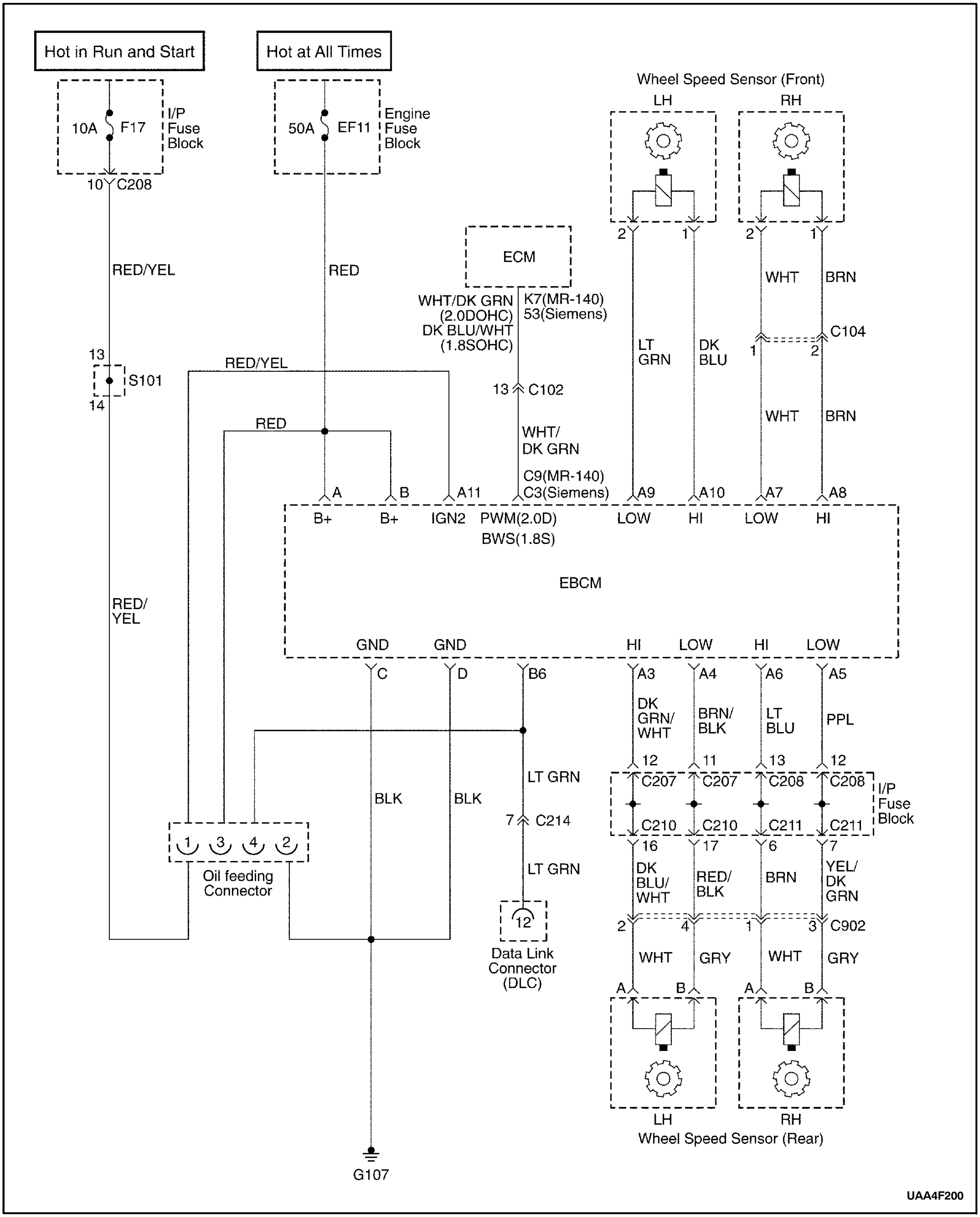
Application	Unit	Description
Antilock Brake System (ABS) Mode	–	4 Channel 4 Sensor
ABS Main Relay Operation Voltage	V	9~16
Front Wheel Speed Sensor:	–	–
Resistance	Ω	988~1,208
Air Gap	mm (inch)	0.5~1.2 (0.0197~0.0472)
Rear Wheel Speed Sensor:	–	–
Resistance	Ω	2,295~2,500
Air Gap	mm (inch)	0.6~1.2 (0.0236~0.0472)
Speed Ring	–	–
Outside Diameter (Front)	mm (inch)	83.72 (3.2961)
Outside Diameter (Rear)	mm (inch)	77 (3.0315)
Inside Diameter (Front)	mm (inch)	73.75 (2.9035)
Inside Diameter (Rear)	mm (inch)	67 (2.6378)
Tooth Volume of the Speed Ring (Front)	EA	47
Tooth Volume of the Speed Ring (Rear)	EA	34
Brake Oil	–	–
Type	–	DOT–3
Capacity	L (qt.)	0.5 (0.53)

FASTENER TIGHTENING SPECIFICATIONS

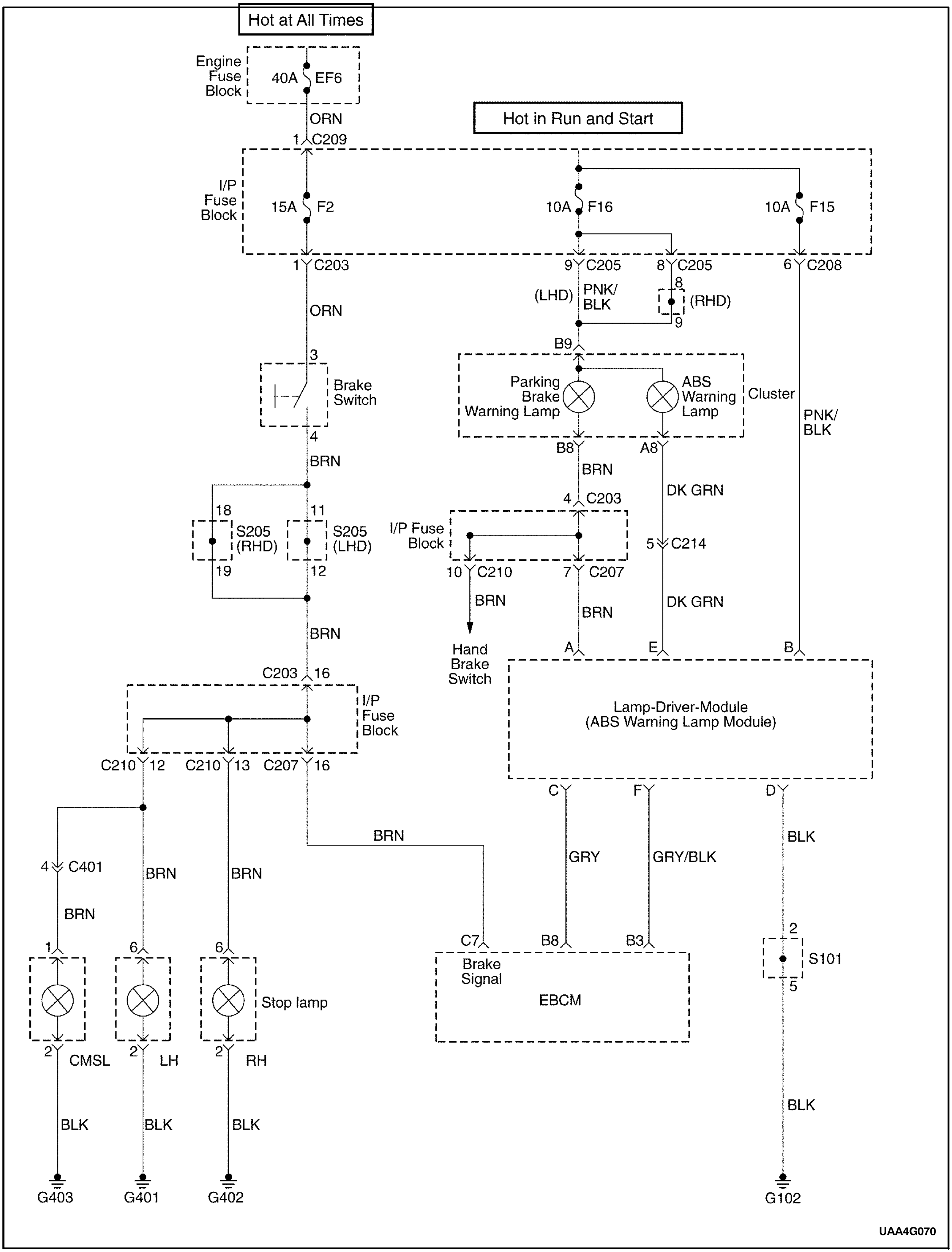
Application	N•m	Lb-Ft	Lb-In
Brake Pipe Fitting Nut (Hydraulic Unit)	16	12	–
ABS Mounting Bracket Bolt	22	16	–
Front Wheel Speed Sensor Bolt	9	6	80
Rear Wheel Speed Sensor Bolt	9	6	80

SCHEMATIC AND ROUTING DIAGRAMS

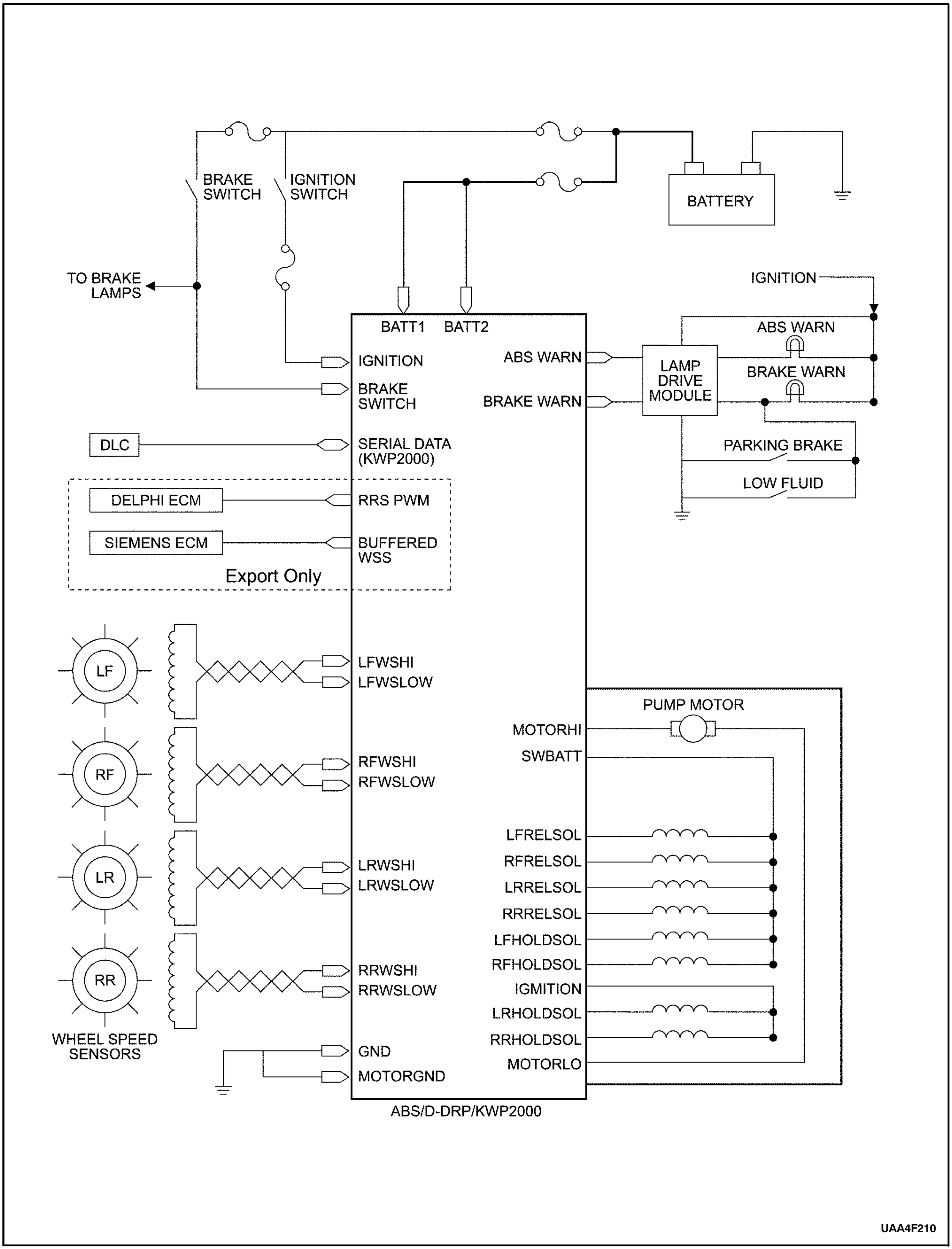
ABS SYSTEM CIRCUIT (I)



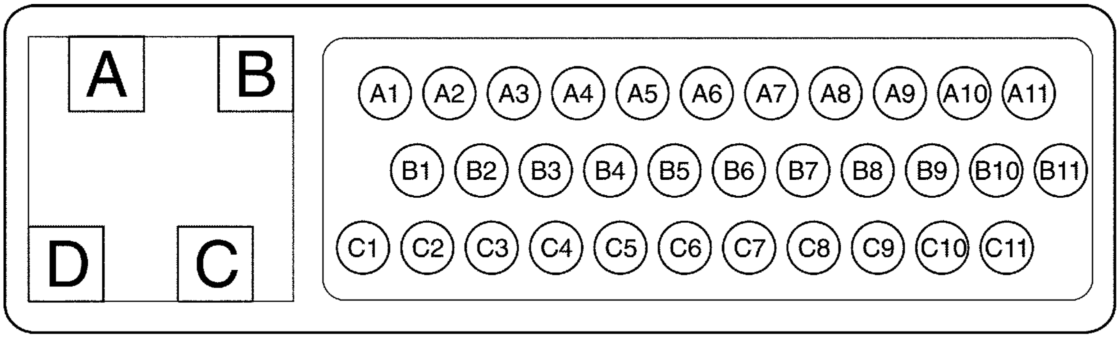
ABS SYSTEM CIRCUIT (II)



ELECTRICAL SCHEMATIC



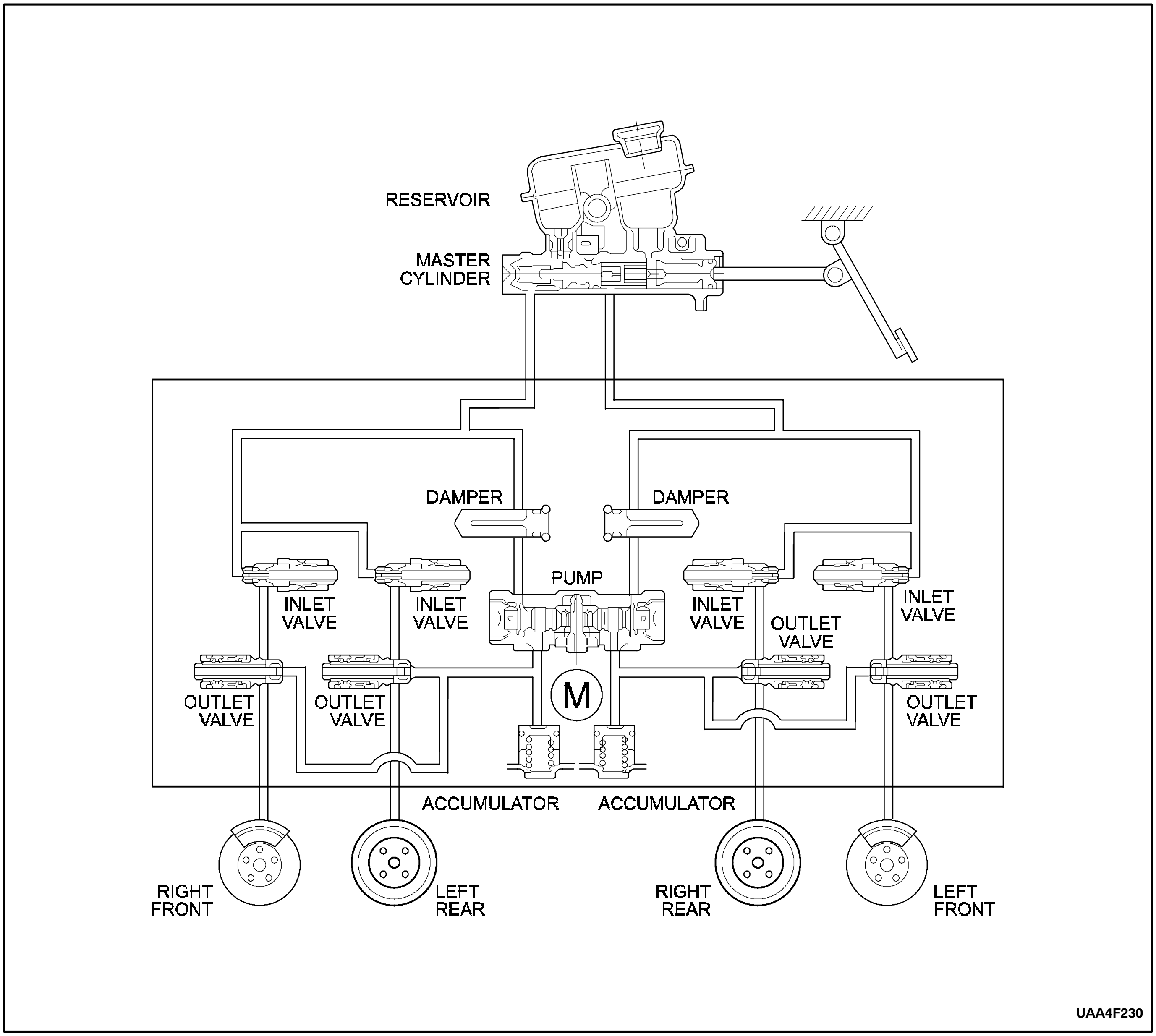
EBCM HARNESS CONNECTOR END VIEW AND PIN LAYOUT



ABS (Export) Pin Assignments

Pin Location	Circuit Function
A	BATTERY (HOT AT ALL TIMES)
B	BATTERY (HOT AT ALL TIMES)
C	EBCM GROUND
D	PUMP MOTOR GROUND
A3	LEFT REAR WHEEL SPEED SENSOR (HI)
A4	LEFT REAR WHEEL SPEED SENSOR (LOW)
A5	RIGHT REAR WHEEL SPEED SENSOR (LOW)
A6	RIGHT REAR WHEEL SPEED SENSOR (HI)
A7	RIGHT FRONT WHEEL SPEED SENSOR (HI)
A8	RIGHT FRONT WHEEL SPEED SENSOR (LOW)
A9	LEFT FRONT WHEEL SPEED SENSOR (LOW)
A10	LEFT FRONT WHEEL SPEED SENSOR (HI)
A11	SWITCHED IGNITION
B3	BRAKE WARNING LAMP OUTPUT
B6	SERIAL DATA INPUT/OUTPUT
B8	ABS WARNING LAMP OUTPUT
C3	BUFFERED WHEEL SPEED SIGNAL (TO SIEMENS ECM)
C7	BRAKE SWITCH INPUT
C9	PULSE WIDTH MODULATION ROUGH ROAD SIGNAL (TO DELPHI MR–140 ECM)
C11	VENT TUBE

HYDRAULIC DIAGRAM



SECTION 4G

PARKING BRAKE

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION

This braking system uses a BRAKE warning light located in the instrument panel cluster.

The following conditions will activate the BRAKE lamp:

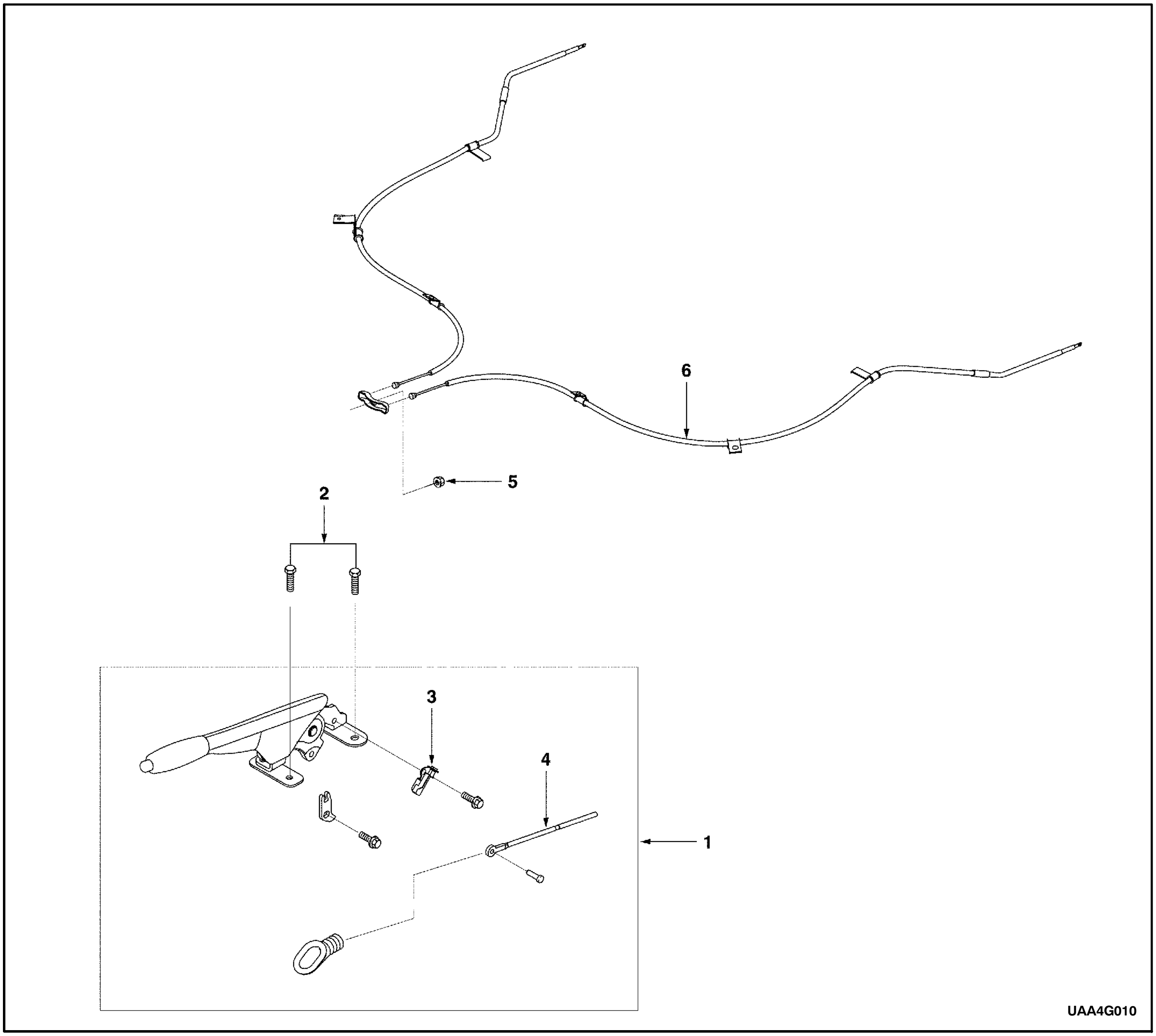
- The parking brake is applied when the ignition is ON. The lamp will turn off when the parking brake is released.
- The fluid level is below the minimum mark in the master cylinder reservoir. The lamp will turn off when the fluid level is above the minimum.
- As a test of the lamp circuit, the BRAKE lamp will glow dimly when the ignition is ON, even if the parking brake is off and fluid level is above the minimum. The lamp will turn off when the engine is started.

When the brake is firmly applied, the parking brake should hold the vehicle with ample pedal travel remaining.

Check for frayed cables, rust, etc. or any condition that may inhibit present (or future) free movement of the parking brake lever assembly.

COMPONENT LOCATOR

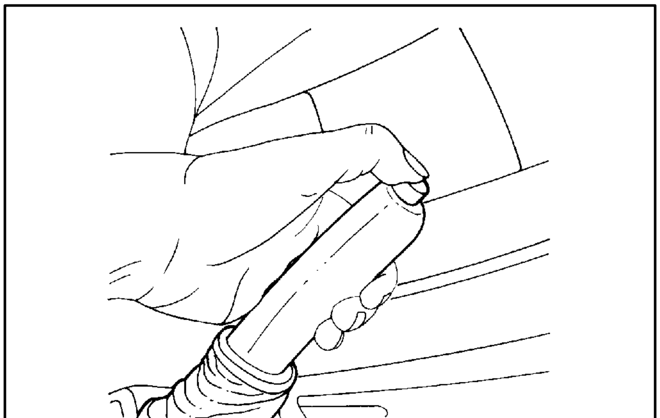
PARKING BRAKE



1 Parking Brake Lever Assembly
2 Parking Brake Lever Mounting Nut
3 Parking Brake Warning Lamp Switch
4 Parking Brake Cable Pull Rod
5 Parking Brake Cable Nut
6 Parking Brake Cable

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

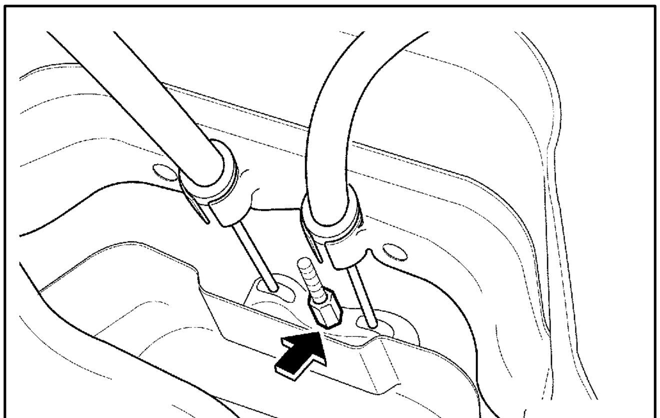


B207G003

PARKING BRAKE ADJUSTMENT – REAR DRUM BRAKES

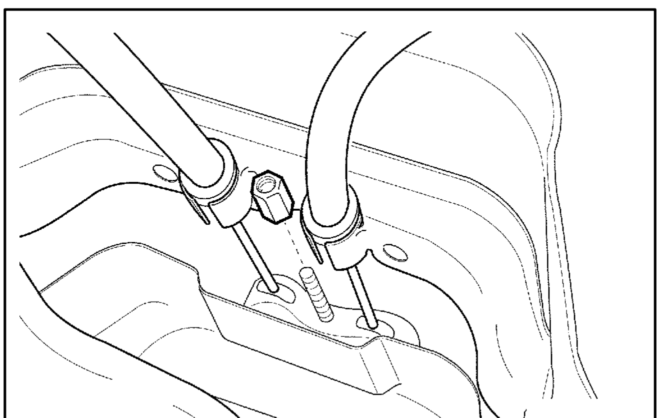
Adjustment Procedure

1. Adjust the rear brakes. Refer to *Section 4E, Rear Drum Brakes.*
2. Release the parking brake.
3. Raise and suitably support the vehicle.
4. Check the parking brake cables for free movement.



UAA2G020

5. Turn the self-locking nut until the wheels are difficult to turn. (Parking position)
6. Back off the nut until the rear wheels are just free to turn. (Release parking position)
7. Lower the vehicle.



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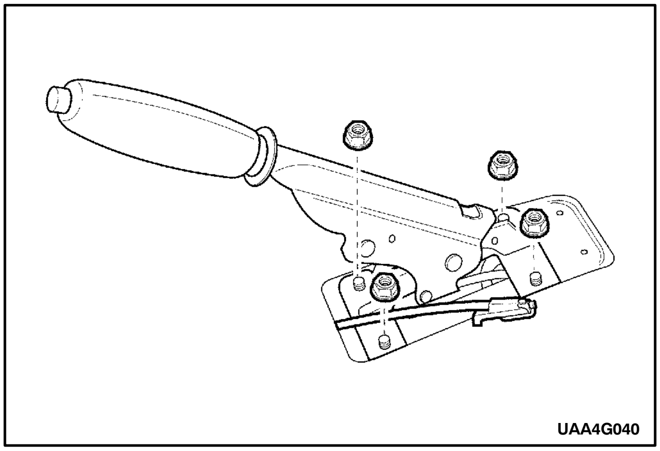
PARKING BRAKE LEVER

Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Remove the adjustment nut from the parking brake cable.
3. Lower the vehicle.

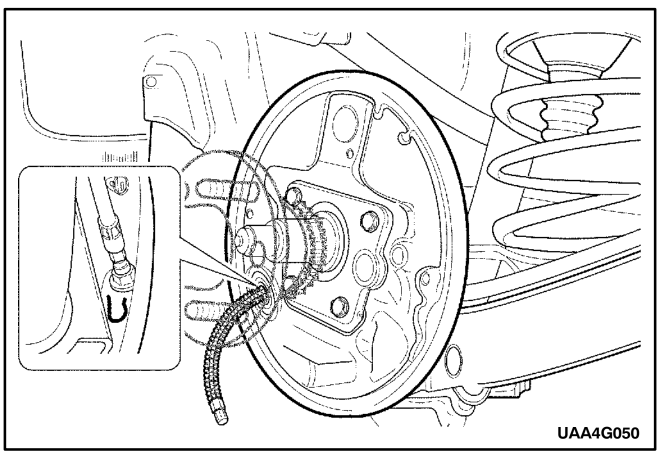


4. Release the parking brake.
5. Remove the parking brake/gearshift console hood. Refer to *Section 9G, Interior Trim.*
6. Disconnect the parking brake switch.
7. Remove the parking brake lever mounting nuts which secure the complete parking brake lever assembly to the underbody.

Installation Notice

Tightening Torque	22 N·m (16 lb–ft)

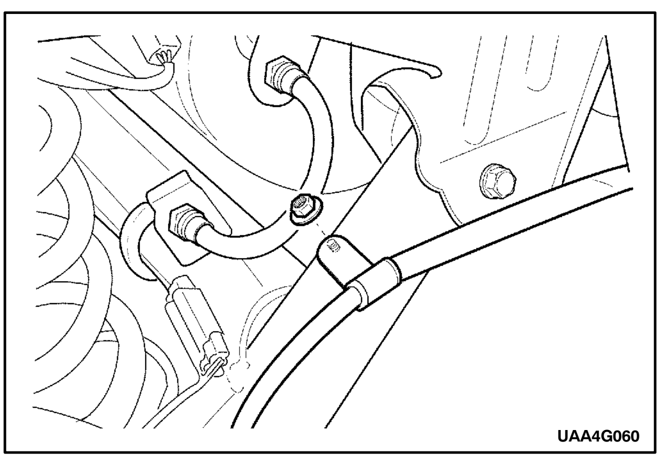
- The parking brake switch should be replaced if the BRAKE warning light in the instrument panel cluster did not glow when the parking brake was applied with the ignition switch ON.
- Check the parking brake adjustment Refer to "Parking Brake Adjustment" in this section.



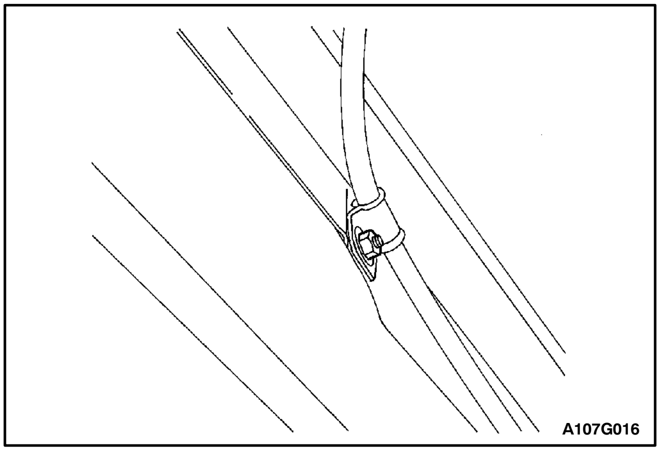
PARKING BRAKE CABLE

Removal and Installation Procedure

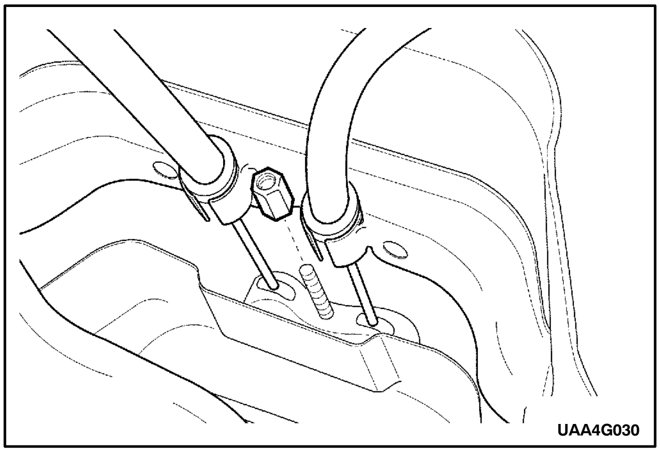
1. Release the parking brake.
2. Raise and suitably support the vehicle.
3. Remove the brake drum. Refer to "Drum" in this section.
4. Remove the parking brake retaining clip from the backing plate. Refer to *Section 4E, Rear Drum Brakes.*
5. Remove the parking brake cable from the brake shoe lever and from the brake backing plate.



6. Remove the nuts that fasten the parking brake cable to the bracket on the rear axle. Remove the cable from the bracket.



7. Remove the bolts that fasten the parking brake cable to the bracket on the underbody.
8. Remove the bolts that fasten the parking brake cable to the bracket on the fuel tank bracket.



9. Remove the adjustment nut from the parking brake cable.
10. Remove the parking brake cable.

Installation Notice

Tightening Torque	Parking Brake Cable-to-Axle Bracket Nuts	6 N·m (4 lb–ft)
Tightening Torque	Parking Brake Cable-to-Underbody Bracket Bolts	6 N·m (4 lb–ft)
Tightening Torque	Parking Brake Cable-to-Fuel Tank bracket Nuts	6 N·m (4 lb–ft)

- Check the parking brake adjustment Refer to “Parking Brake Adjustment” in this section.

SPECIFICATIONS

GENERAL SPECIFICATIONS

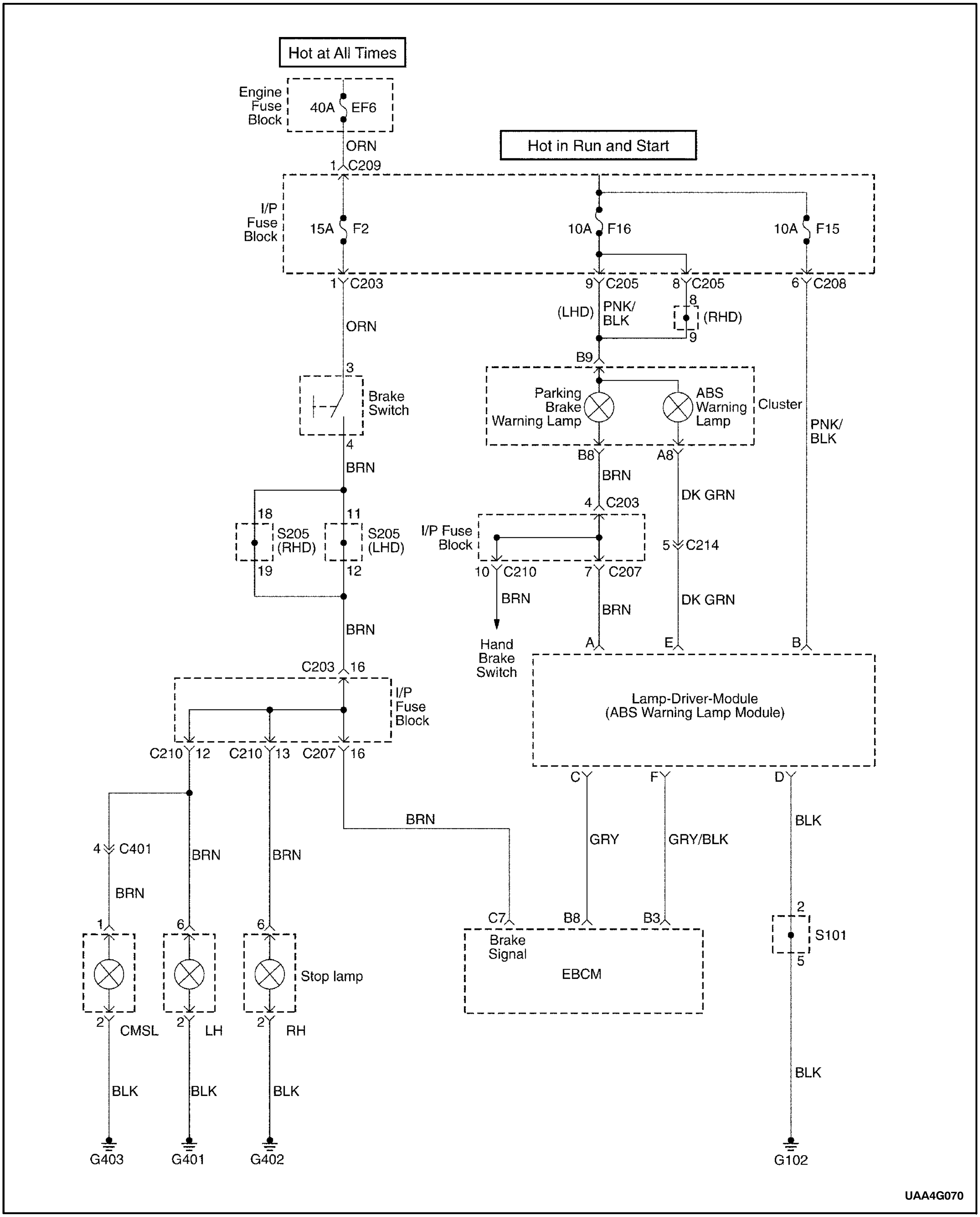
Application	Description
Parking Brake Lever Notch Number	7~9

FASTENER TIGHTENING SPECIFICATIONS

Application	NVm	Lb-Ft	Lb-In
Parking Brake Lever Mounting Nut	22	16	–
Parking Brake Cable-to-Axle Bracket Nut	6	4	53
Parking Brake Cable-to-Underbody Bracket Bolt	6	4	53
Parking Brake Cable-to-Fuel Tank Bracket Nut	6	4	53

SCHEMATIC AND ROUTING DIAGRAMS

PARKING BRAKE WARNING LAMP CIRCUIT



SECTION 5A

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

ZF 4 HP 16 AUTOMATIC TRANSAXLE

TABLE OF CONTENTS

INTRODUCTION

ZF 4HP16 AUTOMATIC TRANSAXLE

The ZF 4 HP 16 is a four-speed automatic transaxle designed for cars with front-wheel drive and a transversely mounted engine.

The transaxle has a hydrodynamic torque converter with a controlled slip lock-up clutch.

A planetary gear train establishes the mechanical gear ratios. The integral constant ratio can be adapted to the engine's power output and the vehicle's weight. The electronic-hydraulic control makes controlled power shifts and various shift programs possible. In selector lever position "P", the output is locked mechanically.

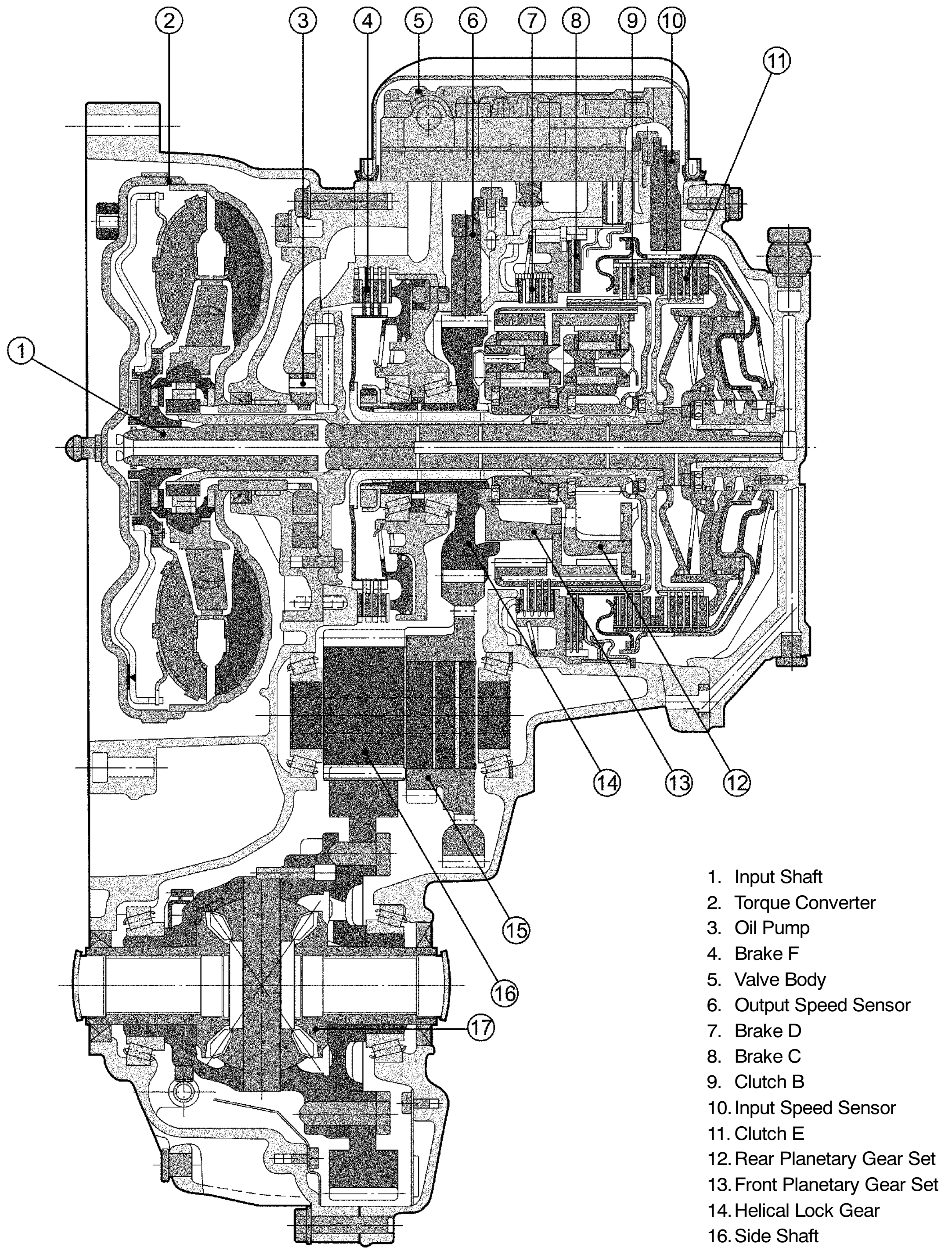
The special feature of this transaxle is that it operates without freewheels. Shifting between individual gears takes place by means of overlapping clutch engagement and release.

The advantage of overlap shifting is as follows:

– The transaxle can be of more compact design and is lighter on account of the absence of freewheels and the lower number of shift elements
– Lower drag losses, i.e. higher efficiency
– Lower peak torques acting on the components and driveline.

However, overlap shifting necessitates high-performance hardware and software, and precision engine signals.

TRANSAXLE COMPONENT



1. Input Shaft
2. Torque Converter
3. Oil Pump
4. Brake F
5. Valve Body
6. Output Speed Sensor
7. Brake D
8. Brake C
9. Clutch B
10. Input Speed Sensor
11. Clutch E
12. Rear Planetary Gear Set
13. Front Planetary Gear Set
14. Helical Lock Gear
16. Side Shaft
17. Differential

UAA5A010

DESCRIPTION AND OPERATION

The ZF 4HP 16 automatic transaxle consists primarily of the following components.

Mechanical

- Torque converter with LOC
- Drive link assembly
- Two multiple disk clutch assemblies : clutch B,E
- Three multiple brake assemblies : brake C,D,F
- Lock-up clutch valve
- Two planetary gear sets
- One oil pump
- Final drive and differential assembly

Electronic

- Two shift solenoid valve(sol.1,2)
- Four pressure control solenoid valve(EDS)
- Tow speed sensor; A/T ISS and A/T OSS
- Fluid temperature sensor
- Automatic transaxle control module(TCM)
- Wiring harness assembly

MECHANICAL COMPONETS

Torque converter

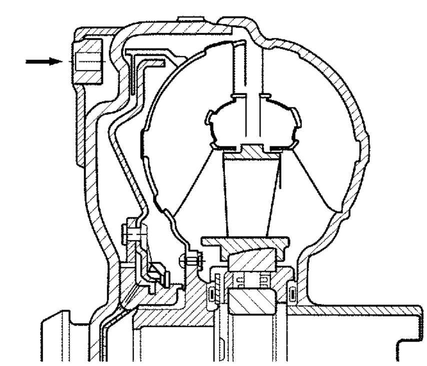
The converter consists of the impeller, the turbine wheel, the reaction member (stator) and the oil to transmit torque. The impeller, which is driven by the engine, causes the oil in the converter to flow in a circular pattern. This oil flow meets the turbine wheel, where is direction of flow is deflected. At the hub, the oil leaves the turbine and reaches the reaction member (stator), where it is once again deflected so that it reaches the impeller at the correct angle of flow.

The reversal effect generates moment in the stator, the reaction torque of which amplifies the turbine torque.

The ratio between turbine torque and torque is referred to as torque multiplication.

The greater the difference is speed between the pump and turbine, the greater the torque multiplication; it is at its highest when the turbine is at a standstill. The higher the speed of the turbine, the lower the torque multiplication.

When the turbine speed reaches about 85%of the pump speed, torque multiplication=1, i.e. the turbine torques is equivalent to pump torque.



UAA5A020

The stator, which bears against the housing via the freewheel, is then rotating freely in the oil flow and the freewheel is over-come. From this point onwards, the converter acts as a straightforward fluid coupling.

Space behind lock-up clutch piston

1. Friction lining
2. Lock-up clutch piston
3. Converter cover
4. Turbine wheel
5. Impeller
6. Stator
7. Turbine hub
8. Torque converter impeller hub

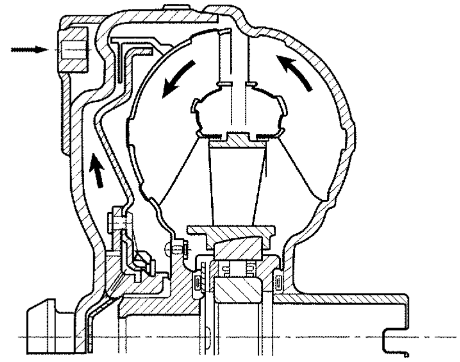
Lock–up clutch (LUC)

The converter lock-up clutch is a device, which eliminates converter slip and thus helps to improve fuel consumption.

The previous control principle for converter lock-up clutch operation has been replaced by a controlling function on the 4 HP 16. The converter lock-up clutch is engaged and released in a controlled manner. During the controlled phase, a slight speed difference between the impeller and turbine wheel is established. This ensures that the engine's rotating vibration is not phased on to the transaxle. The result is optimum shift quality.

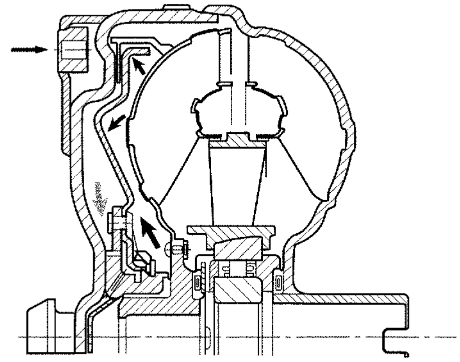
An electronic pressure-regulating valve determines pressure regulation of the converter lock-up clutch's piston.

When open (conversion range), the oil pressure behind the converter lock-up clutch piston and in the turbine zone is equal. The direction of flow is through the turbine shaft and through the space behind the piston, to the turbine chamber.



UAA5A030

To engage the lock-up clutch, the direction of flow is modified (reversed) via a valve in the hydraulic selector unit. At the same time, the space behind the lock-up clutch piston is vented. The oil pressure passes from the turbine chamber to the lock-up clutch piston and presses it against the converter's cover. The turbine is thus blocked by way of the linings between the piston and cover, and permits rigid through drive with no slip (or reduced slip if controlled) to the mechanical stage of the transaxle.



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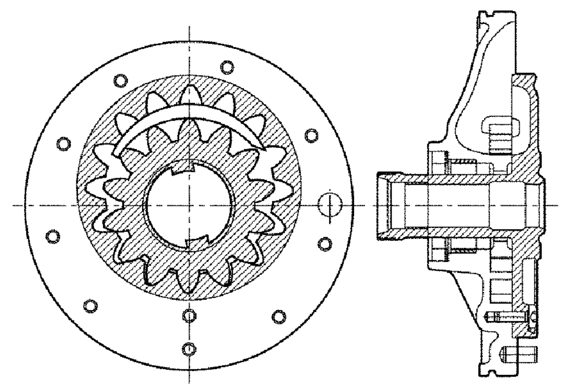
Fluid pump

The fluid pump is located between the torque converter and the transaxle case and is driven directly by the torque converter. The pump sucks the fluid through a filter and delivers it to the main pressure regulator valve of the control system. Excess fluid flows back to the pump. The fluid pump fulfills the following functions:

- Generates line pressure.
- Delivers fluid under pressure to the torque converter, thus preventing air bubbles in the fluid.
- Induces a flow of fluid through the torque converter in order to eliminate heat.
- Supplies fluid pressure to the hydraulic control system.
- Supplies fluid pressure to the shift components.
- Lubricates the transaxle with fluid.



UAA5A050

Pump housing

1. Disc
2. Shaft seal
3. Stator shaft
4. Pump wheel
5. Pump ring gear
6. Dowel pin

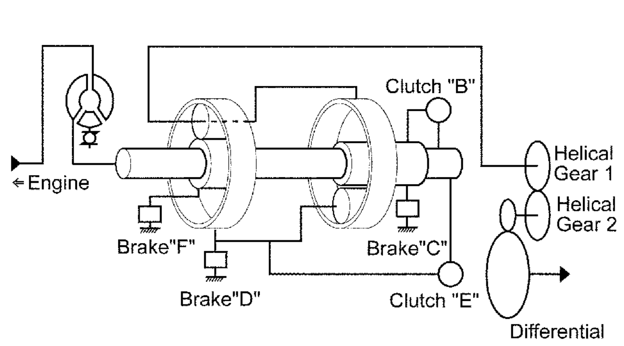
Planetary gears

The ZF 4HP 16 automatic transaxle is equipped with a one sun gear, 4 planetary gears, planetary carrier, ring gear.

Each gears are located one directly behind the other and are linked together. In other words, front ring gear is permanently linked to rear planet carrier, front planet carrier is linked to rear ring gear.

The individual gear ratios are obtained by linking together the gear set elements in different ways by means of clutches and brakes.

On the 4HP 16, the power flow is directed into the planetary gear set via rear planet carrier or rear sun gear, or via both simultaneously, depending on the gear in question. The output is always via front planet carrier.

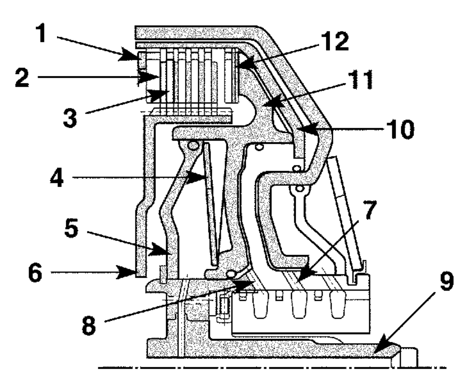


UAA5A060

Shift elements: multi–disc clutches and brakes

The purpose of the shift elements is to perform shifts under load without the tractive flow being interrupted.

The shift elements consist of the following.



UAA5A070

1. snap ring
2. steel disc
3. lined disc
4. cup spring
5. baffle plate
6. disc carrier
7. input shaft
8. oil supply to dynamic pressure equalizer
9. oil supply to clutch
10. cylinder
11. piston
12. spring disc

The shift elements are engaged hydraulically. The pressurized oil reaches the space between the cylinder and piston, as a result of which the discs are compressed. The clutch/brake is engaged. When the oil pressure drops, the cup spring acting on the piston presses the piston back into its initial position. The clutch/brake is now released again.

Depending on the gear, the multi-disc clutches B and E supply the engine torques to the planetary gear train, with multi-disc brakes C, D and F directing the torque into the housing.

The dynamic pressure at clutches B and E is equal; i.e. the dynamic pressure in front of and behind the piston is equal. This equalizing effect is achieved in the following way.

The space between the baffle plate and piston is filled with unpressurised oil. A dynamic pressure dependent on the engine speed builds up. The space between pressure also builds up. However, there is simultaneously a static pressure, which causes the clutch to engage. If the static pressure is relieved, the cup spring is able to force the piston back into its original position.

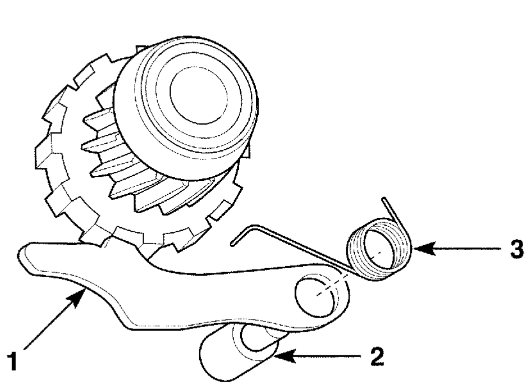
The advantages of this dynamic pressure equalization are:

- Reliable clutch opening in all speed ranges
- Smoother shifts.

Parking lock

The parking lock is actuated via the selector lever when in position P. It protects the vehicle mechanically against rolling away.

The stop plate is actuated by the selector shaft, which is permanently connected to the selector lever via a pull cable. The parking lock pawl in the parking lock gear, which is welded onto the lateral shaft of the transaxle. This blocks the driven wheels.



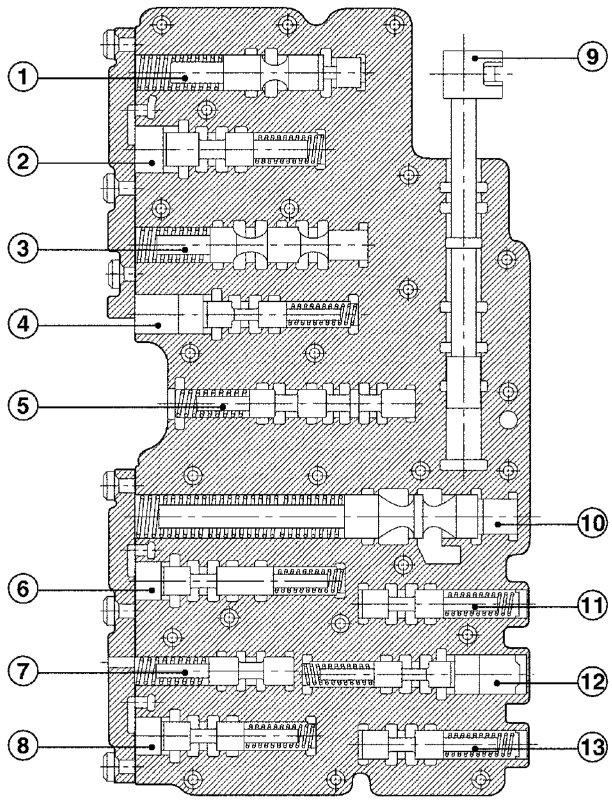
UAA5A080

1. Pawl
2. Supporting bolt
3. leg spring

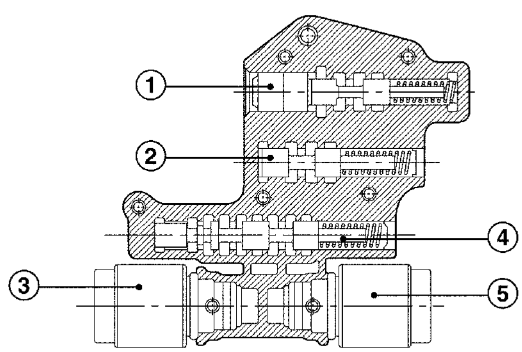
Valve body

Valve body performs the following tasks:

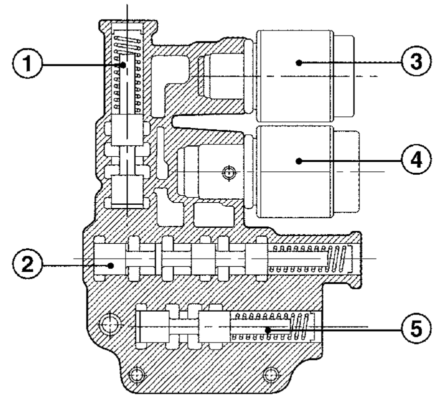
- Generates the line pressure needed for actuating the shift elements.
- Actuates the individual shift elements via the clutch valves.
- Assures limited operation of the automatic transaxle in the event of the electronics failing.
- Actuating the lock-up clutch.
- Generating the lubricating pressure for the transaxle



1. Lubrication Valve
2. Lock–up Clutch Valve
3. Converter Pressure Valve
4. Clutch Calve F
5. Holding Valve E
6. Clutch Valve E
7. Holding Valve B
8. Clutch Valve B
9. Manual Valve
10. Line Pressure Control Valve
11. Reduction Valve
12. Clutch Valve D
13. Holding Valve D



1. Clutch Valve C
2. Holding Valve C
3. Pressure Control Solenoid Valve(EDS)
4. Safety Valve
5. Solenoid Valve



1. Converter Shift Valve
2. Selector Valve
3. Solenoid Valve
4. Pressure Control Solenoid Valve
5. Holding Valve F

UAA5A090

ELECTRONICAL COMPONETS

Selector lever/program switch

The driver engages the travel position via the selector lever:

P: park position	R : reverse
N : neutral	D : forward speeds

Park/Neutral Position Switch

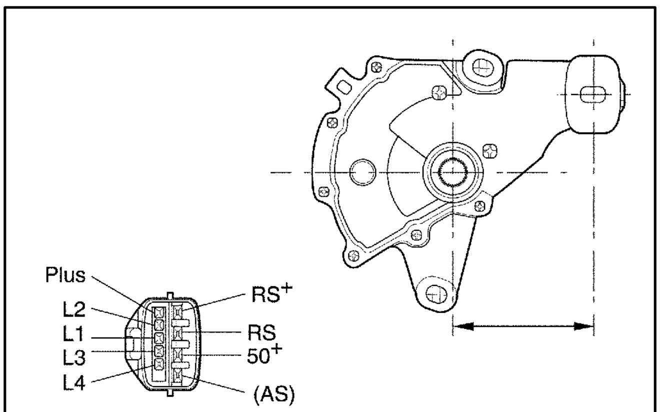
The Park/Neutral Position Switch is located on the selector shaft and informs the TCM of the current selector lever position P–R–N–D–3–2–1.

The selector lever position is transmitted to the TCM in encoded form along 4 lines. The encoding is such that malfunctions in the connecting lead are identified.

The Park/Neutral Position Switch is located on the selector shaft, which is connected to the selector lever via a pull cable. In addition, the Park/Neutral Position Switch controls the starter interlock, the reversing light and the selector lever position indicator on the instrument panel.

Signal combination

	L1	L2	L3	L4
P	0	0	12	0
R	0	0	0	12
N	0	12	0	0
D	12	12	12	0
3	12	12	0	12
2	12	0	12	12
1	0	12	12	12



UAA5A100

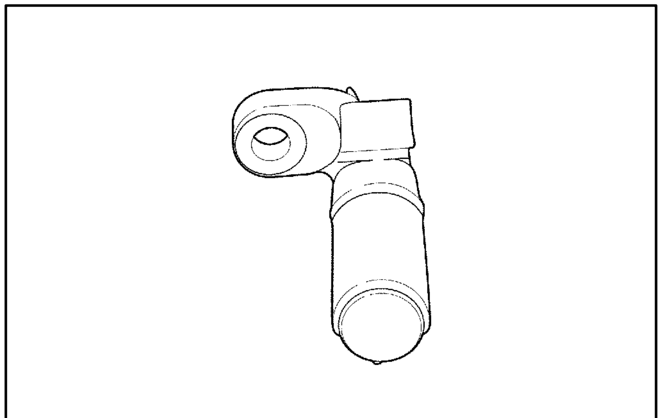
Automatic transaxle output speed sensor (A/T OSS)

The vehicle A/T OSS is a magnetic inductive pickup that relays information relative to vehicle speed to the TCM.

Vehicle speed information is used by the TCM to control shift timing, line pressure, and LUC (lock-up clutch) apply and release.

The output speed sensor mounts in the case at the speed sensor rotor, which is pressed onto the spur gear. An air gap of 0.1mm~1.3mm(0.004~0.05in) is maintained between the sensor and the teeth on the spur gear teeth. The sensor consists of a permanent magnet surrounded by a coil of wire.

As the differential rotates, an AC signal is induce a higher frequency and voltage measurement at the sensor. Sensor resistance should measure ∞ at 20°C(68°F). Sensor can measure from 20HZ~8,000HZ.


UAA5A110

Automatic transaxle input speed sensor (A/T ISS)

The A/T ISS is a magnetic inductive pickup that relays information relative to transaxle input speed to the TCM.

The TCM uses transaxle input speed information to control line pressure, LOC apply and release and transaxle shift patterns. This information is also uses to calculate the appropriate operating gear ratios and LOC slippage.

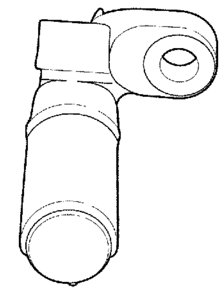
The input speed sensor mounts onto piston B that is inside of valve body.

An air gap of 1.8~2.2mm(0.07~0.086inch) is maintained between the sensor and the piston B.

The sensor consists of a permanent magnet surround by a coil of wire. As the piston B is driven by the turbine shaft, an AC signal induced in the input speed sensor.

Higher vehicle speeds induce a higher frequency and voltage measurement at the sensor.

Sensor resistance should measure between 825~835 ohms at 20°C(68°F). Sensor can measure from 1,000~8,000HZ.



UAA5A120

Shift solenoid valve: Solenoid 1,2

The shift solenoids are two identical, normally open electronic exhaust valve that control upshifts and downshifts in all forward gear ranges. These shift solenoids works together in a combination of ON and OFF sequences to control the line pressure and shift mechanisms (clutches, brakes).

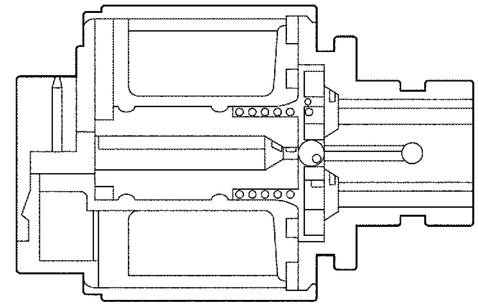
Solenoid 1 control the high or low of the line pressure (flow to each clutch valve) by the operation type (ON/OFF), i.e. solenoid 1is ON, line pressure will be low (6~8bar), solenoid 1 is OFF, line pressure will be high (16~18bar).

Solenoid 2 controls the oil flow to clutch valve E or lock-up clutch valve by the ON/OFF signal.

The TCM monitors numerous inputs to determine the appropriate solenoid state combination and transaxle gear for the vehicle operating conditions.

Gear	Solenoid 1	Solenoid 2
Park, Neutral	ON	ON
First	ON/OFF	ON
Second	ON/OFF	OFF
Third	ON/OFF	OFF
Fourth	ON/OFF	OFF
Reverse	ON/OFF	ON

	Line pressure	Resistance
Solenoid valve 1/ Solenoid valve 2	ON(low) : 6.2~6.8bar OFF(high)15.3~17.4 6bar	26.5±0.5ohm

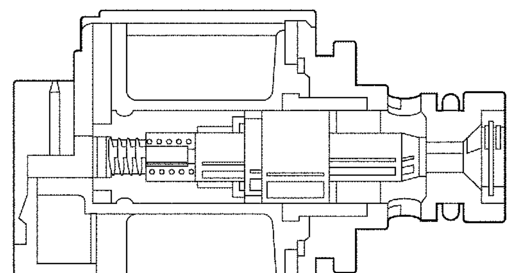


UAA5A130

Pressure control solenoid valve (EDS VALVE 3,4,5,6)

The pressure control valve (EDS valve 3,4,5,6) is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch.

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

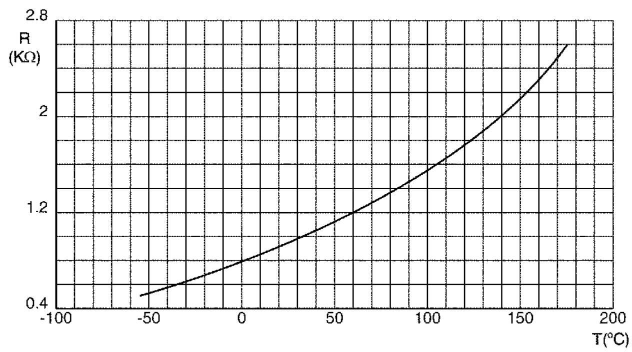


UAA5A140

Transaxle Fluid Temperature (TFT) Sensor

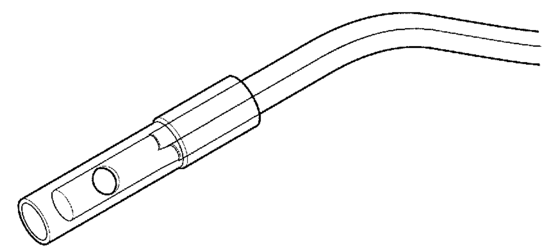
The TFT sensor is a positive temperature coefficient thermistor (temperature sensitive resistor) that provides information to the TCM regarding transaxle fluid temperature. The temperature sensor is located in valve body. Calculated temperature is a factor to determine at the shift time and shift delay time.

The internal electrical resistance of the sensor varies in relation to the operating temperature of the transaxle fluid (see chart).



UAA5A150

The TCM sends a 5volt-reference signal to the temperature sensor and measures the voltage rise in the electrical circuit. A higher fluid temperature creates a higher resistance in the temperature sensor, thereby measuring a lower voltage signal.



UAA5A160

The TCM measures this voltage as another input to help control line pressure, shift schedules and LOC apply.

When transaxle fluid temperature reaches 140°C (284°F) the TCM enters "hot mode." Above this temperature the TCM modifies transaxle shift schedules and LOC apply in an attempt to reduce fluid temperature by reducing transaxle heat generation. During hot mode the TCM applies the LOC at all times in fourth gears.

Also, the TCM performs the 2–3 and 3–4 shifts earlier to help reduce fluid heat generation. Hot mode may not be available on some applications.

Transaxle Sensor – Temperrature To Resistance To Voltage (approximate)					
°C	R hight (ohms)	R low (ohms)	°C	R hight (ohms)	R low (ohms)
–40	586	556	50	1,206	1,173
–30	641	611	60	1,295	1,256
–20	699	670	70	1,388	1,341
–10	760	732	80	1,485	1,430
0	825	799	90	1,585	1,522
10	893	868	100	1,690	1,617
20	963	942	110	1,798	1,715
25	1,000	980	120	1,910	1,816
30	1,039	1,017	130	2,025	1,920
			140	2,145	2,027

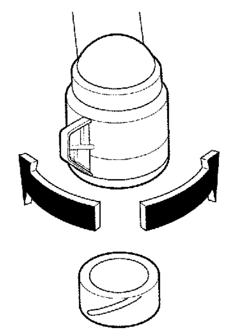
Transaxle electrical connector

The transaxle electrical connector is a very important part of the transaxle operating system. Any interference with the electrical connection can cause the transaxle to set Diagnostic Trouble Codes (DTCs) and/or affect proper operation.

The following items can affect the electrical connections:

- Bent pins in the connector from rough handling during connection and disconnection.
- Wires backing away from the pins or coming unclamped (in either internal or external wiring harness).
- Dirt contamination entering the connector when disconnected.
- Pins in the internal wiring connector backing out of the connector or pushed out during reconnection.

- Excessive transaxle fluid leaking into the connector, wicking up into the external wiring harness, and degrading the wire insulation.
- Water/moisture intrusion in the connector.
- Low pin retention in the external connector from excessive connection and disconnection of the wiring connector assembly.
- Pin corrosion from contamination.
- Broken/cracked connector assembly.
- Points to remember when working with transaxle wiring connector assembly.
- To remove the connector, squeeze the two tabs towards each other and pull straight up (refer to illustration).


UAA5A170

Carefully limit twisting or wiggling the connector during removal. Bent pins can occur.

DO NOT pry the connector off with a screwdriver or other tool.

To reinstall the external wiring connector, first orient the pins by lining up arrows on each half of the connector.

Push the connector straight down into the transaxle without twisting or angling the mating parts.

The connector should click into place with a positive fell and/or noise.

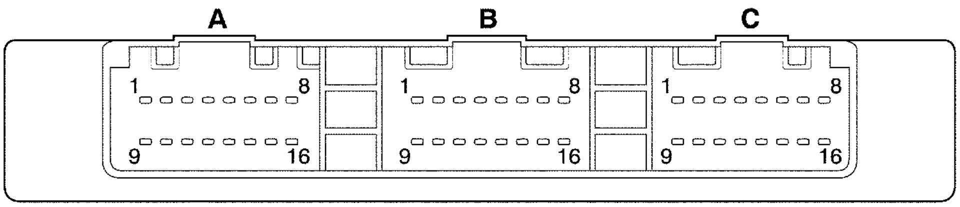
Transaxle control module (TCM)

The transaxle control module (TCM) is an electronic device which monitors inputs to control various transaxle functions including shift quality and transaxle sensors, switches, and components to process for use within its' control program. Based on this input information, the TCM controls various transaxle output functions and devices.

Data link connector (DLC)

The data link connector (DLC) is a multiple cavity connector. The DLC provides the means to access serial data from the TCM to aid in powertrain diagnosis. The DLC allows the technician to use a scan tool to monitor various systems and display diagnostic trouble codes (DTCs). The DLC connector is located within the driver's compartment, directly below the steering column.

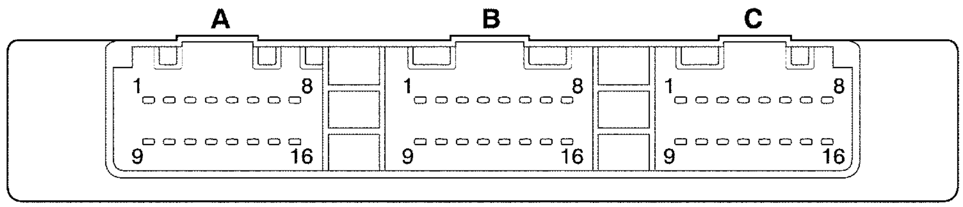
Explain of the data link Connector (CAN TYPE)
1.8L SOHC (Simense 16 bit), 2.0L DOHC (Delphi 32 bit)



UAA5A180

	A connector (blue)	B connector (green)	C connector (gray)
1	Solenoid 2	Fluid Temperature Ground	Selector Lever Line L1
2	Power Mode Indicator / Auto Transaxle Emergency Lamp	Input Speed Sensor (+)	Not Used
3	EDS 4	BAT +	Not Used
4	TFT Sensor	Input Speed Sensor (–)	Hold Mode Switch
5	Brake Switch	Output Speed Sensor (–)	Not Used
6	Hold Mode Indicator	Selector Lever Line L3	EDS Supply
7	Diagnose(ALDL)	Input Speed Sensor Ground	EDS Supply
8	Can High	Tachometer	Solenoid Supply
9	Solenoid 1	Power Mode Switch	Not Used
10	Pressure Control Solenoid Valve(EDS 5)	Output Speed Sensor (+)	Not Used
11	Pressure Control Solenoid Valve(EDS 3)	Selector Lever Line L4	Not Used
12	Pressure Control Solenoid Valve(EDS 6)	Ground	Not Used
13	Not Used	Ground	PNP Signal (TCM→ECU)
14	Not Used	Not Used	Not Used
15	Not Used	Selector Lever Line L2	IG ON
16	Can Low	Not Used	IG ON

Explain of the data link Connector (DISCRETE TYPE) 2.0L DOHC (Delphi 8 bit)



	A connector (blue)	B connector (green)	C connector (gray)
1	Solenoid 2	Fluid Temperature Ground	Selector Lever Line L1
2	Power Mode Indicator / Auto Transaxle Emergency Lamp	Input Speed Sensor (+)	Engine speed signal
3	EDS 4	BAT +	Not Used
4	TFT Sensor	Input Speed Sensor (–)	Hold Mode Switch
5	Brake Switch	Output Speed Sensor (–)	Not Used
6	Hold Mode Indicator	Selector Lever Line L3	EDS Supply
7	Diagnose(ALDL)	Input Speed Sensor Ground	EDS Supply
8	Not Used	Tachometer	Solenoid Supply
9	Solenoid 1	Power Mode Switch	MIL
10	Pressure Control Solenoid Valve(EDS 5)	Output Speed Sensor (+)	Throttle Position Signal
11	Pressure Control Solenoid Valve(EDS 3)	Selector Lever Line L4	Not Used
12	Pressure Control Solenoid Valve(EDS 6)	Ground	Not Used
13	Engine Torque Signal	Ground	PNP Signal (TCM→ECU)
14	Not Used	Not Used	Engine Torque Reduction
15	Not Used	Selector Lever Line L2	IG ON
16	Not Used	Not Used	IG ON

TCM INPUTS THAT AFFECT THE 4HP 16 TRANSAXLE

Throttle position sensor

- Provides throttle position data to the TCM for determining shift patterns and LOC apply/release.
- An incorrect throttle position sensor input could causes erratic or shift pattern, poor shift quality or LOC function

Automatic Transaxle Output (Shaft) Speed Sensor

- Provides vehicle speed data to the TCM for determining shift patterns and LOC apply/release, and gear ratio calculations.
- An incorrect A/T OSS input could causes erratic or shift pattern, poor shift quality or LOC function.

Automatic Transaxle Input (Shaft) Speed Sensor

- Provides transaxle input speed data to the TCM for determining shift patterns and LOC apply/release, and gear ratio.

Engine Coolant Temperature Sensor

- Provides coolant temperature data to the TCM for determining initial LOC engagement.
- An incorrect engine coolant temperature sensor input could causes an incorrect initial LOC apply

Engine Speed

- The ignition module provides engine speed data to the TCM.
- The TCM uses engine speed information for controlling wide open throttle shifts and the LOC PWM solenoid duty cycle.

Brake Switch

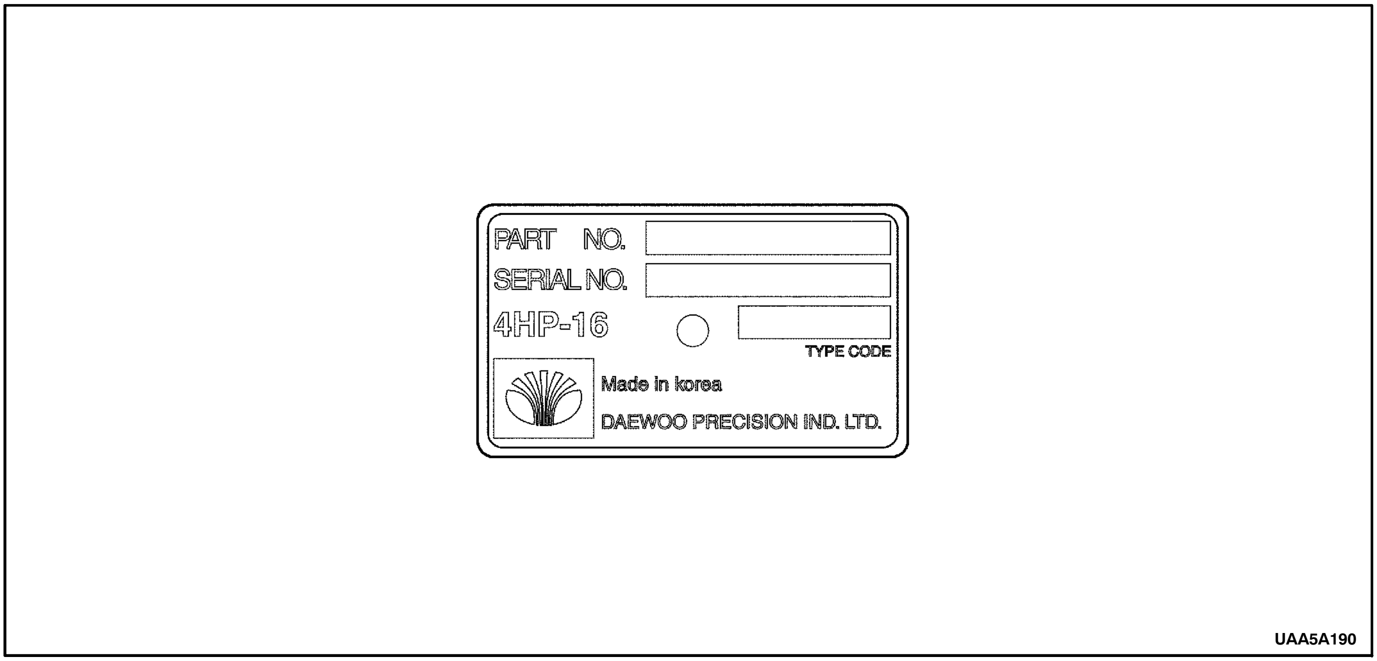
- Provides brake apply information to the TCM for controlling LOC apply and release.
- An incorrect LOC brake switch input could causes an incorrect LOC apply or release.

Transaxle Fluid Temperature (TFT) Sensor

- Provides transaxle fluid temperature information to the TCM for determining alternate shift patterns and LOC apply during high temperature conditions (hot mode operation).
- An incorrect transaxle temperature sensor input could causes altered shift patterns, poor shift quality and incorrect LOC apply.

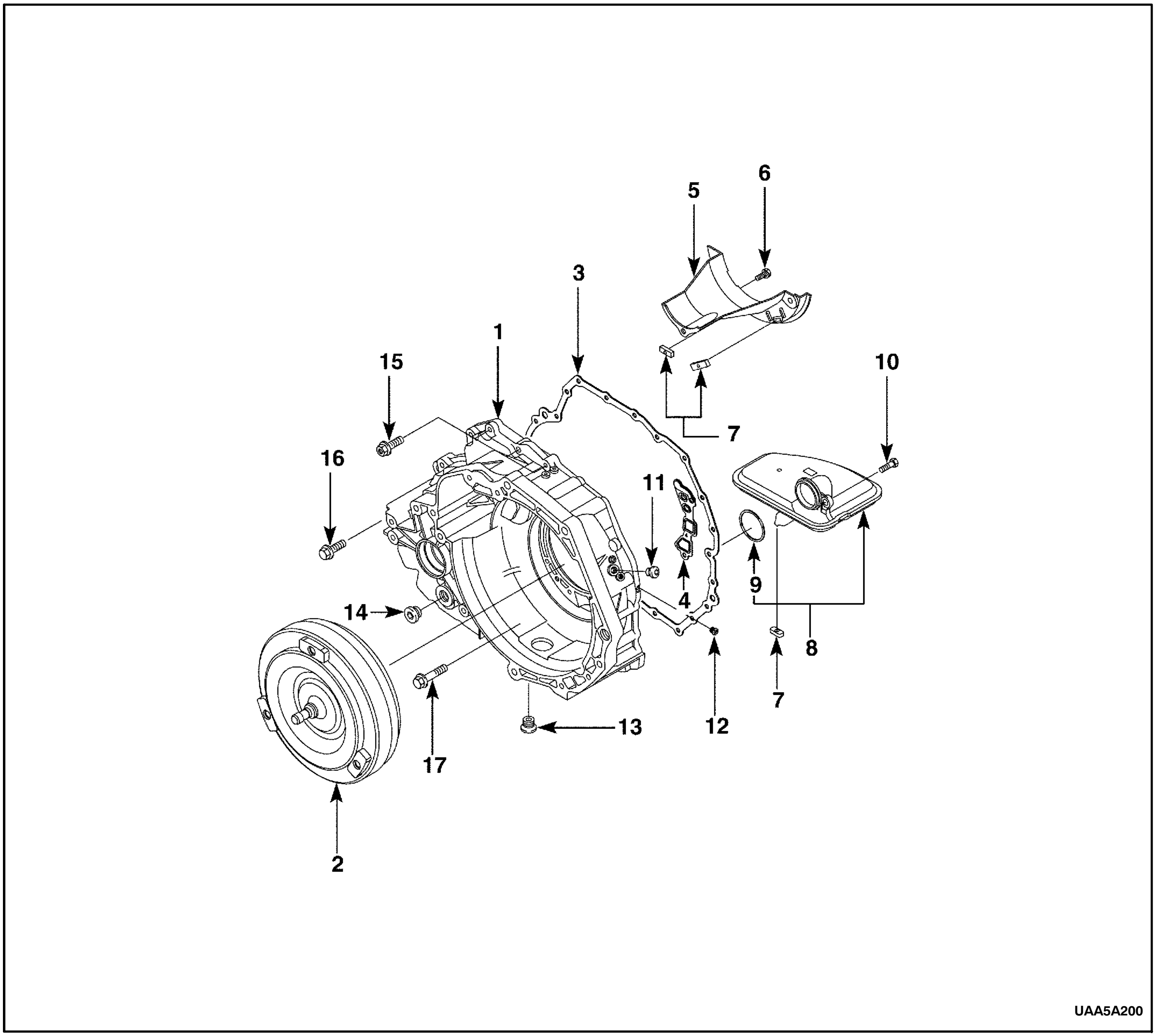
COMPONENT LOCATOR

TRANSAXLE IDENTIFICATION INFORMAITON



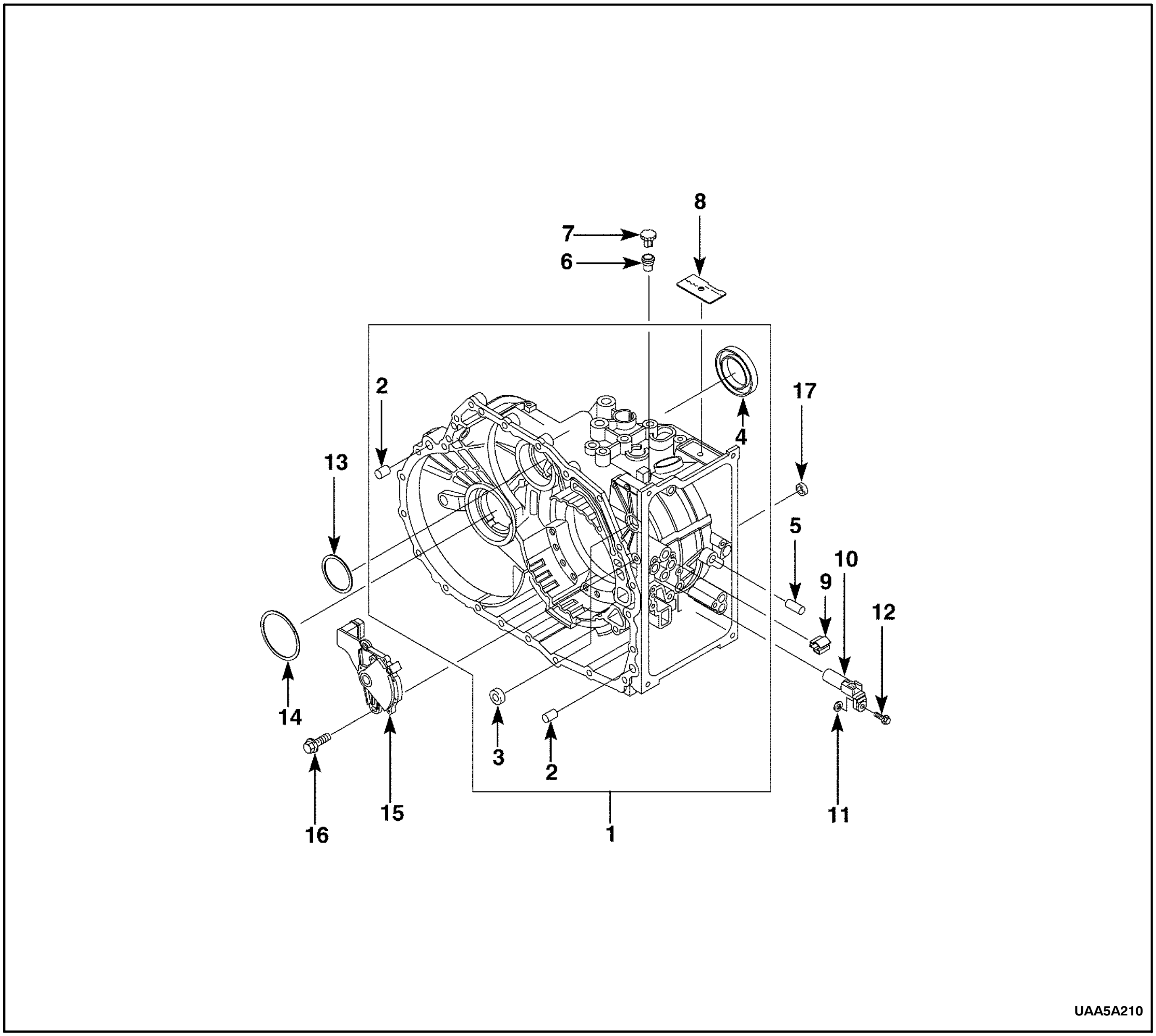
1 Part number
2 Serial number
3 Model code
4 Manufactured nation and company

TORQUE CONVERTER



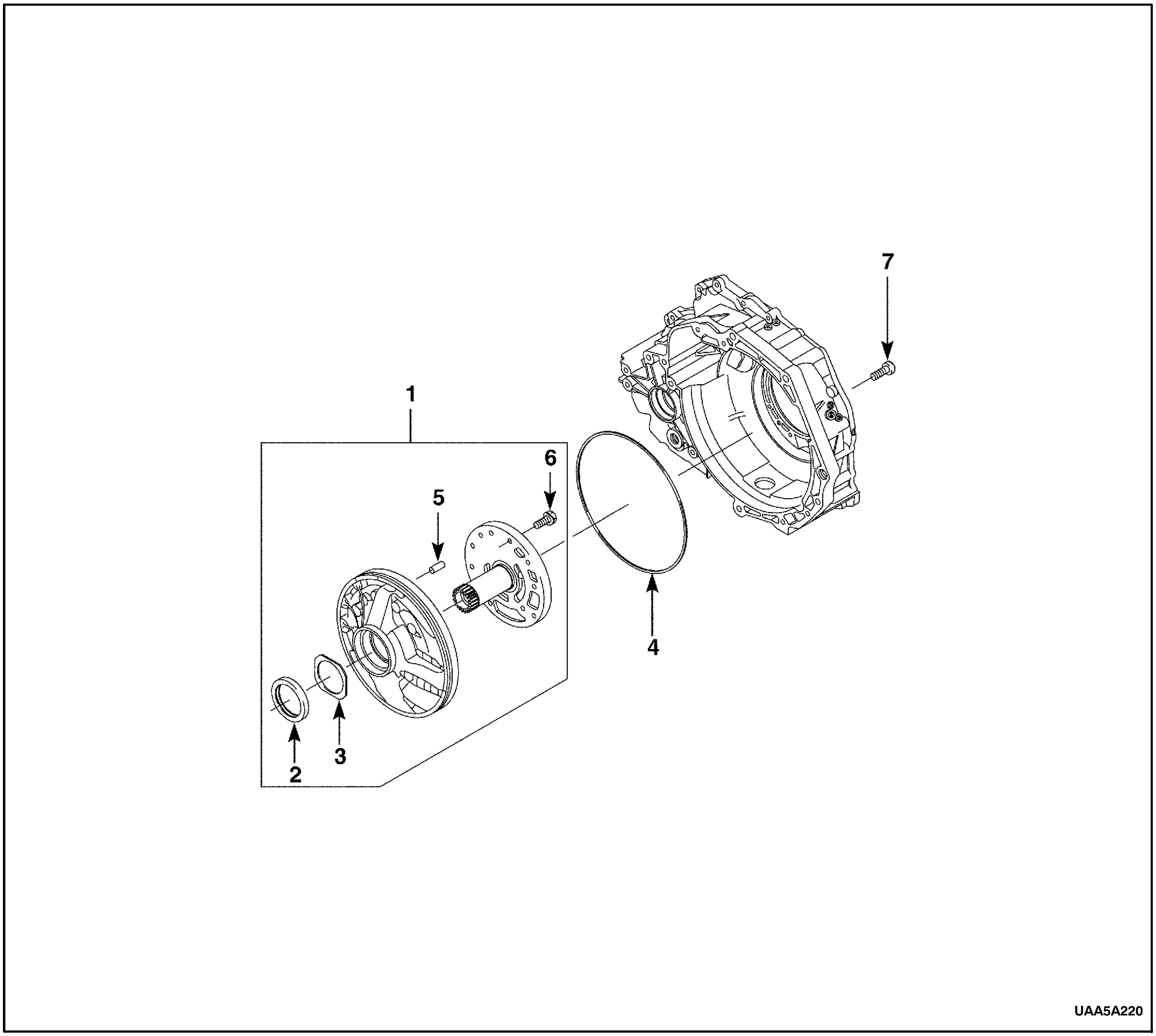
1 Torque converter housing
2 Torque converter
3 Torque converter gasket
4 Steel Gasket
5 Oil baffle plate
6 Bolt
7 Magnet
8 Oil filter
9 O–ring
10 Screw
11 Pressure plug
12 Pressure plug
13 Oil drain plug
14 Oil level plug
15 Screw
16 Bolt
17 Bolt

TRANSAXLE HOUSING



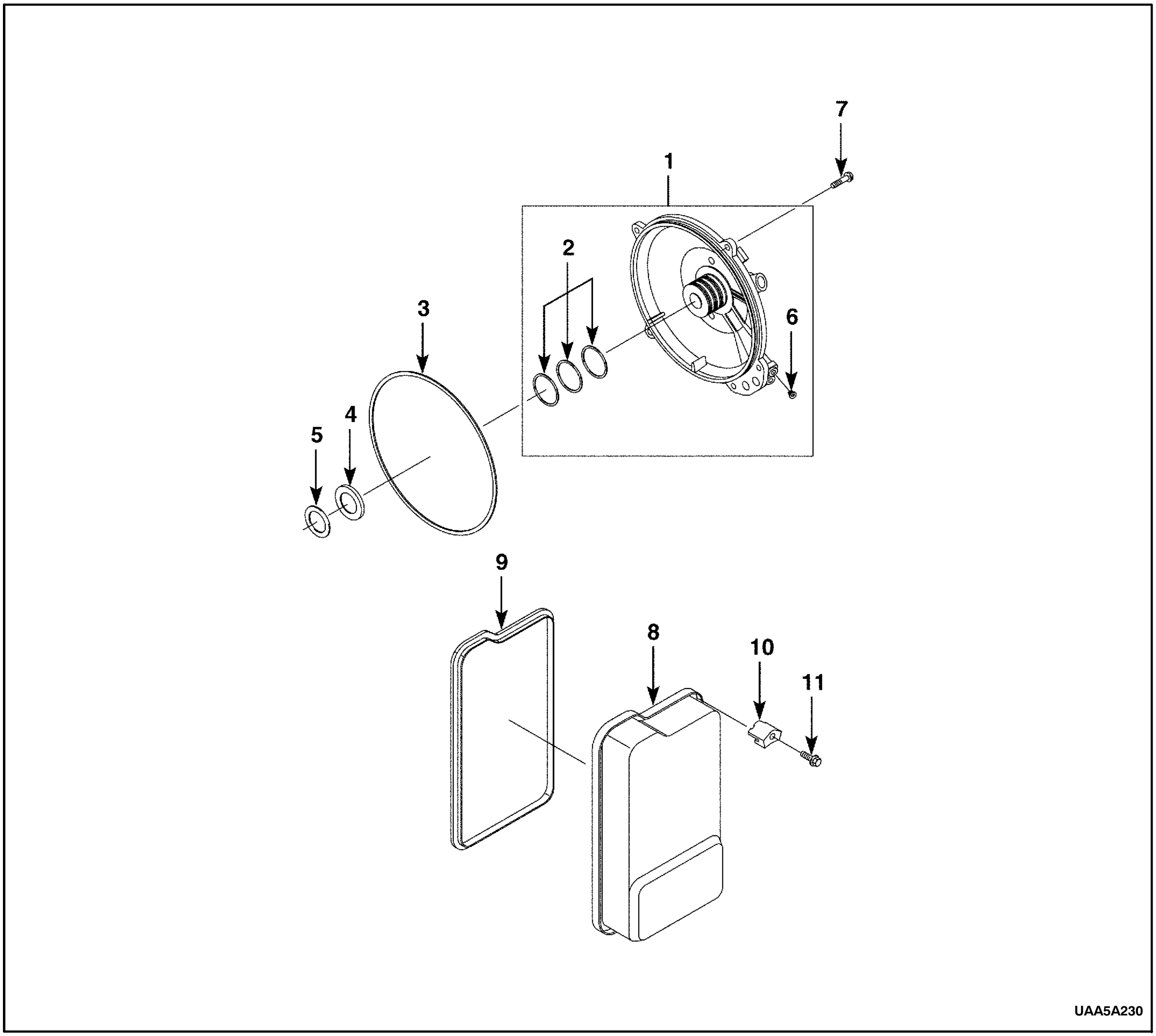
1 Transaxle housing	10 Output speed sensor
2 Bush	11 Washer
3 Shaft seal	12 Bolt
4 Axle shaft seal	13 Shim
5 Sealing sleeve	14 Shim
6 Breather pipe	15 Park/Neutral Position Switch
7 Sleeve protect	16 Bolt
8 Type plate	17 Sealing sleev
9 Cable terminal	

OIL PUMP



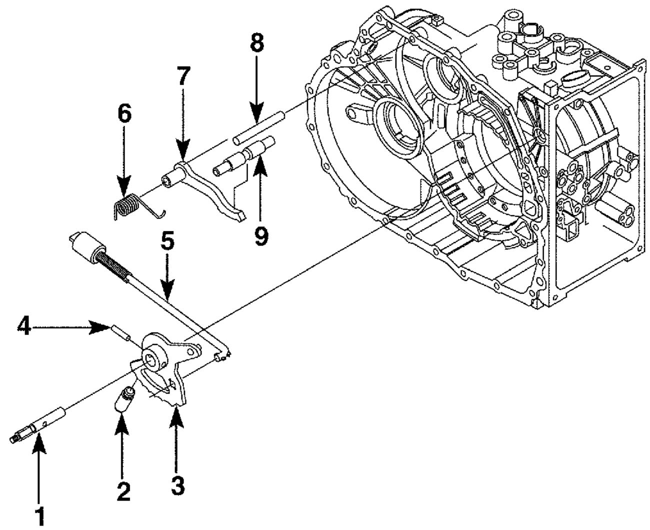
1 Oil pump
2 Oil pump seal
3 Washer
4 O-ring
5 Dowl Pin
6 Bolt
7 Bolt

REAR COVER & OIL PAN COVER



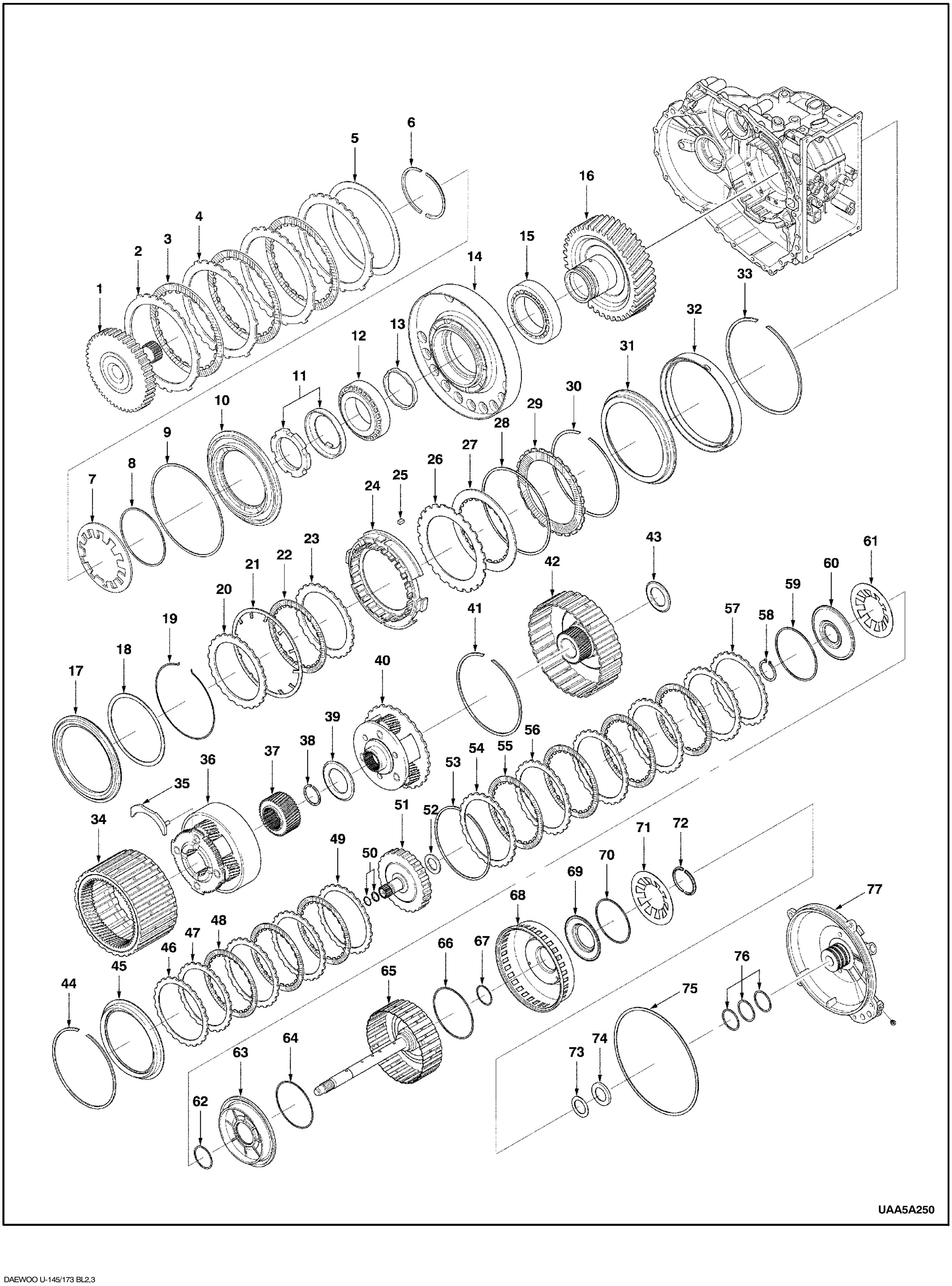
1 Rear cover
2 Piston ring
3 O-ring
4 Needle bearing
5 Shim
6 Screw plug
7 Bolt
8 Oil pan
9 Oil pan gasket
10 Oil pan bracket
11 Bolt

PARKING LEVER



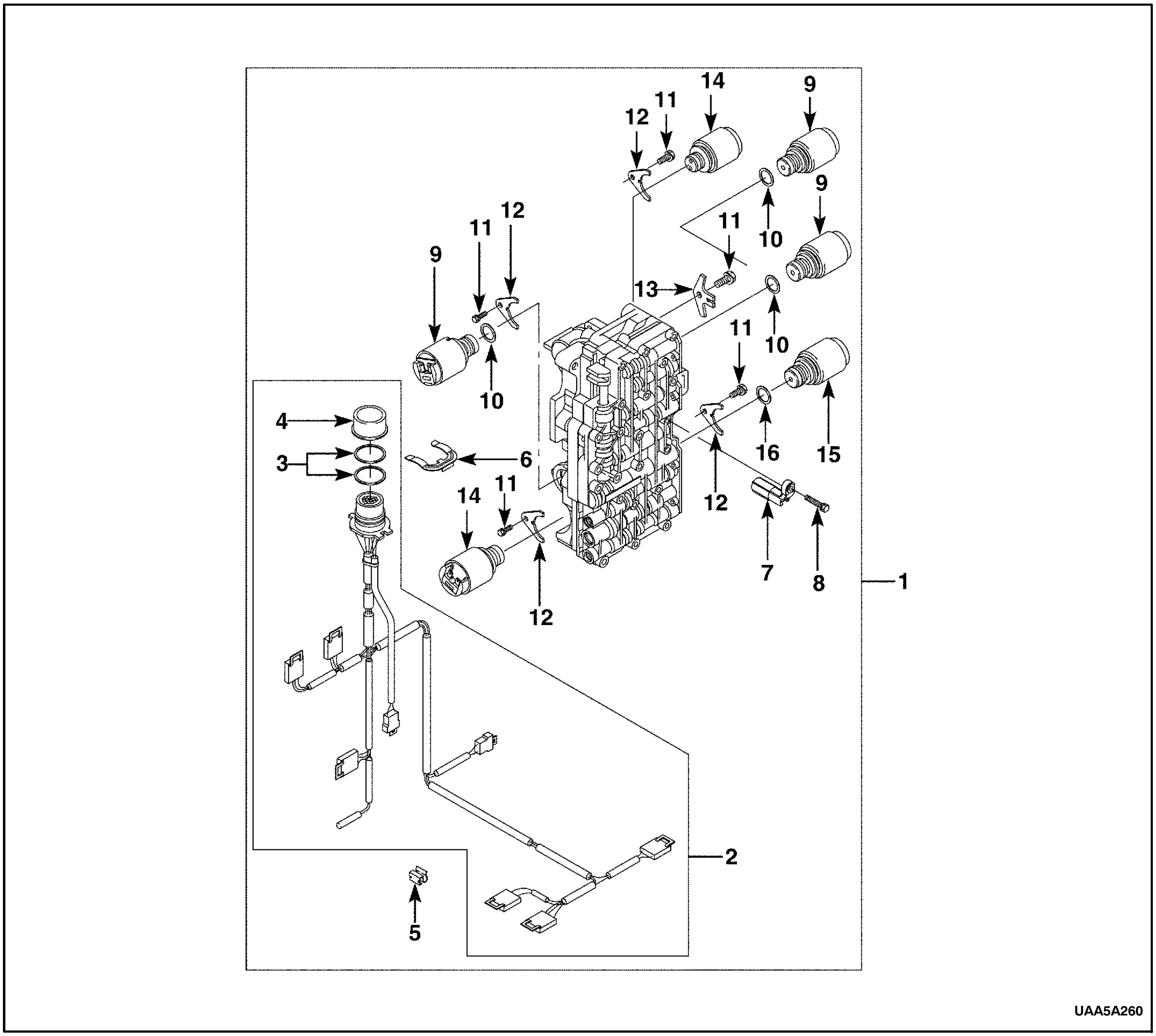
1 Selector shaft
2 Stop bush
3 Detent disc
4 Clamping sleeve
5 Connecting bar
6 Leg spring
7 Pawl
8 Pin
9 Support bolt

INPUT SHAFT & SHIFT GEAR



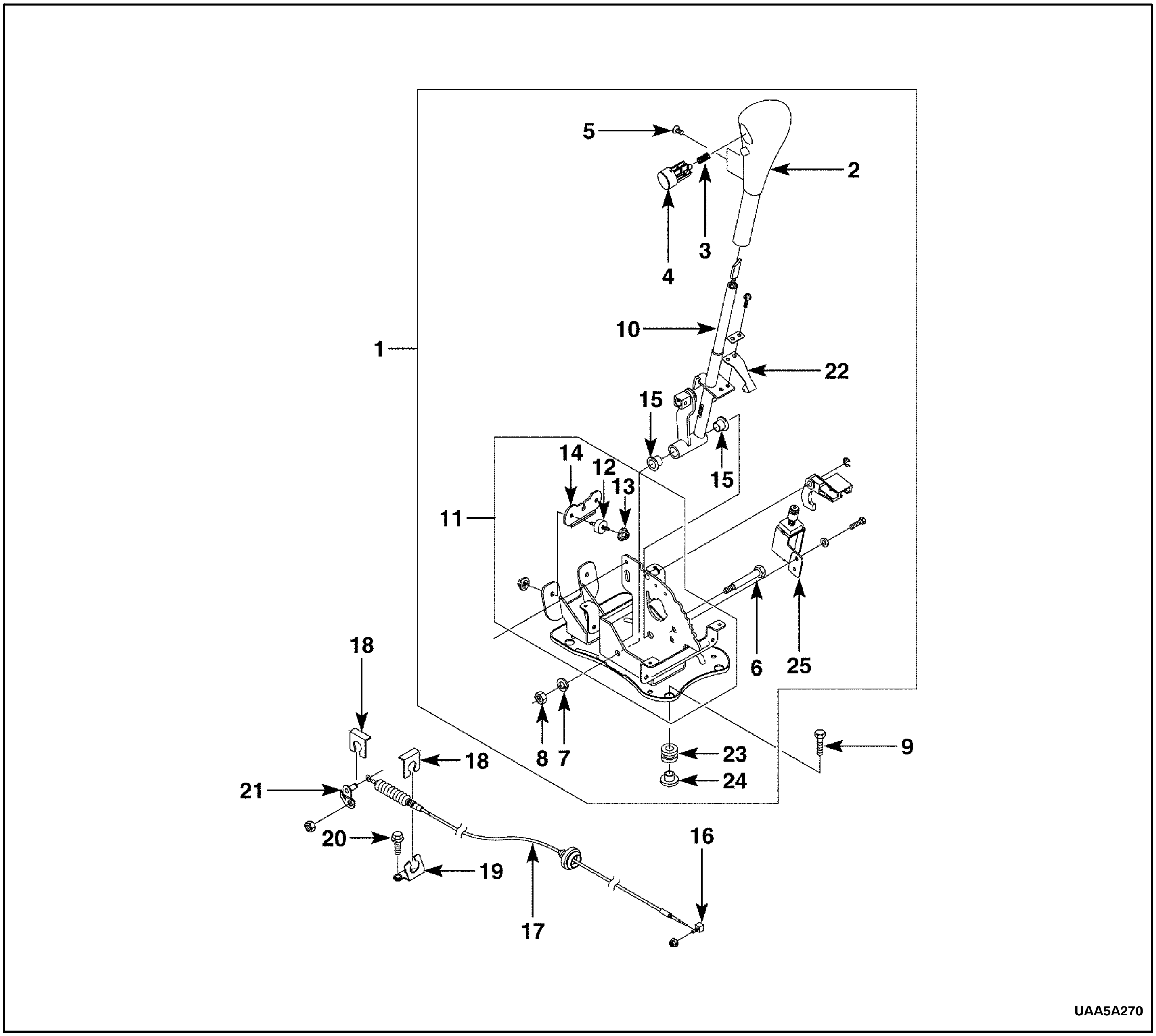
1 Inner disc carrier F
2 Clutch plate F
3 Line clutch disc disc F
4 Clutch outer disc F
5 Spring disc
6 Stop ring
7 Cup spring
8 O-ring
9 O-ring
10 Piston D
11 Slotted nut
12 Roller bearing
13 Adjust ring
14 Bearing plate
15 Roller bearing
16 Spur gear
17 Piston D
18 Spring disc
19 Snap ring
20 Clutch plate D
21 Cup spring
22 Line clutch disc D
23 Spring disc
24 Disc carrier C/D
25 Pitting key
26 Line clutch disc C
27 Clutch outer disc C
28 Cup spring
29 Line clutch disc C
30 Snap ring
31 Piston C
32 Cylinder C
33 Snap ring
34 Front ring gear
35 Oil tray
36 Front planetary gear set
37 Front sun gear
38 Snap ring
39 Needle bearing
40 Rear planetary gear set
41 Snap ring
42 Rear sun gear
43 Needle bearing
44 Snap ring
45 Piston B
46 Clutch plate B
47 Clutch outer disc B
48 Line clutch disc B
49 Spring disc
50 Piston ring
51 Inner disc carrier E
52 Needle bearing
53 Snap ring
54 Clutch plate disc E
55 Line clutch disc E
56 Clutch outer disc E
57 Spring disc
58 Retainer ring
59 O-ring
60 Oil dam
61 Cup spring
62 O-ring
63 Piston E
64 O-ring
65 Input shaft
66 O-ring
67 O-ring
68 Piston
69 Oil dam
70 O-ring
71 Cup spring
72 Stop ring
73 Shim
74 Needle bearing
75 O-ring
76 Piston ring
77 Rear cover

VALVE BODY



1 Control valve body
2 Valve body wiring harness
3 O-ring
4 Plug
5 Cable terminal
6 Retaining clip
7 Input speed sensor
8 Cap screw
9 Pressure control valve(EDS valve)
10 Cap screw
11 Fixing plate
12 Fixing plate
13 Cap screw
14 Pressure control valve(EDS valve)
15 Solenoid valve

GEAR SHIFT CONTROL



1 Selector control
2 Selector control handle
3 Spring
4 Selector control button
5 Screw
6 Selector lever shaft
7 Spring washer
8 Nut
9 Bolt
10 Intermediate lever
11 Base plate
12 Selector control isolator
13 Nut
14 Fastener plate
15 Bush
16 Selector control clamp piece
17 Selector control cable
18 E-ring
19 Cable fastener
20 Bolt
21 Transaxle lever
22 Positioning spring
23 Grommet
24 Bush
25 BTSI Solenoid

DIAGNOSTIC INFORMATION AND PROCEDURES DIAGNOSIS

BASIC KNOWLEDGE REQUIRED

You must be familiar with some basic electronics to use this section of the Service Manual. They will help you to follow diagnostic procedures.

Notice: Lack of the basic knowledge of this transaxle when performing diagnostic procedures could result in incorrect diagnostic performance or damage to transaxle components.
Do not, under any circumstances, attempt to diagnose a transaxle problem without this basic knowledge.

Notice: If a wire is probed with a sharp instrument and not properly sealed afterward, the wire will corrode and an open circuit will result.

Diagnostic test probes are now available that allow you to probe individual wires without leaving the wire open to the environment. These probe devices are inexpensive and easy to install, and they permanently seal the wire from corrosion.

Special Tools

You should be able to use a Digital Volt Meter (DVM), a circuit tester, jumper wires or leads and a line pressure gauge set.

The functional check procedure is designed to verify the correct operation of electronic components in the transaxle.

This will eliminate the unnecessary removal of transaxle components.

FUNCTIONAL CHECK PROCEDURE

Begin with the Functional Check Procedure which provides a general outline of how to diagnose automatic transaxle. The following functional check procedure will indicate the proper path of diagnosing the transaxle by describing the basic checks and then referencing the LUCations of the specific checks.

- Check the fluid level according to the Fluid Level Service Procedure.
- Check the transaxle fluid leak.
- Check if the transaxle fluid is not burnt by color and smell.
- Ensure that the transaxle is not in Limp Home Mode(LHM).
- Check the battery terminals and the earth connections for corrosion or looseness.
- Check that the cooler flow is not restricted.
- Check all electrical plug connections for tightness.
- Use on-board diagnostic tool or a scan tool to see if any transaxle trouble codes have been set. Refer to the appropriate “Diagnostic Trouble Code (DTC)” information and repair the vehicle as directed. After repairing the vehicle, perform the road test and verify that the code has not set again.
- Perform the Electrical/Garage Shift Tests.
- Perform the Road Test Procedure in this section.
- Inspect the oil and check for metal or other contaminants in the oil pan.

LINE PRESSURE CHECK PROCEDURE

The 4HP 16 A/T uses a trochoid type oil pump to produce hydraulic prssure, and a pressure control solenoid (solenoid 1) to control that pressure at the pressure regulator valve, after it leaves the pump. The transaxle pressure control solenoid is controlled by an electrical signal that ranges from o to 12 bolt 12bolt corresponds to minimum line pressure(approx. 6.2 to 8.6 bar) and 0 bolts corresponds to a maximum line pressure (approx. 15.3 to 17.4 bar)in all range.

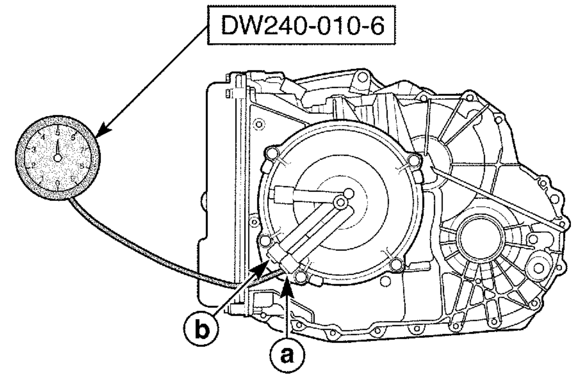
Line pressures are calculated for two sets of gear ranges – Drive–Park–Neutral and Reverse. This allow the transaxle line pressure to be appropriate for different pressure needs in different gear ranges:

Gear Range	Solenoid 1	RPM	Pressure
Drive, Reverse	Off	2,500	15.3~17.4 bar
	On	2,500	1.2~18.6 bar
Neutral, Park	Off	2,500	15.3~17.4 bar
	On	2,500	6.2~18.6 bar

Before performing a line pressure check, verify that the pressure control solenoid is receiving the correct electrical signal from the TCM:

1. Install a scan tool
2. Start the engine and set parking brake
3. Check for a stored pressure control solenoid diagnostic trouble code, and other diagnostic trouble codes.
4. Repair vehicle if necessary
   Inspect
   - Fluid level
   - Manual linkage

   Install or connect
   - Scan tool(scanner)
   - Oil pressure gauge at line pressure tap port (clutch B OR E ports on transaxle case)
5. Put gear selector in Park and set the parking brake.
6. Start engine and allow it to warm up at idle.
7. Access the “solenoid 1 control mode”on the scanner.



8. Switching solenoid 1 ON/OFF, accelerating the engine to 2,500rpm, and then read the line pressure at the each gear.

9. Compare data to the Drive–Park–Neutral line pressure chart below

Notice: Total test running time should not exceed 2 minutes, or transaxle damage could occur

Caution : brake must be applied at all times to prevent unexpected vehicle motion.

If pressure readings differ greatly from the line pressure chart, refer to the Diagnosis Charts contained in this section.

It would causes clutch damage.

The scanner is only able to control the pressure control solenoid in Park and Neutral with the vehicle stopped.

This protects the clutches from extremely high or low pressures in Drive or Reverse rang.

Gear Range	Solenoid	Line Pressure	B Port	E Port
Park / Neutral	ON	LOW	6.2~8.6 bar	
	OFF	HIGH	15.3~17.4 bar	
Reverse	ON	LOW	6.2~8.6 bar	
	OFF	HIGH	15.3~17.4 bar	
Drive	ON	LOW		6.2~8.6 bar
	OFF	HIGH		9.5~11.2 bar
3	ON	LOW	6.2~8.6 bar	6.2~8.6 bar
	OFF	HIGH	15.3~17.4 bar	9.5~11.2 bar
2	ON	LOW		6.2~8.6 bar
	OFF	HIGH		9.5~11.2 bar
1	ON	LOW	6.2~8.6 bar	
	OFF	HIGH	15.3~17.4 bar	

CLUTCH PLATE DIAGNOSIS

Composition plates

Dry the plate and inspect the plates for the following conditions :

- Pitting
- Flaking
- Wear
- Glazing
- Cracking
- Charring

Chips or metal particles embedded in the lining.

Replace a composition plate which shows any of these conditions.

Steel Plates

Wipe the plates dry and check the plates for heat discoloration. If the surfaces are smooth, even if colorsmear is indicated, you can reuse the plate. If the plate is disconnected with heat spots or if the surface is scuffed, replace the plate.

Important : if the clutch shows evidence or extreme heat or burning, replace the springse.

Cause Of Burned Clutch Plates

The following conditions can result in a burned clutch palte :

- Incorrect usage of clutch plates.
- Engine coolant in the transaxle fluid.
- A cracked clutch piston.
- Damaged or missing seals.
- Low line pressure.
- Valve problems.
  - The valve body face is not flat
  - Porosity between channels
  - The valve bushing clips are improperly installed
  - The check balls are misplaced

- The seal rings are worn or damaged

Engine coolant in transaxle

Notice: Antifreeze will deteriorate the O-ring seals and the glue used to bond the clutch material to the pressure plate. Both conditions may cause transaxle damage.

Perform the following steps if the transaxle oil cooler has developed a leak, allowing engine coolant to enter the transaxle:

1. Because the coolant will attach the seal material causing leakage, disassemble the transaxle and replace all rubber type seals.
2. Because the facing material may become separated from the steel center portion, replace the composition faced clutch plate assemblies.
3. Replace all nylon parts including washers.
4. Replace the torque converter.
5. Thoroughly clean and rebuild the transaxle, using new gaskets and oil filter.
6. Flush the cooler lines after you have properly repaired or replaced the transaxle.

COOLER FLUSHING AND FLOW TEST

Notice: yow must flush the cooler whenever you receive a transaxle for service. Cooler flushing is essential for SRTA installation, major overhaul, whenever you replace a pump or torque converter, or whenever you suspect that the fluid has been contaminated.

After filling the transaxle with fluid, start the engine and run for 30 seconds. This will remove any residual moisture from the oil cooler. A minimum of two quarts of fluid flow, disconnect the return line at the transaxle and observe the flow with the engine running. If the fluid flow is insufficient, check the fluid flow by disconnecting the feed line at the cooler. Observe the flow with the engine running.

- If the flow from the cooler return line at the transaxle is insufficient, check the flow rate from the feed line to the cooler. BLockage exists in the transaxle or the cooler.
- If the flow from the transaxle feed line to the cooler is insufficient, the transaxle is the cause of the fluid flow problem.
- If the flow the transaxle feed line to the cooler is insufficient, but flow from the cooler return line to the transaxle is insufficient, inspect the cooler pipes and fittings. Then repeat the cooler flushing procedure. If the flow is still insufficient, replace the cooler

TRANSAXLE FLUID LEVEL SERVICE PROCEDURE

This procedure is to be used when checking a concern with the fluid level in a vehicle. A low fluid level will result in slipping and loss of drive/ reverse or delay on engagement of drive/ reverse when the vehicle is cold.

The vehicle is first checked for transaxle diagnostic messages on the scan tool. If the oil level is low, it is possible to register a vehicle speed signal fault.

The vehicle is to be test driven to determine if there is an abnormal delay when selecting drive or reverse, or loss of drive. One symptom of low fluid level is a momentary loss of drive when driving the vehicle around a corner. Also when the transaxle fluid level is low, a loss of drive may occur when the transaxle fluid temperature is low.

If there is no loss of drive when the vehicle is driven warm and a vehicle speed signal fault is registered, then fluid should be added to the transaxle.

When adding or changing transaxle fluid use only ESSO LT 71141 automatic transaxle fluid or other approved fluids. The use of incorrect fluid will cause the performance and durability of the transaxle to be severely degraded.

Fluid Level Diagnosis procedure

1. If the vehicle is at operating temperature allow the vehicle to cool down for two hours, but no greater than four hours. Or if the vehicle is at cool status, start the engine and allow the engine to idle for approximately 5 minutes (at engine rpm is 825~875rpm) , if possible, drive the vehicle for a few kilometers (N–D, N–R, shift until two gear). This will allow the transaxle to be within the correct temperature range. Transaxle fluid level should be checked at temperature 20 to 45°C (68 to 113°F).

Caution: Removal of the fluid filler plug when the transaxle fluid is hot may cause injury if fluid drains from the filler hole.

2. Switch off accessories, especially air conditioner, heater.
3. With the brake pedal pressed, move the fear shift control lever through the gear ranges, pausing a few seconds in each range. Return the gearshift lever to P(Park). Turn the engine OFF.
4. Park the vehicle on a hoist, inspection pit or similar raised level surface. The vehicle must be level to obtain a correct fluid level measurement.
5. Place a fluid container below the fluid filler plug.
6. Clean all dirt from around the fluid filler plug.

   Remove the fluid filler plug. Clean the filler plug and check that there is no damage to the ‘O’ ring.

   - If fluid drains through the filler hole the transaxle may have been overfilled. When the fluid stops draining the fluid level is correct. Install the fluid filler plug and tighten it to 45N·m(34 lb–ft).
   - If fluid does not drain through the filler hole, the transaxle fluid level may be low. Lower the vehicle, and start the vehicle in P(Park) with the parking brake and the brake applied. With the engine id-

ling, move the gear shift lever through the gear ranges, pausing a few seconds in each range and adding the fluid until gear application is felt. Return the gear shift lever to P(Park). Turn the engine OFF and raise the vehicle. Check if the fluid level is aligned with the bottom of the filler hole. If not, add a small quantity of fluid to the correct level. Install the fluid filler plug and tighten it to 45N·m(34 lb–ft).

7. When the fluid level checking procedure is completed, wipe any fluid around the filler plug with a rag or shop towel.

Fluid Level Set After Service

1. Depending on the service procedure performed, add the following amounts of fluid through the filler plug hole prior to adjusting the fluid level:

Oil pan removal	4liters (4.23quarts)
Converter removal	2 liters (2.11 quarts)
Overhaul	6.9liters (7.3quarts)
Oil drain plug removal	4liters (4.23 quarts)

2. Follow steps 1 through 4 of the Fluid Level Diagnosis Procedure.
3. Clean all dirt from around the fluid filler plug.

   Remove the fluid filler plug. Clean the filler plug and check that there is no damage to the 'O' ring.
4. Lower the vehicle with the filler pump still connected and start the vehicle in P(Park) with the parking brake and the brake applied. With the engine idling, move the gear shift lever through the gear ranges, pausing a few seconds in each range and adding the fluid until gear application is felt.

   Then add an additional 0.5 liters of fluid. Return the gear shift lever to P(Park). Turn the engine OFF and raise the vehicle. Install the fluid filler plug and tighten it to 45N·m(34 lb–ft).
5. Drive the vehicle at 3.5 to 4.5 kilometers with light throttle so that the engine does not exceed 2500 rpm. This should result in the transaxle temperature being in the range 20 to 45°C (68 to 11°F). With the brake applied, move the shift lever through the gear ranges, pausing a few seconds in each range at the engine idling.
6. Return the gear shift lever to P(Park). Turn the engine OFF and raise the vehicle on the hoist, if applicable, ensuring the vehicle is level. When the three minutes passed after the engine stopped, remove the filler plug. Check if the fluid level is aligned with the bottom of the filler hole. If not, add a small quantity of fluid to the correct level. Install the fluid filler plug and tighten it to 45N·m(34 lb–ft).
7. Wipe any fluid around the filler plug with a rag or shop towel.

Fluid Leak Diagnosis And Repair

The cause of most external leaks can generally be Located and repaired with the transaxle in the vehicle.

Methods for Locating Leaks

General Method

1. Verify that the leak is transaxle fluid.
2. Thoroughly clean the suspected leak area.
3. Drive the vehicle for approximately 25 km (15 miles) or until the transaxle reaches normal operating temperature (88°C, 190°F).
4. Park the vehicle over clean paper or cardboard.
5. Turn the engine OFF and look for fluid spots on the paper.
6. Make the necessary repairs to correct the leak.

Powder Method

1. Thoroughly clean the suspected leak area.
2. Apply an aerosol type powder (foot powder) to the suspected leak area.
3. Drive the vehicle for approximately 25 km (15 miles) or until the transaxle reaches normal operating temperature (88°C, 190°F).
4. Turn the engine OFF.
5. Inspect the suspected leak area and trace the leak path through the powder to find the source of the leak.
6. Make the necessary repairs.

Dye and Black Light Method

1. Add dye to the transaxle though the transaxle fluid filler plug. Follow the manufacturer's recommendation for the amount of dye to be used.
2. Use the black light to find the fluid leak.
3. Make the necessary repairs.

Repairing the Fluid Leak

Once the leak point is found the source of the leak must be determined. The following list describes the potential causes for the leak:

- Fasteners are not torqued to specification.
- Fastener threads and fastener holes are dirty or corroded.
- Gaskets, seals or sleeves are misarranged, damaged or worn.
- Damaged, warped or scratched seal bore or gasket surface.
- Loose or worn bearing causing excess seal or sleeve wears.
- Case or component porosity.
- Fluid level is too high.
- Plugged vent or damaged vent tube.
- Water or coolant in fluid.
- Fluid drain back holes plugged.

ELECTRICAL / GARAGE SHIFT TEST

This preliminary test should be performed before a hoist or road test to make sure electronic control inputs is connected and operating. If the inputs are not checked before operating the transaxle, a simple electrical condition could be misdiagnosed as a major transaxle condition.

A scan tool provides valuable information and must be used on the automatic transaxle for accurate diagnosis.

1. Move gear shift control lever to P (Park) and set the parking brake.
2. Connect scan tool to Data Link Connector (DLC) terminal.
3. Start engine.
4. Turn the scan tool ON.
5. Verify that the appropriate signals are present.

   These signals may include:
   - ENGINE SPEED
   - VEHICLE SPEED
   - THROTTLE POSITION
   - ACCEL. PEDAL POSITION
   - TRANSAXLE GEAR STATE
   - GEAR SHIFT LEVER POSITION
   - TRANSAXLE FLUID TEMPERATURE
   - CLOSED THROTTLE POSITION LEARN
   - OPEN THROTTLE POSITION LEARNT
   - CLOSED ACCEL. PEDAL POSITION LEARNT
   - OPEN ACCEL. PEDAL POSITION LEARNT
   - A/C COMPRESSOR STATUS
   - MODE SWITCH
   - THROTTLE POSITION VOLTAGE
   - GEAR SHIFT LEVER POSITION VOLTAGE
   - TRANS. FLUID TEMPERATURE VOLTAGE
   - A/C SWITCH
   - MODE SWITCH VOLTAGE
   - BATTERY VOLTAGE
6. Monitor the A/C COMPRESSOR STATUS signal while pushing the A/C switch.
   - The A/C COMPRESSOR STATUS should come ON when the A/C switch is pressed, and turns OFF when the A/C switch is repushed.
7. Monitor the GEAR SHIFT LEVER POSITION signal and move the gear shift control lever through all the ranges.
   - Verify that the GEAR SHIFT LEVER POSITION value matches the gear range indicated on the instrument panel or console.
   - Gear selections should be immediate and not harsh.
8. Move gear shift control lever to neutral and monitor the THROTTLE POSITION signal while increasing and decreasing engine speed with the accelerator pedal.
   - THROTTLE POSITION should increase with engine speed.

ROAD TEST PROCEDURE

- Perform the road test using a scan tool.
- This test should be performed when traffic and road conditions permit.
- Observe all traffic regulations.

The TCM calculates upshift points based primarily on two inputs : throttle angle and vehicle speed. When the TCM says a shift should occur, an electrical signal is sent to the shift solenoids which in turn moves the valves to perform the upshift.

The shift speed charts reference throttle angle instead of "min throttle" or "wot" to make shift speed measurement more uniform and accurate. A scan tool should be used to monitor throttle angle. Some scan tools have been programmed to record shift point information. Check the intruction manual to see if this test is available.

Upshift procedure

With gear selector in drive(D)

1. Lock at the shift speed chart contained in this section and choose a percent throttle angle of 10 or 25%.
2. Set up the scan tool to monitor throttle angle and vehicle speed.
3. Accelerate to the chosen throttle angle and hold the throttle steady.
4. As the transaxle upshifts, note the shift speed and commanded gear changes for :
   - Second gear.
   - Third gear.
   - Fourth gear.

Important : shift speeds may vary due to slight hydraulic delays responding to electronic controls. A change from the original equipment tire size affects shift speeds.

Note when LUC applies. This should occur in fourth gear. If the apply is not noticed by an rpm drop, refer to the *"Lock Up Clutch Diagnosis"* information contained in this section

The Lock up clutch should not apply unless the transaxle has reached a minimum operating temperature of 8°C (46°F)TRAN TEMP AND engine coolant temp of 50°C (122°F).

5. Repeat steps 1–4 using several different throttle angles.

Part Throttle Detent Downshift

At vehicle steeds of 55 to 65km/h(34 to 40mph)in Fourth gear, quickly increase throttle angle to greater than 50%.

Verify that :

- LUC apply.
- Transaxle downshift to 3rd gear.
- Solenoid 1 turns ON to OFF.
- Solenoid 2 turns OFF.

Full Throttle Detent Downshift

At vehicle speeds of 55 to 65km/h(34 to 40mph)in Fourth gear, quickly increase throttle angle to its maximum position(100%)

Verify that :

- LUC release.
- Transaxle downshift to Second gear immediately.
- Solenoid 1 turns ON to OFF
- Solenoid 2 turns OFF

Manual Downshifts

1. At vehicle speeds of 60km/h(40mph)in Fourth gear, release accelerator pedal while moving gear selector to Manual Third(3). Observe that :
   - Transaxle downshift to Third gear immediately.
   - Engine slows vehicle down
2. Move gear selector back to overdrive(D) and accelerate to 50km/h31mph). Release the accelerator pedal with moving the gear selector to Manual First(1)and observe that :
   - Transaxle downshift to Second gear immediately.
   - Engine slows vehicle down

Notice: A Manual First–Third Gear Ratio will occur at high speeds as an upshift safety feature. Do not attempt to perform this shift.

Coasting Downshifts

1. With the gear selector in Overdrive(D), accelerate to Fourth gear with LUC applied.
2. Release the accelerator pedal and lightly apply the brakes, and observe that :
   - LUC release.
   - Down shifts occur at speeds shown ON the shift speed chart.

Manual Gear Range Selection

Upshifts in the manual gear ranges are controlled by the shift solenoids. Perform the following tests by accelerating at 25percent TP sensor positions.

Manual Third(3)

- With vehicle stopped, move the gear selector to Manual third(3) and accelerate to observe :
  - 1–2 shift.
  - 2–3 shift.

Manual Second(2)

- With vehicle stopped, move the gear selector to Manual second(2) and accelerate to observe :
  - 1–2 shift.
- Accelerate to 40km/h(25mph) and observe :
  - 2–3 shift does not occur
  - LUC does not apply

Manual First(1)

- With vehicle stopped, move gear selector to Manual First(1). Accelerate to 30km/h(19mph) and observe :
  - no upshifts occur

Reverse (R)

- With vehicle stopped, move gear selector to R(Reverse) and observe :
  - Solenoid 1 is OFF
  - Solenoid 2 is OFF

Use a scan tool to see if any transaxle trouble codes have been set. Refer to *“Diagnostic Trouble Codes”* In This Section and repair the vehicle as directed. After repairing the vehicle, perform the hoist test and verify that the code has not set again.

If the transaxle is not performing well and no trouble codes have been set, there may be an intermittent condition. Check all elcetrical connections for damage or a loose fit. You also have to perform a snapshot test which can help catch an intermittent condition that does not occur long enough to set a code.

You may want to read “Electronic Component Diagnosis” In This Section to become familiar with transaxle conditions caused by transaxle electrical malfunction.

If no trouble codes have been set and the condition is suspected to be hydraulic, take the vehicle on a road test.

TORQUE CONVERTER LOCK UP CLUTCH(LUC) DIAGNOSIS

To properly diagnosis the Lock up clutch(LUC)system, perform all electrical testing first and then the hydraulic testing.

The LUC is applied by fluid pressure which is controlled by a solenoid Located inside the valve body. The solenoid is energized by completing an electrical circuit through a combination of switches and sensors.

Functional Check Procedure

inspect

1. Install a tachometer or scan tool.

2. Operate the vehicle unit proper operating temperature is reached.
3. Drive the vehicle at 80 to 88km/h(50 to 55 mph)with light throttle(road load).
4. Maintaining throttle, lightly touch the brake pedal and check for release of the LUC and a slight increase in engine speed(rpm).
5. Release the brake slowly accelerate and check for a reapply of the Lock up clutch and a slight decrease in engine speed(rpm).

Torque Converter Evaluation

Torque converter stator

The torque converter stator roller clutch can have one of two different type malfunctions :

A. Stator assembly freewheels in both directions.

B. Stator assembly remains Locked up at all times.

Condition A – Poor Acceleration Low Speed

The car tends to have poor acceleration from a stand still. At speeds above 50 to 55km/h(30 to 35mph), the car may act normal. If poor acceleration is noted, it should first be determined that the exhaust system is not bLocked, and the transaxle is in 1st(First)gear when starting out.

If the engine freely accelerates to high rpm in N(Neutral), it can be assumed that the engine and exhaust system are normal. Checking for poor performance in "Drive" and "Reverse" will help determine if the stator is freewheeling at all times.

Condition B – Poor Acceleration High Speed

Engine rpm and car speed limited or restricted at high speeds. Performance when accelerating from a standstill is normal. Engine may overheat. Visual examination of the converter may reveal a blue color from overheating.

If the converter has been removed, the stator roller clutch can be checked by inserting two fingers into the splined inner race of the roller clutch and trying to turn freely clockwise, but not turn or be very difficult to turn counter clockwise.

Noise

Torque converter whine is usually noticed when the vehicle is stopped and the transaxle is in "Drive" or "Reverse". The noise will increase when engine rpm is increased. The noise will stop when the vehicle is moving or when the torque converter clutch is applied because both halves of the converter are turning at the same speed.

Perform a stall test to make sure the noise is actually coming from the converter :

1. Place toot on brake.
2. Put gear selector in "Drive"
3. Depress accelerator to approximately 1200rpm for no. more than six seconds.

Notice: If the accelerator is depressed for more than six seconds, damage to the transaxle may occur.
A torque converter noise will increase under this load.

Important : This noise should not be confused with pump whine noise which is usually noticeable in P (Park), N (Neutral) and all other gear ranges. Pump whine will vary with pressure ranges.

The torque converter should be replaced under any of the following conditions:

- External leaks in the hub weld area.
- Converter hub is scored or damaged.
- Converter pilot is broken, damaged or fits poorly into crankshaft.
- Steel particles are found after flushing the cooler and cooler lines.
- Pump is damaged or steel particles are found in the converter.
- Vehicle has LUC shudder and/or no LUC apply.
  Replace only after all hydraulic and electrical diagnoses have been made.(Lock up clutch material may be glazed.)
- Converter has an imbalance which cannot be corrected. (Refer To Converter Vibration Test Procedure.)
- Converter is contaminated with engine coolant containing antifreeze.
- Internal failure of stator roller clutch.
- Excess end play.
- Heavy clutch debris due to overheating (blue converter).
- Steel particles or clutch lining material found in fluid filter or on magnet when no internal parts in unit are worn or damaged(indicates that lining material came from converter).

The torque converter should not be replace if :

- The oil has an odor, is discolored, and there is no evidence of metal or clutch facing particles.
- The threads in one or more of the converter bolt holes are damaged.
  – correct with thread insert.
- Transaxle failure did not display evidence of damage or worn internal parts, steel particles or clutch plate lining material in unit and inside the fluid filter.
- Vehicle has been exposed to high mileage(only).
  The exception may be where the Lock up clutch damper plate lining has seen excess wear by vehicles

operated in heavy and/or constant traffic, such as taxi, delivery or police use.

Lock Up Clutch Shudder Diagnosis

The key to diagnosing Lock up clutch(LUC)shudder is to note when it happens and under what conditions.

LUC shudder should only occur during the APPLY and/or RELEASE of the Lock up clutch ; SELDOM after what conditions.

While LUC Is Applying Or Releaing

If the shudder occurs while LUC is applying, the problem can be within the transaxle or torque converter.

Something is not allowing the clutch to become fully engaged, not allowing clutch to release, or is trying to release and apply the clutch at the same time. This could be caused by leaking turbine shaft seals, a restricted release orifice, a distorted clutch or housing surface due to long converter bolts, or defective friction material on the LUC plate.

Shudder Occurs After LUC Has Applied :

In this case, most of the times there is nothing wrong with the transaxle! As mentioned above, once the LUC has been applied, it is very unlikely that will slip. Engine problems may go unnoticed under light throttle and load, but become noticeable after LUC apply when going up a hill or accelerating, due to the mechanical coupling between engine and transaxle.

Important : Once LUC is applied there is no torque converter assistance. Engine or driveline vibrations could be unnoticeable before LUC engagement.

Inspect the following components to avoid misdiagnosis of LUC shudder and possibly disassembling a transaxle and/or replacing a torque converter unnecessarily :

- Spark plugs – Inspect for cracks, high resistance or broken insulator.
- Plug wires – Lock in each end, if there is red dust(ozone) or black substance (carbon) present, then the wires are bad. Also look for a white discoloration of the wire indicating arcing during hard acceleration.
- Distributor cap and rotor – look for broken or uncrimped parts.
- Coil – look for black on bottom indication arcing while engine is misfiring.
- Fuel injector – filter may be plugged.
- Vacuum leak – engine won't get correct amount of fuel. May run rich or lean depending on where the leak is.
- EGR valve – valve may let it too much unburnable exhaust gas and cause engine to run lean.
- MAP sensor – like vacuum leak, engine won't get correct amount of fuel for proper engine operation.
- Carbon on intake valves – restricts proper flow or air/fuel mixture into cylinders.
- Flat cam – valves don't open enough to let proper fuel/air mixture into cylinders.
- Oxygen sensor – may command engine too rich or too lean for too long.
- Fuel pressure – may be too low.
- Engine mounts – vibration of mounts can be multiplied by LUC engagement.
- Axle joints – checks for vibration.
- TPS – LUC apply and release depends on TPS in many engines. If TPS is out of specification, LUC may remain applied during initial engine crowd.
- Cylinder balance – bad piston rings or poorly sealing valves can cause low power in a cylinder.
- Fuel contamination – causes poor engine performance.

SHIFT SPEED CHART

Up Shift Speed

MODEL	First–Second gear (±4.8km/h)				Second–Third gear (±6.4km/h)				Third–Fourth gear (±8km/h)			
	10% TPS	25% TPS	50% TPS	100% TPS	10% TPS	25% TPS	50% TPS	100% TPS	10% TPS	25% TPS	50% TPS	100% TPS
2.0 DOHC EOBD	20	20	27	57	37	38	49	108	50	53	74	168
2.0 DOHC Non EOBD	18	19	26	57	32	35	50	108	43	50	77	164

Down Shift Speed

MODEL	Down Shift (±6.4km/h)			Lock Up Clutch Applied (Fourth)		Lock Up Clutch Released (Fourth)	
	Fourth–Third (Coast)	Third–Second (Coast)	Second–First (Coast)	10%	25%	10%	25%
2.0 DOHC EOBD	43	22	12	70	70	65	65
2.0 DOHC Non EOBD	35	22	12	60	62	55	55

INTERNAL WIRING HARNESS CHECK

Step	Action	Value(s)	Yes	No
1	1. Disconnected the transaxle harness. 2. Measure the resistance between terminals 3 and 4 the transaxle wiring connector. Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 3*	Go to *Step 2*
2	1. Disconnected the internal transaxle harness from the first solenoid valve 2. Measure the resistance of the first solenoid valve Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 20*	Go to *Step 22*
3	Measure the resistance between terminals 3 and 12 the second solenoid valve Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 5*	Go to *Step 4*
4	1. Disconnected the internal transaxle harness from the second solenoid valve. 2. Measure the resistance of the second solenoid valve. Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 20*	Go to *Step 22*
5	Measure the resistance between terminals 5 and 6 the transaxle wiring connector(EDS 3) Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 7*	Go to *Step 6*
6	1. Disconnected the internal transaxle harness from the pressure control valve 3(EDS 3). 2. Measure the resistance of the EDS 3. Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 20*	Go to *Step 22*

Internal Wiring Harness Check (Cont'd)

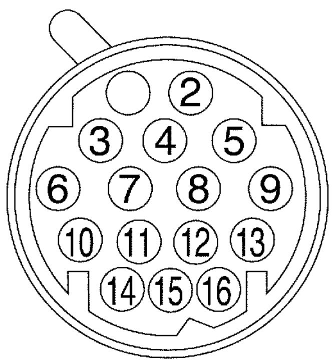
Step	Action	Value(s)	Yes	No
7	Measure the resistance between terminals 5 and 7 the transaxle wiring connector(EDS 4). Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 9*	Go to *Step 8*
8	1. Disconnected the internal transaxle harness from the pressure control valve 4(EDS 4). 2. Measure the resistance of the EDS 4. Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 20*	Go to *Step 22*
9	Measure the resistance between terminals 5 and 10 the transaxle wiring connector(EDS 5). Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 11*	Go to *Step 10*
10	1. Disconnected the internal transaxle harness from the pressure control valve 5(EDS 5). 2. Measure the resistance of the EDS 5. Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 20*	Go to *Step 22*
11	Measure the resistance between terminals 5 and 11 the transaxle wiring connector(EDS 6). Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 13*	Go to *Step 12*
12	1. Disconnected the internal transaxle harness from the pressure control valve 6(EDS 6). 2. Measure the resistance of the EDS 6. Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 20*	Go to *Step 22*
13	Measure the resistance between terminals 4 and 9 the transaxle wiring connector(transaxle temperature sensor). Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 15*	Go to *Step 14*
14	1. Disconnected the internal transaxle harness from the transaxle temperature sensor. 2. Measure the resistance of the transaxle temperature sensor. Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 20*	Go to *Step 22*
15	Measure the resistance between terminals 15 and 16 the transaxle wiring connector(transaxle input speed sensor). Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 17*	Go to *Step 16*
16	1. Disconnected the internal transaxle harness from the transaxle input speed sensor. 2. Measure the resistance of the input speed sensor. Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 20*	Go to *Step 22*
17	Measure the resistance between terminals 1 and 2 the transaxle wiring connector(transaxle output speed sensor). Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 19*	Go to *Step 18*
18	1. Disconnected the internal transaxle harness from the transaxle output speed sensor. 2. Measure the resistance of the transaxle output speed sensor. Is the resistance within the values shown?	Refer to *Component Resistance Chart*	Go to *Step 20*	Go to *Step 22*

Internal Wiring Harness Check (Cont'd)

Step	Action	Value(s)	Yes	No
19	Measure the resistance between terminals of internal wiring harness. Is the resistance within the values shown?	Refer to *Component Resistance Chart*	No problem found, exit table	Go to *Step 21*
20	Inspect for resistance: ● Ispect the transaxle wiring for poor eletrical connections at the transaxle. ● Look for possible bent, backed out, deformed of damaged terminals. Check for weak terminal tension.	–	Verify repair and Go to *Step 12*	No problem found, exit table
21	Replace the internal wiring harness. Is the replacement complete.	–	No problem found, exit table	–
22	Replace the component. Is the replacement complete.	–	No problem found, exit table	–

TRANSAXLE WIRING HARNESS CONNECTOR

Wiring harness connector



1	Transaxle output speed sensor (+)
2	Transaxle output speed sensor (–)
3	Solenoid valve (+)
4	Transaxle temperature sensor (–)
5	Pressure control valve solenoid vlave (+)
6	Pressure control valve solenoid vlave (EDS3)
7	Pressure control valve solenoid vlave (EDS4)
8	Not used
9	Transaxle temperature sensor (+)
10	Pressure control valve solenoid vlave (EDS5)
11	Pressure control valve solenoid vlave (EDS6)
12	Solenoid valve 1
13	Solenoid valve 2
14	Not used
15	Transaxle output speed sensor (–)
16	Transaxle output speed sensor (–)

Component Resistance Chart

Component	Pass Through Pins	Resistance 20°C (68°F) Ohms	Resistance ≥ 140°C (212°F) Ohms
Solenoid 1	3, 12	26.5±0.5Ω	26–345Ω (not relative to emperature)
Solenoid 2	3, 13	26.5±0.5Ω	26–345Ω (not relative to emperature)
Pressure control solenoid valve (EDS3)	5, 6	5.7±0.45Ω	5.3–6.3Ω (not relative to emperature)
Pressure control solenoid valve (EDS4)	5, 7	5.7±0.45Ω	5.3–6.3Ω (not relative to emperature)
Pressure control solenoid valve (EDS5)	5, 10	5.7±0.45Ω	5.3–6.3Ω (not relative to emperature)
Pressure control solenoid valve (EDS6)	5, 11	5.7±0.45Ω	5.3–6.3Ω (not relative to emperature)
Transaxle temperature sensor*	4, 9	980–1,000Ω	
Transaxle input speed sensor	15, 16	830±5Ω	788–871Ω (not relative to emperature)
Transaxle output speed sensor*	1, 2	∞	∞

* The resistance of the transaxle is necessarily dependent on the temperature.

SYMPTOM DIAGNOSIS

Oil leakage

Notice:

– Careful LUCalization of leakage points may make it possible to prevent incorrect or cost-intensive repairs.

Test steps :

– Thoroughly clean the transaxle, engine, and surrounding area(using a steam jet, for example).

– To LUCate leakage, use a suitable identifying spray or similar product.

– Depending on the amount of leakage, take the car for a short or a longer test drive – It may prove sufficient to place the car on a hoist and run the engine at idle speed to trace the leak.

– If possible, determine exactly which type of oil is escaping.

Symptom	Possible Cause	Action
Transaxle oil leakage	Oil pump(torque converter sealing)	• Visually check torque converter sealing. • Replace the converter sealing as described in the transaxle repair on the vehicle service.
	Crankshaft sealing ring	• Check whether engine oil or TFT is leaking out. • If leak is engine oil, replace the sealing ring as described in the engine repair instruction.
	Torque converter	• Visual check. • Fit an exchange converter as described in the repair instruction.
	Oil content too high	• Check oil level(TFT and axle oil)as described in this chapter. • Correct oil level, and recheck after a test drive. **Notice:** comply with the measuring procedure (filling procedure) in the repair instruction. Check the oil level at the overflow plug adjust to proper level if necessary.
	O–ring at bolt head damaged or missing	• Check O-ring. • Replace O-ring as described in the repair instruction.
	Shaft seal	• Visually check the shaft seal. • Replace the sealing ring as described in the repair instruction.
	Hose clamp loose	• Check to ensure that the hose clamp fits tightly. • If necessary, retighten clamp.
	Oil pan gasket not installed properly	• Check to see if the gasket was positioned properly. • Install gasket properly as described in the repair instruction.
	Oil pan gasket damaged	• Check the gasket visually. • Replace gasket as described in the repair instruction.
	Bolt at bracket loose	Check the Tightening Torque Retighten bolt
	Sealing ring at oil dipstick	• Check O-ring. • If necessary, replace O-ring.
	Sealing ring near end-cover connection defective	• Check sealin rings. • Put in new sealing ring Check O-ring as described in the repair instruction.
	Sealing ring selector shaft	• Check sealing ring. • Replace saeling ring as described in the repair instruction.

Oil leakage (cont'd)

Symptom	Possible Cause	Action
Transaxle oil leakage	O-ring at socket outlet	• Check O-ring. • Replace O-ring as described in the repair instruction.
	O-ring and speed sensor connection	• Check O-ring. • Replace O-ring as described in the repair instruction.
	Oil leak incorrectly identified	• No oil leak is possible at this point.
	Speed sensor itself is leaking	• Check speed sensor. • Replace speed sensor as described in the repair instruction.
	Hair line crack at the piping in the connection area, sealing ring fit in transaxle housing	• Pressurize the line with compressed air and check it. • Replace lines as described in the repair instruction.
	O-ring defective, incorrect	Check O-ring. Replace O-rings as described in the repair instruction.
	Plug loos	Check the Tightening Torque for the screw plug. Tighten to torque specified in the repair instruction.

Noise

Symptom	Possible Cause	Action
Noise	TFT level too low	• When the TFT level is too low, the gear wheels from the transaxle oil pump might generate noise. • Check the TFT level as described in the repair instruction and fill to the proper level.
	Monolith in catalytic converter has broken	• Check according to the exhaust gas diagnostic procedure or by shaking the catalytic converter casing. • Replace catalytic converter if necessary.
	Noise from auxiliaries (e.g. exhaust system, alternator, drive shafts.)	• Check these components; if necessary, eliminate the faults as described in the repair instruction
	Noise from tires or wheel bearings	• Eliminate fault if necessary
	Noise from planetary gears	• Whistling noise on traction and overrun(in first gear only)caused by high rotating speeds(functionally unavoidable)
	Cumulative tooth backlash in the complete drive line	• Production status. Customer must be convinced.
	Jerky noise of the parking Lock (e.g. when the car is standing on a gradient)	• Load–reversal reaction • Apply the handbrake before selection the parking Lock(position P)
Noise	The engine's torsional vibrations are being transmitted to the drive shafts	• At low speeds in fourth gear, vibration car arise(driving at too low an engine speed) • Noise is functionally unavoidable; due to tolerances. Convince the customer.
Noise	Torque reaction strut loose	• Check mounting and repair if necessary.

Shift quality

Notice:

- The assessment of shaft quality is, to a large extent, an individual, subjective matter. Take careful note of how the customer describes the complaint and of the manner in which he or she handles the vehicle and the controls.
- A sudden deterioration of shift quality may also be caused by the transaxle selecting an emergency or substitute program

Test steps :

- Carry out the general checks described in the automatic transaxle diagnostic information.
- Perform a test drive to answer the following questions.
  In which driving situations does the shift quality complaint arise?
  To which shifts does the complaint apply?
  Is the complaint reproducible within a short period, or has it only occurred sporadically or on a single occasion?
- Check the oil level and oil quality
- Interrogate the fault memory and read out measurement block data.

Symptom	Possible Cause	Action
Shift quality	Rapid pressure build–up in the clutch	• Operating error (position selected several times in quick succession).
	Jerk when parking Lock is released	• Refer to “*noise*” in this Section.
	Incorrect electronic transaxle control module	• Check the data status for transaxle control module ; refer to “*TCM*’ in this Section.
	Emergency/substitute program has been activated	• For checking and remedial action, refer to “*emergency/substitute program*” in this Section.
	Accelerator pedal in indefinite position between full throttle and kick down	• Persuade customer to choose clearly between kick down and full throttle • Check setting according go engine repair instruction ; adjust if necessary.
	Control overlap between to clutches during shift	• Production status • Convince the customer
	Temperature sensor(not fault memory)	• Check function according to “*emergency/substitute program*” in this Section.
	Kick down setting incorrect	• Check A) Fllor mat is obstructing accelerator pedal B) The kick down setting as described in the Engine Section.

Malfunction

Notice:

The faults dealt with here concern transaxle functions such as “traction”(forwards and reverse) and all type of shifts. Entries will not always be made in the fault memory.

Test steps :

Perform the general checks according to the automatic transaxle diagnostic procedure.

- Test drive
- Check oil level and quality
- Interrogate fault memory

Symptom	Possible Cause	Action
Malfunction	Defective clutch in transaxle it there is still no drive with the TCM disconnected	• This is usually due to too little oil being added or to internal ldakage • Repair is not possible ; if necessary, exchange transaxle.
	Kick down switch not functioning properly	• For checking and remedial action, refer to “*Emergency/Substitute Program*” in this ction.
	Kick down switch not operating properly	• For checking and remedial action, refer to *Engine instruction*.
	Vehicle is in emergency mode	• For checking and remedial action, refer to “*Emergency/Substitute Program*” in this Section.

DIAGNOSTIC TROUBLE CODE DIAGNOSIS

DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

DTC	Description	Indication	Default Action
P0562	System Voltage Low	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut off to the EDS valve.
P0563	System Voltage High	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut off to the EDS valve.
P0601	Internal Control Module Memory Checksum Error	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON : 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut off to the EDS valve.
P0603	• Internal Control Module Keep Alive Memory(KAM)Error	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut off to the EDS valve.
P0604	Internal Control Module Random Access Memory(RAM)Error	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON : 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut off to the EDS valve.
P1604	• Data Check Of Internal & Extended	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON : 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut off to the EDS valve.

Diagnostic Trouble Code (DTC) Identification (Cont'd)

DTC	Description	Indication	Default Action
P0606	• Trans Control Module Processor Fault	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut off to the EDS valve.
P1606	• Failure Of External Watchdog	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut OFF to the EDS valve.
P1671	CAN Transmit Message Failure	Power lamp flashing	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
P1672	CAN Bus OFF Failure	Power lamp flashing	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
P1673	CAN Receive ECM Message	Power lamp flashing	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
P0703	Brake Switch Circuit Malfunction	No Change	• TCM assume that the brake light always active. • Open lock up clutch.
P0705	Park/Neutral Position Switch	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON : 3rd gear by hydraulic control, position P, R and N also possible.
P0710	• Transaxle Fluid Temperature sensor circuit malfunction	Power lamp flashing	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • TCM assume the transaxle fluid temperature is 60°C. • No influence at vehicle running.

Diagnostic Trouble Code (DTC) Identification (Cont'd)

DTC	Description	Indication	Default Action
P0715	• Input Speed Sensor Circuit Malfunction	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON : 3rd gear by hydraulic control, position P, R and N also possible. • Open lock up clutch.
P0716	• Input Speed Sensor Circuit Range/Performance	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON : 3rd gear by hydraulic control, position P, R and N also possible. • Open lock up clutch.
P0717	• Input Speed Sensor Circuit No Signal	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON : 3rd gear by hydraulic control, position P, R and N also possible. • Open lock up clutch.
P0720	Output Speed Sensor Circuit Malfunction	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear. • Open lock up clutch.
P0721	Output Speed Sensor Circuit Range/Performance	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear. • Open lock up clutch.
P0722	• Output Speed Sensor Circuit No Signal	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Vehicle running remains actual gear. • Open lock up clutch.
P0726	• Engine Speed Input Circuit(CAN) Range/Performance	MIL ON	• The Malfunction Indicator Lamp(MIL) will illuminate. • The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear. • Open lock up clutch.

Diagnostic Trouble Code (DTC) Identification (Cont'd)

DTC	Description	Indication	Default Action
P0731	• Gear 1 Incorrect Ratio	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear. • High line pressure
P0732	• Gear 2 Incorrect Ratio	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 3rd gear. • High line pressure.
P0733	• Gear 1 Incorrect Ratio	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear. • High line pressure
P0734	• Gear 1 Incorrect Ratio	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible. • High line pressure.
P1779	Engine Torque Input Signal (CAN) Malfunction	No Change	• Adjustable value, calculated over the substitute map throttle position. (engine speed, engine torque)
P0781	• 1–2 Shift Malfunction	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 1st gear. • Open lock up clutch.
P0782	• 2–3 Shift Malfunction	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 2nd gear. • Open lock up clutch.
P0783	• 3–4 Shift Malfunction	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 3rd gear. • Open lock up clutch.
P1791	Throttle Position Input Signal (CAN) Malfunction	No Change	• Adjustable value, calculated over the substitute map throttle position. (engine speed, engine torque)

Diagnostic Trouble Code (DTC) Identification (Cont'd)

DTC	Description	Indication	Default Action
P1839	EDS3 Output Shortage To Ground	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut OFF to the EDS valve.
P1840	• EDS3 output shortage to battery	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut OFF to the EDS valve.
P1841	EDS3 output open	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut OFF to the EDS valve.
P1850	Solenoid 1 Output Shortage To Ground	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
P1851	Solenoid 1 Output Shortage To Battery	Power Lamp Flashing	• Power lamp will blink. • The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
P1852	Solenoid 1 Output Open	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
P1853	Solenoid 2 Output Shortage To Ground	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.

Diagnostic Trouble Code (DTC) Identification (Cont'd)

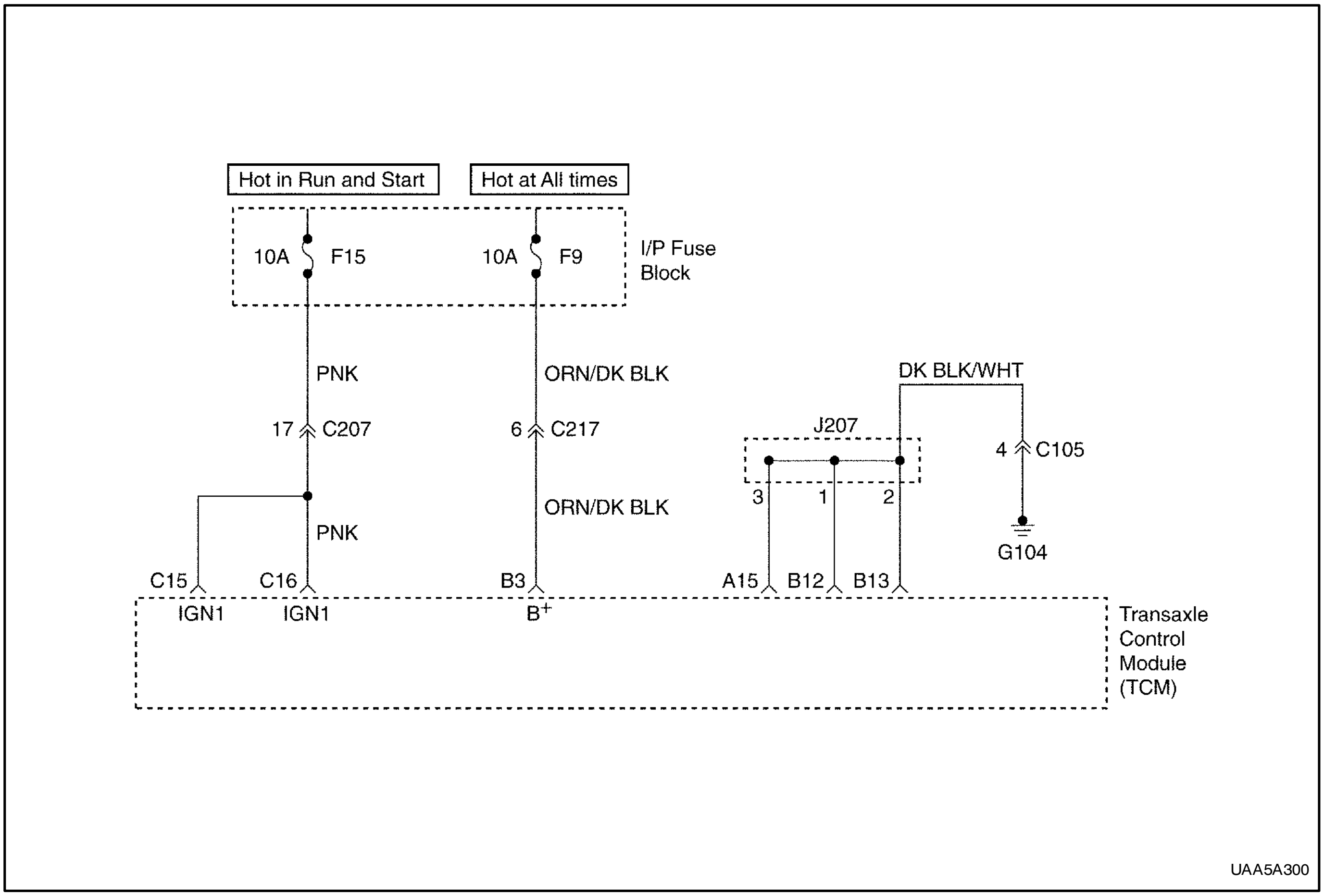
DTC	Description	Indication	Default Action
P1854	Solenoid 2 Output Shortage To Battery	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
P1855	Solenoid 2 Output Open	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
P1861	• EDS4 Output Shortage To Ground	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut OFF to the EDS valve.
P1862	• EDS4 output shortage to battery	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut OFF to the EDS valve.
P1863	EDS4 output open	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut OFF to the EDS valve.
P1864	EDS5 Output Shortage To Ground	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut OFF to the EDS valve.

Diagnostic Trouble Code (DTC) Identification (Cont'd)

DTC	Description	Indication	Default Action
P1865	EDS5 Output Shortage To Battery	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut OFF to the EDS valve.
P1866	EDS5 Output Open	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut OFF to the EDS valve.
P1867	EDS6 Output Shortage To Ground	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut OFF to the EDS valve.
P1868	• EDS6 Output Shortage To Battery	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut OFF to the EDS valve.
P1869	EDS6 Output Open	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut OFF to the EDS valve.
P1870	EDS Valve Power Supply Circuit Shortage To Ground	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. • Possible P, R and N also possible. • Power supply cut OFF to the EDS valve.

Diagnostic Trouble Code (DTC) Identification (Cont'd)

DTC	Description	Indication	Default Action
P1871	• EDS Valve Power Supply Circuit Shortage To Battery	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/Substitute mode and constant 4th gear by hydraulic control. • After ignition LOCK/ON: 3rd gear by hydraulic control. Possible P, R and N also possible. • Power supply cut OFF to the EDS valve.
P1873	• Solenoid Valve Power Supply Circuit Shortage To Ground	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
P1874	• Solenoid Valve Power Supply Circuit Shortage To Battery	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control. • After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
P1881	2–1 Shift Malfunction	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 3rd gear. • Open lock up clutch.
P1883	• 3–2 Shift Malfunction	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 3rd gear. • Open lock up clutch.
P1884	4–3 Shift Malfunction	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear. • Open lock up clutch.
P1885	• 3–1 Shift Malfunction	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 3rd gear. • Open lock up clutch.
P1886	• 4–2 Shift Malfunction	MIL ON	• The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer. • Adopt Emergency/ Substitute mode and constant 4th gear. • Open lock up clutch.



DIAGNOSTIC TROUBLE CODE(DTC) P0562 SYSTEM VOLTAGE LOW

Circuit Description

The transaxle control module(TCM) is an electronic device which monitors inputs to control various transaxle functions including shift quality and transaxle sensors, swithces, and components to process for use within its' control program. Based on this input information, the TCM controls various transaxle output functions and devices.

Conditions for Setting the DTC

- System voltage is too low.
- Transaxle input voltage is too low.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition LOCK/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

- The MIL will turn LOCK when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

DTC P0562 – System Voltage Low

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Run the engine to 1,200rpm. 4. Record then clear DTC(s). 5. Select system voltage on the scan tool. 6. Drive the vehicle and observe the scan tool for either of the flowing conditions: Is the voltage within the values shown?	9–16V	Go to Step 5	Go to Step 3
3	1. Disconnect the battery cable. 2. Measure the voltage of the battery. Is the voltage within the values shown?	9–16V	Go to Step 5	Go to Step 4
4	Replace the battery. Is the replacement completed?	–	System OK	–
5	1. Turn the headlamp ON. 2. Turn the air conditioner ON. 3. Run the engine to 1,200rpm. 4. Observe the scan tool for system voltage. Is the voltage within the values shown?	9–16V	Go to Step 7	Go to Step 6
6	1. Turn the ignition LOCK. 2. Repair the alternator circuit if necessary. Is the action completed?	–	System OK	–
7	Inspection the F15, Ef6 fuse for an open. Was a problem found?	–	Go to Step 8	Go to Step 9
8	Inspection the F15, Ef6 fuse for short Replace the fuse if necessary. Is the replacement complete?	–	System OK	–
9	1. Turn the ignition ON. 2. Measure the voltage of F15, Ef6. Is the voltage within the values shown?	9–16V	Go to Step 11	Go to Step 10
10	Repair the fuse voltage supply lines for open. Is the action completed?	–	System OK	–
11	1. Turn the ignition LOCK. 2. Disconnect the TCM wiring connector. 3. Measure the resistance between Ef6 fuse and terminal B3 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 13	Go to Step 12
12	Repair the circuit(between Ef6 and terminal B3) for short to ground and open. Is the repair completed?	–	System OK	–
13	1. Disconnect the C203 connector and TCM connector. 2. Turn the ignition ON. 3. Measure the voltage of the terminal B3(TCM wiring connector) Is the voltage within the values shown?	9–16V	Go to Step 14	Go to Step 15

DTC P0562 – System Voltage Low (Cont'd)

Step	Action	Value(s)	Yes	No
14	Repair the circuit from Ef6 to terminal B3 of the TCM for short to battery. Is the repair complete?	–	System OK	–
15	1. Turn the ignition LOCK 2. Disconnect the C102 connector. 3. Measure the resistance between F15 fuse and terminal C16 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 17	Go to Step 16
16	Repair the circuit(between F15 and terminal C16) for short to ground and open. Is the repair completed?	–	System OK	–
17	1. Turn the ignition ON. 2. Measure the voltage of the terminal C16(TCM wiring connector) Is the voltage within the values shown?	9–16V	Go to Step 18	Go to Step 19
18	Repair the circuit(between F15 and terminal C16) for short to battery. Is the repair complete?	–	System OK	–
19	1. Inspect the transaxle wiring for poor electrical connections at the transaxle connector. 2. Look for possible bent, backed out, deformed, or damaged terminals. 3. Check for weak terminal tension. Was a condition found?	–	Verify repair and Go to Step 1	Go to Step 20
20	Replace the TCM. Is the replacement complete?	–	Go to Step 21	–
21	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart

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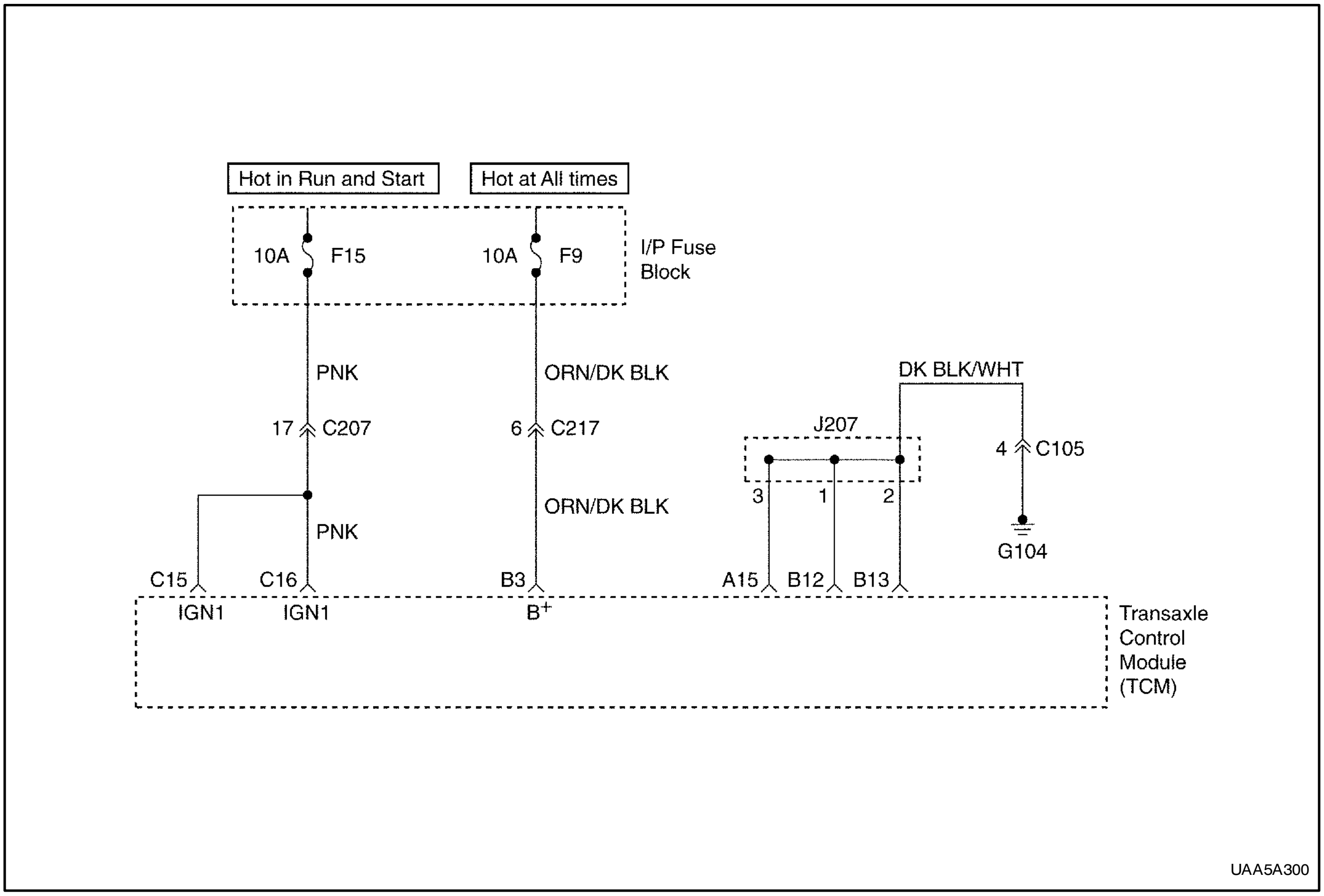

DIAGNOSTIC TROUBLE CODE(DTC) P0563 SYSTEM VOLTAGE HIGH

Circuit Description

The transaxle control module(TCM) is an electronic device which monitors inputs to control various transaxle functions including shift quality and transaxle sensors, swithces, and components to process for use within its' control program. Based on this input information, the TCM controls various transaxle output functions and devices.

Conditions for Setting the DTC

- System voltage is too high.
- Transaxle input voltage is too high.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition LOCK/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

- The MIL will turn LOCK when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

DTC P0563 – System Voltage High

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Run the engine to 1,200rpm. 4. Record then clear DTC(s). 5. Select system voltage on the scan tool. 6. Drive the vehicle and observe the scan tool for either of the flowing conditions: Is the voltage within the values shown?	9–16V	Go to Step 5	Go to Step 3
3	1. Disconnect the battery cable. 2. Measure the voltage of the battery. Is the voltage within the values shown?	9–16V	Go to Step 5	Go to Step 4
4	Replace the battery. Is the replacement completed?	–	System OK	–
5	1. Turn the headlamp ON. 2. Turn the air conditioner ON. 3. Run the engine to 1,200rpm. 4. Observe the scan tool for system voltage. Is the voltage within the values shown?	9–16V	Go to Step 7	Go to Step 6
6	1. Turn the ignition LOCK. 2. Repair the alternator circuit if necessary. Is the repair completed?	–	System OK	–
7	Inspection the F15, Ef6 fuse for an open. Was a problem found?	–	Go to Step 8	Go to Step 9
8	Inspection the F15, Ef6 fuse for short Replace the fuse if necessary. Is the replacement complete?	–	System OK	–
9	1. Turn the ignition ON. 2. Measure the voltage of F15, Ef6. Is the voltage within the values shown?	9–16V	Go to Step 11	Go to Step 10
10	Repair the fuse voltage supply lines for open. Is the repair completed?	–	System OK	–
11	1. Turn the ignition LOCK. 2. Disconnect the TCM wiring connector. 3. Measure the resistance between Ef6 fuse and terminal B3 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 13	Go to Step 12
12	Repair the circuit(between Ef6 and terminal B3) for short to ground and open. Is the repair completed?	–	System OK	–
13	1. Disconnect the C203 connector and TCM connector. 2. Turn the ignition ON. 3. Measure the voltage of the terminal B3(TCM wiring connector) Is the voltage within the values shown?	9–16V	Go to Step 14	Go to Step 15

DTC P0563 – System Voltage High(Cont'd)

Step	Action	Value(s)	Yes	No
14	Repair the circuit(between Ef6 and terminal B3) for short to battery. Is the repair complete?	–	System OK	–
15	1. Turn the ignition LOCK 2. Disconnect the C102 connector. 3. Measure the resistance between F15 fuse and terminal C16 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 17	Go to Step 16
16	Repair the circuit(between F15 and terminal C16) for short to ground and open. Is the repair completed?	–	System OK	–
17	1. Turn the ignition ON. 2. Measure the voltage of the terminal C16(TCM wiring connector). Is the voltage within the values shown?	11–14V	Go to Step 18	Go to Step 19
18	Repair the circuit(between F15 and terminal C16) for short to battery. Is the repair complete?	–	System OK	–
19	1. Inspect the transaxle wiring for poor electrical connections at the transaxle connector. 2. Look for possible bent, backed out, deformed, or damaged terminals. 3. Check for weak terminal tension. Was a condition found?	–	Verify repair and Go to Step 1	Go to Step 20
20	Replace the TCM. Is the replacement complete?	–	Go to Step 21	–
21	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart

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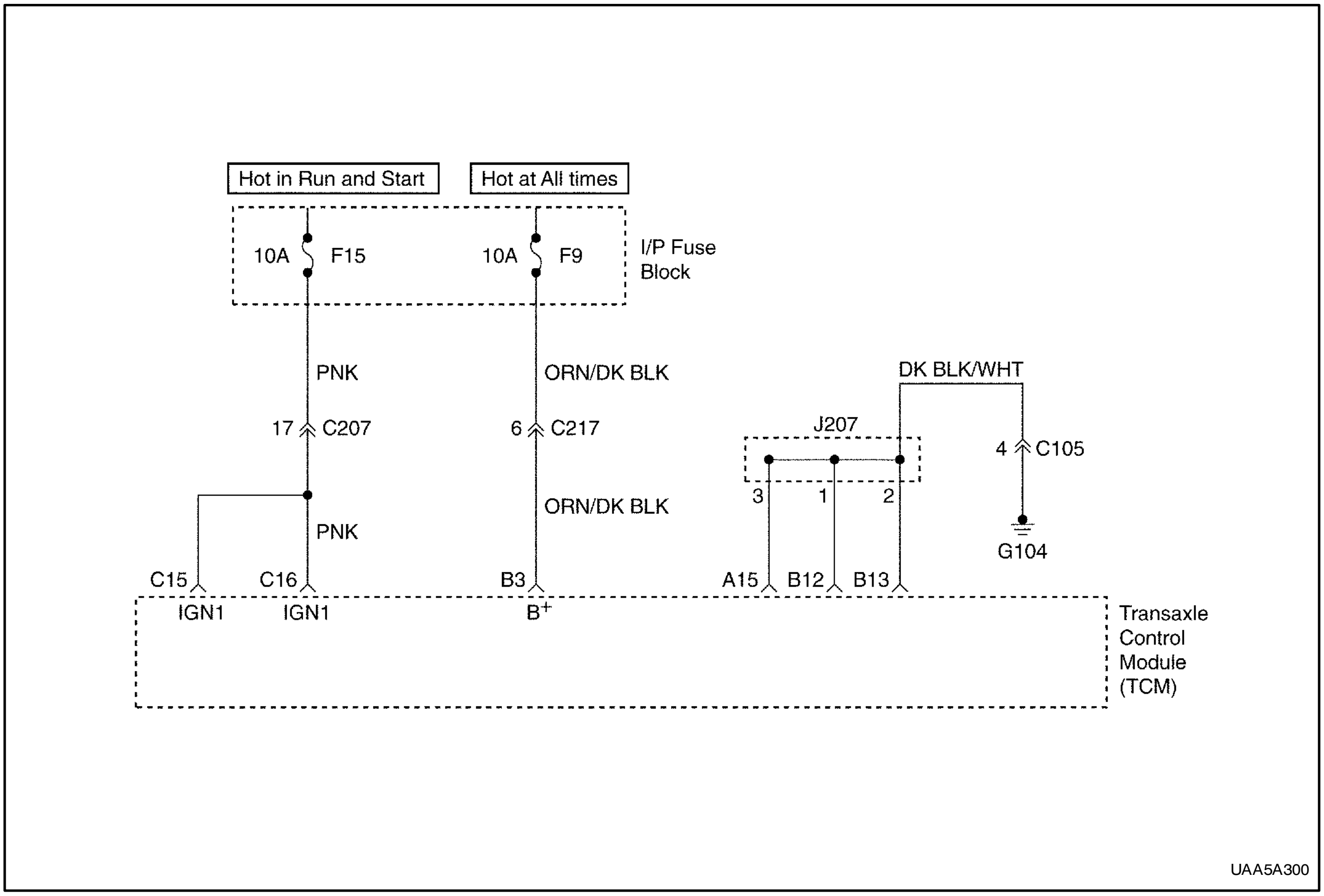


DIAGNOSTIC TROUBLE CODE(DTC) P0601
INTERNAL CONTROL MODULE MEMORY CHECKSUM ERROR

Circuit Description

A normal function of the Transmission Control Module (TCM) programming is to perform an internal check that verifies the integrity of the RAM memory allocations.

The DTC P0601 sets when the Random Access Memory(RAM) is not operating correctly when checked on initialization. An area of RAM is failed a read/ write test.

Conditions for Setting the DTC

- The EEPROM checksum test is seperated in two independent parts, the code checksum test and the calibration checksum test. For each area the checksum is calculated and compared with the corresponding checksum valve. If the valves are different, the fault will be set.
- System voltage is too high or too low.
- Transaxle input voltage is too high or too low.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition LOCK/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

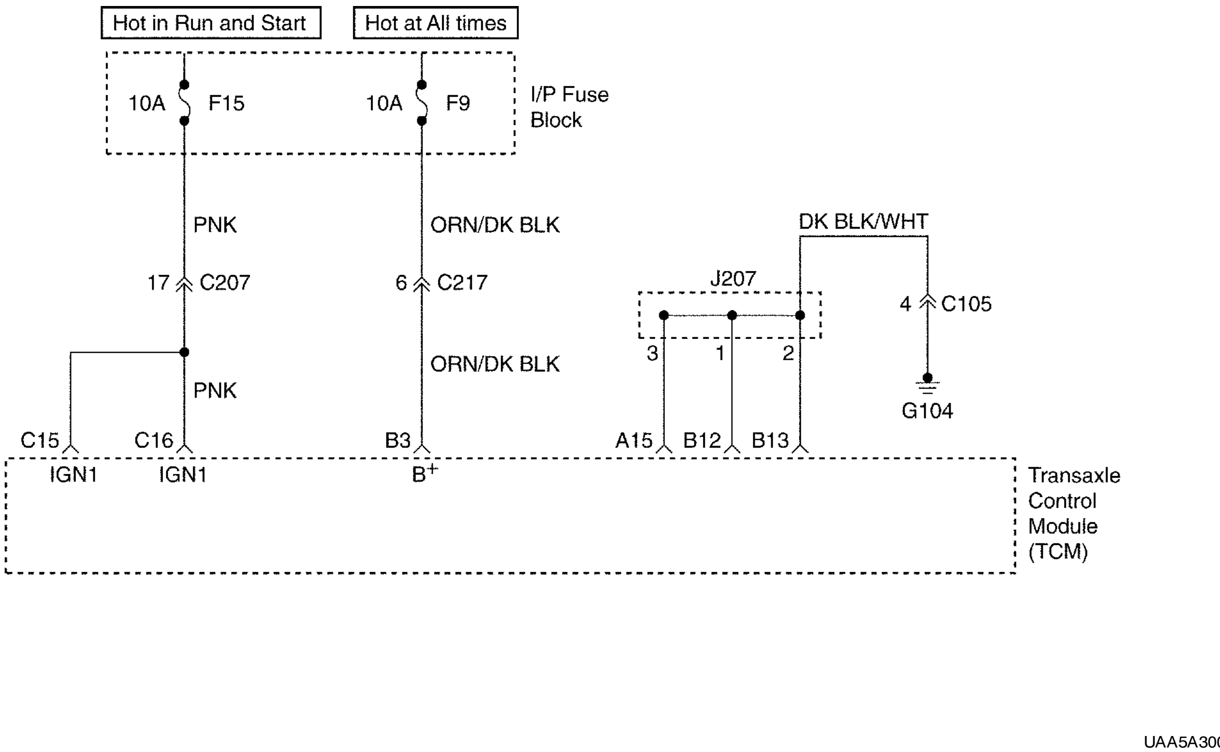
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P0601 sets, the replacement of TCM is recommended.

DTC P0601 – Internal Control Module Memory Checksum Error

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. Does the scan tool display P0601?	–	Go to Step 3	Go to “Diagnostic Aids”
3	1. Turn the ignition LOCK. 2. Replace the TCM. Is the action complete?	–	Go to Step 4	–
4	1. Using the scan tool, clear the DTCs. 2. Road test the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to Step 5	Go to Step 2
5	1. Check if any DTCs are set. 2. Are any DTCs displayed that have not been diagnosed?	–	Go to “Applicabel DTC table”	System OK



DIAGNOSTIC TROUBLE CODE(DTC) P0603
INTERNAL CONTROL MODULE KEEP ALIVE MEMORY(KAM) ERROR

Circuit Description

A normal function of the Transmission Control Module (TCM) programming is to perform an internal check that verifies the integrity of the KAM memory allocations.

The DTC P0603 sets when the keep alive memory (KAM) is not operating correctly when checked on initialization.

An area of KAM is failed a read/ write test.

Conditions for Setting the DTC

- The checksum of the current regulator data will be tested. If the checksum is not OK, then the error bit will bw set.
- If writing to FLASH during power latch phase failed.
- Each of both flash blocks has its own status which is located at the beginning of the each flash block and the status of the FLASH blocks do not fit togather.
- System voltage is too high or too low.
- Transaxle input voltage is too high or too low.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition LOCK/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

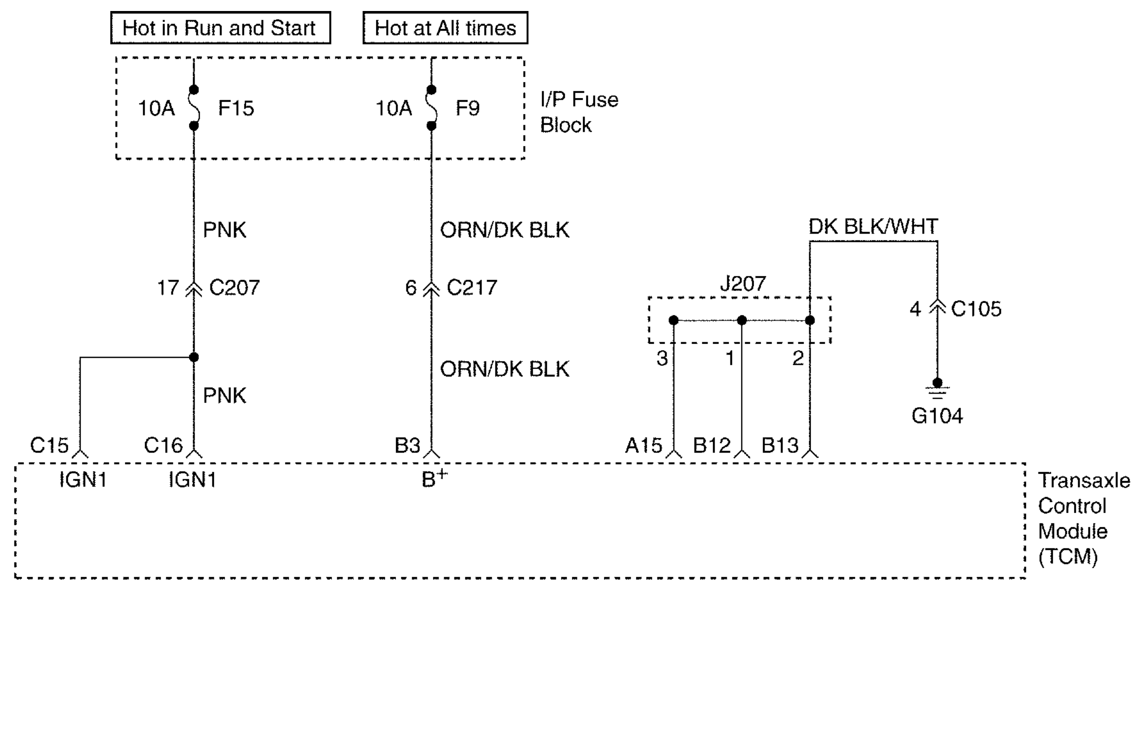
- The MIL will turn LOCK when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P0603 sets, the replacement of TCM is recommended.

DTC P0603 – Internal Control Module Keep Alive Memory(KAM) Error

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. Does the scan tool display P0603?	–	Go to Step 3	Go to “Diagnostic Aids”
3	1. Turn the ignition LOCK. 2. Replace the TCM. Is the replacement complete?	–	Go to Step 4	–
4	1. Using the scan tool, clear the DTCs. 2. Road test the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to Step 5	Go to Step 2
5	1. Check if any DTCs are set. 2. Are any DTCs displayed that have not been diagnosed?	–	Go to “Applicabel DTC table”	System OK



DIAGNOSTIC TROUBLE CODE(DTC) P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY(RAM) ERROR

Circuit Description

A normal function of the Transmission Control Module (TCM) programming is to perform an internal check that verifies the integrity of the RAM memory allocations.

The DTC P0604 sets when the Random Access Memory(RAM) is not operating correctly when checked on initialization. An area of RAM is failed a read/ write test.

Conditions for Setting the DTC

- An area of RAM is failed a read/ write test.
- System voltage is too high or too low.
- Transaxle input voltage is too high or too low.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

The Malfunction Indicator Lamp(MIL) will illuminate.

- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition LOCK/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

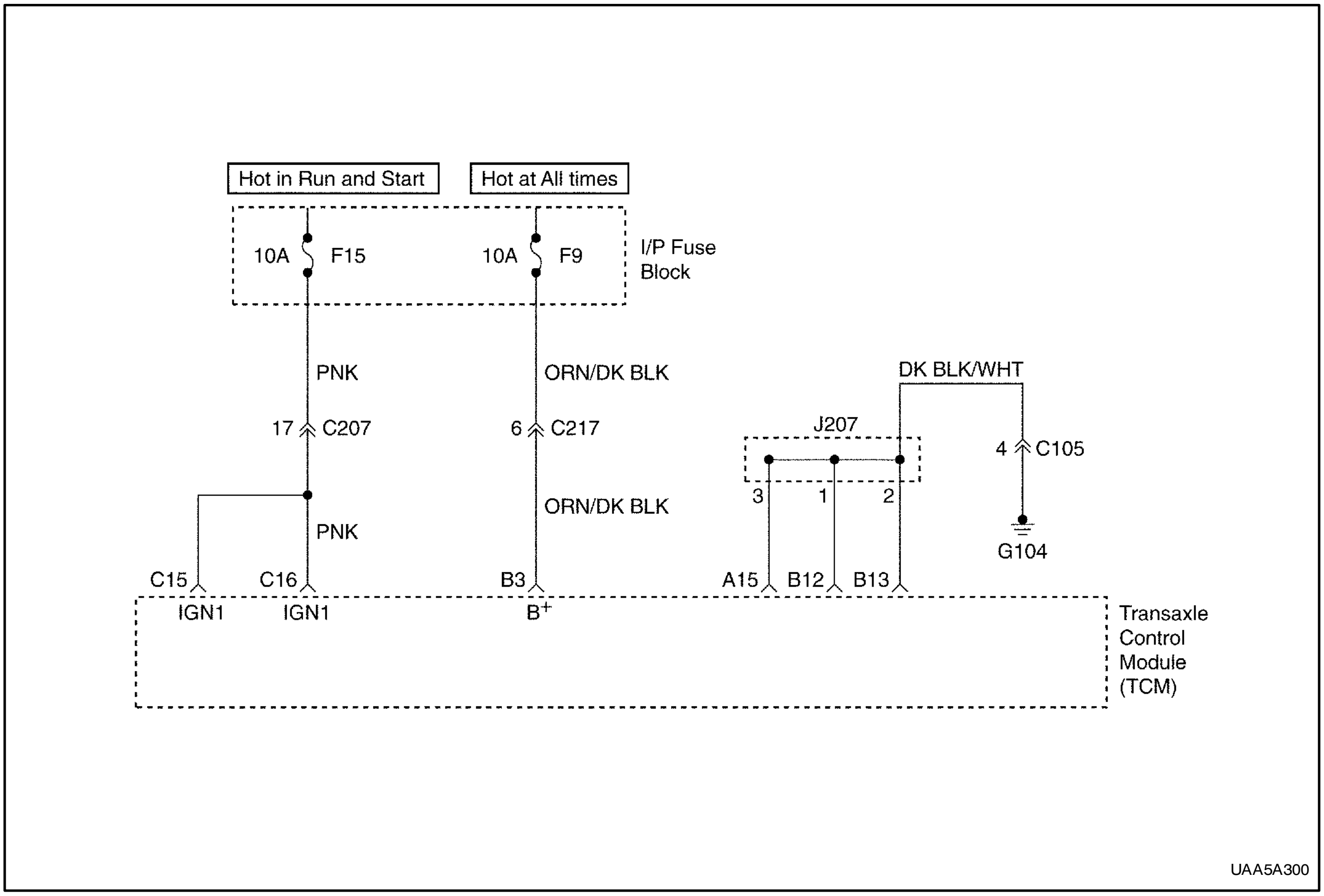
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P0604 sets, the replacement of TCM is recommended.

DTC P0604 – Internal Control Module Random Access Memory(RAM) Error

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. Does the scan tool display P0604?	–	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition LOCK. 2. Replace the TCM. Is the action complete?	–	Go to Step 4	–
4	1. Using the scan tool, clear the DTC. 2. Road test the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to Step 5	Go to Step 2
5	1. Check if any DTC(s) are set. 2. Are any DTC(s) displayed that have not been diagnosed?	–	Go to "Applicabel DTC table"	System OK



DIAGNOSTIC TROUBLE CODE(DTC) P1604
DATA CHECK OF INTERNAL & EXTENDED RAM FAILED

Circuit Description

A normal function of the Transmission Control Module (TCM) programming is to perform an internal check that verifies the integrity of the RAM memory allocations.

The DTC P1604 sets when the Random Access Memory(RAM) is not operating correctly when checked on initialization. An area of RAM is failed a read/ write test.

Conditions for Setting the DTC

- An area of RAM is failed a read/ write test.
- System voltage is too high or too low.
- Transaxle input voltage is too high or too low.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

The Malfunction Indicator Lamp(MIL) will illuminate.

- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition LOCK/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.

A history DTC will clear after 40 consecutive warm up cycles without a fault.

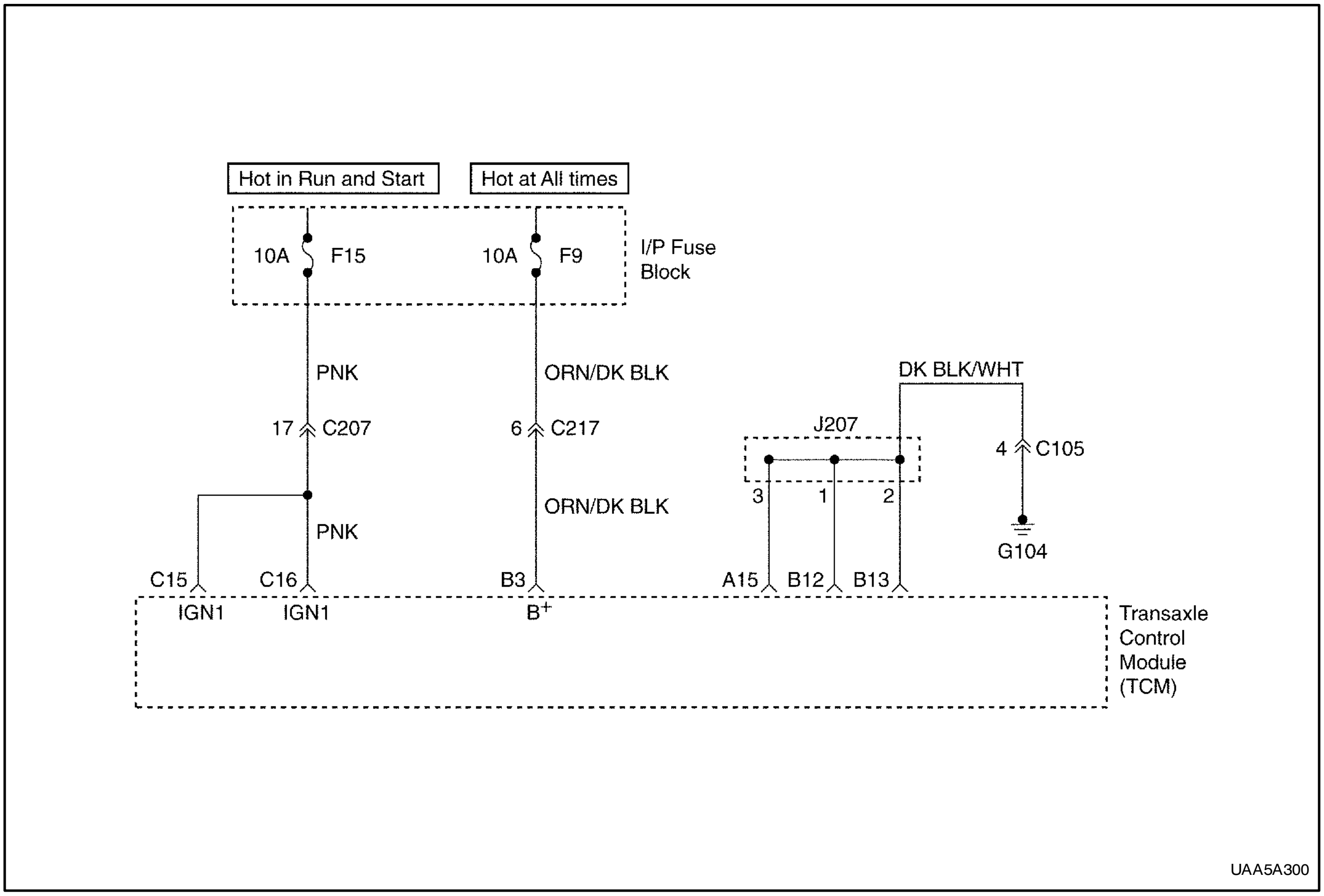
Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1604 sets, the replacement of TCM is recommended.

DTC P1604 – Data Check Of Internal & Extended Ram Failed

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. Does the scan tool display P1604?	–	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition LOCK. 2. Replace the TCM. Is the action complete?	–	Go to Step 4	–
4	1. Using the scan tool, clear the DTC. 2. Road test the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to Step 5	Go to Step 2
5	1. Check if any DTC(s) are set. 2. Are any DTC(s) displayed that have not been diagnosed?	–	Go to "Applicabel DTC table"	System OK



DIAGNOSTIC TROUBLE CODE(DTC) P0606 TRANSAXLE CONTROL MODULE PROCESSOR FAULT

Circuit Description

In case that TCM reset has been occured by software (warm reset) not by ignition key ON, TCM increments software reset counter. If the counter exceeds the permissible maximum value for the software count then the fault will be detected.

Conditions for Setting the DTC

- System voltage is too high or too low.
- Transaxle input voltage is too high or too low.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

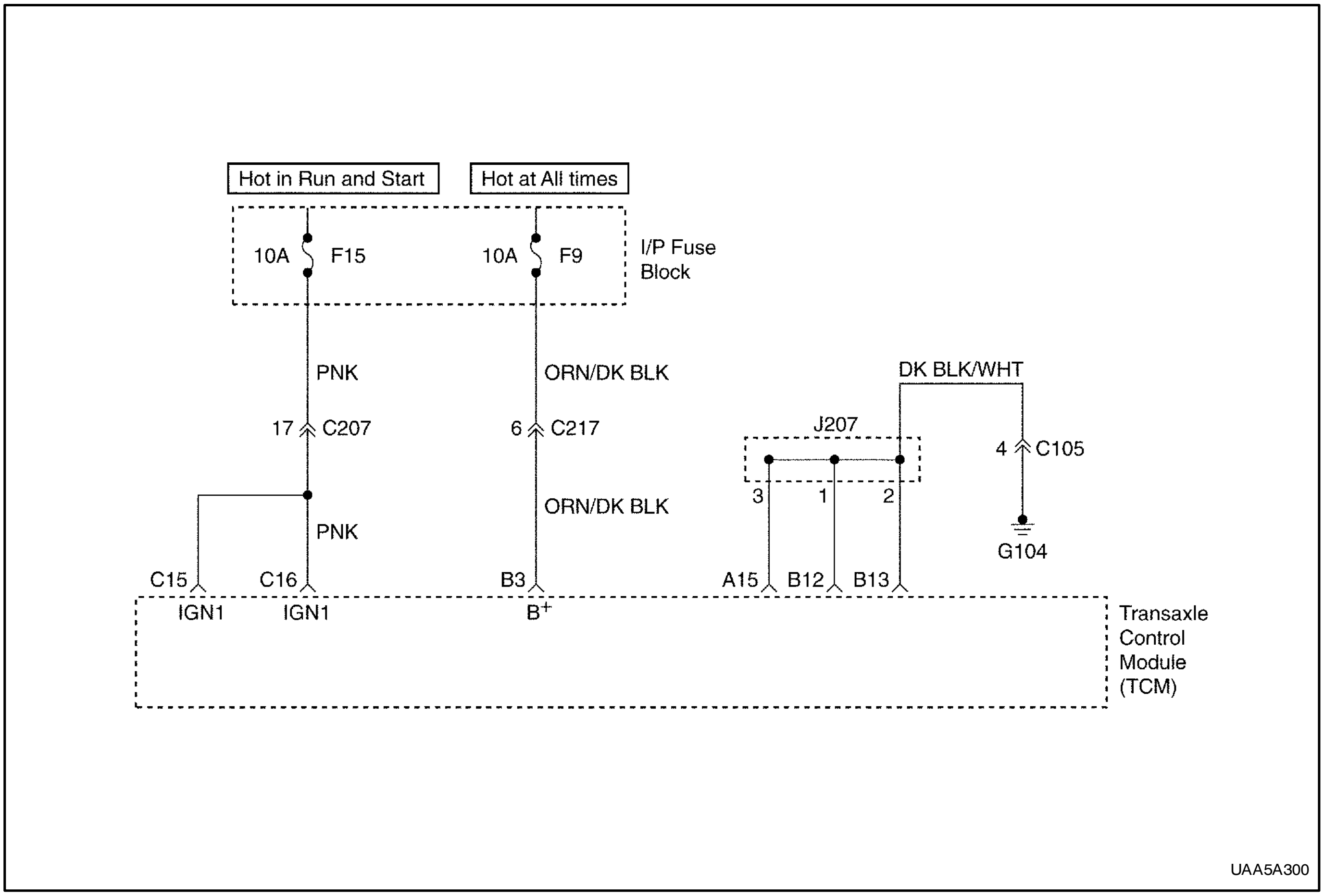
- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

DTC P0606 – Transaxle control module processor fault

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. Does the scan tool display P0606?	–	Go to Step 3	Go to “Diagnostic Aids”
3	Replace the TCM. Is the action complete?	–	Go to Step 4	–
4	1. Using the scan tool, clear the DTCs. 2. Road test the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to Step 5	Go to Step 2
5	1. Check if any DTCs are set. 2. Are any DTCs displayed that have not been diagnosed?	–	Go to “Applicabel DTC table”	System OK



DIAGNOSTIC TROUBLE CODE(DTC) P1606
FAILURE OF EXTERNAL WATCHDOG

Circuit Description

The external watchdog will be triggered. If the external warchdog does not run out after 30ms then the fault will be detected.

Conditions for Setting the DTC

- System voltage is too high or too low.
- Transaxle input voltage is too high or too low.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition LOCK/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

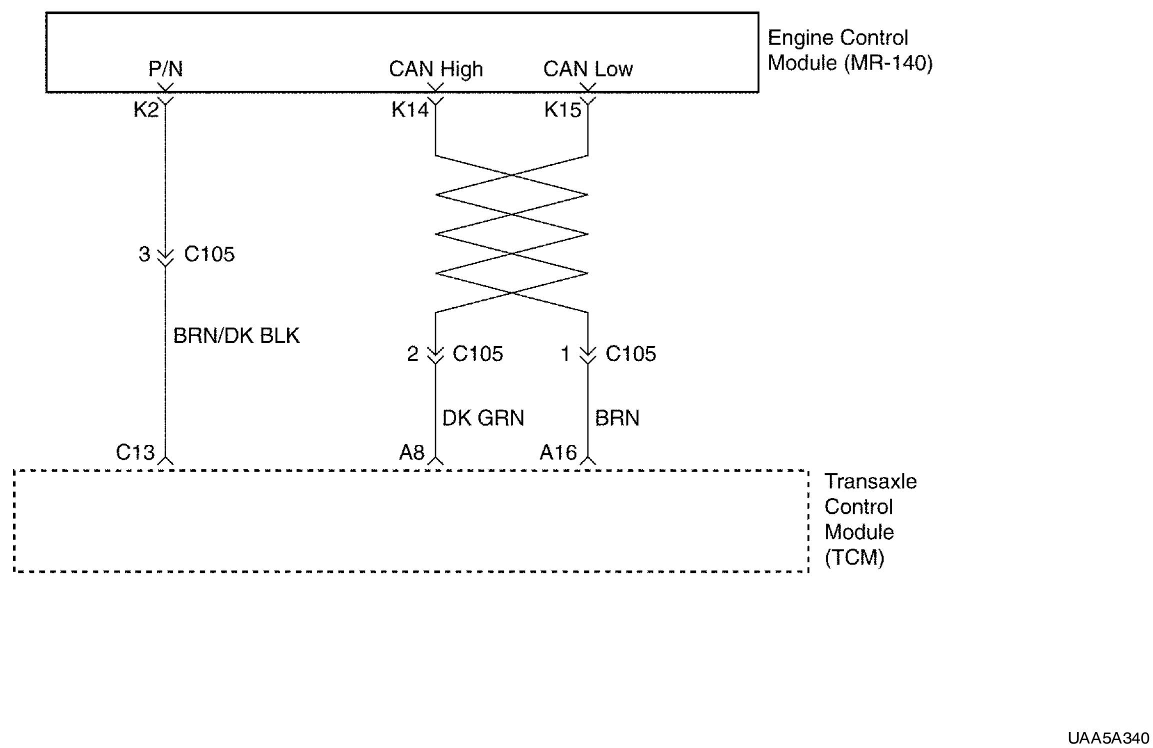
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- History OTCs can be cleared by using a scan tool.

Diagnostic Aids

- When DTC P1606 sets, the replacement of TCM is recommended.

DTC P1606 – Failure Of External Watchdog

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. Does the scan tool display P1606?	–	Go to Step 3	Go to "Diagnostic Aids"
3	Replace the TCM. Is the replacement complete?	–	Go to Step 4	–
4	1. Using the scan tool, clear the DTCs. 2. Road test the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to Step 5	Go to Step 2
5	1. Check if any DTCs are set. 2. Are any DTCs displayed that have not been diagnosed?	–	Go to "Applicabel DTC table"	System OK



DIAGNOSTIC TROUBLE CODE(DTC) P1671
CAN TRANSMIT MESSAGE FAILURE (2.0L DOHC DELPHI 32BIT)

Circuit Description

The transaxle control module(TCM) is an electronic device which monitors inputs to control various transaxle functions including shift quality and transaxle sensors, swithces, and components to process for use within its' control program. Based on this input information, the TCM controls various transaxle output functions and devices.

Information transmit between TCM and ECM through the CAN line. information is as follows :

- Engine Malfunction Signal.
- Engine Speed.
- Engine Output Torque Reduction Signal.
- Engine Coolant Temperature.

Conditions for Setting the DTC

- System voltage is too high or too low.
- CAN transmitting wiring harness shortage or open.
- TCM or ECM is defective.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

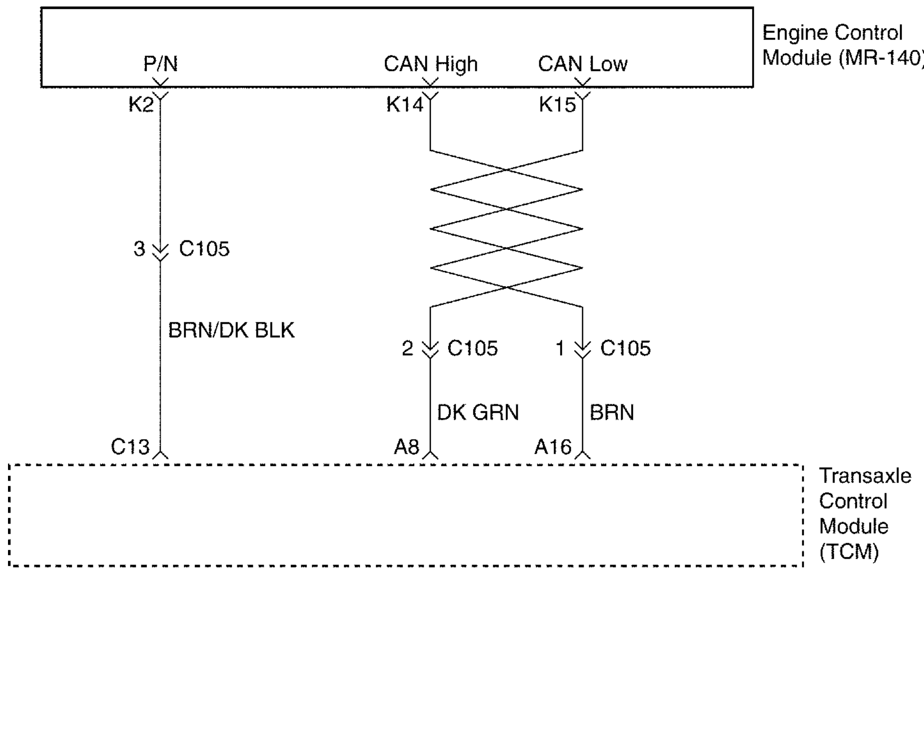
- The malfunction indicator lamp(MIL) will illuminate
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycles.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

DTC P1671 – Can Transmit Message Failure(2.0L DOHC DELPHI 32BIT)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Disconnect the TCM wiring connector. And ECM wiring connector. 3. Measure the resistance between terminal A8 of the TCM wiring connector and terminal K14 of the ECM wiring connector. 4. Measure the resistance between terminal A16 of the TCM wiring connector and terminal K15 of the ECM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 4	Go to Step 3
3	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
4	1. Turn the ignition ON. 2. Measure the voltage of terminal A8. 3. Measure the voltage of terminal A16. Is the resistance within the values shown?	11–14V	Go to Step 5	Go to Step 6
5	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
6	1. Replace the TCM. 2. Turn the ignition OFF. 3. Turn the ignition On. 4. Check if P1671 DTC is set. 5. Is The DTC set?	–	Go to Step 7	Go to Step 8
7	1. Replace the ECM. 2. Is the action complete?	–	Go to Step 8	–
8	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. 3. Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1672
CAN BUS OFF FAILURE (2.0L DOHC DELPHI 32BIT)

Circuit Description

The transaxle control module(TCM)is an electronic device which monitors inputs to control various transaxle functions including shift quality and transaxle sensors, swithces, and components to process for use within its' control program. Based on this input information, the TCM controls various transaxle output functions and devices.

Information transmit between TCM and ECM through the CAN line. information is as follows :

- Engine Malfunction Signal.
- Engine Speed.
- Engine Output Torque Reduction Signal.
- Engine Coolant Temperature.

Conditions for Setting the DTC

- System voltage is too high or too low.
- CAN transmitting wiring harness shortage or open.
- TCM or ECM is defective.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

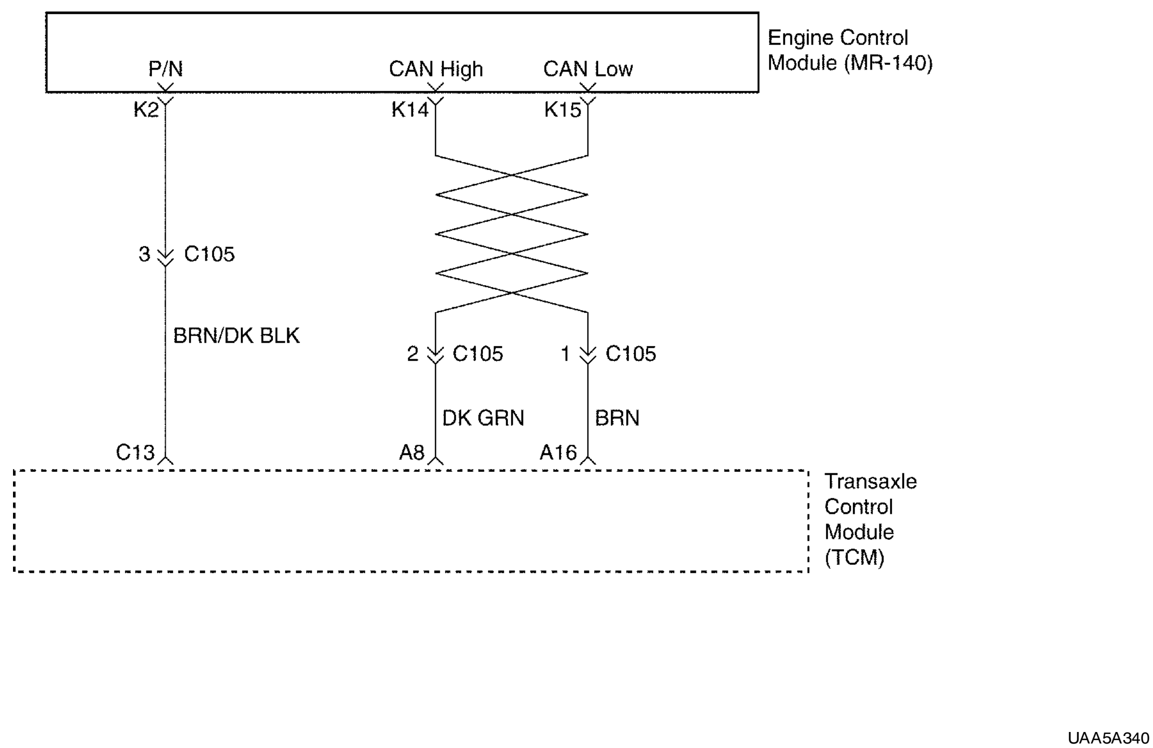
- The malfunction indicator lamp(MIL) will illuminate
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycles.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

DTC P1672 – CAN Bus OFF Failure(2.0L DOHC DELPHI 32BIT)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Disconnect the TCM wiring connector. And ECM wiring connector. 3. Measure the resistance between terminal A8 of the TCM wiring connector and terminal K14 of the ECM wiring connector. 4. Measure the resistance between terminal A16 of the TCM wiring connector and terminal K15 of the ECM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 4	Go to Step 3
3	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
4	1. Turn the ignition ON. 2. Measure the voltage of terminal A8. 3. Measure the voltage of terminal A16. Is the resistance within the values shown?	11–14V	Go to Step 5	Go to Step 6
5	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
6	1. Replace the TCM. 2. Turn the ignition OFF. 3. Turn the ignition On. 4. Check if P1672 DTC is set. 5. Is The DTC set?	–	Go to Step 7	Go to Step 8
7	1. Replace the ECM. 2. Is the action complete?	–	Go to Step 8	–
8	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. 3. Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1673
CAN RECEIVE ECM MESSAGE FAILURE (2.0L DOHC DELPHI 32BIT)

Circuit Description

The transaxle control module(TCM) is an electronic device which monitors inputs to control various transaxle functions including shift quality and transaxle sensors, swithces, and components to process for use within its' control program. Based on this input information, the TCM controls various transaxle output functions and devices.

Information transmit between TCM and ECM through the CAN line. information is as follows :

- Engine Malfunction Signal.
- Engine Speed.
- Engine Output Torque Reduction Signal.
- Engine Coolant Temperature.

Conditions for Setting the DTC

- System voltage is too high or too low.
- CAN transmitting wiring harness shortage or open.
- TCM or ECM is defective.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

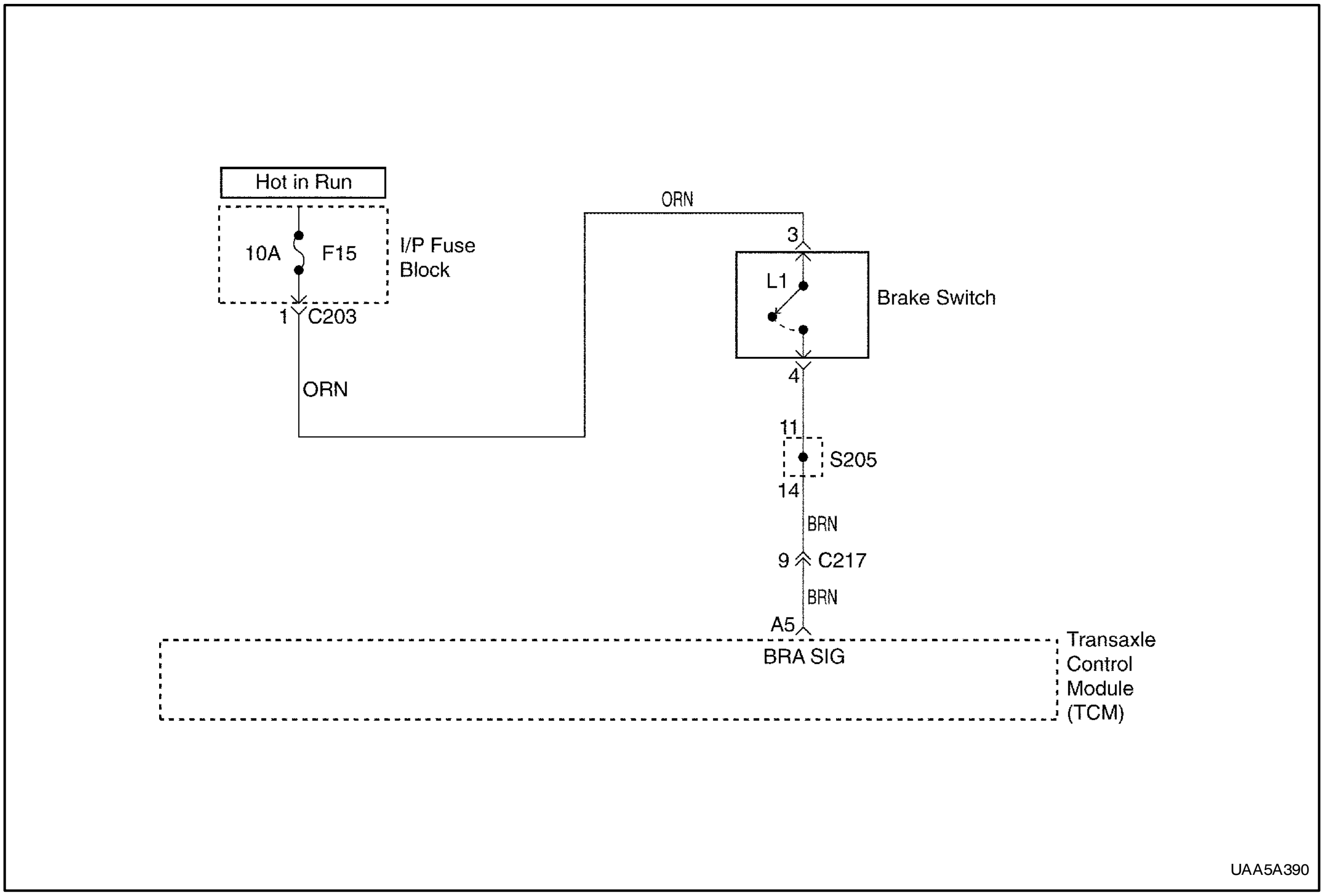
- The malfunction indicator lamp(MIL) will illuminate
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycles.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

DTC P1673 – Can Receive Ecm Message Failure(2.0L DOHC DELPHI 32BIT)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Disconnect the TCM wiring connector. And ECM wiring connector. 3. Measure the resistance between terminal A8 of the TCM wiring connector and terminal K14 of the ECM wiring connector. 4. Measure the resistance between terminal A16 of the TCM wiring connector and terminal K15 of the ECM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 4	Go to Step 3
3	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
4	1. Turn the ignition ON. 2. Measure the voltage of terminal A8. 3. Measure the voltage of terminal A16. Is the resistance within the values shown?	11–14V	Go to Step 5	Go to Step 6
5	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
6	1. Replace the TCM. 2. Turn the ignition OFF. 3. Turn the ignition On. 4. Check if P1673 DTC is set. 5. Is The DTC set?	–	Go to Step 7	Go to Step 8
7	1. Replace the ECM. 2. Is the action complete?	–	Go to Step 8	–
8	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. 3. Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P0703 BRAKE SWITCH CIRCUIT MALFUNCTION

Circuit Description

The brake switch is used to indicate brake pedal status to the transaxle control module(TCM). The brake switch is a normally open switch. Applying the brake pedal closes the switch, supplying voltage to the TCM. Releasing the brake pedal interrupts voltage to the TCM.

This error is set with status status flag static at the system initialization phase. After that if the debaunced brake light switch signal is active in the TCM run mode then the failure statue is set to sporadic. In this case the fault isn't deluded but it is suppressed in keyword service.

Conditions for Setting the DTC

- Brake switch stuck to closed.
- Brake switch wiring harness shortage to ground.
- Brake switch wiring harness shortage to battery.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

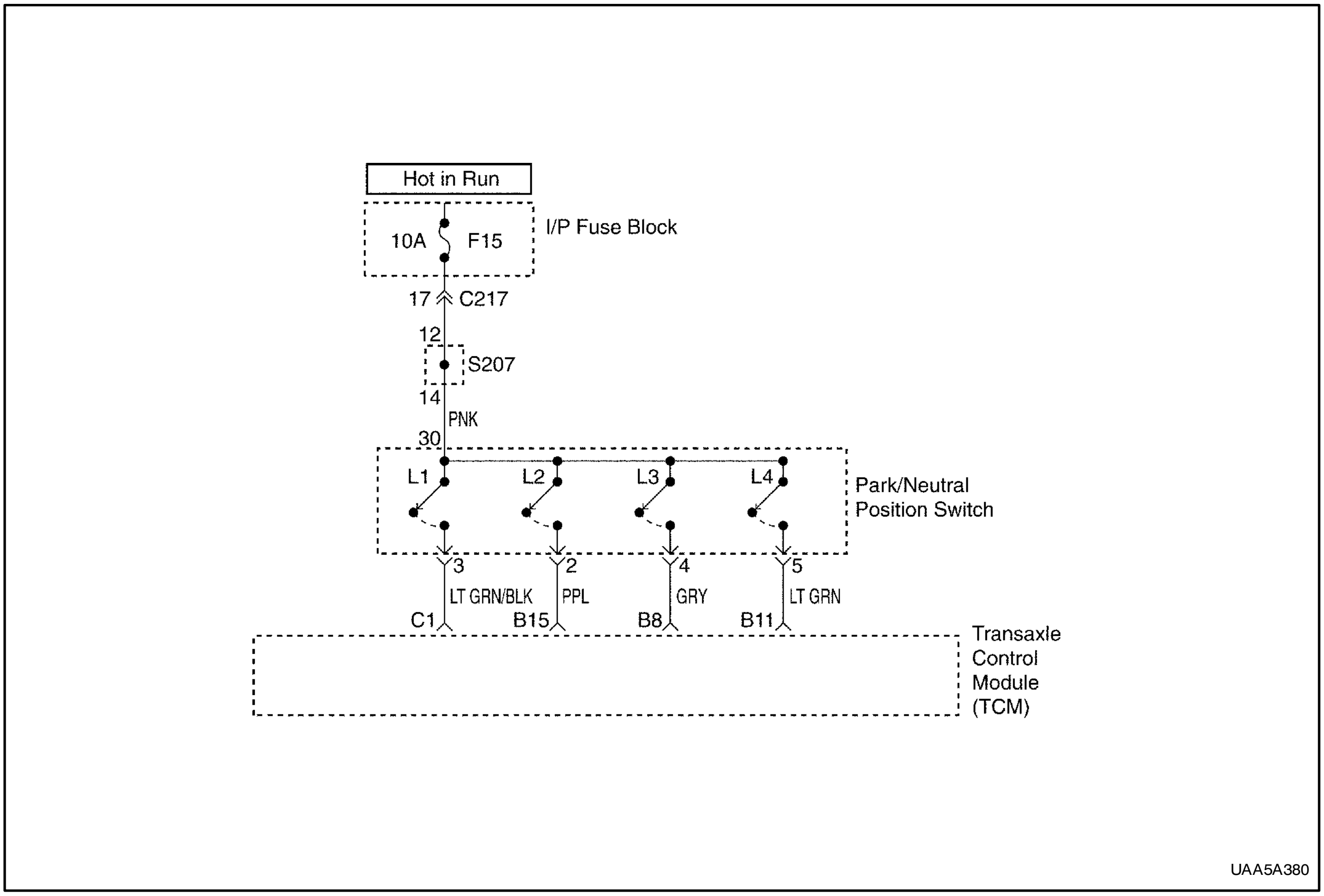
- No lamp control required but diagnostic information should be stored immediately when malfunction is detected.
- TCM assume that the brake light always active.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

- Using a scan tool can clear history DTCs.

DTC P0703 – Brake Switch Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON. With the engine OFF. 3. Record then clear DTC(s) 4. Select scan tool Brake Switch. 5. Disconnect the brake switch connector. 6. Did the brake switch status change from "closed" to "open"?	–	Go to Step 3	Go to Step 4
3	1. Replace the brake switch. 2. Refer to Brake Switch Replacement. 3. Is the action complete?	–	System OK	–
4	Inspect circuit from brake switch to TCM for shortage or open. Was the problem found?	–	Go to Step 5	Go to Step 6
5	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
6	Replace the TCM. Is the action complete?	–	Go to Step 7	–
7	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P0705
PARK/NEUTRAL POSITION SWITCH CIRCUIT MALFUNCTION

Circuit Description

The neutral start switch is located on the selector shaft and informs the TCM of the current selector lever position P–R–N–D–3–2–1.

The selector lever position is transmitted to the TCM in encoded form along 4 lines. The encoding is such that malfunctions in the connecting lead are identified.

The neutral start switch is located on the selector shaft, which is connected to the selector lever via a pull cable. In addition, the neutral start switch controls the starter interlock, the reversing light and the selector lever position indicator on the instrument panel.

Conditions for Setting the DTC

- Neutral start switch stuck to closed.
- Neutral start switch wiring harness shortage to ground.
- Neutral start switch wiring harness shortage to battery.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycles.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P0705 sets, the replacement of neutral start switch is recommended.

Gear Position And Range Signal Chart.

	L1	L2	L3	L4
P	0	0	12	0
R	0	0	0	12
N	0	12	0	0
D	12	12	12	0
3	12	12	0	12
2	12	0	12	12
1	0	12	12	12

DTC P0705 – Park/Neutral Position Switch Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON. 3. Record then clear DTC(s). 4. Applying the brakes and select each transaxle range (P, R,N,D,3,2,1), while monitoring scan tool. Refer to Gear Position And Range Signal Chart. Does each selected transaxle range match scan tool and signal range chart?	–	Go to Step 2	Go to “Diagnostic Aids”
3	Inspect the F15 for shortage to ground? Was the problem found?	–	Go to Step 4	Go to Step 5
4	Replace the fuse as necessary. Is the action complete?	–	System OK	–
5	Inspect the neutral start switch. refer to “Diagnostic Aids”. Was the problem found?	–	Go to Step 6	Go to Step 7
6	Replace the neutral start switch. Is the action complete?	–	System OK	–
7	1. Disconnect the neutral start switch connector and TCM connector. 2. Measure the resistance between terminal 3 of the neutral start switch and terminal C1 of the TCM connector. 3. Measure the resistance between terminal 2 of the neutral start switch and terminal B15 of the TCM connector. 4. Measure the resistance between terminal 4 of the neutral start switch and terminal B6 of the TCM connector. 5. Measure the resistance between terminal 5 of the neutral start switch and terminal B11 of the TCM connector. Is the resistance within the values shown?	0Ω	Go to Step 9	Go to Step 8
8	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–

DTC P0705 – Park/Neutral Position Switch Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Turn the ignition on. 2. Measure the voltage of terminal 3. 3. Measure the voltage of terminal 2. 4. Measure the voltage of terminal 4. 5. Measure the voltage of terminal 5. Is the resistance within the values shown?	11–14V	Go to Step 10	Go to Step 11
10	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
11	Replace the TCM. Is The action complete?	–	Go to Step 12	–
12	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart

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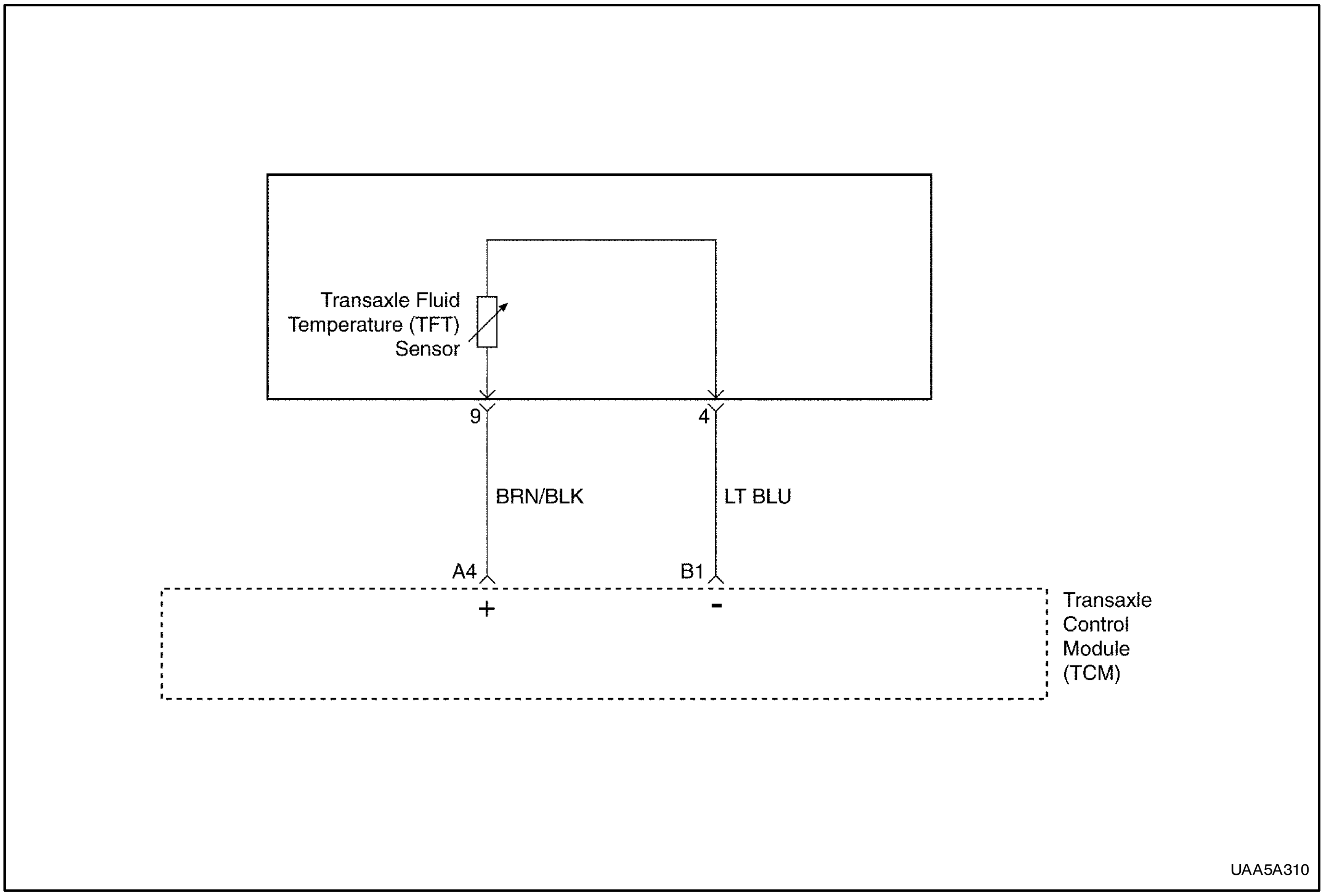

DIAGNOSTIC TROUBLE CODE(DTC) P0710
TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT MALFUNCTION

Circuit Description

The TFT sensor is a positive temperature coefficient thermistor (temperature sensitive resistor)that provides information to the TCM regarding transaxle fluid temperature. The temperature sensor is located in valve body. Calculated temperature is a factor to determine at the shift time and shift delay time.

The internal electrical resistance of the sensor varies in relation to the operating temperature of the transaxle fluid.

The TCM sends a 5volt-reference signal to the temperature sensor and measures the voltage rise in the electrical circuit. A higher fluid temperature creates a higher resistance in the temperature sensor, thereby measuring a lower voltage signal.

The TCM measures this voltage as another input to help control line pressure, shift schedules and LOC apply. When transaxle fluid temperature reaches 120**b**C (248**b**F) the TCM enters “hot mode.” Above this temperature the TCM modifies transaxle shift schedules and LOC apply in an attempt to reduce fluid temperature by reducing transaxle heat generation.

Conditions for Setting the DTC

- The calculated temperature is compared with the predeter mined min, and max, value.
- If the temperature is less than min. value or greater than max value then the current temperature is regared as out of range and the corresponding error but will be set.

Action Taken When the DTC Sets

- For activating power lamp blinking.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- TCM assume the transaxle fluid temperature is 60**b**C.
- No influence at vehicle running.

Conditions for Clearing the MIL/DTC

- The power lamp blinking will turn LOCK when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P0710 sets, the replacement of Transaxle Temperature Sensor is recommended.

DTC P0710 – Transmission Fluid Temperature Sensor Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record then clear DTC(s). 4. Select TFT on the scan tool. 5. Drive the vehicle and observe the scan tool for either of the flowing conditions: 6. The TFT does not change more than 1.5bC (2.7bF) in 80 seconds since start-up. 7. The TFT changes more than 20bC (36bF) in 0.200 seconds 14 times within 7 seconds (unrealistic change). Did either of the fail conditions occur?	–	Go to Step 3	Go to “Diagnostic Aids”
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector. 3. Measure the resistance between terminals 5 and 11 the transaxle wiring connector. Is the resistance within the values shown?	TFT 25bC 990Ω	Go to Step 7	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the wiring connector of the transaxle temperature sensor. 3. Inspect the automatic transaxle wiring harness for an intermittent short or open. Was a problem found?	–	Go to Step 5	Go to Step 6
5	Replace the automatic transaxle wiring harness. Is the replacement complete?	–	System OK	–
6	Replace the TFT sensor. Is the replacement complete?	–	System OK	–
7	1. Disconnect the automatic transaxle wiring connector and disconnect the wiring connector of the TCM(transaxle control module). 2. Measure the resistance between terminal 4 of the transaxle wiring connector and terminal B1 of the TCM wiring connector. 3. Measure the resistance between terminal 9 of the transaxle wiring connector and terminal A4 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 9	Go to Step 8
8	1. Inspect the automatic transaxle wiring harness for an intermittent short to ground or open condition. 2. Inspect the automatic TFT sensor wiring harness for an intermittent short to ground or open condition. 3. Repair the circuits if necessary. Is the repair complete?	–	System OK	–

DTC P0710 – Transmission Fluid Temperature Sensor Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Turn the ignition ON. 2. Measure the voltage of terminal A4 of the TCM wiring connector. 3. Measure the voltage of terminal B1 of the TCM wiring connector. Is the voltage within the values shown?	9–16V	Go to Step 10	Go to Step 11
10	1. Inspect the automatic transaxle wiring harness for an intermittent short to battery. 2. Inspect the automatic TFT sensor wiring harness for an intermittent short to battery. 3. Repair the circuits if necessary. Is the repair complete?	–	System OK	–
11	Replace the TCM. Is the replacement complete?	–	Go to Step 12	–
12	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart

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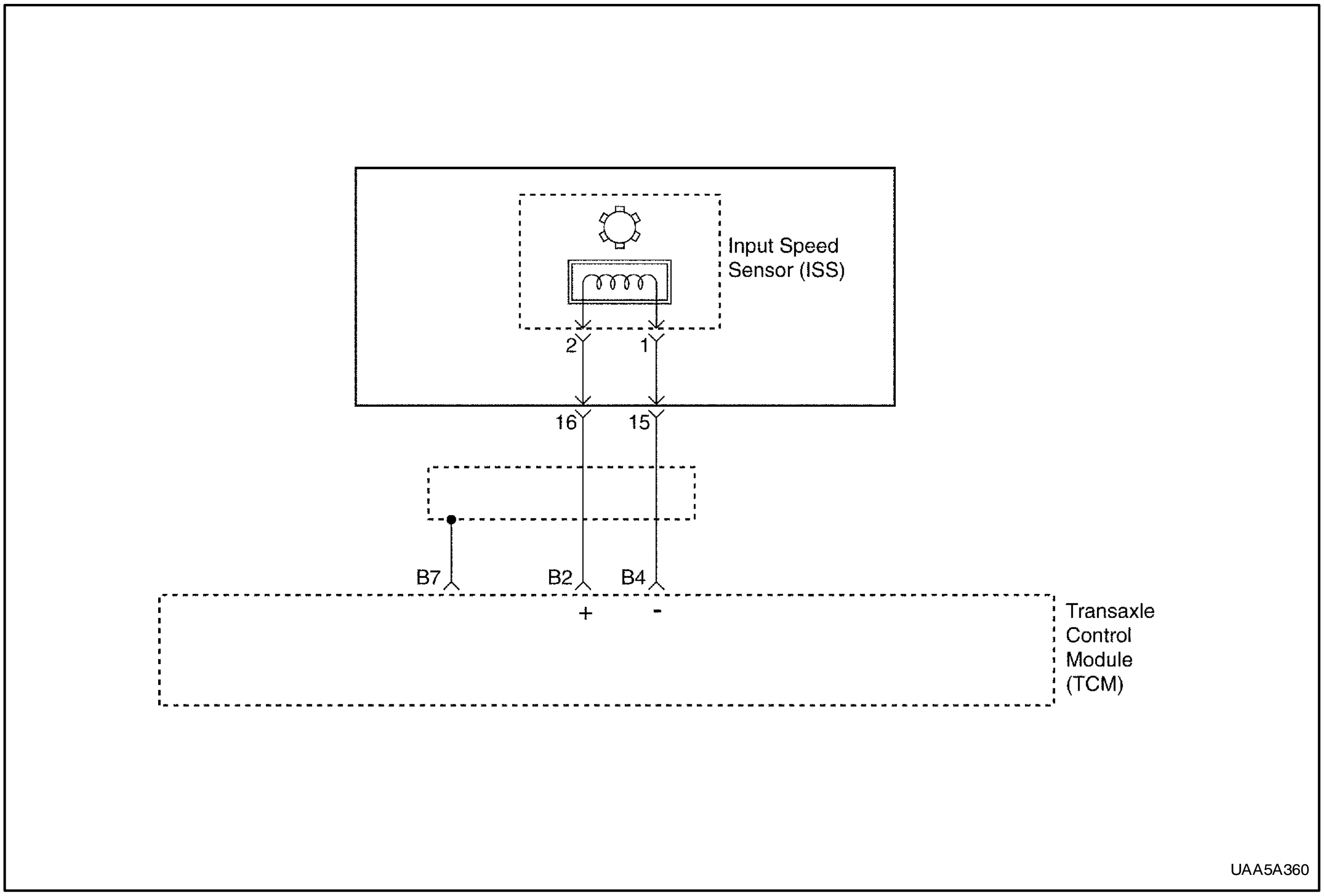

DIAGNOSTIC TROUBLE CODE(DTC) P0715
INPUT SPEED SENSOR(ISS) CIRCUIT MALFUNCTION

Circuit Description

Information relative to transaxle input speed to the TCM. The TCM uses transaxle input speed information to control line pressure, LOC apply and release and transaxle shift patterns. This information is also uses to calculate the appropriate operating gear ratios and LOC slippage.

The input speed sensor mounts onto piston B that is inside of valve body.

An air gap of 1.8~2.2mm(0.07~0.086inch) is maintained between the sensor and the piston B.

The sensor consists of a permanent magnet surround by a coil of wire. As the piston B is driven by the turbine shaft, an AC signal induced in the input speed sensor. Higher vehicle speeds induce a higher frequency and voltage measurement at the sensor.

Sensor resistance should measure between 825~835 ohms at 20**b**C(68**b**F). Sensor can measure from 1,000~ 8,000HZ.

Conditions for Setting the DTC

- Turbine speed is more than 7,000rpm.
- System voltage is too high or too low.
- TCM or ECM is defective.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition LOCK/ON : 3rd gear by hydraulic control, position P, R and N also possible.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycles.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P0715 sets, the replacement of ISS(input speed sensor) is recommended.

DTC P0715 – Input Speed Sensor(ISS) Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON(at 3,100rpm). 3. Observe the turbine speed on the scan tool. Is the speed within the values shown?	Engine speed 0–7,000rpm increasing rate : less than 25,000 rpm/sec	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the trasaxle wiring connector. 3. Measure the resistance between terminals 15 and 16 of the transaxle wiring connector. Is the resistance within the values shown?	830±5Ω	Go to Step 9	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the input speed sensor wiring connector. 3. Measure the resistance between terminal 1 of the input speed sensor wiring connector and terminal 15 of the transaxle wiring connector. 4. Measure the resistance between terminal 2 of the input speed sensor wiring connector and terminal 16 of the transaxle wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 6	Go to Step 5
5	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
6	1. Turn the ignition ON. 2. Measure the voltage of terminal 1. 3. Measure the voltage of terminal 2. Is the resistance within the values shown?	11–14V	Go to Step 7	Go to Step 8
7	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
8	Replace the input speed sensor. Is the action complete?	–	System OK	–
9	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 15 of the transaxle wiring connector and terminal B4 of the TCM wiring connector. 3. Measure the resistance between terminal 16 of the transaxle wiring connector and terminal B7 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 11	Go to Step 10
10	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–

DTC P0715 – Input Speed Sensor(ISS) Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition ON. 2. Measure the voltage of terminal 15. 3. Measure the voltage of terminal 16. Is the resistance within the values shown?	11–14V	Go to Step 12	Go to Step 13
12	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
13	Replace the TCM. Is the action complete?	–	Go to Step 14	–
14	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart

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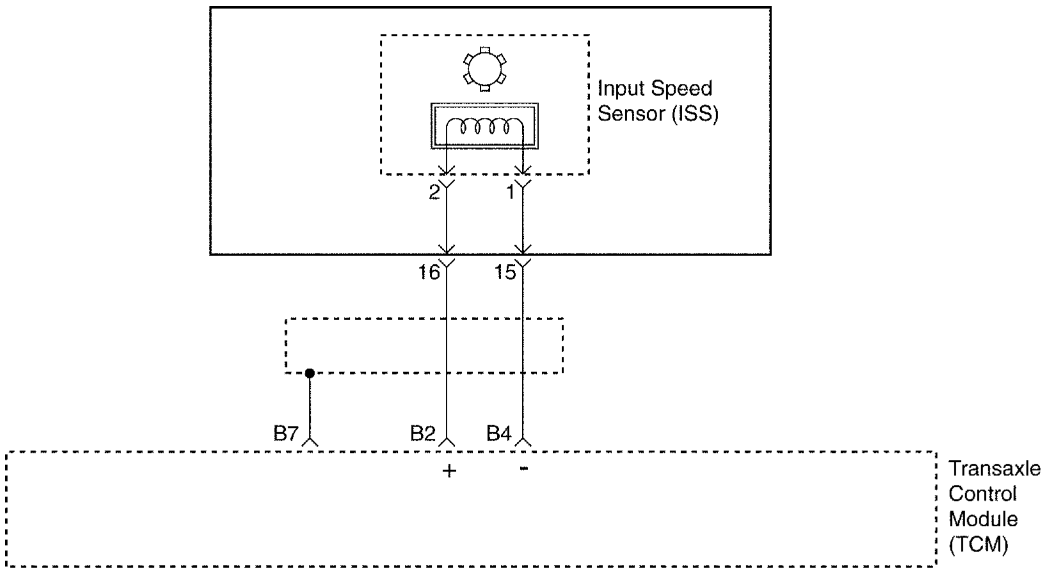

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DIAGNOSTIC TROUBLE CODE(DTC) P0716
INPUT SPEED SENSOR(ISS) CIRCUIT RANGE/PERFORMANCE

Circuit Description

Information relative to transaxle input speed to the TCM. The TCM uses transaxle input speed information to control line pressure, LOC apply and release and transaxle shift patterns. This information is also uses to calculate the appropriate operating gear ratios and LOC slippage.

The input speed sensor mounts onto piston B that is inside of valve body.

An air gap of 1.8~2.2mm(0.07~0.086inch) is maintained between the sensor and the piston B.

The sensor consists of a permanent magnet surround by a coil of wire. As the piston B is driven by the turbine shaft, an AC signal induced in the input speed sensor. Higher vehicle speeds induce a higher frequency and voltage measurement at the sensor.

Sensor resistance should measure between 825~835 ohms at 20**b**C(68**b**F). Sensor can measure from 1,000~ 8,000HZ.

Conditions for Setting the DTC

- The increasing rate of the turbine speed is more than 25,000rpm/sec.
- System voltage is too high or too low.
- TCM or ECM is defective.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition LOCK/ON : 3rd gear by hydraulic control, position P, R and N also possible.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycles.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P0716 sets, the replacement of ISS(input speed sensor) is recommended.

DTC P0716 – Input Speed Sensor(ISS) Circuit Range/performance

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON(at 3,100rpm). 3. Observe the turbine speed on the scan tool. Is the speed within the values shown?	Engine speed 0–7,000rpm increasing rate : less than 25,000 rpm/sec	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the trasaxle wiring connector. 3. Measure the resistance between terminals 15 and 16 of the transaxle wiring connector. Is the resistance within the values shown?	830±5Ω	Go to Step 9	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the input speed sensor wiring connector. 3. Measure the resistance between terminal 1 of the input speed sensor wiring connector and terminal 15 of the transaxle wiring connector. 4. Measure the resistance between terminal 2 of the input speed sensor wiring connector and terminal 16 of the transaxle wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 6	Go to Step 5
5	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
6	1. Turn the ignition ON. 2. Measure the voltage of terminal 1. 3. Measure the voltage of terminal 2. Is the resistance within the values shown?	11–14V	Go to Step 7	Go to Step 8
7	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
8	Replace the input speed sensor. Is the action complete?	–	System OK	–
9	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 15 of the transaxle wiring connector and terminal B4 of the TCM wiring connector. 3. Measure the resistance between terminal 16 of the transaxle wiring connector and terminal B7 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 11	Go to Step 10
10	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–

DTC P0716 – Input Speed Sensor(ISS) Circuit Range/performance (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition ON. 2. Measure the voltage of terminal 15. 3. Measure the voltage of terminal 16. Is the resistance within the values shown?	11–14V	Go to Step 12	Go to Step 13
12	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
13	Replace the TCM. Is the action complete?	–	Go to Step 14	–
14	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart

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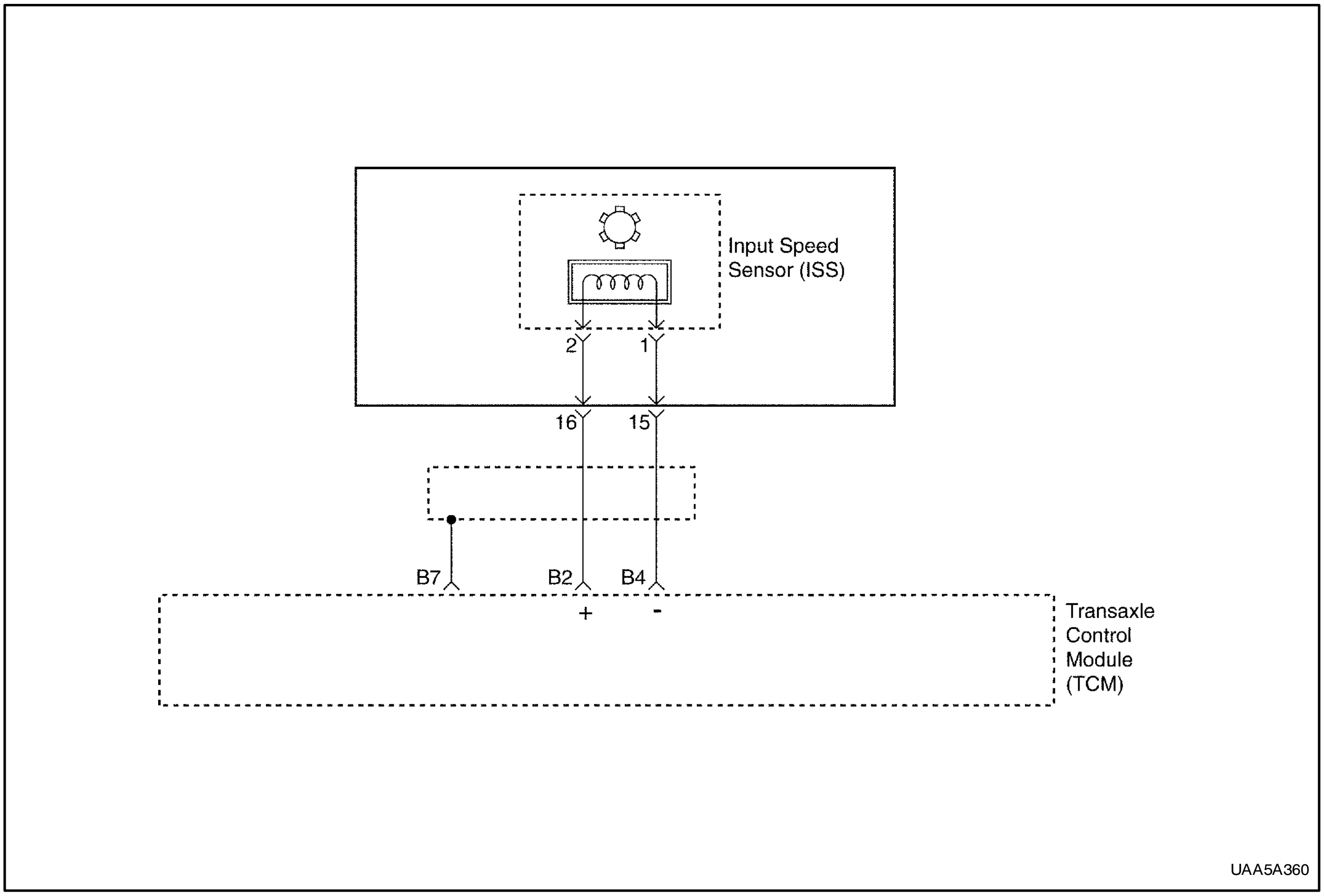

DIAGNOSTIC TROUBLE CODE(DTC) P0717
INPUT SPEED SENSOR(ISS) CIRCUIT NO SIGNAL

Circuit Description

Information relative to transaxle input speed to the TCM. The TCM uses transaxle input speed information to control line pressure, LOC apply and release and transaxle shift patterns. This information is also uses to calculate the appropriate operating gear ratios and LOC slippage.

The input speed sensor mounts onto piston B that is inside of valve body.

An air gap of 1.8~2.2mm(0.07~0.086inch) is maintained between the sensor and the piston B.

The sensor consists of a permanent magnet surround by a coil of wire. As the piston B is driven by the turbine shaft, an AC signal induced in the input speed sensor. Higher vehicle speeds induce a higher frequency and voltage measurement at the sensor.

Sensor resistance should measure between 825~835 ohms at 20**b**C(68**b**F). Sensor can measure from 1,000~ 8,000HZ.

Conditions for Setting the DTC

- When engine speed(rpm) is more than 3,100rpm, Turbine speed is less than 100rpm.
- System voltage is too high or too low.
- CAN transmitting wiring harness shortage or open.
- TCM or ECM is defective.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition LOCK/ON : 3rd gear by hydraulic control, position P, R and N also possible.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycles.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.

- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P0717 sets, the replacement of ISS(input speed sensor) is recommended.

DTC P0717 – Input Speed Sensor(ISS) Circuit No Signal

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON(at 3,100rpm). 3. Observe the turbine speed on the scan tool. Is the speed within the values shown?	Engine speed 0–7,000rpm increasing rate : less than 25,000 rpm/sec	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the trasaxle wiring connector. 3. Measure the resistance between terminals 15 and 16 of the transaxle wiring connector. Is the resistance within the values shown?	830±5Ω	Go to Step 9	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the input speed sensor wiring connector. 3. Measure the resistance between terminal 1 of the input speed sensor wiring connector and terminal 15 of the transaxle wiring connector. 4. Measure the resistance between terminal 2 of the input speed sensor wiring connector and terminal 16 of the transaxle wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 6	Go to Step 5
5	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
6	1. Turn the ignition ON. 2. Measure the voltage of terminal 1. 3. Measure the voltage of terminal 2. Is the resistance within the values shown?	11–14V	Go to Step 7	Go to Step 8
7	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
8	Replace the input speed sensor. Is the action complete?	–	System OK	–
9	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 15 of the transaxle wiring connector and terminal B4 of the TCM wiring connector. 3. Measure the resistance between terminal 16 of the transaxle wiring connector and terminal B7 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 11	Go to Step 10
10	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–

DTC P0717 – Input Speed Sensor(ISS) Circuit No Signal (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition ON. 2. Measure the voltage of terminal 15. 3. Measure the voltage of terminal 16. Is the resistance within the values shown?	11–14V	Go to Step 12	Go to Step 13
12	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
13	Replace the TCM. Is the action complete?	–	Go to Step 14	–
14	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart

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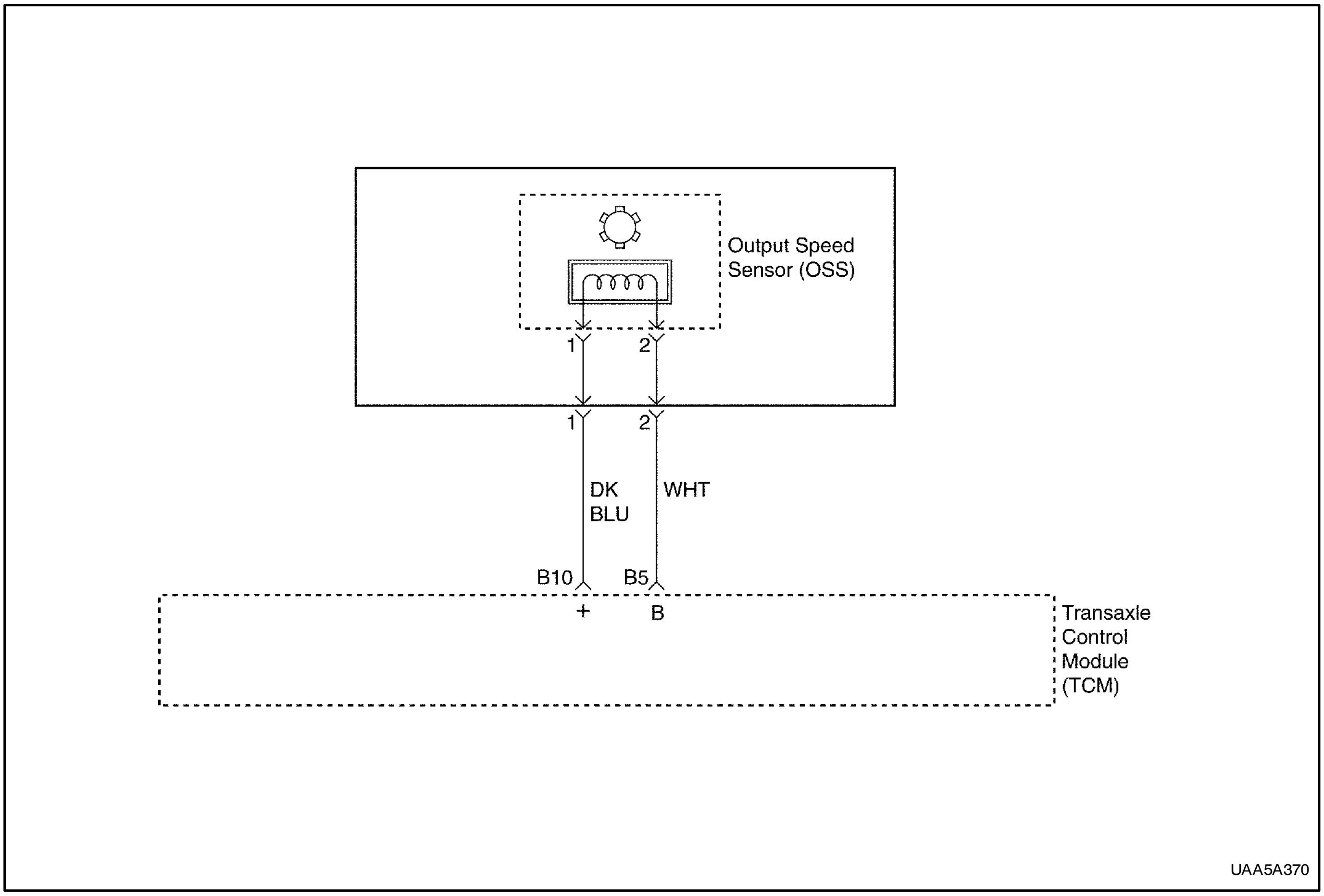

DIAGNOSTIC TROUBLE CODE(DTC) P0720
OUTPUT SPEED SENSOR(OSS) CIRCUIT MALFUNCTION

Circuit Description

The vehicle A/T OSS is a magnetic inductive pickup that relays information relative to vehicle speed to the TCM.

Vehicle speed information is used by the TCM to control shift timing, line pressure, and LUC(lock-up clutch)apply and release.

The output speed sensor mounts in the case at the speed sensor rotor, which is pressed onto the spur gear. An air gap of 0.1mm~1.3mm(0.004~0.05in) is maintained between the sensor and the teeth on the spur gear teeth. The sensor consists of a permanent magnet surrounded by a coil of wire. As the differential rotates, an AC signal is induce a higher frequency and voltage measurement at the sensor. Sensor resistance should measure ∞ at 20°C(68°F). Sensor can measure from 20HZ~8,000HZ.

Conditions for Setting the DTC

- Tranaxle speed is less than 9,762rpm.
- The increasing rate of vehicle speed is more than 10,000rpm/sec.
- System voltage is too high or too low.
- CAN transmitting wiring harness shortage or open.
- TCM or ECM is defective.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycles.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P0720 sets, the replacement of OSS (Output speed sensor) is recommended.

DTC P0720 – Output Speed Sensor(OSS) Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON(at 3,100rpm). 3. Observe the turbine speed on the scan tool. Is the speed within the values shown?	Engine speed 190-9,762rpm increasing rate : less than 10,000 rpm/sec	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the trasaxle wiring connector. 3. Measure the resistance between terminals 1 and 2 of the transaxle wiring connector. Is the resistance within the values shown?	∞	Go to Step 9	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the output speed sensor wiring connector. 3. Measure the resistance between terminal 1 of the output speed sensor wiring connector and terminal 1 of the transaxle wiring connector. 4. Measure the resistance between terminal 2 of the output speed sensor wiring connector and terminal 2 of the transaxle wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 6	Go to Step 5
5	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
6	1. Turn the ignition ON. 2. Measure the voltage of terminal 1. 3. Measure the voltage of terminal 2. Is the resistance within the values shown?	11–14V	Go to Step 7	Go to Step 8
7	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
8	Replace the input speed sensor. Is the action complete?	–	System OK	–
9	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 1 of the transaxle wiring connector and terminal B10 of the TCM wiring connector. 3. Measure the resistance between terminal 2 of the transaxle wiring connector and terminal B5 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 11	Go to Step 10
10	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–

DTC P0720 – Output Speed Sensor(OSS) Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition ON. 2. Measure the voltage of terminal 1. 3. Measure the voltage of terminal 2. Is the resistance within the values shown?	11–14V	Go to Step 12	Go to Step 13
12	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
13	Replace the TCM. Is the action complete?	–	Go to Step 14	–
14	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart

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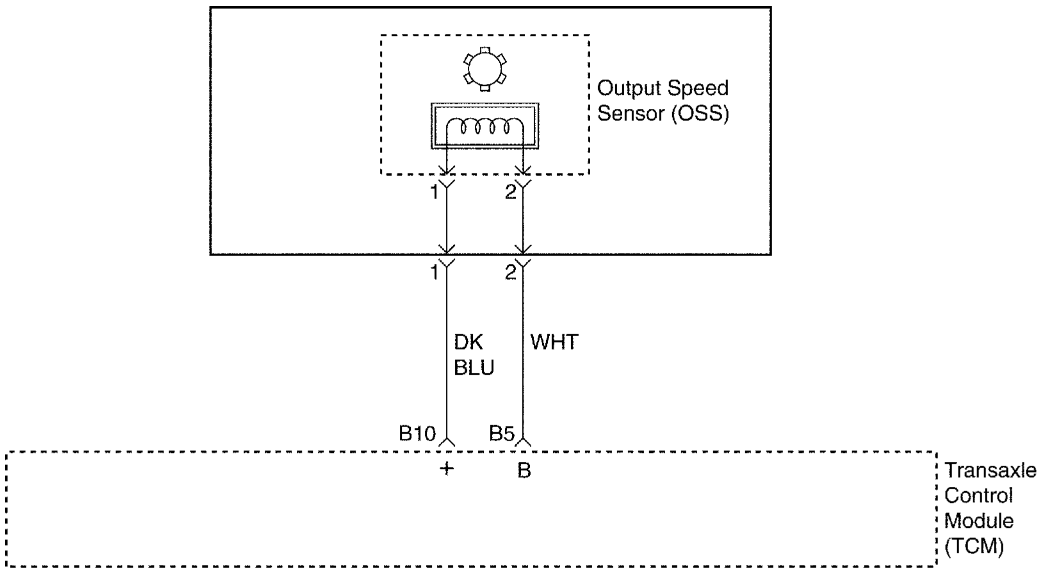

DIAGNOSTIC TROUBLE CODE(DTC) P0721
OUTPUT SPEED SENSOR(OSS) CIRCUIT RANGE/PERFORMANCE

Circuit Description

The vehicle A/T OSS is a magnetic inductive pickup that relays information relative to vehicle speed to the TCM.

Vehicle speed information is used by the TCM to control shift timing, line pressure, and LUC(lock-up clutch)apply and release.

The output speed sensor mounts in the case at the speed sensor rotor, which is pressed onto the spur gear. An air gap of 0.1mm~1.3mm(0.004~0.05in) is maintained between the sensor and the teeth on the spur gear teeth. The sensor consists of a permanent magnet surrounded by a coil of wire. As the differential rotates, an AC signal is induce a higher frequency and voltage measurement at the sensor. Sensor resistance should measure ∞ at 20**b**C(68**b**F). Sensor can measure from 20HZ~8,000HZ.

Conditions for Setting the DTC

- Tranaxle speed is less than 8,160rpm.
- The increasing rate of vehicle speed is more than 45,000rpm/sec.
- System voltage is too high or too low.
- TCM or ECM is defective.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycles.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P0721 sets, the replacement of OSS (Output speed sensor) is recommended.

DTC P0721 – Output Speed Sensor(OSS) Circuit Range/Performance

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON(at 3,100rpm). 3. Observe the turbine speed on the scan tool. Is the speed within the values shown?	Engine speed 190-9,762rpm increasing rate : less than 45,000 rpm/sec	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the trasaxle wiring connector. 3. Measure the resistance between terminals 1 and 2 of the transaxle wiring connector. Is the resistance within the values shown?	∞	Go to Step 9	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the output speed sensor wiring connector. 3. Measure the resistance between terminal 1 of the output speed sensor wiring connector and terminal 1 of the transaxle wiring connector. 4. Measure the resistance between terminal 2 of the output speed sensor wiring connector and terminal 2 of the transaxle wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 6	Go to Step 5
5	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
6	1. Turn the ignition ON. 2. Measure the voltage of terminal 1. 3. Measure the voltage of terminal 2. Is the resistance within the values shown?	11–14V	Go to Step 7	Go to Step 8
7	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
8	Replace the input speed sensor. Is the action complete?	–	System OK	–
9	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 1 of the transaxle wiring connector and terminal B10 of the TCM wiring connector. 3. Measure the resistance between terminal 2 of the transaxle wiring connector and terminal B5 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 11	Go to Step 10
10	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–

DTC P0721 – Output Speed Sensor(OSS) Circuit Range/Performance (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition ON. 2. Measure the voltage of terminal 1. 3. Measure the voltage of terminal 2. Is the resistance within the values shown?	11–14V	Go to Step 12	Go to Step 13
12	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
13	Replace the TCM. Is the action complete?	–	Go to Step 14	–
14	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart

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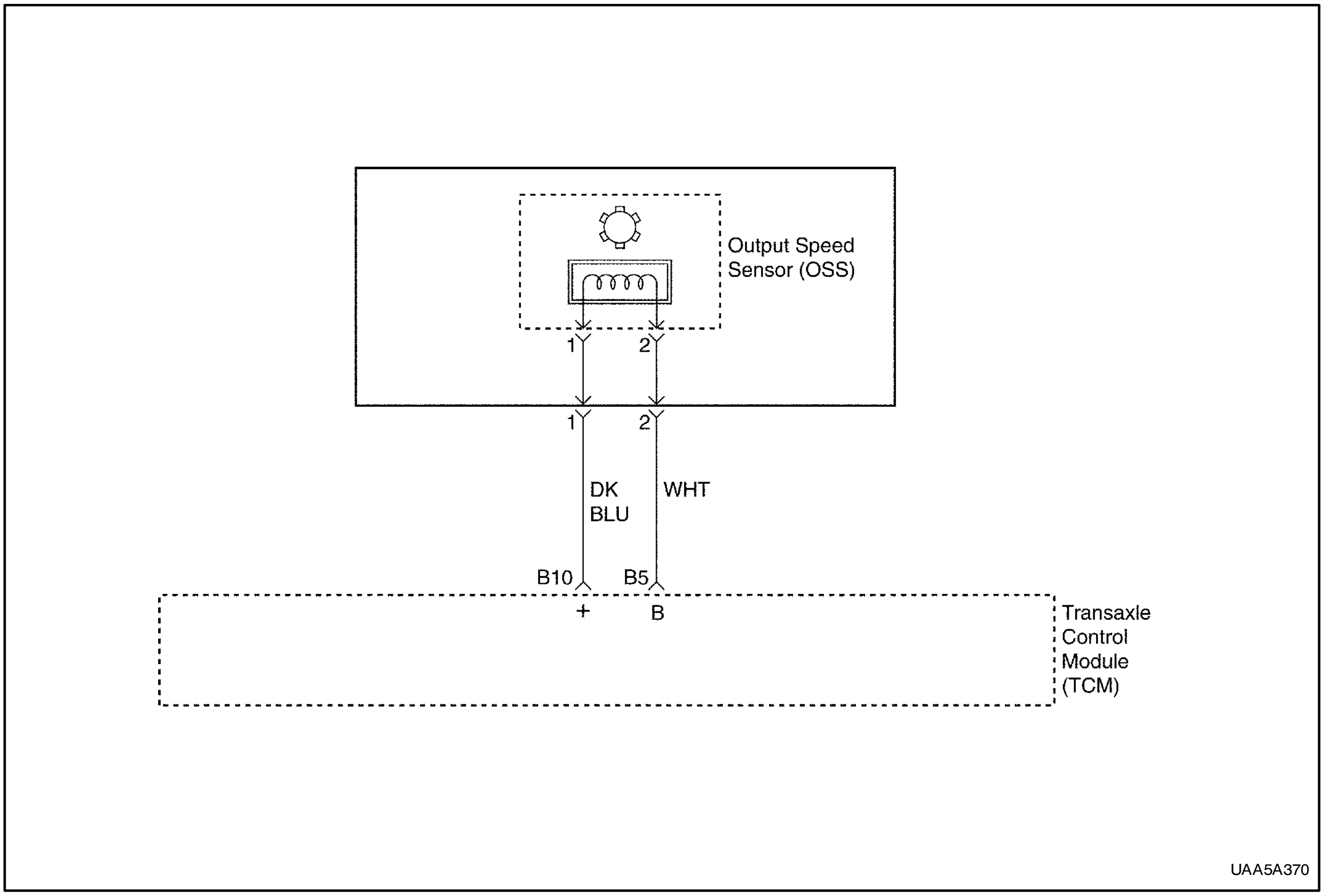

DIAGNOSTIC TROUBLE CODE(DTC) P0722
OUTPUT SPEED SENSOR(OSS) CIRCUIT NO SIGNAL

Circuit Description

The vehicle A/T OSS is a magnetic inductive pickup that relays information relative to vehicle speed to the TCM.

Vehicle speed information is used by the TCM to control shift timing, line pressure, and LUC(lock-up clutch) apply and release.

The output speed sensor mounts in the case at the speed sensor rotor, which is pressed onto the spur gear. An air gap of 0.1mm~1.3mm(0.004~0.05in) is maintained between the sensor and the teeth on the spur gear teeth. The sensor consists of a permanent magnet surrounded by a coil of wire. As the differential rotates, an AC signal is induce a higher frequency and voltage measurement at the sensor. Sensor resistance should measure ∞ at 20**b**C(68**b**F). Sensor can measure from 20HZ~8,000HZ.

Conditions for Setting the DTC

- If the gear shift is not in progress and the selector lever position is “1”, “2”, “3” or, “D” and the transaxle output speed is less than the limit value of tramsaxle output speed for plausibility check of transaxle output speed and the turbine speed is greater than the limit value of turbine speed for plausibility check of transaxle output speed then the error bit will be set.
- System voltage is too high or too low.
- TCM or ECM is defective.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Vehicle running remains actual gear.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycles.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.

- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P0722 sets, the replacement of OSS (Output speed sensor) is recommended.

DTC P0722 – Output Speed Sensor(OSS) Circuit No Signal

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON(at 3,100rpm). 3. Observe the turbine speed on the scan tool. Is the speed within the values shown?	Engine speed 190-8,160rpm increasing rate : less than 10,000 rpm/sec	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the trasaxle wiring connector. 3. Measure the resistance between terminals 1 and 2 of the transaxle wiring connector. Is the resistance within the values shown?	∞	Go to Step 9	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the output speed sensor wiring connector. 3. Measure the resistance between terminal 1 of the output speed sensor wiring connector and terminal 1 of the transaxle wiring connector. 4. Measure the resistance between terminal 2 of the output speed sensor wiring connector and terminal 2 of the transaxle wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 6	Go to Step 5
5	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
6	1. Turn the ignition ON. 2. Measure the voltage of terminal 1. 3. Measure the voltage of terminal 2. Is the resistance within the values shown?	11–14V	Go to Step 7	Go to Step 8
7	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
8	Replace the input speed sensor. Is the action complete?	–	System OK	–
9	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 1 of the transaxle wiring connector and terminal B10 of the TCM wiring connector. 3. Measure the resistance between terminal 2 of the transaxle wiring connector and terminal B5 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 11	Go to Step 10
10	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–

DTC P0722 – Output Speed Sensor(OSS) Circuit No Signal (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition ON. 2. Measure the voltage of terminal 1. 3. Measure the voltage of terminal 2. Is the resistance within the values shown?	11–14V	Go to Step 12	Go to Step 13
12	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
13	Replace the TCM. Is the action complete?	–	Go to Step 14	–
14	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart

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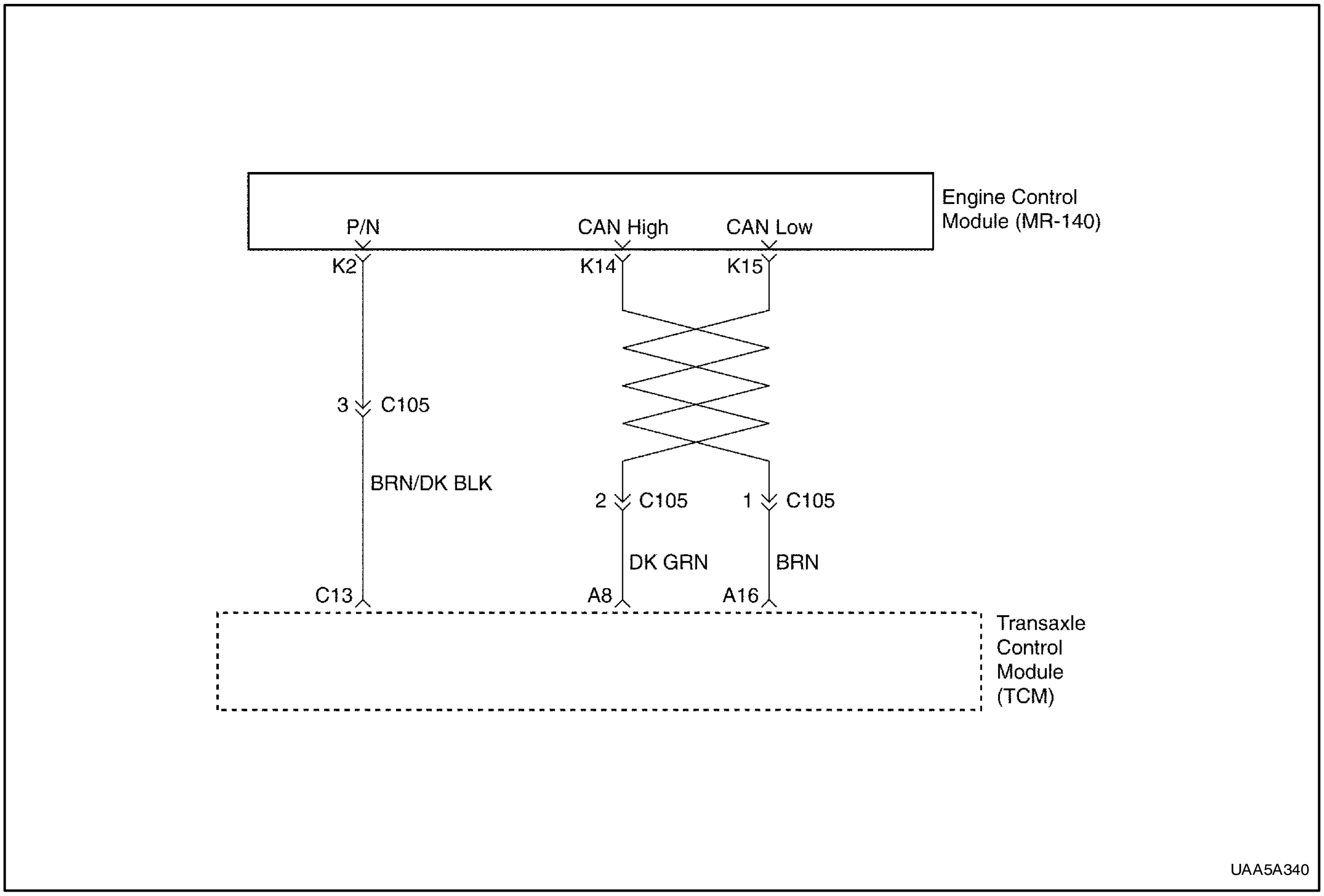


DIAGNOSTIC TROUBLE CODE(DTC) P0726
ENGINE SPEED INPUT CIRCUIT MALFUNCTION (CAN TYPE)
(2.0L DOHC DELPHI 32BIT)

Circuit Description

The transaxle control module(TCM) is an electronic device which monitors inputs to control various transaxle functions including shift quality and transaxle sensors, swithces, and components to process for use within its' control program. Based on this input information, the TCM controls various transaxle output functions and devices.

The P0727, P0725 DTC is same DTC. So when the DTCS detected, consider same DTC. And when the P0275 detected, MIL Lamp not will illuminate.

Information transmit between TCM and ECM through the CAN line. information is as follows :

- Engine Malfunction Signal.
- Engine Speed.
- Engine Output Torque Reduction Signal.
- Engine Coolant Temperature.

Conditions for Setting the DTC

- When Turbine speed is more than 1,500rpm, Engine speed is less than 400rpm.
- Engine speed is more than 7,000rpm.
- The increasing rate of the engine speed is more than 25,000rpm/sec.
- System voltage is too high or too low.
- CAN transmitting wiring harness shortage or open.
- TCM or ECM is defective.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate. (exception for P0725).
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear.
- Open lock up clutch.

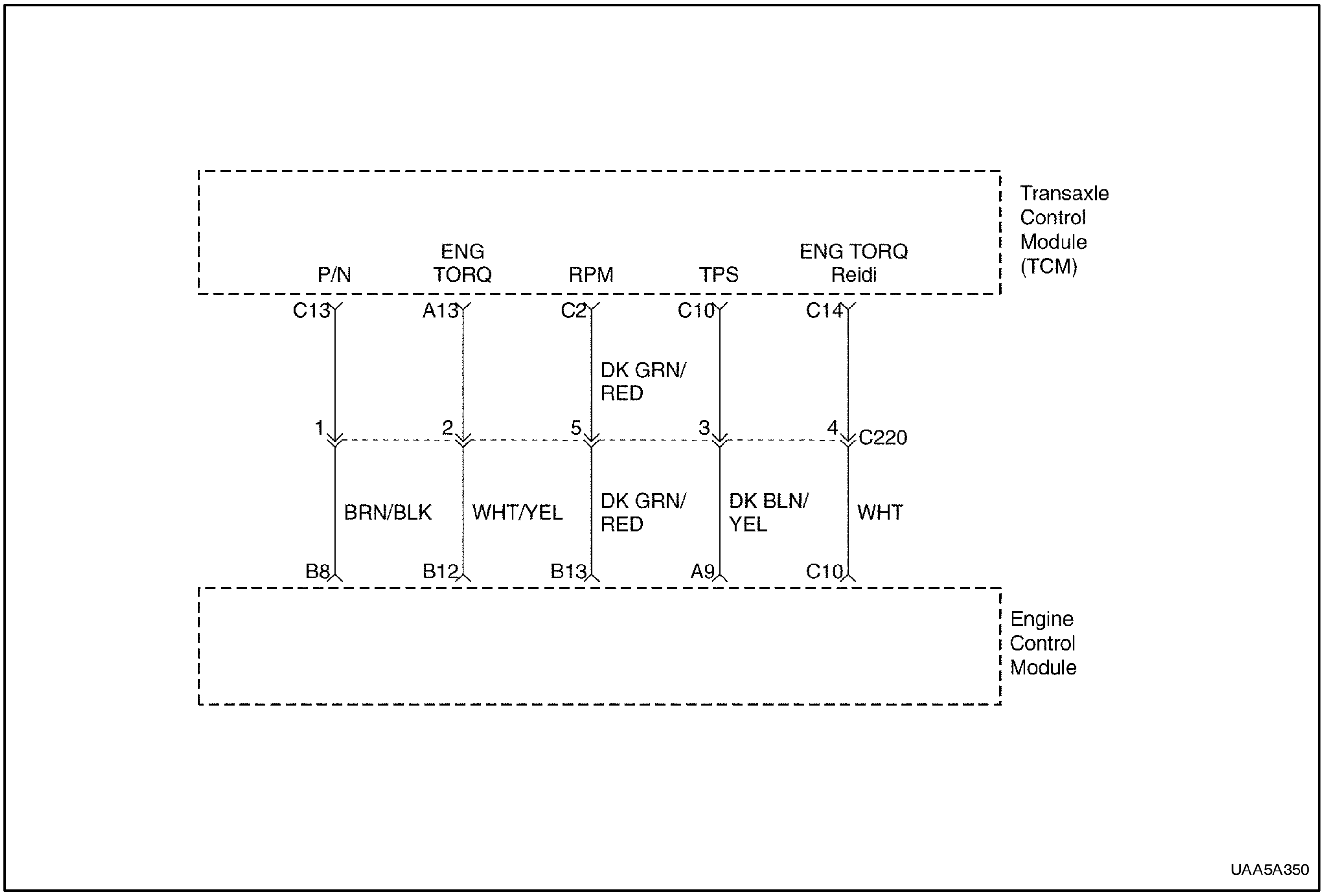
Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycles.

- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

DTC P0726 – Engine Speed Input Circuit Malfunction (CAN TYPE) (2.0L DOHC DELPHI 32bit)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON(at 3,100rpm). 3. Observe the engine speed on the scan tool. Is the speed within the values shown?	Engine speed 0–7,500rpm increasing rate : less than 25,000 rpm/sec	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the TCM wiring connector. And ECM wiring connector. 3. Measure the resistance between terminal A8 of the TCM wiring connector and terminal K14 of the ECM wiring connector. 4. Measure the resistance between terminal A16 of the TCM wiring connector and terminal K15 of the ECM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 5	Go to Step 4
4	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
5	1. Turn the ignition ON. 2. Measure the voltage of terminal A8. 3. Measure the voltage of terminal A16. Is the resistance within the values shown?	11–14V	Go to Step 6	Go to Step 7
6	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
7	Inspect the "Engine Speed". Refer to Section 1F. Engine Diagnostic Information And Procedures. Was a problem found?	–	Refer to Section 1F, Engine Diagnostic Information And Procedures.	Go to Step 8
8	1. Replace the TCM. 2. Turn the ignition LOCK. 3. Turn the ignition On. 4. Check if P0726 DTC is set. 5. Is The DTC set?	–	Go to Step 9	Go to Step 10
9	Replace the ECM. Is the action complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P0726
ENGINE SPEED INPUT CIRCUIT MALFUNCTION (DISCRETE TYPE)
(2.0L DOHC DELPHI 8BIT)

Circuit Description

The transaxle control module(TCM) is an electronic device which monitors inputs to control various transaxle functions including shift quality and transaxle sensors, swithces, and components to process for use within its' control program. Based on this input information, the TCM controls various transaxle output functions and devices.

The P0727, P0725 DTC is same DTC. So when the DTCS detected, consider same DTC. And when the P0275 detected, MIL Lamp not will illuminate.

Information transmit between TCM and ECM through the DISCRETE line. information is as follows :

- Engine Speed.
- Engine Output Torque Reduction Signal.

Conditions for Setting the DTC

- When Turbine speed is more than 1,500rpm, Engine speed is less than 400rpm.
- Engine speed is more than 7,000rpm.
- The increasing rate of the engine speed is more than 25,000rpm/sec.
- System voltage is too high or too low.
- TCM or ECM is defective.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate. (exception for P0725).
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycles.

- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

DTC P0726 – Engine Speed Input Circuit Malfunction (DISCRETE TYPE) (2.0L DOHC DELPHI 8bit)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON(at 3,100rpm). 3. Observe the engine speed on the scan tool. Is the speed within the values shown?	Engine speed 0–7,000rpm increasing rate : less than 25,000 rpm/sec	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the TCM wiring connector. And ECM wiring connector. 3. Measure the resistance between terminal C2 of the TCM wiring connector and terminal B13 of the ECM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 5	Go to Step 4
4	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
5	1. Turn the ignition ON. 2. Measure the voltage of terminal C2. Is the resistance within the values shown?	11–14V	Go to Step 6	Go to Step 7
6	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
7	Inspect the "Engine Speed". Refer to Section 1F, Engine Diagnostic Information And Procedures. Was a problem found?	–	Refer to Section 1F, Engine Diagnostic Information And Procedures.	Go to Step 8
8	1. Replace the TCM. 2. Turn the ignition LOCK. 3. Turn the ignition On. 4. Check if P0726 DTC is set. 5. Is The DTC set?	–	Go to Step 9	Go to Step 10
9	Replace the ECM. Is the action complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart

Range	Park/ Neutral	Reverse	D				3			2		1
Gear	N	R	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	1st
Solenoid Valve 1	ON	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF
Solenoid Valve 2	ON	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
Line Pressure Control Solenoid Valve 3 (EDS 3)	OFF	OFF	OFF	ON	ON/ OFF	ON/ OFF	OFF	ON	ON/ OFF	OFF	ON	ON/ OFF
Line Pressure Control Solenoid Valve 4 (EDS 4)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Line Pressure Control Solenoid Valve 5 (EDS 5)	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	ON
Line Pressure Control Solenoid Valve 6 (EDS 6)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Brake B	A	A	A		A		A		A	A		A
Brake C						H						
Brake D		H										
Clutch E				A	A	A		A	A		A	
Brake F			H	H			H	H		H	H	H
Lock–up Clutch						A						

A = Applied
H = Holding
ON = The solenoid is energized.
OFF = The solenoid is de-energized.
** = Manual Second–Third gear is only available above approximately 100 km/h (62 mph).
*** = Manual First–Second gear is only available above approximately 100 km/h (62 mph).
NOTE: Manual First–Third gear is also possible at high vehicle speed as a safety feature.

DIAGNOSTIC TROUBLE CODE(DTC) P0731 GEAR 1 INCORRECT RATIO

Circuit Description

The TCM uses transaxle input speed information and output speed sensor to control line pressure, LOC apply and release and transaxle shift patterns. This information is also uses to calculate the appropriate operating gear ratios and LOC slippage. Conditions for Setting the DTC.

Conditions for Setting the DTC

- Engine is running.
- No DTC P0733.
- Selector lever is not N(Neutral), P(Park) position.
- Throttle position is more than 15%.
- Map value is more than 10kpa.
- Vehicle velocity is more than 16km/h(9.9mph).
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear.
- High line pressure

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignitioncycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- Check for intermittent input speed sensor or output speed sensor circuit problems.
- Check for possible incorrect calibration.

DTC P0731 – Gear 1 Incorrect Ratio

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	Visually inspect the transaxle cooling system for fluid leaks. Was condition found and corrected?	–	Go to Step 7	Go to Step 3
3	Has the transaxle fluid checking procedure been performed?	–	Go to Step 4	Go to transaxle fluid check, procedures
4	1. Using the scan tool record each transaxle drive range. 2. Drive the vehicle in transaxle gear ratio 1,2,3,4 and D with TP greater than 15% and vehicle speed greater than 16km/h(10mph) for five seconds. Does commanded gear ratio match ranges as shown?	1st = 2.719 2nd = 1.487 3rd = 1.000 4th = 0.717	Refer to Diagnostic Aids	Go toStep 5
5	Perform line pressure check. Was the condition found and corrected?	–	Go to Step 7	Go toStep 6
6	Check for possible clutch slippage. Was the condition found and corrected?	–	Go to Step 7	–
7	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Replace transaxle assembly	Repair verified exit DTC chart

Range	Park/ Neutral	Reverse	D				3			2		1
Gear	N	R	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	1st
Solenoid Valve 1	ON	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF
Solenoid Valve 2	ON	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
Line Pressure Control Solenoid Valve 3 (EDS 3)	OFF	OFF	OFF	ON	ON/ OFF	ON/ OFF	OFF	ON	ON/ OFF	OFF	ON	ON/ OFF
Line Pressure Control Solenoid Valve 4 (EDS 4)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Line Pressure Control Solenoid Valve 5 (EDS 5)	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	ON
Line Pressure Control Solenoid Valve 6 (EDS 6)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Brake B	A	A	A		A		A		A	A		A
Brake C						H						
Brake D		H										
Clutch E				A	A	A		A	A		A	
Brake F			H	H			H	H		H	H	H
Lock–up Clutch						A						

A = Applied
H = Holding
ON = The solenoid is energized.
OFF = The solenoid is de-energized.
** = Manual Second–Third gear is only available above approximately 100 km/h (62 mph).
*** = Manual First–Second gear is only available above approximately 100 km/h (62 mph).
NOTE: Manual First–Third gear is also possible at high vehicle speed as a safety feature.

DIAGNOSTIC TROUBLE CODE(DTC) P0732
GEAR 2 INCORRECT RATIO

Circuit Description

The TCM uses transaxle input speed information and output speed sensor to control line pressure, LOC apply and release and transaxle shift patterns. This information is also uses to calculate the appropriate operating gear ratios and LOC slippage. Conditions for Setting the DTC.

Conditions for Setting the DTC

- Engine is running.
- No DTC P0733.
- Selector lever is not N(Neutral), P(Park) position.
- Throttle position is more than 15%.
- Map value is more than 10kpa.
- Vehicle velocity is more than 16km/h(9.9mph).
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 3rd gear.
- High line pressure.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignitioncycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- Check for intermittent input speed sensor or output speed sensor circuit problems.
- Check for possible incorrect calibration.

DTC P0732 – Gear 2 Incorrect Ratio

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	Visually inspect the transaxle cooling system for fluid leaks. Was condition found and corrected?	–	Go to Step 7	Go to Step 3
3	Has the transaxle fluid checking procedure been performed?	–	Go to Step 4	Go to transaxle fluid check, procedures
4	1. Using the scan tool record each transaxle drive range. 2. Drive the vehicle in transaxle gear ratio 1,2,3,4 and D with TP greater than 15% and vehicle speed greater than 16km/h(10mph) for five seconds. Does commanded gear ratio match ranges as shown?	1st = 2.719 2nd = 1.487 3rd = 1.000 4th = 0.717	Refer to Diagnostic Aids	Go toStep 5
5	Perform line pressure check. Was the condition found and corrected?	–	Go to Step 7	Go toStep 6
6	Check for possible clutch slippage. Was the condition found and corrected?	–	Go to Step 7	–
7	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Replace transaxle assembly	Repair verified exit DTC chart

Range	Park/ Neutral	Reverse	D				3			2		1
Gear	N	R	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	1st
Solenoid Valve 1	ON	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF
Solenoid Valve 2	ON	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
Line Pressure Control Solenoid Valve 3 (EDS 3)	OFF	OFF	OFF	ON	ON/ OFF	ON/ OFF	OFF	ON	ON/ OFF	OFF	ON	ON/ OFF
Line Pressure Control Solenoid Valve 4 (EDS 4)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Line Pressure Control Solenoid Valve 5 (EDS 5)	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	ON
Line Pressure Control Solenoid Valve 6 (EDS 6)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Brake B	A	A	A		A		A		A	A		A
Brake C						H						
Brake D		H										
Clutch E				A	A	A		A	A		A	
Brake F			H	H			H	H		H	H	H
Lock–up Clutch						A						

A = Applied
H = Holding
ON = The solenoid is energized.
OFF = The solenoid is de-energized.
** = Manual Second–Third gear is only available above approximately 100 km/h (62 mph).
*** = Manual First–Second gear is only available above approximately 100 km/h (62 mph).
NOTE: Manual First–Third gear is also possible at high vehicle speed as a safety feature.

DIAGNOSTIC TROUBLE CODE(DTC) P0733
GEAR 3 INCORRECT RATIO

Circuit Description

The TCM uses transaxle input speed information and output speed sensor to control line pressure, LOC apply and release and transaxle shift patterns. This information is also uses to calculate the appropriate operating gear ratios and LOC slippage .Conditions for Setting the DTC.

Conditions for Setting the DTC

- Engine is running.
- No DTC P0731, P0732, P0734.
- Selector lever is not N(Neutral), P(Park) position.
- Throttle position is more than 15%.
- Map value is more than 10kpa.
- Vehicle velocity is more than 16km/h(9.9mph) Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear.
- High line pressure.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignitioncycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- Check for intermittent input speed sensor or output speed sensor circuit problems.
- Check for possible incorrect calibration.

DTC P0733 – Gear 3 Incorrect Ratio

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	Visually inspect the transaxle cooling system for fluid leaks. Was condition found and corrected?	–	Go to Step 7	Go to Step 3
3	Has the transaxle fluid checking procedure been performed?	–	Go to Step 4	Go to transaxle fluid check, procedures
4	1. Using the scan tool record each transaxle drive range. 2. Drive the vehicle in transaxle gear ratio 1,2,3,4 and D with TP greater than 15% and vehicle speed greater than 16km/h(10mph) for five seconds. Does commanded gear ratio match ranges as shown?	1st = 2.719 2nd = 1.487 3rd = 1.000 4th = 0.717	Refer to Diagnostic Aids	Go toStep 5
5	Perform line pressure check. Was the condition found and corrected?	–	Go to Step 7	Go toStep 6
6	Check for possible clutch slippage. Was the condition found and corrected?	–	Go to Step 7	–
7	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Replace transaxle assembly	Repair verified exit DTC chart

Range	Park/ Neutral	Reverse	D				3			2		1
Gear	N	R	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	1st
Solenoid Valve 1	ON	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF
Solenoid Valve 2	ON	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
Line Pressure Control Solenoid Valve 3 (EDS 3)	OFF	OFF	OFF	ON	ON/ OFF	ON/ OFF	OFF	ON	ON/ OFF	OFF	ON	ON/ OFF
Line Pressure Control Solenoid Valve 4 (EDS 4)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Line Pressure Control Solenoid Valve 5 (EDS 5)	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	ON
Line Pressure Control Solenoid Valve 6 (EDS 6)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Brake B	A	A	A		A		A		A	A		A
Brake C						H						
Brake D		H										
Clutch E				A	A	A		A	A		A	
Brake F			H	H			H	H		H	H	H
Lock–up Clutch						A						

A = Applied
H = Holding
ON = The solenoid is energized.
OFF = The solenoid is de-energized.
** = Manual Second–Third gear is only available above approximately 100 km/h (62 mph).
*** = Manual First–Second gear is only available above approximately 100 km/h (62 mph).
NOTE: Manual First–Third gear is also possible at high vehicle speed as a safety feature.

DIAGNOSTIC TROUBLE CODE(DTC) P0734
GEAR 4 INCORRECT RATIO

Circuit Description

The TCM uses transaxle input speed information and output speed sensor to control line pressure, LOC apply and release and transaxle shift patterns. This information is also uses to calculate the appropriate operating gear ratios and LOC slippage. Conditions for Setting the DTC.

Conditions for Setting the DTC

- Engine is running.
- No DTC P0733.
- Selector lever is not N(Neutral), P(Park) position.
- Throttle position is more than 15%.
- Map value is more than 10kpa.
- Vehicle velocity is more than 16km/h(9.9mph)
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- High line pressure.

Conditions for Clearing the MIL/DTC

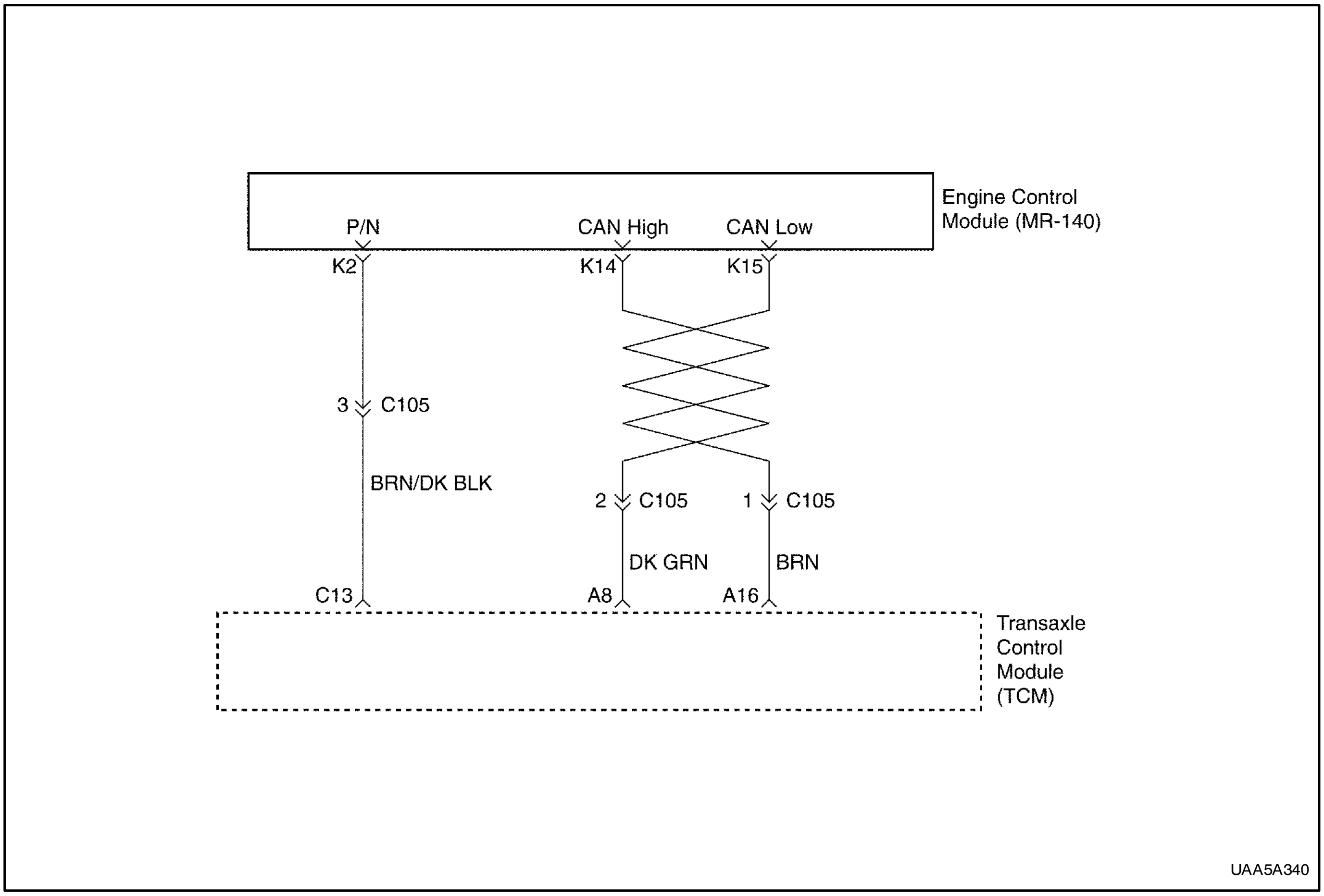
- The MIL will turn OFF when the malfunction has not occurred after three-ignitioncycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- Check for intermittent input speed sensor or output speed sensor circuit problems.
- Check for possible incorrect calibration.

DTC P0734 – Gear 4 Incorrect Ratio

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	Visually inspect the transaxle cooling system for fluid leaks. Was condition found and corrected?	–	Go to Step 7	Go to Step 3
3	Has the transaxle fluid checking procedure been performed?	–	Go to Step 4	Go to transaxle fluid check, procedures
4	1. Using the scan tool record each transaxle drive range. 2. Drive the vehicle in transaxle gear ratio 1,2,3,4 and D with TP greater than 15% and vehicle speed greater than 16km/h(10mph) for five seconds. Does commanded gear ratio match ranges as shown?	1st = 2.719 2nd = 1.487 3rd = 1.000 4th = 0.717	Refer to Diagnostic Aids	Go toStep 5
5	Perform line pressure check. Was the condition found and corrected?	–	Go to Step 7	Go toStep 6
6	Check for possible clutch slippage. Was the condition found and corrected?	–	Go to Step 7	–
7	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Replace transaxle assembly	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1779 ENGINE TORQUE INPUT SIGNAL MALFUNCTION (CAN TYPE) (2.0L DOHC DELPHI 32BIT)

Circuit Description

The transaxle control module(TCM)is an electronic device which monitors inputs to control various transaxle functions including shift quality and transaxle sensors, swithces, and components to process for use within its' control program. Based on this input information, the TCM controls various transaxle output functions and devices.

Information transmit between TCM and ECM through the CAN line. information is as follows :

- Engine Malfunction Signal.
- Engine Speed.
- Engine Output Torque Reduction Signal.
- Engine Coolant Temperature.

Conditions for Setting the DTC

- System voltage is too high or too low.
- TCM or ECM is defective.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- No lamp control required but diagnostic information should be stored immediately when malfunction is detected.
- Adjustable value, calculated over the substitute map engine torque. (throttle position, engine speed)

Conditions for Clearing the MIL/DTC

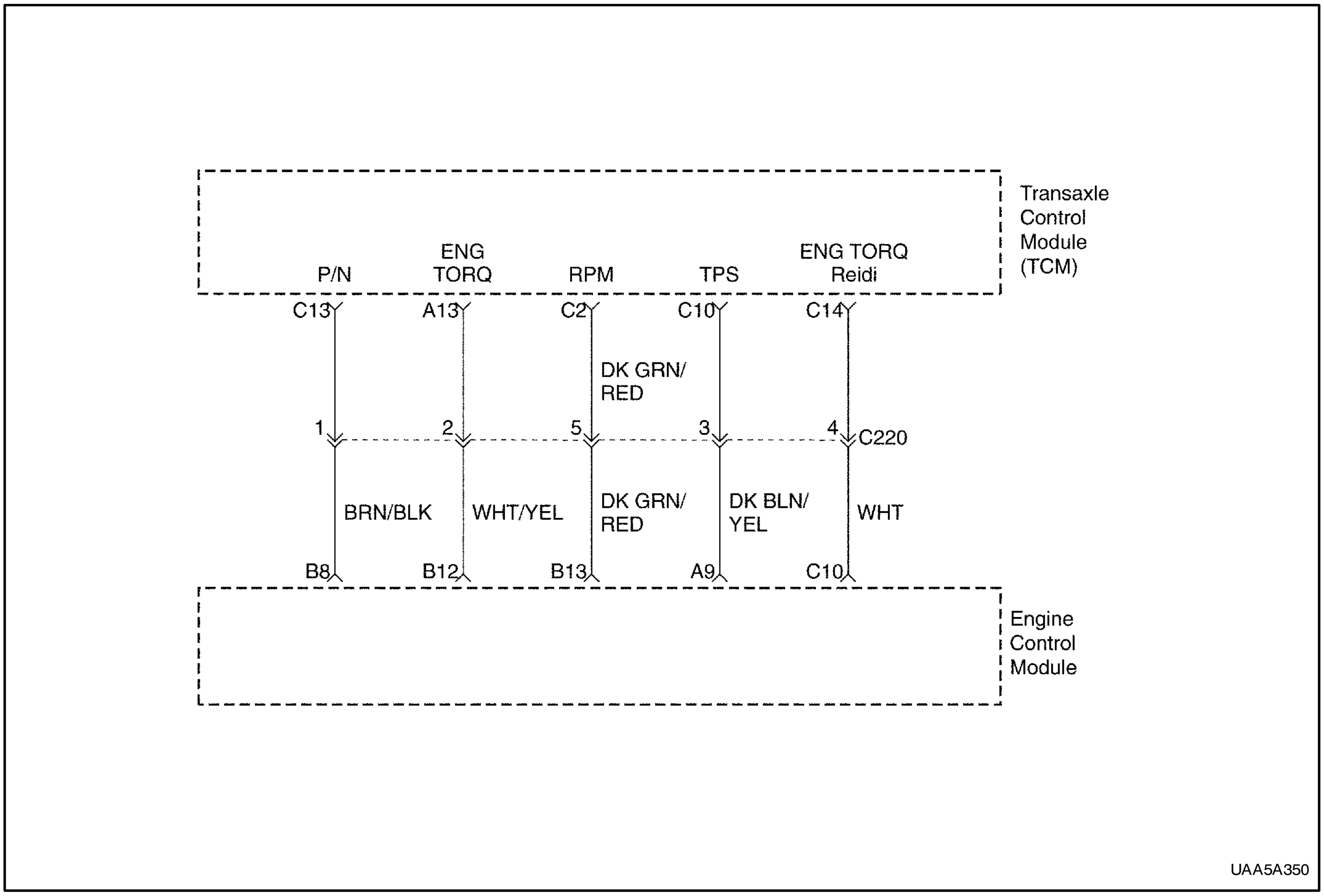
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycles.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1791 sets, the replacement of TCM is recommended.

DTC P1779 – Engine Torque Input Signal Malfunction (CAN TYPE) (2.0L DOHC DELPHI 32bit)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON. 3. Observe the throttle position value on the scan tool. Is the speed within the values shown?	0–100%	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the TCM wiring connector. And ECM wiring connector. 3. Measure the resistance between terminal A8 of the TCM wiring connector and terminal K14 of the ECM wiring connector. 4. Measure the resistance between terminal A16 of the TCM wiring connector and terminal K15 of the ECM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 5	Go to Step 4
4	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
5	1. Turn the ignition ON. 2. Measure the voltage of terminal A8. 3. Measure the voltage of terminal A16. Is the resistance within the values shown?	11–14V	Go to Step 6	Go to Step 7
6	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
7	Inspect the "Engine Torque" Refer to Section 1F, Engine Diagnostic Information And Procedures. Was a problem found?	–	Refer to Section 1F, Engine Diagnostic Information And Procedures.	Go to Step 8
8	1. Replace the TCM. 2. Turn the ignition LOCK. 3. Turn the ignition On. 4. Check if P1779 DTC is set. 5. Is The DTC set?	–	Go to Step 9	Go to Step 10
9	Replace the ECM. Is the action complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1779
ENGINE TORQUE INPUT SIGNAL MALFUNCTION (DISCRETE TYPE)
(2.0L DOHC DELPHI 8BIT)

Circuit Description

The transaxle control module(TCM)is an electronic device which monitors inputs to control various transaxle functions including shift quality and transaxle sensors, swithces, and components to process for use within its' control program. Based on this input information, the TCM controls various transaxle output functions and devices.

Information transmit between TCM and ECM through the DISCRETE line. information is as follows :

- Engine Speed.
- Engine Output Torque Reduction Signal.

Conditions for Setting the DTC

- System voltage is too high or too low.
- DISCRETE transmitting wiring harness shortage or open.
- TCM or ECM is defective.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- No lamp control required but diagnostic information should be stored immediately when malfunction is detected.
- Adjustable value, calculated over the substitute map engine torque. (throttle position, engine speed)

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycles.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

DTC P1779 – Engine Torque Input Signal Malfunction (DISCRETE TYPE) (2.0L DOHC DELPHI 8bit)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON. 3. Observe the throttle position value on the scan tool. Is the speed within the values shown?	0–100%	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the TCM wiring connector. And ECM wiring connector. 3. Measure the resistance between terminal A13 of the TCM wiring connector and terminal B12 of the ECM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 5	Go to Step 4
4	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
5	1. Turn the ignition ON. 2. Measure the voltage of terminal C10. Is the resistance within the values shown?	11–14V	Go to Step 6	Go to Step 7
6	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
7	Inspect the "Engine Torque". Refer to Section 1F, Engine Diagnostic Information And Procedures. Was a problem found?	–	Refer to Section 1F, Engine Diagnostic Information And Procedures.	Go to Step 8
8	1. Replace the TCM. 2. Turn the ignition LOCK. 3. Turn the ignition On. 4. Check if P1779 DTC is set. 5. Is The DTC set?	–	Go to Step 9	Go to Step 10
9	Replace the ECM. Is the action complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart

Range	Park/ Neutral	Reverse	D				3			2		1
Gear	N	R	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	1st
Solenoid Valve 1	ON	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF
Solenoid Valve 2	ON	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
Line Pressure Control Solenoid Valve 3 (EDS 3)	OFF	OFF	OFF	ON	ON/ OFF	ON/ OFF	OFF	ON	ON/ OFF	OFF	ON	ON/ OFF
Line Pressure Control Solenoid Valve 4 (EDS 4)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Line Pressure Control Solenoid Valve 5 (EDS 5)	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	ON
Line Pressure Control Solenoid Valve 6 (EDS 6)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Brake B	A	A	A		A		A		A	A		A
Brake C						H						
Brake D		H										
Clutch E				A	A	A		A	A		A	
Brake F			H	H			H	H		H	H	H
Lock–up Clutch						A						

A = Applied
H = Holding
ON = The solenoid is energized.
OFF = The solenoid is de-energized.
** = Manual Second–Third gear is only available above approximately 100 km/h (62 mph).
*** = Manual First–Second gear is only available above approximately 100 km/h (62 mph).
NOTE: Manual First–Third gear is also possible at high vehicle speed as a safety feature.

DIAGNOSTIC TROUBLE CODE(DTC) P0781
1–2 SHIFT MALFUNCTION

Circuit Description

The special feature of 4HP 16 Auto Transaxle is that it operates without freewheels. Shifting between individual gears takes place by means of overlapping clutch engagement and release.

The advantage of overlap shifting are as follows:

- The transaxle can be of more compact design and is lighter on account of the absence of freewheels and the lower number of shift elements.
- Lower drag losses, i.e. higher efficiency.
- Lower peak torque acting on the components and driveline.

However, overlap shifting necessitates high-performance hardware and software, and precision engine signals.

Conditions for Setting the DTC

- Engine is running.
- No DTC P1885, P1886.
- No DTC P1881, P1883.
- No DTC P1884, P0783, P0782.
- Selector lever is not N(Neutral), P(Park) position.
- Engine torque is unstable state.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 1st gear.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignitioncycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P0781 sets, the replacement of T/M is recommended.

DTC P0781 – 1–2 shift malfunction

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Start engine and allow it to warm up at idle. 4. Observe “engine revolution, idle rpm, TPS and so on” on the scan tool. Was a problem found?	–	Go to “Engine diagnostic information”	Go to Step 3
3	Inspect “ECU”. Refer to Section 1F Engine diagnostic information and procedures. Was a problem found?	–	Go to “Engine diagnostic information”	Go to Step 4
4	1. Turn the ignition LOCK. 2. Disconnect the TCM wiring connector. 3. Measure the voltage between terminal B3 of and B13 of the transaxle wiring connector. 4. Turn the ignition ON. 5. Measure the voltage between terminal C15 of and B13 of the transaxle wiring connector. 6. Measure the voltage between terminal C16 of and B13 of the transaxle wiring connector. Is the voltage within the values shown?	11–14V	Go to Step 5	Go to “System voltage low or high”
5	Replace the TCM. Is the action complete?	–	Go to Step 8	–
6	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. Has the last test failed or is the current DTC displayed?	–	Replace transaxle assembly	Repair verified exit DTC chart

Range	Park/ Neutral	Reverse	D				3			2		1
Gear	N	R	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	1st
Solenoid Valve 1	ON	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF
Solenoid Valve 2	ON	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
Line Pressure Control Solenoid Valve 3 (EDS 3)	OFF	OFF	OFF	ON	ON/ OFF	ON/ OFF	OFF	ON	ON/ OFF	OFF	ON	ON/ OFF
Line Pressure Control Solenoid Valve 4 (EDS 4)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Line Pressure Control Solenoid Valve 5 (EDS 5)	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	ON
Line Pressure Control Solenoid Valve 6 (EDS 6)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Brake B	A	A	A		A		A		A	A		A
Brake C						H						
Brake D		H										
Clutch E				A	A	A		A	A		A	
Brake F			H	H			H	H		H	H	H
Lock–up Clutch						A						

A = Applied
H = Holding
ON = The solenoid is energized.
OFF = The solenoid is de-energized.
** = Manual Second–Third gear is only available above approximately 100 km/h (62 mph).
*** = Manual First–Second gear is only available above approximately 100 km/h (62 mph).
NOTE: Manual First–Third gear is also possible at high vehicle speed as a safety feature.

DIAGNOSTIC TROUBLE CODE(DTC) P0782 2–3 SHIFT MALFUNCTION

Circuit Description

The special feature of 4HP 16 Auto Transaxle is that it operates without freewheels. Shifting between individual gears takes place by means of overlapping clutch engagement and release.

The advantage of overlap shifting are as follows:

- The transaxle can be of more compact design and is lighter on account of the absence of freewheels and the lower number of shift elements.
- Lower drag losses, i.e. higher efficiency.
- Lower peak torque acting on the components and driveline.

However, overlap shifting necessitates high-performance hardware and software, and precision engine signals.

Conditions for Setting the DTC

- Engine is running.
- No DTC P1885, P1886.
- No DTC P1881, P1883.
- No DTC P1884, P0783, P0781.
- Selector lever is not N(Neutral), P(Park) position.
- Engine torque is unstable state.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 2nd gear.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignitioncycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P0782 sets, the replacement of T/M is recommended.

DTC P0782 – 2–3 shift malfunction

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Start engine and allow it to warm up at idle. 4. Observe “engine revolution, idle rpm, TPS and so on” on the scan tool. Was a problem found?	–	Go to “Engine diagnostic information”	Go to Step 3
3	Inspect “ECU”. Refer to Section 1F Engine diagnostic information and procedures. Was a problem found?	–	Go to “Engine diagnostic information”	Go to Step 4
4	1. Turn the ignition LOCK. 2. Disconnect the TCM wiring connector. 3. Measure the voltage between terminal B3 of and B13 of the transaxle wiring connector. 4. Turn the ignition ON. 5. Measure the voltage between terminal C15 of and B13 of the transaxle wiring connector. 6. Measure the voltage between terminal C16 of and B13 of the transaxle wiring connector. Is the voltage within the values shown?	11–14V	Go to Step 5	Go to “System voltage low or high”
5	Replace the TCM. Is the action complete?	–	Go to Step 8	–
6	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. Has the last test failed or is the current DTC displayed?	–	Replace transaxle assembly	Repair verified exit DTC chart

Range	Park/ Neutral	Reverse	D				3			2		1
Gear	N	R	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	1st
Solenoid Valve 1	ON	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF
Solenoid Valve 2	ON	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
Line Pressure Control Solenoid Valve 3 (EDS 3)	OFF	OFF	OFF	ON	ON/ OFF	ON/ OFF	OFF	ON	ON/ OFF	OFF	ON	ON/ OFF
Line Pressure Control Solenoid Valve 4 (EDS 4)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Line Pressure Control Solenoid Valve 5 (EDS 5)	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	ON
Line Pressure Control Solenoid Valve 6 (EDS 6)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Brake B	A	A	A		A		A		A	A		A
Brake C						H						
Brake D		H										
Clutch E				A	A	A		A	A		A	
Brake F			H	H			H	H		H	H	H
Lock–up Clutch						A						

A = Applied
H = Holding
ON = The solenoid is energized.
OFF = The solenoid is de-energized.
** = Manual Second–Third gear is only available above approximately 100 km/h (62 mph).
*** = Manual First–Second gear is only available above approximately 100 km/h (62 mph).
NOTE: Manual First–Third gear is also possible at high vehicle speed as a safety feature.

DIAGNOSTIC TROUBLE CODE(DTC) P0783 3–4 SHIFT MALFUNCTION

Circuit Description

The special feature of 4HP 16 Auto Transaxle is that it operates without freewheels. Shifting between individual gears takes place by means of overlapping clutch engagement and release.

The advantage of overlap shifting are as follows:

- The transaxle can be of more compact design and is lighter on account of the absence of freewheels and the lower number of shift elements.
- Lower drag losses, i.e. higher efficiency.
- Lower peak torque acting on the components and driveline.

However, overlap shifting necessitates high-performance hardware and software, and precision engine signals.

Conditions for Setting the DTC

- Engine is running.
- No DTC P1885, P1886.
- No DTC P1881, P1883.
- No DTC P1884, P0782, P0781.
- Selector lever is not N(Neutral), P(Park) position.
- Engine torque is unstable state.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 3rd gear.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

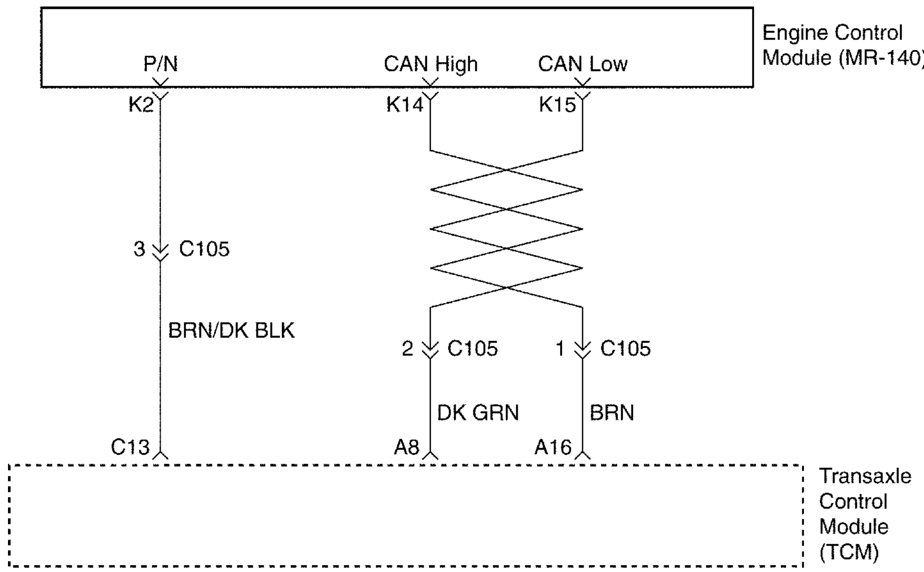
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P0783 sets, the replacement of T/M is recommended.

DTC P0783– 3–4 shift malfunction

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Start engine and allow it to warm up at idle. 4. Observe “engine revolution, idle rpm, TPS and so on” on the scan tool. Was a problem found?	–	Go to “Engine diagnostic information”	Go to Step 3
3	Inspect “ECU”. Refer to Section 1F Engine diagnostic information and procedures. Was a problem found?	–	Go to “Engine diagnostic information”	Go to Step 4
4	1. Turn the ignition LOCK. 2. Disconnect the TCM wiring connector. 3. Measure the voltage between terminal B3 of and B13 of the transaxle wiring connector. 4. Turn the ignition ON. 5. Measure the voltage between terminal C15 of and B13 of the transaxle wiring connector. 6. Measure the voltage between terminal C16 of and B13 of the transaxle wiring connector. Is the voltage within the values shown?	11–14V	Go to Step 5	Go to “System voltage low or high”
5	Replace the TCM. Is the action complete?	–	Go to Step 8	–
6	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. Has the last test failed or is the current DTC displayed?	–	Replace transaxle assembly	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1791
THROTTLE POSITION INPUT SIGNAL CIRCUIT MALFUNCTION (CAN TYPE)
(2.0L DOHC DELPHI 32BIT)

Circuit Description

The transaxle control module(TCM) is an electronic device which monitors inputs to control various transaxle functions including shift quality and transaxle sensors, swithces, and components to process for use within its' control program. Based on this input information, the TCM controls various transaxle output functions and devices.

Information transmit between TCM and ECM through the CAN line. information is as follows :

- Engine Malfunction Signal.
- Engine Speed.
- Engine Output Torque Reduction Signal.
- Engine Coolant Temperature.

Conditions for Setting the DTC

- System voltage is too high or too low.
- TCM or ECM is defective.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

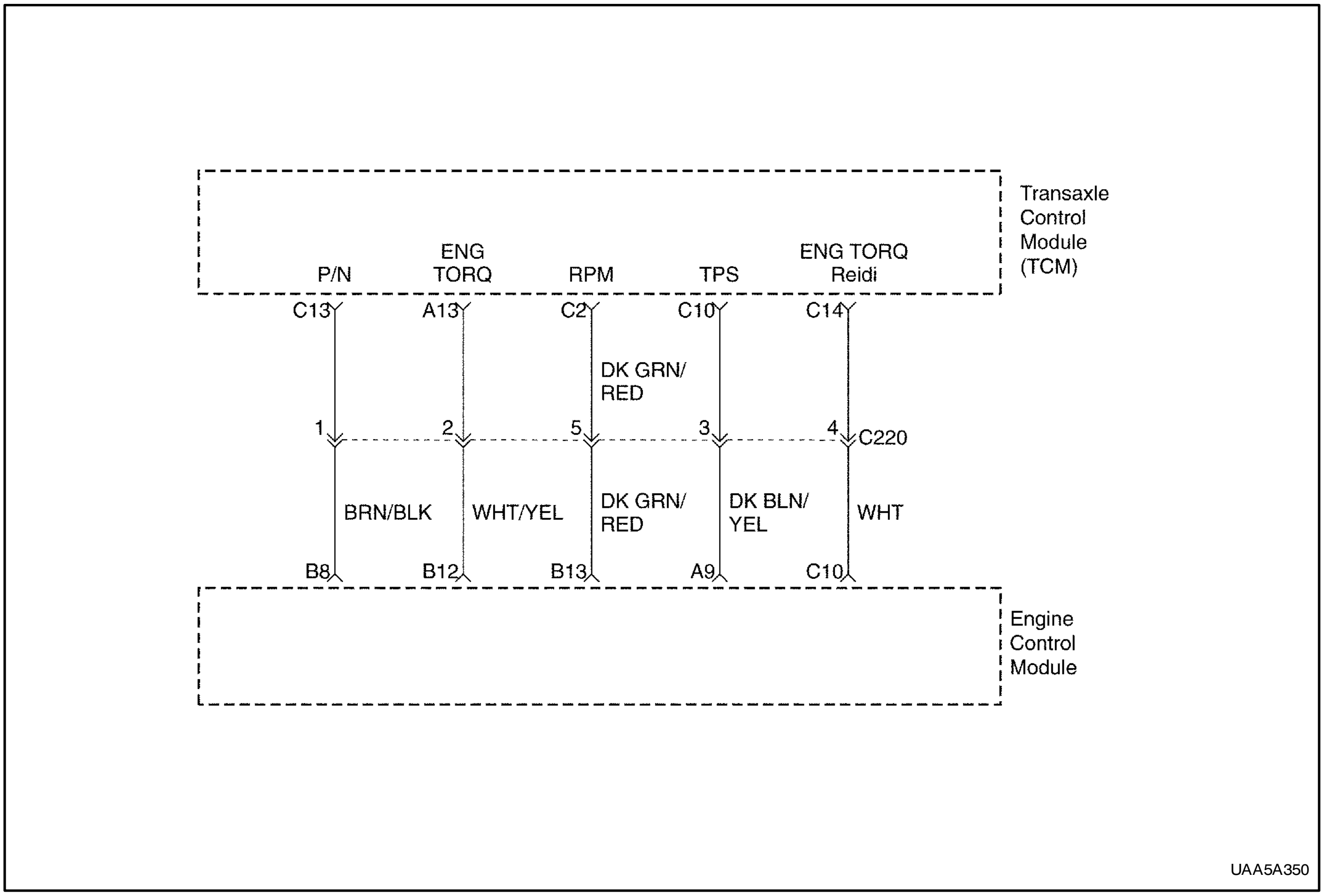
- No lamp control required but diagnostic information should be stored immediately when malfunction is detected.
- Adjustable value, calculated over the substitute map throttle position. (engine speed, engine torque)

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycles.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

DTC P1791 – THROTTLE POSITION INPUT SIGNAL CIRCUIT MALFUNCTION (CAN TYPE) (2.0L DOHC DELPHI 32bit)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON. 3. Observe the throttle position value on the scan tool. Is the speed within the values shown?	0–100%	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the TCM wiring connector. And ECM wiring connector. 3. Measure the resistance between terminal A8 of the TCM wiring connector and terminal K14 of the ECM wiring connector. 4. Measure the resistance between terminal A16 of the TCM wiring connector and terminal K15 of the ECM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 5	Go to Step 4
4	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
5	1. Turn the ignition ON. 2. Measure the voltage of terminal A8. 3. Measure the voltage of terminal A16. Is the resistance within the values shown?	11–14V	Go to Step 6	Go to Step 7
6	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
7	Inspect the "Throttle Position". Refer to Section 1F, Engine Diagnostic Information And Procedures. Was a problem found?	–	Refer to Section 1F, Engine Diagnostic Information And Procedures.	Go to Step 8
8	1. Replace the TCM. 2. Turn the ignition LOCK. 3. Turn the ignition On. 4. Check if P0726 DTC is set. 5. Is The DTC set?	–	Go to Step 9	Go to Step 10
9	Replace the ECM. Is the action complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1791 THROTTLE POSITION INPUT SIGNAL CIRCUIT MALFUNCTION (DISCRETE TYPE) (2.0L DOHC DELPHI 8BIT)

Circuit Description

The transaxle control module(TCM) is an electronic device which monitors inputs to control various transaxle functions including shift quality and transaxle sensors, swithces, and components to process for use within its' control program. Based on this input information, the TCM controls various transaxle output functions and devices.

Information transmit between TCM and ECM through the DISCRETE line. information is as follows :

- Engine Speed.
- Engine Output Torque Reduction Signal.

Conditions for Setting the DTC

- System voltage is too high or too low.
- DISCRETE transmitting wiring harness shortage or open.
- TCM or ECM is defective.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

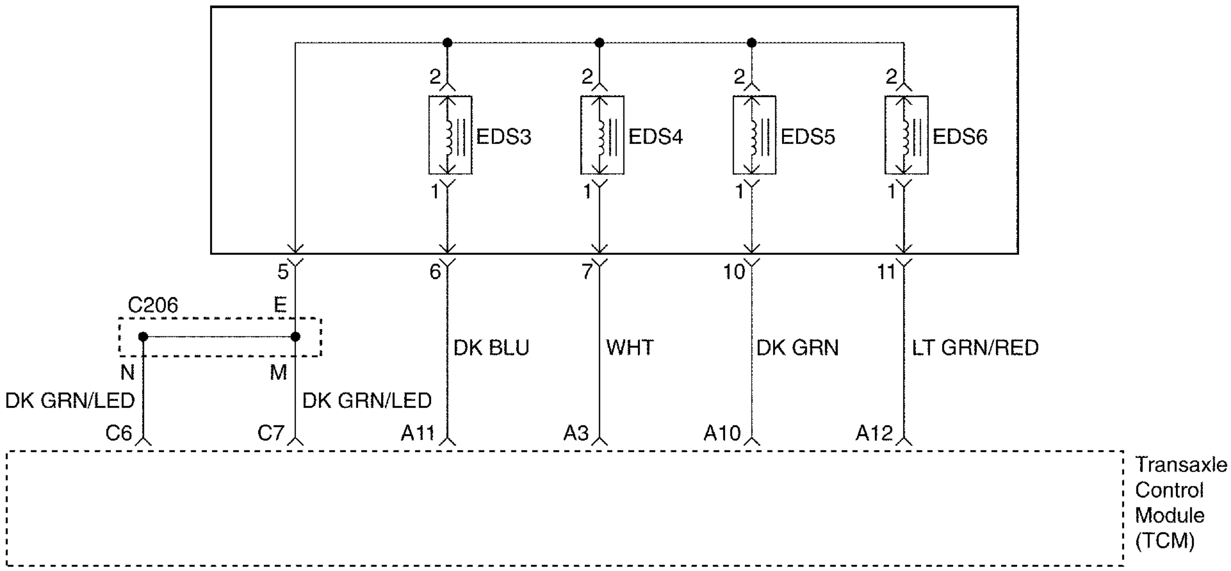
- No lamp control required but diagnostic information should be stored immediately when malfunction is detected.
- Adjustable value, calculated over the substitute map throttle position. (engine speed, engine torque)

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycles.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

DTC P1791 – THROTTLE POSITION INPUT SIGNAL CIRCUIT MALFUNCTION (DISCRETE TYPE) (2.0L DOHC DELPHI 8bit)

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON. 3. Observe the throttle position value on the scan tool. Is the speed within the values shown?	0–100%	Go to “Diagnostic Aids”	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the TCM wiring connector. And ECM wiring connector. 3. Measure the resistance between terminal C10 of the TCM wiring connector and terminal A9 of the ECM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 5	Go to Step 4
4	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
5	1. Turn the ignition ON. 2. Measure the voltage of terminal C10. Is the resistance within the values shown?	11–14V	Go to Step 6	Go to Step 7
6	Repair the malfunctioning terminals as necessary. Is the action complete?	–	System OK	–
7	Inspect the “Throttle Position”. Refer to Section 1F, Engine Diagnostic Information And Procedures. Was a problem found?	–	Refer to Section 1F, Engine Diagnostic Information And Procedures.	Go to Step 8
8	1. Replace the TCM. 2. Turn the ignition LOCK. 3. Turn the ignition On. 4. Check if P1791 DTC is set. 5. Is The DTC set?	–	Go to Step 9	Go to Step 10
9	Replace the ECM. Is the action complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1839
EDS 3 OUTPUT SHORTAGE TO GROUND

Circuit Description

The pressure control valve (EDS valve 3,4,5,6) is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch.

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

Conditions for Setting the DTC

- Output voltage of the EDS 3 is less than 2 volt.
- No DTC P1840, P1841.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition LOCK/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

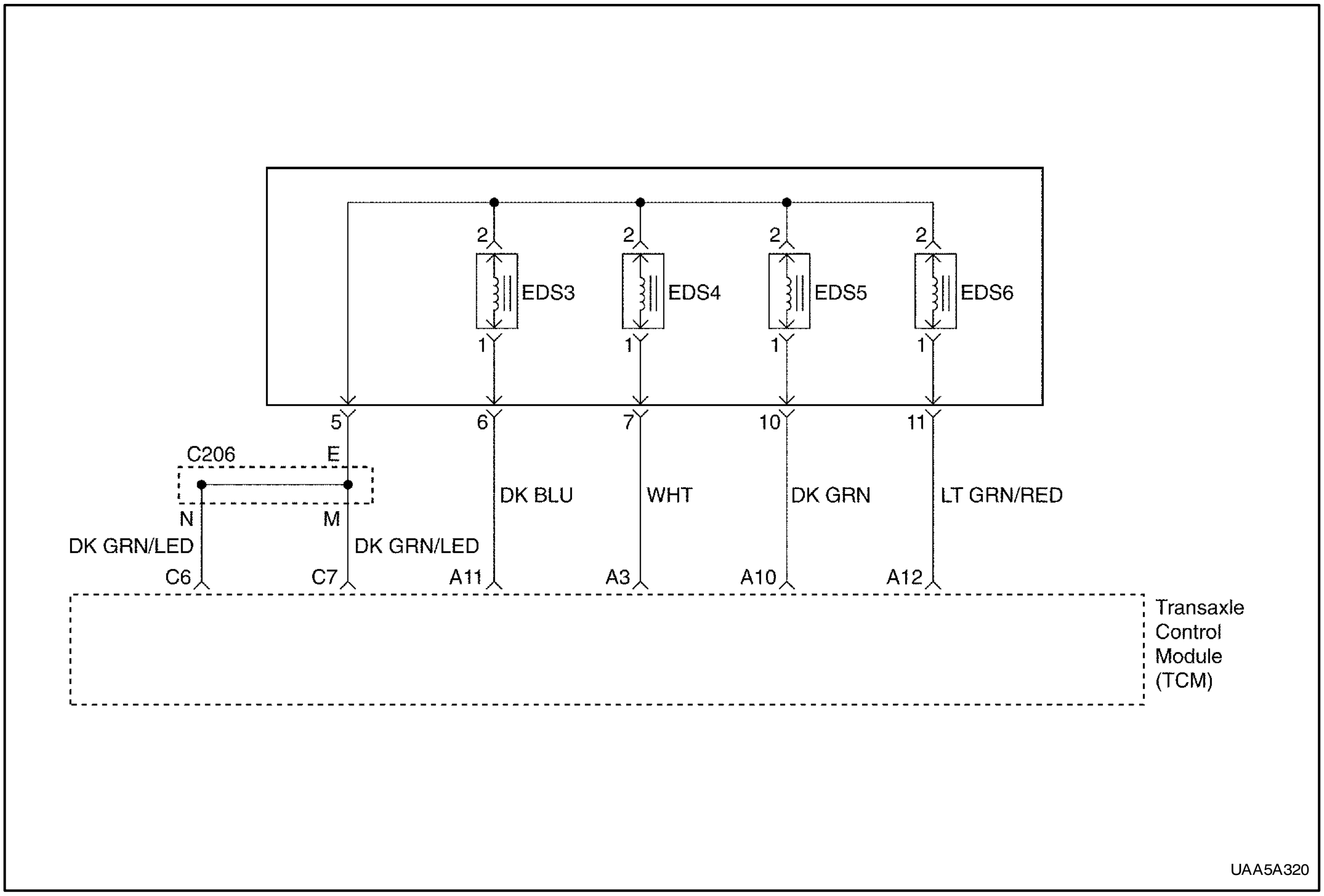
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1839 sets, the replacement of EDS 3 valve is recommended.

DTC P1839 – EDS 3 Output Shortage To Ground

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition On, with the engine OFF. 3. Select “Actuating” on the scan tool. 4. Actuate EDS 3 is ON/OFF. Does the EDS 3 change ON/OFF?	ON/OFF	Go to “Diagnostic Aids”	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector. 3. Measure the resistance between terminals 5 and 6 the transaxle wiring connector. Is the resistance within the values shown?	TFT 25bC 6Ω	Go to Step 7	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the wiring connector of the EDS 3. 3. Measure the resistance between terminal 2 of the EDS 3 and ground. 4. Measure the resistance between terminal 1 of the EDS 3 and ground. Is the resistance within the values shown?	–	Go to Step 6	Go to Step 5
5	Repair the internal line(EDS 3) for short to ground. Is the repair complete?	–	System OK	–
6	Replace the EDS 3. Is the replacement complete?	–	System OK	–
7	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 5 of the transaxle wiring connector and ground. 3. Measure the resistance between terminal 6 of the transaxle wiring connector and ground. Is the resistance within the values shown?	∞	Go to Step 9	Go to Step 8
8	Repair the transaxle wirng harness for short to ground. Is the repair complete?	–	System OK	–
9	Replace the TCM. Is the replacement complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool “clear info” function and road tests the vehicle. 2. Review the “DTC infor”. Has the last failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1840
EDS 3 OUTPUT SHORTAGE TO BATTERY

Circuit Description

The pressure control valve (EDS valve 3,4,5,6) is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch .

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

Conditions for Setting the DTC

- Output voltage of the EDS 3(at ON) is 12 volt.
- No DTC P1839, P1841.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition LOCK/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

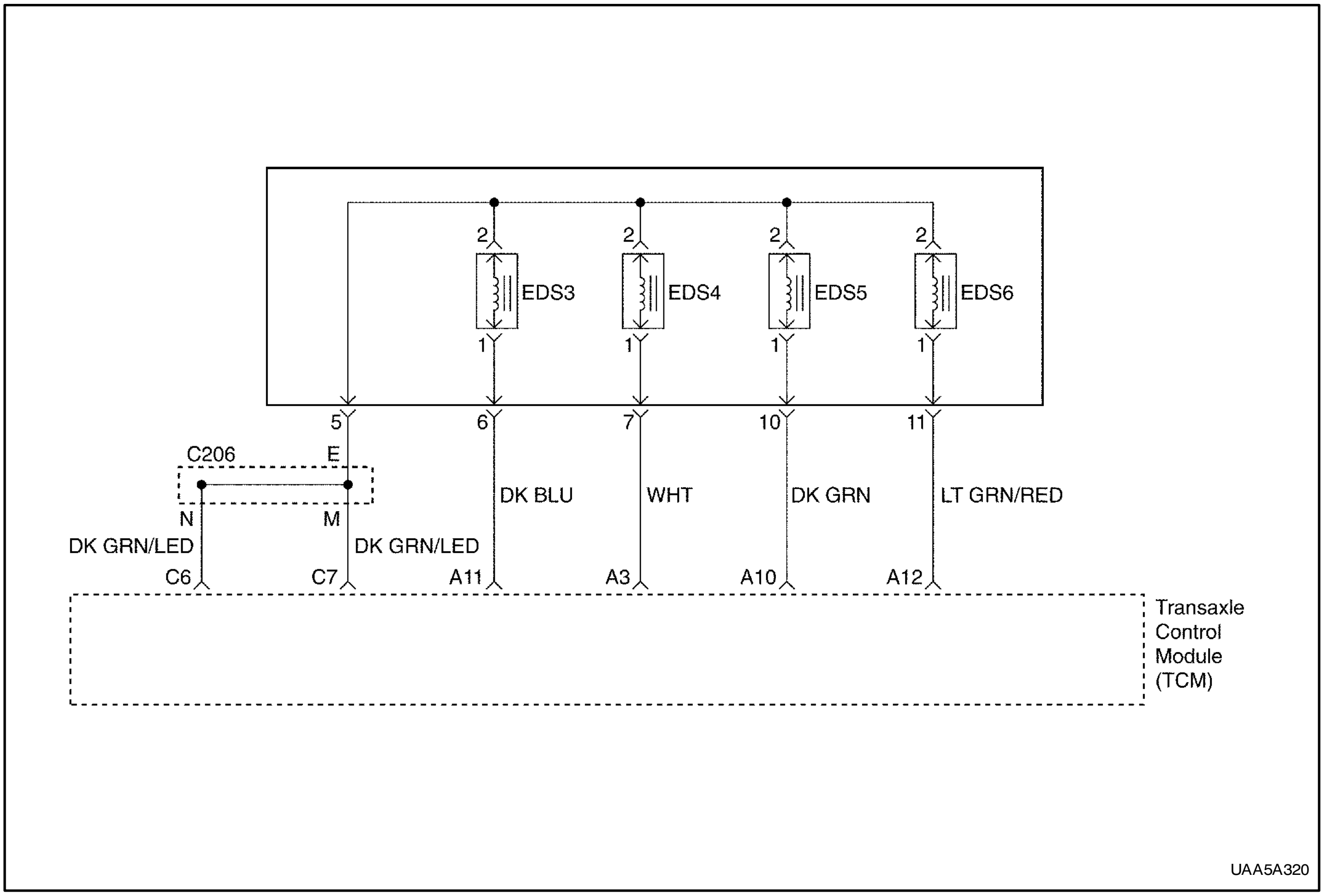
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1840 sets, the replacement of EDS 3 is recommended.

DTC P1840 – EDS 3 Output Shortage To Battery

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Select "Actuating" on the scan tool. 4. Actuate EDS 3 ON/OFF. Does the EDS 3 change ON/OFF?	ON/OFF	Go to "Diagnostic Aids"	Go to Step 3
3	1. Remove the oil pan. 2. Disconnect the wiring connector of the EDS 3. 3. Turn the ignition on, with the engine OFF. 4. Measure the voltage terminal 2 of the EDS3 wiring connector. Is the voltage within the values shown?	11–14V	Go to Step 4	Go to Step 5
4	Repair the internal line(EDS 3) for short to ground. Is the repair complete?	–	System OK	–
5	Replace the EDS 3. Is the replacement complete?	–	Go to Step 6	–
6	1. Check if any DTCs are set. 2. Are any DTCs displayed that have not been diagnosed?	–	Go to "Applicable DTC table"	System OK



DIAGNOSTIC TROUBLE CODE(DTC) P1841
EDS 3 OUTPUT OPEN

Circuit Description

The pressure control valve (EDS valve 3,4,5,6)is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch .

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

Conditions for Setting the DTC

- Output ampere of the EDS 3 is less than 10mA.
- No DTC P1839, P1840.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition LOCK/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

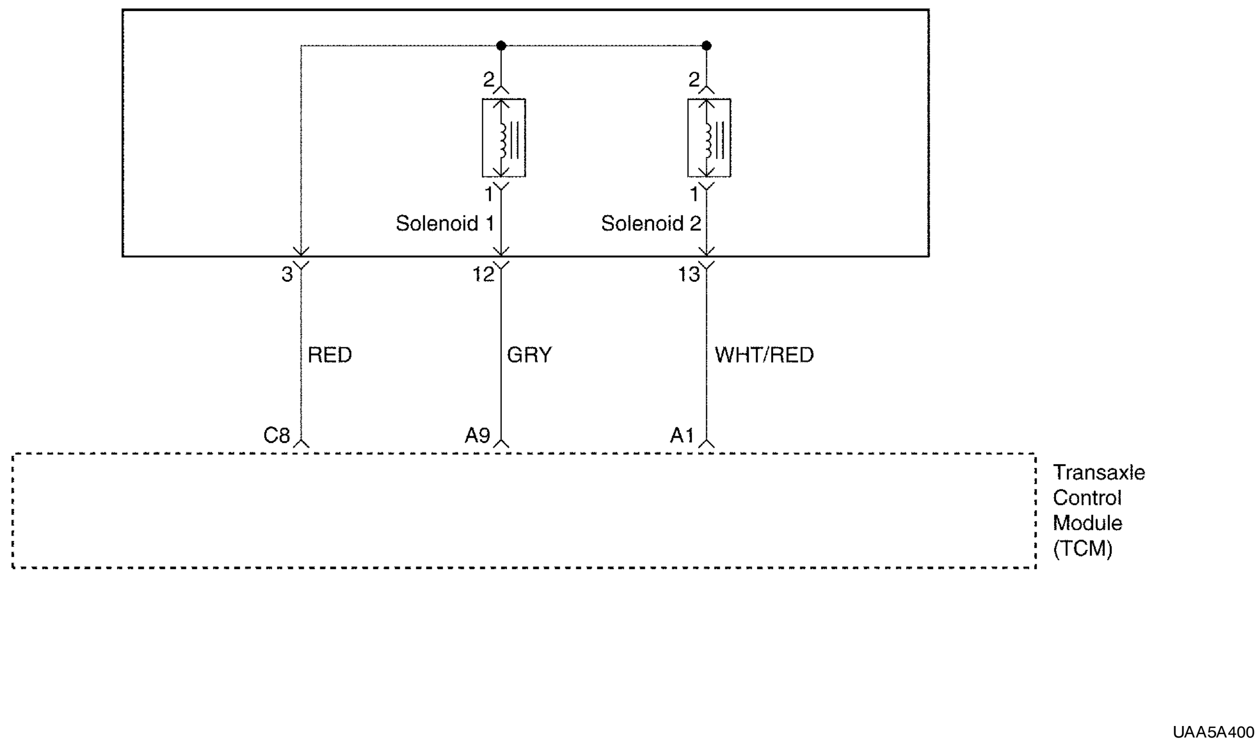
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1841 sets, the replacement of EDS3 valve is recommended.

DTC P1841 – EDS 3 Output Open

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition On, with the engine OFF. 3. Select "Actuating" on the scan tool. 4. Actuate EDS 3 is ON/OFF. Does the EDS 3 change ON/OFF?	ON/OFF	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector. 3. Measure the resistance between terminals 5 and 6 the transaxle wiring connector. Is the resistance within the values shown?	TFT 25bC 6Ω	Go to Step 7	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the wiring connector of the EDS 3. 3. Measure the resistance between terminal 2 of the EDS 3 and terminal 5 of the transaxle connector. 4. Measure the resistance between terminal 1 of the EDS 3 and terminal 6 of the transaxle connector. Is the resistance within the values shown?	0Ω	Go to Step 6	Go to Step 5
5	1. Repair the circuit(between terminal 2 and terminal 5) for open. 2. Repair the circuit(between terminal 1 and terminal 6) for open. Is the repair complete?	–	System OK	–
6	Replace the EDS 3. Is the replacement complete?	–	System OK	–
7	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 5 of the transaxle wiring connector and terminal C7 of the TCM wiring connector. 3. Measure the resistance between terminal 6 of the transaxle wiring connector and terminal A11 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 9	Go to Step 8
8	Repair the transaxle wiring harness for open. Is the repair complete?	–	System OK	–
9	Replace the TCM. Is the replacement complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1850 SOLENOID 1 OUTPUT SHORTAGE TO GROUND

Circuit Description

The shift solenoids are two identical, normally open electronic exhaust valve that control upshifts and downshifts in all forward gear ranges. These shift solenoids works together in a combination of ON and OFF sequences to control the line pressure and shift mechanisms(clutches, brakes).

Solenoid 1 control the high or low of the line pressure (flow to each clutch valve) by the operation type (ON/OFF), i.e. solenoid 1is ON, line pressure will be low (6~8bar), solenoid 1 is OFF, line pressure will be high (16~18bar) Solenoid 2 control the oil flow to clutch valve E or lock-up clutch valve by the ON/OFF signal.

The TCM monitors numerous inputs to determine the appropriate solenoid state combination and transaxle gear tor the vehicle operating conditions.

Conditions for Setting the DTC

- Solenoid wiring shortage to ground.
- No DTC P1851, P1852.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.

Conditions for Clearing the MIL/DTC

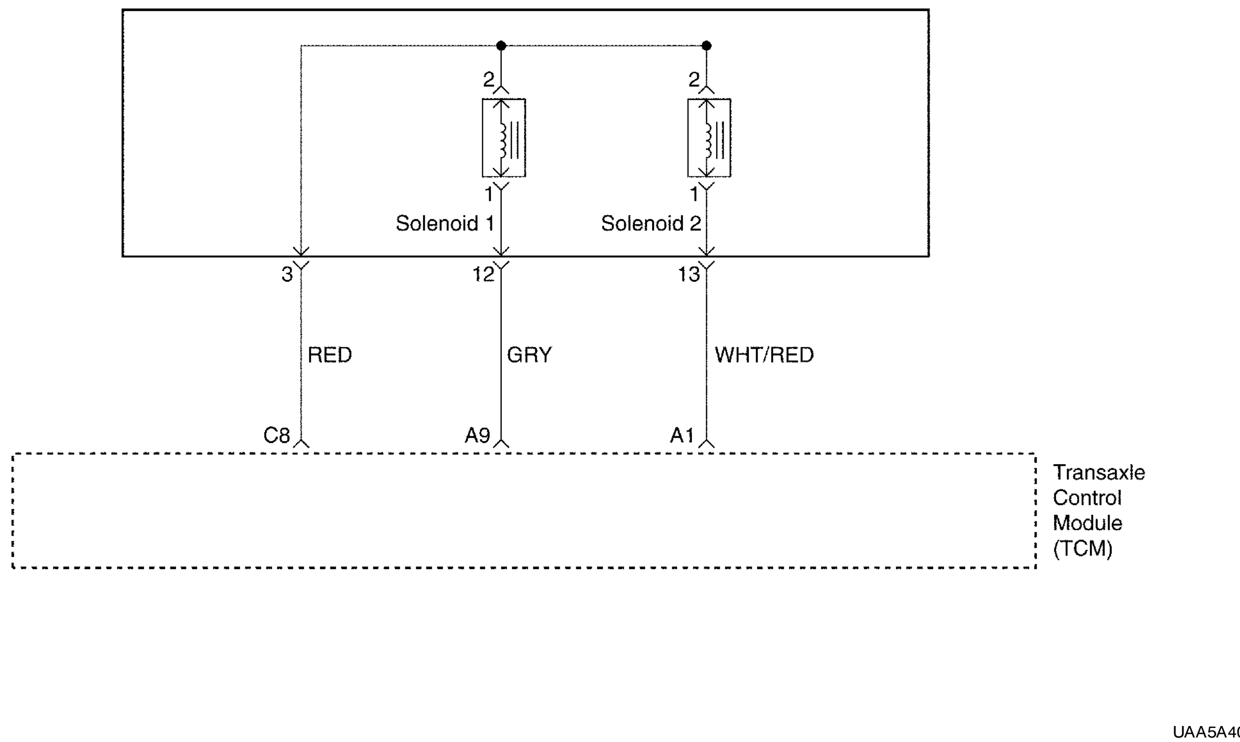
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1850 sets, the replacement of solenoid 1 is recommended.

DTC P1850 – Solenoid 1 Output Shortage to Ground

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record then clear DTC(s). 4. Select “Actuating” on the scan tool. 5. Actuate solenoid is ON/OFF. Does the solenoid 1 change ON/?	ON/OFF	Go to “Diagnostic Aids”	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector. 3. Measure the resistance between terminals 3 and 12 the transaxle wiring connector. Is the resistance within the values shown?	TFT 25bC 26–34.5Ω	Go to Step 7	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the wiring connector of the solenoid 1. 3. Measure the resistance between terminal 2 of the solenoid 1 and ground. 4. Measure the resistance between terminal 1 of the solenoid 1 and ground. Is the resistance within the values shown?	∞	Go to Step 6	Go to Step 5
5	Repair the internal line(solenoid 1) for short to ground. Is the repair complete?	–	System OK	–
6	Replace the solenoid 1. Is the replacement complete?	–	System OK	–
7	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 3 of the transaxle wiring connector and ground. 3. Measure the resistance between terminal 12 of the transaxle wiring connector and ground. Is the resistance within the values shown?	∞	Go to Step 9	Go to Step 8
8	Repair the transaxle wiring harness for short to ground. Is the repair complete?	–	System OK	–
9	Replace the TCM. Is the replacement complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool “clear info” function and road tests the vehicle. 2. Review the “DTC info”. 3. Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1851
SOLENOID 1 OUTPUT SHORTAGE TO BATTERY

Circuit Description

The shift solenoids are two identical, normally open electronic exhaust valve that control upshifts and downshifts in all forward gear ranges. These shift solenoids works together in a combination of ON and OFF sequences to control the line pressure and shift mechanisms (clutches, brakes).

Solenoid 1 control the high or low of the line pressure (flow to each clutch valve) by the operation type(ON/OFF), i.e. solenoid 1is ON, line pressure will be low (6~8bar), solenoid 1 is OFF, line pressure will be high (16~18bar) Solenoid 2 control the oil flow to clutch valve E or lock-up clutch valve by the ON/OFF signal.

The TCM monitors numerous inputs to determine the appropriate solenoid state combination and transaxle gear tor the vehicle operating conditions.

Conditions for Setting the DTC

- Solenoid wiring shortage to battery.
- No DTC P1850, P1852
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- Power lamp will blink. The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.

Conditions for Clearing the MIL/DTC

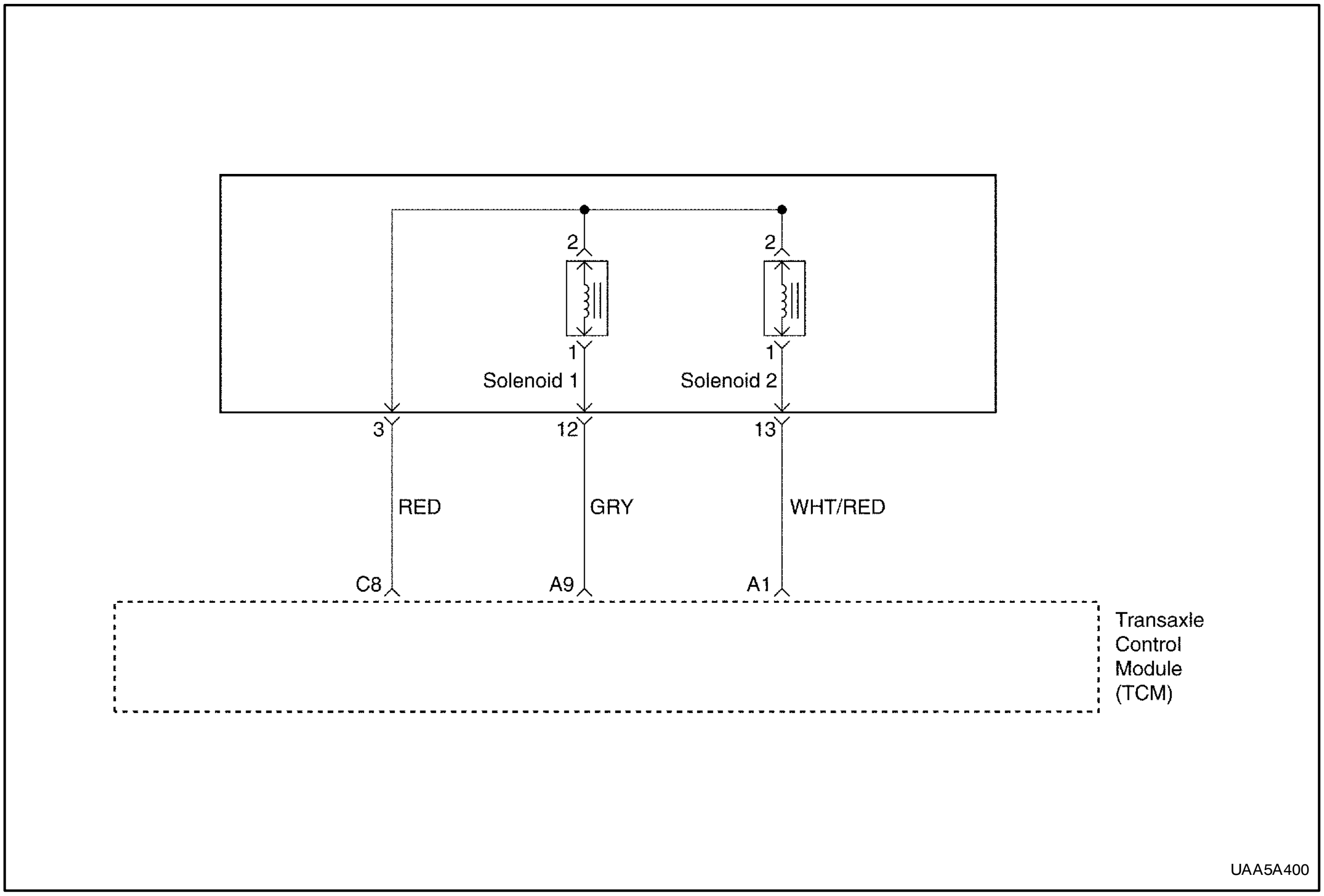
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1851 sets, the replacement of SOLENOID 1 is recommended.

DTC P1851 – SOLENOID 1 Output Shortage To Battery

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Select “Actuating” on the scan tool. 4. Actuate solenoid 1 ON/OFF. Does the solenoid 1 change ON/?	ON/OFF	Go to “Diagnostic Aids”	Go to Step 3
3	1. Remove the oil pan. 2. Disconnect the wiring connector of the solenoid 1. 3. Turn the ignition on, with the engine OFF. 4. Measure the voltage terminal 1 of the solenoid 1 wiring connector. Is the voltage within the values shown?	11–14V	Go to Step 4	Go to Step 5
4	Repair the internal line(solenoid 1) for short to battery. Is the repair complete?	–	System OK	–
5	Replace the solenoid 1. Is the replacement complete?	–	Go to Step 6	–
6	1. Check if any DTCs are set. 2. Are any DTCs displayed that have not been diagnosed?	–	Go to “Applicable DTC table”	System OK



DIAGNOSTIC TROUBLE CODE(DTC) P1852
SOLENOID 1 OUTPUT OPEN

Circuit Description

The shift solenoids are two identical, normally open electronic exhaust valve that control upshifts and downshifts in all forward gear ranges. These shift solenoids works together in a combination of ON and OFF sequences to control the line pressure and shift mechanisms (clutches, brakes).

Solenoid 1 control the high or low of the line pressure (flow to each clutch valve) by the operation type (ON/OFF), i.e. solenoid 1is ON, line pressure will be low (6~8bar), solenoid 1 is OFF, line pressure will be high (16~18bar) Solenoid 2 control the oil flow to clutch valve E or lock-up clutch valve by the ON/OFF signal.

The TCM monitors numerous inputs to determine the appropriate solenoid state combination and transaxle gear tor the vehicle operating conditions.

Conditions for Setting the DTC

- Solenoid wiring open.
- No DTC P1850, P1851.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.

Conditions for Clearing the MIL/DTC

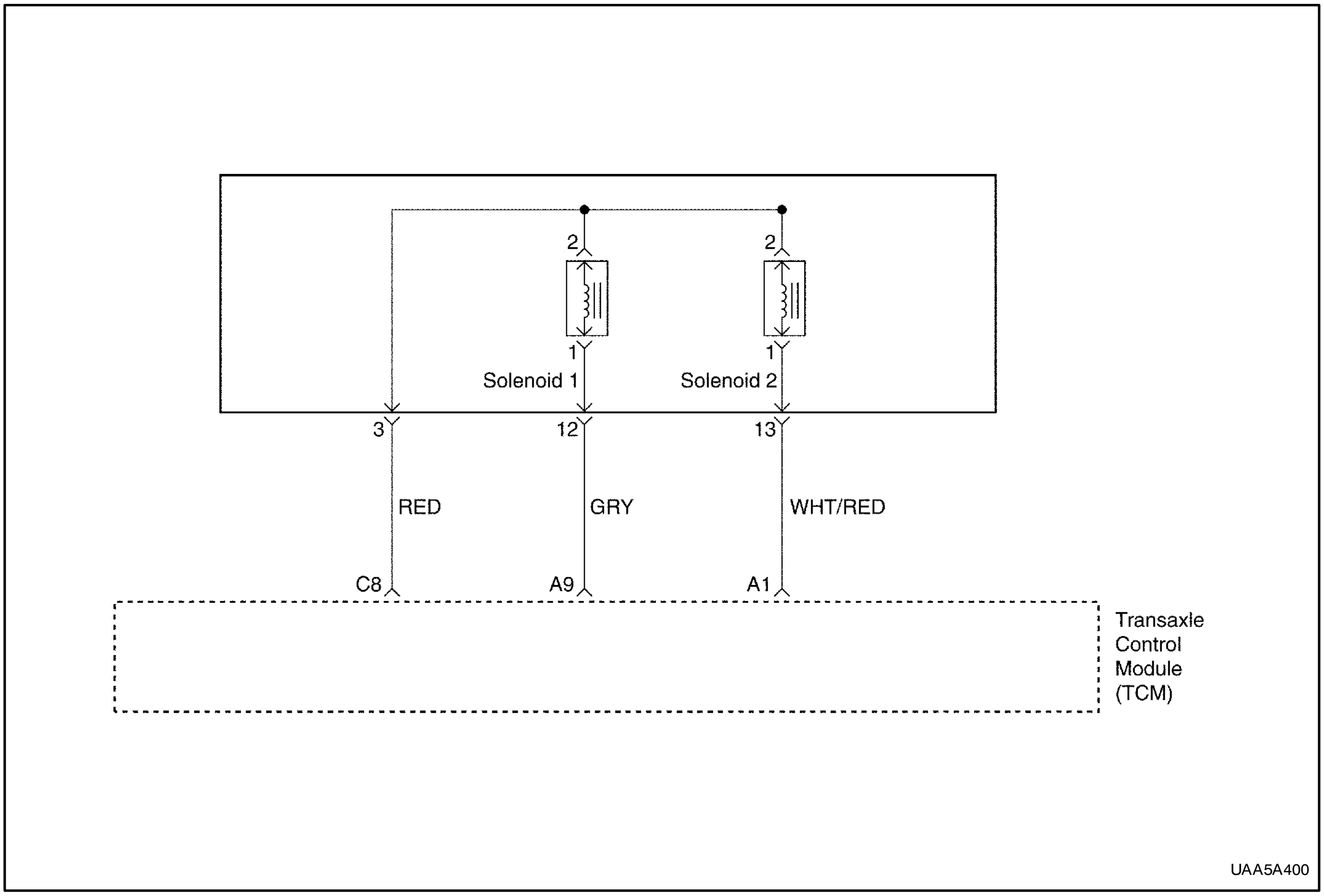
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1852 sets, the replacement of solenoid 1 is recommended.

DTC P1852 – SOLENOID 1 Output Open

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Select “Actuating” on the scan tool. 4. Actuate solenoid 1 is ON/OFF. Does the solenoid 1 change ON/?	ON/OFF	Go to “Diagnostic Aids”	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector. 3. Measure the resistance between terminal 3 and 12 the transaxle wiring connector. Is the resistance within the values shown?	TFT 25bC 6Ω	Go to Step 7	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the wiring connector of the solenoid 1. 3. Measure the resistance between terminal 1 of the solenoid 1 and terminal 12 of the transaxle connector. 4. Measure the resistance between terminal 2 of the solenoid 1 and terminal 3 of the transaxle connector. Is the resistance within the values shown?	0Ω	Go to Step 6	Go to Step 5
5	1. Repair the line(between terminal 1 and terminal 12) for open. 2. Repair the line(between terminal 2 and terminal 3) for open. Is the repair complete?	–	System OK	–
6	Replace the solenoid 1. Is the replacement complete?	–	System OK	–
7	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 3 of the transaxle wiring connector and terminal C7 of the TCM wiring connector. 3. Measure the resistance between terminal 12 of the transaxle wiring connector and terminal A9 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 9	Go to Step 8
8	Repair the transaxle wiring harness for open. Is the repair complete?	–	System OK	–
9	Replace the TCM. Is the replacement complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1853
SOLENOID 2 OUTPUT SHORTAGE TO GROUND

Circuit Description

The shift solenoids are two identical, normally open electronic exhaust valve that control upshifts and downshifts in all forward gear ranges. These shift solenoids works together in a combination of ON and OFF sequences to control the line pressure and shift mechanisms(clutches, brakes).

Solenoid 2 control the high or low of the line pressure (flow to each clutch valve) by the operation type (ON/OFF), i.e. solenoid 2is ON, line pressure will be low (6~8bar), solenoid 2 is OFF, line pressure will be high (16~18bar) Solenoid 2 control the oil flow to clutch valve E or lock-up clutch valve by the ON/OFF signal.

The TCM monitors numerous inputs to determine the appropriate solenoid state combination and transaxle gear tor the vehicle operating conditions.

Conditions for Setting the DTC

- Solenoid wiring shortage to ground.
- No DTC P1854, P1855.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.

Conditions for Clearing the MIL/DTC

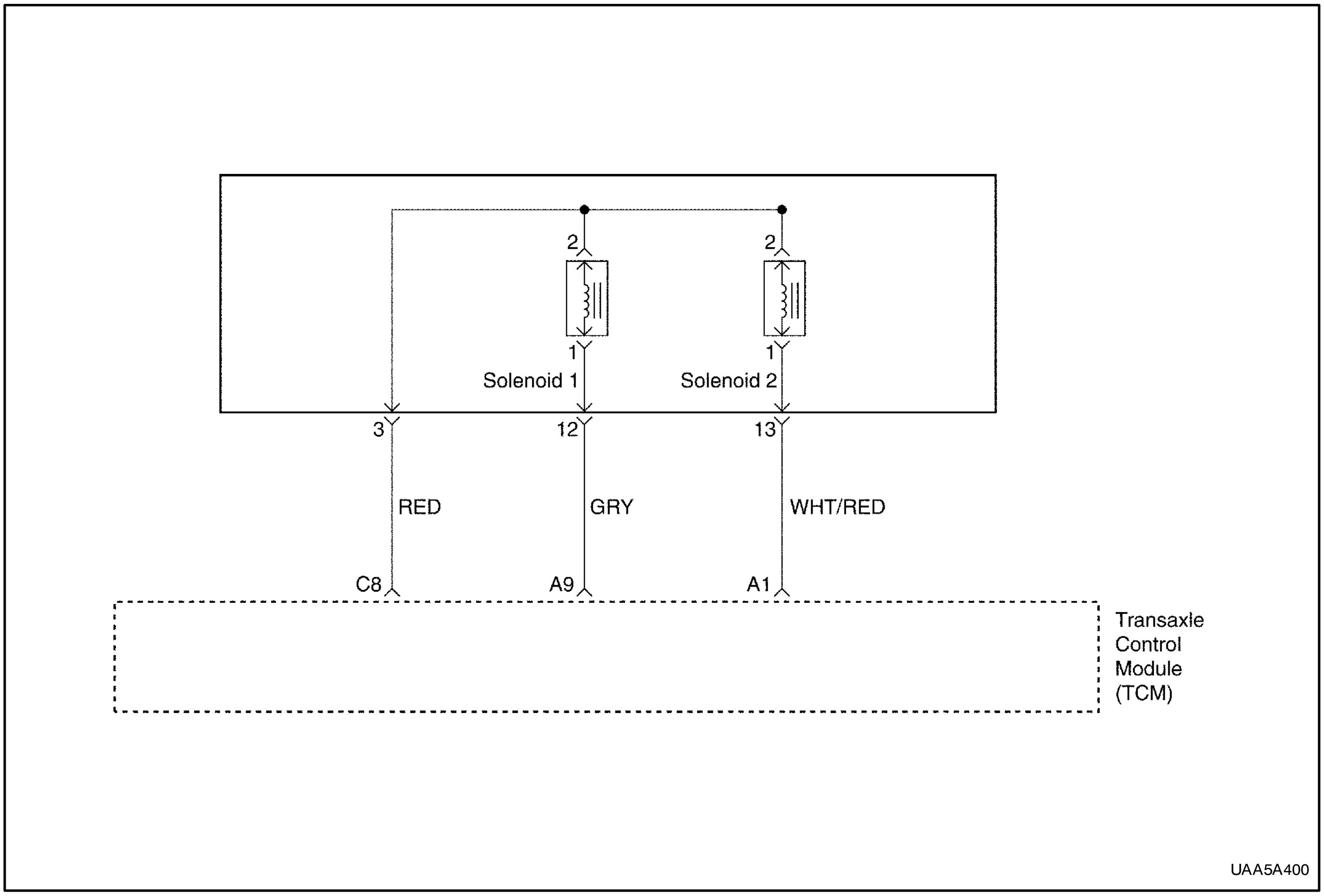
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1853 sets, the replacement of solenoid 2 is recommended.

DTC P1853 – Solenoid 2 Output Shortage to Ground

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record then clear DTC(s). 4. Select "Actuating" on the scan tool. 5. Actuate solenoid is ON/OFF. Does the solenoid 2 change ON/?	ON/OFF	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector. 3. Measure the resistance between terminals 3 and 12 the transaxle wiring connector. Is the resistance within the values shown?	TFT 25bC 26–34.5Ω	Go to Step 7	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the wiring connector of the solenoid 2. 3. Measure the resistance between terminal 2 of the solenoid 2 and ground. 4. Measure the resistance between terminal 1 of the solenoid 2 and ground. Is the resistance within the values shown?	∞	Go to Step 6	Go to Step 5
5	Repair the internal line(solenoid 2) for short to ground. Is the repair complete?	–	System OK	–
6	Replace the solenoid 2. Is the replacement complete?	–	System OK	–
7	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 3 of the transaxle wiring connector and ground. 3. Measure the resistance between terminal 13 of the transaxle wiring connector and ground. Is the resistance within the values shown?	∞	Go to Step 9	Go to Step 8
8	Repair the transaxle wiring harness for short to ground. Is the repair complete?	–	System OK	–
9	Replace the TCM. Is the replacement complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool "clear info" function and road tests the vehicle. 2. Review the "DTC info". 3. Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1854
SOLENOID 2 OUTPUT SHORTAGE TO BATTERY

Circuit Description

The shift solenoids are two identical, normally open electronic exhaust valve that control upshifts and downshifts in all forward gear ranges. These shift solenoids works together in a combination of ON and OFF sequences to control the line pressure and shift mechanisms(clutches, brakes).

Solenoid 2 control the high or low of the line pressure(flow to each clutch valve) by the operation type (ON/OFF), i.e. solenoid 2is ON, line pressure will be low (6~8bar), solenoid 2 is OFF, line pressure will be high (16~18bar) Solenoid 2 control the oil flow to clutch valve E or lock-up clutch valve by the ON/OFF signal.

The TCM monitors numerous inputs to determine the appropriate solenoid state combination and transaxle gear tor the vehicle operating conditions

Conditions for Setting the DTC

- Solenoid wiring shortage to battery.
- No DTC P1853, P1855.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear.

Conditions for Clearing the MIL/DTC

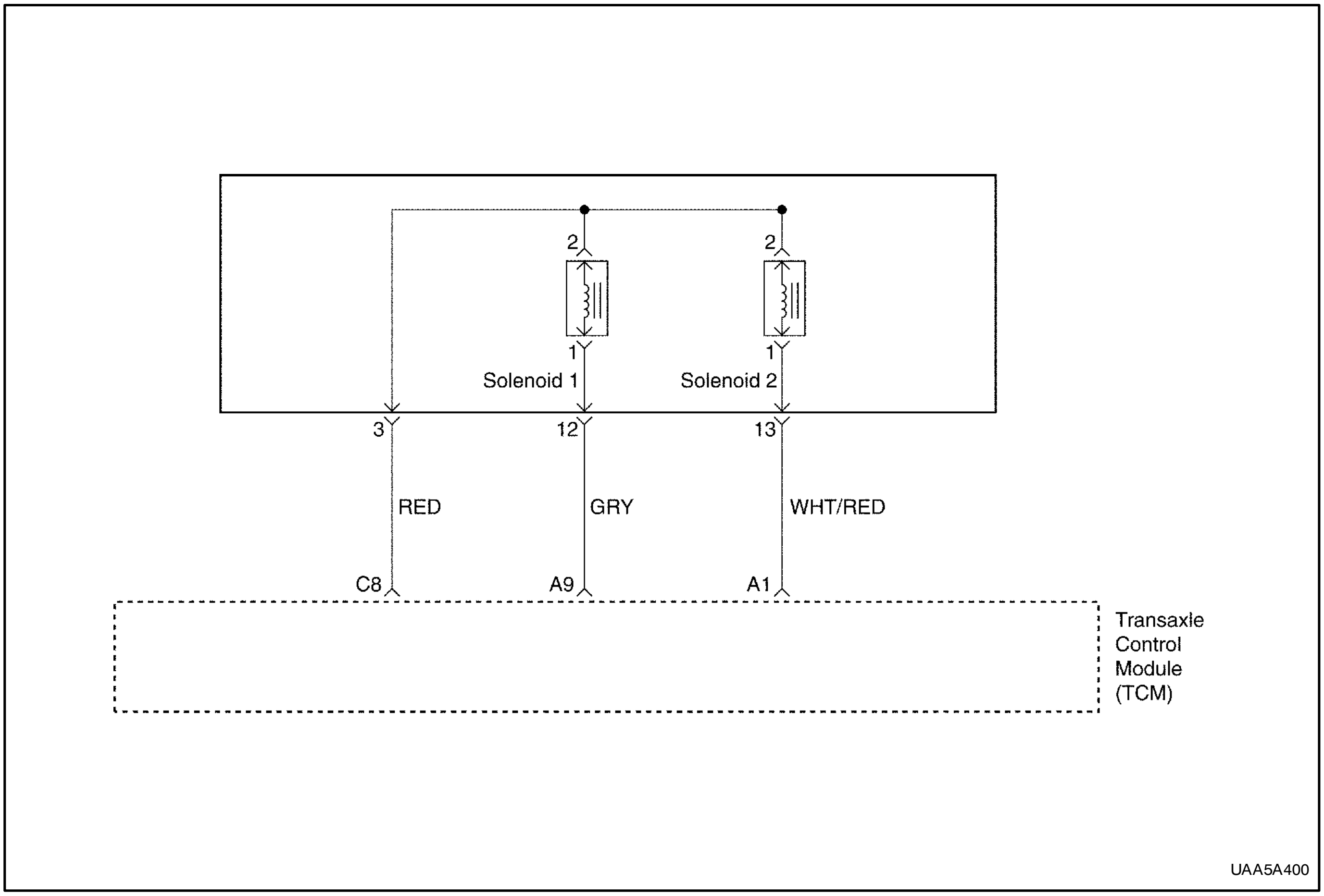
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1854 sets, the replacement of SOLENOID 2 is recommended.

DTC P1854 – SOLENOID 2 Output Shortage To Battery

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Select “Actuating” on the scan tool. 4. Actuate solenoid 2 ON/OFF. Does the solenoid 2 change ON/?	ON/OFF	Go to “Diagnostic Aids”	Go to Step 3
3	1. Remove the oil pan. 2. Disconnect the wiring connector of the solenoid 2. 3. Turn the ignition on, with the engine OFF. 4. Measure the voltage terminal 1 of the solenoid 2 wiring connector. Is the voltage within the values shown?	11–14V	Go to Step 4	Go to Step 5
4	Repair the internal line(solenoid 2) for short to battery. Is the repair complete?	–	System OK	–
5	Replace the solenoid 2. Is the replacement complete?	–	Go to Step 6	–
6	1. Check if any DTCs are set. 2. Are any DTCs displayed that have not been diagnosed?	–	Go to “Applicable DTC table”	System OK



DIAGNOSTIC TROUBLE CODE(DTC) P1855
SOLENOID 2 OUTPUT OPEN

Circuit Description

The shift solenoids are two identical, normally open electronic exhaust valve that control upshifts and downshifts in all forward gear ranges. These shift solenoids works together in a combination of ON and OFF sequences to control the line pressure and shift mechanisms(clutches, brakes).

Solenoid 2 control the high or low of the line pressure (flow to each clutch valve) by the operation type (ON/OFF), i.e. solenoid 2 is ON, line pressure will be low (6~8bar), solenoid 2 is OFF, line pressure will be high (16~18bar) Solenoid 2 control the oil flow to clutch valve E or lock-up clutch valve by the ON/OFF signal.

The TCM monitors numerous inputs to determine the appropriate solenoid state combination and transaxle gear tor the vehicle operating conditions.

Conditions for Setting the DTC

- Solenoid wiring open.
- No DTC P1853, P1854.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.

Conditions for Clearing the MIL/DTC

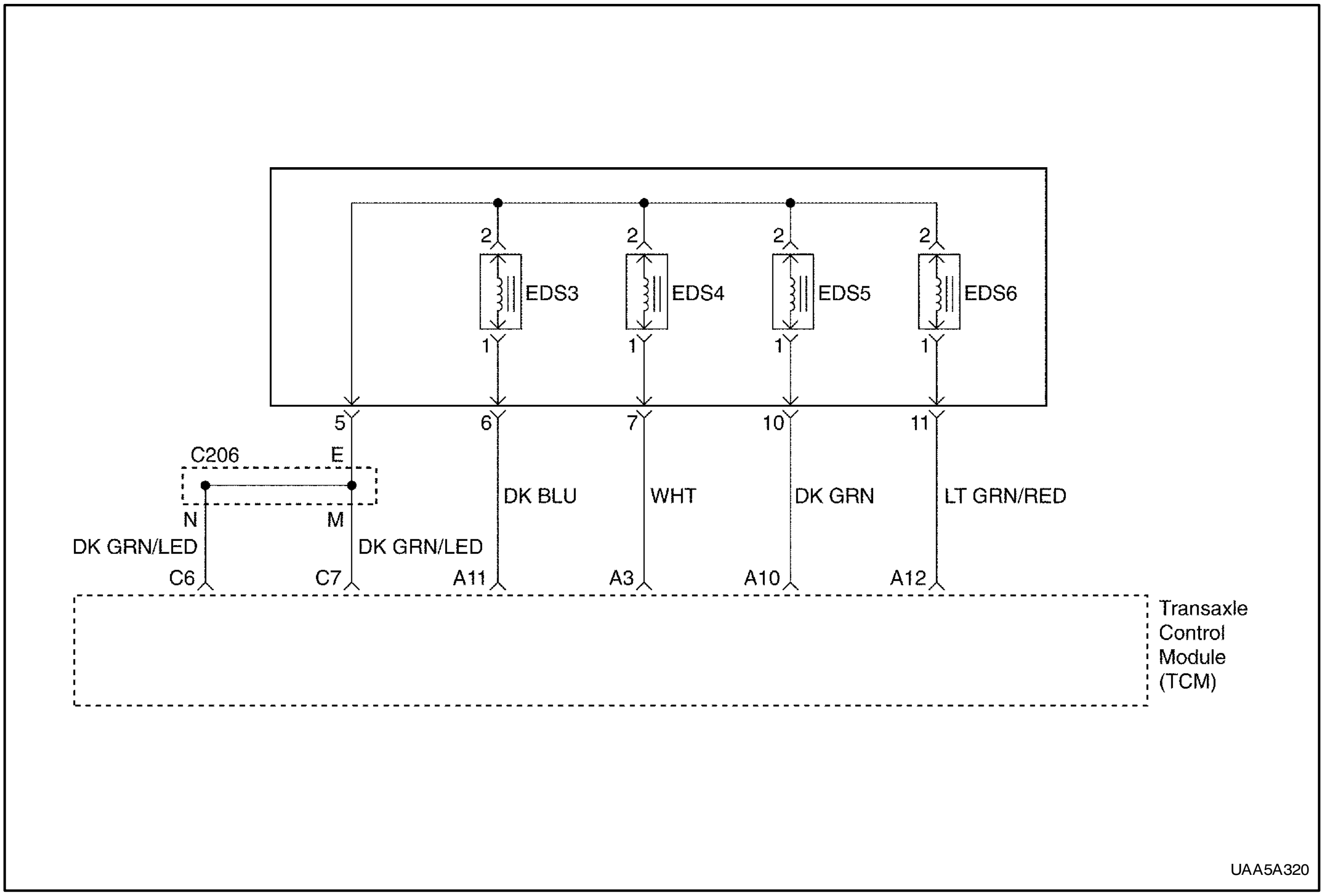
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1855 sets, the replacement of solenoid 2 is recommended.

DTC P1855 – SOLENOID 2 Output Open

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Select “Actuating” on the scan tool. 4. Actuate solenoid 2 is ON/OFF. Does the solenoid 2 change ON/?	ON/OFF	Go to “Diagnostic Aids”	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector. 3. Measure the resistance between terminal 3 and 12 the transaxle wiring connector. Is the resistance within the values shown?	TFT 25bC 6Ω	Go to Step 7	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the wiring connector of the solenoid 2. 3. Measure the resistance between terminal 1 of the solenoid 2 and terminal 13 of the transaxle connector. 4. Measure the resistance between terminal 2 of the solenoid 2 and terminal 3 of the transaxle connector. Is the resistance within the values shown?	0Ω	Go to Step 6	Go to Step 5
5	1. Repair the line(between terminal 1 and terminal 13) for open. 2. Repair the line(between terminal 2 and terminal 3) for open. Is the repair complete?	–	System OK	–
6	Replace the solenoid 2. Is the replacement complete?	–	System OK	–
7	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 3 of the transaxle wiring connector and terminal C7 of the TCM wiring connector. 3. Measure the resistance between terminal 13 of the transaxle wiring connector and terminal A9 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 9	Go to Step 8
8	Repair the transaxle wiring harness for open. Is the repair complete?	–	System OK	–
9	Replace the TCM. Is the replacement complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1861 EDS 4 OUTPUT SHORTAGE TO GROUND

Circuit Description

The pressure control valve (EDS valve 3,4,5,6)is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch .

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

Conditions for Setting the DTC

- Output voltage of the EDS 4 is less than 2 volt.
- No DTC P1862, P1863.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition LOCK/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

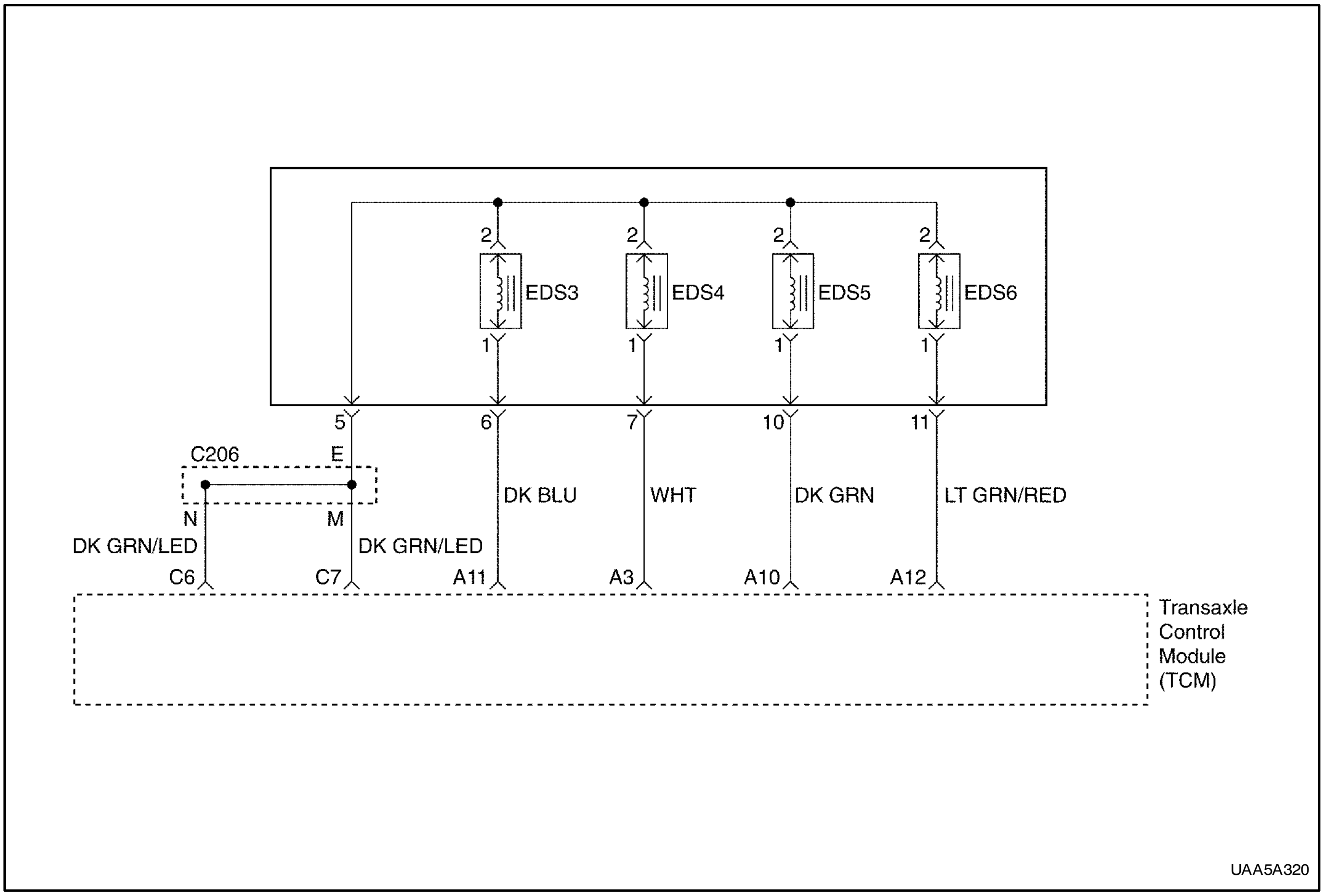
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1861 sets, the replacement of EDS4 valve is recommended.

DTC P1861 – EDS 4 Output Shortage To Ground

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Select “Actuating” on the scan tool. 4. Actuate EDS 4 is ON/OFF. Does the EDS 4 change ON/OFF?	ON/OFF	Go to “Diagnostic Aids”	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector. 3. Measure the resistance between terminal 5 and 7 the transaxle wiring connector. Is the resistance within the values shown?	TFT 25bC 6Ω	Go to Step 7	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the wiring connector of the EDS 4. 3. Measure the resistance between terminal 2 of the EDS 4 and ground. 4. Measure the resistance between terminal 1 of the EDS 4 and ground. Is the resistance within the values shown?	∞	Go to Step 6	Go to Step 5
5	Repair the internal line(EDS 4) for short to ground. Is the repair complete?	–	System OK	–
6	Replace the EDS 4. Is the replacement complete?	–	System OK	–
7	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 5 of the transaxle wiring connector and ground. 3. Measure the resistance between terminal 7 of the transaxle wiring connector and ground. Is the resistance within the values shown?	∞	Go to Step 9	Go to Step 8
8	Repair the transaxle wiring harness for short to ground. Is the repair complete?	–	System OK	–
9	Replace the TCM. Is the replacement complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1862 EDS 4 OUTPUT SHORTAGE TO BATTERY

Circuit Description

The pressure control valve (EDS valve 3,4,5,6) is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch.

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

Conditions for Setting the DTC

- Output voltage of the EDS 4(at ON) is 12 volt.
- No DTC P1861, P1863.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition LOCK/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

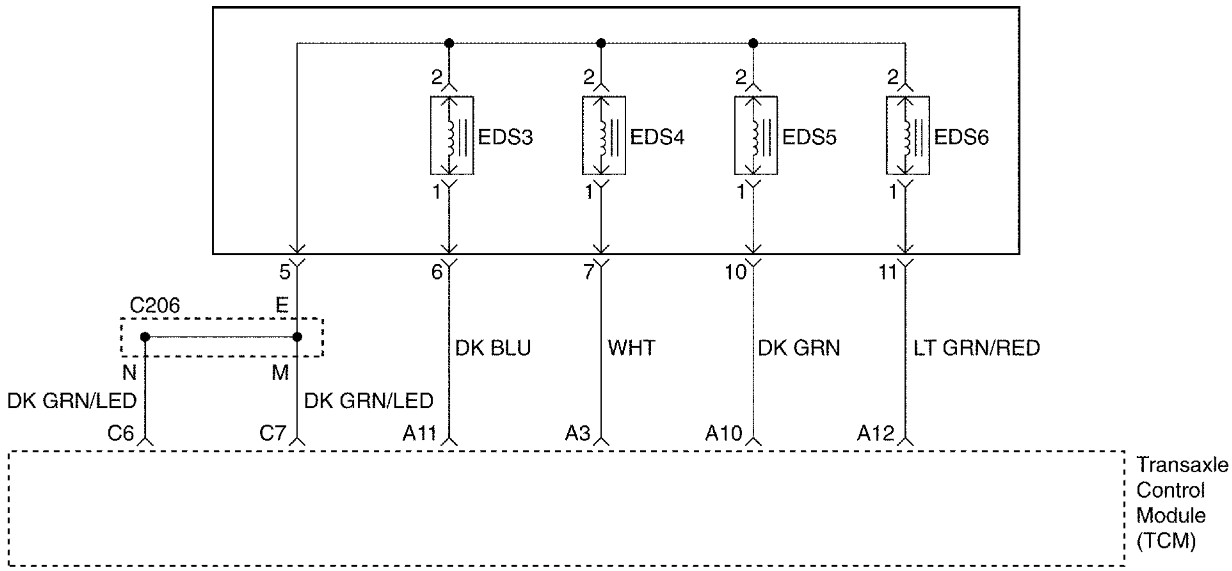
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1862 sets, the replacement of TCM is recommended.

DTC P1862 – EDS 4 Output Shortage To Battery

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Select “Actuating” on the scan tool. 4. Actuate EDS 4 ON/OFF. Does the EDS 4 change ON/OFF?	ON/OFF	Go to “Diagnostic Aids”	Go to Step 3
3	1. Remove the oil pan. 2. Disconnect the wiring connector of the EDS 4. 3. Turn the ignition on, with the engine OFF. 4. Measure the voltage terminal 1 of the EDS 4 wiring connector. Is the voltage within the values shown?	11–14V	Go to Step 4	Go to Step 5
4	Repair the internal line(EDS 4) for short to battery. Is the repair complete?	–	System OK	–
5	Replace the EDS 4. Is the replacement complete?	–	Go to Step 6	–
6	1. Check if any DTCs are set. 2. Are any DTCs displayed that have not been diagnosed?	–	Go to “Applicable DTC table”	System OK



DIAGNOSTIC TROUBLE CODE(DTC) P1863
EDS 4 OUTPUT OPEN

Circuit Description

The pressure control valve (EDS valve 3,4,5,6)is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch .

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

Conditions for Setting the DTC

- Output ampere of the EDS 4 is less than 10mA.
- No DTC P1861, P1862.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition LOCK/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

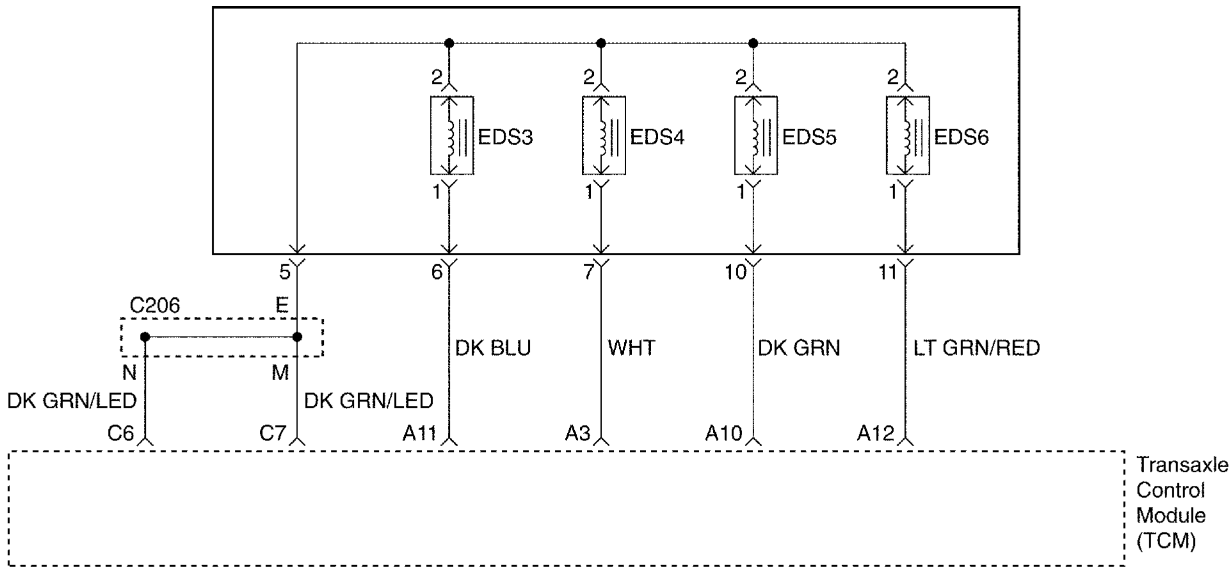
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1863 sets, the replacement of EDS4 valve is recommended.

DTC P1863 – EDS 4 Output Open

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Select "Actuating" on the scan tool. 4. Actuate EDS 4 is ON/OFF. Does the EDS 4 change ON/OFF?	ON/OFF	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector. 3. Measure the resistance between terminal 5 and 7 the transaxle wiring connector. Is the resistance within the values shown?	TFT 25bC 6Ω	Go to Step 7	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the wiring connector of the EDS 4. 3. Measure the resistance between terminal 2 of the EDS 4 and terminal 5 of the transaxle connector. 4. Measure the resistance between terminal 1 of the EDS 4 and terminal 7 of the transaxle connector. Is the resistance within the values shown?	0Ω	Go to Step 6	Go to Step 5
5	1. Repair the circuit(between terminal 2 and terminal 5) for open. 2. Repair the circuit(between terminal 1 and terminal 7) for open. Is the repair complete?	–	System OK	–
6	Replace the EDS 4. Is the replacement complete?	–	System OK	–
7	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 5 of the transaxle wiring connector and terminal C7 of the TCM wiring connector. 3. Measure the resistance between terminal 7 of the transaxle wiring connector and terminal A3 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 9	Go to Step 8
8	Repair the transaxle wiring harness for open. Is the repair complete?	–	System OK	–
9	Replace the TCM. Is the replacement complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1864
EDS 5 OUTPUT SHORTAGE TO GROUND

Circuit Description

The pressure control valve (EDS valve 3,4,5,6) is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch.

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

Conditions for Setting the DTC

- Output voltage of the EDS 5 is less than 2 volt.
- No DTC P1865, P1866.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

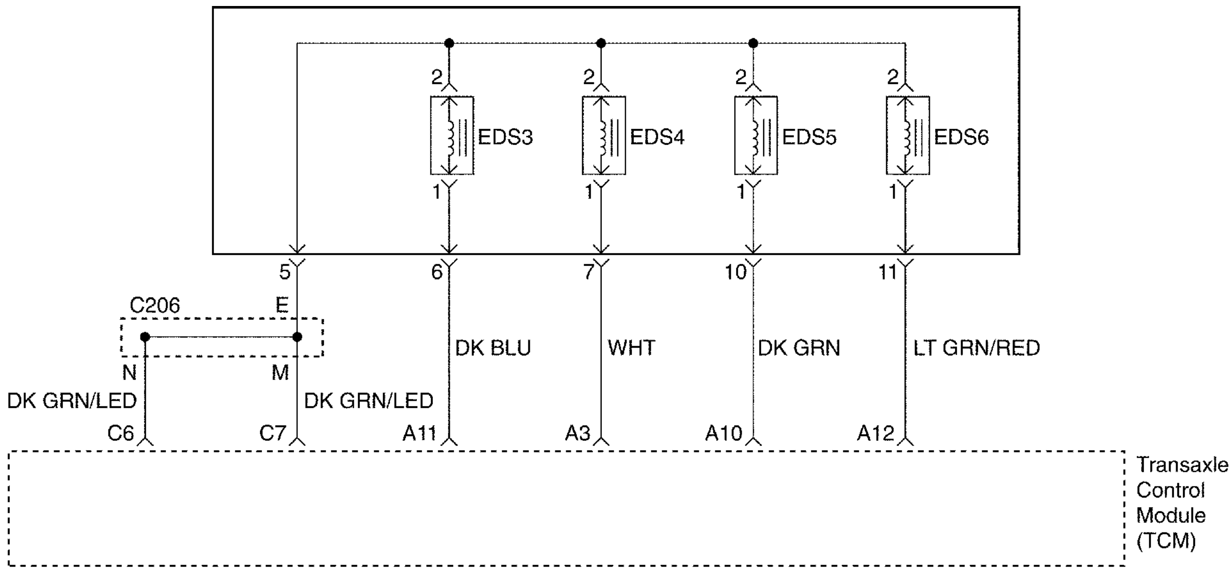
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1864 sets, the replacement of EDS valve is recommended.

DTC P1864 – EDS 5 Output Shortage To Ground

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Select "Actuating" on the scan tool. 4. Actuate EDS 5 is ON/OFF. Does the EDS 5 change ON/OFF?	ON/OFF	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector. 3. Measure the resistance between terminal 5 and 10 the transaxle wiring connector. Is the resistance within the values shown?	TFT 25bC 6Ω	Go to Step 7	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the wiring connector of the EDS 5. 3. Measure the resistance between terminal 2 of the EDS 5 and ground. 4. Measure the resistance between terminal 1 of the EDS 5 and ground. Is the resistance within the values shown?	∞	Go to Step 6	Go to Step 5
5	Repair the internal line(EDS 5) for short to ground. Is the action complete?	–	System OK	–
6	Replace the EDS 5. Is the action complete?	–	System OK	–
7	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 5 of the transaxle wiring connector and ground. 3. Measure the resistance between terminal 10 of the transaxle wiring connector and ground. Is the resistance within the values shown?	∞	Go to Step 9	Go to Step 8
8	Repair the transaxle wiring harness for short to ground. Is the action complete?	–	System OK	–
9	Replace the TCM. Is the action complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1865 EDS 5 OUTPUT SHORTAGE TO BATTERY

Circuit Description

The pressure control valve (EDS valve 3,4,5,6) is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch.

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

Conditions for Setting the DTC

- Output voltage of the EDS 5(at ON) is 12 volt.
- No DTC P1864, P1866.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

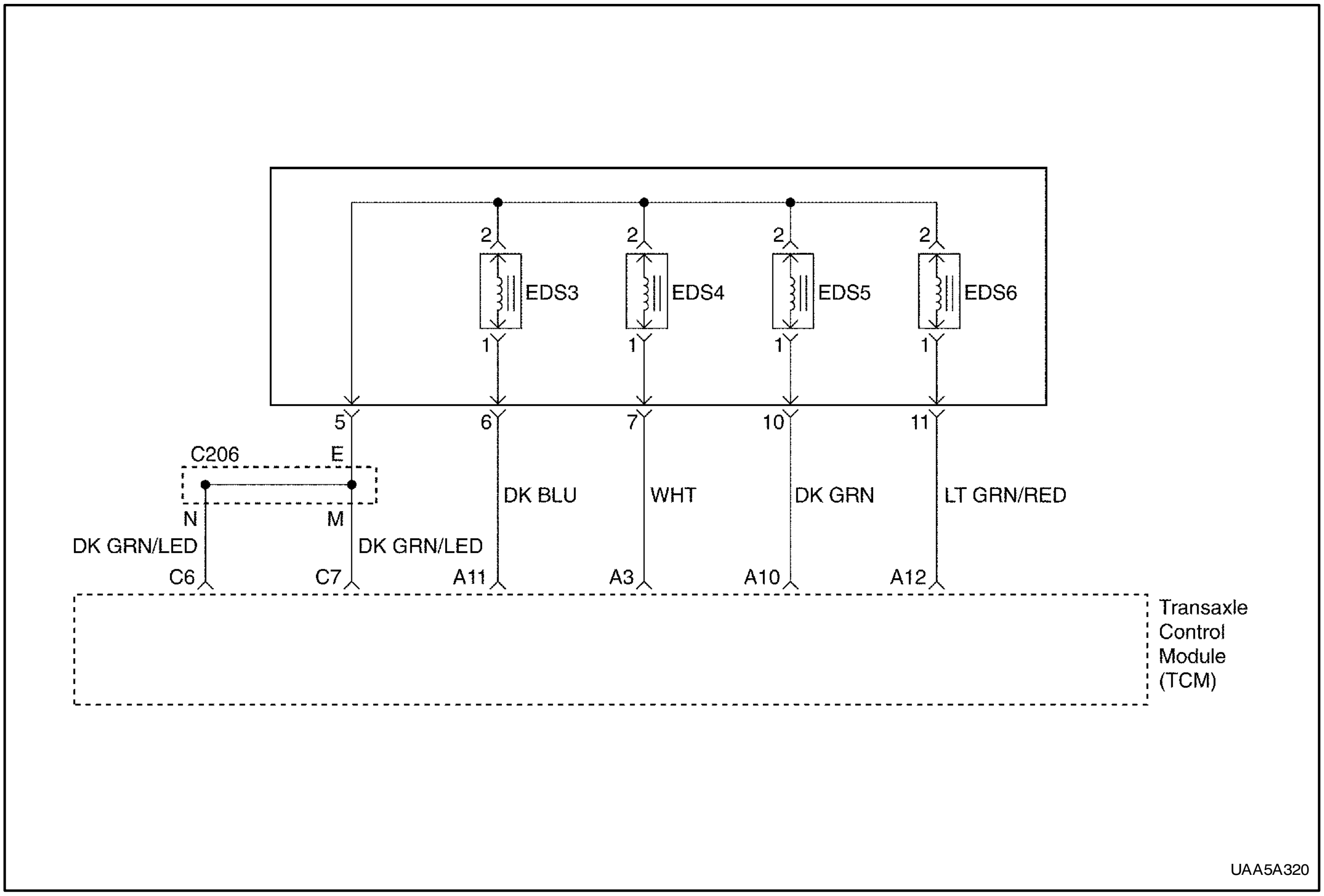
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1865 sets, the replacement of EDS is recommended.

DTC P1865 – EDS 5 Output Shortage To Battery

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Select "Actuating" on the scan tool. 4. Actuate EDS 5 ON/OFF. Does the EDS 5 change ON/OFF?	ON/OFF	Go to "Diagnostic Aids"	Go to Step 3
3	1. Remove the oil pan. 2. Disconnect the wiring connector of the EDS 5. 3. Turn the ignition on, with the engine OFF. 4. Measure the voltage terminal 2 of the EDS 5 wiring connector. Is the voltage within the values shown?	11–14V	Go to Step 4	Go to Step 5
4	Repair the internal line(EDS 5) for short to battery. Is the action complete?	–	System OK	–
5	Replace the EDS 5. Is the action complete?	–	Go to Step 6	–
6	1. Check if any DTCs are set. 2. Are any DTCs displayed that have not been diagnosed?	–	Go to "Applicable DTC table"	System OK



DIAGNOSTIC TROUBLE CODE(DTC) P1866
EDS 5 OUTPUT OPEN

Circuit Description

The pressure control valve (EDS valve 3,4,5,6) is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch.

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

Conditions for Setting the DTC

- Output ampere of the EDS 5 is less than 10mA.
- No DTC P1864, P1865.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

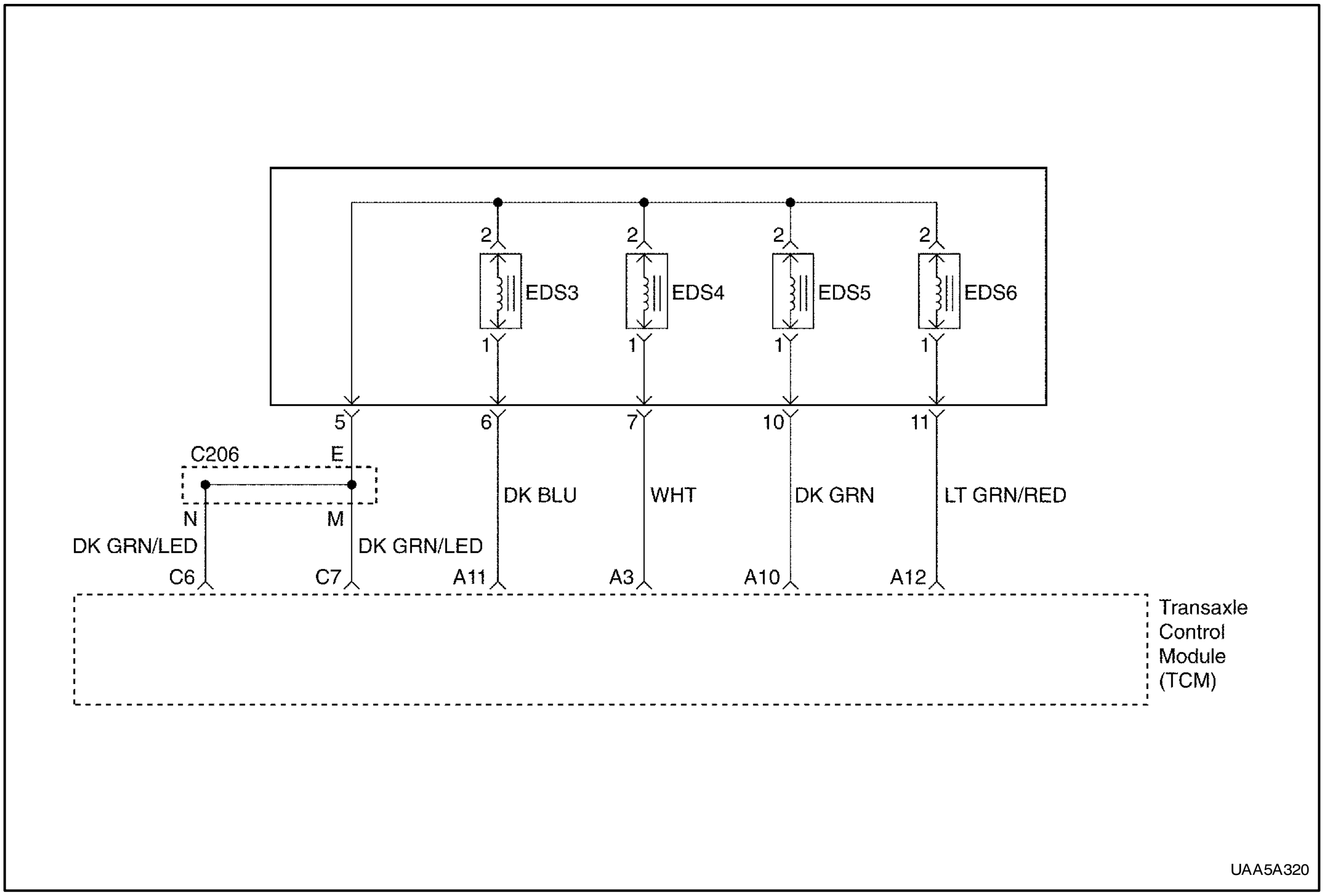
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1866 sets, the replacement of EDS valve is recommended.

DTC P1866 – EDS 5 Output Open

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Select “Actuating” on the scan tool. 4. Actuate EDS 5 is ON/OFF. Does the EDS 5 change ON/OFF?	ON/OFF	Go to “Diagnostic Aids”	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector. 3. Measure the resistance between terminal 5 and 10 the transaxle wiring connector. Is the resistance within the values shown?	TFT 25bC 6Ω	Go to Step 7	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the wiring connector of the EDS 5. 3. Measure the resistance between terminal 2 of the EDS 5 and terminal 5 of the transaxle connector. 4. Measure the resistance between terminal 1 of the EDS 5 and terminal 10 of the transaxle connector. Is the resistance within the values shown?	0Ω	Go to Step 6	Go to Step 5
5	1. Repair the circuit(between terminal 2 and terminal 5) for open. 2. Repair the circuit(between terminal 1 and terminal 10) for open. Is the action complete?	–	System OK	–
6	Replace the EDS 5. Is the action complete?	–	System OK	–
7	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 5 of the transaxle wiring connector and terminal C7 of the TCM wiring connector. 3. Measure the resistance between terminal 10 of the transaxle wiring connector and terminal A10 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 9	Go to Step 8
8	Repair the transaxle wiring harness for open. Is the action complete?	–	System OK	–
9	Replace the TCM. Is the action complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1867 EDS 6 OUTPUT SHORTAGE TO GROUND

Circuit Description

The pressure control valve (EDS valve 3,4,5,6) is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch.

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

Conditions for Setting the DTC

- Output voltage of the EDS 6 is less than 2 volt.
- No DTC P1868, P1869.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

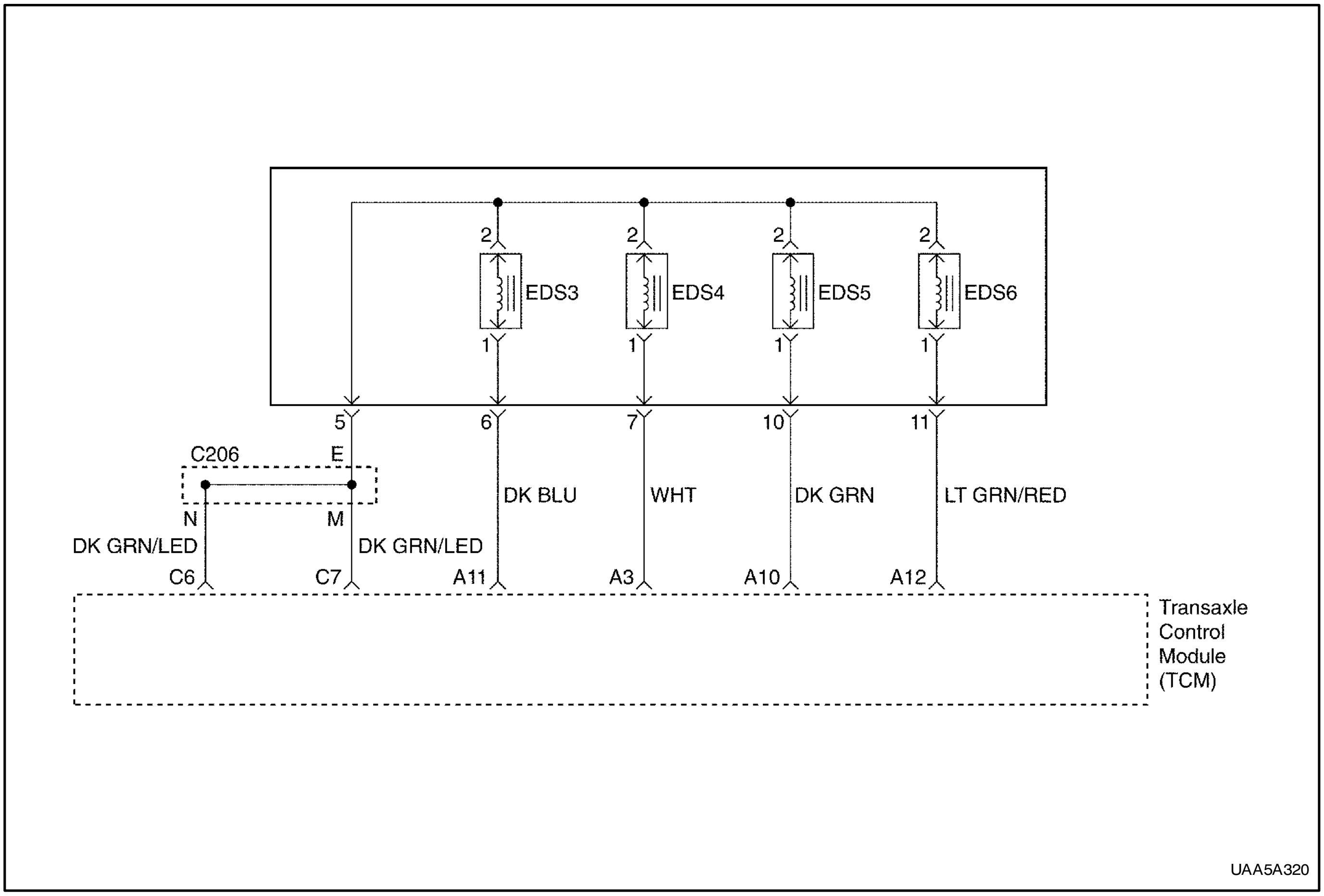
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1867 sets, the replacement of EDS valve is recommended.

DTC P1867 – EDS 6 Output Shortage To Ground

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Select “Actuating” on the scan tool. 4. Actuate EDS 6 is ON/OFF. Does the EDS 6 change ON/OFF?	ON/OFF	Go to “Diagnostic Aids”	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector. 3. Measure the resistance between terminal 5 and 11 the transaxle wiring connector. Is the resistance within the values shown?	TFT 25bC 6Ω	Go to Step 7	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the wiring connector of the EDS 6. 3. Measure the resistance between terminal 2 of the EDS 6 and ground. 4. Measure the resistance between terminal 1 of the EDS 6 and ground. Is the resistance within the values shown?	∞	Go to Step 6	Go to Step 5
5	Repair the internal line(EDS 6) for short to ground. Is the action complete?	–	System OK	–
6	Replace the EDS 6. Is the action complete?	–	System OK	–
7	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 5 of the transaxle wiring connector and ground. 3. Measure the resistance between terminal 11 of the transaxle wiring connector and ground. Is the resistance within the values shown?	∞	Go to Step 9	Go to Step 8
8	Repair the transaxle wiring harness for short to ground. Is the action complete?	–	System OK	–
9	Replace the TCM. Is the action complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1868 EDS 6 OUTPUT SHORTAGE TO BATTERY

Circuit Description

The pressure control valve (EDS valve 3,4,5,6) is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch.

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

Conditions for Setting the DTC

- Output voltage of the EDS 6(at ON) is 12 volt.
- No DTC P1867, P1869.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

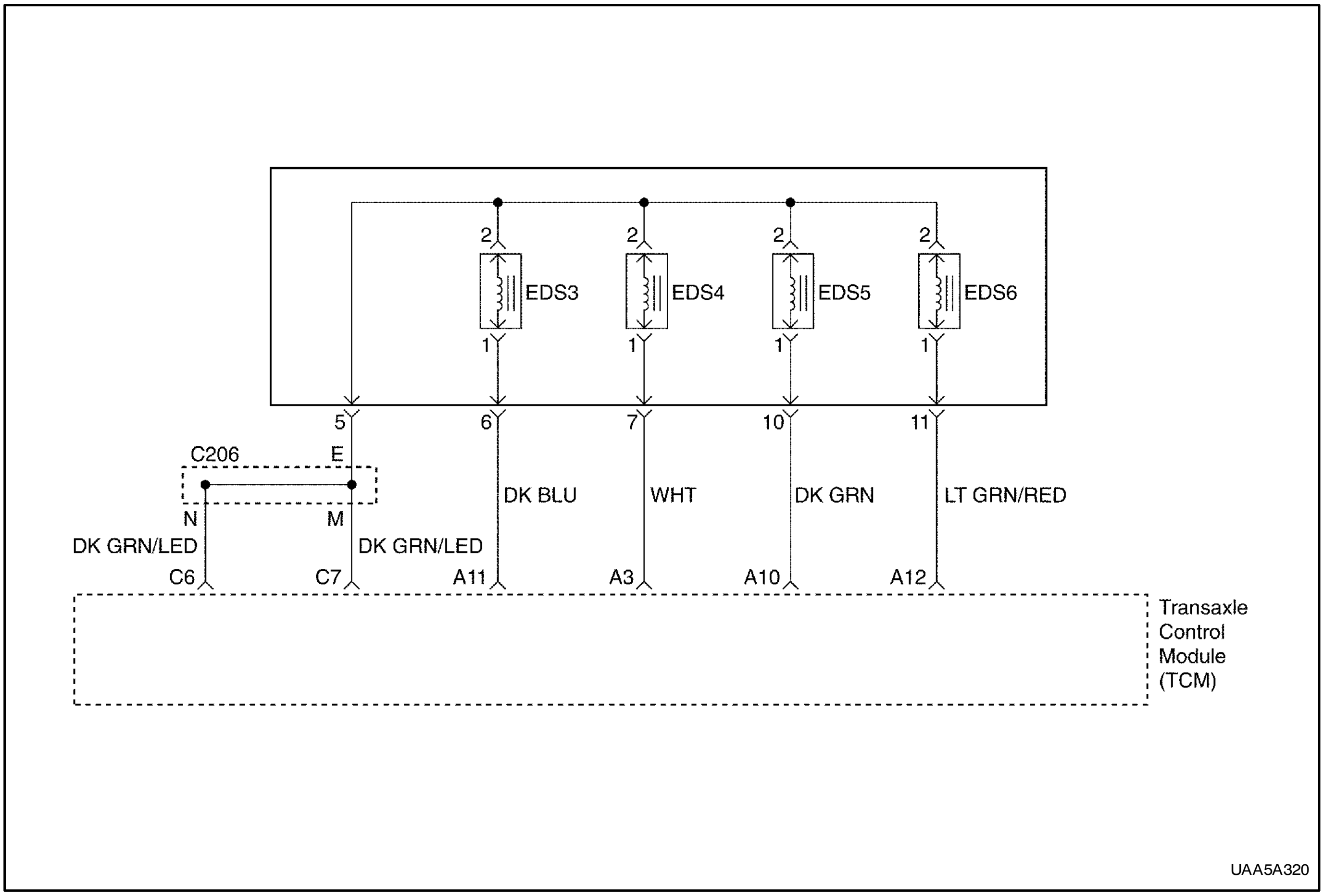
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1868 sets, the replacement of TCM is recommended.

DTC P1868 – EDS 6 Output Shortage To Battery

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Select “Actuating” on the scan tool. 4. Actuate EDS 6 ON/OFF. Does the EDS 6 change ON/OFF?	ON/OFF	Go to “Diagnostic Aids”	Go to Step 3
3	1. Remove the oil pan. 2. Disconnect the wiring connector of the EDS 6. 3. Turn the ignition on, with the engine OFF. 4. Measure the voltage terminal 2 of the EDS 6 wiring connector. Is the voltage within the values shown?	11–14V	Go to Step 4	Go to Step 5
4	Repair the internal line(EDS 6) for short to battery. Is the action complete?	–	System OK	–
5	Replace the EDS 6. Is the action complete?	–	Go to Step 6	–
6	1. Check if any DTCs are set. 2. Are any DTCs displayed that have not been diagnosed?	–	Go to “Applicable DTC table”	System OK



DIAGNOSTIC TROUBLE CODE(DTC) P1869
EDS 6 OUTPUT OPEN

Circuit Description

The pressure control valve (EDS valve 3,4,5,6) is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch .

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

Conditions for Setting the DTC

- Output ampere of the EDS 6 is less than 10mA.
- No DTC P1867, P1868.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

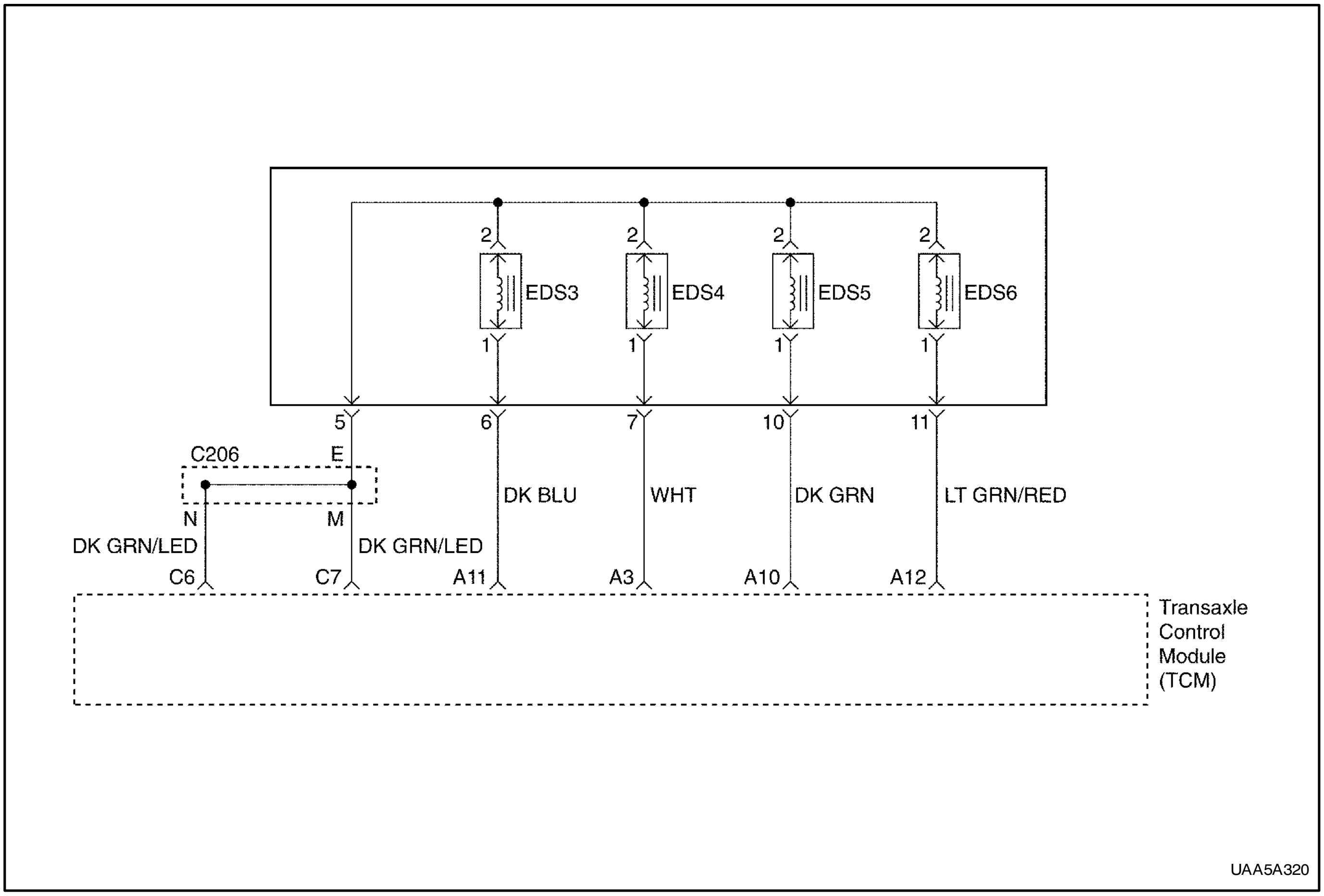
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1869 sets, the replacement of EDS valve is recommended.

DTC P1869 – EDS 6 Output Open

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Select “Actuating” on the scan tool. 4. Actuate EDS 6 is ON/OFF. Does the EDS 6 change ON/OFF?	ON/OFF	Go to “Diagnostic Aids”	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector. 3. Measure the resistance between terminal 5 and 11 the transaxle wiring connector. Is the resistance within the values shown?	TFT 25bC 6Ω	Go to Step 7	Go to Step 4
4	1. Remove the oil pan. 2. Disconnect the wiring connector of the EDS 6. 3. Measure the resistance between terminal 2 of the EDS 6 and terminal 5 of the transaxle connector. 4. Measure the resistance between terminal 1 of the EDS 6 and terminal 11 of the transaxle connector. Is the resistance within the values shown?	0Ω	Go to Step 6	Go to Step 5
5	1. Repair the circuit(between terminal 2 and terminal 5) for open. 2. Repair the circuit(between terminal 1 and terminal 11) for open. Is the action complete?	–	System OK	–
6	Replace the EDS 6. Is the action complete?	–	System OK	–
7	1. Disconnect the transaxle wiring connector and TCM connector. 2. Measure the resistance between terminal 5 of the transaxle wiring connector and terminal C7 of the TCM wiring connector. 3. Measure the resistance between terminal 11 of the transaxle wiring connector and terminal A12 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 9	Go to Step 8
8	Repair the transaxle wiring harness for open. Is the action complete?	–	System OK	–
9	Replace the TCM. Is the action complete?	–	Go to Step 10	–
10	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1870
EDS VALVE POWER SUPPLY CIRCUIT SHORTAGE TO GROUND

Circuit Description

The pressure control valve (EDS valve 3,4,5,6) is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch.

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

Conditions for Setting the DTC

- If the voltage on the ignition voltage applied to high side driver is lower than the value that substracts the constant value(3.5V) to detect shortage to ground from the ignition voltage then a fault is detected.
- No DTC P1871.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

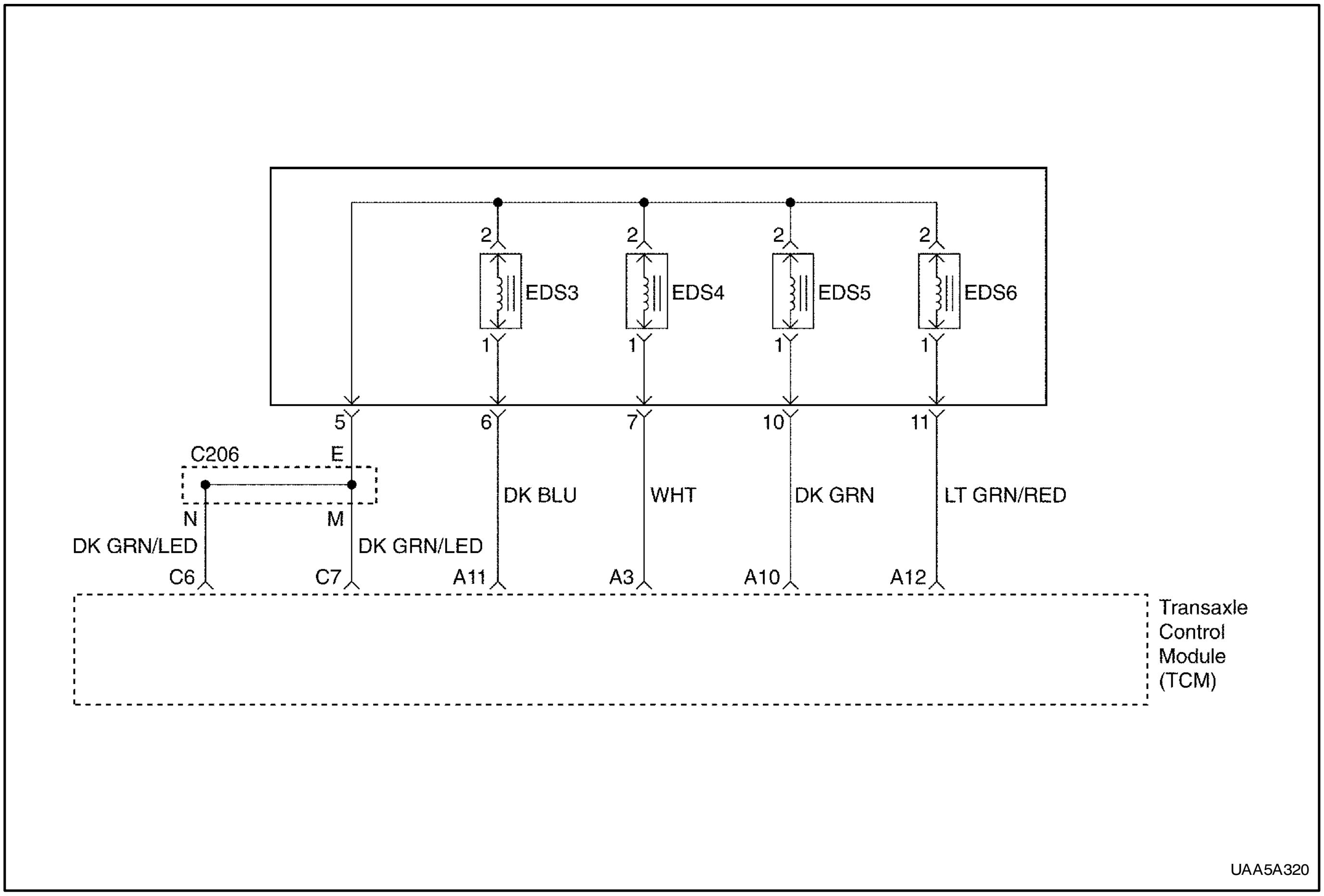
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1870 sets, the repair of EDS valve power supply line is recommended.

DTC P1870 – EDS Valve Power Supply Circuit Shortage To Ground

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Start engine and allow it to warm up at idle. 4. Put gear selector in Park, Neutral and set the parking brake. 5. Observe “EDS 3,4,5,6’s input ampere and output ampere” on the scan tool. Is the resistance within the values shown?	EDS ampere (0–2 Amp)	Go to “Diagnostic Aids”	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector and TCM connector. 3. Measure the resistance between terminal 5 of the transaxle wiring connector and C6 of the TCM wiring connector. 4. Measure the resistance between terminal 5 of the transaxle wiring connector and C7 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 5	Go to Step 4
4	Repair the circuit for short to ground and open. Is the action complete?	–	System OK	–
5	1. Remove the oil pan. 2. Disconnect the EDS 3 wiring connector. 3. Measure the resistance between terminal 5 of the transaxle wiring connector and 2 of the EDS 3 wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 7	Go to Step 6
6	Repair the circuit(power supply lines) for short to ground and open. Is the action complete?	–	System OK	–
7	Replace the TCM. Is the action complete?	–	Go to Step 8	–
8	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1871
EDS VALVE POWER SUPPLY CIRCUIT SHORTAGE TO BATTERY

Circuit Description

The pressure control valve (EDS valve 3,4,5,6) is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch.

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

Conditions for Setting the DTC

- If the voltage on the ignition voltage applied to high side driver is higher than the threshold(6V) with high side driver switch off status then a fault is detected.
- No DTC P1870.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear by hydraulic control.
- After ignition OFF/ON : 3rd gear by hydraulic control. Possible P, R and N also possible.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

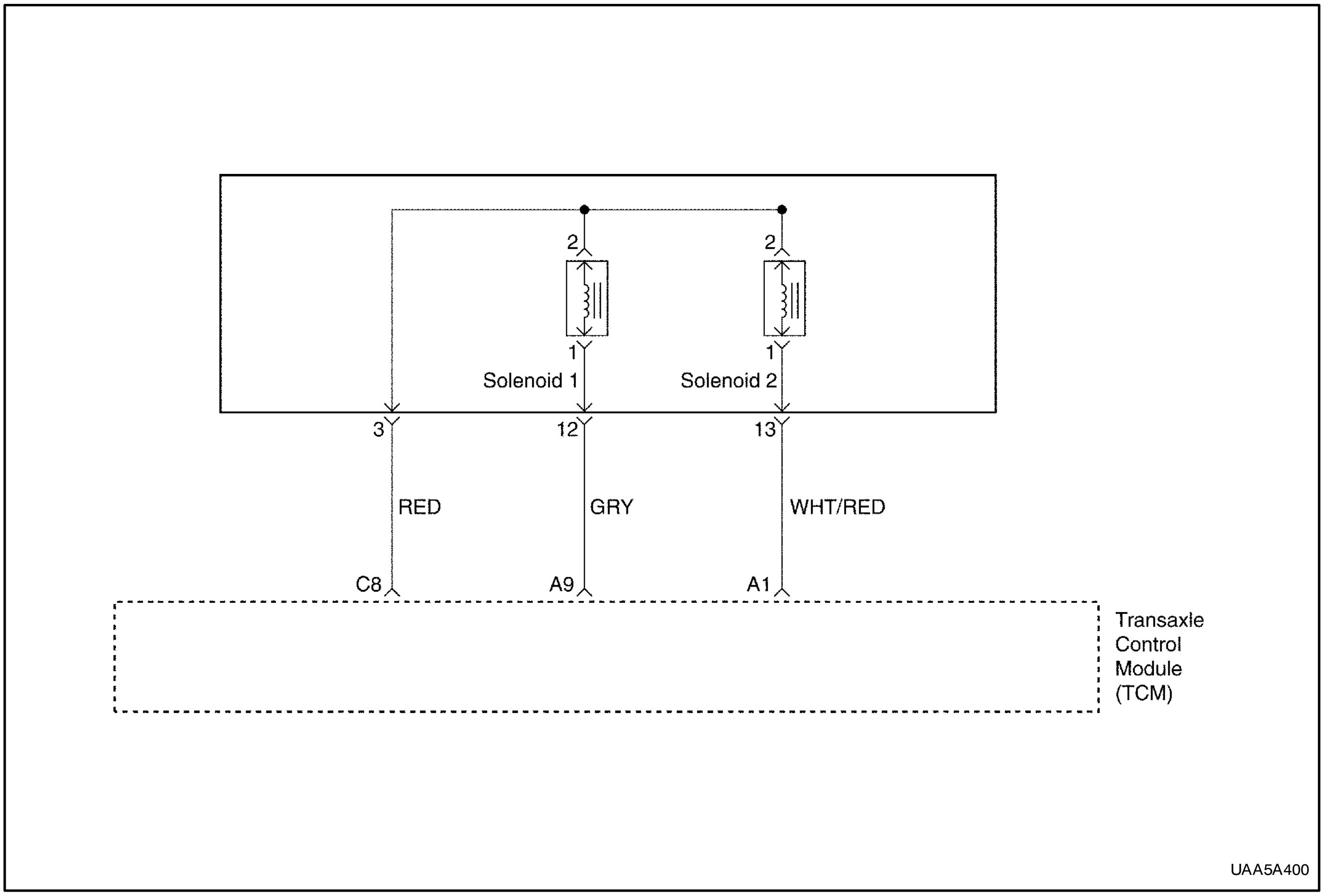
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1871 sets, the repair of EDS valve power supply line is recommended.

DTC P1871 – EDS Valve Power Supply Circuit Shortage To Battery

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Start engine and allow it to warm up at idle. 4. Put gear selector in Park, Neutral and set the parking brake. 5. Observe “EDS 3,4,5,6’s input ampere and output ampere” on the scan tool. Is the resistance within the values shown?	EDS ampere (0–2 Amp)	Go to “Diagnostic Aids”	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector and TCM connector. 3. Measure the voltage terminal 5 of the transaxle wiring. Is the voltage within the values shown?	11–14V	Go to Step 4	Go to Step 5
4	Repair the circuit for short to battery. Is the action complete?	–	System OK	–
5	1. Remove the oil pan. 2. Disconnect the EDS valve wiring connector. 3. Turn the ignition ON. 4. Measure the voltage terminal 2 of the EDS 3. 5. Measure the voltage terminal 2 of the EDS 4. 6. Measure the voltage terminal 2 of the EDS 5. 7. Measure the voltage terminal 2 of the EDS 6. Is the voltage within the values shown?	11–14V	Go to Step 6	Go to Step 7
6	Repair the circuits(power supply lines) for short to battery. Is the action complete?	–	System OK	–
7	Replace the TCM. Is the action complete?	–	Go to Step 8	–
8	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1873
SOLENOID VALVE POWER SUPPLY CIRCUIT SHORTAGE TO GROUND

Circuit Description

The pressure control valve (EDS valve 3,4,5,6) is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch.

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

Conditions for Setting the DTC

- No DTC P1874.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

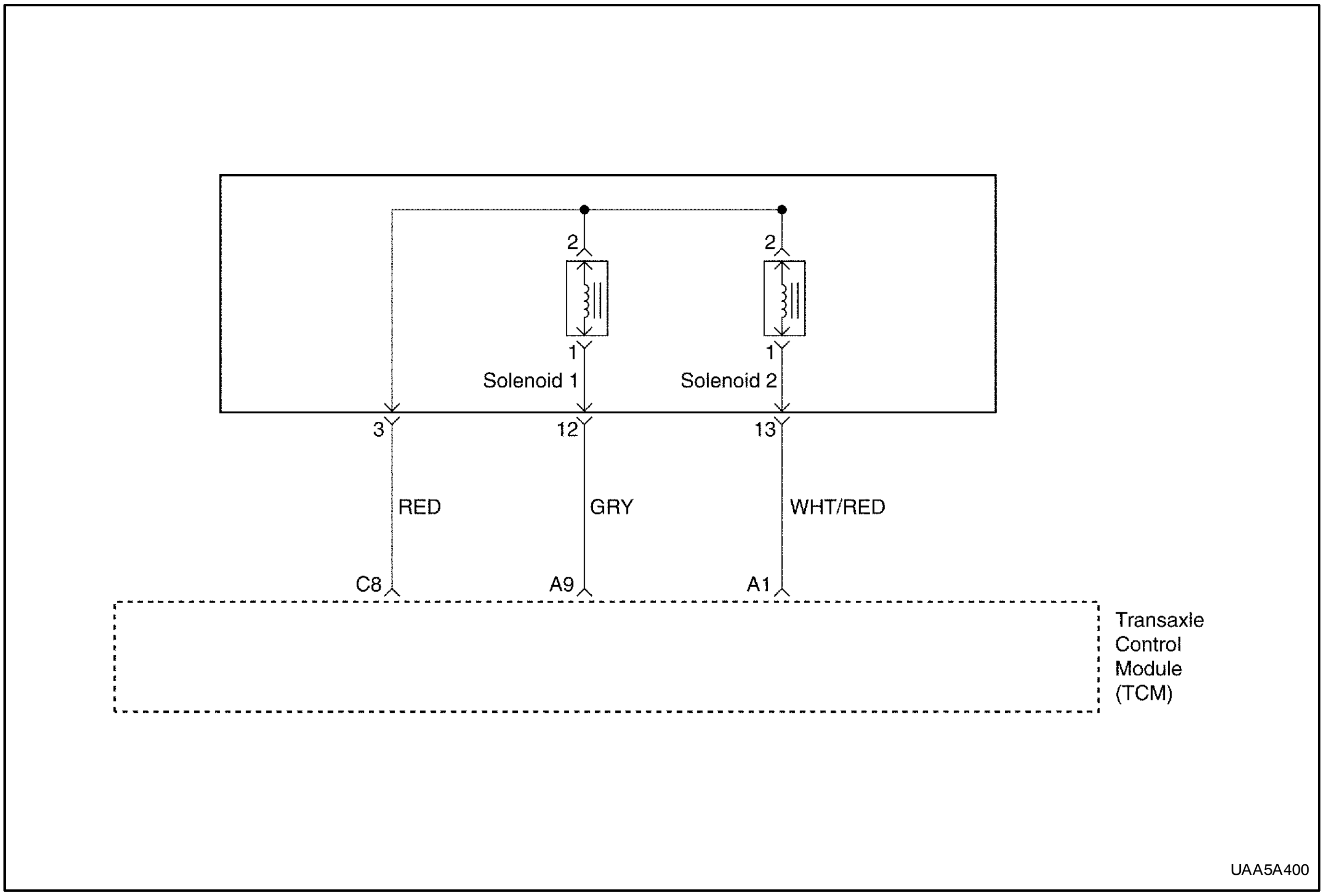
- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1873 sets, the repair of solenoid valve power supply line is recommended.

DTC P1873 – Solenoid Valve Power Supply Circuit Shortage To Ground

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Start engine and allow it to warm up at idle. 4. Put gear selector in Park, Neutral and set the parking brake. 5. Observe “solenoid 1,2” on the scan tool. Is the solenoid ON ?	–	Go to “Diagnostic Aids”	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector and TCM connector. 3. Measure the resistance between terminal 3 of the transaxle wiring connector and C8 of the TCM wiring connector. Is the resistance within the values shown?	0Ω	Go to Step 5	Go to Step 4
4	Repair the circuit for short to ground and open. Is the action complete?	–	System OK	–
5	1. Remove the oil pan. 2. Disconnect the solenoid wiring connector. 3. Measure the resistance between terminal 3 of the transaxle wiring connector and 2 of the solenoid 1 wiring connector. Is the resistance within the values shown?.	0Ω	Go to Step 7	Go to Step 8
6	Repair the circuit(power supply lines) for short to ground and open. Is the action complete?	–	System OK	–
7	Replace the TCM. Is the action complete?	–	Go to Step 8	–
8	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart



DIAGNOSTIC TROUBLE CODE(DTC) P1874
SOLENOID VALVE POWER SUPPLY CIRCUIT SHORTAGE TO BATTERY

Circuit Description

The pressure control valve (EDS valve 3,4,5,6) is a precision electronic pressure regulator that controls the operations of each clutches, brakes, lock-up clutch.

The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are charged. It is possible to sue smaller solenoid valves as a result. The EDS require a constant input pressure.

Conditions for Setting the DTC

- No DTC P1873.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear.
- Power supply cut off to the EDS valve.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1874 sets, the repair of solenoid valve power supply line is recommended.

DTC P1874 – Solenoid Valve Power Supply Circuit Shortage to Battery

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Start engine and allow it to warm up at idle. 4. Put gear selector in Park, Neutral and set the parking brake. 5. Observe “solenoid 1,2” on the scan tool. Is the solenoid ON ?	–	Go to “Diagnostic Aids”	Go to Step 3
3	1. Turn the ignition LOCK. 2. Disconnect the transaxle wiring connector and TCM connector. 3. Measure the voltage terminal 3 of the transaxle wiring. Is the voltage within the values shown?	11–14V	Go to Step 4	Go to Step 5
4	Repair the circuit for short to battery. Is the action complete?	–	System OK	–
5	1. Remove the oil pan. 2. Disconnect the solenoid 1,2 wiring connector. 3. Turn the ignition ON. 4. Measure the voltage terminal 2 of the solenoid 1. 5. Measure the voltage terminal 2 of the solenoid 1. Is the voltage within the values shown?	11–14V	Go to Step 6	Go to Step 7
6	Repair the circuits(power supply lines) for short to battery. Is the action complete?	–	System OK	–
7	Replace the TCM. Is the action complete?	–	Go to Step 8	–
8	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. Has the last test failed or is the current DTC displayed?	–	Begin diagnosis again	Repair verified exit DTC chart

Range	Park/ Neutral	Reverse	D				3			2		1
Gear	N	R	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	1st
Solenoid Valve 1	ON	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF
Solenoid Valve 2	ON	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
Line Pressure Control Solenoid Valve 3 (EDS 3)	OFF	OFF	OFF	ON	ON/ OFF	ON/ OFF	OFF	ON	ON/ OFF	OFF	ON	ON/ OFF
Line Pressure Control Solenoid Valve 4 (EDS 4)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Line Pressure Control Solenoid Valve 5 (EDS 5)	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	ON
Line Pressure Control Solenoid Valve 6 (EDS 6)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Brake B	A	A	A		A		A		A	A		A
Brake C						H						
Brake D		H										
Clutch E				A	A	A		A	A		A	
Brake F			H	H			H	H		H	H	H
Lock–up Clutch						A						

A = Applied
H = Holding
ON = The solenoid is energized.
OFF = The solenoid is de-energized.
** = Manual Second–Third gear is only available above approximately 100 km/h (62 mph).
*** = Manual First–Second gear is only available above approximately 100 km/h (62 mph).
NOTE: Manual First–Third gear is also possible at high vehicle speed as a safety feature.

DIAGNOSTIC TROUBLE CODE(DTC) P1881
2–1 SHIFT MALFUNCTION

Circuit Description

The special feature of 4HP 16 Auto Transaxle is that it operates without freewheels. Shifting between individual gears takes place by means of overlapping clutch engagement and release.

The advantage of overlap shifting are as follows:

- The transaxle can be of more compact design and is lighter on account of the absence of freewheels and the lower number of shift elements.
- Lower drag losses, i.e. higher efficiency.
- Lower peak torque acting on the components and driveline.

However, overlap shifting necessitates high-performance hardware and software, and precision engine signals.

Conditions for Setting the DTC

- Engine is running.
- No DTC P1885, P1886.
- No DTC P1883, P1884.
- No DTC P0783, P0782, P0781.
- Selector lever is not N(Neutral), P(Park) position.
- Engine torque is unstable state.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 3rd gear.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1881 sets, the replacement of T/M is recommended.

DTC P1881 – 2–1 shift malfunction

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Start engine and allow it to warm up at idle. 4. Observe "engine revolution, idle rpm, TPS and so on" on the scan tool. Was a problem found?	–	Go to "Engine diagnostic information"	Go to Step 3
3	Inspect "ECU". Refer to Section 1F Engine diagnostic information and procedures. Was a problem found?	–	Go to "Engine diagnostic information"	Go to Step 4
4	1. Turn the ignition LOCK. 2. Disconnect the TCM wiring connector. 3. Measure the voltage between terminal B3 of and B13 of the transaxle wiring connector. 4. Turn the ignition ON. 5. Measure the voltage between terminal C15 of and B13 of the transaxle wiring connector. 6. Measure the voltage between terminal C16 of and B13 of the transaxle wiring connector. Is the voltage within the values shown?	11–14V	Go to Step 5	Go to "System voltage low or high"
5	Replace the TCM. Is the action complete?	–	Go to Step 8	–
6	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Replace transaxle assembly	Repair verified exit DTC chart

Range	Park/ Neutral	Reverse	D				3			2		1
Gear	N	R	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	1st
Solenoid Valve 1	ON	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF
Solenoid Valve 2	ON	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
Line Pressure Control Solenoid Valve 3 (EDS 3)	OFF	OFF	OFF	ON	ON/ OFF	ON/ OFF	OFF	ON	ON/ OFF	OFF	ON	ON/ OFF
Line Pressure Control Solenoid Valve 4 (EDS 4)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Line Pressure Control Solenoid Valve 5 (EDS 5)	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	ON
Line Pressure Control Solenoid Valve 6 (EDS 6)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Brake B	A	A	A		A		A		A	A		A
Brake C						H						
Brake D		H										
Clutch E				A	A	A		A	A		A	
Brake F			H	H			H	H		H	H	H
Lock–up Clutch						A						

A = Applied
H = Holding
ON = The solenoid is energized.
OFF = The solenoid is de-energized.
** = Manual Second–Third gear is only available above approximately 100 km/h (62 mph).
*** = Manual First–Second gear is only available above approximately 100 km/h (62 mph).
NOTE: Manual First–Third gear is also possible at high vehicle speed as a safety feature.

DIAGNOSTIC TROUBLE CODE(DTC) P1883
3–2 SHIFT MALFUNCTION

Circuit Description

The special feature of 4HP 16 Auto Transaxle is that it operates without freewheels. Shifting between individual gears takes place by means of overlapping clutch engagement and release.

The advantage of overlap shifting are as follows:

- The transaxle can be of more compact design and is lighter on account of the absence of freewheels and the lower number of shift elements.
- Lower drag losses, i.e. higher efficiency.
- Lower peak torque acting on the components and driveline.

However, overlap shifting necessitates high-performance hardware and software, and precision engine signals.

Conditions for Setting the DTC

- Engine is running.
- No DTC P1885, P1886.
- No DTC P1881, P1884.
- No DTC P0783, P0782, P0781.
- Selector lever is not N(Neutral), P(Park) position.
- Engine torque is unstable state.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 3rd gear.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1883 sets, the replacement of T/M is recommended.

DTC P1883 – 3–2 shift malfunction

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Start engine and allow it to warm up at idle. 4. Observe “engine revolution, idle rpm, TPS and so on” on the scan tool. Was a problem found?	–	Go to “Engine diagnostic information”	Go to Step 3
3	Inspect “ECU”. Refer to Section 1F Engine diagnostic information and procedures. Was a problem found?	–	Go to “Engine diagnostic information”	Go to Step 4
4	1. Turn the ignition LOCK. 2. Disconnect the TCM wiring connector. 3. Measure the voltage between terminal B3 of and B13 of the transaxle wiring connector. 4. Turn the ignition ON. 5. Measure the voltage between terminal C15 of and B13 of the transaxle wiring connector. 6. Measure the voltage between terminal C16 of and B13 of the transaxle wiring connector. Is the voltage within the values shown?	11–14V	Go to Step 5	Go to “System voltage low or high”
5	Replace the TCM. Is the action complete?	–	Go to Step 8	–
6	1. After the repair, use a scan tool “clear info” function and road test the vehicle. 2. Review the “DTC info”. Has the last test failed or is the current DTC displayed?	–	Replace transaxle assembly	Repair verified exit DTC chart

Range	Park/ Neutral	Reverse	D				3			2		1
Gear	N	R	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	1st
Solenoid Valve 1	ON	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF
Solenoid Valve 2	ON	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
Line Pressure Control Solenoid Valve 3 (EDS 3)	OFF	OFF	OFF	ON	ON/ OFF	ON/ OFF	OFF	ON	ON/ OFF	OFF	ON	ON/ OFF
Line Pressure Control Solenoid Valve 4 (EDS 4)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Line Pressure Control Solenoid Valve 5 (EDS 5)	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	ON
Line Pressure Control Solenoid Valve 6 (EDS 6)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Brake B	A	A	A		A		A		A	A		A
Brake C						H						
Brake D		H										
Clutch E				A	A	A		A	A		A	
Brake F			H	H			H	H		H	H	H
Lock–up Clutch						A						

A = Applied
H = Holding
ON = The solenoid is energized.
OFF = The solenoid is de-energized.
** = Manual Second–Third gear is only available above approximately 100 km/h (62 mph).
*** = Manual First–Second gear is only available above approximately 100 km/h (62 mph).
NOTE: Manual First–Third gear is also possible at high vehicle speed as a safety feature.

DIAGNOSTIC TROUBLE CODE(DTC) P1884
4–3 SHIFT MALFUNCTION

Circuit Description

The special feature of 4HP 16 Auto Transaxle is that it operates without freewheels. Shifting between individual gears takes place by means of overlapping clutch engagement and release.

The advantage of overlap shifting are as follows:

- The transaxle can be of more compact design and is lighter on account of the absence of freewheels and the lower number of shift elements.
- Lower drag losses, i.e. higher efficiency.
- Lower peak torque acting on the components and driveline.

However, overlap shifting necessitates high-performance hardware and software, and precision engine signals.

Conditions for Setting the DTC

- Engine is running.
- No DTC P1885, P1886.
- No DTC P1881, P1883.
- No DTC P0783, P0782, P0781.
- Selector lever is not N(Neutral), P(Park) position.
- Engine torque is unstable state.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1884 sets, the replacement of T/M is recommended.

DTC P1884 – 4–3 shift malfunction

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Start engine and allow it to warm up at idle. 4. Observe "engine revolution, idle rpm, TPS and so on" on the scan tool. Was a problem found?	–	Go to "Engine diagnostic information"	Go to Step 3
3	Inspect "ECU". Refer to Section 1F Engine diagnostic information and procedures. Was a problem found?	–	Go to "Engine diagnostic information"	Go to Step 4
4	1. Turn the ignition LOCK. 2. Disconnect the TCM wiring connector. 3. Measure the voltage between terminal B3 of and B13 of the transaxle wiring connector. 4. Turn the ignition ON. 5. Measure the voltage between terminal C15 of and B13 of the transaxle wiring connector. 6. Measure the voltage between terminal C16 of and B13 of the transaxle wiring connector. Is the voltage within the values shown?	11–14V	Go to Step 5	Go to "System voltage low or high"
5	Replace the TCM. Is the action complete?	–	Go to Step 8	–
6	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Replace transaxle assembly	Repair verified exit DTC chart

Range	Park/ Neutral	Reverse	D				3			2		1
Gear	N	R	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	1st
Solenoid Valve 1	ON	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF
Solenoid Valve 2	ON	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
Line Pressure Control Solenoid Valve 3 (EDS 3)	OFF	OFF	OFF	ON	ON/ OFF	ON/ OFF	OFF	ON	ON/ OFF	OFF	ON	ON/ OFF
Line Pressure Control Solenoid Valve 4 (EDS 4)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Line Pressure Control Solenoid Valve 5 (EDS 5)	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	ON
Line Pressure Control Solenoid Valve 6 (EDS 6)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Brake B	A	A	A		A		A		A	A		A
Brake C						H						
Brake D		H										
Clutch E				A	A	A		A	A		A	
Brake F			H	H			H	H		H	H	H
Lock–up Clutch						A						

A = Applied
H = Holding
ON = The solenoid is energized.
OFF = The solenoid is de-energized.
** = Manual Second–Third gear is only available above approximately 100 km/h (62 mph).
*** = Manual First–Second gear is only available above approximately 100 km/h (62 mph).
NOTE: Manual First–Third gear is also possible at high vehicle speed as a safety feature.

DIAGNOSTIC TROUBLE CODE(DTC) P1885 3–1 SHIFT MALFUNCTION

Circuit Description

The special feature of 4HP 16 Auto Transaxle is that it operates without freewheels. Shifting between individual gears takes place by means of overlapping clutch engagement and release.

The advantage of overlap shifting are as follows:

- The transaxle can be of more compact design and is lighter on account of the absence of freewheels and the lower number of shift elements.
- Lower drag losses, i.e. higher efficiency.
- Lower peak torque acting on the components and driveline.

However, overlap shifting necessitates high-performance hardware and software, and precision engine signals.

Conditions for Setting the DTC

- Engine is running.
- No DTC P1886, P1881.
- No DTC P1883, P1884.
- No DTC P0783, P0782, P0781.
- Selector lever is not N(Neutral),P(Park) position.
- Engine torque is unstable state.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 3rd gear.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

- When DTC P1885 sets, the replacement of T/M is recommended.

DTC P1885 – 3–1 shift malfunction

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Start engine and allow it to warm up at idle. 4. Observe "engine revolution, idle rpm, TPS and so on" on the scan tool. Was a problem found?	–	Go to "Engine diagnostic information"	Go to Step 3
3	Inspect "ECU". Refer to Section 1F Engine diagnostic information and procedures. Was a problem found?	–	Go to "Engine diagnostic information"	Go to Step 4
4	1. Turn the ignition LOCK. 2. Disconnect the TCM wiring connector. 3. Measure the voltage between terminal B3 of and B13 of the transaxle wiring connector. 4. Turn the ignition ON. 5. Measure the voltage between terminal C15 of and B13 of the transaxle wiring connector. 6. Measure the voltage between terminal C16 of and B13 of the transaxle wiring connector. Is the voltage within the values shown?	11–14V	Go to Step 5	Go to "System voltage low or high"
5	Replace the TCM. Is the action complete?	–	Go to Step 8	–
6	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Replace transaxle assembly	Repair verified exit DTC chart

Range	Park/ Neutral	Reverse	D				3			2		1
Gear	N	R	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	1st
Solenoid Valve 1	ON	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF
Solenoid Valve 2	ON	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
Line Pressure Control Solenoid Valve 3 (EDS 3)	OFF	OFF	OFF	ON	ON/ OFF	ON/ OFF	OFF	ON	ON/ OFF	OFF	ON	ON/ OFF
Line Pressure Control Solenoid Valve 4 (EDS 4)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Line Pressure Control Solenoid Valve 5 (EDS 5)	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	ON
Line Pressure Control Solenoid Valve 6 (EDS 6)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Brake B	A	A	A		A		A		A	A		A
Brake C						H						
Brake D		H										
Clutch E				A	A	A		A	A		A	
Brake F			H	H			H	H		H	H	H
Lock–up Clutch						A						

A = Applied
H = Holding
ON = The solenoid is energized.
OFF = The solenoid is de-energized.
** = Manual Second–Third gear is only available above approximately 100 km/h (62 mph).
*** = Manual First–Second gear is only available above approximately 100 km/h (62 mph).
NOTE: Manual First–Third gear is also possible at high vehicle speed as a safety feature.

DIAGNOSTIC TROUBLE CODE(DTC) P1886 4–2 SHIFT MALFUNCTION

Circuit Description

The special feature of 4HP 16 Auto Transaxle is that it operates without freewheels. Shifting between individual gears takes place by means of overlapping clutch engagement and release.

The advantage of overlap shifting are as follows:

- The transaxle can be of more compact design and is lighter on account of the absence of freewheels and the lower number of shift elements.
- Lower drag losses, i.e. higher efficiency.
- Lower peak torque acting on the components and driveline.

However, overlap shifting necessitates high-performance hardware and software, and precision engine signals.

Conditions for Setting the DTC

- Engine is running.
- No DTC P1885, P1881.
- No DTC P1883, P1884.
- No DTC P0783, P0782, P0781.
- Selector lever is not N(Neutral), P(Park) position.
- Engine torque is unstable state.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp(MIL) will illuminate.
- The TCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Adopt Emergency/ Substitute mode and constant 4th gear.
- Open lock up clutch.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF when the malfunction has not occurred after three-ignition cycle.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using a scan tool can clear history DTCs.

Diagnostic Aids

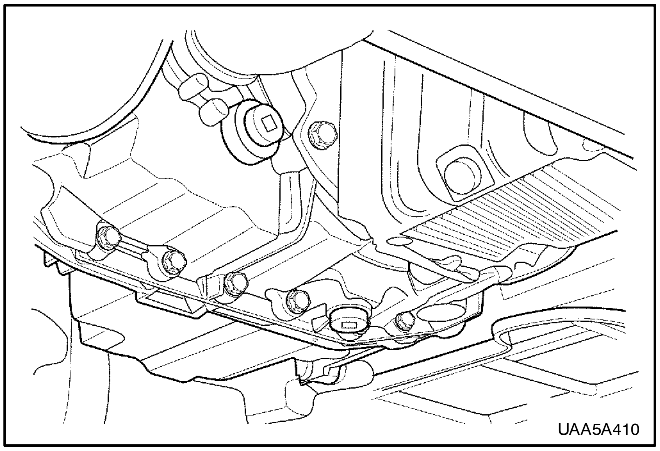
- When DTC P1886 sets, the replacement of T/M is recommended.

DTC P1886 – 4–2 shift malfunction

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the check performed?	–	Go to Step 2	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Start engine and allow it to warm up at idle. 4. Observe "engine revolution, idle rpm, TPS and so on" on the scan tool. Was a problem found?	–	Go to "Engine diagnostic information"	Go to Step 3
3	Inspect "ECU". Refer to Section 1F Engine diagnostic information and procedures. Was a problem found?	–	Go to "Engine diagnostic information"	Go to Step 4
4	1. Turn the ignition LOCK. 2. Disconnect the TCM wiring connector. 3. Measure the voltage between terminal B3 of and B13 of the transaxle wiring connector. 4. Turn the ignition ON. 5. Measure the voltage between terminal C15 of and B13 of the transaxle wiring connector. 6. Measure the voltage between terminal C16 of and B13 of the transaxle wiring connector. Is the voltage within the values shown?	11–14V	Go to Step 5	Go to "System voltage low or high"
5	Replace the TCM. Is the action complete?	–	Go to Step 8	–
6	1. After the repair, use a scan tool "clear info" function and road test the vehicle. 2. Review the "DTC info". Has the last test failed or is the current DTC displayed?	–	Replace transaxle assembly	Repair verified exit DTC chart

REPAIR INSTRUCTION

ON–VEHICLE SERVICE



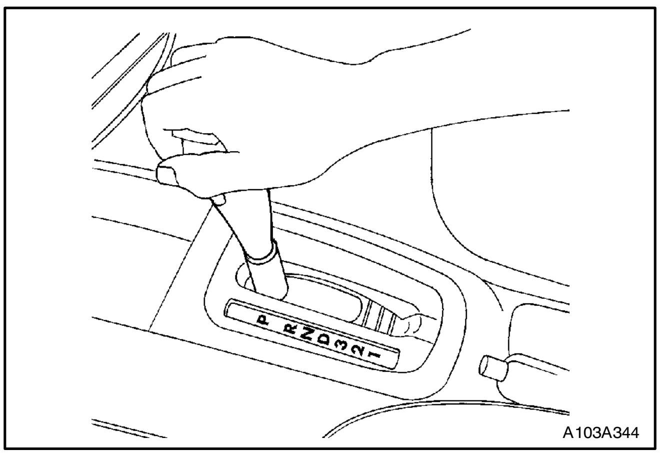
TRANSAXLE FLUID LEVEL CHECKING PROCEDURE

Tools Required

DW260–070 Oil Drain Plug

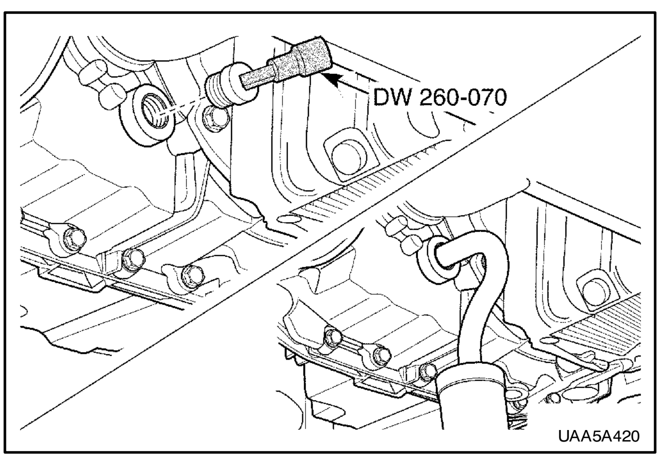
Checking Procedure

1. Start the engine and allow the engine to idle for approximately 5 minutes(850±25rpm), or if possible, drive the vehicle for a few miles to warm the transaxle fluid. Check the fluid level when the transaxle is under 30°C(86°F).
2. Park the vehicle on a hoist, inspection pit, or similar raised-level surface. The vehicle must be level to obtain a correct fluid level measurement.
3. Place a fluid container below the fluid level plug.



Notice: You must know fluid level plug and fluid drain plug.

4. Depress the brake pedal and move the shift lever through the gear ranges, pushing a few seconds in each range. Return the shift lever to the PARK position. ((left-hand Drive Shown, right-hand Drive Similar)



Caution: Do not remove the fluid level plug if the transaxle fluid is hot. This may cause injury if the fluid drains from the plug hole

5. Remove the fluid level plug with DW260-070. Because the transaxle operates correctly over a range of fluid levels, fluid may or may not drain out of the plug hole when the plug is removed.
6. If fluid drains through the plug hole a little bit it is normal. If fluid does not drain through the plug hole, the transaxle was either under filled or the transaxle is leaking fluid. Fix any leaks before setting the transaxle fluid level.

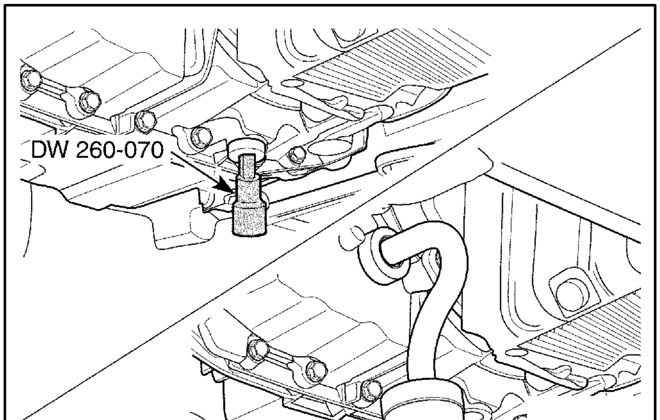
Installation Notice

Tightening Torque	45N·m(33lb–ft)

- When the fluid level checking procedure is completed, wipe any fluid from the transaxle case with a rag or shop towel. Also, check that the fluid fill cap and the vent tube are properly installed.

Adjustment Notice:

- Before checking fluid level, it is necessary to fill oil through the plug hole. Refer to below:
  - Oil pan removal : 4L (4.2 quarts)
  - Torque converter removal : 2L (2.1 quarts)
  - Overhaul : 6.9L (7.3 quarts)
  - Oil drain plug removal : 4L (4.2 quarts)
  - Oil : ESSO LT 71741



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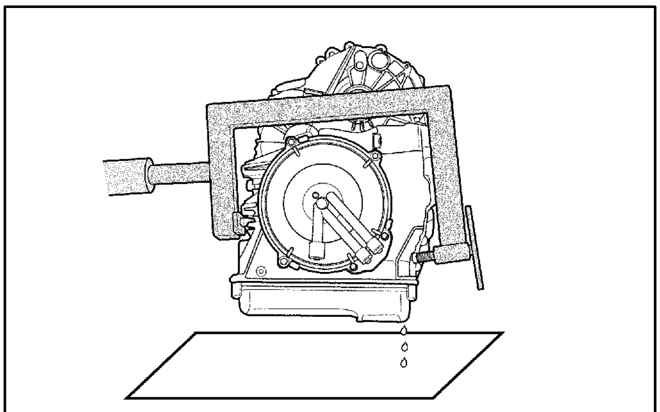
CHANGING THE FLUID

1. Disconnect the negative battery cable.
2. Remove the fluid drain plug with DW260–070.
3. Add transaxle fluid. Refer to "**Transaxle Fluid Level Checking Procedure**" in this Section.

Installation Notice

Tightening Torque	45N·m(33lb–ft)

- When the fluid level checking procedure is completed, wipe any fluid from the transaxle case with a rag or shop towel. Also, check that the fluid fill cap and the vent tube are properly installed.

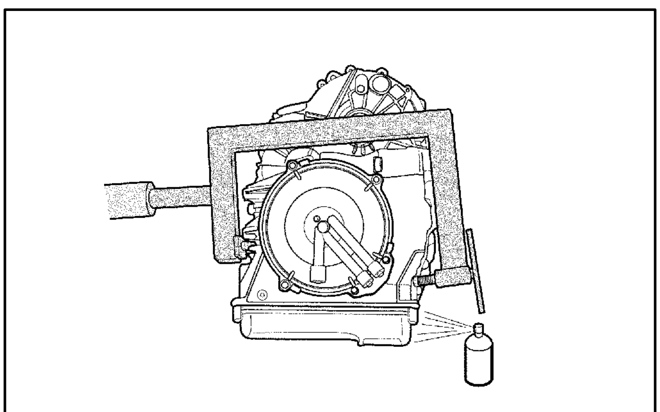

UAA5A440

REPARING FLUID LEAKS

Locating leaks

General Method

1. Verify that the leak is transaxle fluid.
2. Thoroughly clean the suspected leak area.
3. Operate the vehicle for about 15 miles or until the transaxle reaches normal operating temperatures, 88°C(190°F).
4. Park the vehicle over clean paper or cardboard.
5. Shut the engine OFF and look for fluid spots on the paper.
6. Make the necessary repairs of correct the leak.

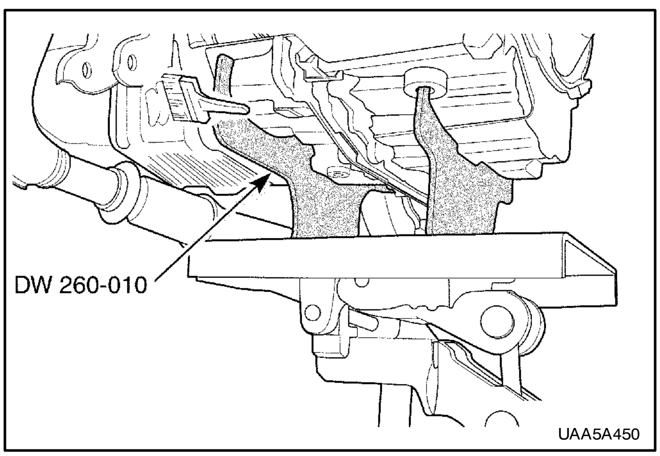

UAA5A441

Powder method

1. Thoroughly clean the suspected leak area.
2. Apply an aerosol-type powder (foot powder).
3. Operate the vehicle for about 15 miles or until the transaxle reaches normal operating temperatures, 88°C(190°F).
4. Shut the engine OFF.
5. Inspect the suspected leak area and trace the leak path through the powder to find the source of the leak.
6. Make the necessary repairs.

Repairing the Fluid Leak

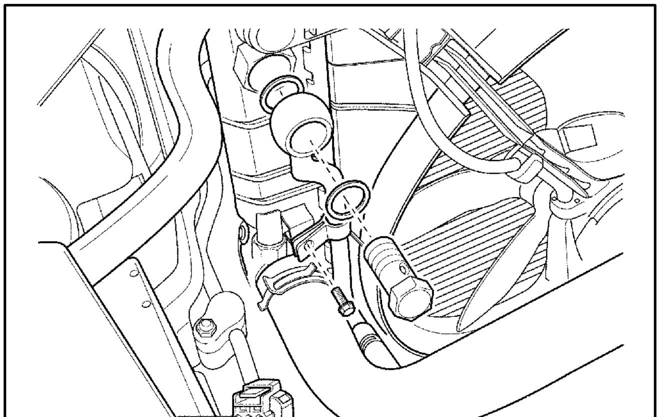
- The following are potential causes for fluid leaks. Check these and repair as necessary.
- Fasteners are not tightened to specification.
- Fastener threads and tapped holes are dirty or corroded.
- Gaskets, seals or sleeves are misaligned, damaged, or worn.
- The seal bore or the gasket surface is damaged, warped, or scratched.
- The manual shaft is nicked or damaged.
- There is loose or worn bearing causing excess seal or sleeve wear.
- Case or component porosity.
- The fluid level is too high.
- There is a plugged vent or a damaged vent tube.
- There is water or coolant in the fluid.
- Fluid drain back holes are plugged.



CASE POROSITY REPAIR

Caution: Epoxy adhesive may cause skin irritations and eye damage. Read and follow all information on the container label as provided by the manufacturer.

1. Thoroughly clean the area to be repaired with a cleaning solvent. Air dry the area.
2. Using instructions from the manufacturer, mix a sufficient amount of epoxy make the repair.
3. While the transaxle case is still hot, apply the epoxy. You can use a clean, dry soldering acid brush to clean the area and also apply the epoxy cement. Make certain that the area to be repaired is fully covered.
4. Allow the epoxy cement to cure for 3 hours before starting the engine.
5. Repeat the fluid leak diagnosis procedures. Refer to "**fluid leak diagnosis and repair**" in this Section.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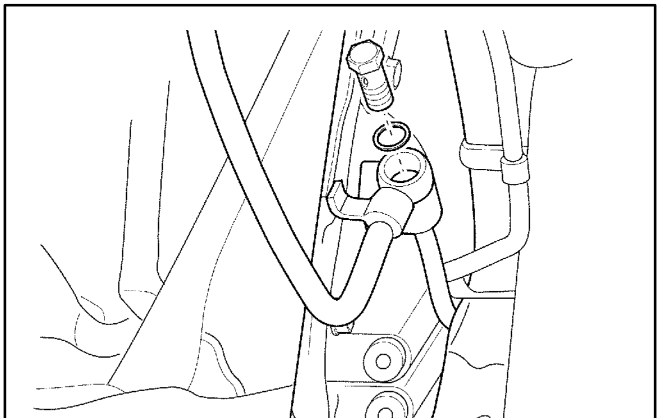
OIL COOLER PIPE/HOSE

Disassembly and Assembly Procedure

1. Remove the oil cooler outlet pipe union bolt from the radiator upper side.
2. Remove the pipe bracket bolt.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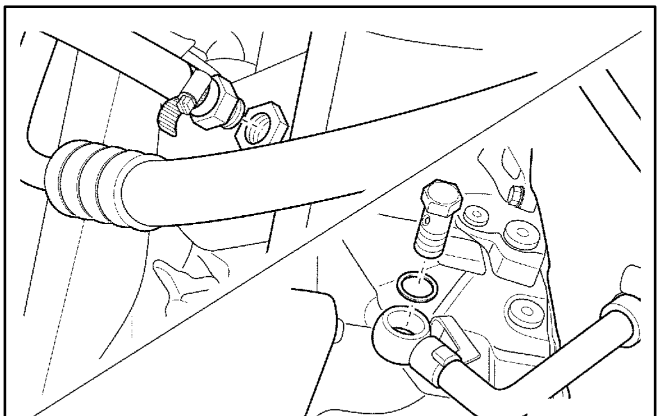
3. Remove the oil cooler outlet pipe union bolt from the transaxle.

Installation Notice

Tightening Torque	32.5N·m(24lb–ft)

4. Disconnect oil cooler outlet pipe assembly.

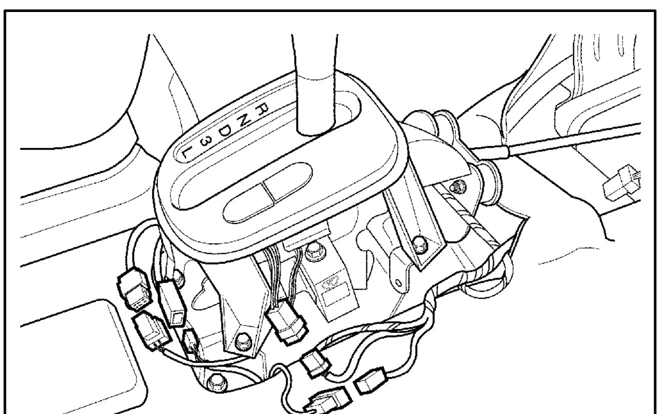

UAA5A480

5. Remove the oil cooler inlet pipe union bolt from the radiator lower side.
6. Remove the oil cooler inlet pipe union bolt from the transaxle.

Installation Notice

Tightening Torque	32.5N·m(24lb–ft)

7. Disconnect oil cooler outlet pipe assembly.
8. Installation should follow the removal procedure in the reverse order.



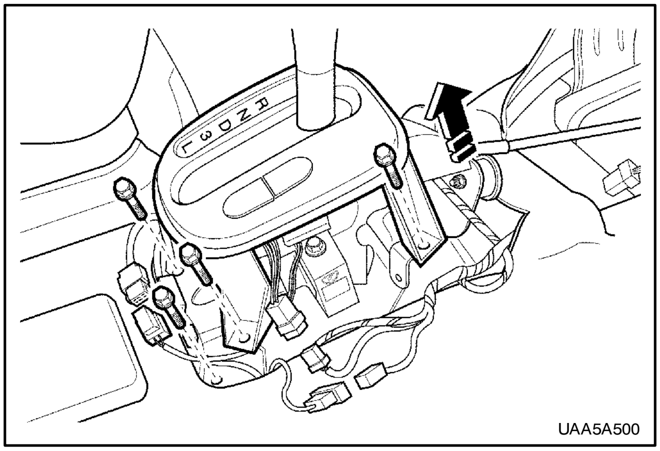
UAA5A490

SHIFT CONTROL LEVER

(Left-hand Drive Shown, right-hand Drive Similar)

Removal and Installation Procedure

1. Remove the right and the left floor panels, the shift control panel, and the floor console, Refer to **Section 9G**, **Interior Trim**.
2. Disconnect the switch connectors



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3. Remove the shift control cable from the selector lever. Refer to "Shift Control Cable" in this Section.
4. Remove the nuts from the shift control cable mounting bracket at the front of the shift control assembly.
5. Remove the bolts and the selector lever assembly.

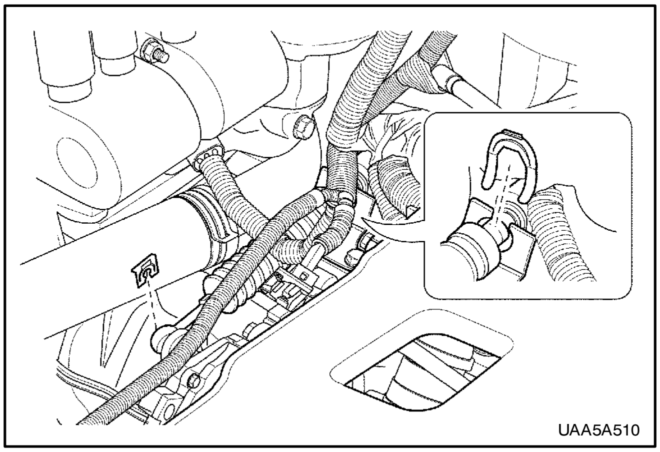
Installation Notice

Tightening Torque	7.5N·m(66.5lb–in)

- Make sure the slot in the Park/Neutral Position switch is all the way forward and the shift control lever is in the P position. Failure to do so may damage to the Park/Neutral Position switch and produce a false gear indication.

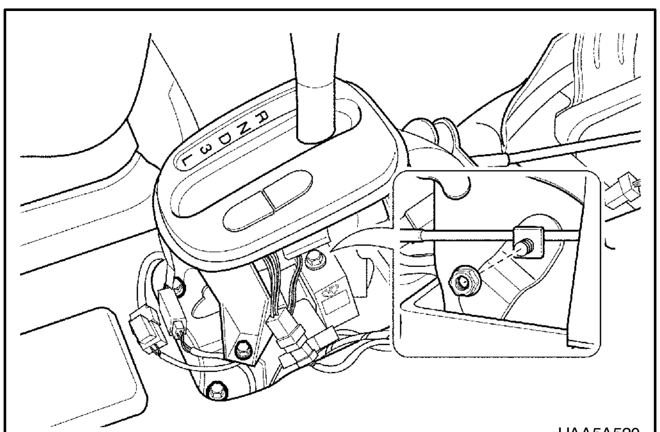
SHIFT CONTROL CABLE

Removal and Installation Procedure



UAA5A510

1. Remove the battery and disconnect the battery cables.
2. Drain the transaxle fluid. Refer to "**Changing the Fluid**" in this Section.
3. Disconnect the shift control cable from the selector lever.
4. Disconnect the shift control cable from the bracket.

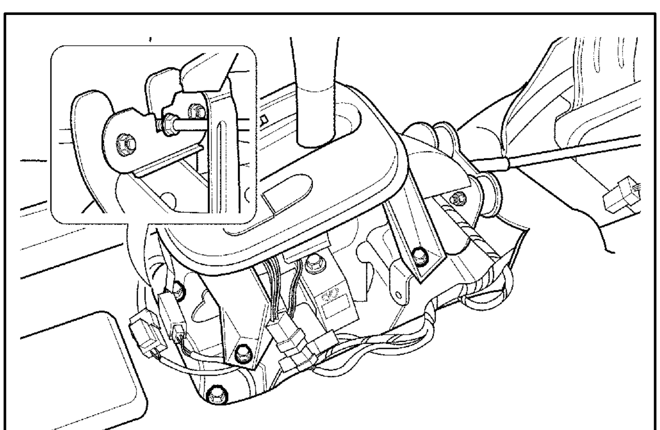


UAA5A520

5. Remove the right and the left front lower trim panels, the shift control panel and the floor console. Refer to **Section 9G, Interior Trim.**
6. Loosen the pinch bolt, nut on the shift control lever.

Installation Notice

Tightening Torque	6N·m(53lb–in)



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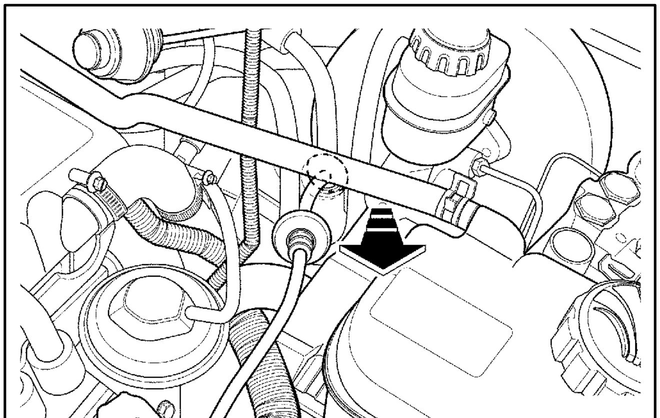
7. Remove the shift control cable from the shift control assembly by holding one nut while loosening the other one.

Installation Notice

Tightening Torque	8N·m(71lb–in)

- Insert the shift control cable into the connecting slot on the shift control lever and secure it with the pinch bolt and nut.

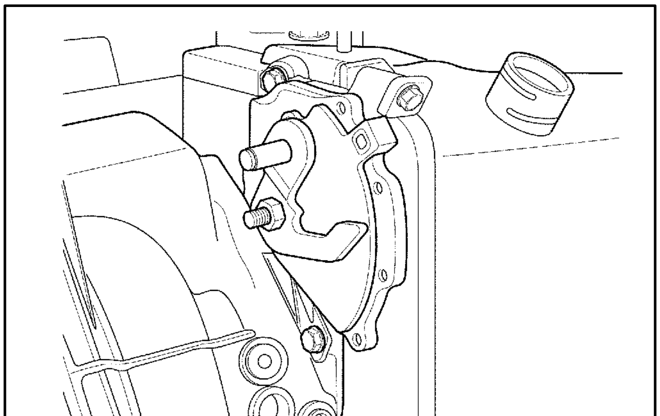


UAA5A530

8. Pull the shift cable through the firewall of the vehicle, bringing the rubber grommet with it.

Installation Notice:

- Push the shift control cable through the firewall of the vehicle and install the rubber grommet.

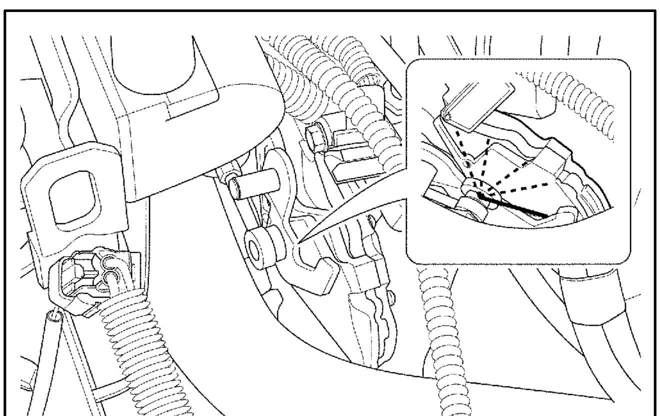


UAA5A540

9. Install shift control cable onto the selector lever and secure with the clip.

Installation Notice:

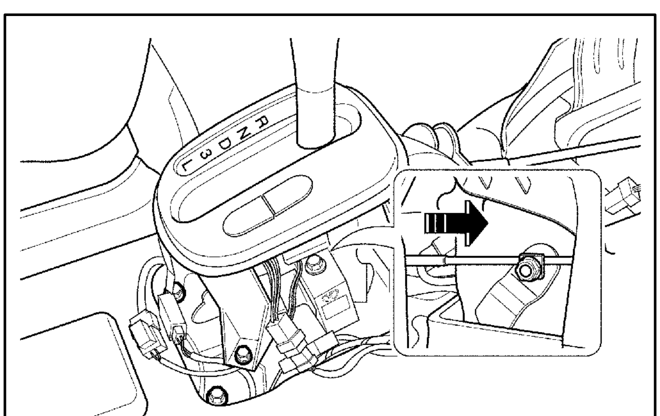
- Perform a control cable adjustment. Refer to "**Control Cable Adjustment**" in this Section.
- Install the floor console, the shift control panel and the right and the left lower trim panels. Refer to **Section 9G, Interior Trim**.
- Connect the negative battery cable.



UAA5A550

SHIFT CONTROL CABLE ADJUSTMENT

1. Disconnect the negative battery cable.
2. Move the selector lever to the PARK position.
3. Make sure the range selector lever on the transaxle is in the PARK position.



UAA5A560

4. Remove the right and the left front lower trim panels, the shift control panel, and the floor console. Refer to **Section 9G, Interior Trim**.
5. Loosen the shift control cable adjustment pinch bolt.
6. Pull the shifter control cable until it is tight.

Installation Notice

Tightening Torque	8N·m(71lb–in)

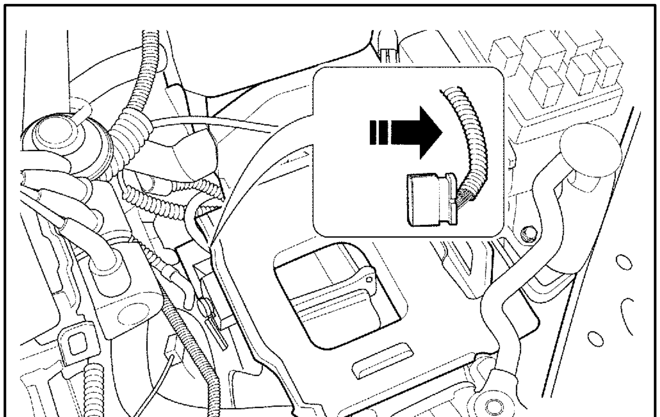
7. Install the floor console, the shift control panel, and the right and the left lower trim panels. Refer to **Section 9G, Interior Trim**.
8. Connect the negative battery cable.

PARK/NEUTRAL POSITION SWITCH

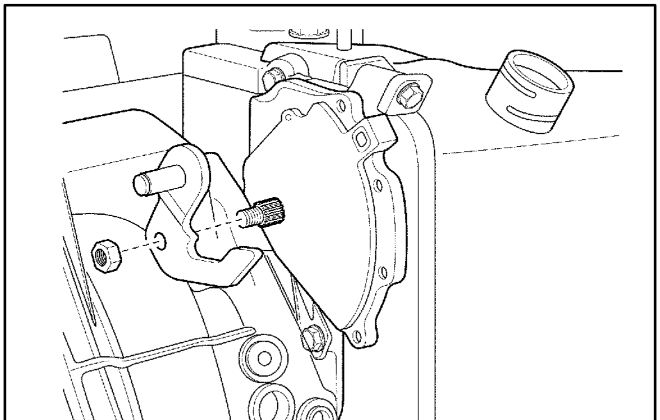
Tools Required

DW260–050 Park/Neutral Position Switch setting gauge

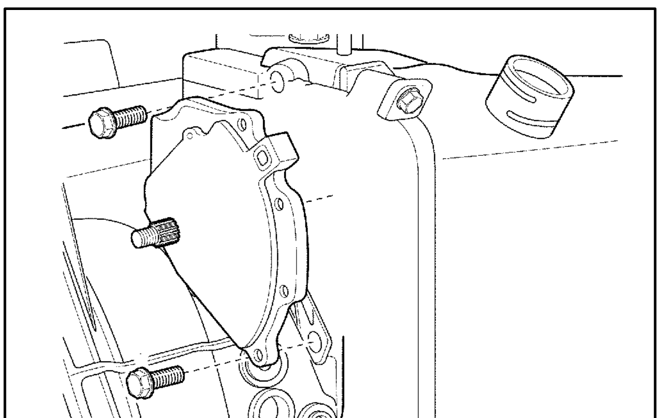
Removal and Installation Procedure


UAA5A570

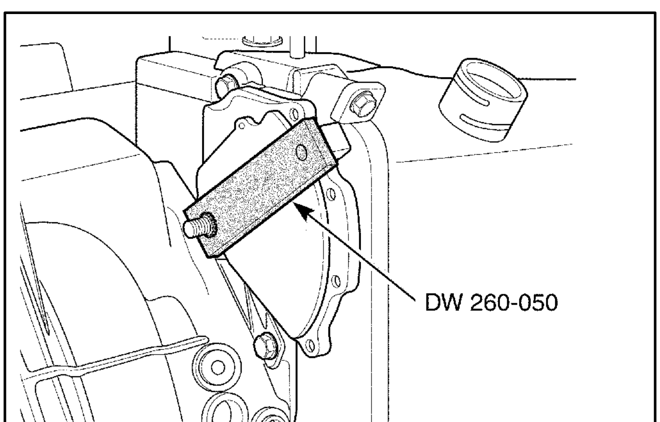
1. Disconnect the negative battery cable.
2. Disconnect the shift control cable. Refer to "**Shift Control Cable**" in this Section.
3. Disconnect the Park/Neutral Position Switch electrical connector.


UAA5A580

4. Remove the shift lever nut and the shift lever.


UAA5A590

5. Remove the Park/Neutral Position Switch bolts.
6. Remove the Park/Neutral Position Switch.

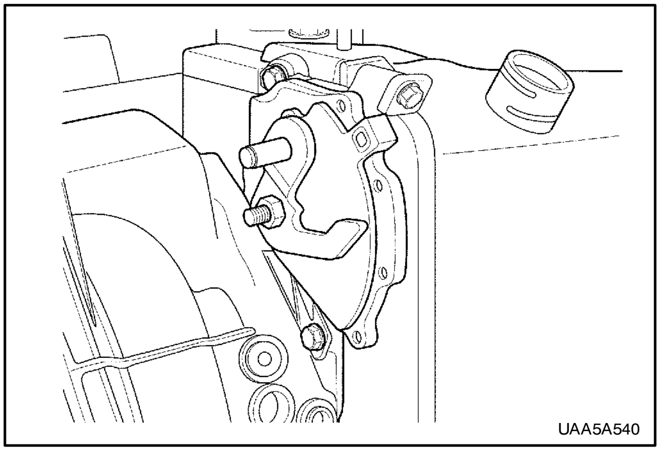


UAA5A600

7. Install the Park/Neutral Position Switch onto the selector shaft.
8. Tight the bolts a little bit. Set the Park/Neutral Position Switch using the setting gauge.

Installation Notice

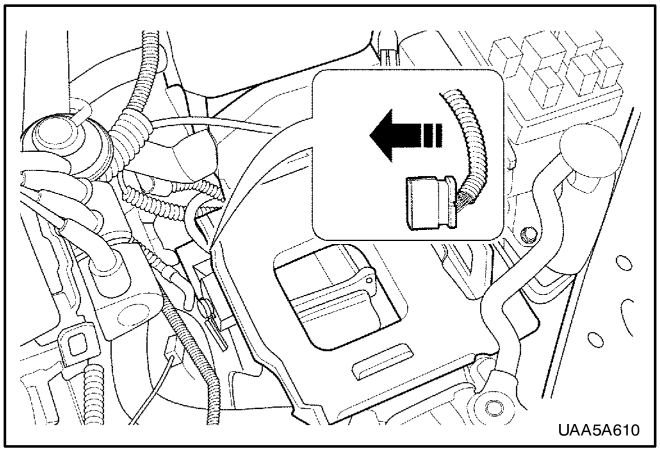
Tightening Torque	10N·m(89lb–in)



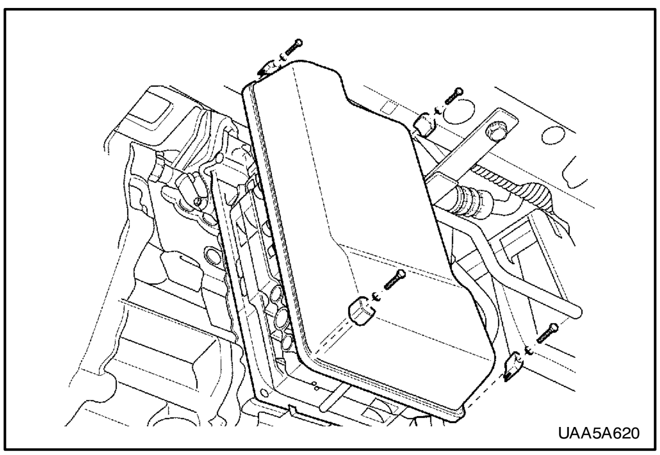
9. Install the shift lever.

Installation Notice

Tightening Torque	10N·m(89lb–in)



10. Connect the Park/Neutral Position Switch electrical connector.
11. Connect the negative battery cable.



PAN, GASKET

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Place a fluid container below the oil pan.
4. Remove left under cover. Refer to the **section 9M. Exterior Trim**.
5. Drain the transaxle fluid.
6. Remove the two oil cooler pipe. Refer to "**Oil Cooler Pipe/Hose**" in this Section.
7. Remove the transaxle oil pan bolts and the pan.
8. Remove the transaxle oil pan gasket. The gasket is reusable.

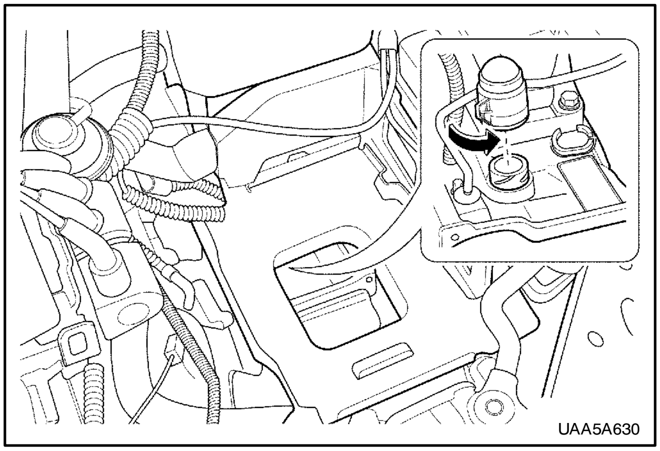
Installation Notice

Tightening Torque	6N·m(53lb–in)

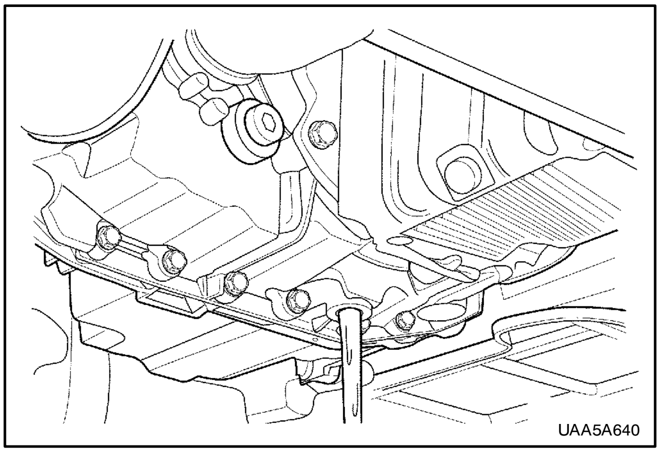
- Inspect the gasket and the pan for cracks, dents, or cuts. Install the transaxle pan and the gasket.
- Refill the transaxle fluid. Refer to "**transaxle fluid level checking procedure**" in this Section.
- Connect the negative battery cable.

VALVE BODY/ TRANSAXLE WIRING HARNESS CONNECTOR

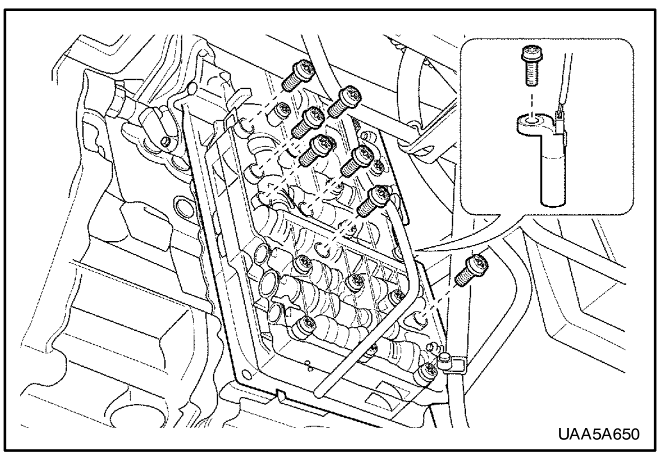
Removal Procedure



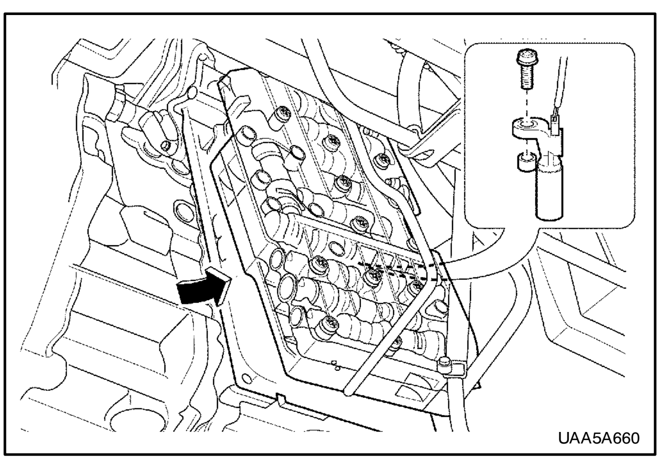
1. Remove the negative battery and disconnect the battery cables.
2. Disconnect the transaxle wiring harness connector by turning to the counter clock wise direction.
3. Remove the clip from wiring harness connector.



4. Drain the transaxle fluid. Refer to "**Transaxle Fluid Checking Procedure**" in this Section.

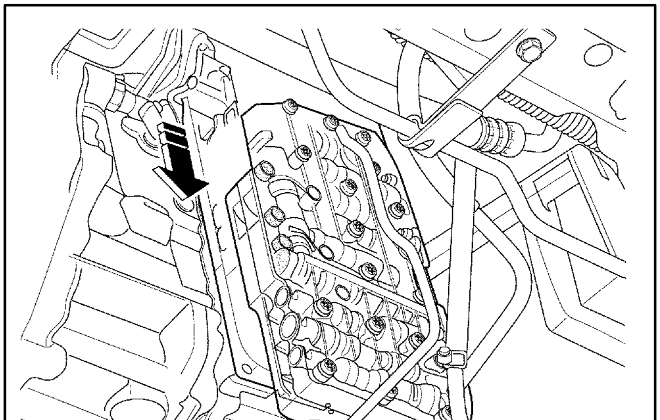


5. Remove the transaxle oil pan and gasket. Refer to " **Pan, Gasket**" in this Section.
6. Remove the valve body assembly bolts.
7. Remove the transaxle input speed sensor bolts and sensor.



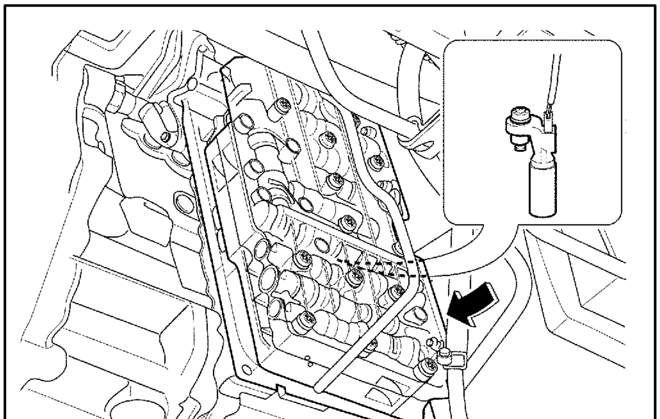
8. Remove the transaxle output speed sensor bolts by tilting the valve body assembly.
9. Remove the transaxle output speed sensor.

Notice: Be careful not to loose washer when removing the transaxle output speed sensor.


UAA5A670

10. Remove the valve body assembly.

Notice: Be careful hurt when removing the valve body assembly.

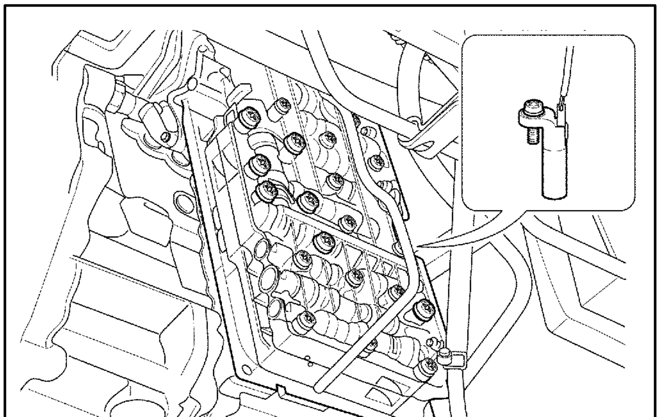

UAA5A680

Installation Procedure

1. Install the transaxle output speed sensor by tilting the valve body assembly.

Installation Notice

Tightening Torque	6N·m(53lb–in)


UAA5A690

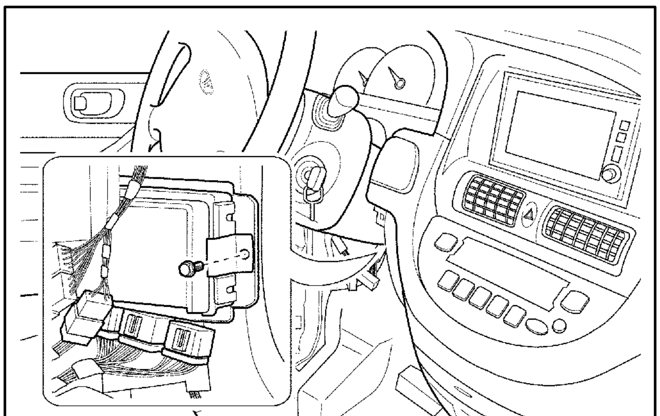
2. Install the valve body assembly.

Notice: Push the transaxle wiring harness connector from the inside of transaxle housing to the outside.

Installation Notice

Tightening Torque	8N·m(71lb–in)

3. Install the transaxle oil pan and gasket. Refer to "**Pan, Gasket**" in this Section.
4. Connect the transaxle wiring harness connector by turning to the clock wise direction.
5. Install the retainer clip to the wiring harness connector.


UAA5A700

TCM (TRNASAXLE CONTROL MODULE)

Removal and Installation Procedure

1. Remove the right A pillar trim. Refer to **Section 9G, Inner Trim.**
2. Disconnect the three TCM connector.
3. Remove the TCM.

Installation Notice

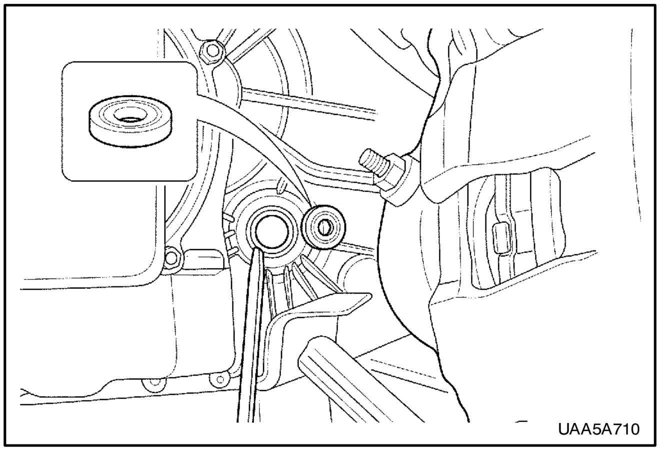
Tightening Torque	7.5N·m(66.5lb–in)

DRIVE AXLE OIL SEAL

Tools Required

DW 260–030 Axle Seal Installer

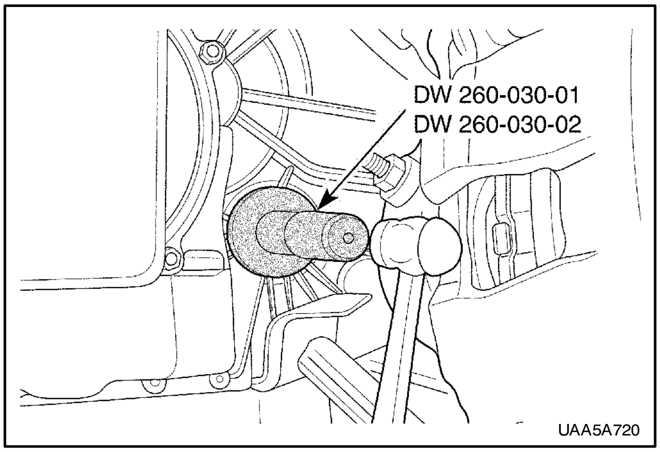
Removal and Installation Procedure



1. Disconnect the negative battery cable.
2. Remove the drive axle. Refer to **Section 3A, Automatic Transaxle Drive Axle.**

Notice: Be careful not to damage the bore of the transaxle case.

3. Remove the transaxle drive seal using a screwdriver if necessary, crush the seal first with the screwdriver in order to loosen the seal from the case.



4. Install the transaxle drive seal using the axle seal installer DW 260–030.
5. Install the drive axle. Refer to **Section 3A, Automatic Transaxle Drive Axle.**
6. Connect the negative battery cable.

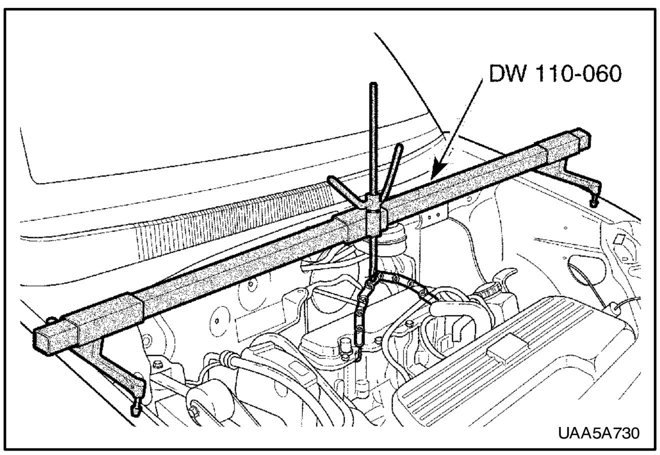
TRANSAXLE MOUNT

Tools Required

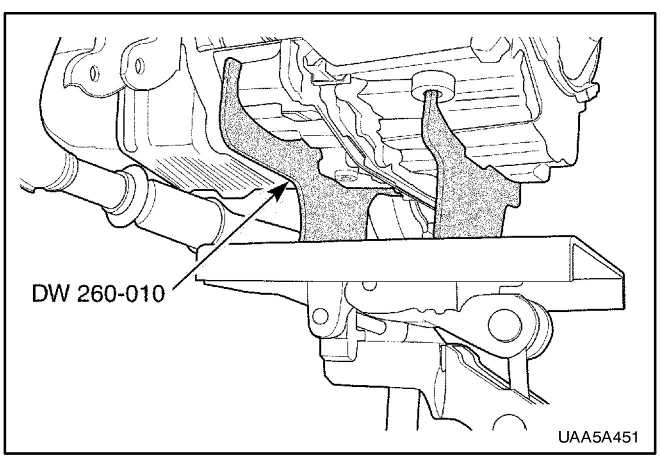
DW 110–060 Engine Support Fixture

DW 260–010 Transaxle Support Fixture

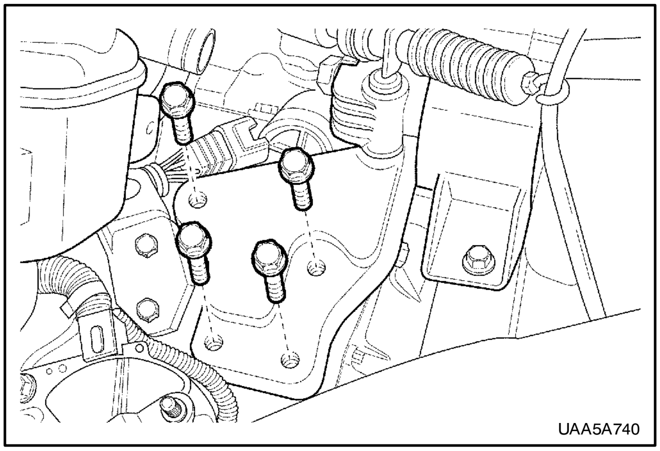
Removal and Installation Procedure



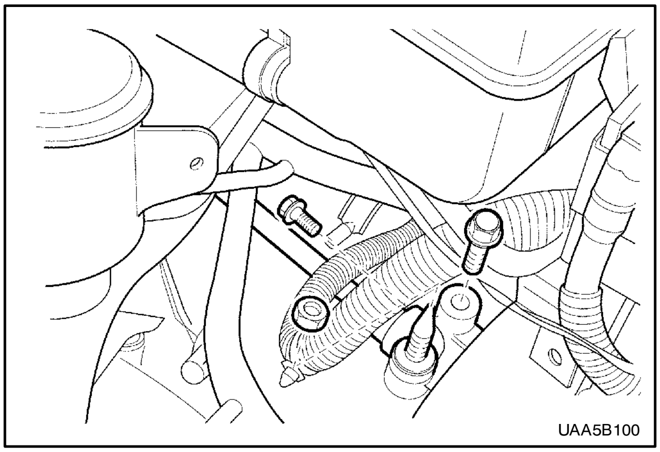
1. Install the engine support fixture DW 110–060. ((left-hand Drive Shown, right-hand Drive Similar)



2. Raise and suitably support the vehicle.
3. Install the transaxle support fixture DW 260–010. ((left-hand Drive Shown, right–hand Drive Similar)



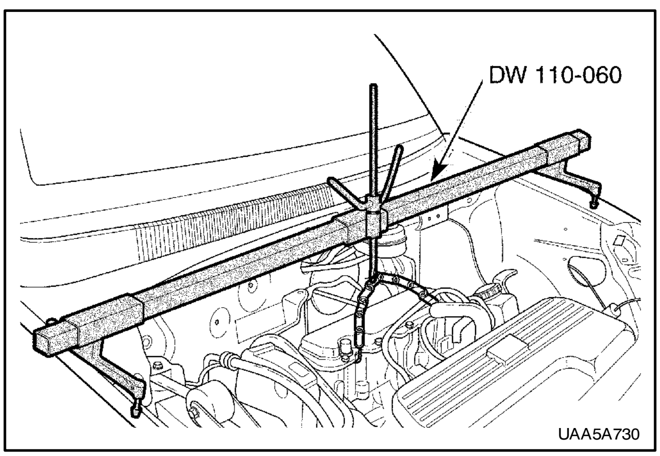
4. Remove the transaxle mount bracket bolts.



5. Remove the bolts from the transaxle mount bracket cage.
6. Remove the transaxle mount bracket cage.
7. Installation should follow the removal procedure in the reverse order.

Installation Notice

Tightening Torque	Transaxle mount bracket cage bolts to 65N·m(48Lb–Ft) Transaxle mount bolts to 81N·m(60Lb–Ft)



TRANSAXLE ASSEMBLY

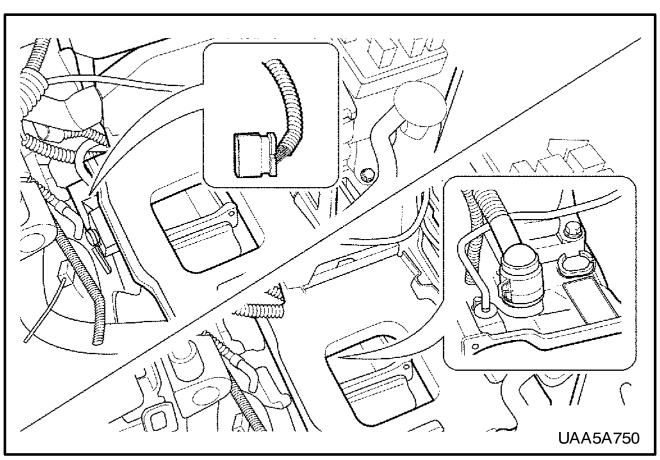
Tools Required

DW 110–060 Engine Support Fixture

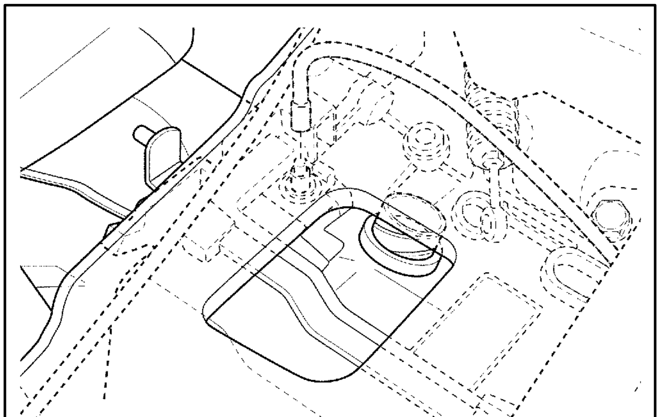
DW 260–010 Transaxle Support Fixture

Removal Procedure

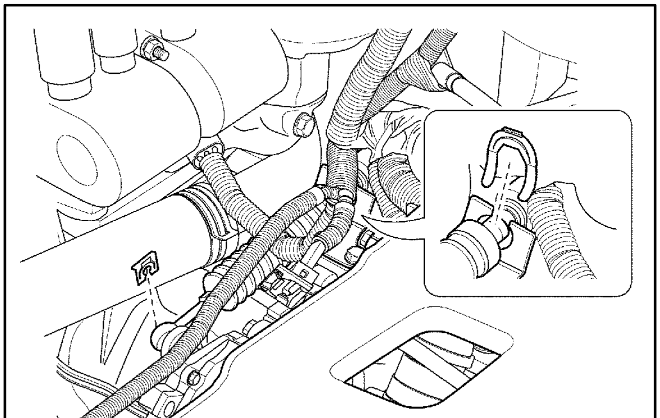
1. Install the engine support fixture DW 110–060. ((left-hand Drive Shown, right-hand Drive Similar)
2. Disconnect the negative battery.



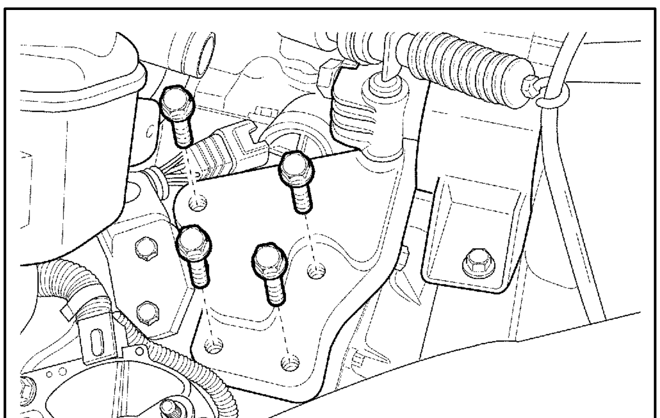
3. Locate the selector lever P position.
4. Disconnect the transaxle wiring harness.


UAA5A760

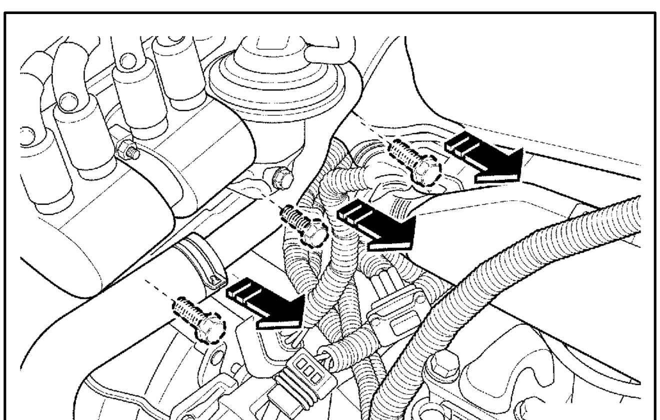
5. Remove the air breather hose.


UAA5A510

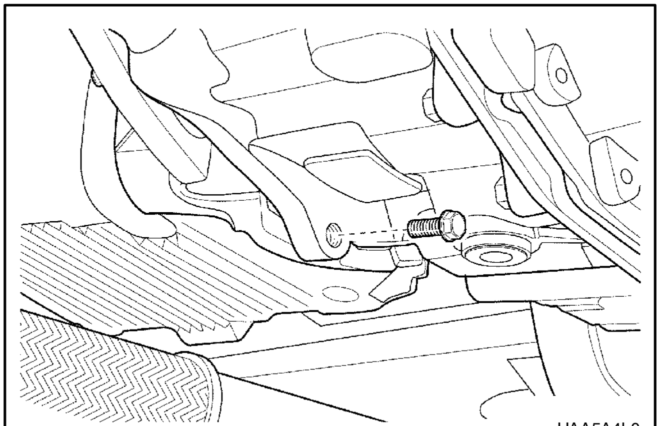
6. Disconnect the Park/Neutral Position Switch electrical connector.
7. Disconnect the shift cable from the shift lever and the shift cable mounting bracket.


UAA5A740

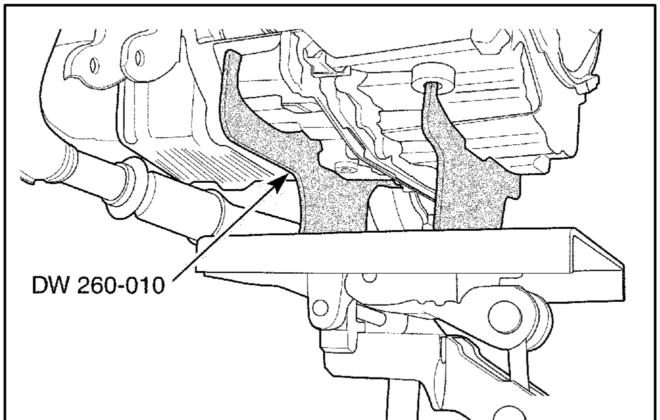
8. Remove the Park/Neutral Position Switch. Refer to "**Park/Neutral Position Switch**" in this Section.
9. Remove the transaxle mount bracket bolts.


UAA5A770

10. Remove the upper transaxle-to-engine bolts.

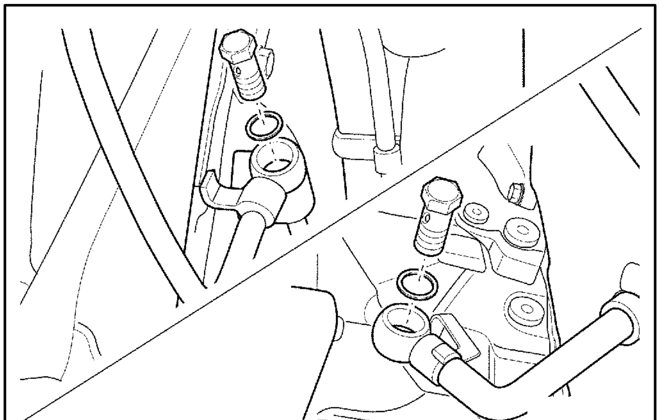

UAA5A4L0

11. Remove the lower transaxle-to-engine bolts.

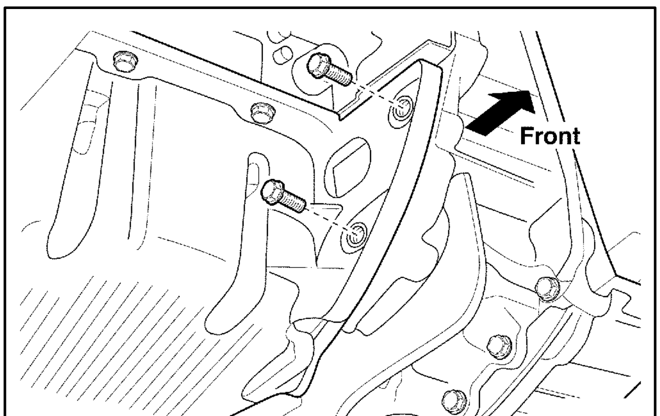


UAA5A451

12. Raise and suitably support the vehicle.
13. Drain transaxle fluid. Refer to "**Transaxle Fluid Level Checking**" in this Section.
14. Install the transaxle support fixture DW 260–010, and transaxle support jack (left-hand Drive Shown, right-hand Drive Similar)

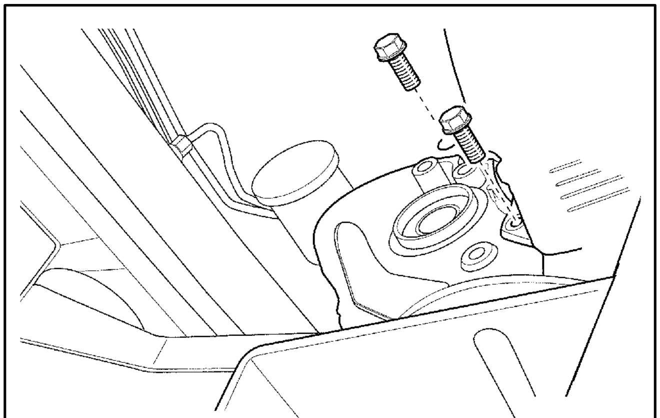

UAA5A780

15. Remover the oil cooler pipes from transaxle case. Refer to "**Oil Cooler Pipe/Hose**" in this Section.

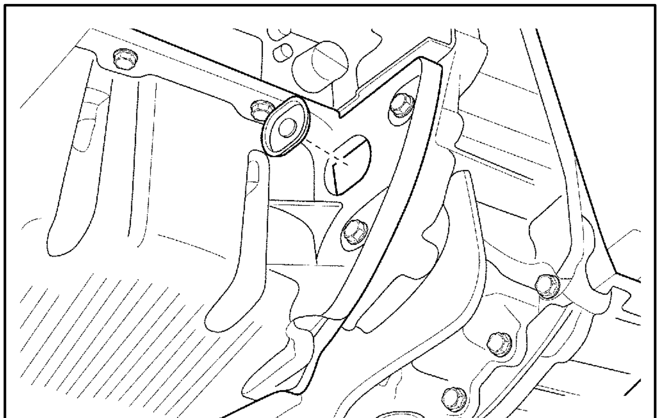


UAA5A790

16. Remove the lower transaxle to-engine bolts.

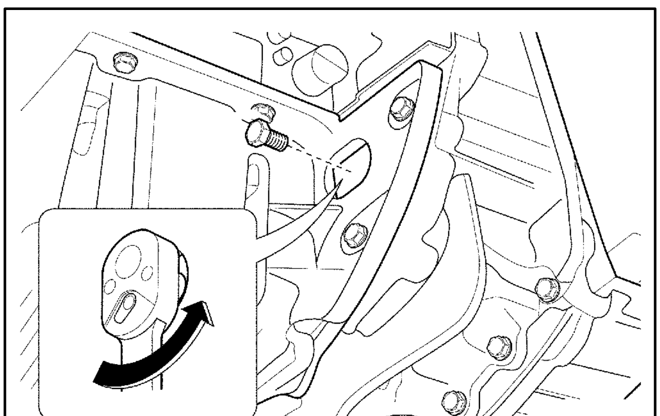


UAA5A800



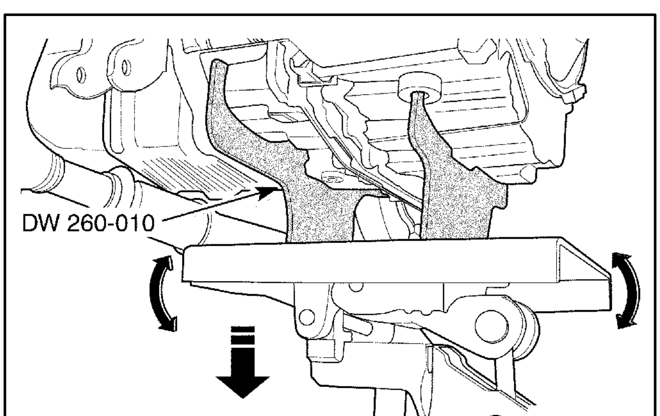
UAA5A810

17. Remove the drive axles. Refer to **Section 3A. Automatic Transaxle Drive Axle.**
18. Remove the service hall cover.



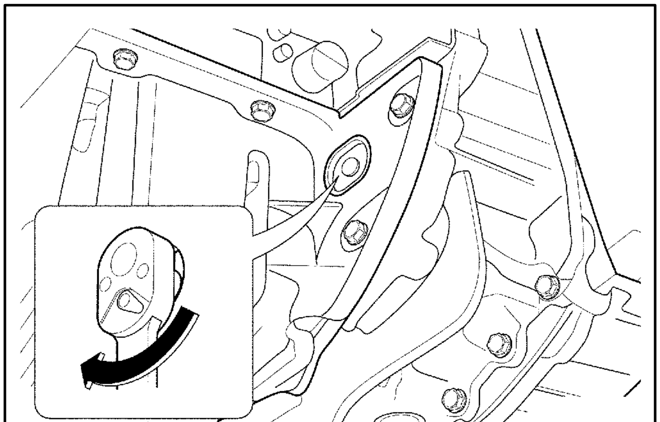
UAA5A820

19. Remove the torque converter bolt.



UAA5A830

20. Remove the transaxle assembly from the vehicle.


UAA5A840

Installation Procedure

1. Installation should follow the removal procedure in the reverse order.
2. Install the torque converter bolt.

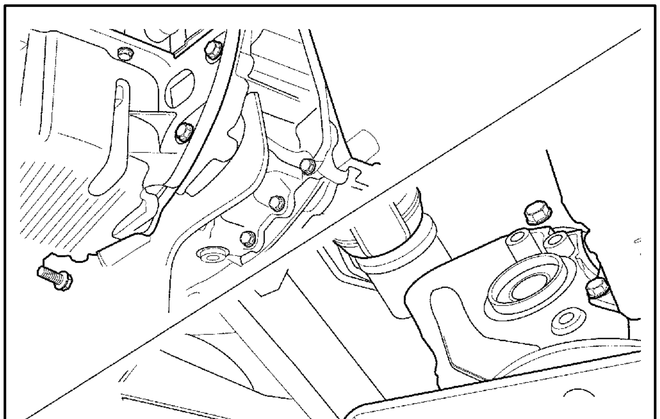
Installation Notice

Tightening Torque	45N·m(33lb–ft)

3. Install the transaxle mounting bracket.

Installation Notice

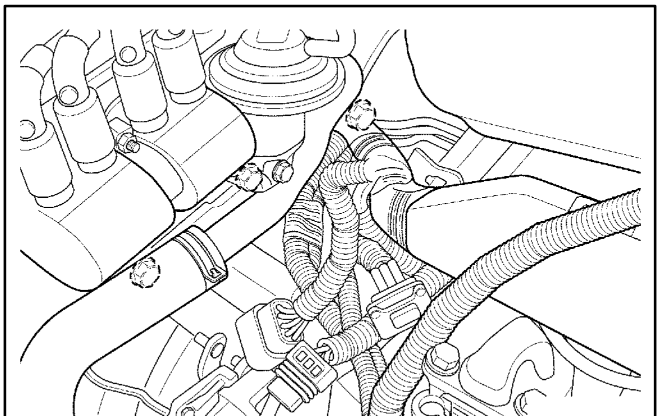
Tightening Torque	90N·m(66lb–ft)


UAA5A850

4. Install the drive axle. Refer to **Section 3A. Automatic Transaxle Drive Axle.**
5. Install the lower transaxle-to-engine bolts.

Installation Notice

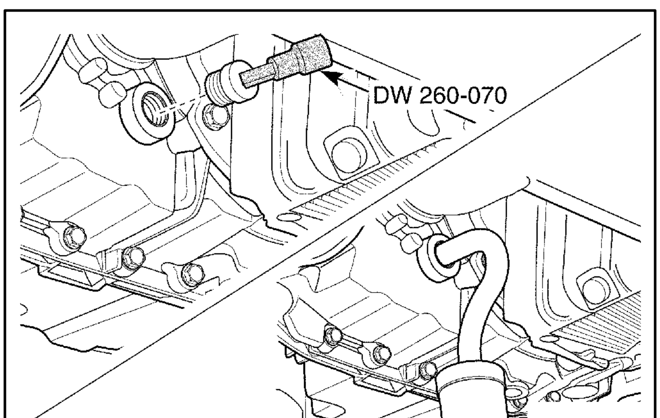
Tightening Torque	The large lower transaxle-to-engine bolts 31N·m(23Lb–Ft). The small the lower transaxle-to-engine bolts to 21N·m(15Lb–Ft)


UAA5A860

6. Install the upper transaxle-to-engine bolts.

Installation Notice

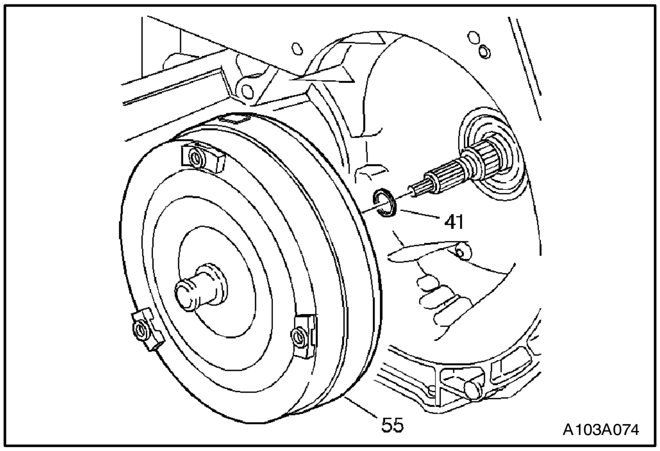
Tightening Torque	75N·m(55lb–ft)



UAA5A420

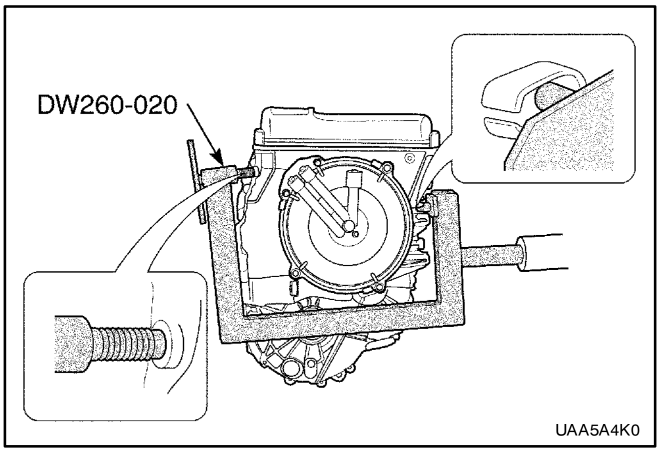
7. Add transaxle fluid. Refer to “**Transaxle Fluid Checking Procedure**” in this Section.
8. Install the under cover bolts.
9. Adjust the shift control cable. Refer to “**Shift Control Cable**” in this Section.
10. Installation should follow the removal procedure in the reverse order.

UNIT REPAIR



TORQUE CONVERTER

1. Remove the torque converter assembly.
2. Installation should follow the removal procedure in the reverse order.



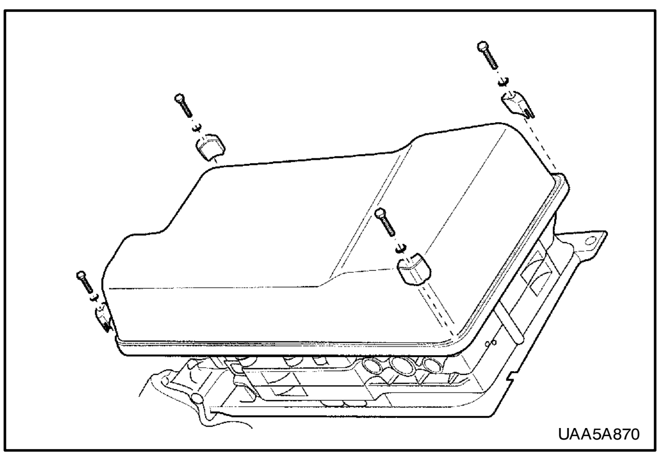
TRANSAXLE HOLDING FIXTURE ASSEMBLY

Tools Required

DW 260–020 Transaxle Support Fixture

Caution : To reduce the possibility of personal injury or transaxle damage, make sure, when doing the next step, that all of the bolts for the support fixture are installed as shown, and that the bolts are tightened to 11N·m(98lb–ft).

1. Install the DW 260–020 transaxle support fixture onto the transaxle.
2. Torque the support fixture bolts to 11N·m(98lb–ft).
3. Position the transaxle with the rear cover facing up.



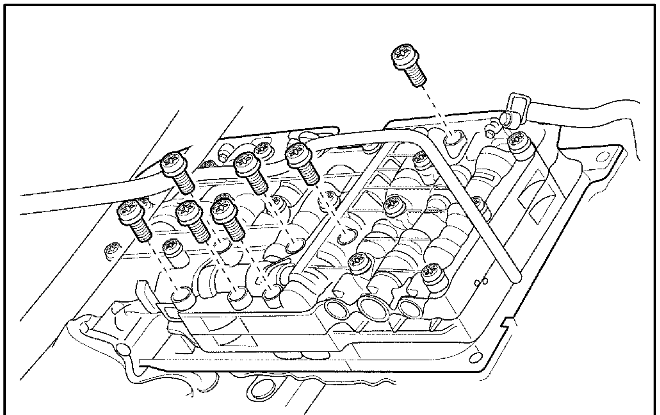
VALVE BODY

Disassembly and Assembly Procedure

1. Remove the oil pan bolts and oil pan.
2. Remove the oil pan gasket.

Installation Notice

Tightening Torque	6N·m(53lb–in)

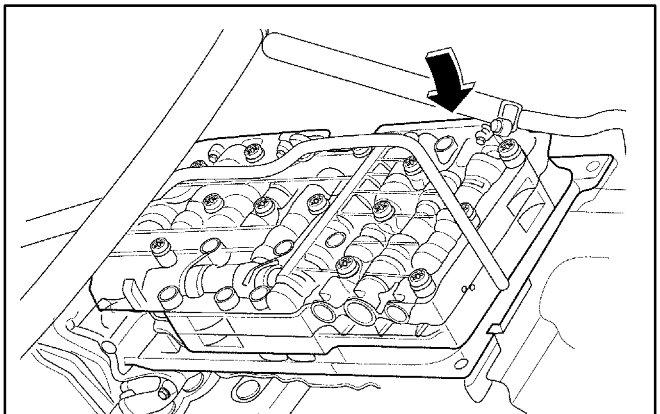


UAA5A880

3. Remove valve body fixing bolts and transaxle input speed sensor bolt on the valve body.
4. Remove the holder for the transaxle input speed sensor.

Installation Notice

Tightening Torque	8N·m(71lb–in)

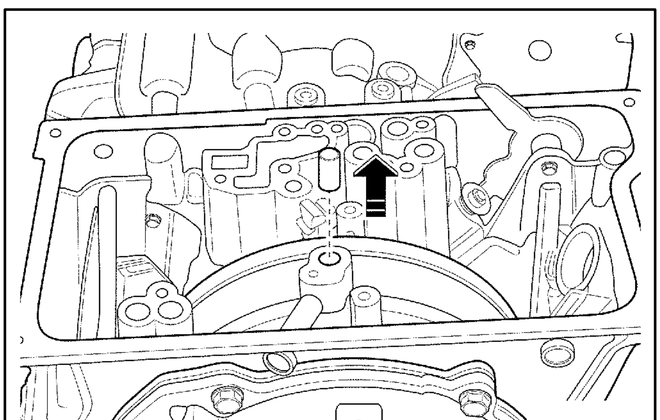


UAA5A890

5. Tilt the valve body.
6. Remove the fastening screw for the output speed sensor under the valve body assembly.
7. Lever the cable out of the retaining clip and pull out the output speed sensor.
8. Installation should follow the removal procedure in the reverse order.

Installation Notice

Tightening Torque	6N·m(53lb–in)

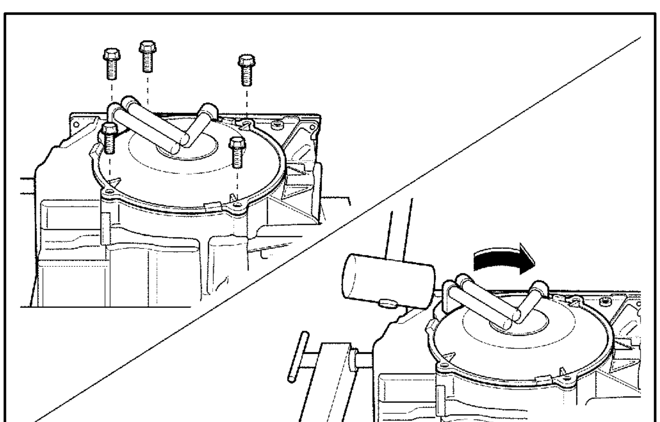


UAA5A900

REAR COVER

Disassembly and Assembly Procedure

1. Removal the valve body assembly. Refer to “**valve body removal**” in this Section.
2. Pull out sealing sleeve(brake C) with a kind of nail.
3. Turn transaxle by 90°.



UAA5A910

4. Remove the rear cover bolts.
5. Hit the rear cover rightly.
6. Remove the cover.
7. Installation should follow the removal procedure in the reverse order.

Installation Notice

Tightening Torque	23N·m(17lb–ft)

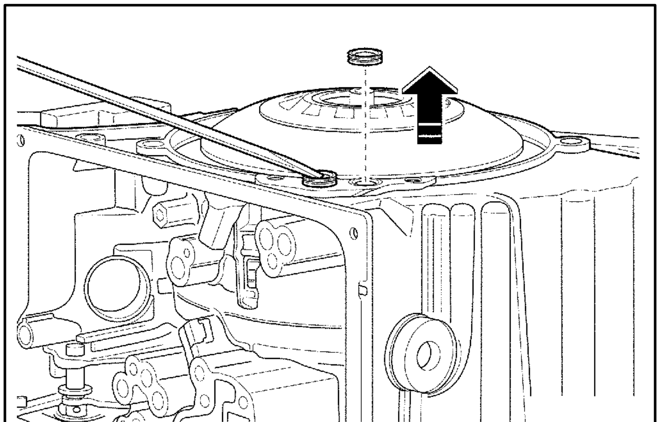
CLUTCH B/E

Disassembly and Assembly Procedure

Tools Required

DW 260–140 Clutch B Stop Ring Remover/Installer

DW 260–150 Clutch B Stop Ring Remover/Installer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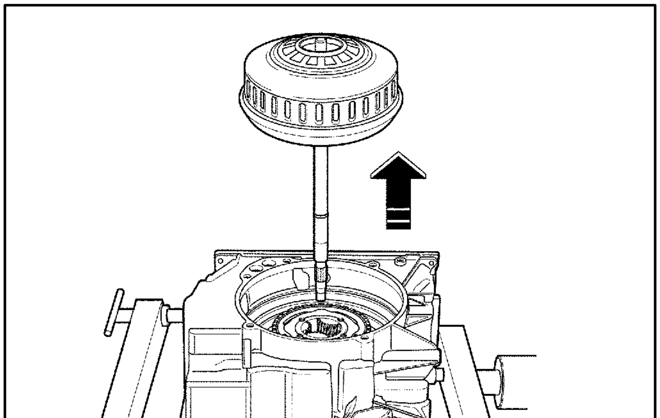
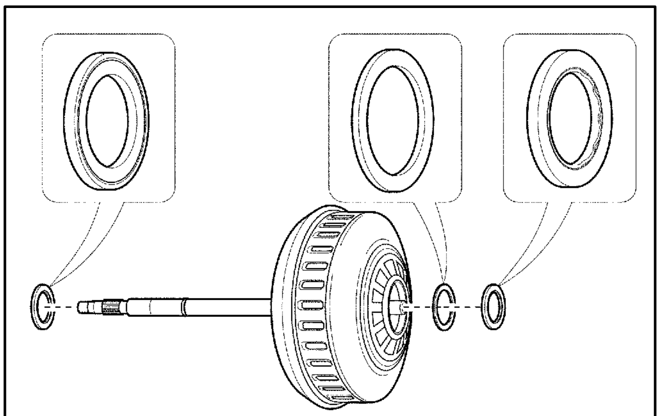
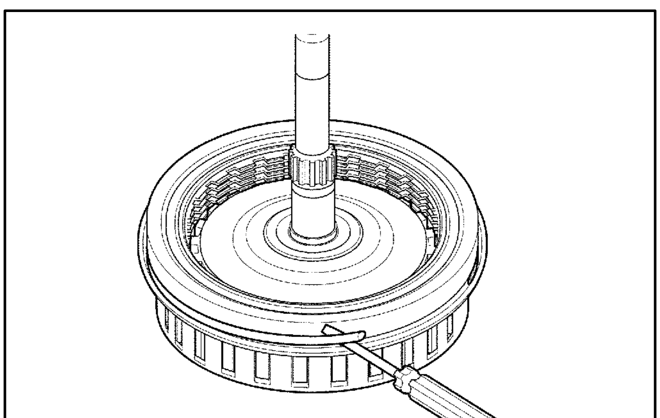
1. Remove the rear cover. Refer to “**rear cover removal**” in this Section.
2. Remove the two sealing rings(clutch B/E)


UAA5A930

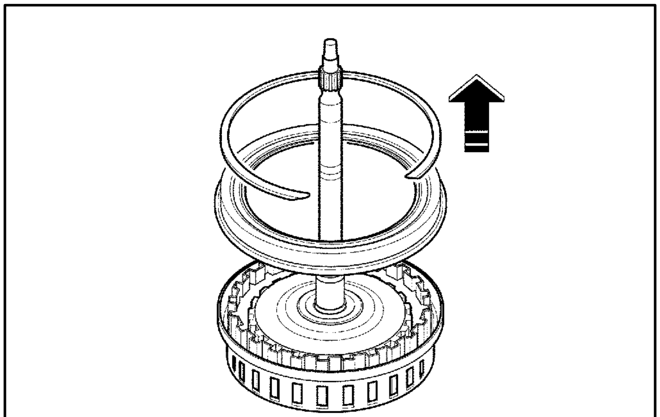
3. Take out input shaft with clutch B/E.


UAA5A940

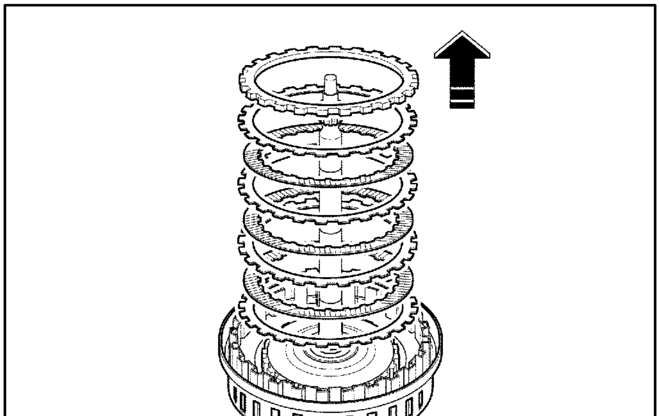
4. Remove needle bearing and thrust washer.
5. Remove shim.


UAA5A950

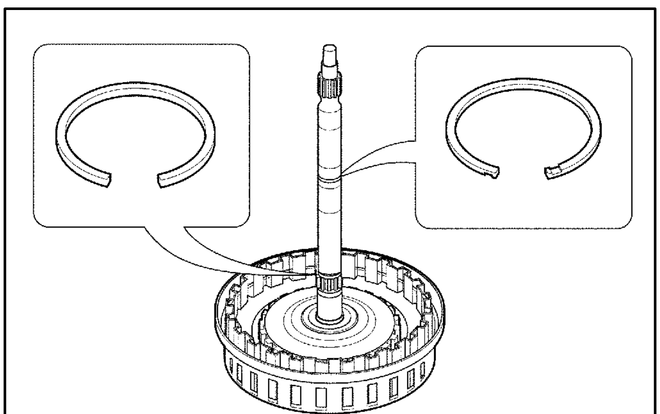
6. Take out the retaining snap ring


UAA5A960

7. Take out the piston B.


UAA5A970

8. Remove disc set B.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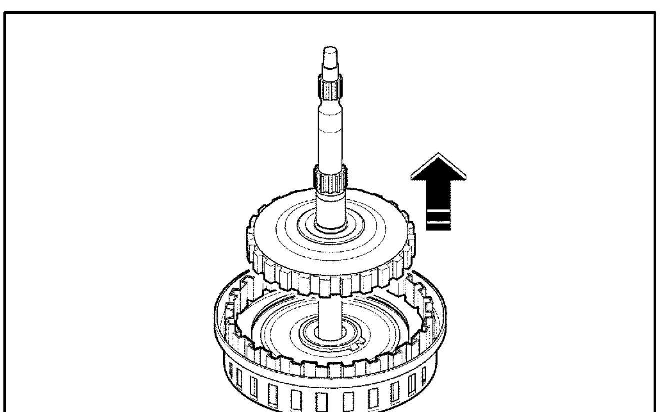
9. Take out the piston rings.

Removal Notice

- Remove the rectangular-section ring for the input shaft and the retaining ring.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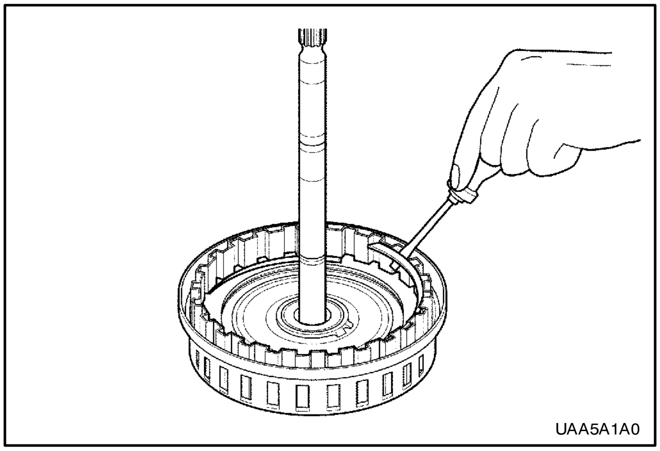
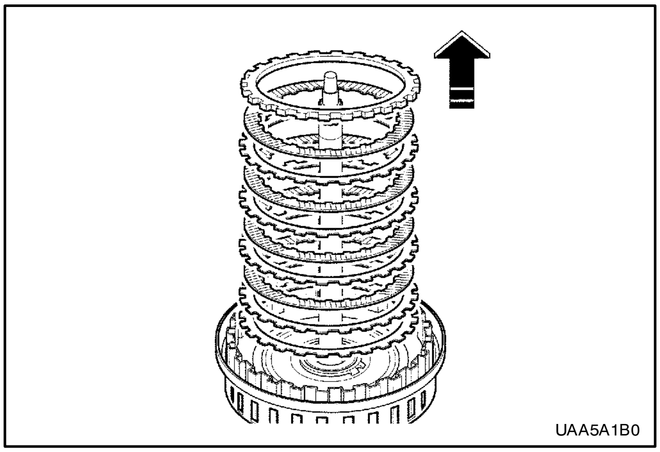
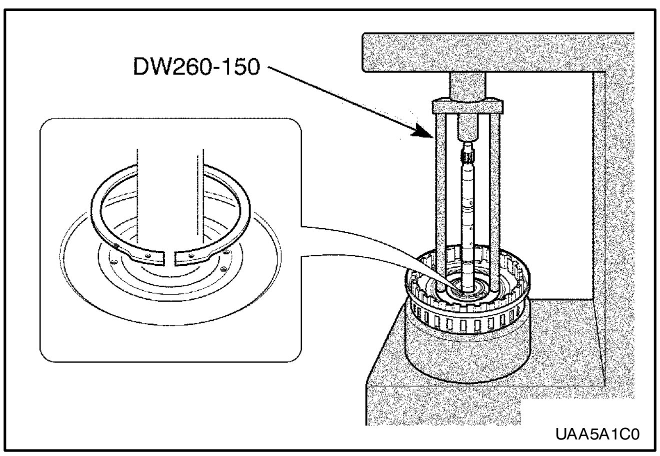
10. Remove inner disc carrier E and needle roller thrust bearing.



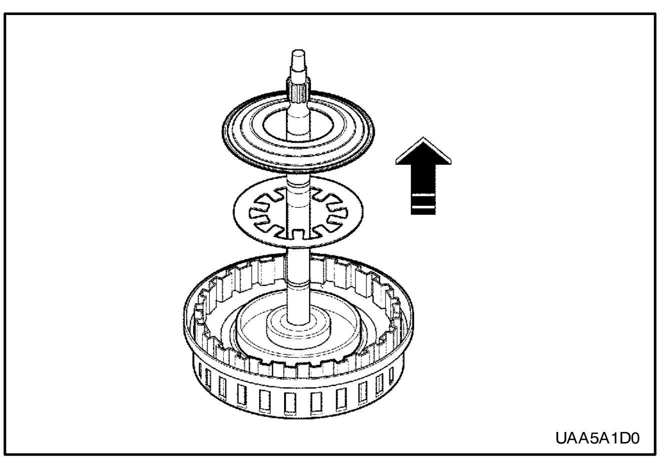
11. Take out the snap ring.



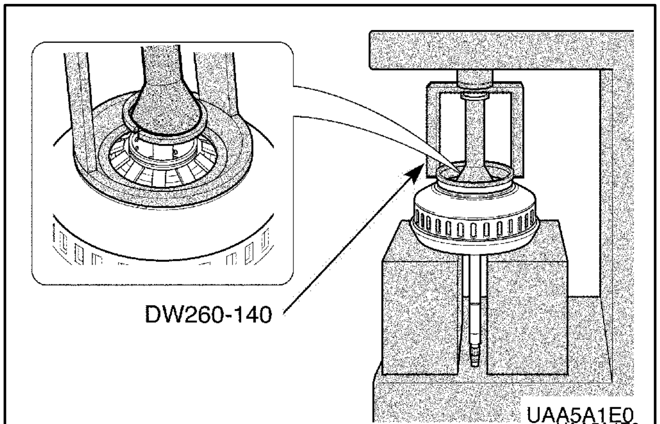
12. Remove Disc set E.



13. Press down cup spring(clutch E) with cup spring press fixture.
14. Remove the split stop ring.



15. Remove the oil dam and cup spring.
16. Pull the O-ring off the oil dam.



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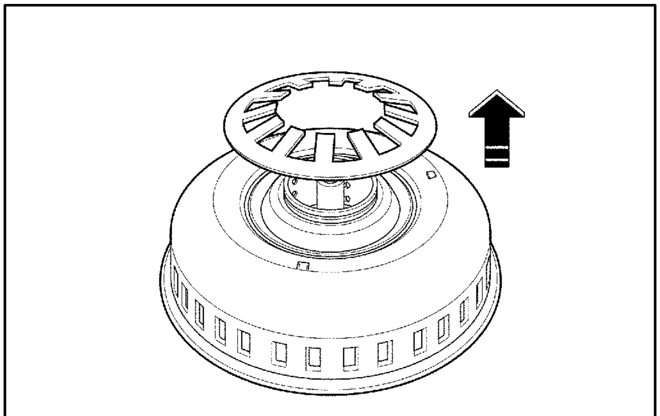
17. Press down cup spring(clutch B)with cup spring press fixture.
18. Remove the split stop ring.



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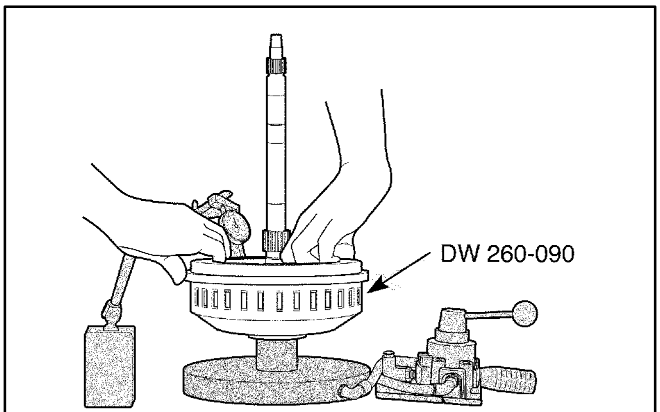
19. Remove the cup spring.
20. Installation should follow the removal procedure in the reverse order.

Adjustment Notice :

Before assembling clutch B/E, setting discs(clutch B/E) have to measured by below measurement procedure.



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CLUTCH B/E MEASUREMENT PROCEDURE

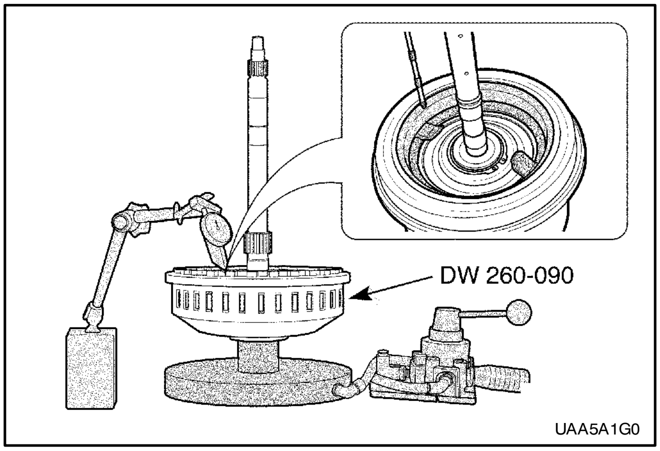
Determine snap ring play

Tools Required

DW 260–090 Clutch B/E(snap ring play, installation space) Measuring Fixture

1. Put the dial gauge sensor on the clutch B adjusting ring.
2. Feed compressed air to clutch B via control valves.
3. Set dial gauge to o.
4. Pressurize clutch E via the control valve and read measurement value.
5. Repeat measurement twice with disc set turned by 120°.
6. Average measurement values M1, M2, M3.(measurement value is S)

- CALCULATION
  S = (M1+M2+M3)/3
- EXAMPLE
  - M1 = 0.27mm, M2 = 0.23mm, M3 = 0.25mm
  - S = 0.25mm



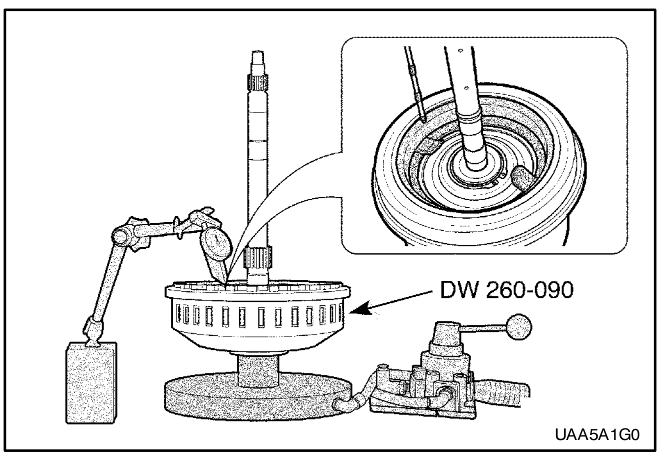
Measuring installation space, clutch B(E_B)

Tools Required

DW 260–090 Clutch B/E(snap ring play, installation space) Measuring Fixture

1. Put the dial gauge's sensor on the clutch B adjusting ring.
2. Feed compressed air to clutch E via control valves.
3. Set dial gauge to o.
4. Lift measurement ring B by hand until it touches the cup and read the measurement value.
5. Repeat measurement twice with the set turned by 120°.
6. Average measurement values M4, M5, M6. (measurement value is M_B)

- The minimum installation space E_B is equal to the height of the ring R_B (specification value ; 11.99mm) plus measurement value M_B
- CALCULATION
  M_B = (M4+M5+M6)/3
  $E_B = R_B + M_B$
- EXAMPLE
  M_4 = 2.36mm
  M_5 = 2.40mm
  M_6 = 2.38mm
  So, M_B = (2.36+2.40+2.38) / 3 = 2.38mm
  E_B = 11.99 + 2.38
  = 14.37mm



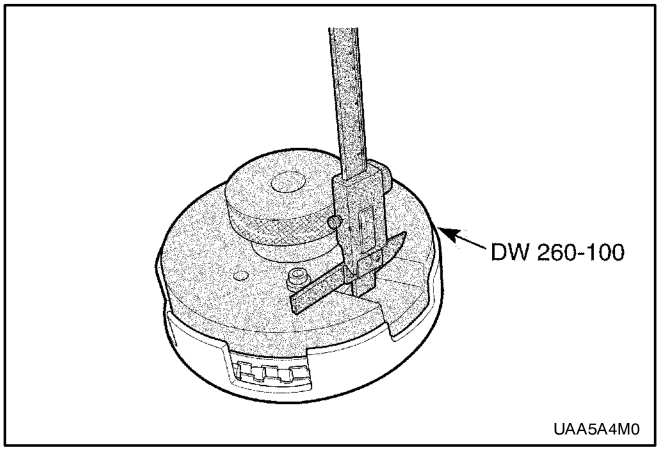
Measuring installation space, clutch E(E_E)

Tools Required

DW 260–090 Clutch B/E(snap ring play, installation space) Measuring Fixture

1. Put the dial gauge's sensor on the clutch E adjusting ring.
2. Set dial gauge to o.
3. Feed compressed air to clutch E via control valves.
4. Read off the measured value.
5. Repeat measurement twice with the set turned by 120°.
6. Average measurement values M7, M8, M9. (measurement value is M_E)

- The minimum installation space B_E is equals ring height R_E (specification value ; 20.98mm) plus M_E – minus snap ring play S.
- CALCULATION
  M_E = (M7+M8+M9)/3
  $E_E = R_E + M_E - S$
- EXAMPLE
  M_7 = 2.6mm
  M_8 = 2.55mm
  M_9 = 2.54mm
  So, M_E = (2.6+2.55+2.54) / 3 = 2.56mm
  E_E = 20.98+2.56–0.25
  = 23.29mm



Determining adjusting disc B(P_B)

Tools Required

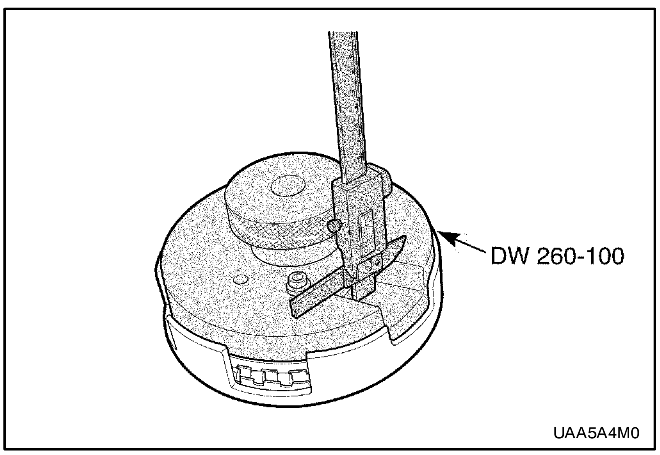
DW 260–100 Brake B/E Disc Thickness Measuring Fixture

1. Using disc thickness gauge, determine thickness M_E for the disc set for clutch B(without adjusting disc, which located in second highest plate).
2. Calculate the test dimension P_B(P_B = E_B – M_B)
   E_B = installation space
   M_B = disc set thickness
   - EXAMPLE
     E_B = 14.37mm
     M_B = 11.3mm
     P_B = 3.07mm
3. Find the disc set's thickness. Refer to the below table.

P_B	Disc set's Thickness
2.83~3.39mm	1.8mm
3.40~3.68mm	2.1mm
3.69~4.08mm	2.5mm
4.09~4.54mm	3.0mm

P_B IS 3.08mm so, the disc set's thickness is 1.8mm.

4. Replace clutch B's setting disc.(1.8mm)



Determining adjusting disc E(P_E)

Tools Required

DW 260–100 Brake B/E Disc Thickness Measuring Fixture

1. Using disc thickness gauge, determine thickness M_B for the disc set for clutch E(without adjusting disc, which located in the lowest plate).
2. Calculate the test dimension P_E(P_E = E_E – M_E)
   E_E = installation space
   M_B = disc set thickness
   - EXAMPLE
     E_E = 23.29mm
     M_E = 16.70mm
     P_E = 6.59mm
3. Find the disc set's thickness. Refer to the below table.

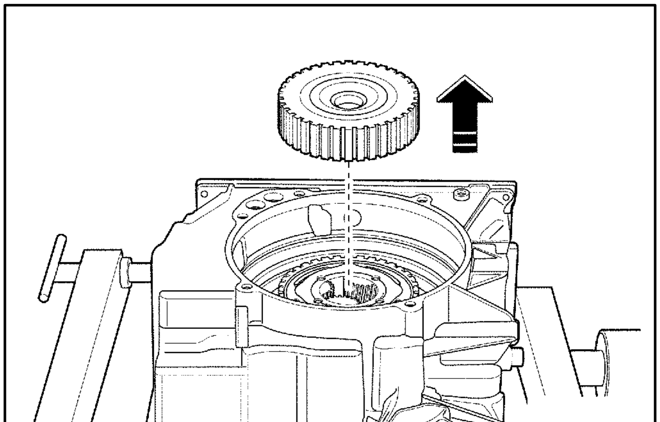
P_E	Disc set's Thickness
5.41~6.00mm	3.9mm
6.01~6.48mm	4.4mm
6.49~6.98mm	5.0mm

P_B IS 3.08mm so, the disc set's thickness is 5.0mm.

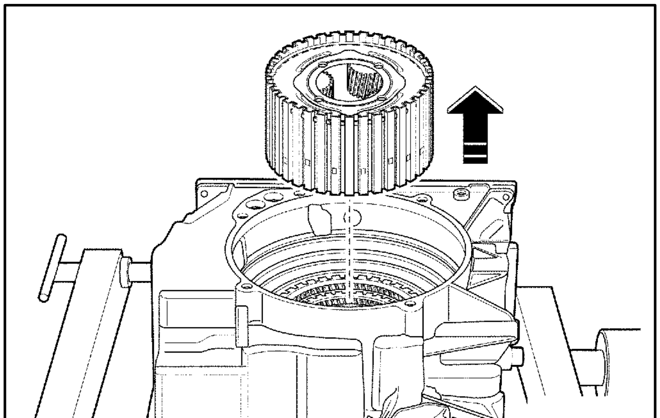
4. Replace clutch B's setting disc.(5.0mm)

PLANETARY GEAR SET

Disassembly and Assembly Procedure


UAA5A1K0

1. Remove the clutch B/E. refer to “**clutch B/E**” in this Section.
2. Remove the rear sun gear.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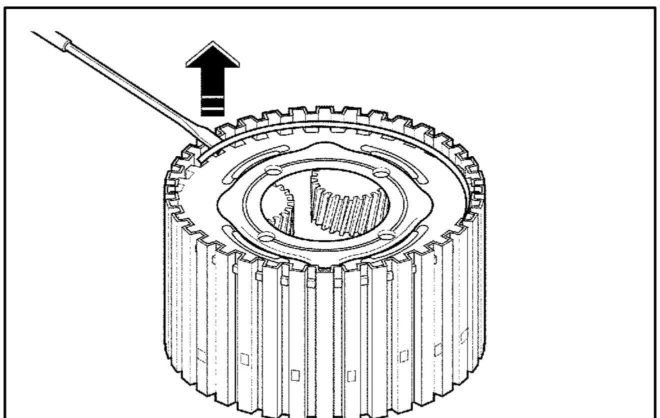
3. Remove the planetary gear set.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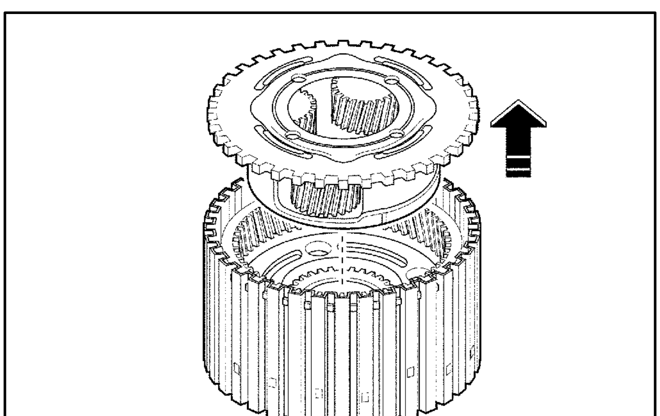
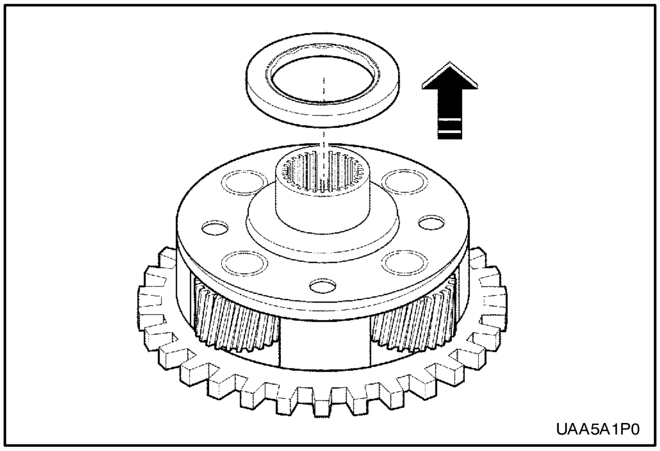
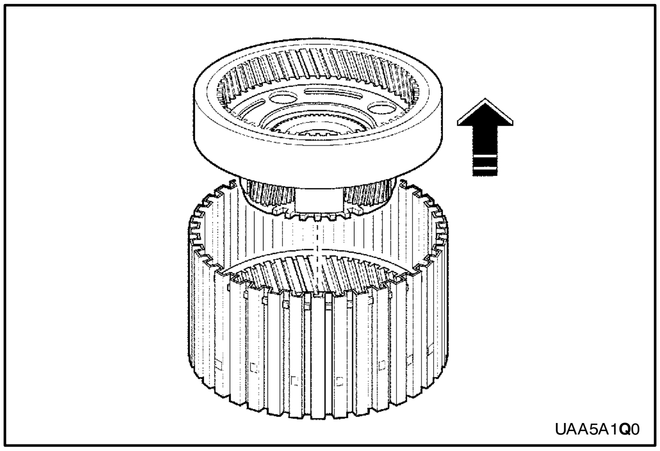
4. Remove snap ring from front ring gear.


UAA5A1N0

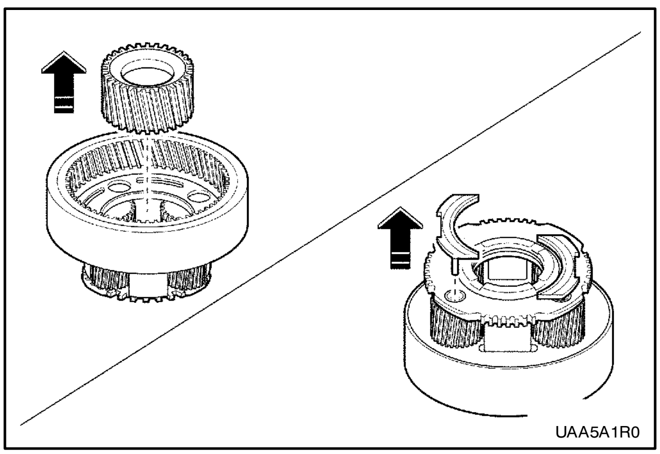
5. Take out rear planetary gear set.



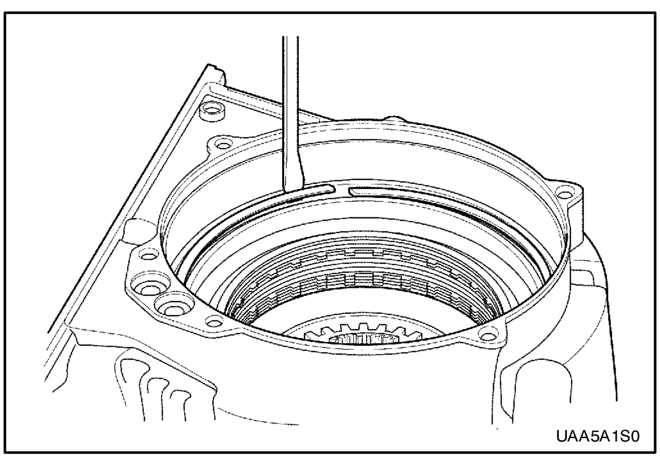
6. Remove the axial needle bearing.



7. Take out front gear set with rear ring gear, front sun gear and oil trays.



8. Take oil trays and front sun gear off the planetary gear set.
9. Installation should follow the removal procedure in the reverse order.



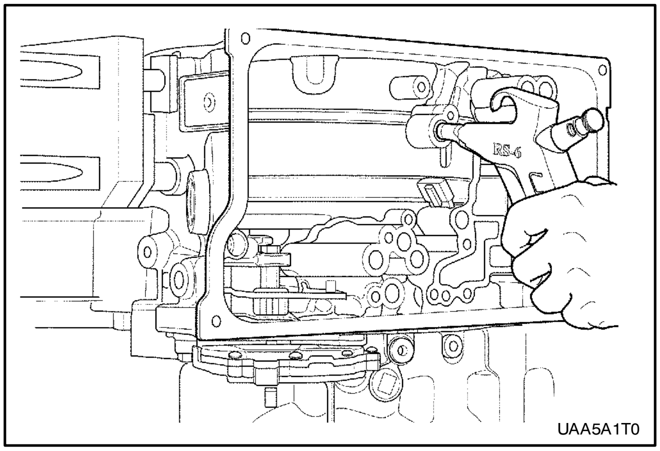
BRAKE C/D

Disassembly and Assembly Procedure

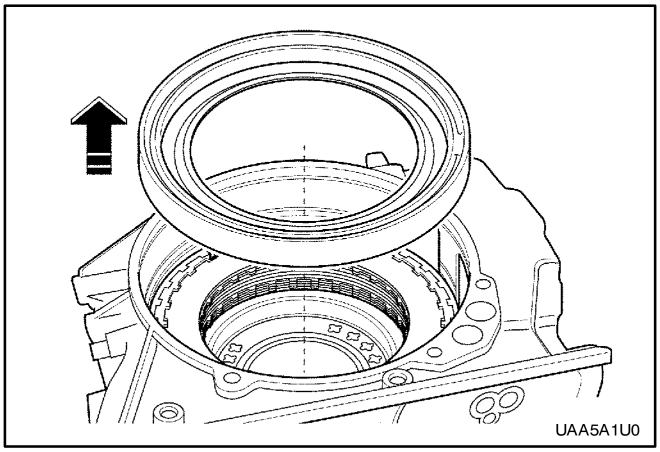
Tools Required

DW 260–160 Brake C/D Snap Ring Remover/Installer

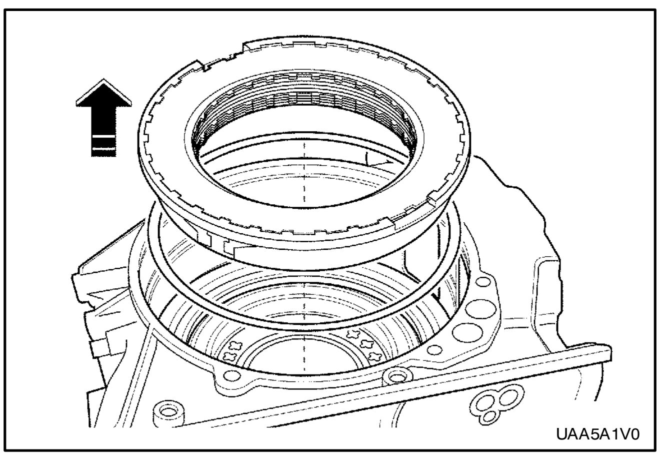
1. Take snap ring out of transaxle housing.



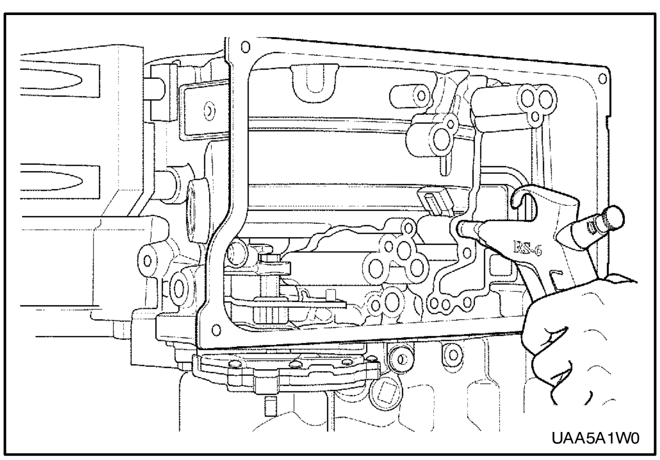
2. Release cylinder with piston C by applying compressed air to the feed bore .



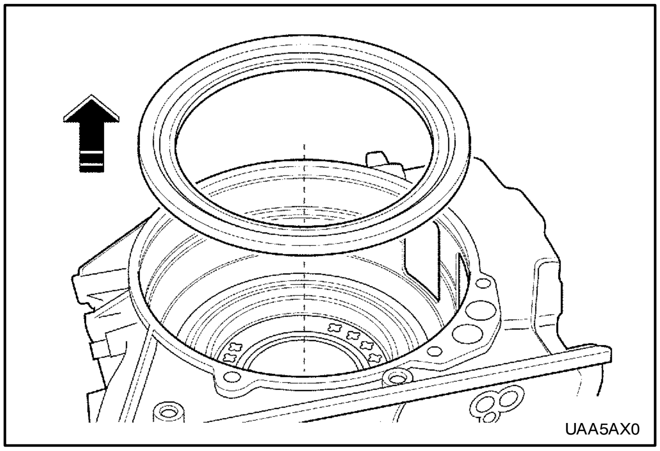
3. Remove cylinder with piston C.



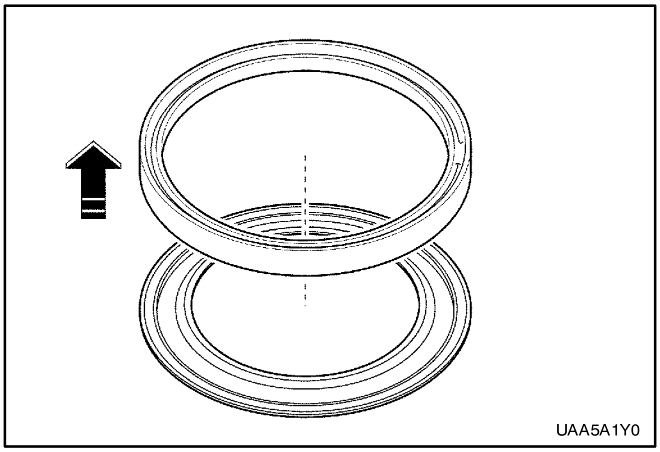
4. Take disc carrier C/D and spring disc out of transaxle housing.



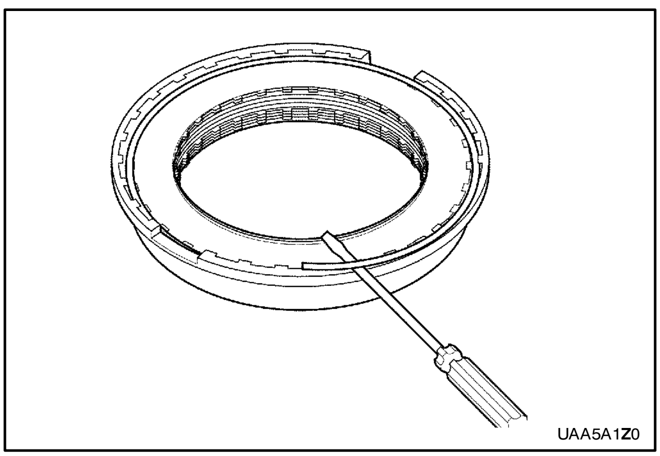
5. Release cylinder with piston D by applying compressed air to the feed bore.



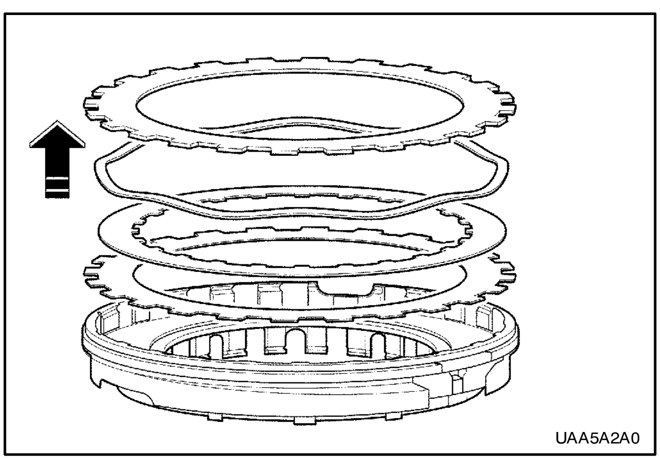
6. Remove cylinder with piston C.



7. Separate between piston C and cylinder C.



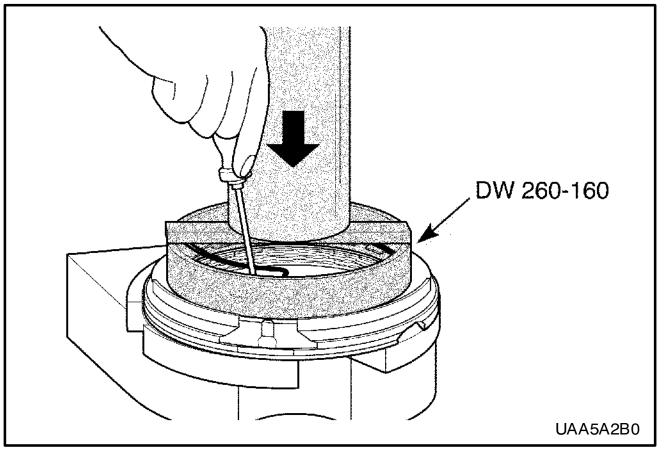
8. Take snap ring out of brake C.



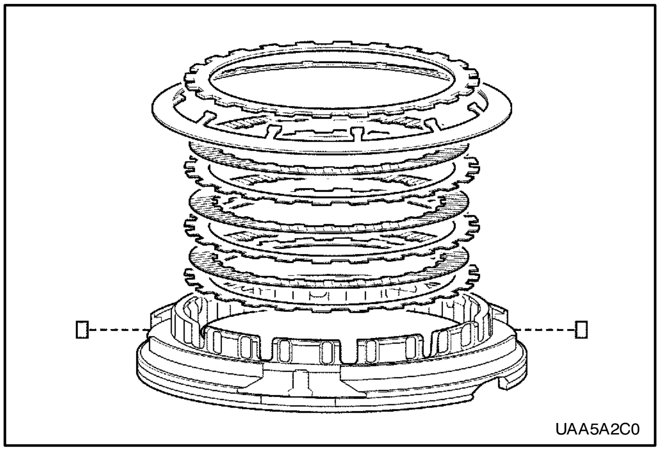
9. Remove the disc set C.

Installation Notice

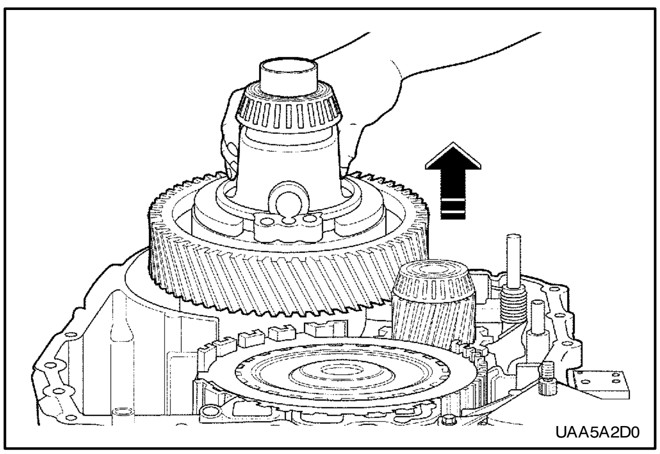
- Transaxle has two lined clutch discs and one steel clutch disc. The lined discs must be installed in such a way that the lining faces the steel disc.
- Insert the fitting keys into the appropriate grooves.



10. Turn the disc carrier C/D by 180°.
11. Using assembly bracket Press down cup spring and take out the snap ring.



12. Remove the disc set D.
13. Installation should follow the removal procedure in the reverse order.



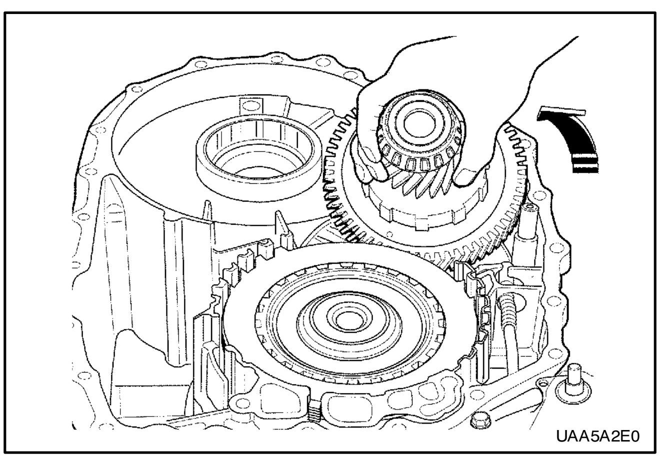
DIFFERENTIAL

Disassembly and Assembly Procedure

1. Remove the torque converter housing. Refer to "**torque converter**" in this Section.
2. Lift out the differential.
3. Installation should follow the removal procedure in the reverse order.

Removal Notice

- Don't disassemble the differential to avoid incorrect operation.



SIDE SHAFT

Disassembly and Assembly Procedure

1. Remove the differential. Refer to "**differential**" in this Section.
2. Tilt and remove the side shaft.
3. Installation should follow the removal procedure in the reverse order.

Removal Notice

- Don't disassemble the differential to avoid incorrect operation.

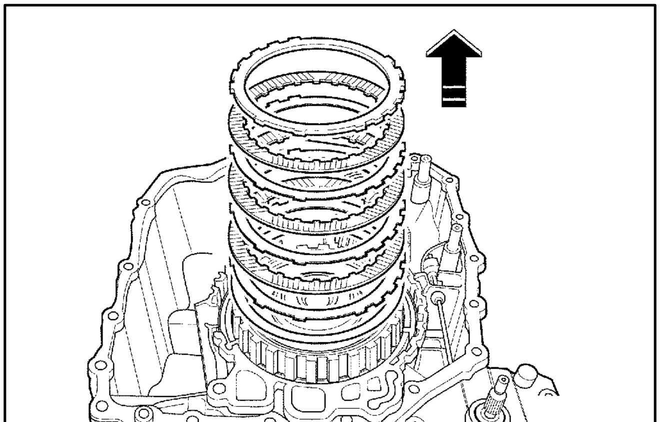
BRAKE F

Disassembly and Assembly Procedure

Tools Required

DW 260–060 Brake F Split Stop Ring Remover

1. Remove the side shaft. Refer to “**side shaft**” in this Section.
2. Take OFF the disc set and the brake F inner disc carrier.



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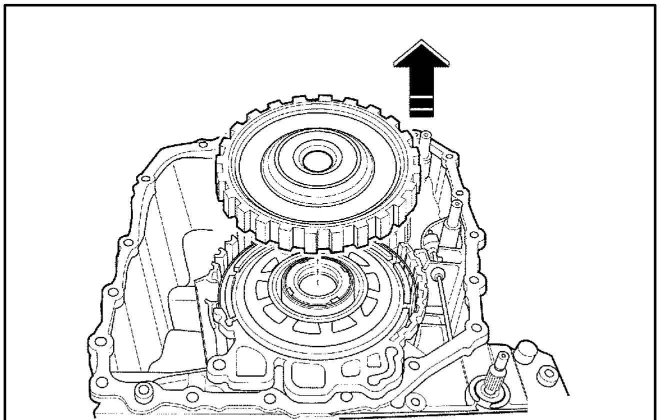

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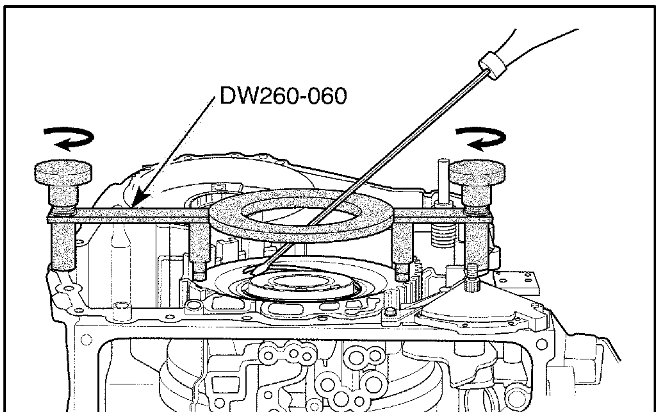
3. Mount fixture and remove the brake F split stop ring.



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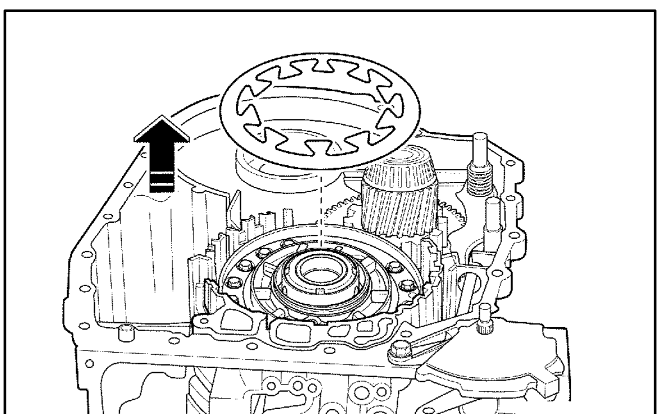
4. Remove the fixture and take off the cup spring.



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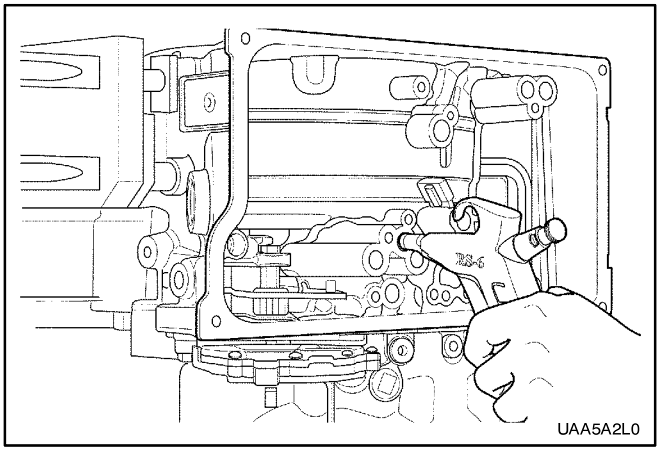
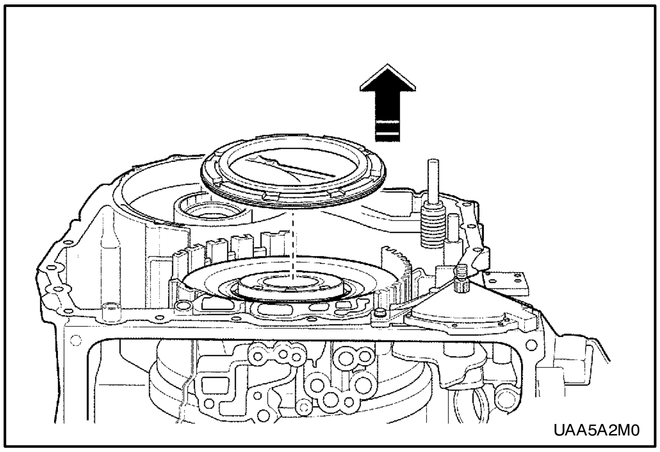


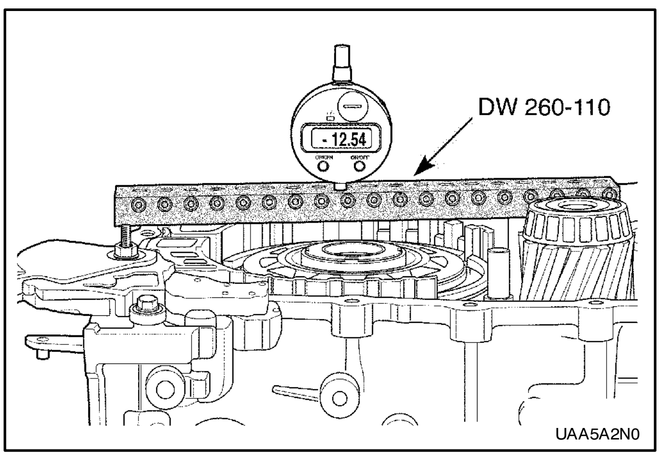
5. Release the piston F by applying compressed air to the bore.



6. Remove piston F. and bearing plate with spur gear.
7. Installation should follow the removal procedure in the reverse order.

Removal Notice

Since the bearing set is tight, press the bearing plate upward from underneath to remove it.



Measuring installation space F

Tools Required

DW 260–110 Brake F Disc Clearance Measuring Bar

1. Using a depth gauge, measuring from the transaxle housing sealing surfaces to the piston's disc support surface at two opposing points = M_1, M_2
2. Average the measurement values M_1, M_2 = B_F
   - CALCULATION
     $B_F = (M_1+M_2)/2$
   - CALCULATION
     M_1 = 18.6mm
     M_2 = 18.8mm
     B_F = 18.7mm

Determining adjusting disc F

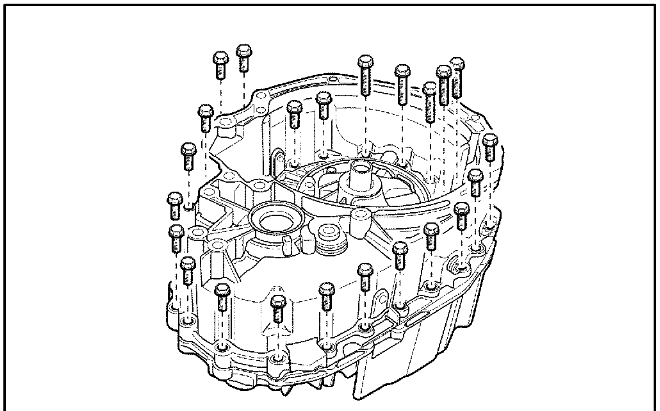
1. Calculate the test dimension P_F($P_F = B_F - M_F$)
   B_F = installation space
   M_F = disc set thickness(assume 14.50mm)
   - EXAMPLE
     B_F = 18.70mm
     M_F = 14.50mm
     P_E = 4.2mm

2. Find the disc set's thickness. Refer to the below table.

P_F	Disc set's Thickness
3.01~3.19mm	1.8mm
3.20~3.48mm	2.1mm
3.49~3.88mm	2.5mm
3.89~4.08mm	2.7mm
4.09~4.30mm	3.0mm

P_E IS 4.20mm so, the disc set's thickness is 3.0mm.

3. Replace clutch B's setting disc.(3.0mm)

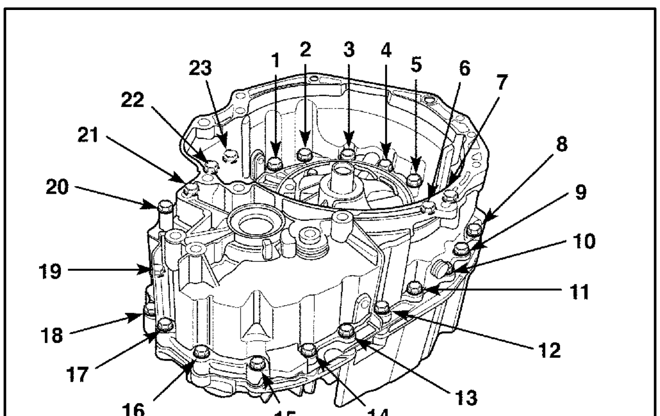


UAA5A2P0

TORQUE CONVERTER HOUSING

Disassembly and Assembly Procedure

1. Remove the torque converter bolts.
2. Hit the torque converter housing lightly.
3. Remove the torque converter housing.



UAA5A2Q0

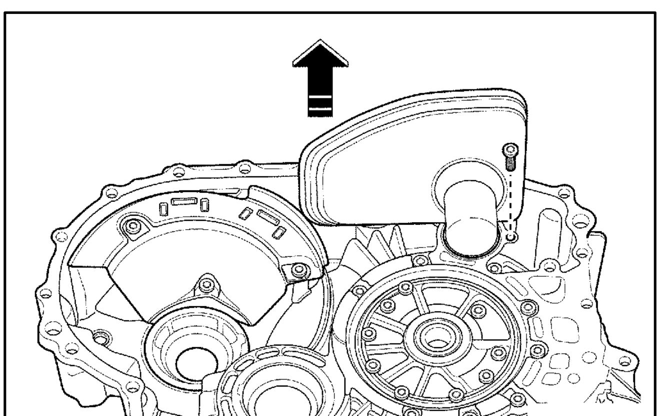
Installation Notice

- First pre-tighten the bolts in the following order. (7,20) → (12,23) → (16,4)

Tightening Torque	15N·m(11lb–ft)

- Then, tighten the bolts in the following order. (15,3) → (16,4) → (14,5) → (13,23) → (12,22) → (11,21) → (10,20) → (9,19) → (8,18) → (7,17) → (6) → (1,2)
- Last, in numerical order, tighten the bolts all the way.(1 → 23)

Tightening Torque	23N·m(17lb–ft)

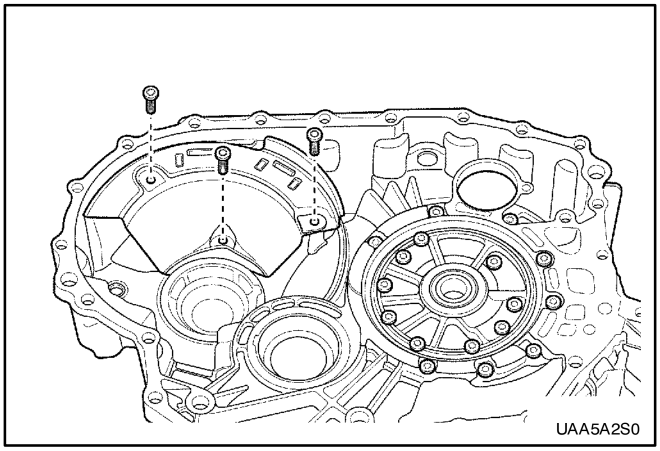


UAA5A2R0

4. Take out the metal gasket.
5. Take out the paper gasket.
6. Remove the oil filter bolt and oil filter.

Installation Notice

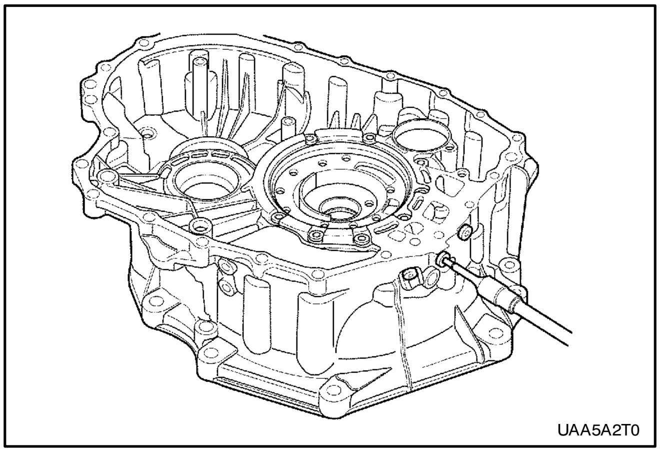
Tightening Torque	10N·m(89lb–in)



7. Remove the baffle plate bolts and baffle plate.

Installation Notice

Tightening Torque	10N·m(89lb–in)



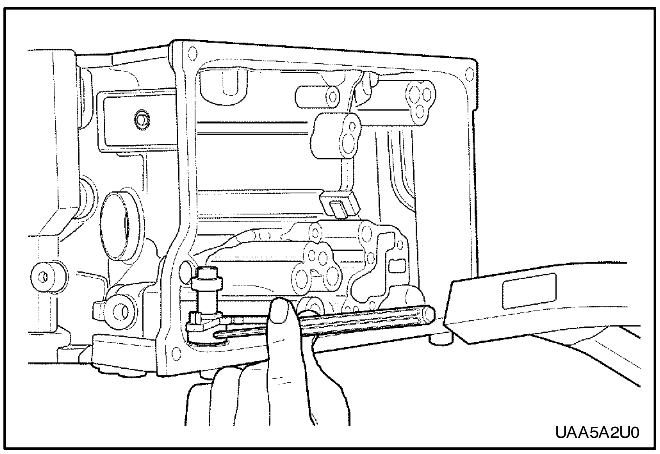
8. Remove the line pressure measurement plug.
9. Installation should follow the removal procedure in the reverse order.

Installation Notice

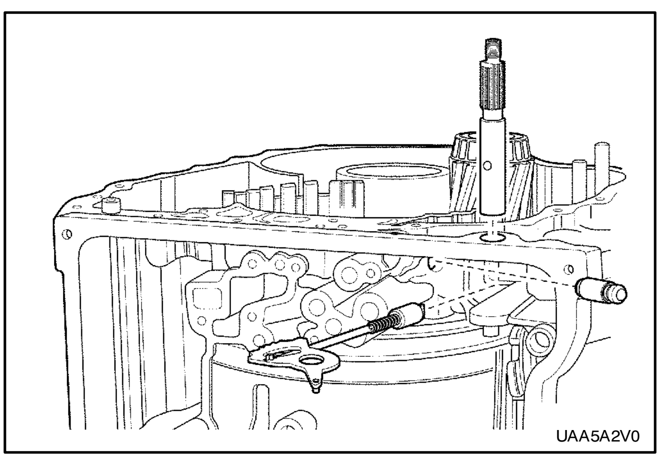
Tightening Torque	20N·m(15lb–ft)

SHIFT MECHANISM

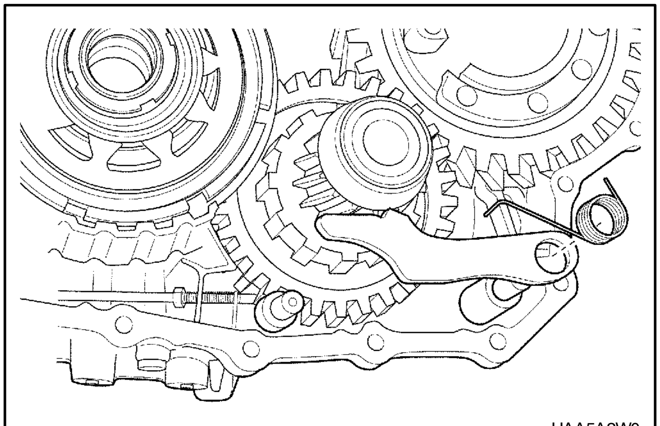
Disassembly and Assembly Procedure



1. Take out the select shaft clamping sleeve.



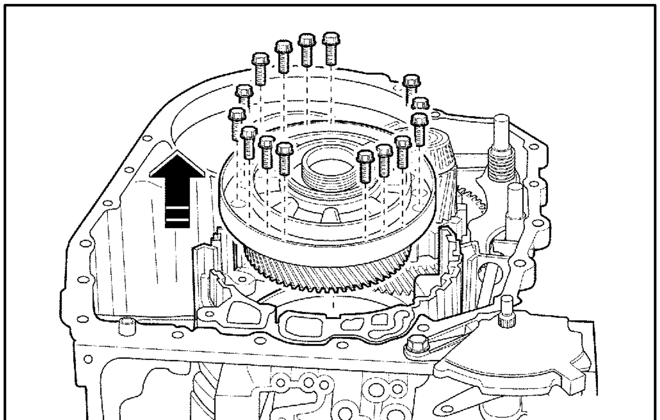
2. Remove the shift mechanism.
   - Shift mechanism is consist of select shaft, detent disc, connecting bar, stop bush.
3. Installation should follow the removal procedure in the reverse order.


UAA5A2W0

PARKING LOCK SYSTEM

Disassembly and Assembly Procedure

1. Remove the parking lock assembly.
   - Parking lock system is consist of parking pawl, leg spring, support bolt.
2. Installation should follow the removal procedure in the reverse order.


UAA5A2X0

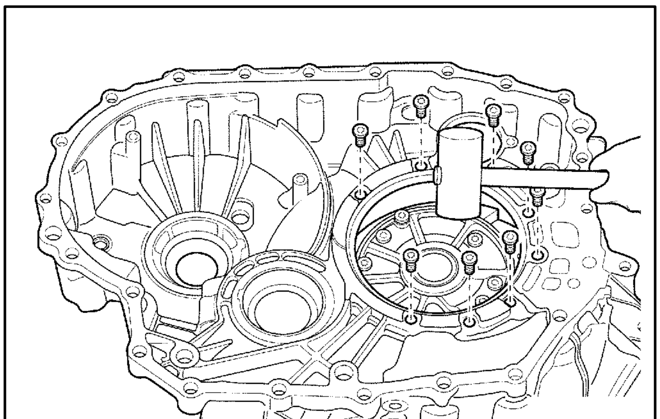
BEARING PLATE(WITH SPUR GEAR) ASSEMBLY

Disassembly and Assembly Procedure

1. Remove the piston F. refer to "**brake F**" in this Section.
2. Remove the bearing plate bolts. And bearing plate.
3. Installation should follow the removal procedure in the reverse order.

Installation Notice

Tightening Torque	27N·m(17lb–ft)


UAA5A2Y0

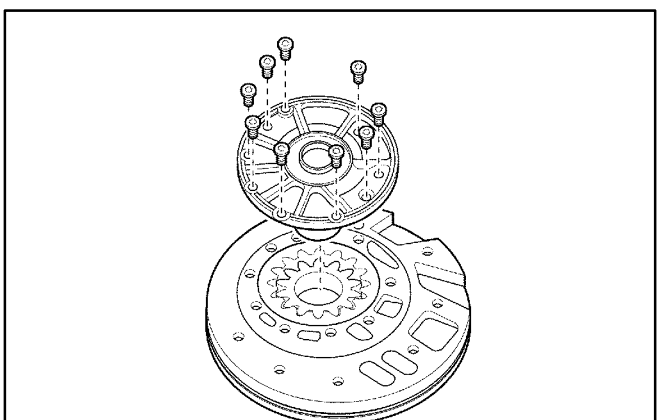
OIL PUMP ASSEMBLY

Disassembly and Assembly Procedure

1. Remove the oil pump housing bolts.
2. Using the plastic hammer. Take out the oil pump housing.

Installation Notice

Tightening Torque	10N·m(89lb–in)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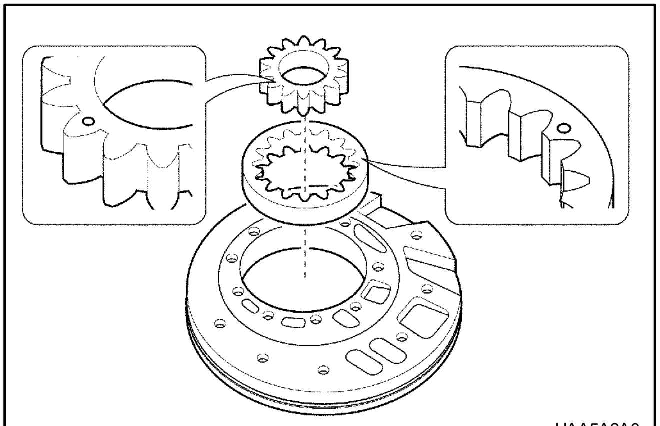
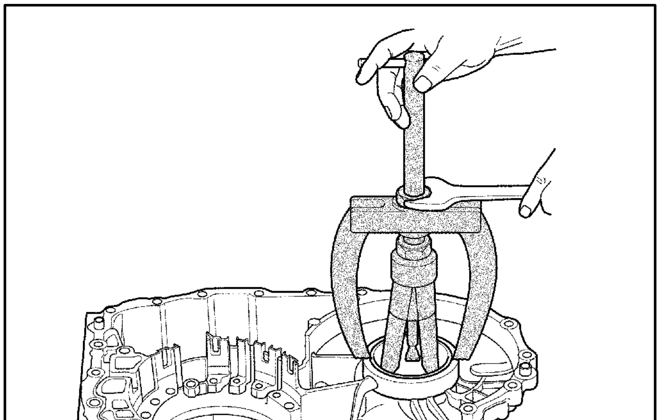
3. Remove the stator shaft bolts.


UAA5A3A0

4. Dismantle the oil pump gear, ring gear
5. Installation should follow the removal procedure in the reverse order.


UAA5A3B0

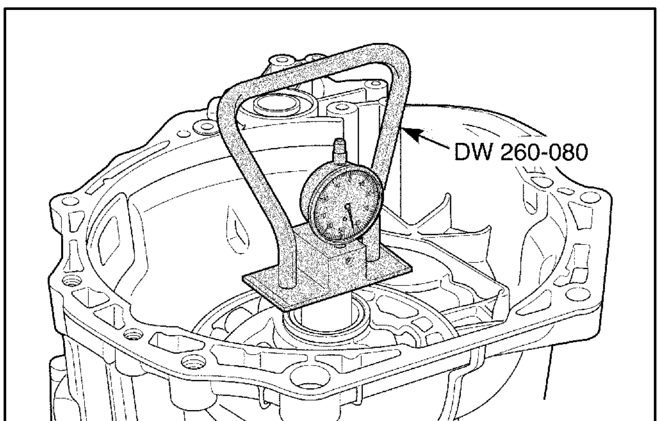
DIFFERENTIAL/SIDE SHAFT OUTER RACE, BEARING SHIM

Disassembly and Assembly Procedure

1. Take out the outer race of the transaxle housing side.
2. Remove the bearing shim.
3. Take out the outer race of the torque converter housing side.

Installation Notice

- Heat the bearing seats well and insert bearing outer rings with shim for differential and side shaft into the transaxle housing.



UAA5A4S0

IMPORTANT MEASUREMENT/ADJUSTMENT

Adjusting axial play, input shaft

Tools Required

DW 260–080 Clutch B/E Shim Setting Gauge

Important : After assembling the rear cover. You must measure the axial play spec'. if the measured data is not satisfied the specification. Replace the clutch B/E's shim.
Incorrect axial play may cause the vibration or noise. The specification of the axial play is 0.18 to 0.42mm.

1. Clamp fixture on the input shaft so that the measuring base rests on the stator shaft.
2. Set dial gauge to 0.
3. Measure axial play by pulling and pressing on the handle(repeat measurement)

4. Calculate the measurement values.(average)
   - EXAMPLE
     M_1 = 0.51mm
     M_2 = 0.49mm
     M = (0.51+0.49)/2 = 0.5mm
     S(specification) = 0.18~0.42mm
     D(adjustment value) = 0.5mm − (0.18~0.42)mm
     So, D is 0.08 to 0.32mm
     Calculate the average, so D is 0.2mm
5. Replace shim.
   - Disc thickness must be between 0.08 and 0.32mm thicker. It is sensible to select one with a disc that average 0.2mm thicker than the one that was installed.

SPECIFICATIONS

GENERAL SPECIFICATIONS

	Definition
Transaxle Type	4–speed with four–wheel drive and transverse engine
Input Torque	240N·m
Transaxle Weight	76kg
Torque Converter Capacity	9.72kg
Transaxle Fluid Type(manufacture company)	ESSO LT 71141
Transaxle Fluid Capacity	6.9kg

TRANSAXLE GEAR RATIO

Gear	Ratio
First	2.719
Second	1.487
Third	1.000
Fourth	0.717
Reverse	2.529
Final	3,945 (2.0DOHC)

FLUID CAPACITY

	Litres	Quarts
Bottom Pan Removal	4	4.2
Complete Overhaul	6.9	7.3
Torque Converter Removal	2	2.1
(Measurements are approximate)		

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Bearing Plate Bolts	23.5	17.5	–
Slotted Nut	220	–	–
Rear Cover Attachment Bolts	23.5	17.5	–
Baffle Plate Attachment Bolts	10	–	89
Park/Neutral Position Switch	10	–	89
Fluid Pump Connecting Bolts	10	–	89
Fluid Filter Housing Cover Attachment Bolts	10	–	89
Input Speed sensor Attachment Bolts	8	–	71
Output Speed sensor Attachment Bolts	8	–	71
Valve Body Bolts	8	–	71

FASTENER TIGHTENING SPECIFICATIONS (CONT'D)

Application	N•m	Lb-Ft	Lb-In
Valve Body Upper&Lower Fixing Bolts	6	–	53
Fluid Pan Connecting Bolts	6	–	53
Fluid Pan Drain Plug	45	33	–
Fluid Level Plug	45	33	–
Line Pleasure Plugs	20	15	–
Valve Housing 1 Cover Attachment Bolts	6	–	53
Solenoid Valve Attachment Bolts	6	–	53
Pressure Control Regulator(EDS) Attachment Bolts	6	–	53
Cooler Pipe Attachment Bolts	32.5	24	–
Shift Control Cable Adjuster Pinch Nut	8	–	71
Shift Control Cable Attachment Nut	8	–	71
Shift Control Cable Bracket Attachment Nut	25	18	–
Shift Control Lever Bracket Attachment Bolt	8	–	71
Transaxle Upper Attachment Bolts	72.5	53	–
Transaxle Lower Attachment Bolts(Long Bolts)	31	23	–
Transaxle Lower Attachment Bolts(Short Bolts)	21	15	–
Selector Lever(On Transaxle Case)	15	11	–
TCM Attachment Bolts	7	–	62
TCM Bracket Attachment Bolts	7	–	62
Transaxle Center Mounting Bracket Attachment Bolts	61	44	–
Transaxle Center Mounting Bracket Attachment Nuts	100	74	–
Transaxle Left Mount–to–Connecting Bolts	48	35	–
Transaxle Left Mount–to–Connecting Nuts	48	35	–
Transaxle Rear Mount Bracket Attachment Bolts	75	55	–
Torque Converter Attachment Bolts	45	33	–

Range	Park/ Neutral	Reverse	D				3			2		1
Gear	N	R	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	1st
Solenoid Valve 1	ON	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF	ON/ OFF
Solenoid Valve 2	ON	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
Line Pressure Control Solenoid Valve 3 (EDS 3)	OFF	OFF	OFF	ON	ON/ OFF	ON/ OFF	OFF	ON	ON/ OFF	OFF	ON	ON/ OFF
Line Pressure Control Solenoid Valve 4 (EDS 4)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Line Pressure Control Solenoid Valve 5 (EDS 5)	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	ON
Line Pressure Control Solenoid Valve 6 (EDS 6)	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON
Brake B	A	A	A		A		A		A	A		A
Brake C						H						
Brake D		H										
Clutch E				A	A	A		A	A		A	
Brake F			H	H			H	H		H	H	H
Lock–up Clutch						A						

A = Applied
H = Holding
ON = The solenoid is energized.
OFF = The solenoid is de-energized.
** = Manual Second–Third gear is only available above approximately 100 km/h (62 mph).
*** = Manual First–Second gear is only available above approximately 100 km/h (62 mph).
NOTE: Manual First–Third gear is also possible at high vehicle speed as a safety feature.

SHIFT SPEED CHART

Up Shift Speed

MODEL	First–Second gear (±4.8km/h)				Second–Third gear (±6.4km/h)				Third–Fourth gear (±8km/h)			
	10% TPS	25% TPS	50% TPS	100% TPS	10% TPS	25% TPS	50% TPS	100% TPS	10% TPS	25% TPS	50% TPS	100% TPS
2.0 DOHC EOBD	20	20	27	57	37	38	49	108	50	53	74	168
2.0 DOHC Non EOBD	18	19	26	57	32	35	50	108	43	50	77	164

Down Shift Speed

MODEL	Down Shift (±6.4km/h)			Lock Up Clutch Applied (Fourth)		Lock Up Clutch Released (Fourth)	
	Fourth–Third (Coast)	Third–Second (Coast)	Second–First (Coast)	10%	25%	10%	25%
2.0 DOHC EOBD	43	22	12	70	70	65	65
2.0 DOHC Non EOBD	35	22	12	60	62	55	55

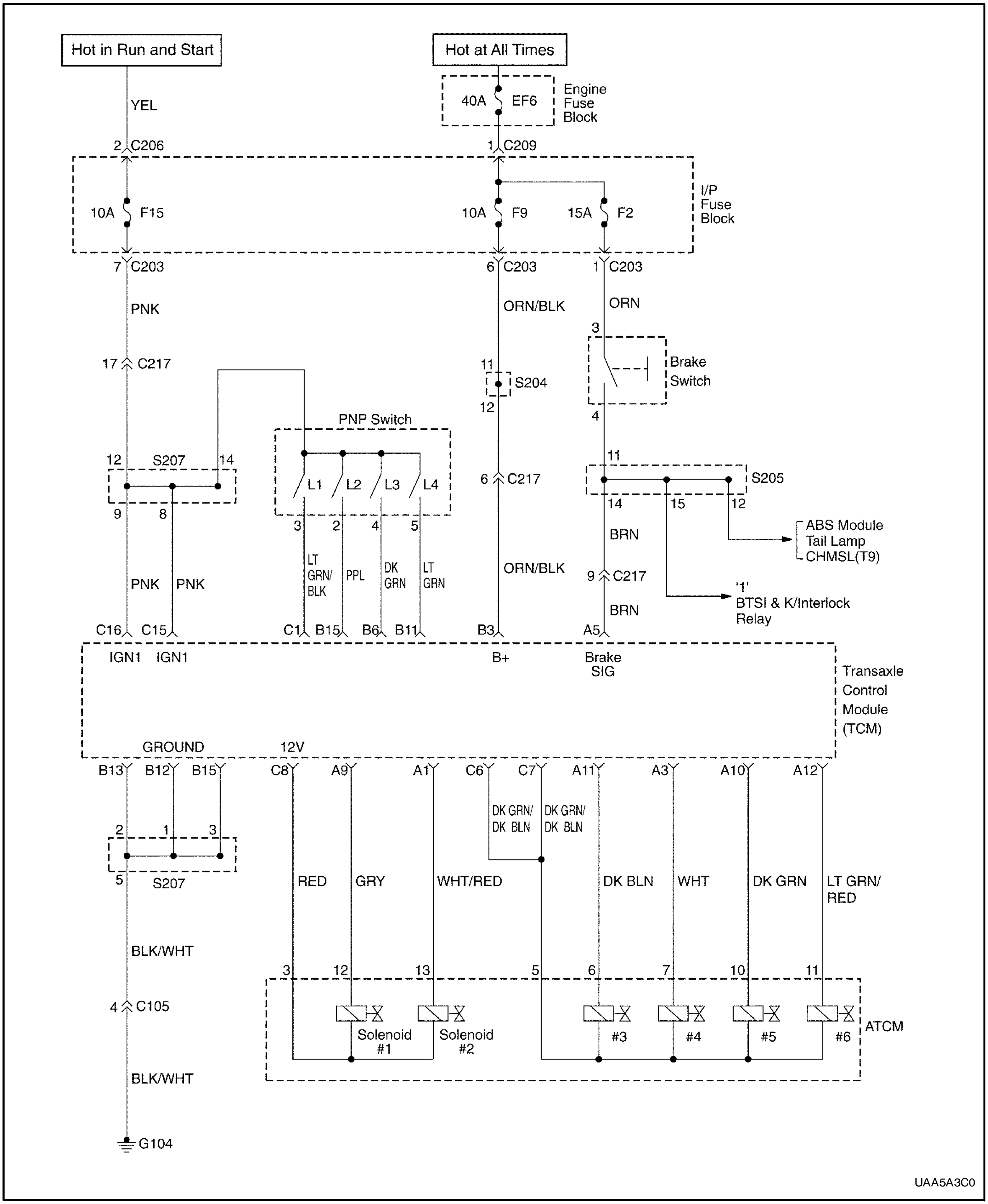
LINE PRESSURE

Gear Range	Solenoid	Line Pressure	B Port	E Port
Park / Neutral	ON	LOW	6.2~8.6 bar	
	OFF	HIGH	15.3~17.4 bar	
Reverse	ON	LOW	6.2~8.6 bar	
	OFF	HIGH	15.3~17.4 bar	
Drive	ON	LOW		6.2~8.6 bar
	OFF	HIGH		9.5~11.2 bar
3	ON	LOW	6.2~8.6 bar	6.2~8.6 bar
	OFF	HIGH	15.3~17.4 bar	9.5~11.2 bar
2	ON	LOW		6.2~8.6 bar
	OFF	HIGH		9.5~11.2 bar
1	ON	LOW	6.2~8.6 bar	
	OFF	HIGH	15.3~17.4 bar	

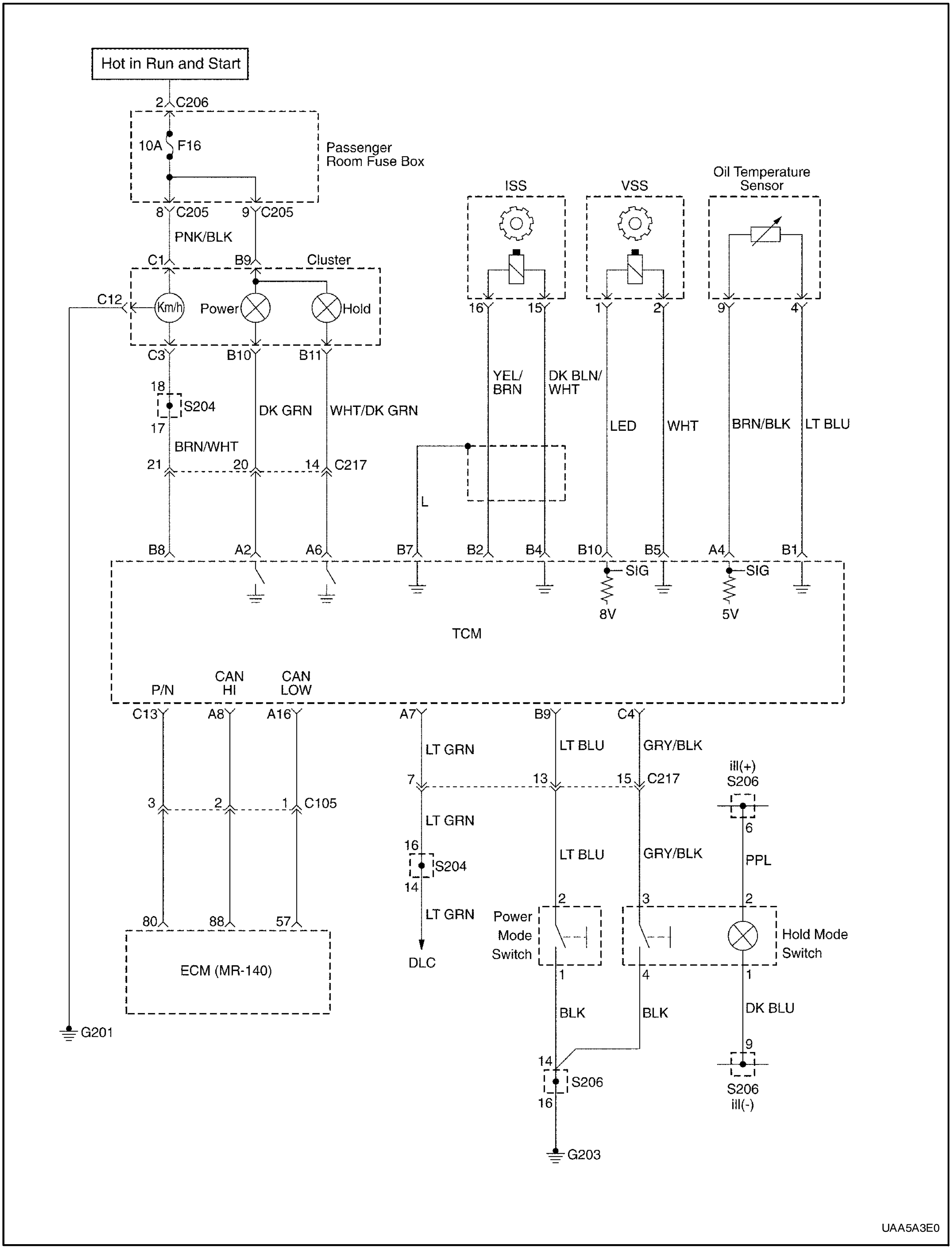
SCHEMATIC AND ROUTING DIAGRAMS

TRANSAXLE CONTROL MODULE

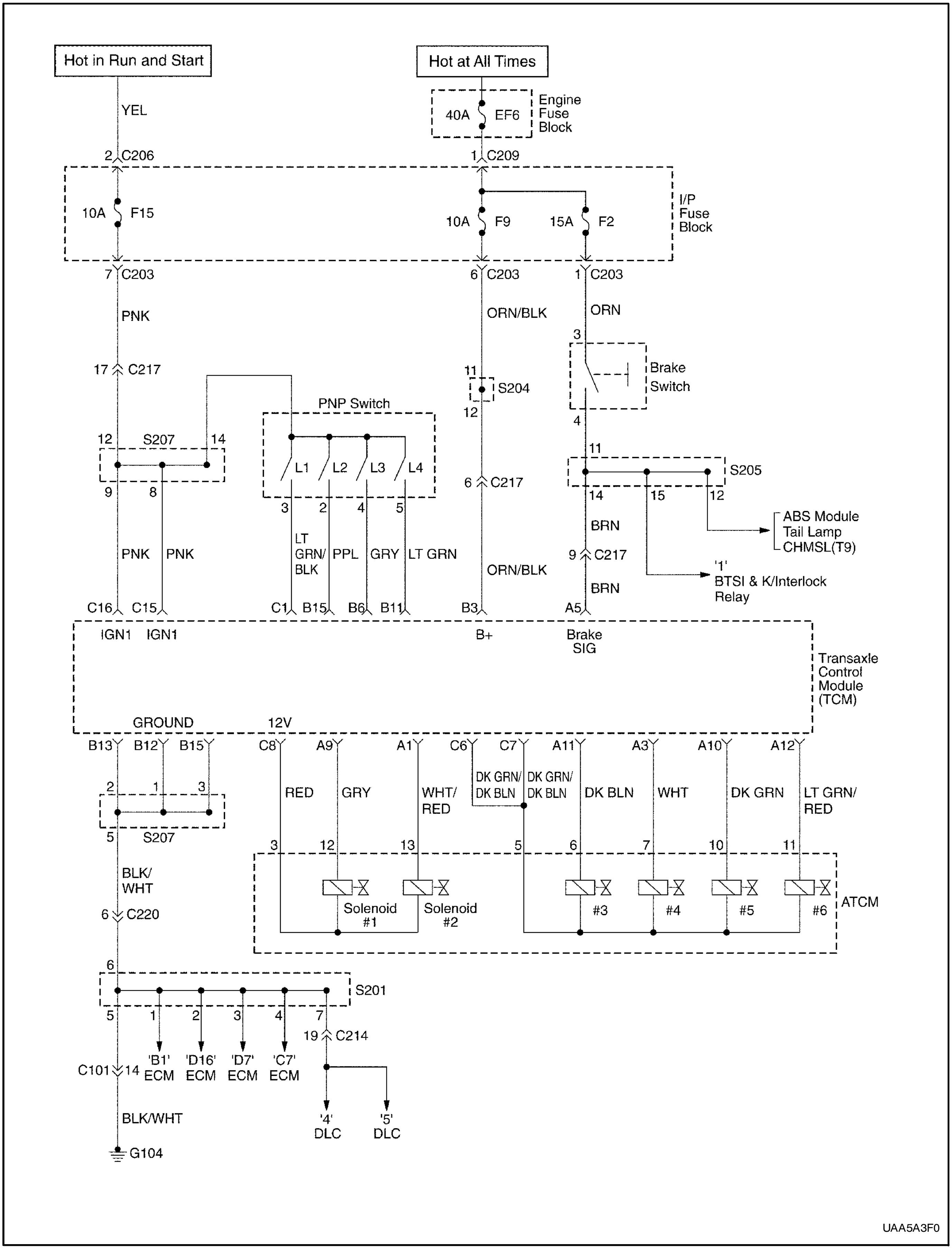
2.0L DOHC (DELPHI 32bit) (1 of 2)



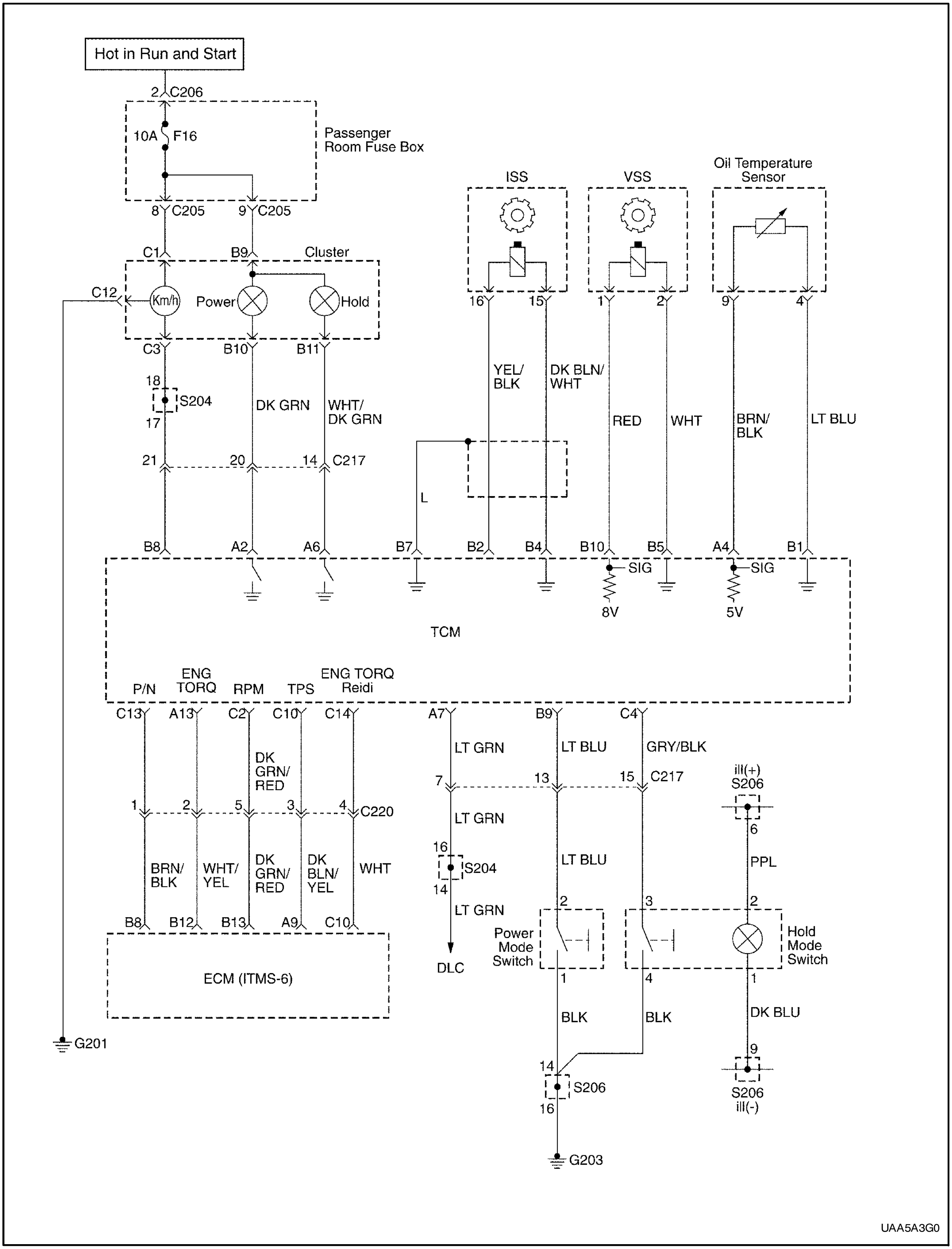
2.0L DOHC (DELPHI 32bit) (2 of 2)



2.0L DOHC (DELPHI 8bit) (1 of 2)

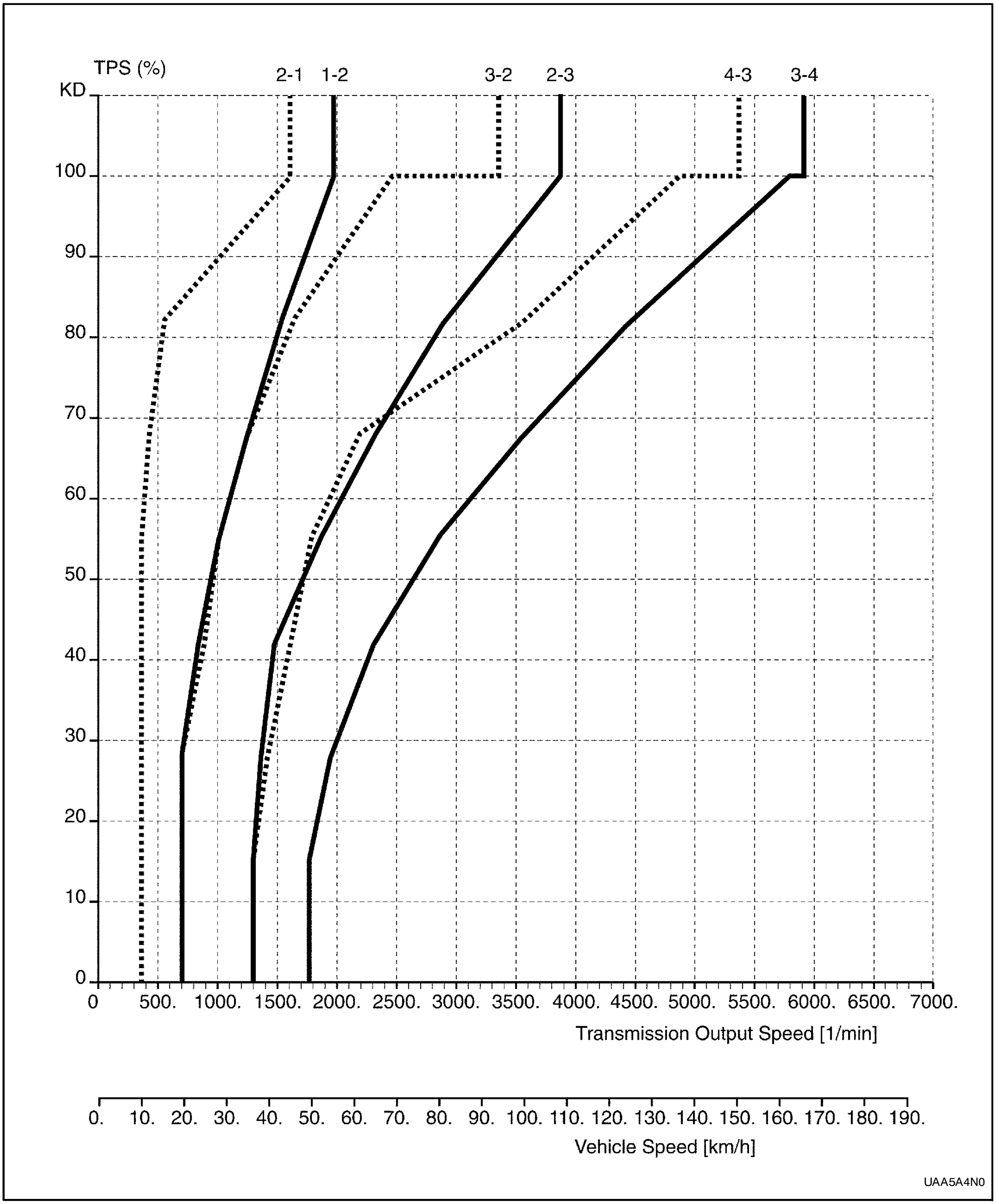


2.0L DOHC (DELPHI 8bit) (2 of 2)

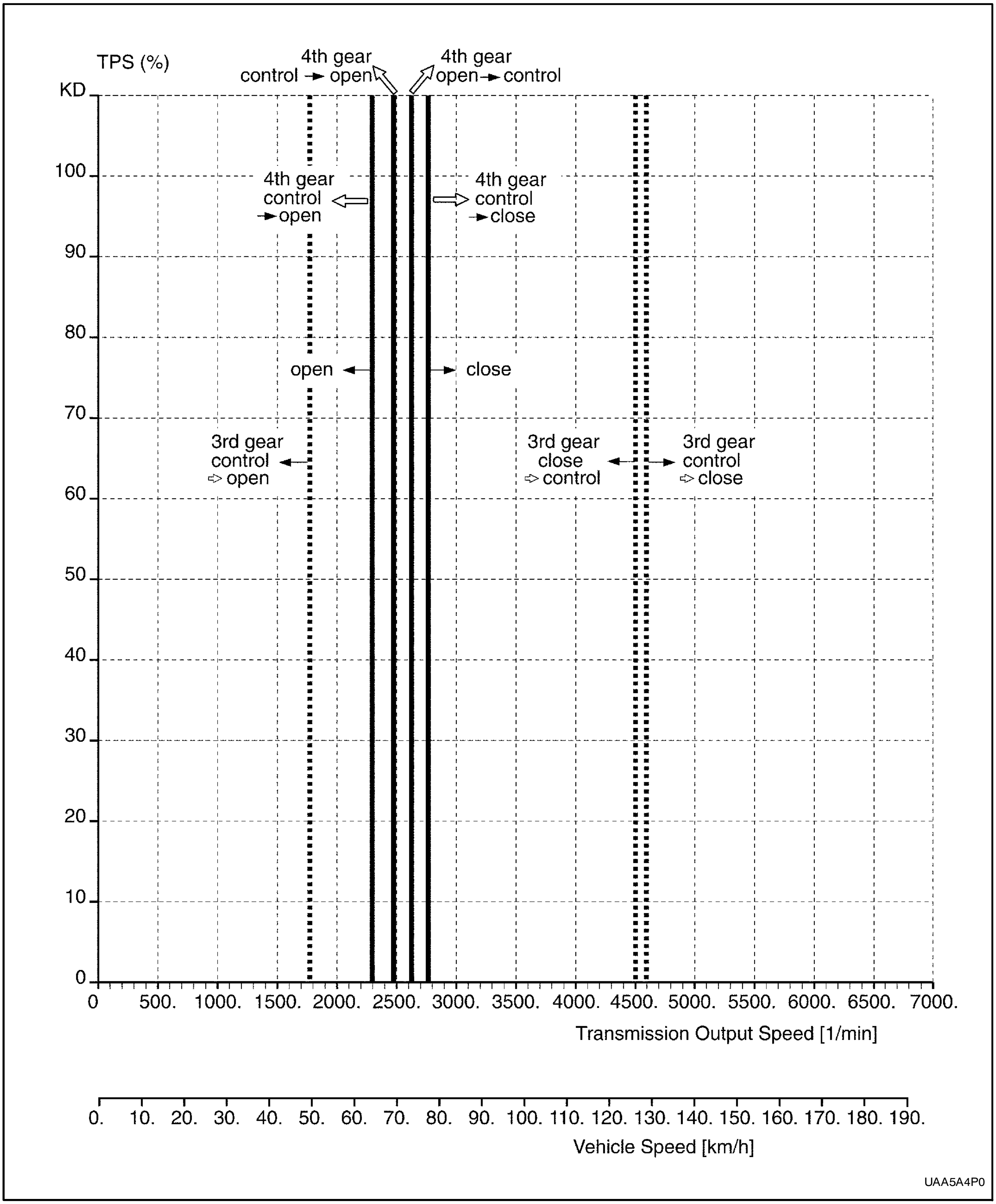


SHIFT MODE DIAGRAM

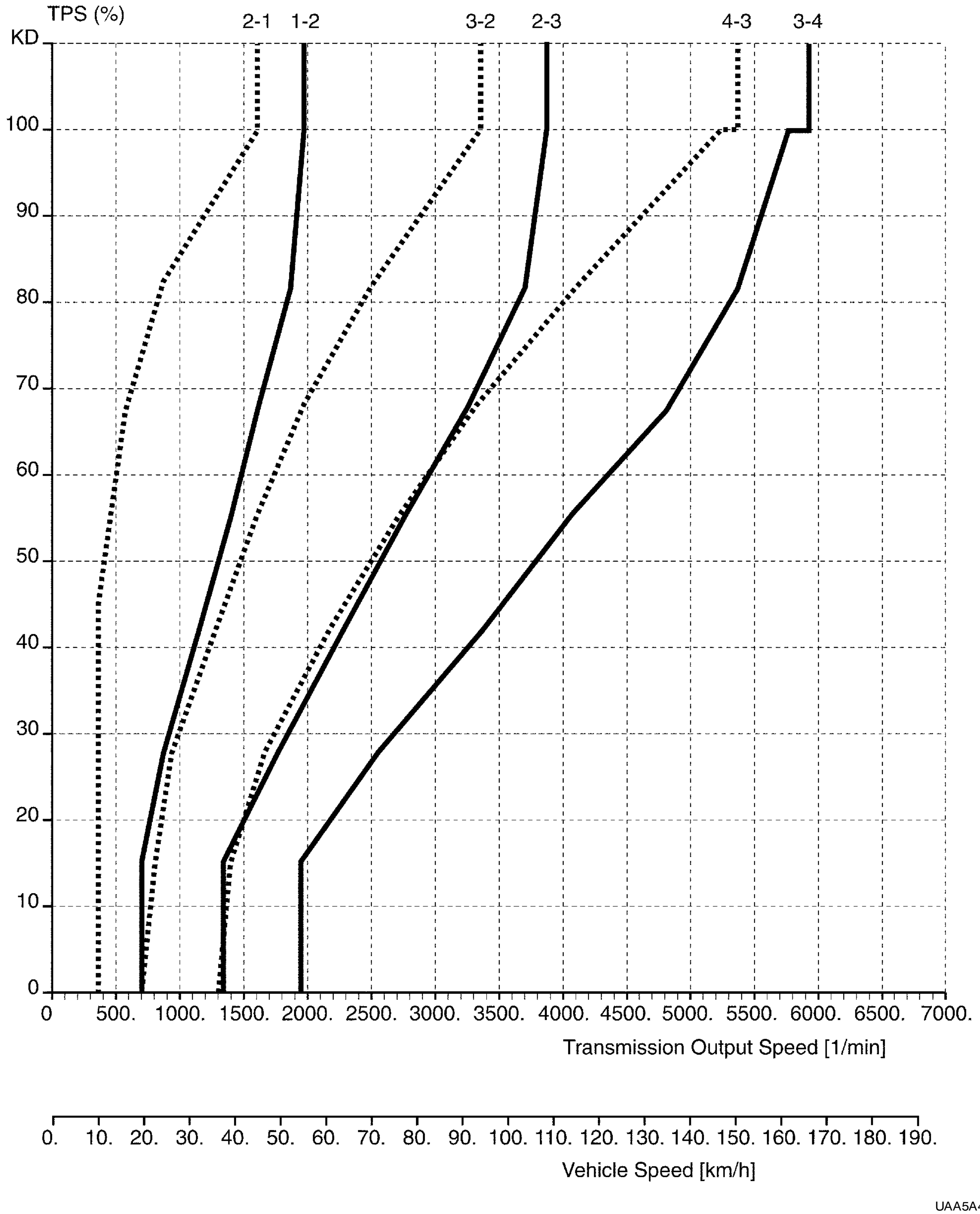
Economic mode (2.0L DOHC EOBD)



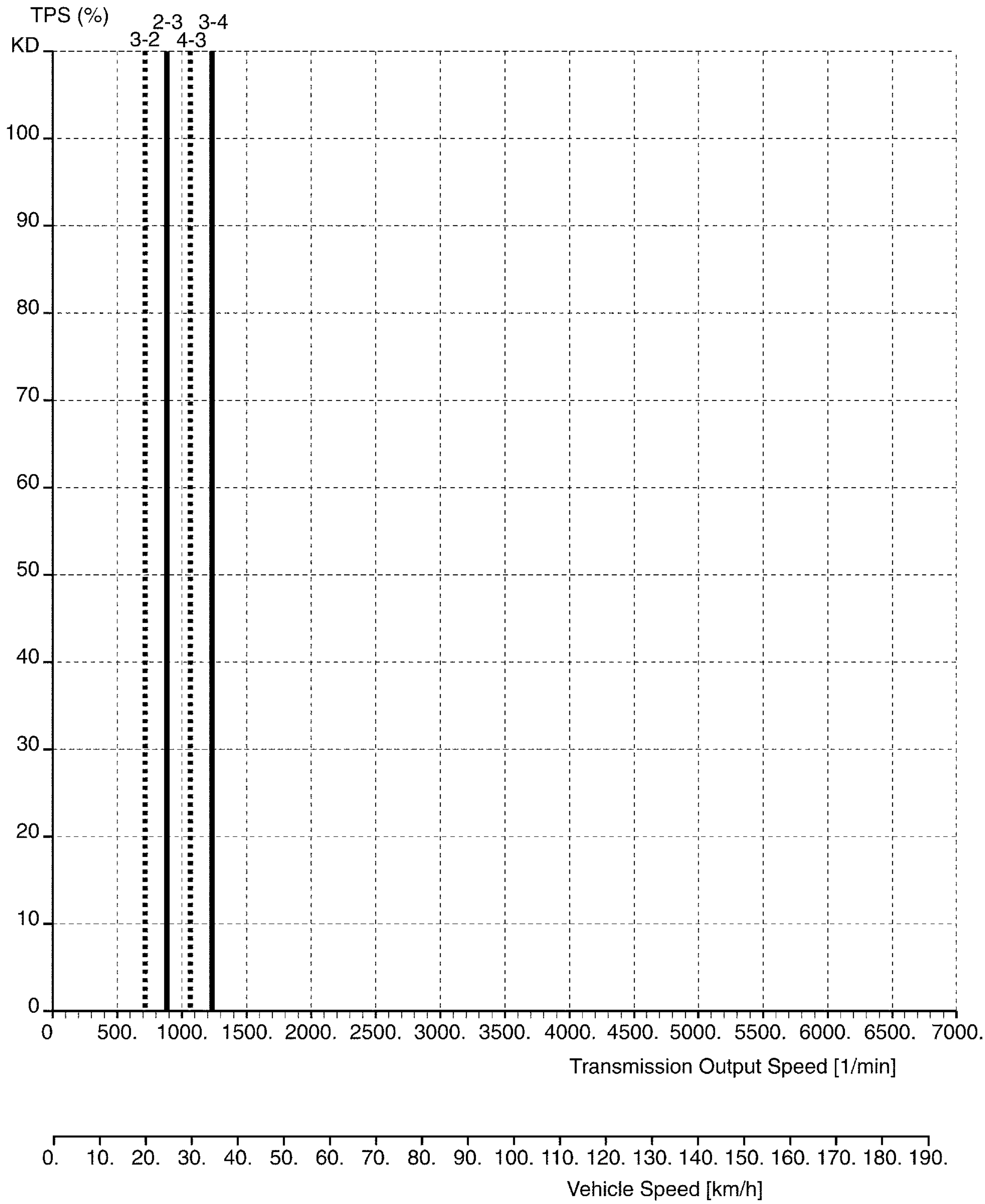
Lock up clutch applied (economic mode ; Third gear, Fourth gear) (2.0L DOHC EOBD)



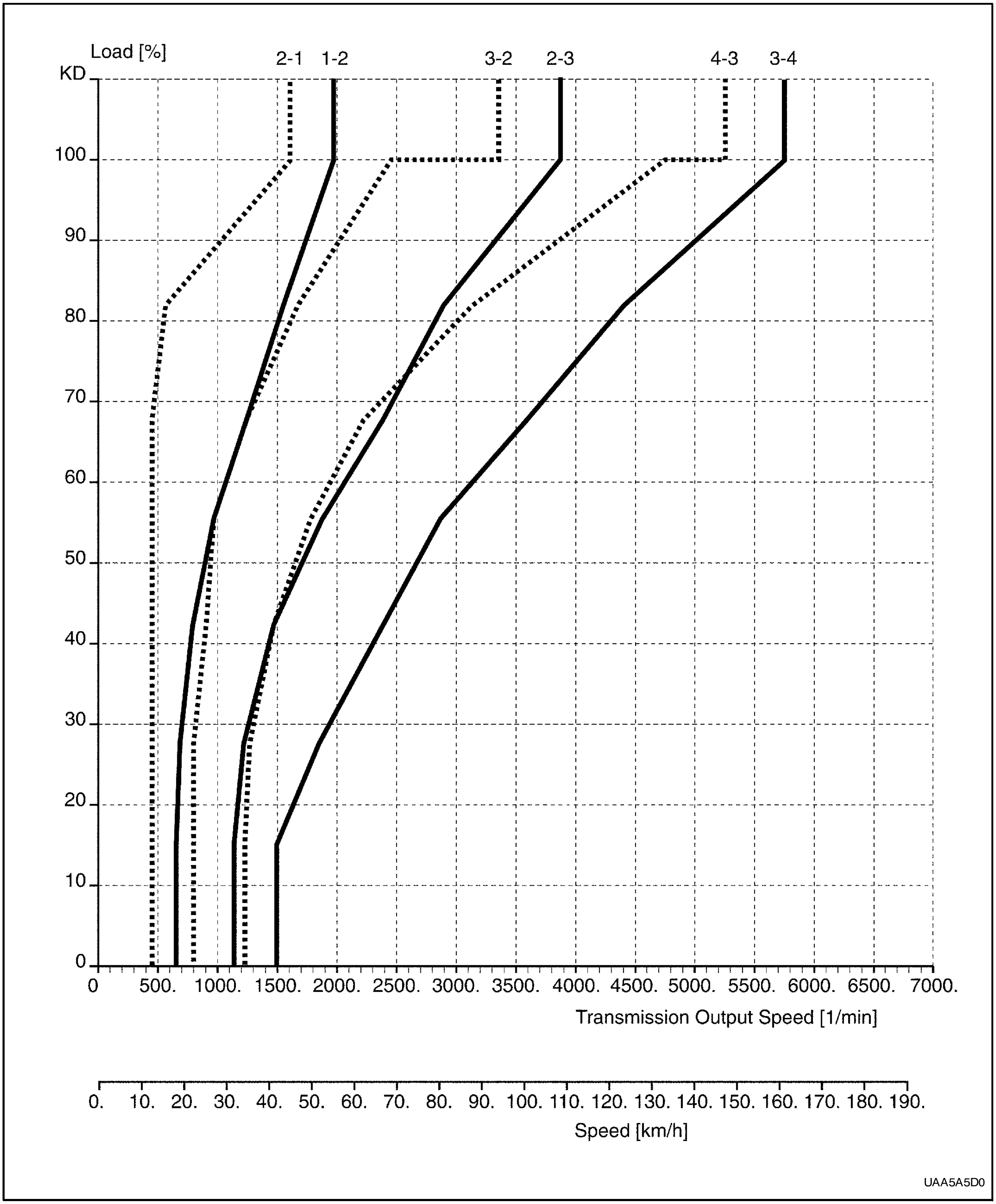
Power mode (2.0L DOHC EOBD)



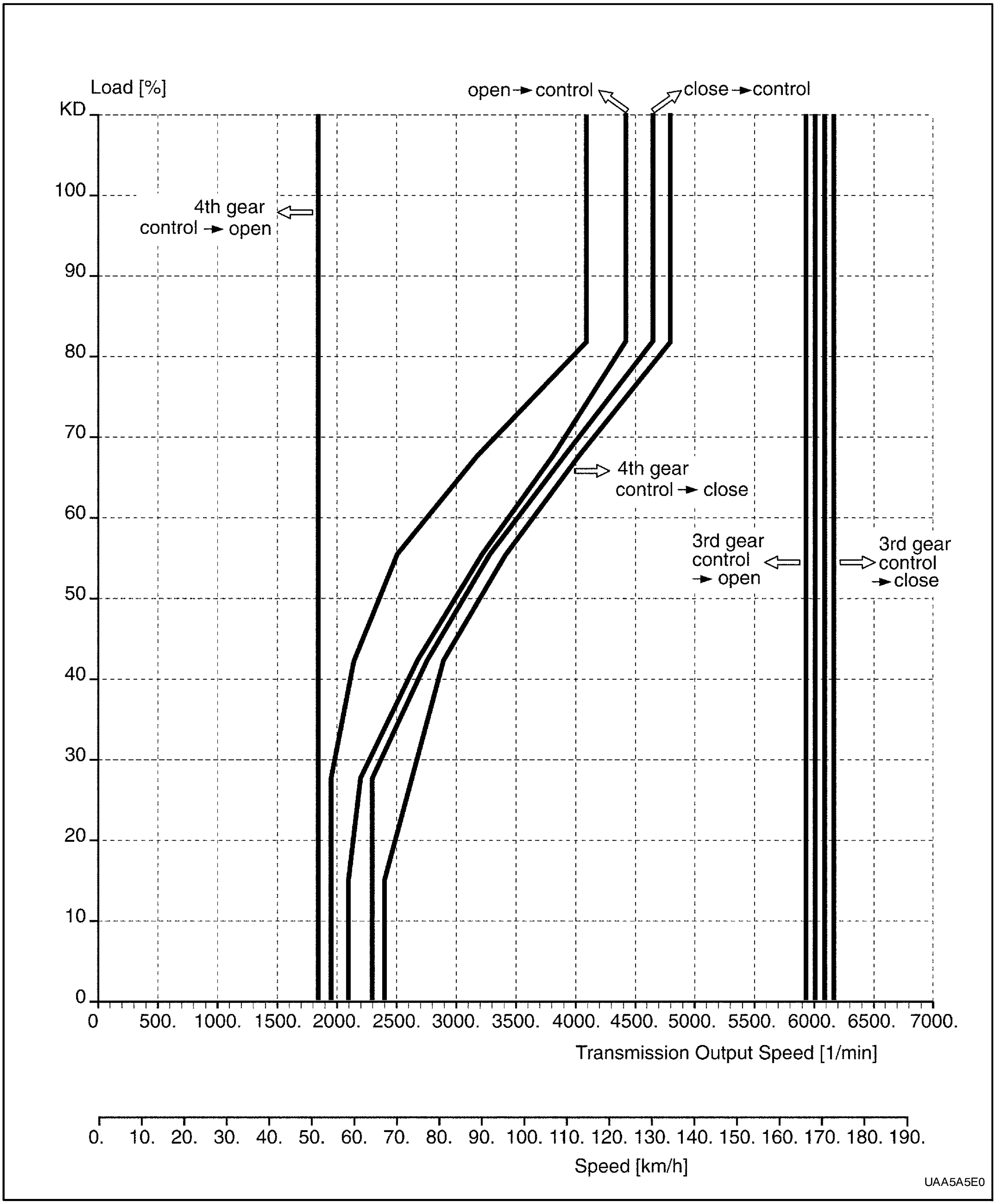
Hold mode (2.0L DOHC EOBD)



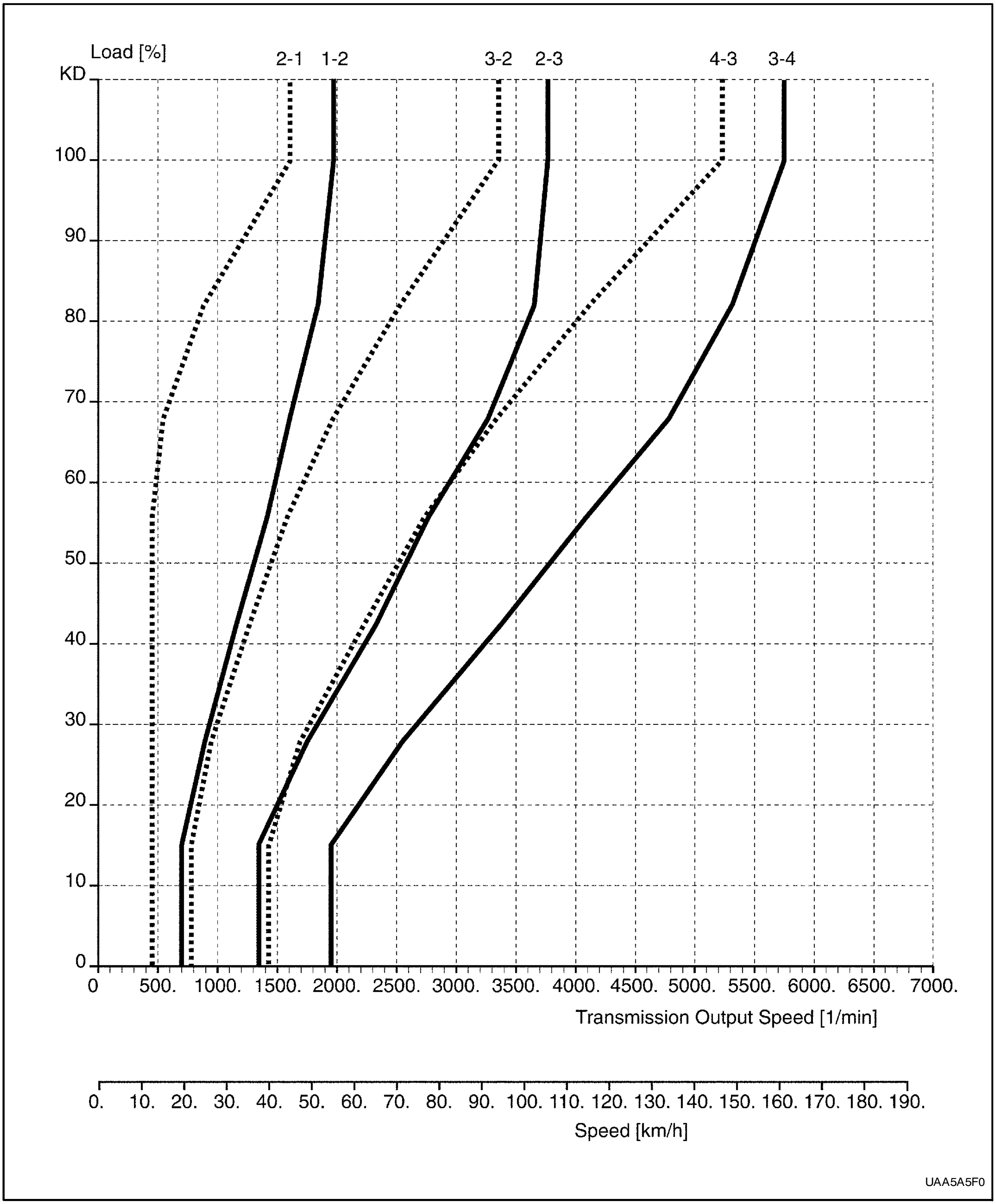
Economic mode (2.0L DOHC NON EOBD)



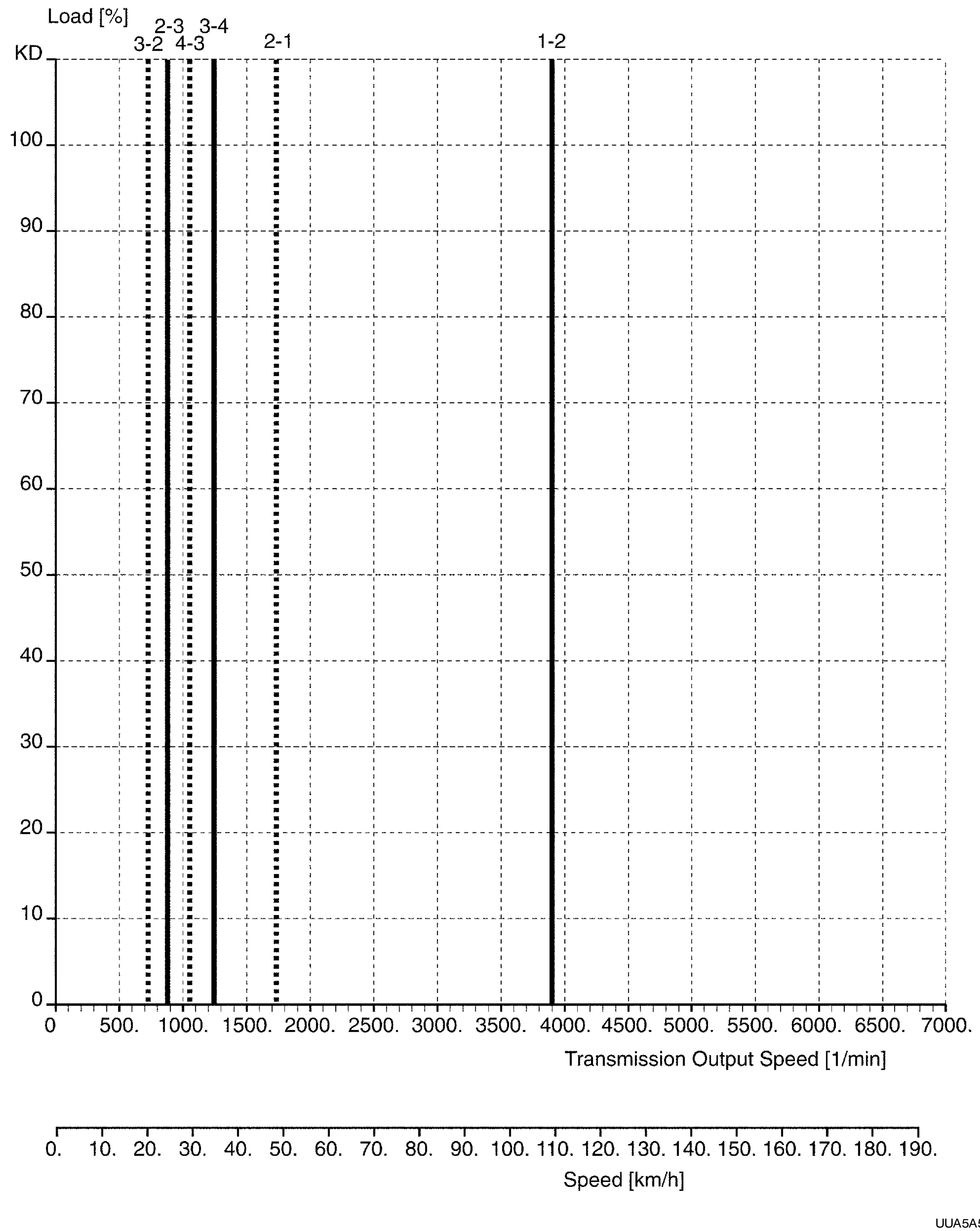
Lock up clutch applied (economic mode ; Fourth gear) (2.0L DOHC NON EOBD)



Power mode (2.0L DOHC NON EOBD)

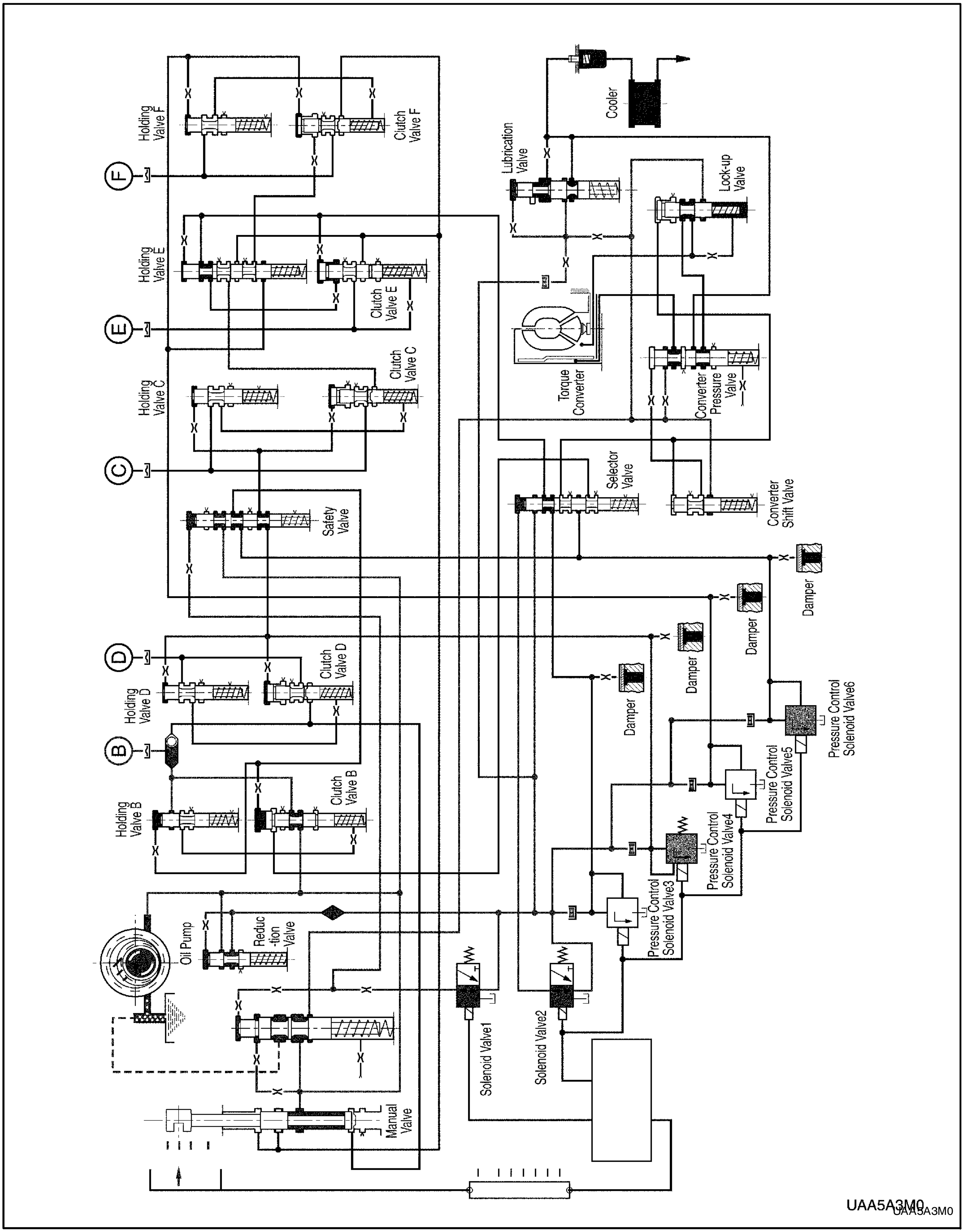


Hold mode (2.0L DOHC NON EOBD)



POWER FLOW DIAGRAM

Park/Neutral



Park/Neutral

In Park and Neutral and engine is running. And there is no drive to the planetary gear set. Line pressure(comes from oil pump) apply valve body. Only clutch B apply and torque converter is released.

Control

Line pressure control valve

The line pressure control valve sets the general pressure level in the valve body. When gearshifts are not taking place, the line pressure varies between two levels, depending on the turbine torque. Line pressure increase linearly by time. But it has a limit point. When pressure reach that point, oil pressure drain to the oil sump.

Reduction valve

The reduction valve reduces the line pressure with which the downstream solenoid valves and pressure control solenoid valve (EDS)are charged. It is possible to use smaller solenoid valves as a result.

The line pressures comes from the oil pump flow to the eleven spool of the reduction valve and press the fourteen spool of the reduction valve via the twelve spool. As a result, the eleven spool is blocked. So the line pressure is control to the appropriate level.

Solenoid valve 1, 2

Solenoid 1 control the high or low of the line pressure(flow to each clutch valve) by the operation type(ON/OFF), i.e. solenoid 1 is ON, line pressure will be low(6~8bar), solenoid 1 is OFF, line pressure will be high(16~18bar).

Solenoid 2 controls the oil flow to clutch valve E or lock–up clutch valve by the ON/OFF signal.

The TCM monitors numerous inputs to determine the appropriate solenoid state combination and transaxle gear for the vehicle operating conditions.

In Park and Neutral solenoid valve 1 is ON. So line pressure flow to the safety valve and the line pressure control valve via the solenoid valve.

When solenoid 1 is ON, Line pressure is controlled at a Lower level compare with when solenoid 1 is OFF.

Clutch B engaged

In Park and Neutral solenoid valve 1, 2 are ON and EDS4, 6 are ON.

As EDS 6 is ON, the oil which is supplied from the reduction valve flow to the sixty two spool of thesafety valve via the sixty port of the EDS, and flow clutch valve B, input port holding valve B via the sixty three spool of the safety valve.

The oil that is supplied to input port(64) of the clutch valve presses the valve spool. As a result, line pressure flow 102 port to via 101 port.

In this manner, clutch B is engaged, check ball is block the brake D direction.

The oil, which is supplied to 102 port, is connect to 103 port, 104 port(clutch valve spool).

Oil pushing the spool above, as a result, clutch B is released.

Lock up clutch

Solenoid valve 2 is ON, line pressure control valve spool compressed, flow to the 131port via 130 port of the torque converter pressure valve.

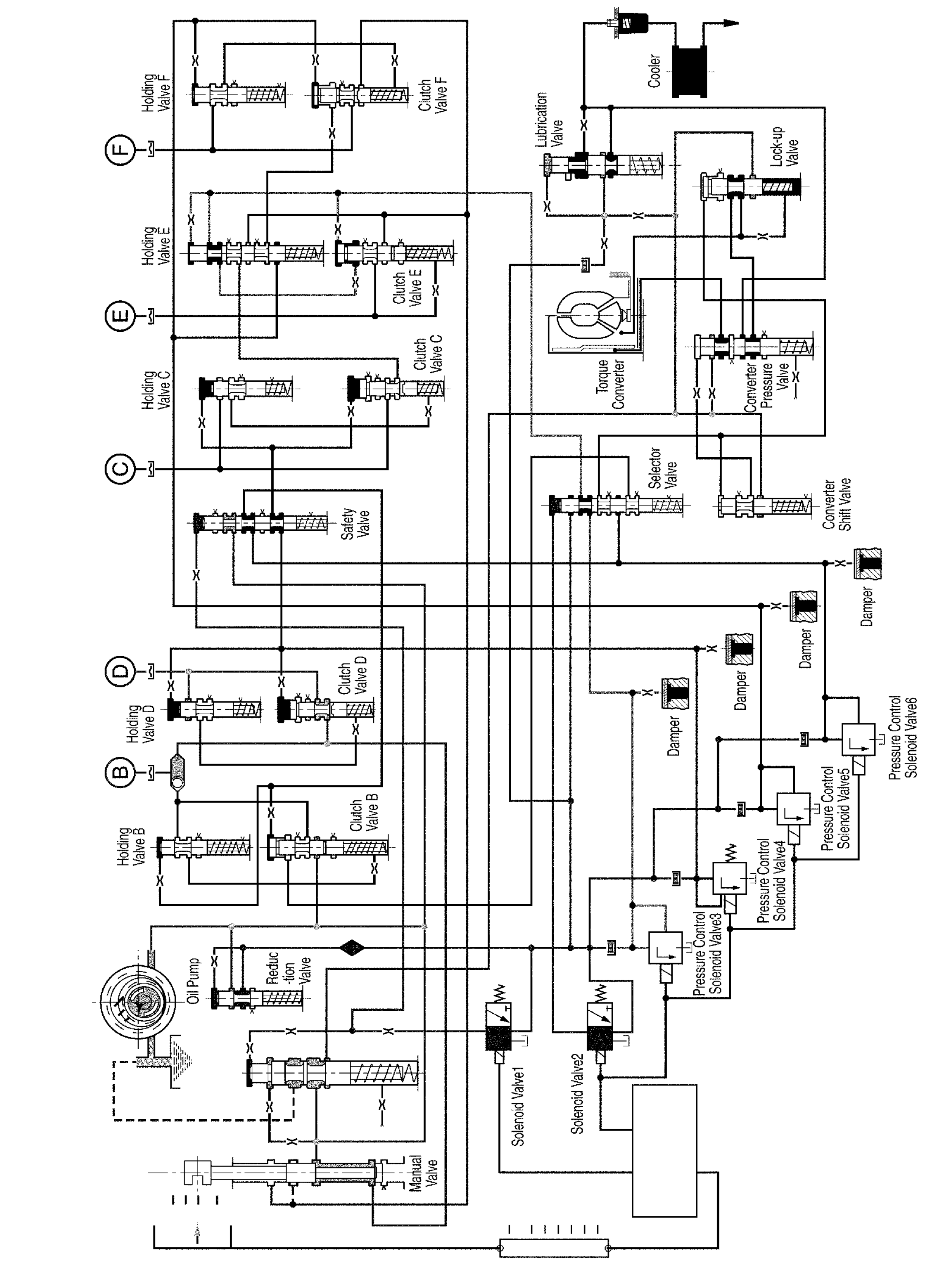
As a result, the oil pressure behind the converter lock–up clutch piston and in the turbine zone is equal. The direction of flow is through the turbine shaft and through the space behind the piston, to the turbine chamber.

Lubrication, cooling.

The lubricating valve ensures that the converter is supplied with cooling oil first if the pump rate is low. The lubricating pressure valve in addition guarantees that the necessary amount of cooling and lubricating oil is available via the bypass duct.

The oil which is supplied from torque converter flow to 135 port via 133,134 port, and flow to cooler via lubrication valve

Reverse



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Reverse

In Reverse, transaxle drive is via the input shaft and the clutch B. the elements of the transaxle function as follows;

- The B clutch is engaged and drives the reverse sun gear in a clock–wise direction.
- The D band is engaged and holds the planetary gear carrier(front, rear) stationary causing the differential pinion to rotate clockwise.
- The differential rotate anti–clockwise direction.
- The output shaft drives it in an anti–clockwise or reverse direction.

Control

Clutch B(remain)

The line pressure, which is supplied to oil pump, is directly engage. This time the place of check ball is change.

Brake D engaged

he line pressure, which engaged clutch, B is waiting at the 91port of clutch valve D.

In Reverse, solenoid is switched ON and EDS 4 switched OFF. So the oil which is supplied to reduction valve is flow to the 42 port of the clutch valve D via the 40, 41 port of the EDS 4.

The spool of the clutch valve pressed to below. So line pressure flow to the 95 port via the 93, 94 port. As a rule, valve spool push against direction.

Lock up clutch

Solenoid valve 2 switch ON, line pressure control valve spool compressed, flow to the 131port via 130 port of the torque converter pressure valve.

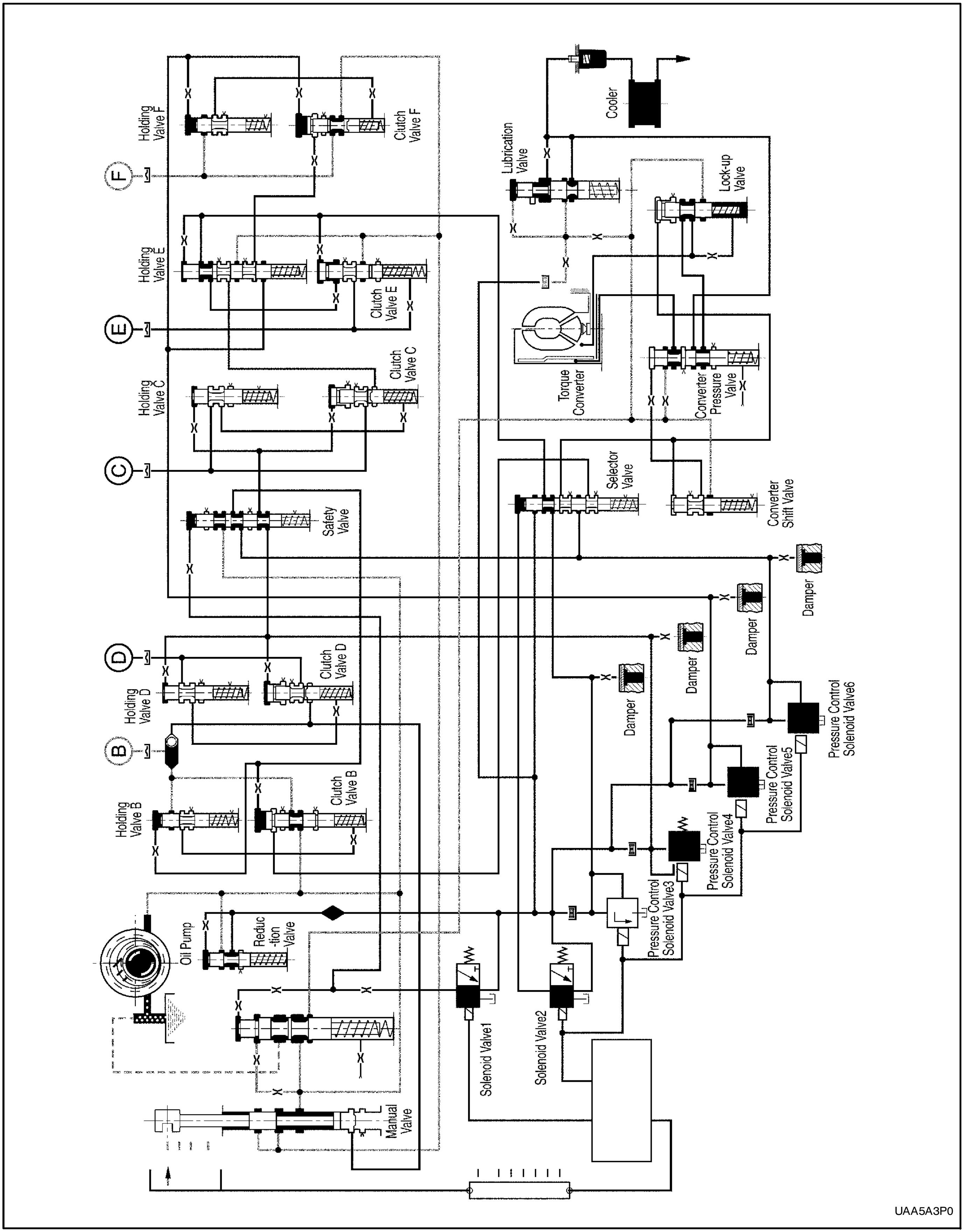
As a result, the oil pressure behind the converter lock–up clutch piston and in the turbine zone is equal. The direction of flow is through the turbine shaft and through the space behind the piston, to the turbine chamber.

Lubrication, cooling

The lubricating valve ensures that the converter is supplied with cooling oil first if the pump rate is low. The lubricating pressure valve in addition guarantees that the necessary amount of cooling and lubricating oil is available via the bypass duct.

The oil which is supplied from torque converter flow to 135 port via 133,134 port, and flow to cooler via lubrication valve.

Drive range–First gear



Drive range – First gear

In Drive 1, transaxle drive is via the input shaft to the clutch B. the elements of the transaxle function as follows:

- The B clutch is engaged to drive the rear sun gear.
- The rear sun gear drives the front planetary gear carrier clockwise.
- The rear planetary gear carrier drives the front ring gear and front planetary gear carrier clockwise.

Control

Clutch B engaged

In Park and Neutral solenoid valve 1, 2 are ON and EDS4, 6 are ON. As EDS 6 is ON, the oil which is supplied from the reduction valve flow to the sixty two spool of the safety valve via the sixty port of the EDS, and flow clutch valve B, input port holding valve B via the sixty three spool of the safety valve.

The oil that is supplied to input port (64) of the clutch valve presses the valve spool. As a result, line pressure flow to the 102 port to via the 101 port.

In this manner, clutch B is engaged, check ball is blocked the brake D direction.

The oil, which is supplied to the 102 port, connects to the 103 port, 104 port (clutch valve spool).

Oil pushing the spool above, as a result, clutch B is released.

Clutch F engaged

EDS 5 switched ON. The line pressure which passed through the reduction valve flow to the 52 port of the holding valve, the 55,56 ports of the clutch valve upper input port. As a result valve spool pressed.

Lock up clutch

Solenoid valve 2 switch ON, line pressure control valve spool compressed, flow to the 131port via 130 port of the torque converter pressure valve.

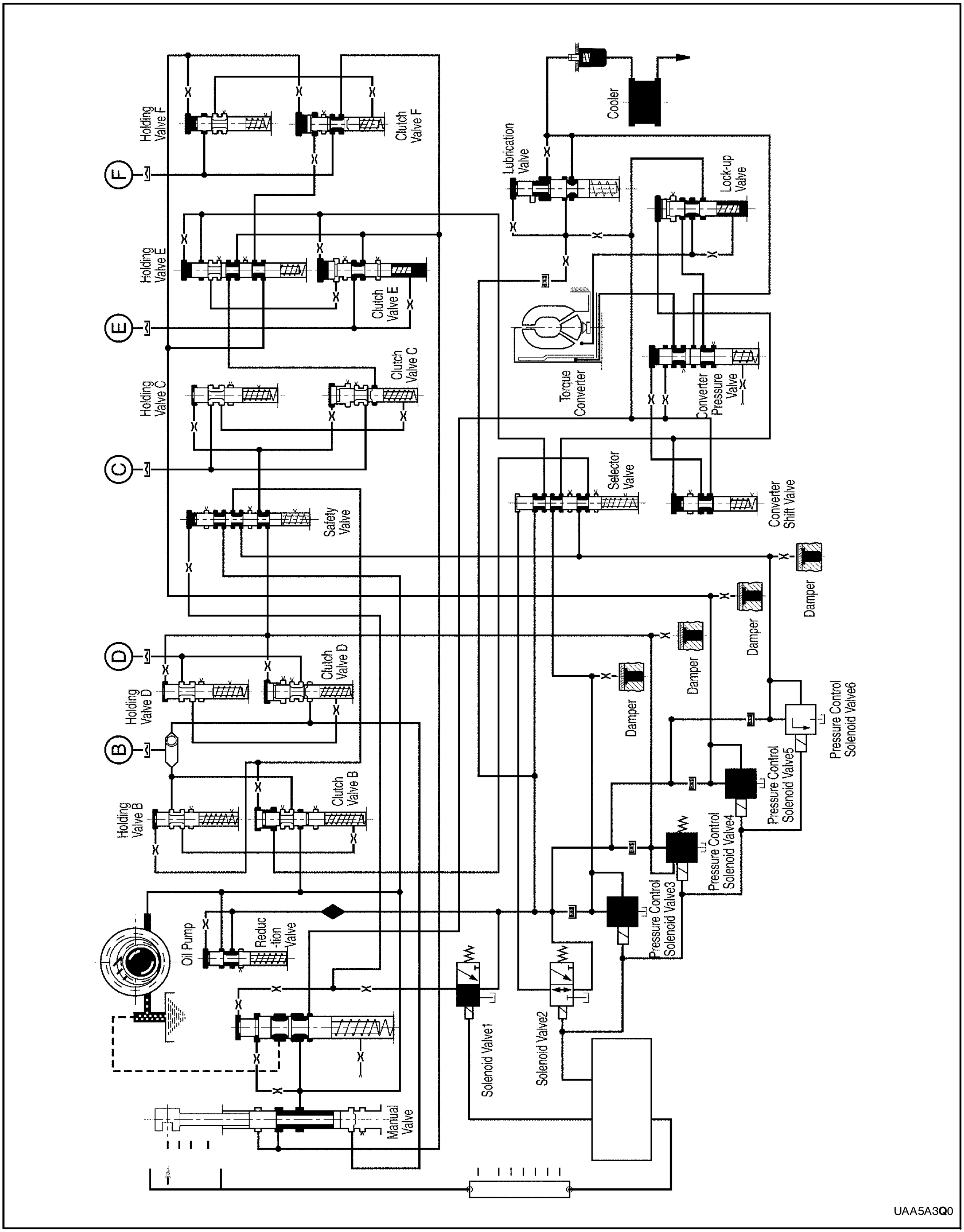
As a result, the oil pressure behind the converter lock–up clutch piston and in the turbine zone is equal. The direction of flow is through the turbine shaft and through the space behind the piston, to the turbine chamber.

Lubrication, cooling

The lubricating valve ensures that the converter is supplied with cooling oil first if the pump rate is low. The lubricating pressure valve in addition guarantees that the necessary amount of cooling and lubricating oil is available via the bypass duct.

The oil which is supplied from torque converter flow to 135 port via 133,134 port, and flow to cooler via lubrication valve.

Drive range–Second gear



Drive range – Second Gear

In Drive 2, transaxle drives is via the input shaft and clutch E. the elements of the transaxle function as follows;

- The clutch E is applied to drive the front ring gear.
- The front ring gear drives the front planetary gear carrier.
- The front planetary gear carrier drives the differential pinion gear clockwise.
- The brake F is applied holding the front sun gear stationary.

Control

Clutch E engaged

Solenoid 2 switched OFF. So the line pressure which is supplied from the 12 port of the reduction valve flow to the upper inlet port(34,35,36 port)of the clutch valve E. Line pressure connect to the 72 port.

As a result, clutch E engaged.

Clutch F engaged

EDS 5 switched ON. The line pressure which passed through the reduction valve flow to the 52 port of the holding valve, the 55,56 ports of the clutch valve upper input port. As a result valve spool pressed.

Lock up clutch

Solenoid valve 2 is ON, line pressure control valve spool compressed, flow to the 131port via 130 port of the torque converter pressure valve.

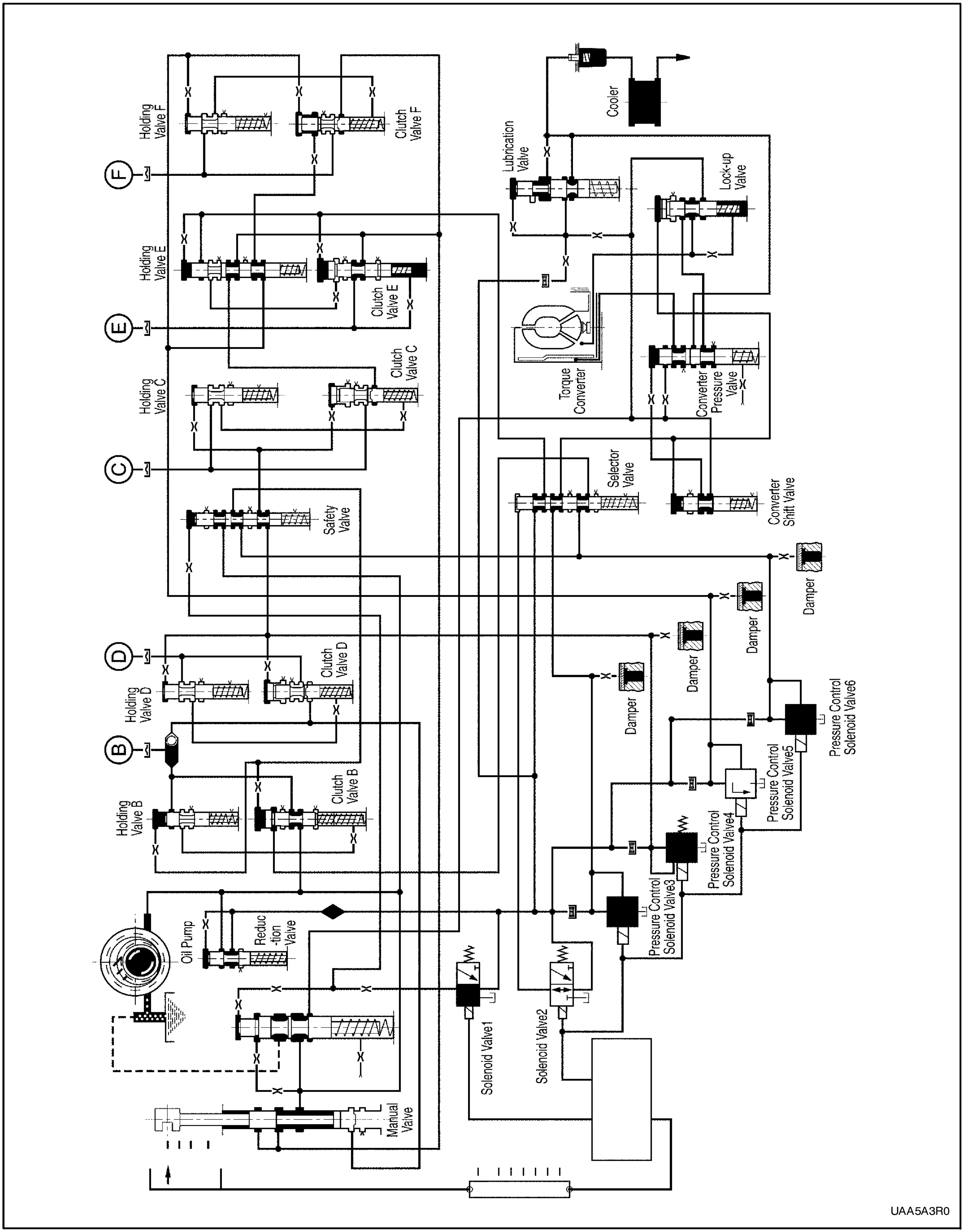
As a result, the oil pressure behind the converter lock–up clutch piston and in the turbine zone is equal. The direction of flow is through the turbine shaft and through the space behind the piston, to the turbine chamber.

Lubrication, cooling

The lubricating valve ensures that the converter is supplied with cooling oil first if the pump rate is low. The lubricating pressure valve in addition guarantees that the necessary amount of cooling and lubricating oil is available via the bypass duct.

The oil which is supplied from torque converter flow to 135 port via 133,134 port, and flow to cooler via lubrication valve.

Drive range–Third gear



Drive range – Third Gear

In Drive 3, transaxle drive is via the input shaft to the clutch B,E. the elements of the transaxle function as follows;

- The clutch B, E is engaged to drive the rear sun gear, rear planetary gear carrier clockwise.
- The rear sun gear, rear planetary gear carrier clockwise rotate the front planetary gear clockwise.

Control

Clutch B engaged

In Park and Neutral solenoid valve 1, 2 are ON and EDS 4, 6 are ON.

As EDS 6 is ON, the oil which is supplied from the reduction valve flow to the sixty two spool of the safety valve via the sixty port of the EDS, and flow clutch valve B, input port holding valve B via the sixty three spool of the safety valve.

The oil, which is, supplied to input port(64) of the clutch valve press the valve spool. As a result, line pressure flow 102 port to via 101 port.

In this manner, clutch B is engaged, check ball is block the brake D direction.

The oil, which is supplied to 102 port, is connect to 103 port, 104 port(clutch valve spool).

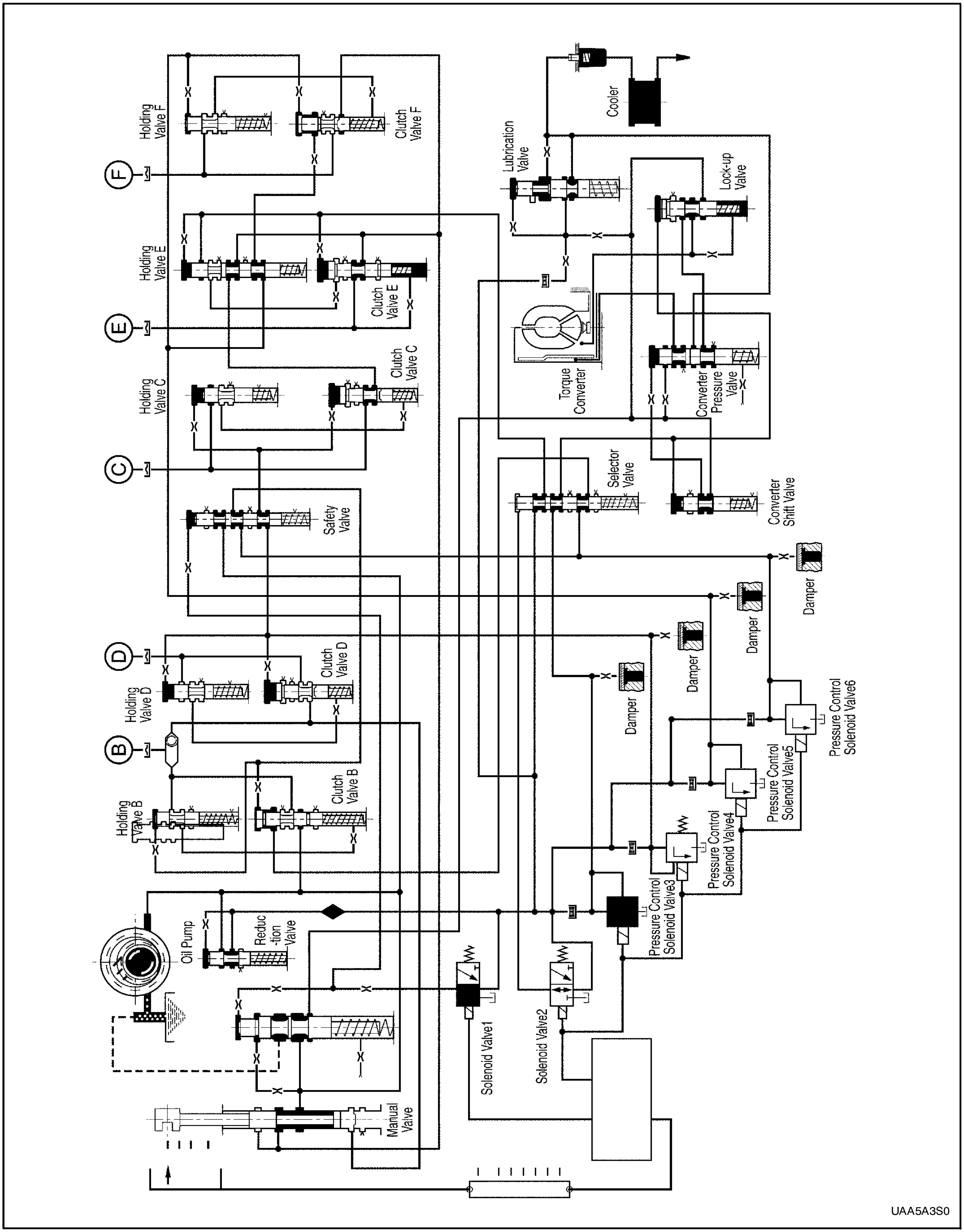
Oil pushing the spool above, as a result, clutch B is released.

Lock up clutch

Solenoid valve 2 is ON, line pressure control valve spool compressed, flow to the 131port via 130 port of the torque converter pressure valve.

As a result, the oil pressure behind the converter lock–up clutch piston and in the turbine zone is equal. The direction of flow is through the turbine shaft and through the space behind the piston, to the turbine chamber.

Drive range–Fourth gear



Drive range – Fourth Gear

In Drive 4, transaxle drive is via the input shaft to the clutch E,C. The elements of the transaxle function as follows; no–slip converter drive.

- The clutch E is engaged to drive the rear planetary gear carrier.
- The rear planetary gear carrier drive the rear ring gear.
- The rear ring gear carrier drive the differential gear.

Control

Clutch E engaged

Solenoid 2 switched OFF. So the line pressure which is supplied from the 12 port of the reduction valve flow to the upper inlet port(34, 35, 36 port)of the clutch valve E. Line pressure connect to the 72 port.

As a result, clutch E engaged.

Clutch C engaged

EDS 4 is OFF. So oil level is high.

The line pressure flow to the 44 port of the safety valve via the 40, 41, 42, 43 ports.

The spools of the clutch valve D, holding valve D pressed to low.

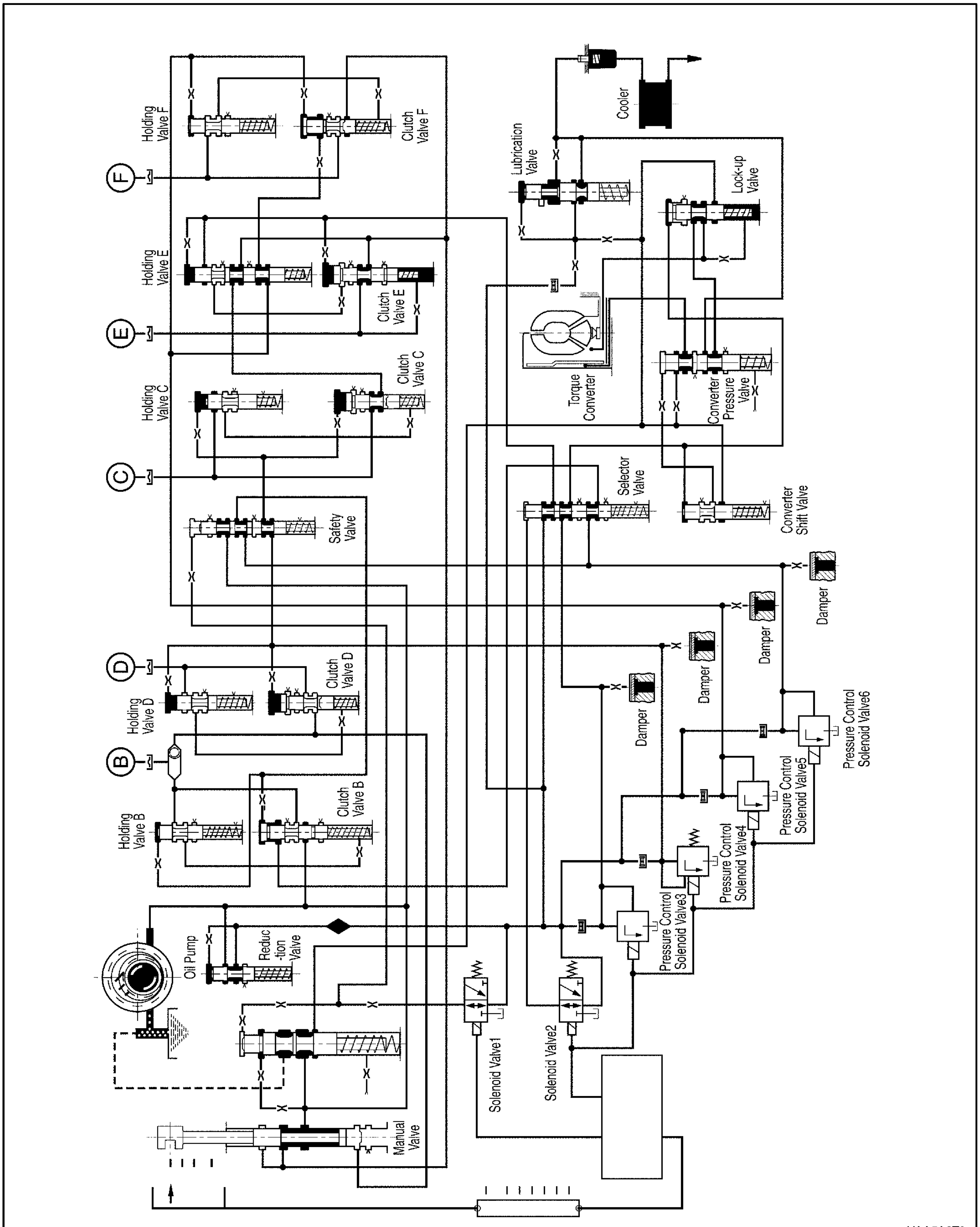
And, the oil which is supplied to the safety valve flow to the 46, 47 ports of the holding valve C via the 45 port.

Lock up clutch

Solenoid valve 2 is ON, line pressure control valve spool compressed, flow to the 131port via 130 port of the torque converter pressure valve.

As a result, the oil pressure behind the converter lock–up clutch piston and in the turbine zone is equal. The direction of flow is through the turbine shaft and through the space behind the piston, to the turbine chamber.

Drive range–Fourth gear ; Emergency/Substitute mode



UAA5A3T0

Drive range – Fourth Gear ; Emergency/Substitute Mode

In Drive 4, transaxle drive is via the input shaft to the clutch E. The elements of the transaxle function as follows; no–slip converter drive.

- The clutch E is engaged to drive the rear planetary gear carrier.
- The rear planetary gear carrier drive the rear ring gear.
- The rear ring gear carrier drive the differential gear.

Control

Clutch E engaged

Solenoid 2 switched OFF. So the line pressure which is supplied from the 12 port of the reduction valve flow to the upper inlet port(34, 35, 36 port)of the clutch valve E.

Line pressure connect to the 72 port.

As a result, clutch E engaged.

Clutch C engaged

EDS 4 is OFF. So oil level is high.

The line pressure flow to the 44 port of the safety valve via the 40, 41, 42, 43 ports.

The spools of the clutch valve D, holding valve D pressed to low.

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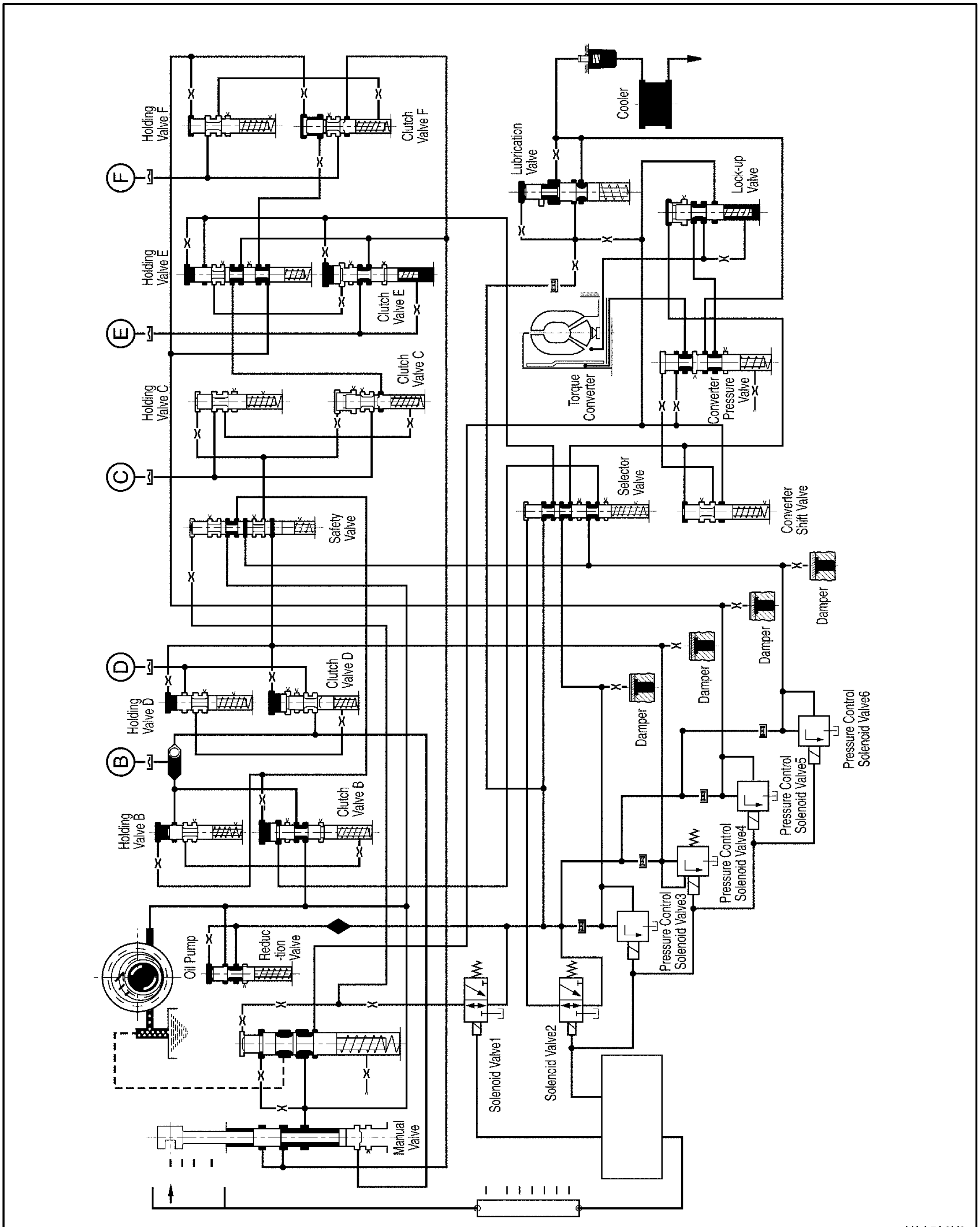
Drive range–Third gear ; Emergency/Substitute mode



UAA5A3U0

Drive Range – Third Gear ; Emergency/Substitute Mode

In Drive 3, transaxle drive is via the input shaft to the clutch B, E. the elements of the transaxle function as follows;

- The clutch B,E is engaged to drive the rear sun gear, rear planetary gear carrier clockwise.
- The rear sun gear, rear planetary gear carrier clockwise rotate the front planetary gear clockwise.

Control

Clutch B engaged

In Park and Neutral solenoid valve 1, 2 are ON and EDS4, 6 are ON. As EDS 6 is ON, the oil which is supplied from the reduction valve flow to the sixty two spool of the safety valve via the sixty port of the EDS, and flow clutch valve B, input port holding valve B via the sixty three spool of the safety valve.

The oil, which is, supplied to input port(64) of the clutch valve press the valve spool. As a result, line pressure flow 102 port to via 101 port.

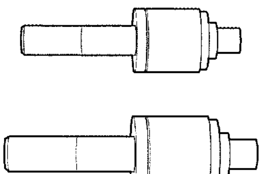
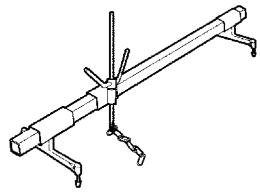
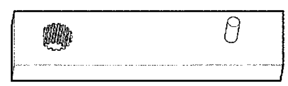
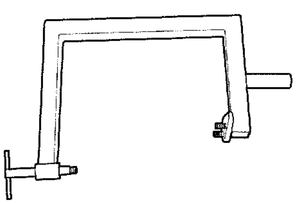
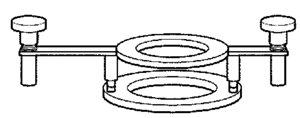
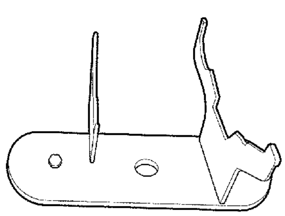
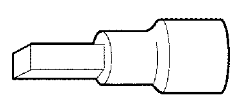
In this manner, clutch B is engaged, check ball is block the brake D direction.

The oil, which is supplied to 102 port, is connect to 103 port, 104 port(clutch valve spool).

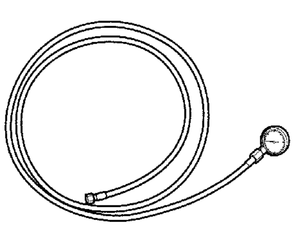
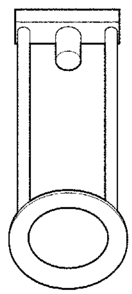
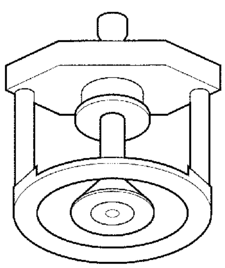
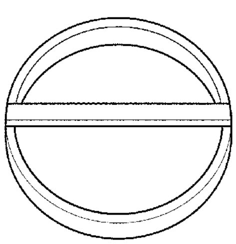
Oil pushing the spool above, as a result, clutch B is released.

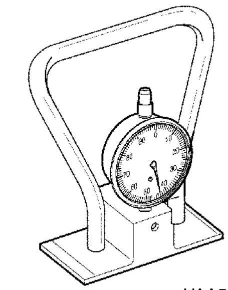
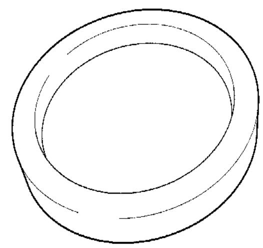
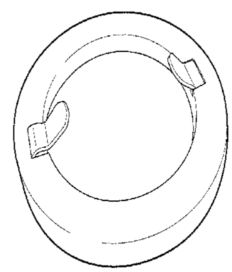
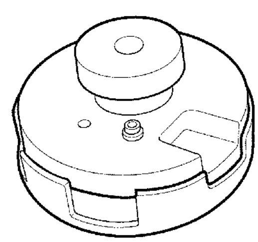
SPECIAL TOOLS AND EQUIPMENT

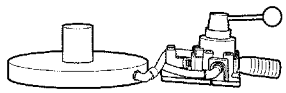
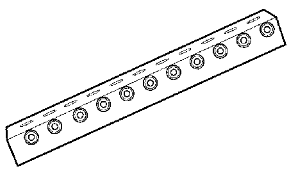
SPECIAL TOOLS TABLE

 UAA5A3V0	Scan Tool	 UAA5A3Z0	DW 260–030 Axle Seal Installer
 UAA5A3W0	DW 110–060 Engine Support Fixture	 UAA5A4B0	DW 260–050 Park / Neutral Position Switch Installer
 UAA5A3X0	DW 260–020 Transaxle Holding Fixture	 UAA5A4C0	DW 260–060 Brake F Split Stop Ring Remover/Installer
 UAA5A3Y0	DW 260–010 Transaxle Support Fixture	 UAA5A4D0	DW 260–070 Transaxle Fluid Plug Remover / Installer

SPECIAL TOOLS TABLE (Cont'd)

 UAA5A4E0	DW 240–010–6 Universal Pressure Gauge Set
 UAA5A4F0	DW 260–150 Clutch E Stop Ring Remove / Installer
 UAA5A4G0	DW 260–140 Clutch B Stop Ring Remover / Installer
 UAA5A4H0	DW 260–160 Brake C/D Snap Ring Remover / Installer

 UAA5A4J0	DW 260–080 Clutch B/E Shim Setting Gauge
 UAA5A4U0	DW 260–120 Clutch B Adjust Ring
 UAA5A4T0	DW 260–130 Clutch E Adjust Ring
 UAA5A5B0	DW 260–100 Clutch B/E Disc Thickness Measuring Fixture

 UAA5A5A0	DW 260–090 Clutch B/E (Snap Ring Play, Installation Space) Measuring Fixture
 UAA5A5C0	DW 260–110 Brake F Disc Clearance Measuring Bar

SECTION 5B

FIVE-SPEED MANUAL TRANSAXLE

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION

FIVE-SPEED MANUAL TRANSAXLE

This five-speed transaxle assembly is a transmission of constant-mesh design.

Combined in the assembly are:

- All forward gears.
- The reverse gear.
- The differential output.

The basic components of the five-speed transaxle assembly units are the:

- Transaxle case.
- Input shaft.
- Input shaft gears.
- Output shaft.
- Output shaft gears.
- Ring gear and differential assembly.

Forward Gear

Shifting to a forward gear is accomplished through a combination of synchronizers with blocker rings controlled by sliding shift forks.

Reverse Gear

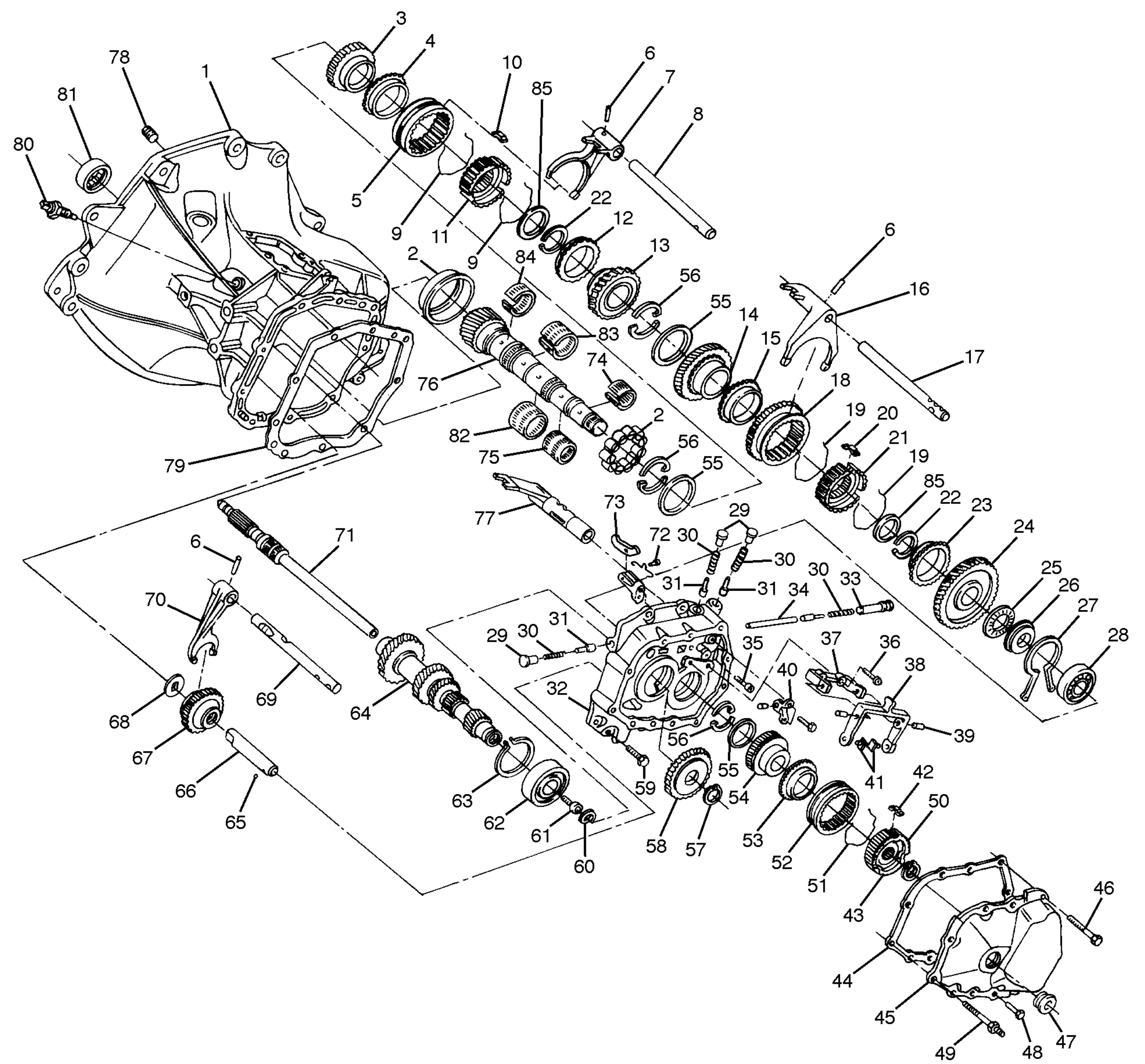
Reverse gear is not synchronized and uses a sliding idler gear arrangement.

Differential Assembly

The differential is a conventional arrangement of gears that is supported by tapered roller bearings. The final output gear turns the ring gear and differential assembly which turns the drive axle shafts.

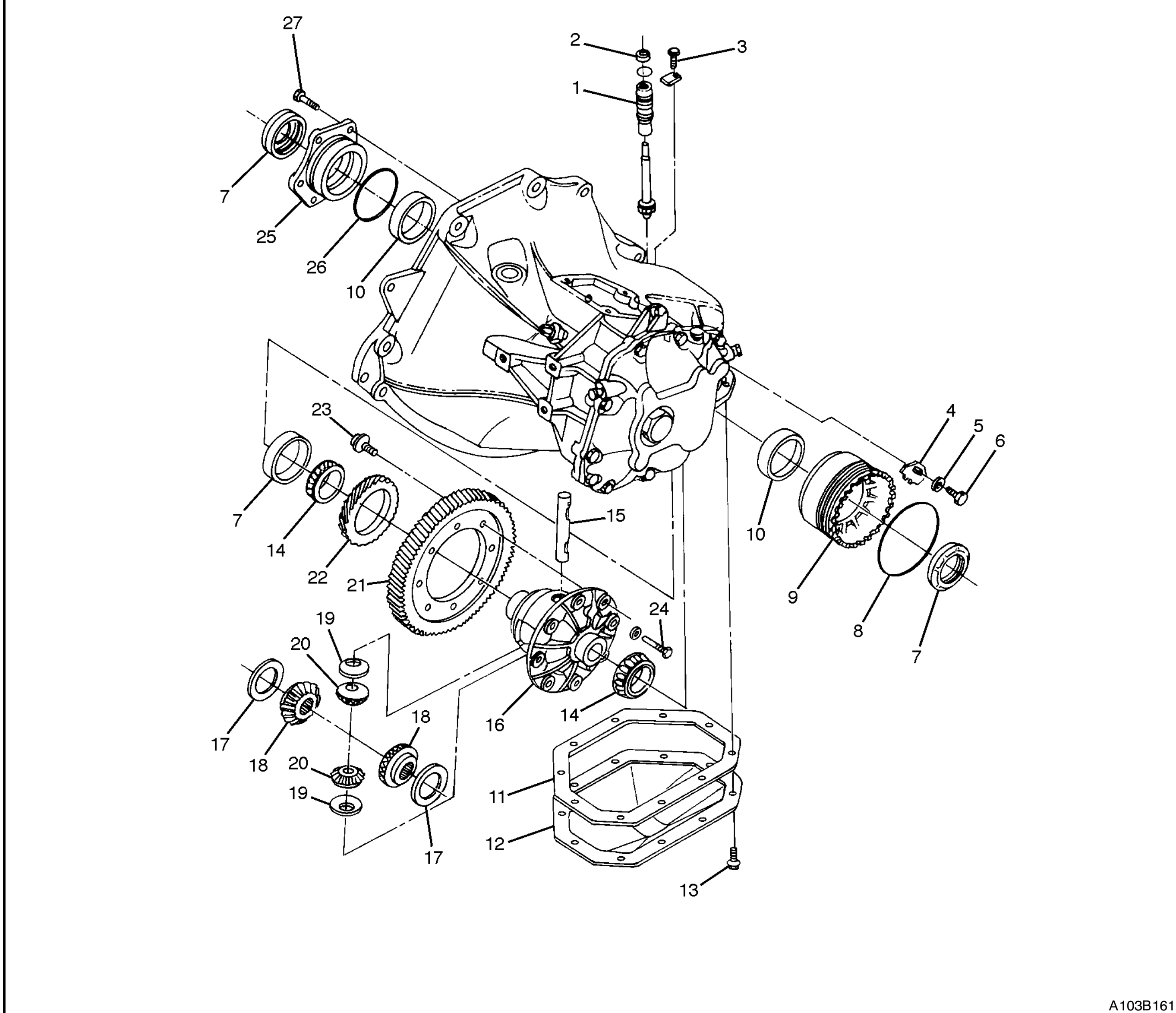
COMPONENT LOCATORS

GEARS AND CASE



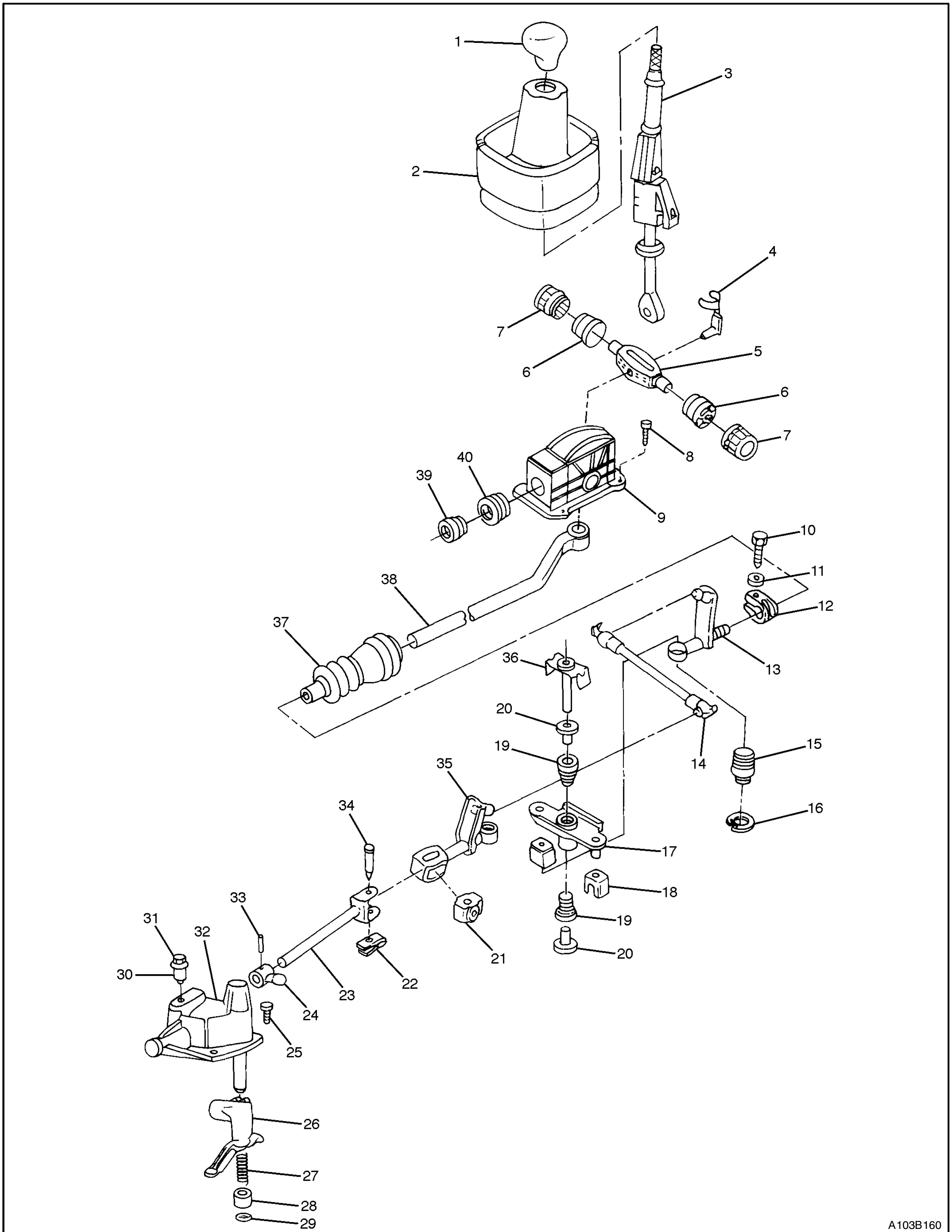
1 Case
2 Mainshaft Bearing-outer Race
3 Fourth Gear
4 Synchronizer Ring
5 Synchronizer Sleeve
6 Pin
7 Third-Fourth Gearshift Fork
8 Third-Fourth Gearshift Rod
9 Spring
10 Key
11 Third-Fourth Synchronizer Hub
12 Synchronizer Ring
13 Third Gear
14 Second Gear
15 Synchronizer Ring
16 First-Second Gearshift Fork
17 First-Second Gearshift Rod
18 Sliding Gear-Rev. Gear
19 Synchronizer Spring
20 Key
21 1/2nd Hub
22 Snap Ring
23 Synchronizer
24 First Gear
25 Thrust Needle Bearing
26 Mainshaft Disk
27 Snap Ring
28 Mainshaft Bearing
29 Detent Sleeve
30 Spring
31 Detent Ball
32 Bearing Plate
33 Detent Sleeve
34 Rod Bolt
35 Bolt
36 Bolt
37 Support
38 Fifth Gearshift Fork
39 Pin
40 Bridge-strain Bolt
41 Shoe
42 Key
43 Snap Ring
44 Gasket
45 Cover
46 Bolt
48 Bolt
49 Screw
50 Fifth Gear Hub
51 Spring
52 Synchronizer Sleeve
53 Synchronizer Blocking Ring
54 Mainshaft Driven Fifth Gear
55 Retaining Ring
56 Thrust Washer
57 Circlip
58 Input Drive Fifth Gear
59 Bolt
60 Cluster Gear Snap Ring
61 Screw
62 Input Shaft Ball Bearing
63 Ring
64 Input Shaft Cluster Gear
65 Ball
66 Reverse Idler Gear Shaft
67 Reverse Idler Gear
68 Washer
69 Reverse Gear Rod
70 Reverse Gearshift Fork
71 Input Shaft
72 Bolt
73 Fifth-Gear Pawl
74 Fifth-Gear Needle Bearing
75 First-Gear Needle Bearing
76 Main Shaft
77 Fifth Gearshift Lever
78 Hex Plug
79 Gasket-Bearing Plate
80 Reverse Lamp Switch
81 Input Shaft Bearing
82 Second-Gear Needle Bearing
83 Third-Gear Needle Bearing
84 Fourth-Gear Needle Bearing
85 Retaining Ring

DIFFERENTIAL AND CASE



1 Speedometer-Driven Gear
2 Seal
3 Hex Bolt
4 Plate-Lock
5 Washer
6 Bolt
7 Seal
8 O–Ring
9 Ring Bearing
10 Side Bearing Race
11 Differential Cover Gasket
12 Differential Cover
13 Bolt
14 Differential Bearing
15 Differential Gear Shaft
16 Differential Housing
17 Thrust Washer
18 Side Bevel Gear
19 Washer
20 Pinion Bevel Gear
21 Ring Gear
22 Speedometer Drive Gear
23 Bolt
24 Differential Gear Shaft Lock Pin
25 Flange Bearing
26 O–Ring
27 Bolt

SHIFT LINKAGE



1 Gearshift Lever Knob
2 Gearshift Lever Boot
3 Gearshift Lever
4 Gearshift Lever Stop Clamp
5 Gearshift Lever Shaft
6 Gearshift Lever Stop Bushing
7 Gearshift Lever Stop Bushing
8 Bolt
9 Gearshift Housing
10 Shift Rod Clamp Bolt
11 Washer
12 Clamp
13 Linkage Adjuster Bolt
14 Gearshift Control Rod
15 Linkage Ball Socket
16 Circlip Ring
17 Linkage Reverse Lever
18 Gearshift Boot
19 Bushing
20 Bushing
21 Rod U-Joint Bushing
22 Clip
23 Gearshift Rod
24 Shift Finger Lever
25 Cover Bolt
26 Intermediate Lever
27 Shift Lever Thrust Spring
28 Bushing
29 Snap Ring
30 Oil Filler Plug
31 Oil Plug Cap
32 Gearshift Lever Cover
33 Pin
34 Bolt
35 Gearshift Adjuster Linkage
36 Shift Reverse Pivot Bolt
37 Boot
38 Gearshift Tube
39 Bushing
40 Gearshift Tube Bearing

DIAGNOSTIC INFORMATION AND PROCEDURES

ISOLATE NOISE

Identify the cause of any noise before attempting to repair the clutch, the transaxle, or their related linkages.

Symptoms of trouble with the clutch or the manual transaxle include:

- A great effort required to shift gears.
- The sound of gears clashing and grinding.
- Gear blockout.

Any of these conditions requires a careful analysis. Make the following checks before disassembling the clutch or the transaxle for repairs.

Road Travel Noise

Many noises that appear to come from the transaxle may actually originate with other sources such as the:

- Tires.
- Road surfaces.
- Wheel bearings.
- Engine.
- Exhaust system.

These noises may vary according to the:

- Size of the vehicle.
- Type of the vehicle.
- Amount of insulation used in the body of the vehicle.

Transaxle Noise

Transaxle gears, like any mechanical device, are not absolutely quiet and will make some noise during normal operation.

To verify suspected transaxle noises:

1. Select a smooth, level asphalt road to reduce tire and resonant body noise.
2. Drive the vehicle far enough to warm up all the lubricants thoroughly.
3. Record the speed and the gear range of the transaxle when the noise occurs.
4. Check for noises with the vehicle stopped, but with the engine running.
5. Determine if the noise occurs while the vehicle operates in:
   - Drive – under a light acceleration or a heavy pull.
   - Float – maintaining a constant speed with a light throttle on a level road.
   - Coast – with the transaxle in gear and the throttle partly or fully closed.
   - All of the above.

Bearing Noise

Differential Side Bearing Noise

Differential side bearing noise and wheel bearing noise can be confused easily. Since side bearings are preloaded, a differential side bearing noise should not diminish much when the differential/transaxle is run with the wheels off the ground.

Wheel Bearing Noise

Wheel bearings produce a rough growl or grating sound that will continue when the vehicle is coasting and the transaxle is in NEUTRAL. Since wheel bearings are not pre-loaded, a wheel bearing noise should diminish considerably when the wheels are off the ground.

Other Noise

Brinelling

A brinelled bearing causes a “knock” or “click” approximately every second revolution of the wheel because the bearing rollers do not travel at the same speed as the wheel. In operation, the effect is characterized by a low-pitched noise.

A brinelled bearing is caused by excessive thrust which pushes the balls up on the pathway and creates a triangular-shaped spot in the bearing race. A brinelled bearing can also be caused from pressing one race into position by applying pressure on the other race.

A false indication of a brinelled bearing occurs as a result of vibration near the area where the bearing is mounted. Brinelling is identified by slight indentations, resulting in a washboard effect in the bearing race.

Lapping

Lapped bearing noise occurs when fine particles of abrasive materials such as scale, sand, or emery circulate through the oil in the vehicle, causing the surfaces of the roller and the race to wear away. Bearings that wear loose but remain smooth, without spalling or pitting, are the result of dirty oil.

Locking

Large particles of foreign material wedged between the roller and the race usually causes one of the races to turn, creating noise from a locked bearing. Pre-loading regular taper roller bearings to a value higher than that specified also can result in locked bearings

Pitting

Pitting on the rolling surface comes from normal wear and the introduction of foreign materials.

Spalling

Spalled bearings have flaked or pitted rollers or races caused by an overload or an incorrect assembly that results in a misalignment, a cocking of bearings, or adjustments that are too tight.

After completing these checks, refer to the “Diagnosis Chart” in this section.

SYMPTOM DIAGNOSIS

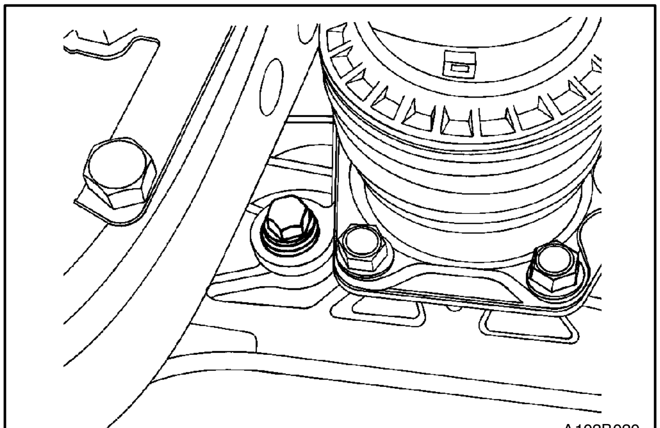
Checks	Action
Check for a knock at low speeds.	• Replace any worn drive axle CV joints. • Replace any worn side gear hub.
Check for a noise most pronounced on turns.	• Correct any abnormalities in the differential gear.
Check for a clunk upon acceleration or deceleration.	• Tighten any loose engine mounts. • Replace any worn drive axle inboard joints. • Replace any worn differential pinion shaft in the case. • Replace any worn side gear hub in the case.
Check for a clunking noise in turns.	• Replace any worn outboard CV joint.
Check for a vibration.	• Replace any rough wheel bearing. • Replace any bent drive axle shaft. • Replace any out-of-round tires. • Balance any unbalanced tire. • Replace any worn CV joint in the drive axle shaft. • Correct an excessive drive axle angle by adjusting the trim height.
Check for a noise in the NEUTRAL gear with the engine running.	• Replace any worn cluster bearing shaft. • Replace any worn clutch-release bearing. • Replace any worn input shaft cluster gears. • Replace any worn first-gear/bearing. • Replace any worn second-gear/bearing. • Replace any worn third-gear/bearing. • Replace any worn fourth-gear/bearing. • Replace any worn fifth-gear/bearing. • Replace any worn mainshaft bearings.
Check for a noise in the first gear (1) only.	• Replace any chipped, scored, or worn first-gear constant mesh gears. • Replace any worn first-second gear synchronizer. • Replace any worn first-gear/bearing. • Replace any worn differential-gear/bearing. • Replace any worn-ring gear. • Adjust, repair, or replace the shift lever and the rods.
Check for a noise in the second gear (2) only.	• Replace any chipped, scored, or worn second-gear constant mesh gears. • Replace any worn first-second gear synchronizer. • Replace any worn second-gear/bearing. • Replace any worn differential-gear/bearing. • Replace any worn-ring gear. • Adjust, repair, or replace the shift lever and the rods.
Check for a noise in the third gear (3) only.	• Replace any chipped, scored, or worn third-gear constant mesh gears. • Replace any worn third-fourth gear synchronizer. • Replace any worn third-gear/bearing. • Replace any worn differential-gear/bearing. • Replace any worn-ring gear. • Adjust, repair, or replace the shift lever and the rods.
Check for a noise in the fourth gear (4) only.	• Replace any chipped, scored, or worn fourth gear or output gear. • Replace any worn third-fourth gear synchronizer. • Replace any worn fourth-gear/bearing. • Replace any worn differential-gear/bearing. • Replace any worn-ring gear. • Adjust, repair, or replace the shift lever and the rods.

Symptom Diagnosis (Cont'd)

Checks	Action
Check for a noise in the fifth gear (5) only.	• Replace any chipped, scored, or worn fifth gear or output gear. • Repair any worn fifth-gear synchronizer. • Replace any worn fifth-gear/bearing. • Replace any worn differential-gear/bearing. • Replace any worn-ring gear. • Adjust, repair, or replace the shift lever and the rods.
Check for a noise in the reverse (R) gear only.	• Replace any chipped, scored, or worn reverse idler gear, idler-gear bushing, input gear, or output gear. • Replace any worn first-second gear synchronizer. • Replace any worn output gear. • Replace any worn differential-gear/bearings. • Replace any worn-ring gear.
Check for a noise in all gears.	• Add sufficient lubricant. • Replace any worn bearings. • Replace any chipped, scored, or worn input-gear shaft or output-gear shaft.
Check for the transaxle slipping out of gear.	• Adjust or replace the linkage, as needed. • Adjust, repair, or replace any binding shift linkage. • Tighten or replace the input-gear bearing retainer, as needed. • Repair or replace any worn or bent shift fork.
Check for a leak in the area of the clutch.	• Repair the transaxle casing. • Replace any damaged release bearing guide.
Check for a leak at the center of the transaxle.	• Repair the transaxle casing. • Repair the shift mechanism. • Replace the damaged backup lamp switch.
Check for a leak at the differential.	• Adjust or replace the bearing retainers. • Tighten or replace the differential cover. • Adjust or replace the drive axle shaft seals.
Check for a hard shift.	• Replace any damaged release-bearing guide. • Adjust, repair, or replace the shift mechanism. • Adjust, repair, or replace the clutch-release system. • Replace any chipped, scored, or worn fifth-gear synchronizer. • Replace any chipped, scored, or worn first-second gear synchronizer. • Replace any worn third-fourth gear synchronizer. • Adjust, repair, or replace the shift lever and the rods.
Check for a clashing of gears.	• Replace any damaged release-bearing guide. • Adjust, repair, or replace the clutch-release system. • Replace the chipped, scored, or worn input shaft/gear-cluster gears. • Replace any worn fifth-gear synchronizer. • Replace any worn fifth-gear/bearing. • Replace any worn first-gear/bearing. • Replace any worn first-second gear synchronizer. • Replace any worn second-gear/bearing. • Replace any worn third-gear/bearing. • Replace any worn third-fourth synchronizer. • Replace any worn fourth-gear/bearing. • Replace any worn reverse-idler gear.

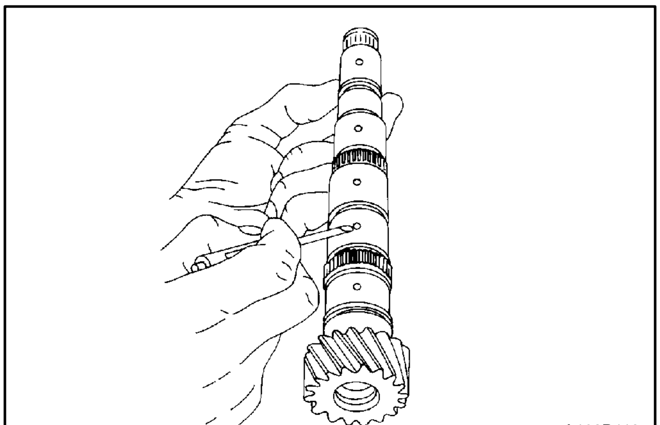
REPAIR INSTRUCTIONS

ON-VEHICLE SERVICE


A103B030

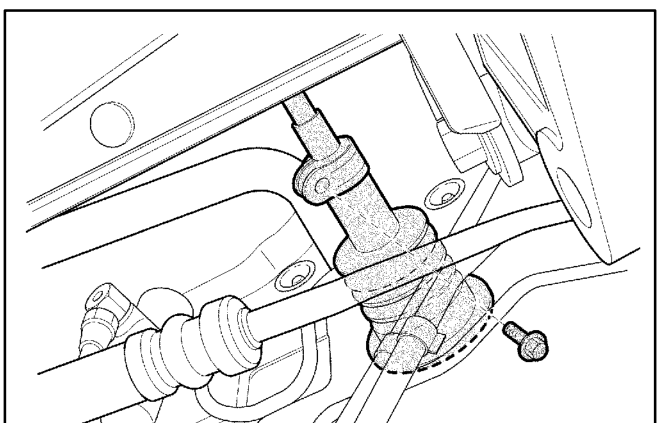
CHECKING FLUID LEVEL

1. With the vehicle on a level surface and the fluid in the transaxle cold, Remove the filter plug and check the fluid level. the fluid should come to the bottom edge of the plughole.
2. If the level is low, add SAE 80 manual transaxle fluid through the filter plughole until the fluid begins to run out.
3. Reinstall the filter plug and tighten it securely.


A103B118

The speed gears and the synchronizer parts on this vehicle receive lubrication through specific passages in the mainshaft.

It takes 1.9 liters (2.01 quarts) to fill the transaxle completely.


UAA5B010

SHIFT LINKAGE ADJUSTMENT

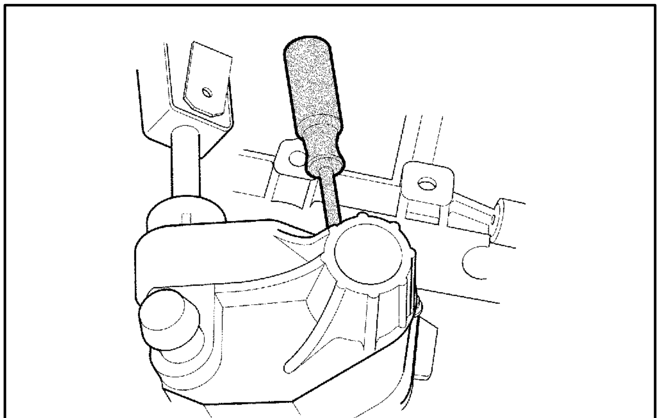
1. Disconnect the negative battery cable.
2. Position the gearshift lever into NEUTRAL.

Important: All the gears must be easy to engage when the vehicle is stationary, the engine is running, and the clutch is disengaged.

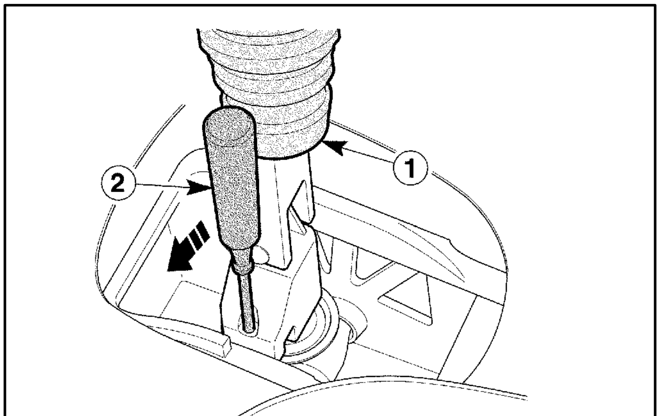
3. Loosen the rod clamp bolt.

Installation Notice

Tightening Torque	14 N·m (124 lb–in)

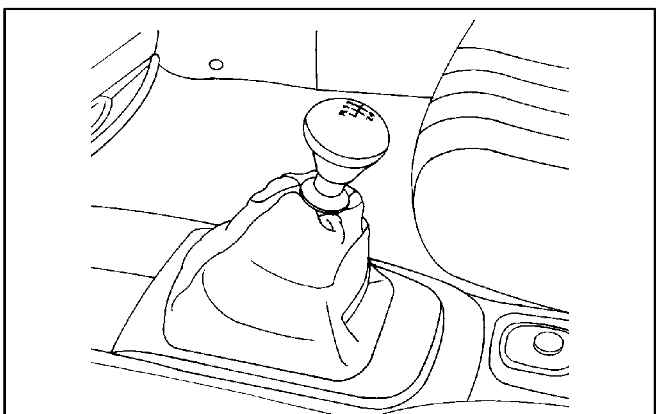

UAA5B020

4. Remove the adjustment hole plug from the shift lever cover.
5. Turn the gearshift rod and fully insert a 5 mm (0.2 inch) gauge pin into the adjustment hole.

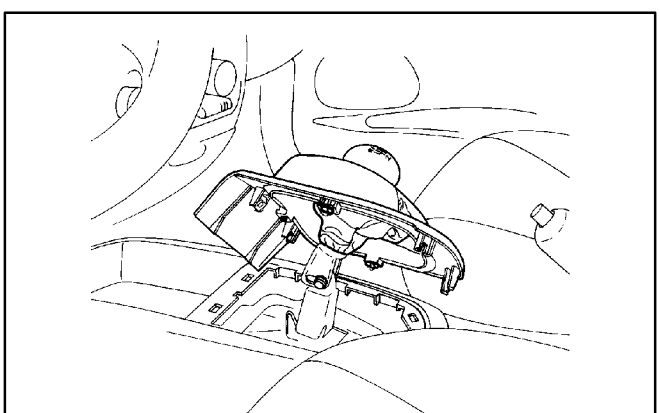


UAA5B030

6. Remove the boot from the console.
7. Pull the boot upward to expose the shift control lever mechanism.
8. Position the gearshift lever close to the left side of the NEUTRAL position.
9. Insert a 5 mm (0.2 inch) gauge pin into the holes to align the gearshift lever with the gearshift lever housing.


B103B006

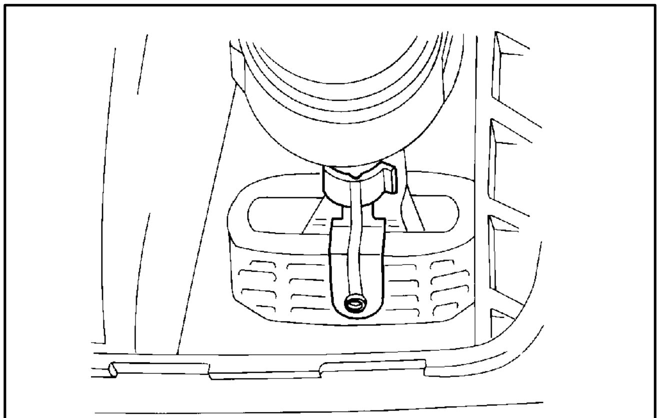
10. Remove the 5 mm (0.2 inch) gauge pin from the adjustment hole.
11. Install the adjustment hole plug.
12. Remove the 5 mm (0.2 inch) gauge pin from the gearshift lever.
13. Install the boot to the console.
14. Connect the negative battery cable.


B103B004

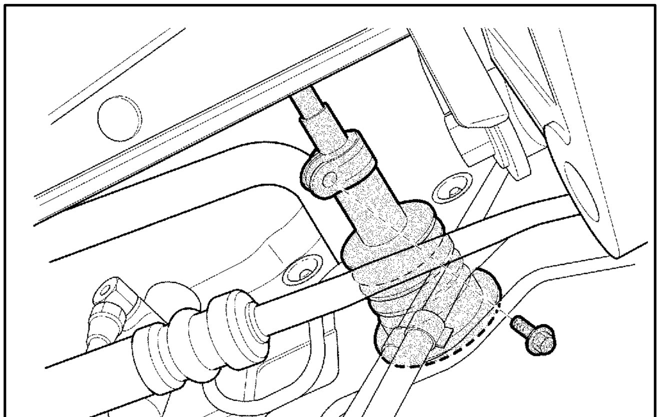
GEARSHIFT LEVER

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Position the gearshift lever into NEUTRAL.
3. Disconnect the boot from the console cover.
4. Lift the console cover upward to expose the shift control lever mechanism.


A103B120

5. Rotate the gearshift lever stop clamp and remove it.
6. Remove the gearshift lever from the gearshift lever shaft.
7. Installation should follow the removal procedure in the reverse order.


UAA5B010

GEARSHIFT TUBE, BOOT, BUSHING AND/OR BEARING RING

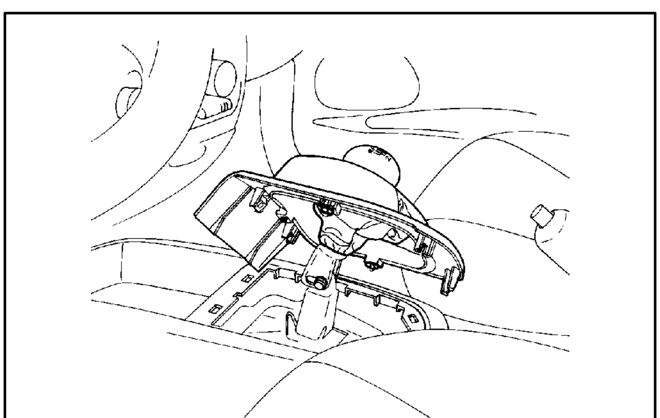
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal and Installation Procedure

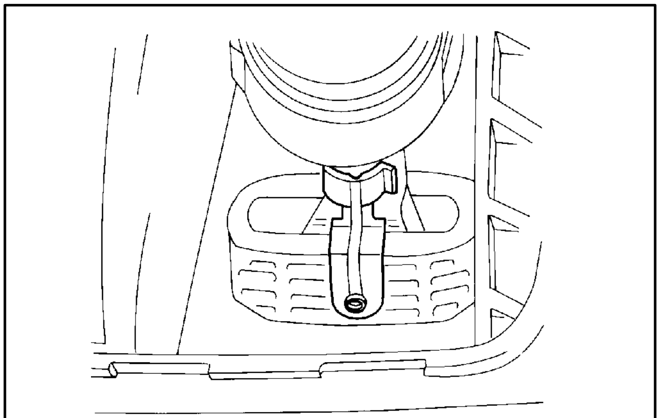
1. Disconnect the negative battery cable.
2. Remove the rod clamp bolt.
3. Separate the linkage bolt from the gearshift tube.
4. Remove the rod clamp from the gearshift tube.
5. Remove the center console. Refer to Section 9G, Interior Trim.

Installation Notice

Tightening Torque	14 N·m (124 lb–in)

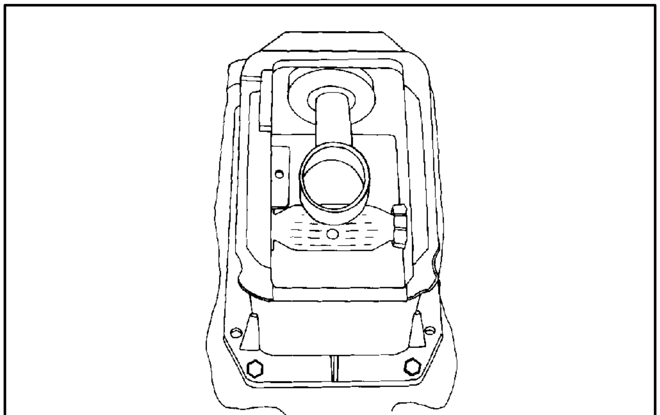

B103B004

6. Position the shift lever into NEUTRAL.
7. Disconnect the gearshift boot from the front portion of the floor console and lift upward to expose the shift control lever mechanism.



A103B120

8. Rotate the gearshift lever stop clamp and remove it.
9. Remove the gearshift lever and the boot.



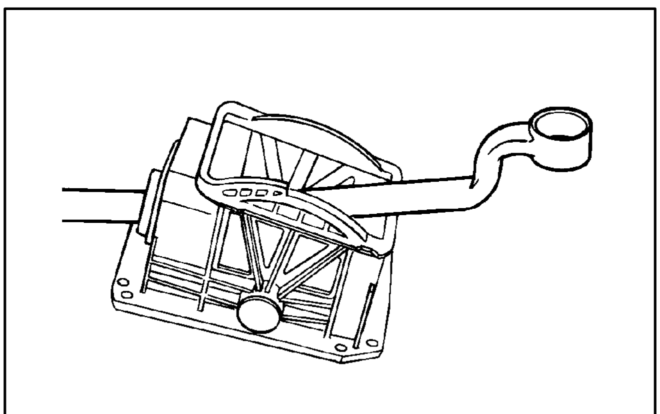
A103B127

10. Remove the gearshift housing bolts.

Installation Notice

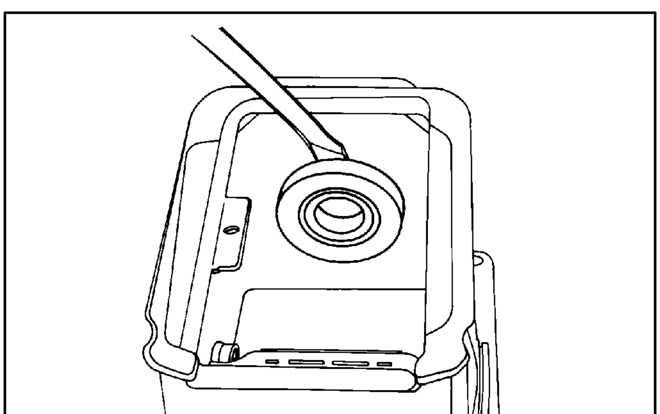
Tightening Torque	6 N·m (53 lb–in)

11. Remove the gearshift tube with the gearshift housing from the vehicle.



A103B128

12. Remove the gearshift tube from the gearshift housing.

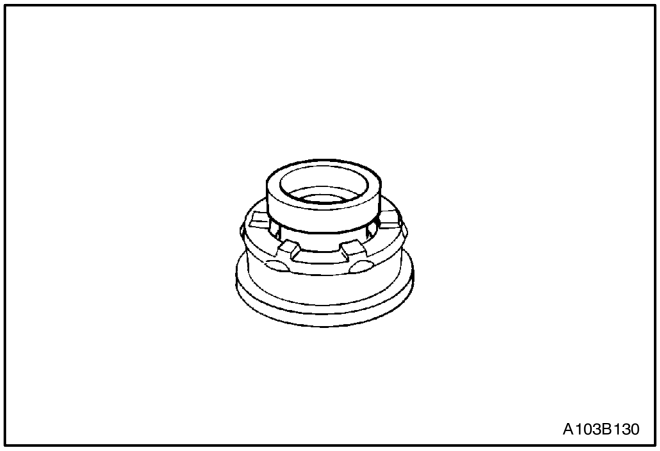


A103B129

13. Remove the bushing and the gearshift tube bearing from the gearshift housing.

Installation Notice

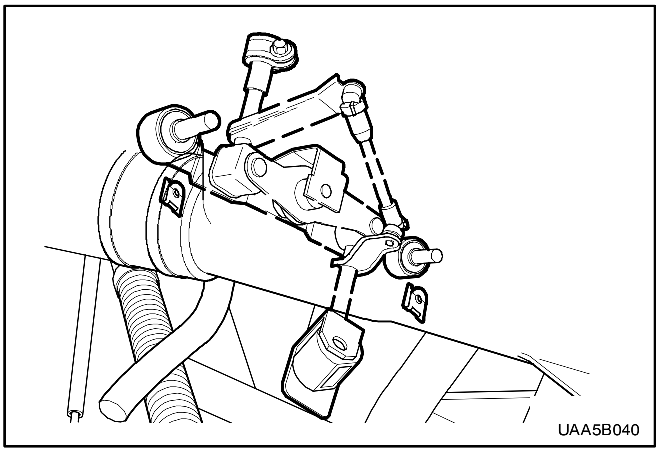
- Press the bearing ring into the gearshift housing from the inside.



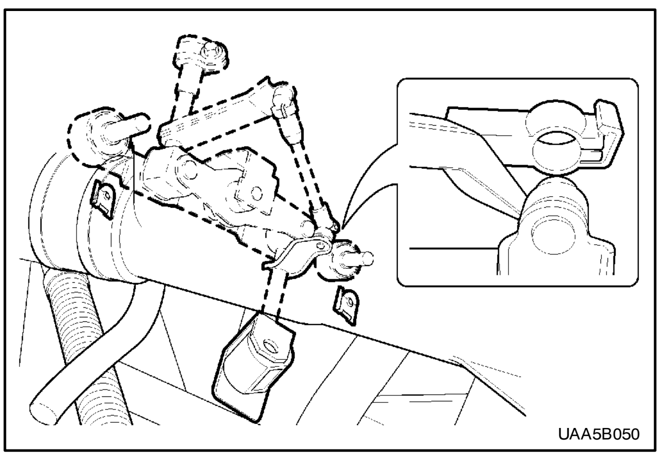
14. Remove the bushing from the gearshift tube bearing.
15. Installation should follow the removal procedure in the reverse order.

CONTROL SHIFT ROD

Removal and Installation Procedure



1. Disconnect the negative battery cable.
2. Separate the plastic clip from the end of each ball socket.



3. Separate the ball sockets from the ball studs on the linkage bolts using a pry bar.

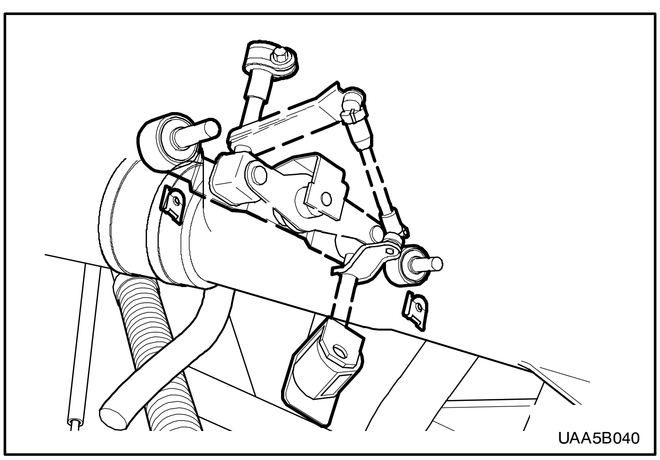
Installation Notice

- Press the ball sockets from the ball studs on the linkage bolts using a pry bar.

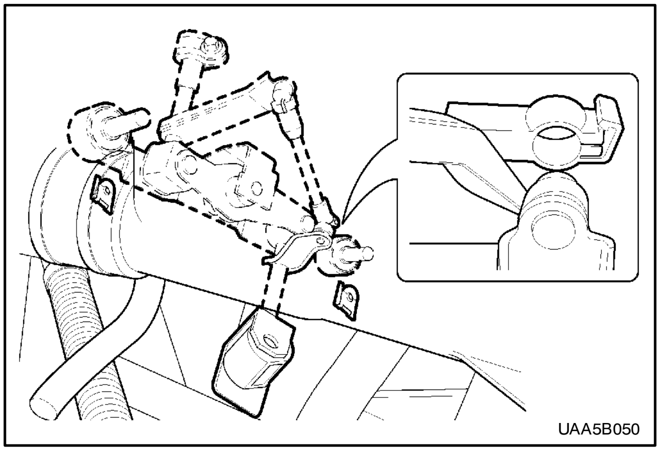
4. Remove the control shift rod from the vehicle.
5. Installation should follow the removal procedure in the reverse order.

LINKAGE LEVER AND/OR BUSHINGS

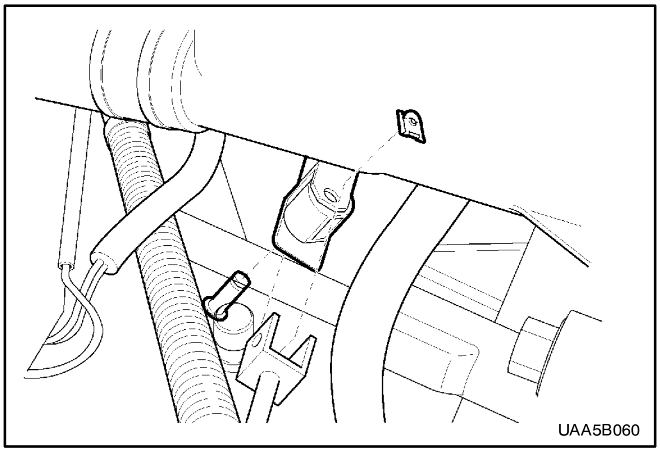
Removal and Installation Procedure



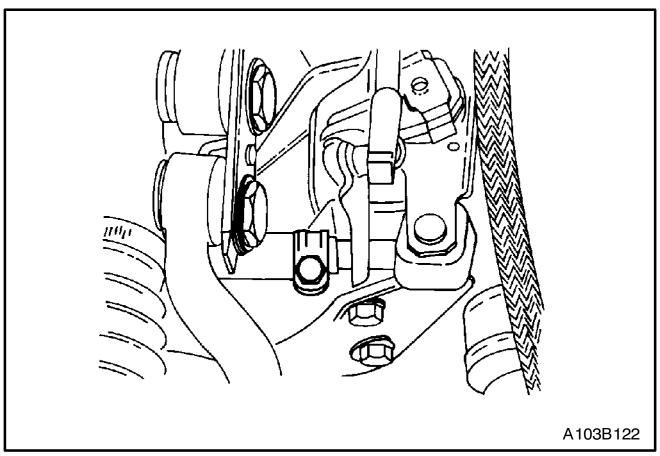
1. Disconnect the negative battery cable.
2. Separate the plastic clip from the end of each ball socket.



3. Separate the ball sockets from the ball studs on the linkage bolts using a pry bar.
4. Remove the control shift rod.



5. Remove the clip and the bolt from the universal joint.

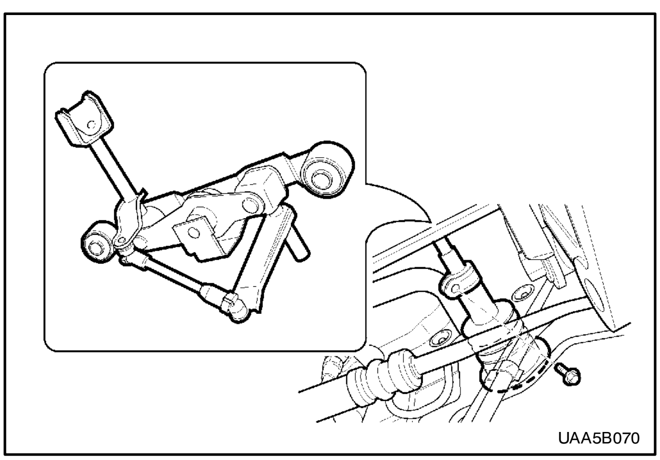


6. Remove the rod clamp bolt.

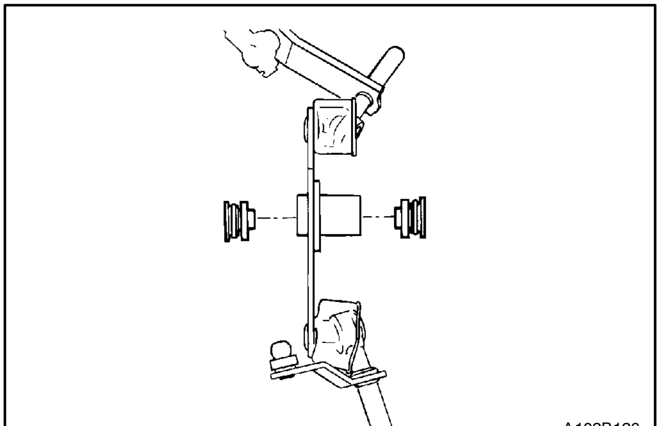
Installation Notice

Tightening Torque	14 N·m (124 lb–in)

7. Separate the linkage bolt from the shift tube.



8. Remove the linkage lever assembly from the vehicle.

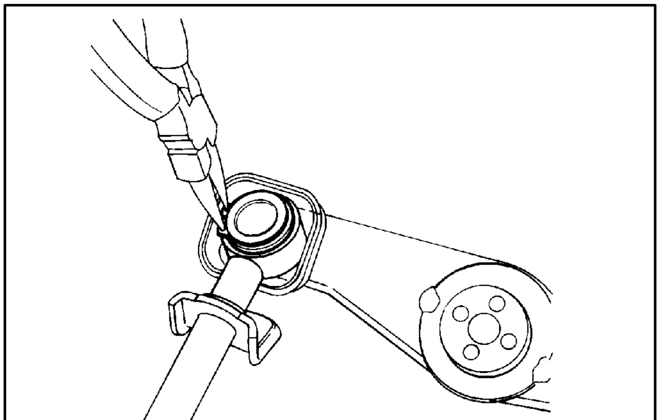


A103B136

9. Remove both linkage lever bushings from the linkage lever assembly.

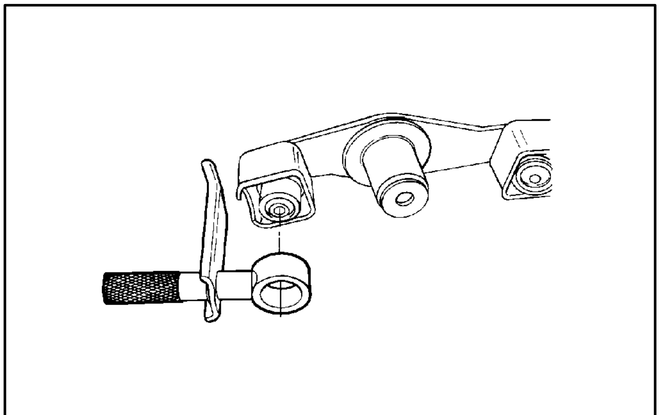
Installation Notice

- Coat the linkage lever bushing with silicone grease.



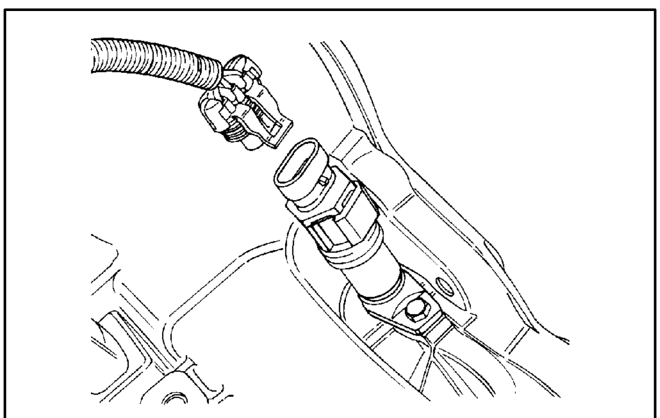
A103B137

10. Remove the snap rings retaining the linkage bolts to the linkage lever assembly.



A103B138

11. Disconnect the linkage bolts from the linkage lever.
12. Installation should follow the removal procedure in the reverse order.

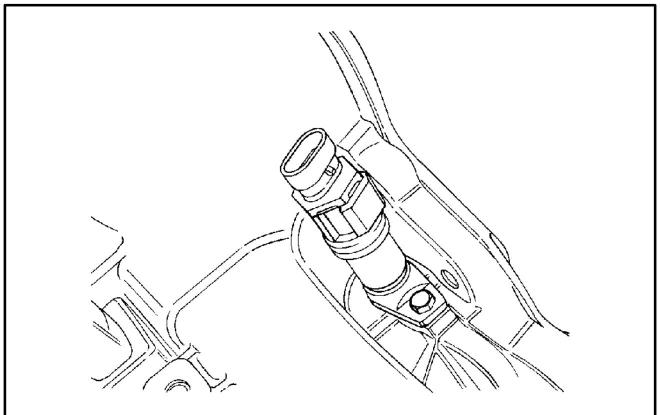


A103B142

SPEEDOMETER DRIVEN GEAR

Removal and Installation Procedure

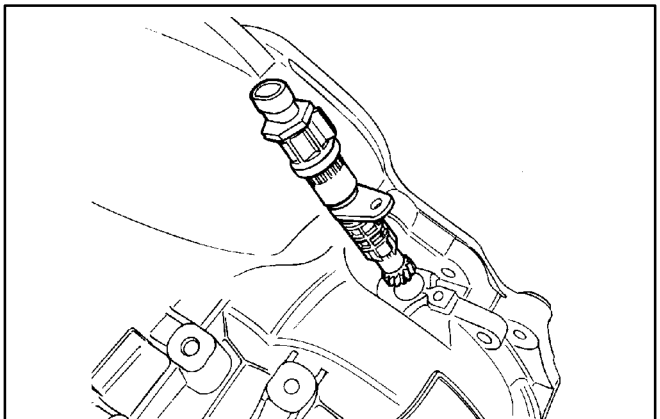
1. Disconnect the speedometer speed sensor electrical connector.


A103B144

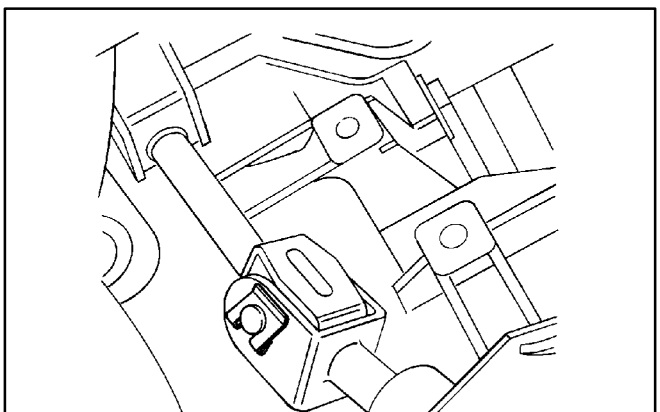
2. Remove the speedometer housing retaining bolt.

Installation Notice

Tightening Torque	4 N·m (35 lb-in)


A103B145

3. Remove the speedometer-driven gear and the speedometer housing.
4. Installation should follow the removal procedure in the reverse order.


A103B133

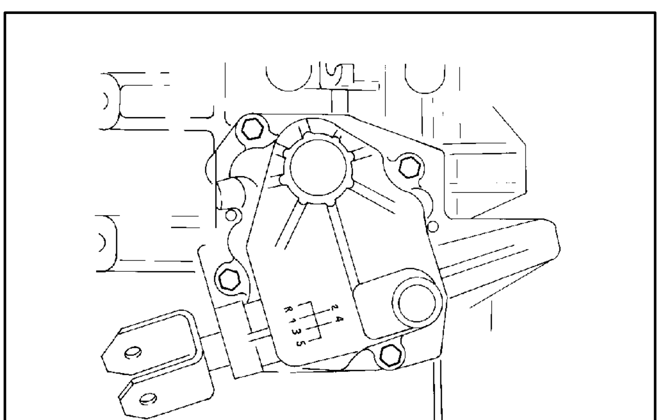
SHIFT LEVER COVER

Removal and Installation Procedure

1. Remove the clip and the bolt at the universal joint.

Adjustment Notice :

- Check and adjust the fluid level. Refer to “Checking Fluid Level” in this Section,.

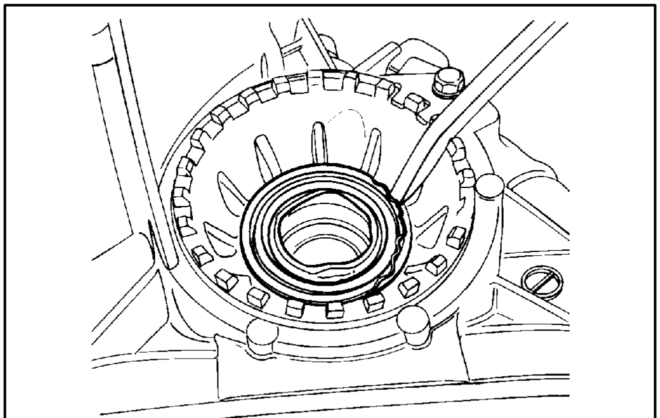

A103B037

2. Remove the gearshift lever cover bolts.

Installation Notice

Tightening Torque	22 N·m (16 lb-ft)

3. Separate the gearshift lever cover and the gasket from the case.
4. Installation should follow the removal procedure in the reverse order.


A103B146

DRIVE AXLE SEAL

Tools Required

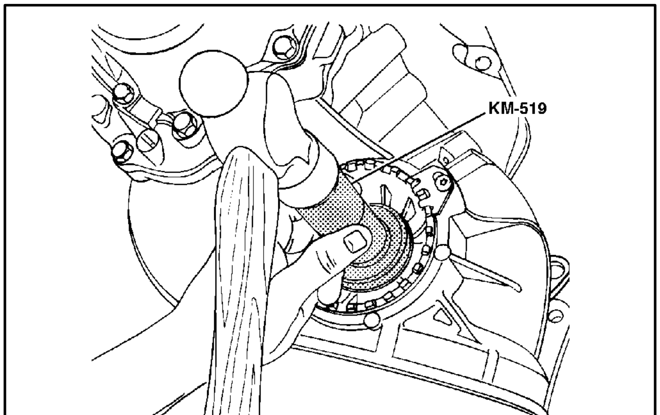
KM–519 Ring Installer

Removal and Installation Procedure

1. Remove the drive axle from the transaxle. Refer to *Section 3B, Manual Transaxle Drive Axle.*
2. Remove the drive axle seal by lifting the outer lip of the seal with a pry bar.

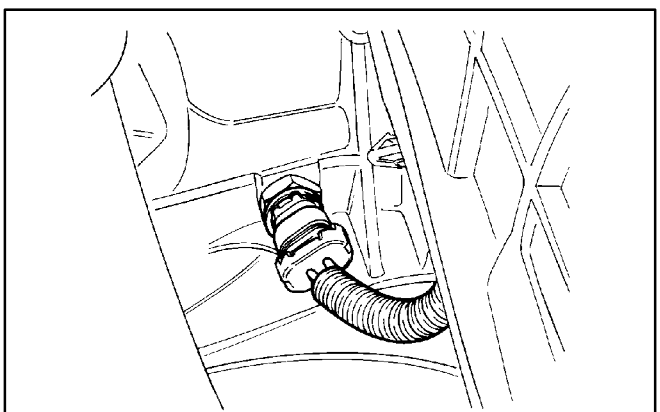
Removal Notice

- Do not damage the bearing adjusting ring with the pry bar.



A103B147

3. Install the new drive axle seal using the ring installer KM–519 and a hammer.
4. Coat the seal lip with the transaxle fluid.
5. Install the drive axle. Refer to *Section 3B, Manual Transaxle Drive Axle.*


A103B150

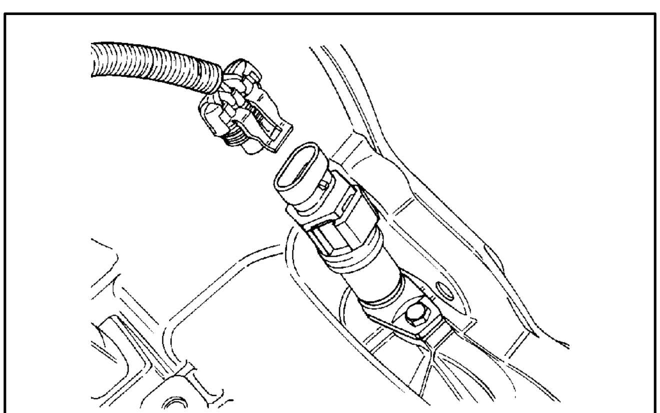
TRANSAXLE ASSEMBLY

Tools Required

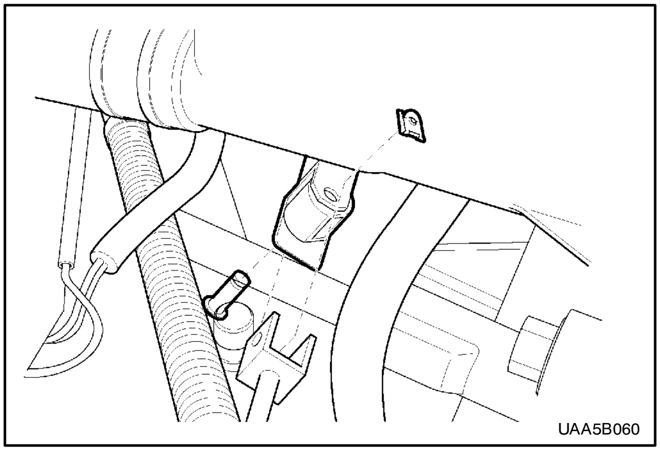
DW 110–060 Engine Support Fixture

Removal and Installation Procedure

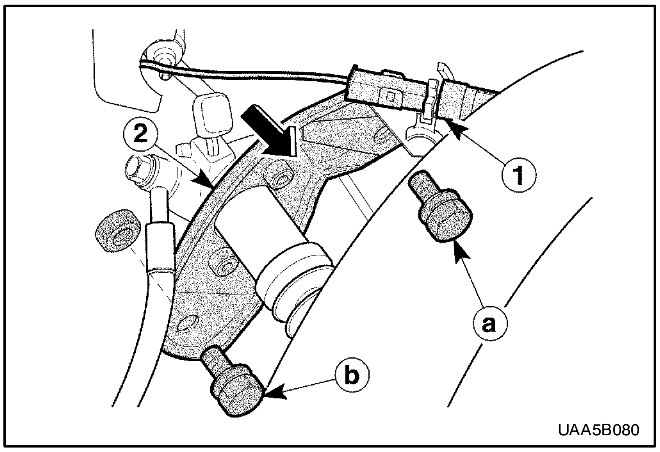
1. Disconnect the backup lamp switch electrical connector.


A103B142

2. Disconnect the speedometer speed sensor electrical connector.



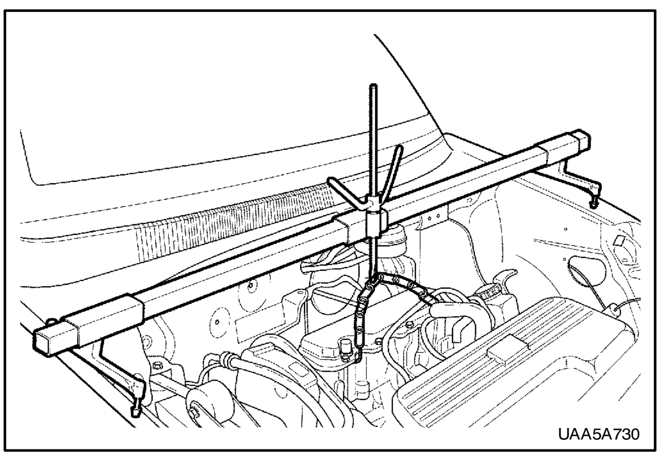
3. Remove the clip and the bolt from the universal joint.



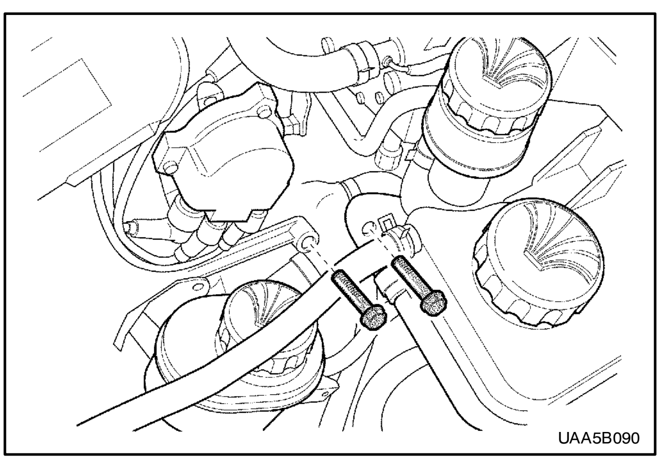
4. Remove the clutch release cylinder bracket bolts and the clutch release cylinder bracket.

Installation Notice

Tightening Torque	70 N·m (52 lb–ft)



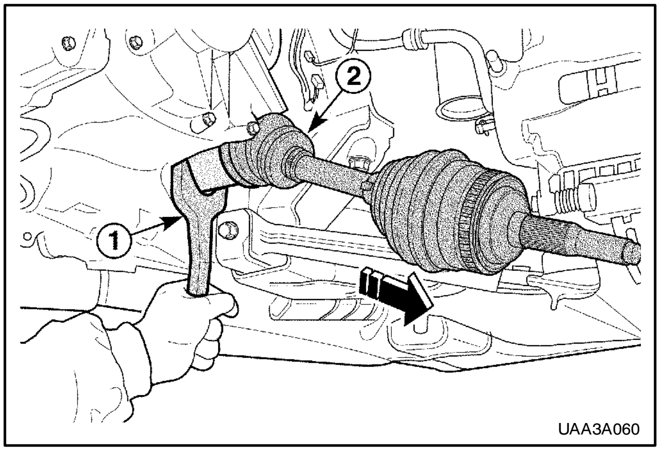
5. Install the engine support fixture DW 110–060.



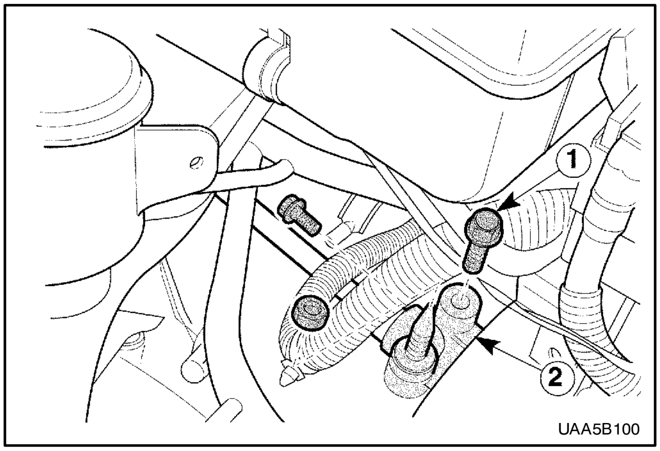
6. Remove the upper transaxle-to-engine bolts.

Installation Notice

Tightening Torque	70 N·m (52 lb–ft)



7. Remove both of the drive axle shafts. Refer to *Section 3B, Manual Transaxle Drive Axle.*

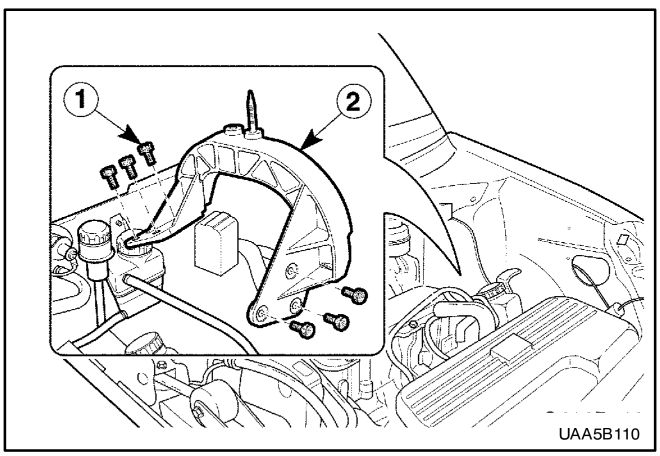


8. Remove the left front transaxle support bracket bolts and nut.

Installation Notice

Tightening Torque	60 N·m (44 lb–ft)

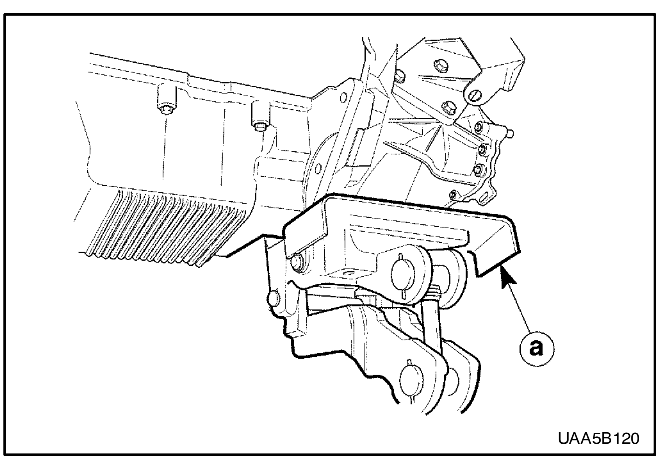
9. Remove the left front transaxle support bracket cage.



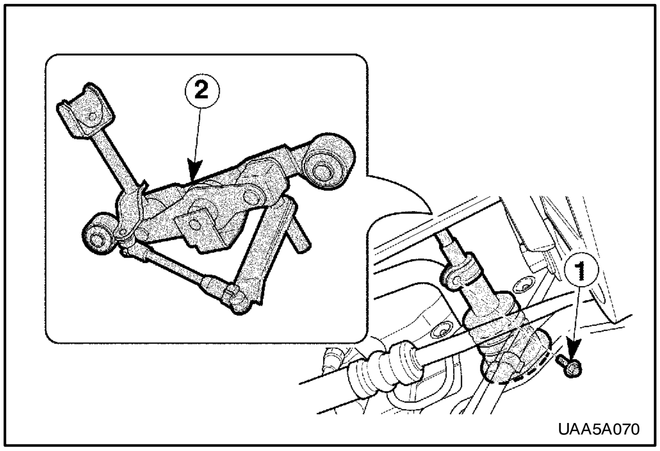
10. Remove the left front transaxle support bracket bolts and the left front transaxle support bracket.

Installation Notice

Tightening Torque	50 N·m (37 lb–ft)



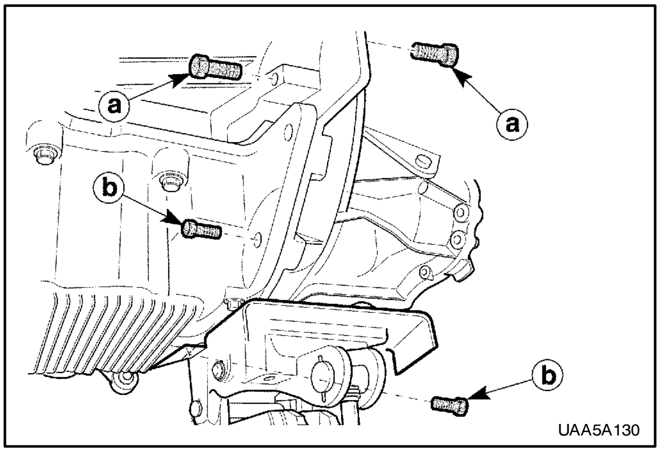
11. Support the transaxle with a transaxle support jack.



12. Remove the shift linkage bolt and the shift linkage.

Installation Notice

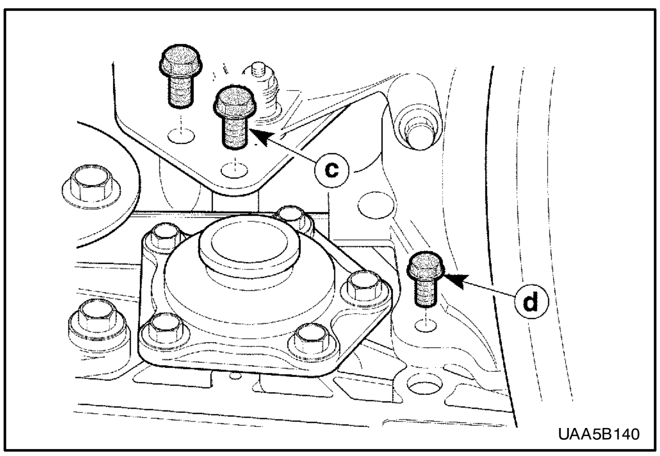
Tightening Torque	14 N·m (124 lb–in)

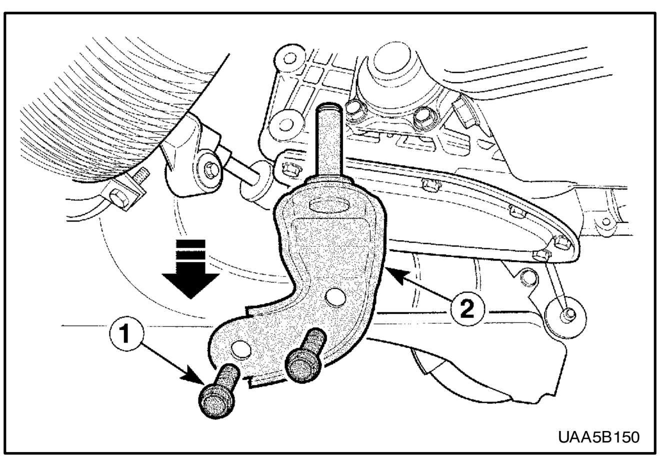


13. Remove the lower transaxle-to-engine bolts.

Installation Notice

Tightening Torque	19mm bolts	75 N·m (55lb–ft)
	14mm bolts	30 N·m (22lb–ft)

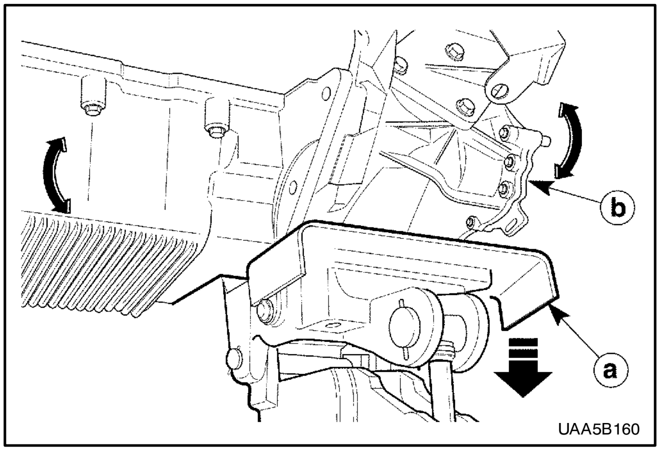




14. Remove the left shift linkage bracket bolts and the left shift linkage bracket.

Installation Notice

Tightening Torque	75 N·m (55 lb–ft)



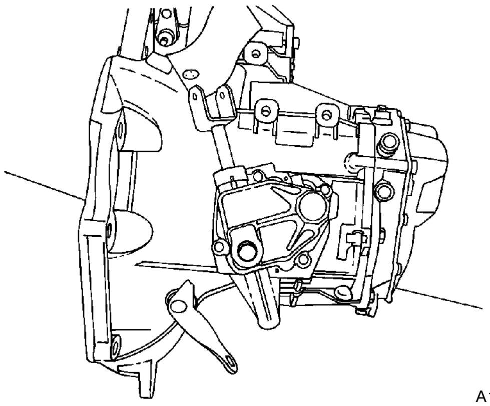
15. Remove the transaxle.

Removal Notice

- Rest the transaxle only in an upright position.

16. Slide the transaxle sideways away from the engine block.
17. Lower the transaxle
18. Installation should follow the removal procedure in the reverse order.

UNIT REPAIR



A103B031

MAJOR COMPONENT

Tools Required

J–6125–B Slide Hammer

J–22888–20–A Bearing Puller with J–22888–35 Puller Legs

KM–553–A Fifth Gear Puller

J–36633 Snap Ring Retainer

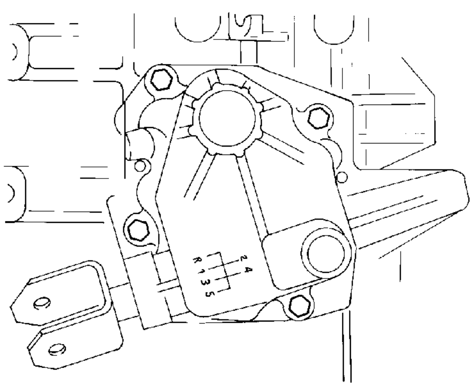
KM–113–2 Base

J–42469 Shift Rod Remover

KM–552 Fixture

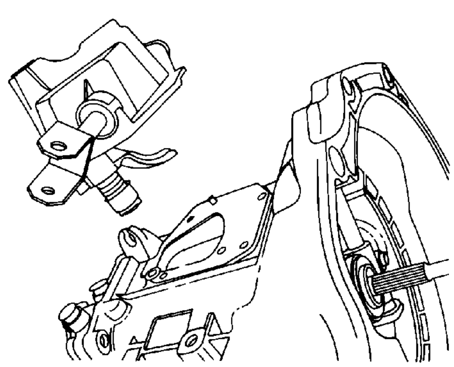
Disassembly and Assembly Procedure

1. Remove the transaxle from the vehicle. Refer to *"Transaxle Assembly"* in this section.
2. Remove the filler plug at the cover.



A103B037

3. Remove the bolts from the gearshift lever cover.

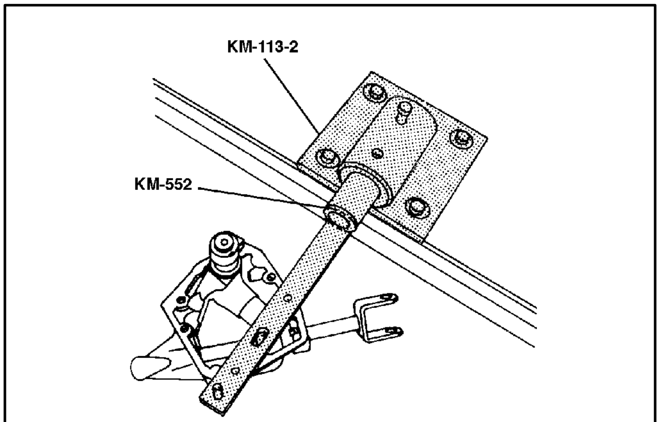


A103B038

4. Remove the gearshift lever cover.

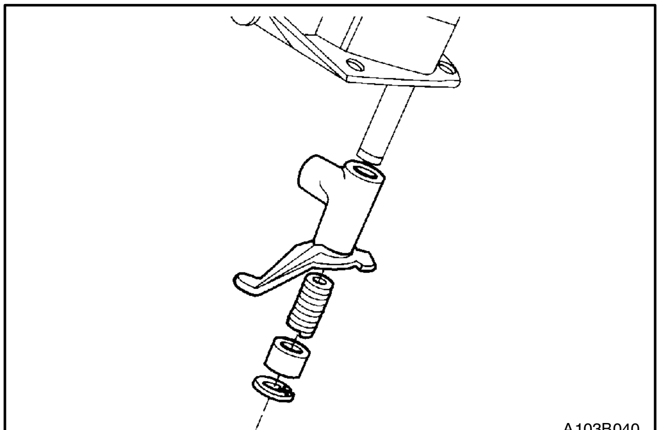
Installation Notice

Tightening Torque	22 N·m (16 lb–ft)

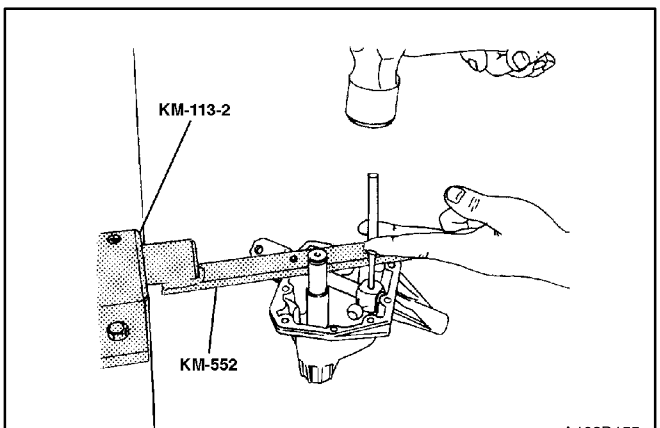


A103B039

5. Bolt the gearshift lever cover to the fixture KM–552.
6. Position the fixture KM–552 into the base KM–113–2.

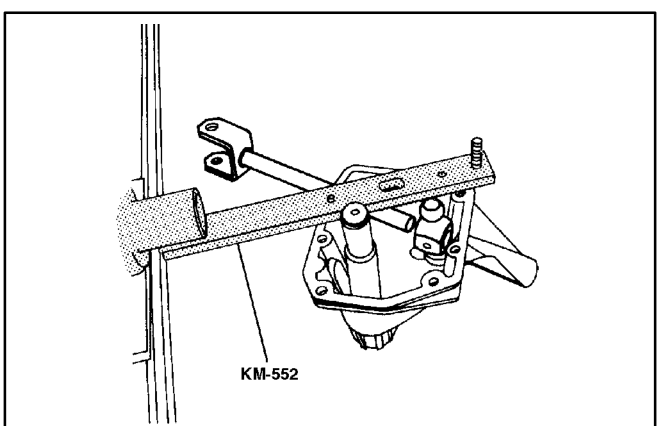

A103B040

7. Remove the snap ring, the bushing, the spring, and the intermediate lever.



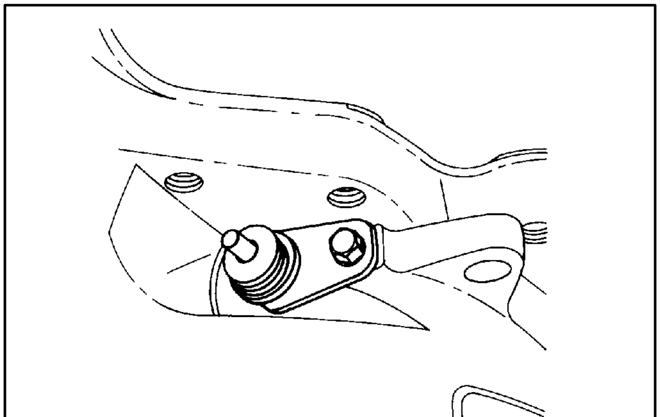
A103B155

8. Remove the shift finger lever pin.



A103B041

9. Remove the gearshift rod and the shift finger lever.

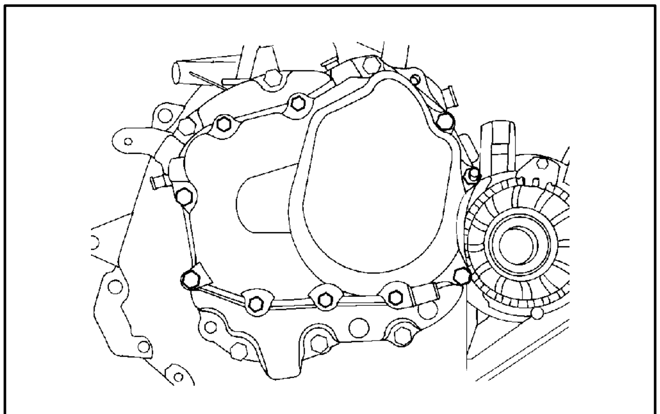


A103B073

10. Remove the bolt and the speedometer-driven gear from the transaxle housing.

Installation Notice

Tightening Torque	4 N·m (35 lb–in)

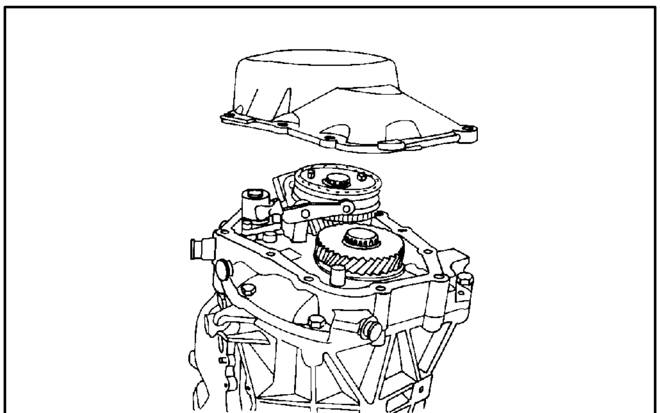


A103B042

11. Remove the transaxle cover bolts.

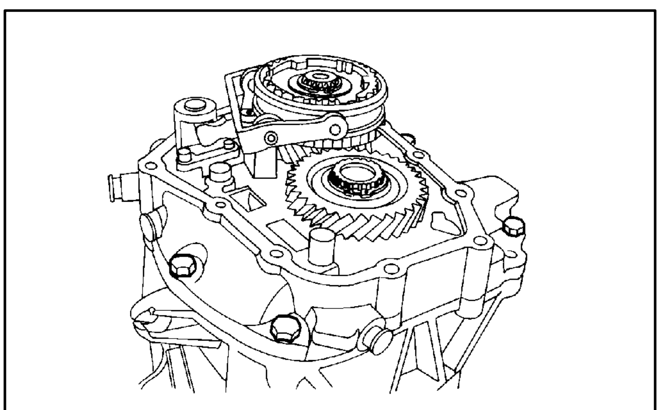
Installation Notice

Tightening Torque	18 N·m (13 lb–ft)



A103B043

12. Remove the transaxle cover.

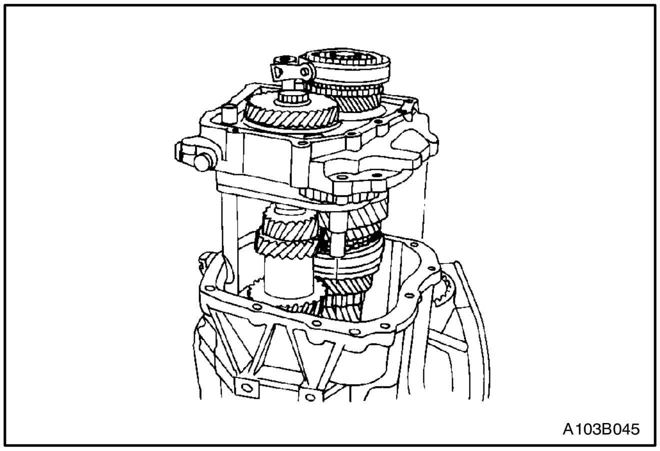


A103B044

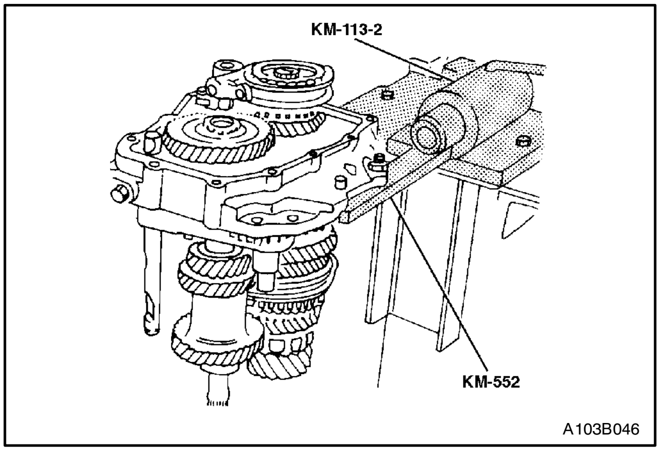
13. Shift the transaxle into second gear.
14. Remove the bearing plate bolts.

Installation Notice

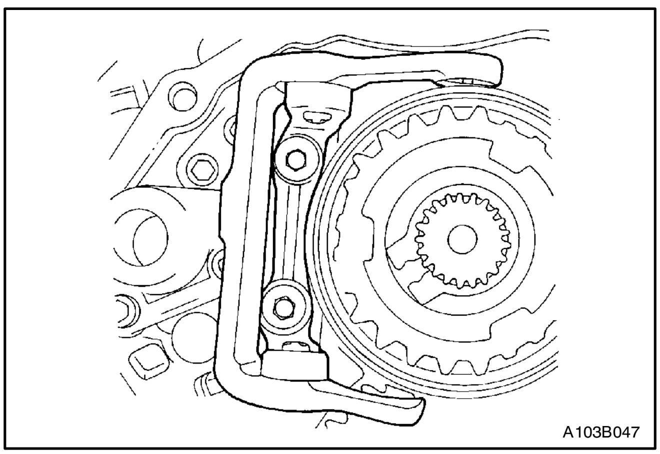
Tightening Torque	22 N·m (16 lb–ft)



15. Remove the bearing plate from the case with the shafts attached.



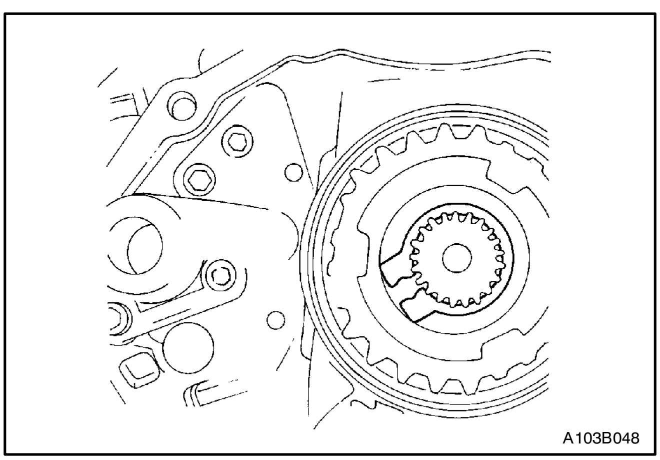
16. Shift the transaxle into reverse (R).
17. Bolt the bearing plate to the fixture KM–552 and install the fixture KM–552 into the base KM–113–2.



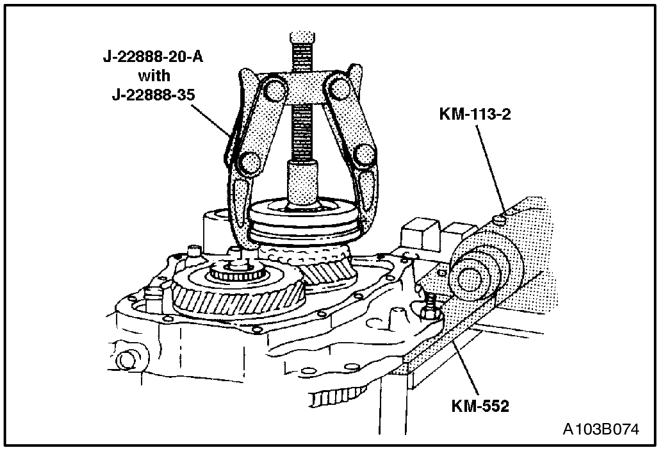
18. Remove the bolts and the fifth-gear fork from the bearing plate.

Installation Notice

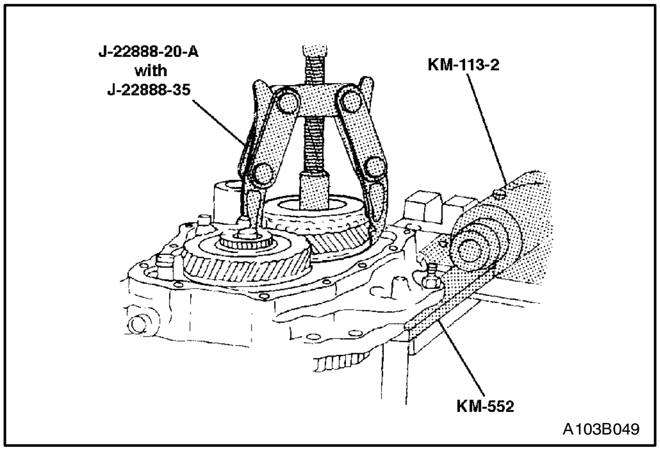
Tightening Torque	22 N·m (16 lb–ft)



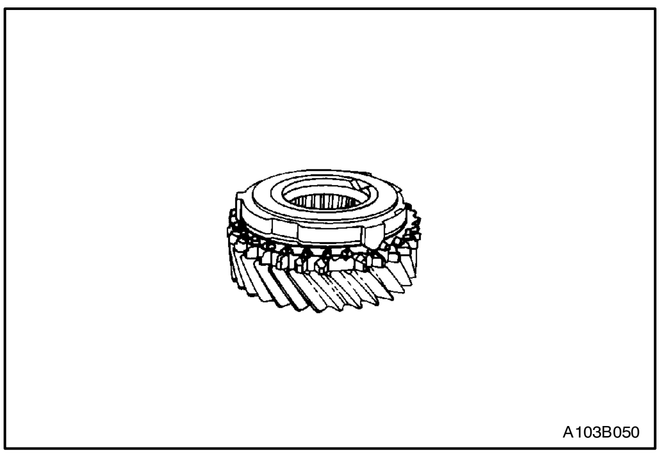
19. Remove the mainshaft-driven fifth-speed assembly snap ring.



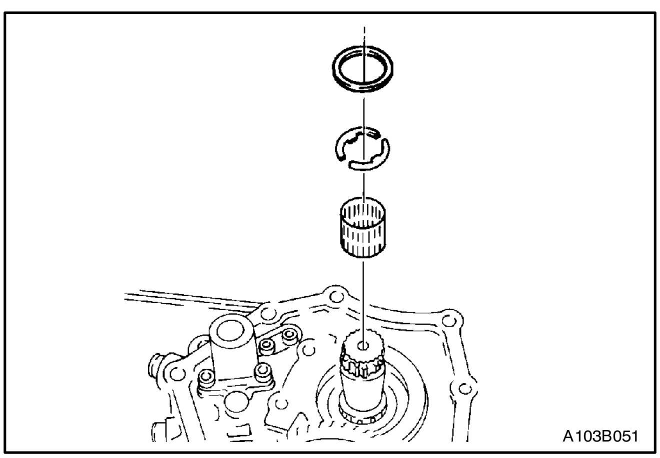
20. Remove the fifth driven gear synchronizer sleeve and the synchronizer gear using the bearing puller J–22888–20–A with the puller legs J–22888–35.



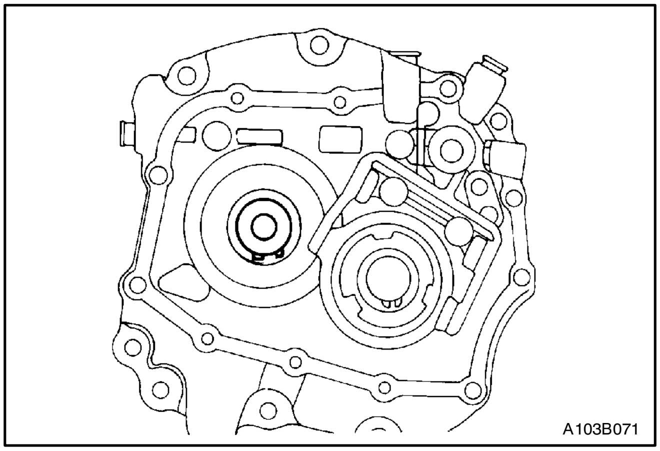
21. Remove the mainshaft-driven fifth-gear assembly.



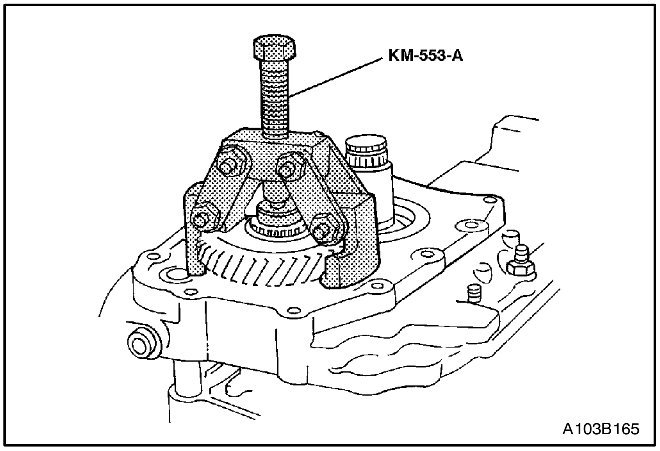
22. Remove the brass synchronizer ring.



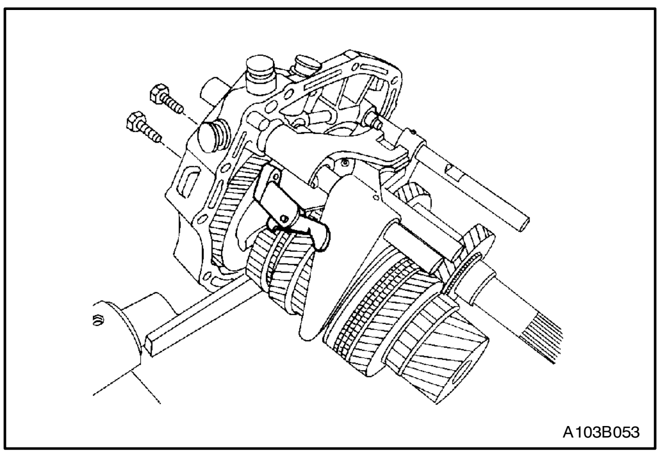
23. Remove the needle bearing, the retaining ring, and the thrust washers.



24. Remove the input drive fifth-gear snap ring.



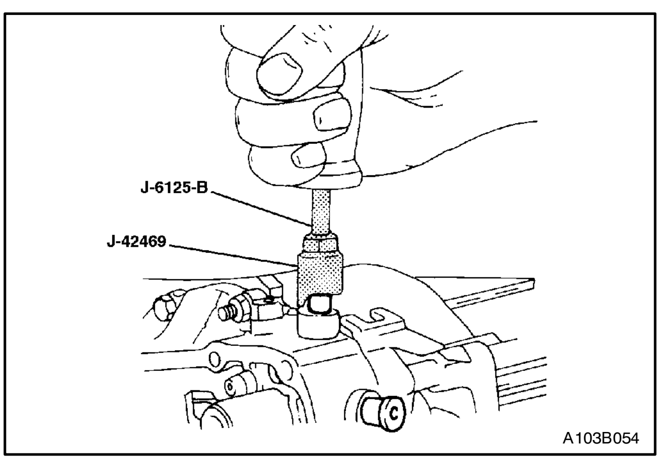
25. Remove the input drive fifth gear using the fifth-gear puller KM–553–A.



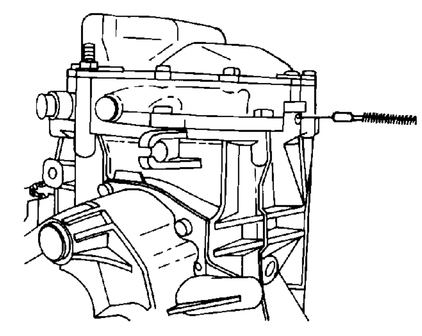
26. Remove the bolts and the fifth-gearshift connector from the bearing plate using the pawl.

Installation Notice

Tightening Torque	7 N·m (62 lb–in)

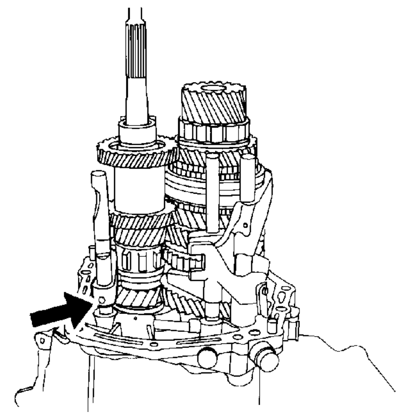


27. Remove the four shift-rod plugs using the shift rod remover J–42469 and the slide hammer J–6125–B.



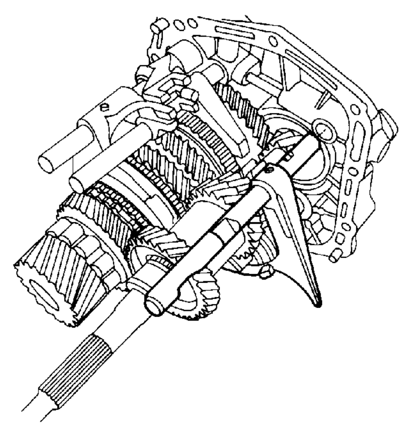
A103B055

28. Remove the spring and the rod lock pin from the small plughole.



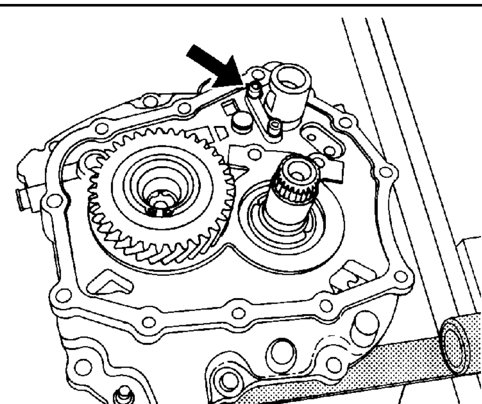
A103B056

29. Remove the pin from the reverse gearshift rod/fork assembly.



A103B057

30. Remove the reverse gearshift rod/fork assembly from the bearing plate.

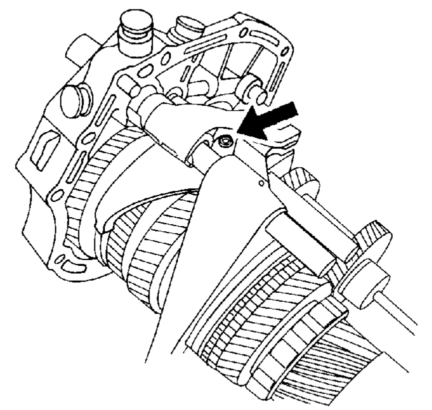


A103B058

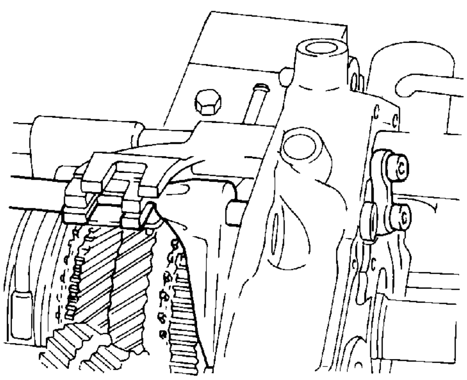
31. Remove the bolts from the support bracket.

Installation Notice

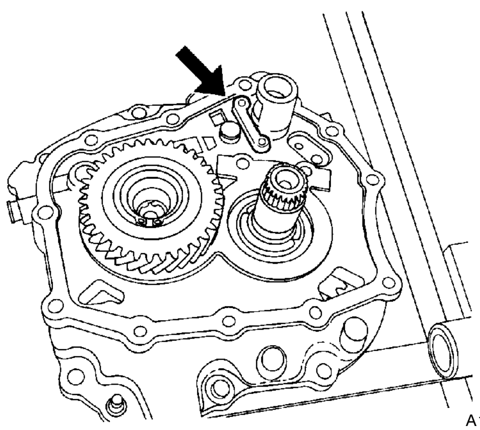
Tightening Torque	7 N·m (62 lb–in)


A103B059

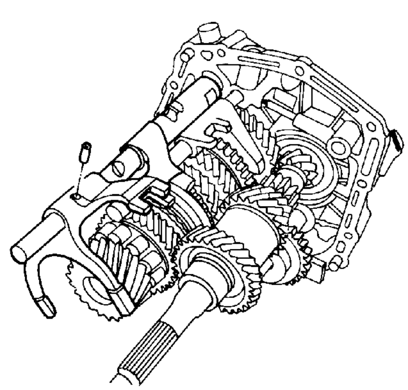
32. Remove the first-second gearshift fork holding pin.


A103B060

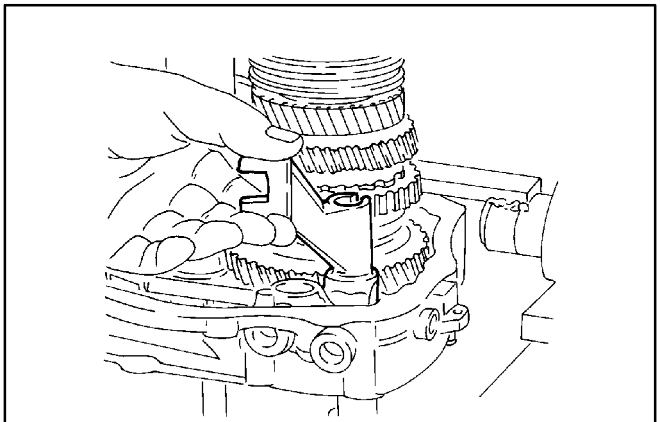
33. Drive the first-second gearshift rod out until it is just free of the bearing plate.


A103B061

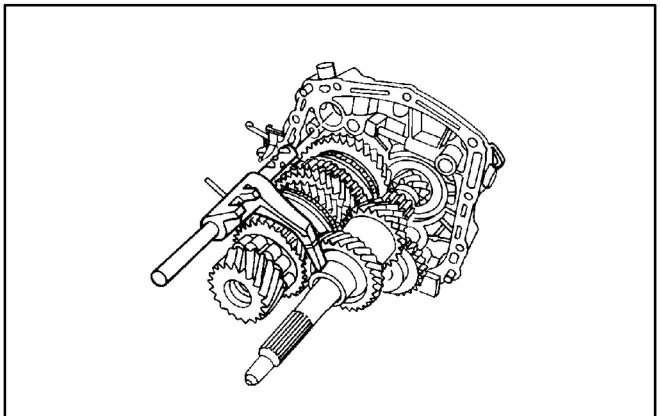
34. Remove the support bracket from the bearing plate.


A103B062

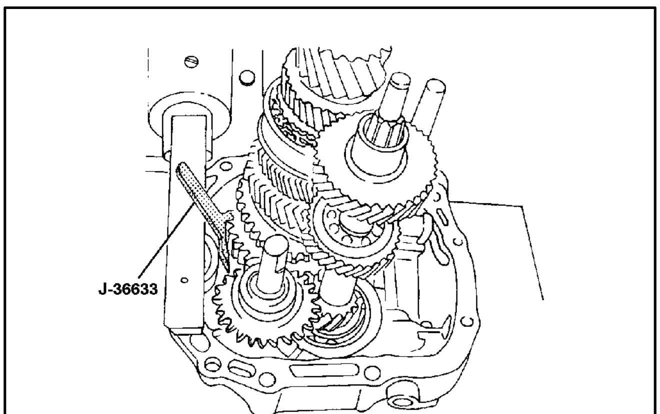
35. Remove the third-fourth gearshift fork holding pin and the third-fourth gearshift rod.


A103B064

36. Remove the fifth gearshift lever from the bearing plate.

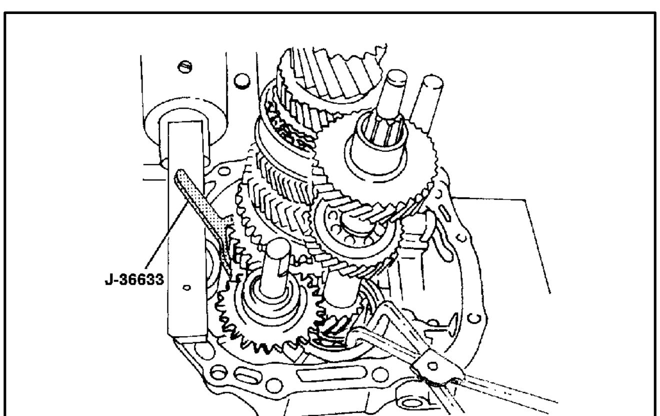

A103B063

37. Remove the first-second gearshift rod.



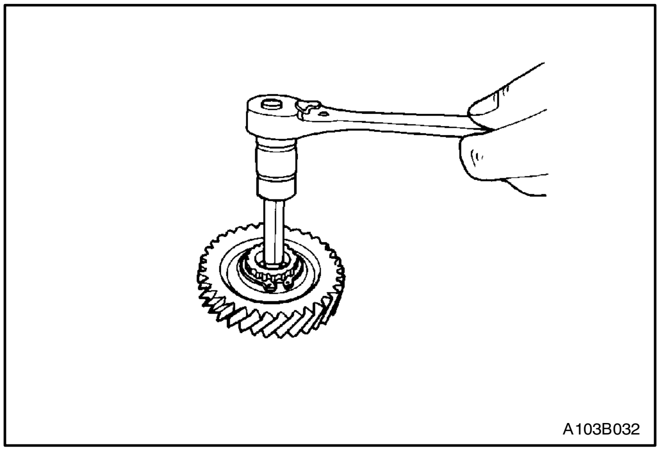
A103B065

38. Compress the snap ring holding the mainshaft and secure it with the snap ring retainer J–36633.



A103B066

39. Hold the snap ring open at the base of the input shaft using the snap ring pliers.
40. Remove the mainshaft assembly and the input shaft assembly from the bearing plate.
41. Assembly should follow the disassembly procedure in the reverse order.



INPUT SHAFT AND CLUSTER GEAR

Tools Required

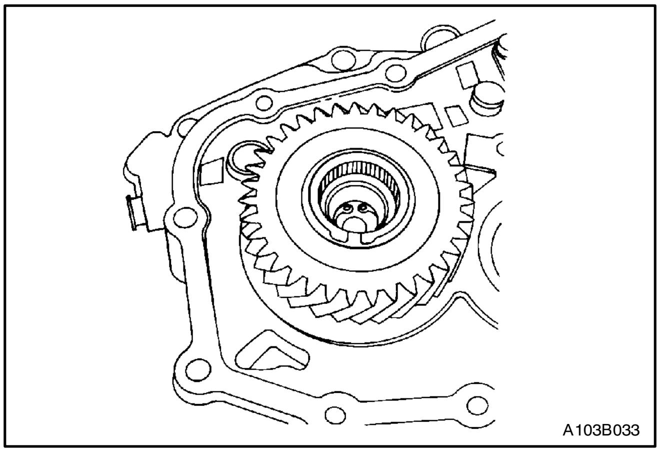
J–22912–01 Universal Bearing Puller

Disassembly and Assembly Procedure

1. Remove the detent screw at the end of the input driveshaft.

Installation Notice

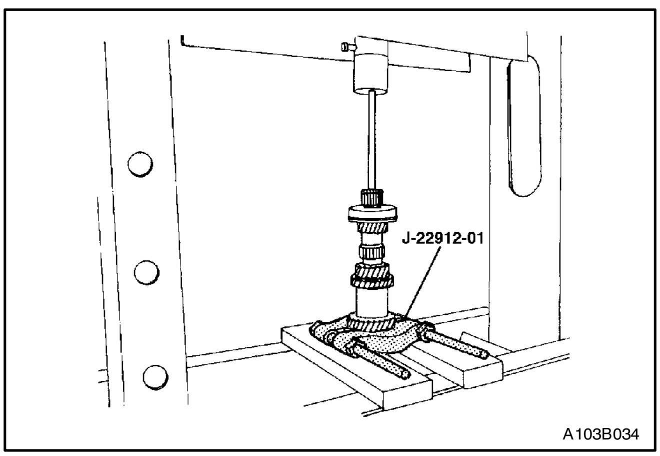
Tightening Torque	15 N·m (11 lb–ft)



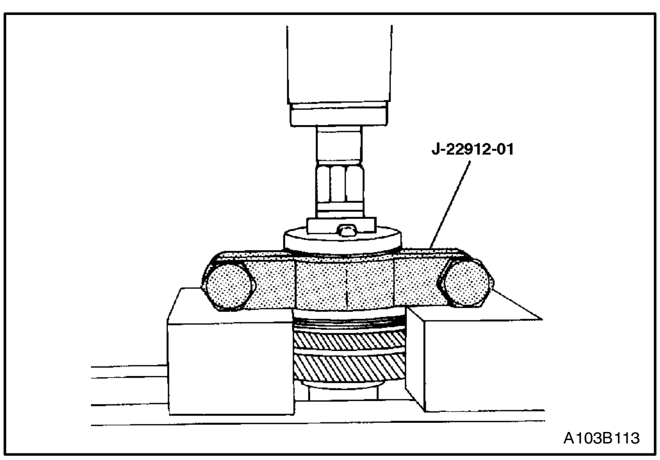
2. Remove the snap ring at the base of the gear cluster.

Installation Notice

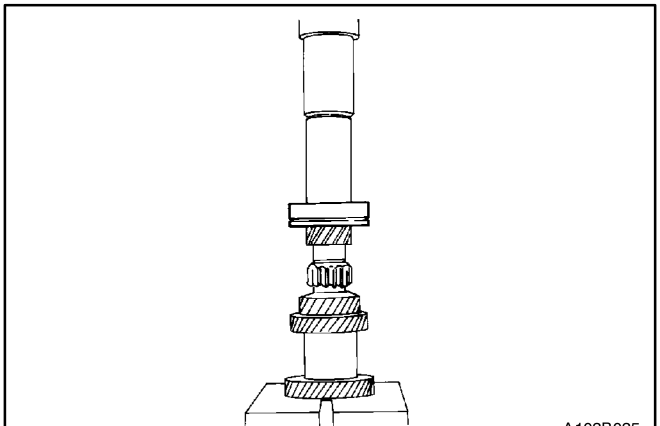
- Install the snap ring at the base of the gear cluster.



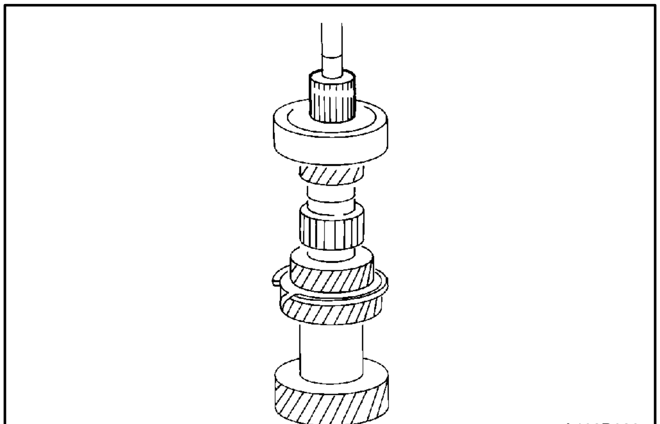
3. Press the input driveshaft from the input shaft cluster gear using the universal bearing puller J–22912–01.



4. Remove the cluster shaft bearing from the input shaft gear cluster using universal bearing puller J–22912–01.


A103B035

5. Press the cluster shaft bearing onto the input shaft gear cluster.


A103B036

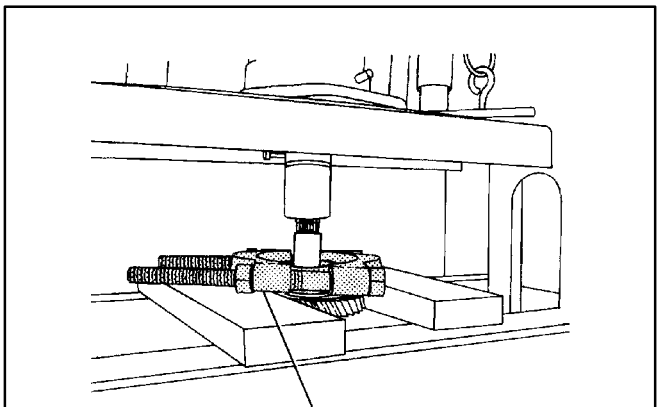
6. Press the input driveshaft into the input shaft gear cluster assembly.

MAINSHAFT

Tools Required

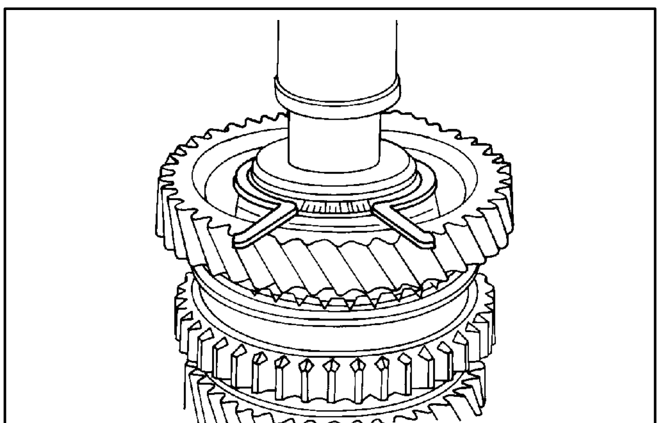
J–22912–01 Universal Bearing Puller

Disassembly and Assembly Procedure

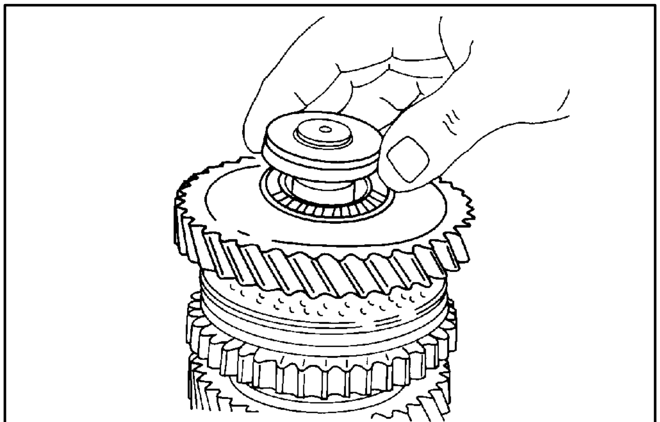


A103B086

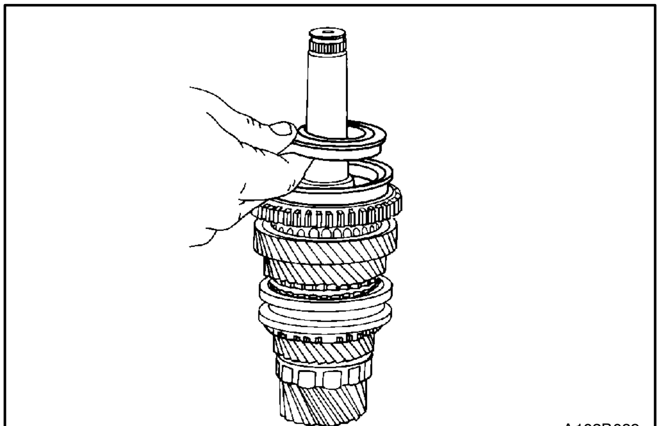
1. Remove the mainshaft bearing using the universal bearing puller J–22912–01.


A103B087

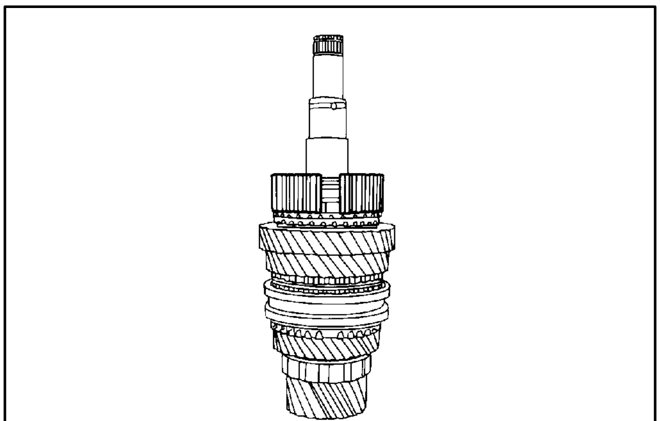
2. Remove the snap ring.


A103B088

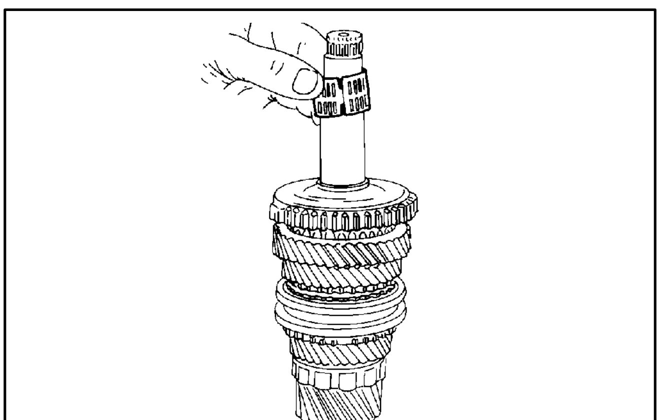
3. Remove the first gear, the thrust needle bearing, and the mainshaft disk.


A103B089

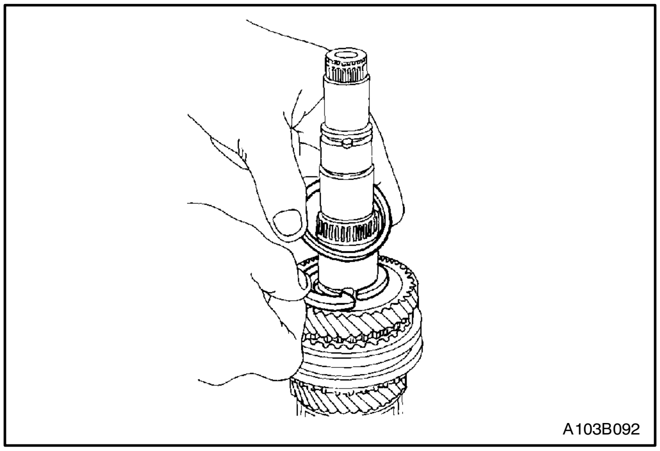
4. Remove the synchronizer hub sleeve that contains the synchronizer spring.
5. Remove the outer blocking ring.


A103B090

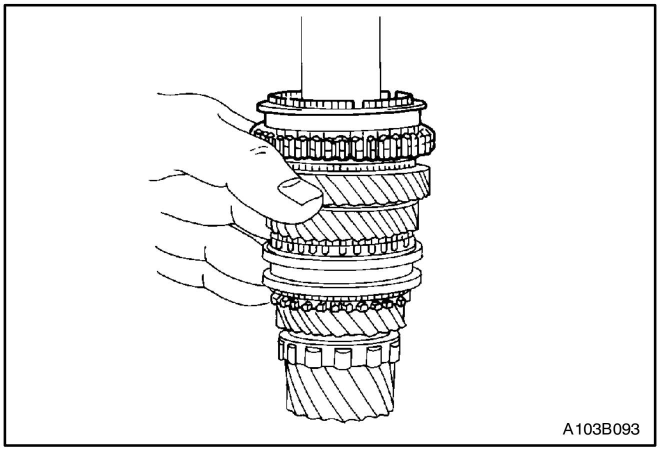
6. Remove the keys from the first-second synchronizer gear.


A103B091

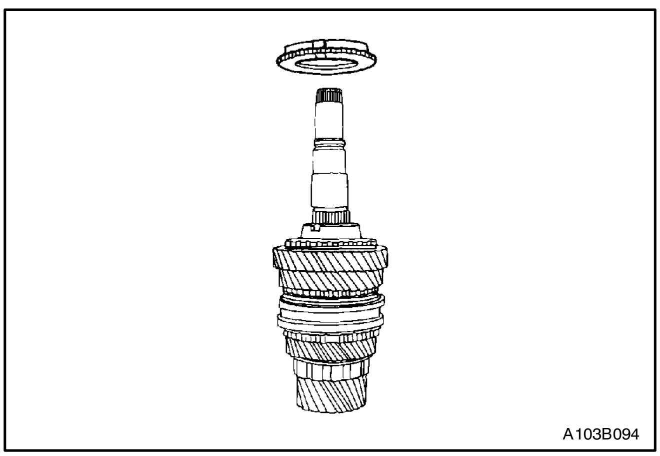
7. Remove the barrel-type first-gear needle bearing.



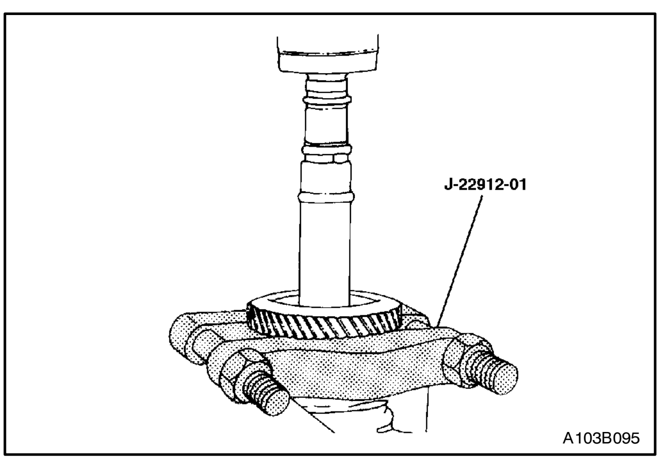
8. Remove the retaining ring and the thruster washer.



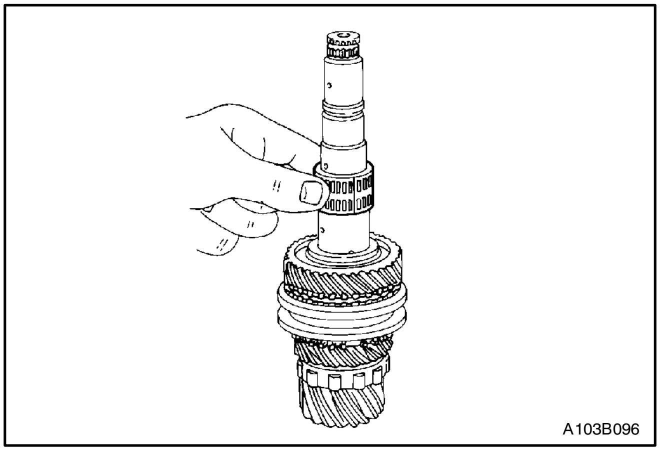
9. Remove the first-second synchronizer hurb from the mainshaft.



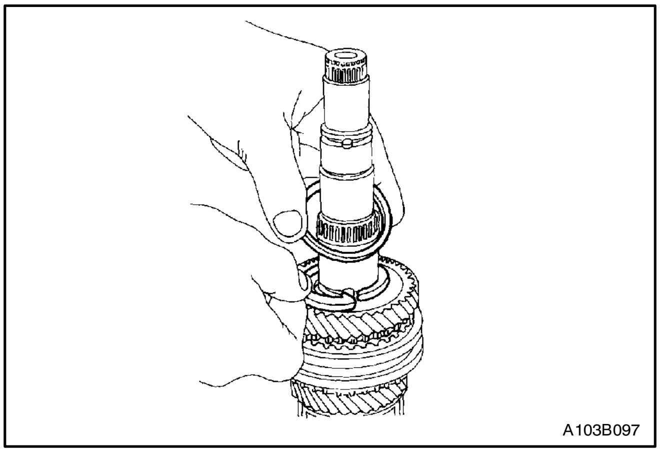
10. Remove the first-second gear syncronizer ring.



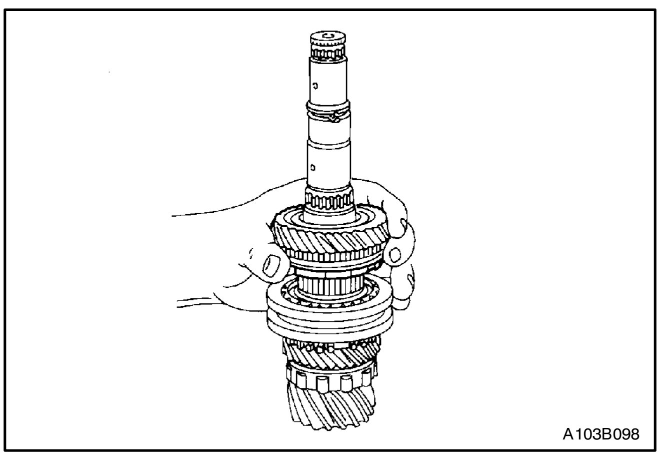
11. Remove the second gear using the universal bearing puller J–22912–01.



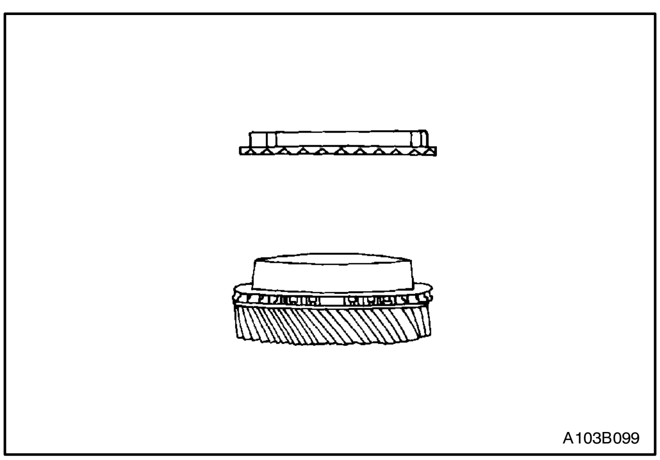
12. Remove the second-gear needle bearing.



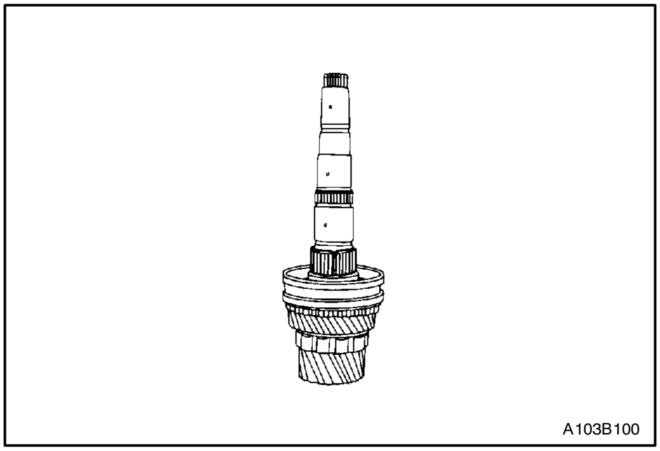
13. Remove the retaining ring and the thrust washer.



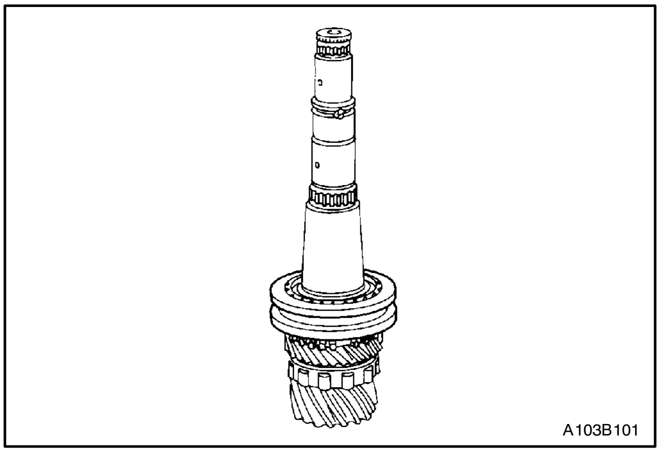
14. Remove the third gear and the synchronizer blocking ring.



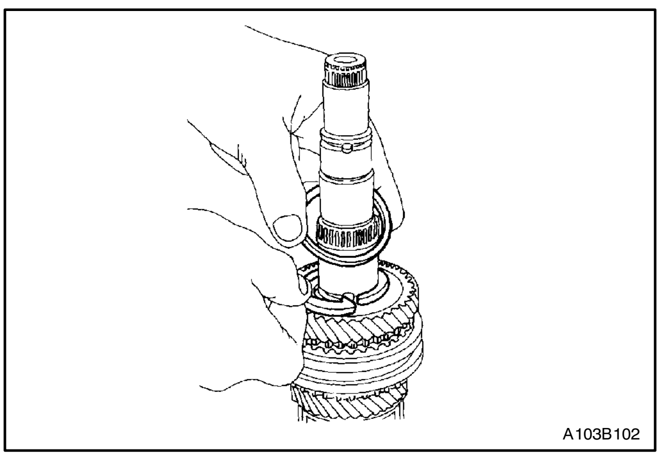
15. Separate the synchronizer blocking ring from the third gear.



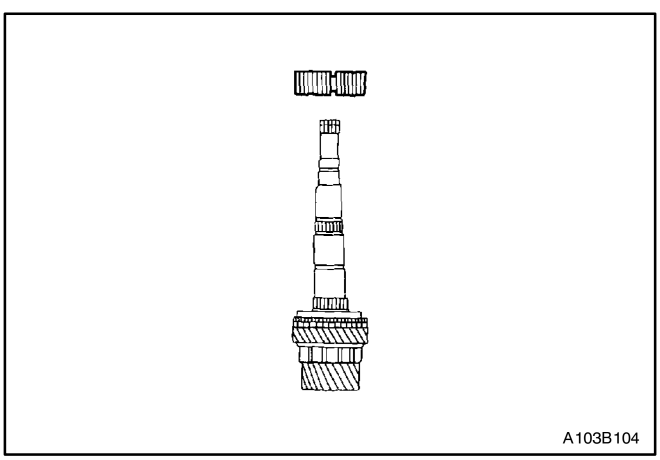
16. Remove the third-gear needle bearing from the mainshaft.



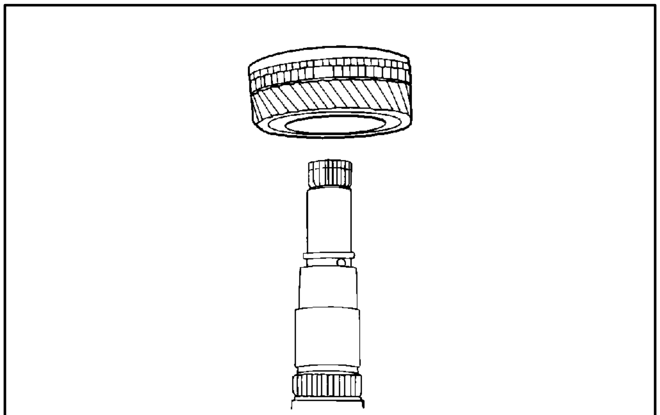
17. Remove the synchronizer sleeve containing the keys and the spring.



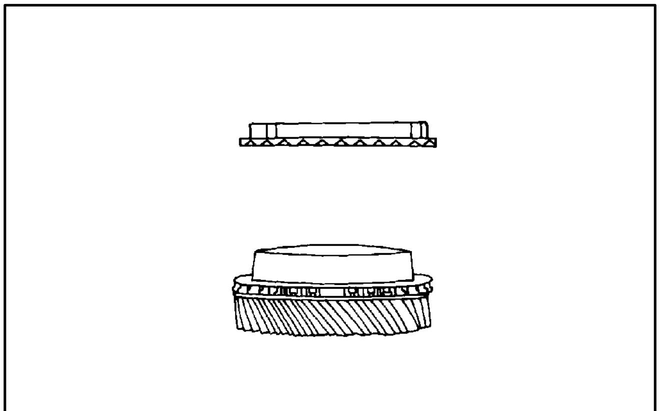
18. Remove the retaining ring and the thruster washer from the mainshaft.



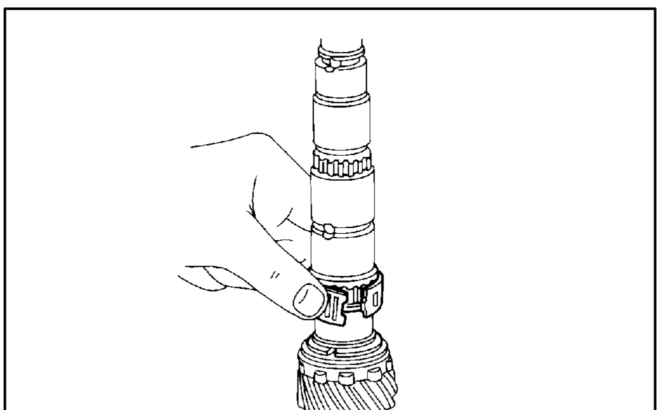
19. Remove the third-fourth synchronizer hub containing the synchronizer spring.


A103B103

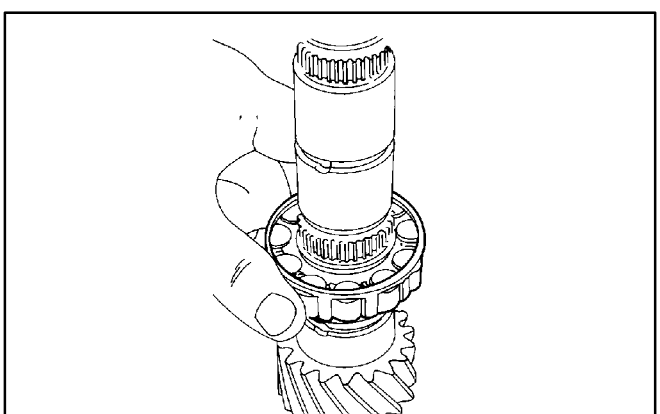
20. Remove the fourth-gear assembly.


A103B105

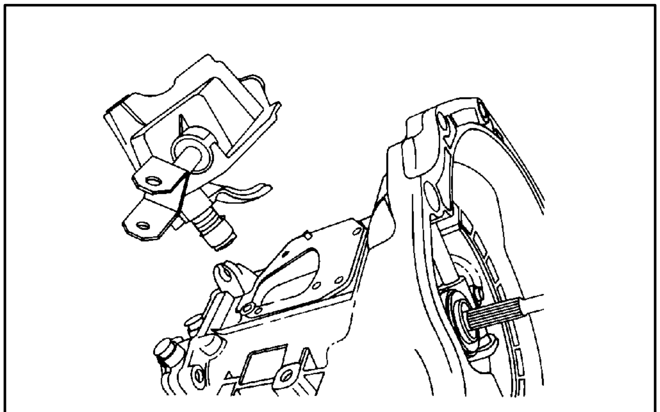
21. Separate the synchronizer blocking ring from the fourth gear.


A103B106

22. Remove the fourth-gear needle bearing, the retaining ring, and the thrust washer.


A103B107

23. Remove the mainshaft bearing.
24. Installation should follow the removal procedure in the reverse order.



A103B038

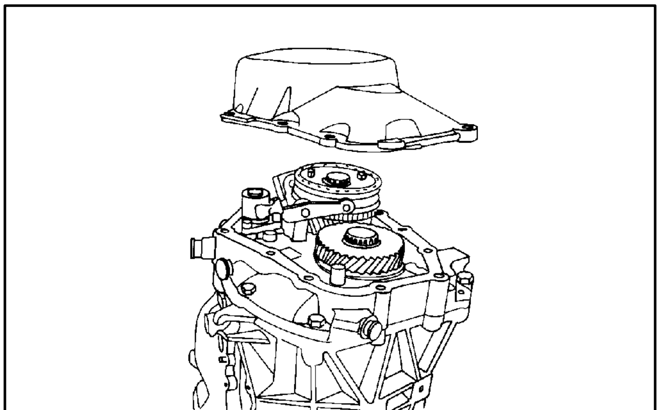
HOUSING CASE

Disassembly and Assembly Procedure

1. Remove the transaxle from the vehicle. Refer to *"Transaxle Assembly"* in this section.
2. Remove the shift lever cover bolts and the shift lever cover. Do not disassemble the shift lever cover.

Installation Notice

Tightening Torque	22 N·m (16 lb–ft)

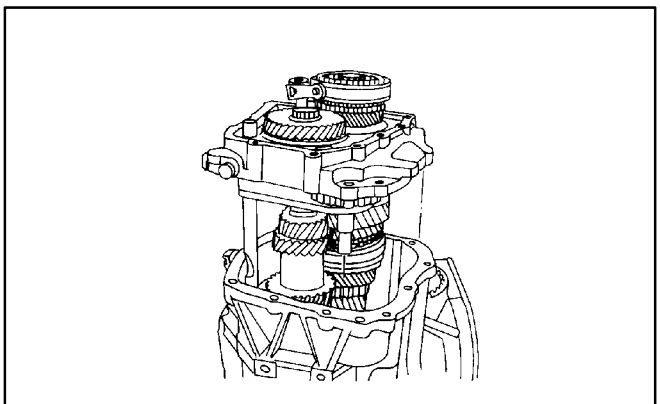


A103B043

3. Remove the transaxle cover bolts and the transaxle cover.

Installation Notice

Tightening Torque	18 N·m (13 lb–ft)

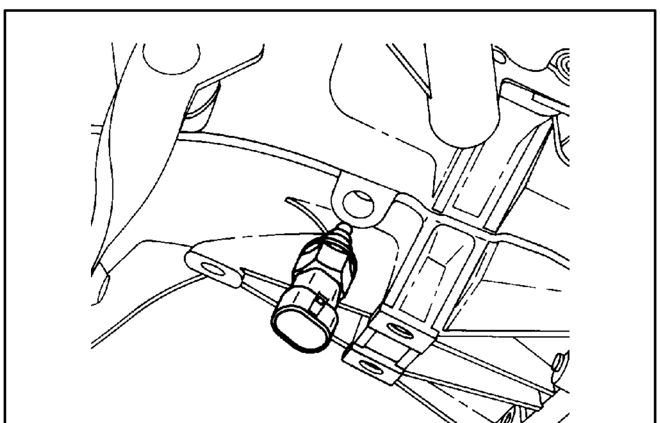


A103B045

4. Remove the bearing plate bolts and the bearing plate, with the shafts attached. Do not disassemble the shafts.

Installation Notice

Tightening Torque	22 N·m (16 lb–ft)

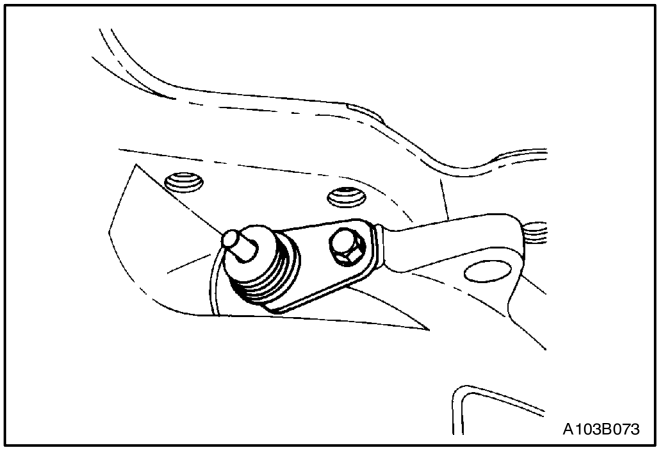


A103B114

5. Remove the differential from the transaxle housing. Do not disassemble the differential. Refer to *"Differential"* in this section.
6. Remove the backup lamp switch from the transaxle housing.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

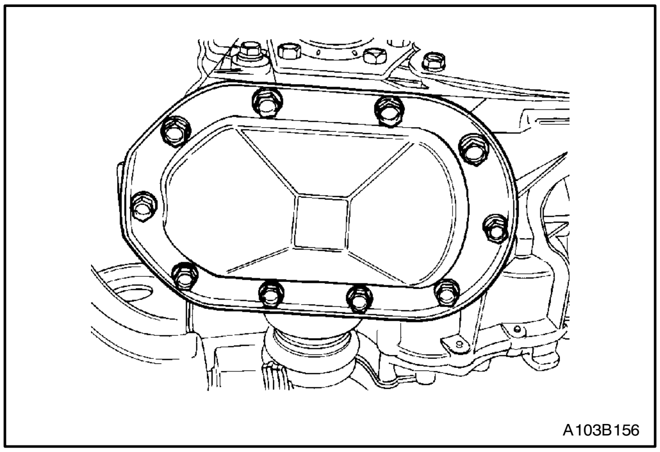


7. Remove the clutch-release bearing and the clutch-release bearing guide. Refer to *Section 5C, Clutch.*
8. Remove the speedometer-driven gear bolt and the speedometer-driven gear from the transaxle housing.

Installation Notice

Tightening Torque	5 N·m (44 lb–in)

9. Assembly should follow the disassembly procedure in the reverse order.



DIFFERENTIAL

Tools Required

KM–520 Remover/Installer

KM–525 Installer

J–22888–20–A Bearing Puller with J–22888–35 Puller Legs

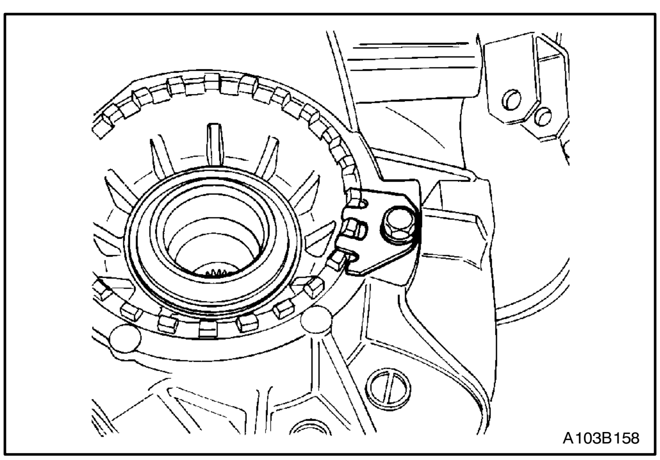
KM–522 Installer

Disassembly and Assembly Procedure

1. Remove the differential cover bolts, the differential cover, and the differential cover gasket.

Installation Notice

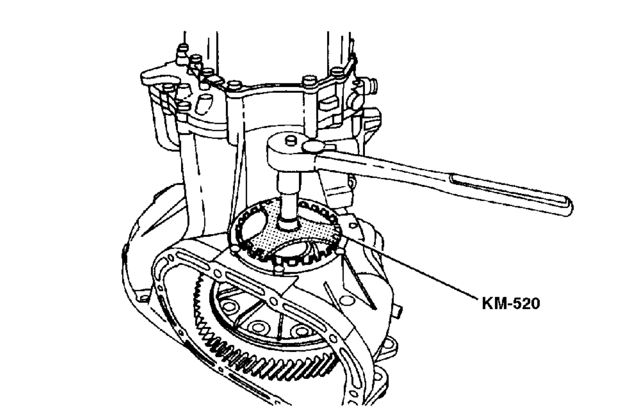
Tightening Torque	40 N·m (30 lb–ft)



2. Remove the bearing-adjusting ring retainer plate bolt and the bearing-adjusting ring retainer plate.

Installation Notice

Tightening Torque	5 N·m (44 lb–in)



A103B075

3. Remove the bearing-adjusting ring using the remover/installer KM–520.

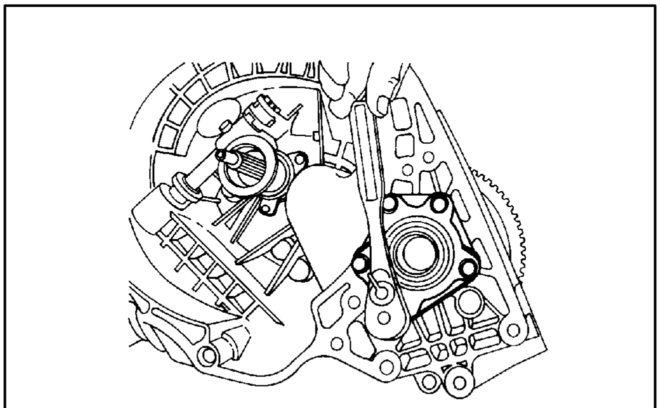
Installation Notice

Tightening Torque	Used Bearing	1 N·m (9 lb–in)
	New Bearing	2 N·m (18 lb–in)

- Tighten or loosen the bearing ring adjuster to get the required preload on the bearings.
- Used Bearings:

  1 N·m (9 lb–in) required to rotate the differential one revolution per second.
- New Bearings:

  2 N·m (18 lb–in) required to rotate the differential one revolution per second.

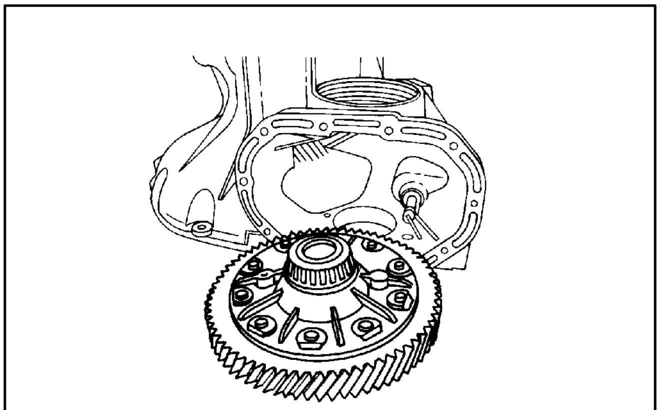


A103B076

4. Remove the right-side bearing-retainer bolts and the right-side bearing retainer.

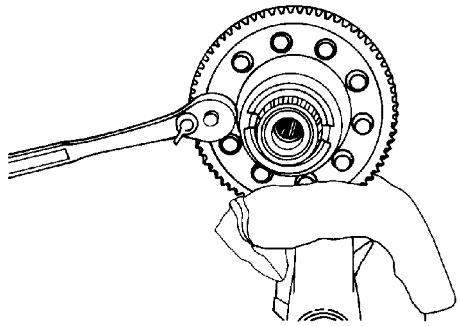
Installation Notice

Tightening Torque	25 N·m (18 lb–ft)



A103B077

5. Remove the differential assembly from the transaxle case.

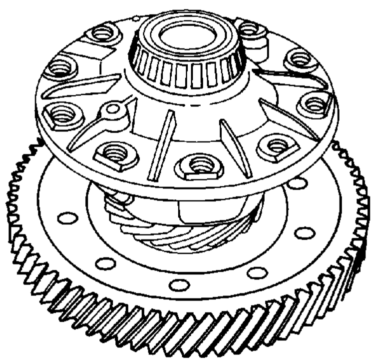


A103B078

6. Remove the ring gear bolts.

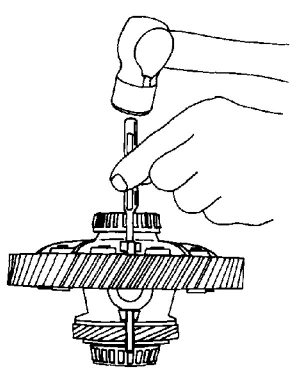
Installation Notice

Tightening Torque	90 N·m (66 lb–ft)



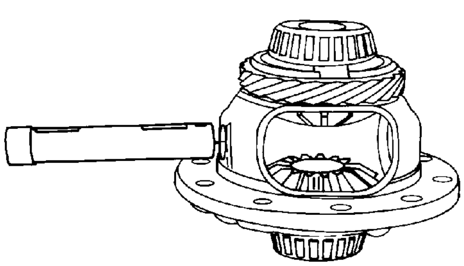
A103B079

7. Separate the ring gear from the differential housing.



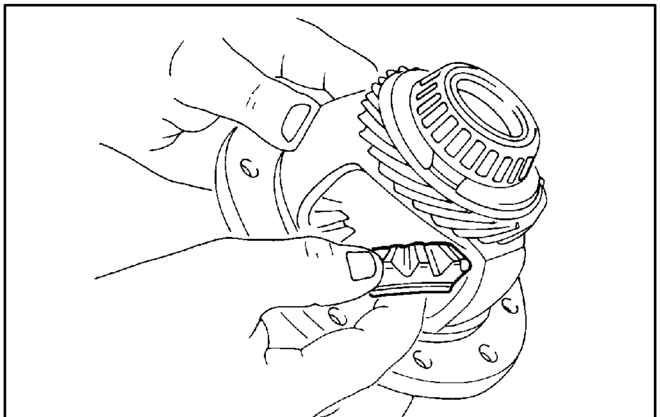
A103B080

8. Drive the pinion gear shaft lock pin from the differential housing and the pinion gear shaft.

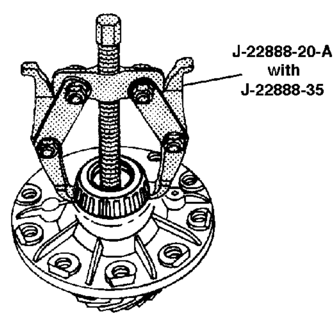


A103B081

9. Remove the pinion gear shaft.

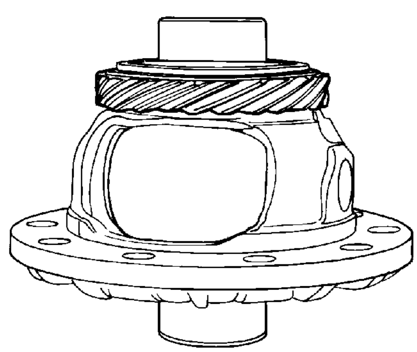

A103B082

10. Remove the pinion gears and the washers.
11. Remove the side gears and the side thrust washers.



A103B083

12. Remove both of the differential bearings using the bearing puller J–22888–20–A with the puller legs J–22888–35.


A103B157

13. Remove the speedometer drive gear from the differential gear housing.
14. Installation should follow the removal procedure in the reverse order.

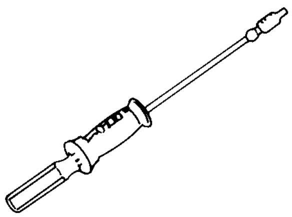
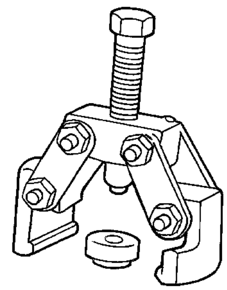
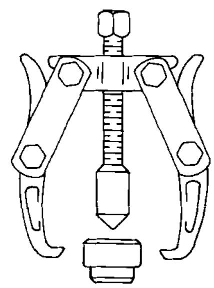
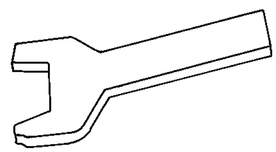
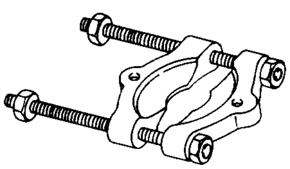
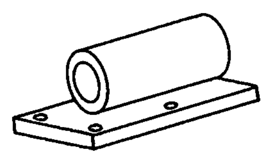
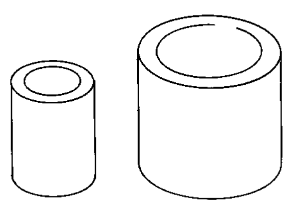
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

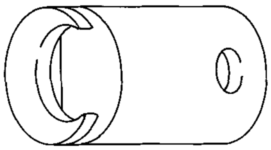
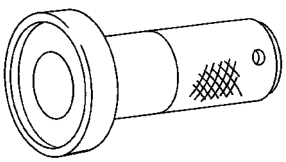
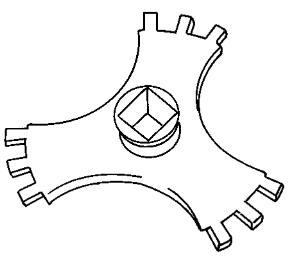
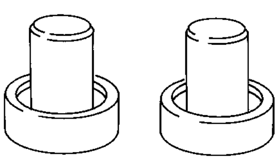
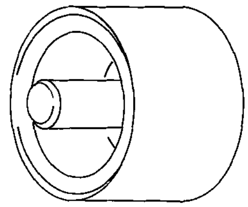
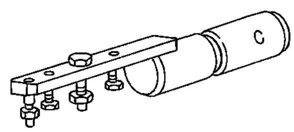
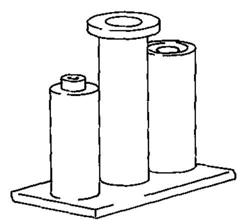
Application	N•m	Lb-Ft	Lb-In
Backup Lamp Switch	20	15	–
Bearing Plate Bolts	22	16	–
Bearing Retainer Bolts, Right Side	25	18	–
Bearing-Adjusting Ring-Retainer Plate Bolt	5	–	44
Center Rear Transaxle Support Bracket Bolts	90	66	–
Clutch-Release Cylinder Bracket Bolts	75	55	–
Differential Cover Bolts	40	30	–
Fifth-Gear Fork Bolts	22	16	–
Fifth-Gearshift Connector Bolts	7	–	62
Gearshift Housing Bolts	6	–	53
Gearshift Lever Cover Bolts	22	16	–
Input Driveshaft Detent Screw	15	11	–
Left Front Transaxle Support Bracket Bolts	60	44	–
Left Rear Transaxle Support Bracket Bolts	60	44	–
Lower Transaxle-to-Engine Bolts	75	55	–
Ring-Gear Bolts	70	52	–
Rod Clamp Bolt	14	–	124
Speedometer Housing Retaining Bolt	4	–	35
Speedometer-Driven Gear Bolt	5	–	44
Support Bracket Bolt	7	–	62
Transaxle Cover Bolts	18	13	–
Upper Transaxle-to-Engine Bolts	75	55	–

SPECIAL TOOLS

SPECIAL TOOLS TABLE

 A103B110	J-6125-B Slide Hammer	 A103B163	KM-553-A Fifth-Gear Puller
 A103B003	J-22888-20-A Bearing Puller with J-22888-35 Puller Legs	 A103B028	J-36633 Snap Ring Retainer
 A103B112	J-22912-01 Universal Bearing Puller	 A103B002	KM-113-2 Base
UAA5A3Z0	DW 110–060 Engine Support Fixture	 A103B025	KM-334 Installer Sleeve

SPECIAL TOOLS TABLE (Cont'd)

 A103B013	J-42469 Shift Rod Remover
 A103B007	KM-519 Ring Installer
 A103B008	KM-520 Remover/Installer
 A103B009	KM-522 Installer
 A103B017	KM-525 Installer
 A103B019	KM-552 Fixture
 A103B021	KM-554 Installer

SECTION 5C

CLUTCH

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION

Driving Members

The driving members consist of two flat surfaces machined to a smooth finish. One of these is the rear face of the engine flywheel, and the other is the pressure plate. The pressure plate is fitted into a steel cover, which is bolted to the flywheel.

Driven Members

The driven member is the clutch disc with a splined hub which is free to slide lengthwise along the splines of the input shaft, but which drives the input shaft through these same splines.

The driving and driven members are held in contact by spring pressure. This pressure is exerted by a diaphragm spring in the pressure plate assembly.

Operating Members

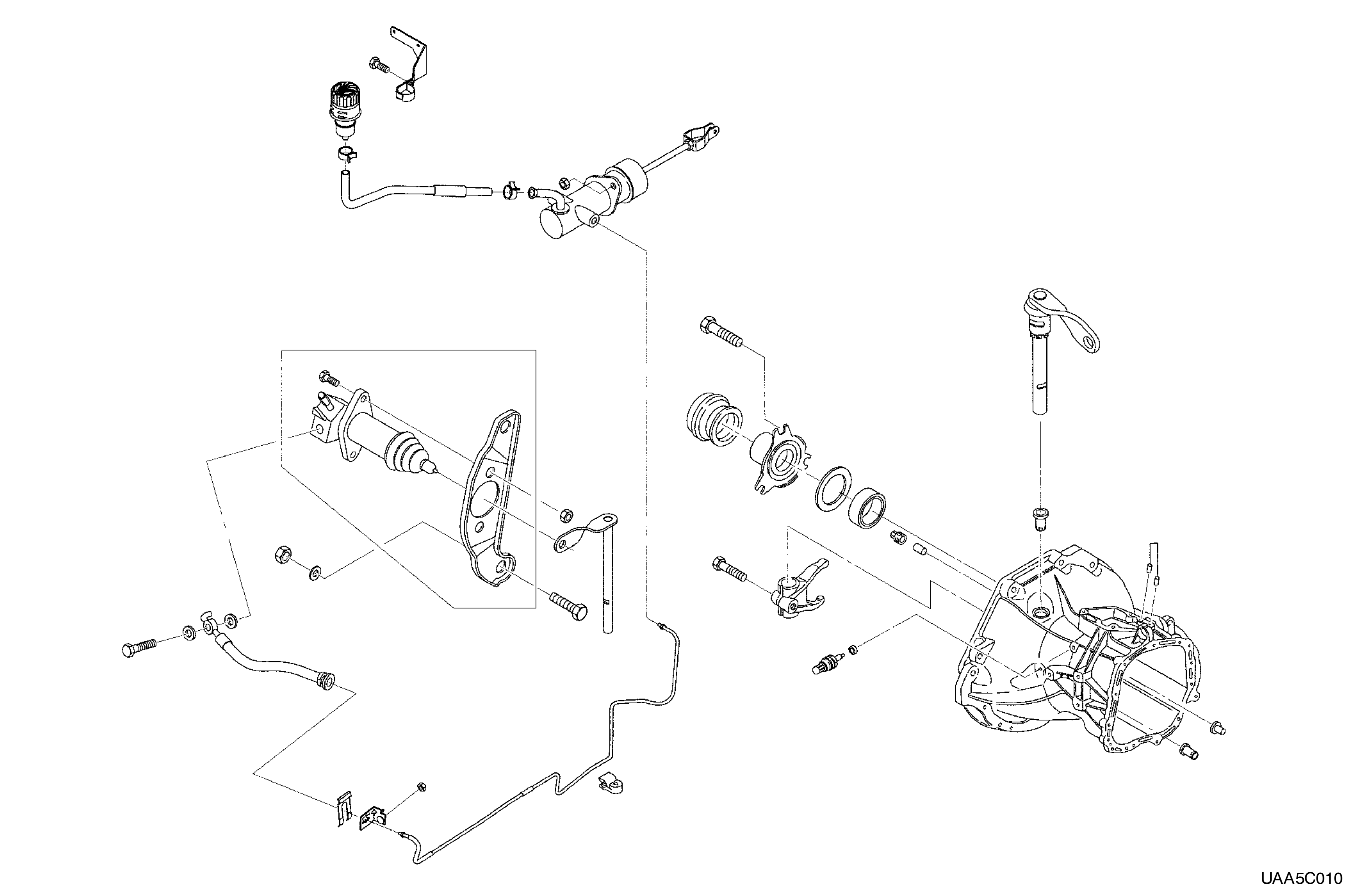
The clutch release system consists of the clutch pedal, the clutch shaft, the fork, and the release bearing.

When pressure is applied to the clutch pedal, the fork pivots on its shaft and the inner end pushes against the release bearing. The bearing then pushes against the release levers in the pressure plate assembly, thereby releasing the clutch.

COMPONENT LOCATOR

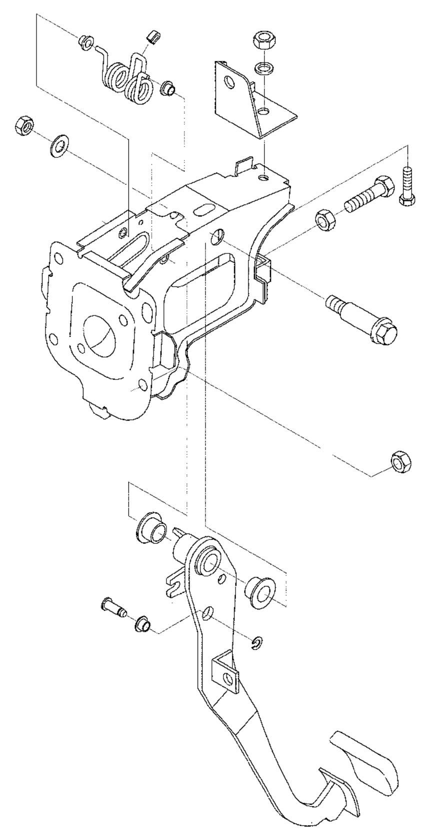
HYDRAULIC CLUTCH COMPONENTS

Clutch Release Cylinder/Lever
(Left–Hand Drive Shown, Right–Hand Drive Similar)



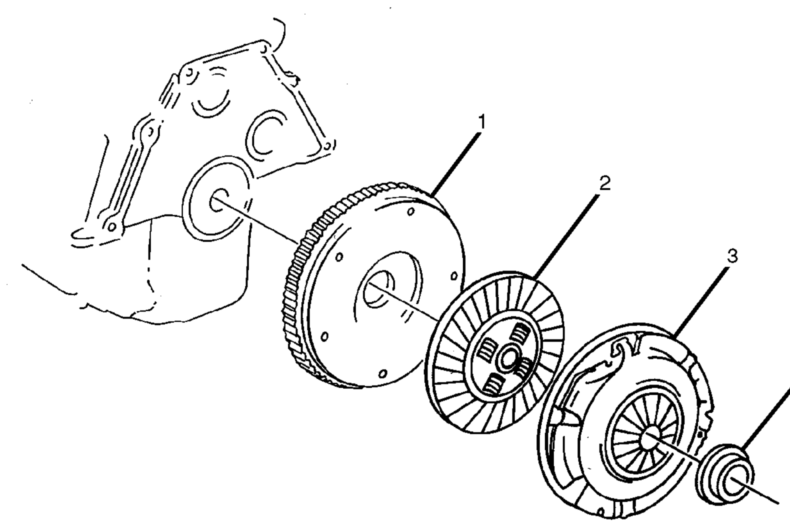
1. Master Cylinder
2. Clutch Reservoir
3. Reservoir Hose
4. Spring Clamp
5. Release Cylinder Assembly
6. Release Cylinder
7. Release Cylinder Bracket
8. Release Hose
9. Hydraulic Clutch Pipe
10. Clamp
11. Release Lever
12. Bushing
13. Pin
14. main shaft Oil Seal
15. Bolt
16. Release Bearing
17. Bearing Guide Sleeve
18. O–Ring
19. Input Shaft Seal
20. Screw Plug
21. Magnet
22. Release pork
23. Back up lamp switch
24. washer

Clutch Pedal



1. Clutch Pedal Brace
2. Nut
3. Washer Spring
4. Turn Over Spring
5. Spring Bushing
6. Bushing
7. Pedal Brace Bracket
8. Bolt
9. Clutch Pedal Shaft
10. Clutch Pedal
11. Pedal Plate Cover
12. Pin
13. Bushing
14. Bushing

Clutch Disc



1 Flywheel
2 Clutch Disc
3 Pressure Plate
4 Release Bearing

DIAGNOSTIC INFORMATION AND PROCEDURES

CLUTCH OPERATION

Fails to Release

Checks	Action
DEFINITION: When the pedal is pressed to the floor, the shift lever does not move freely in and out of reverse gear.	
Check for a loose linkage.	Repair or replace loose linkage, if necessary.
Check for a damaged clutch disc.	Replace the damaged clutch disc.
Check for an improperly installed fork shaft.	Remove and properly reinstall the fork shaft. Very lightly lubricate the fork fingers at the release bearing with wheel bearing grease.
Check for the clutch disc hub binding on the input shaft splines.	Repair or replace the clutch disc hub.
Check for a warped or bent clutch disc.	Replace the warped or bent clutch disc.

Slipping

Checks	Action
Check for the driver improperly operating the vehicle.	Correct the driver's operation of the vehicle as necessary.
Check for an oil–soaked clutch disc.	Correct the leak at its source and install a new clutch disc.
Check for worn facing or facing torn from the disc.	Replace the worn disc with a new disc.
Check for warped pressure plate or a warped flywheel.	Replace the pressure plate.
Check for a driven plate that is not seated.	Start the engine 30 to 40 times. Do not overheat the engine.
Check for a driven plate that is overheated.	Allow the driven plate to cool.

Grabbing (Chattering)

Checks	Action
Check for burned or glazed facing caused by oil on the facing.	Correct the leak at its source and install a new clutch disc.
Check for worn splines on the input shaft.v	Replace the worn input shaft.
Check for a warped pressure plate or a warped flywheel.	Replace the warped pressure plate or the warped flywheel.
Check for burned or smeared resin on the flywheel or the pressure plate.	Sand off the burned or smeared resin if it is superficial. Replace any or heat–checked parts.

Rattling (Transaxle Click)

Checks	Action
Check for weak retracting springs.	Replace the pressure plate.
Check for a loose release fork.	Remove and reinstall the release fork properly.
Check for oil in the driven plate damper.	Correct the cause of the oil leak and replace the driven disc.
Check for a damaged driven plate damper spring.	Replace the driven disc.

Release Bearing Noise with Clutch Fully Engaged

Checks	Action
Check for the driver improperly operating the vehicle.	Correct the driver's operation of the vehicle as necessary.
Check for a binding release bearing.	Clean and re-lubricate the release bearing. Inspect the release bearing for burrs and nicks.
Check for an improperly installed release lever.	Remove and reinstall the release lever properly.
Check for a weak linkage return spring.	Replace the weak linkage return spring.

Noise

Checks	Action
Check for a worn release bearing.	Replace the worn release bearing.
Check for an improperly installed release lever.	Remove and properly reinstall the fork shaft. Very lightly lubricate the fork fingers at the release bearing with wheel bearing grease.

Pedal Stays on Floor When Disengaged

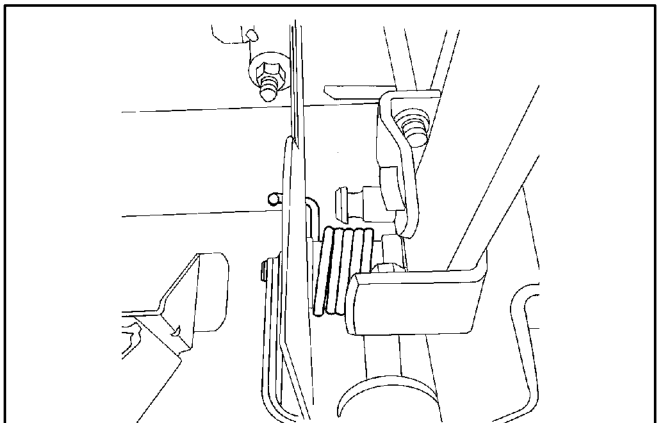
Checks	Action
Check for binding in the linkage or the release bearing.	Lubricate and freeup the binding linkage or the release bearing.
Check for weak pressure plate springs.	Replace the pressure plate.

Hard Pedal Effort

Checks	Action
Check for binding in the linkage.	Lubricate and free-up the binding linkage.
Check for a worn driven plate.	Replace the worn driven plate.

REPAIR INSTRUCTIONS

ON VEHICLE SERVICE

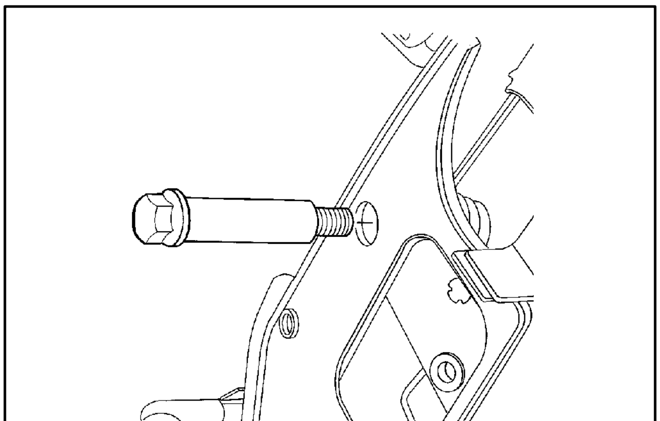

A103C049

CLUTCH PEDAL

(Left–hand Drive Shown, Right–hand Drive Similar)

Removal and Installation Procedure

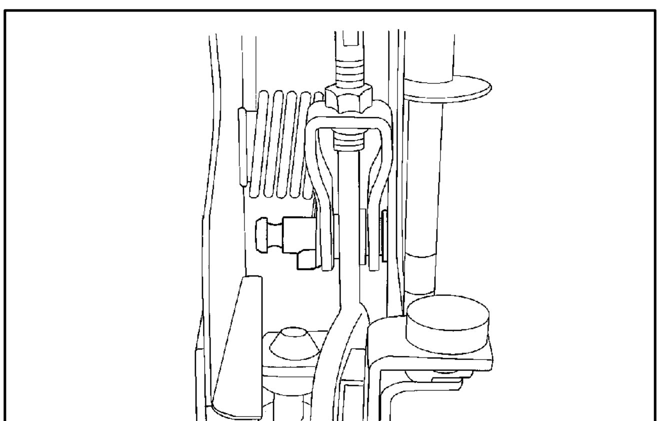
1. Disconnect the negative battery cable.
2. Disconnect the return spring from the mount brace.


A103C036

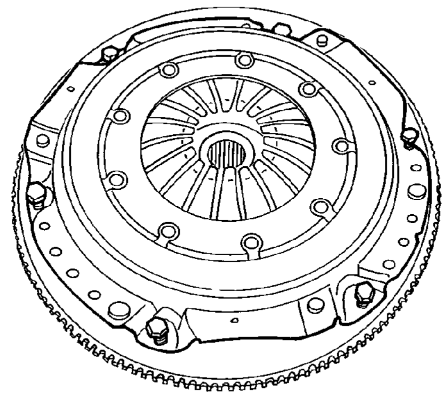
3. Remove the nut, the washer, and the pedal mounting shaft.

Installation Notice

Tightening Torque	18N·m(13lb–ft)


A103C067

4. Remove the locking washer and the piston rod bolt.
5. Remove the clutch pedal with the return spring from the vehicle.



A103C025

CLUTCH DISC AND RELATED COMPONENTS

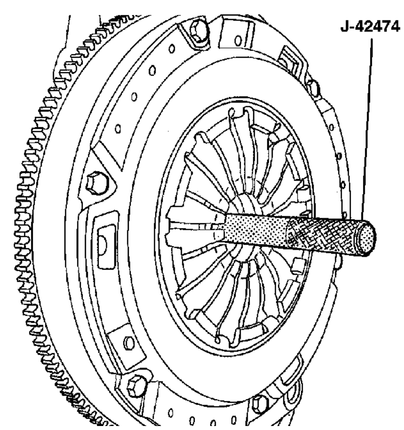
Tools Required

J–36547 Input shaft seal installer

J–42474 Clutch Arbor

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Remove the left front wheel. Refer to *Section 2E, Tires and • heels*.
4. Remove the engine under covers. Refer to *Section 9N, Frame and Under°ody*.
5. Remove the transaxle from the vehicle. Refer to *Section 5B. "Five–Speed Manual Transaxle".*
6. Remove the pressure plate bolts and the pressure plate. Support the pressure plate when you remove the last bolt.



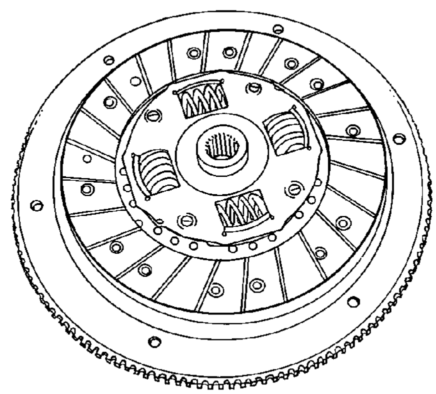
A103C044

Adjustment Notice :

- Coat the spline on the clutch disc with multi-purpose grease.
- Align the pressure plate and the clutch disc onto the flywheel using the clutch arbor J–42474.

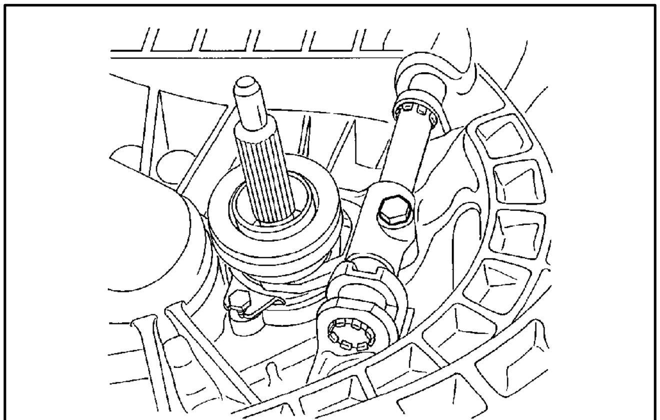
Installation Notice

Tightening Torque	15N·m(11lb–ft)



A103C026

7. Remove the clutch disc.

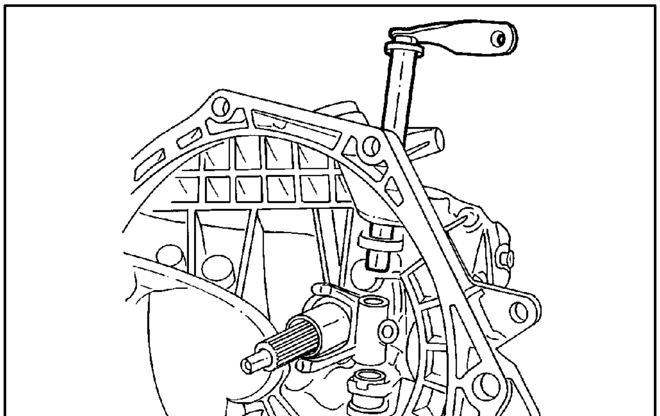


A103C027

8. Remove the release fork bolt.

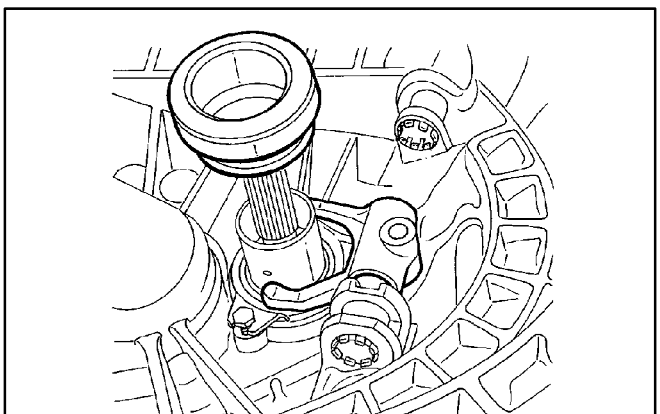
Installation Notice

Tightening Torque	35N·m(26lb–ft)



A103C028

9. Pull the clutch release shaft upward, out of the transaxle.

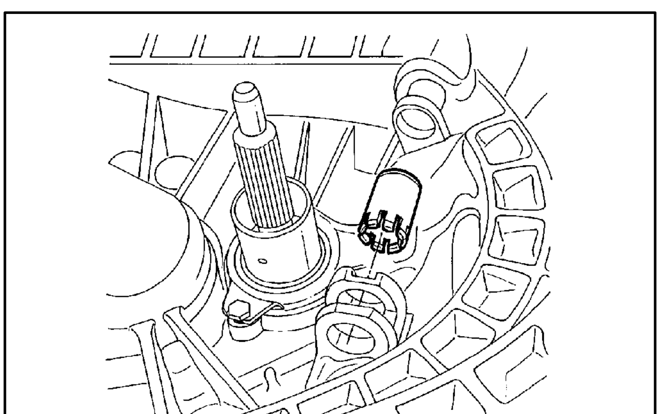


A103C029

10. Remove the fork and the release bearing from the release bearing guide sleeve.

Installation Notice

- Coat the release bearing bore with multi-purpose grease.

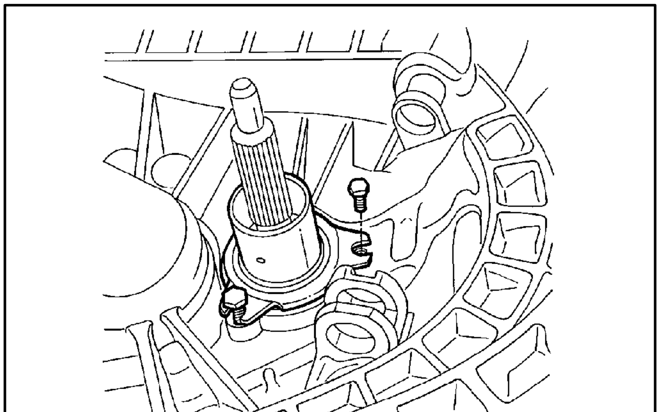


A103C033

11. Remove the release lever shaft bushings.

Installation Notice

- Coat the bushing bores with multi-purpose grease.



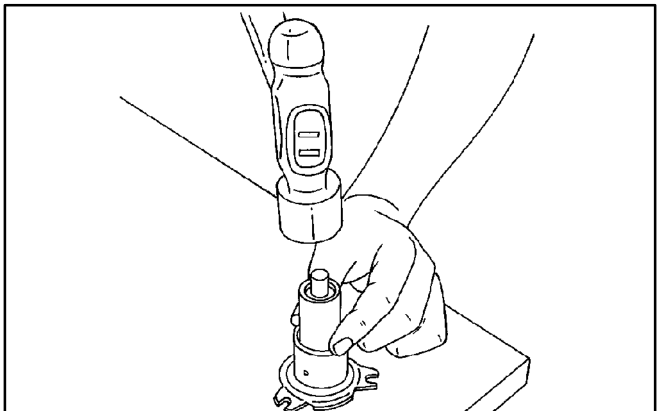
A103C030

12. Remove the release bearing guide sleeve bolts and the release bearing guide sleeve.

Installation Notice

Tightening Torque	5N·m(45lb–in)

- Coat the sleeve surface with multi–purpose grease.

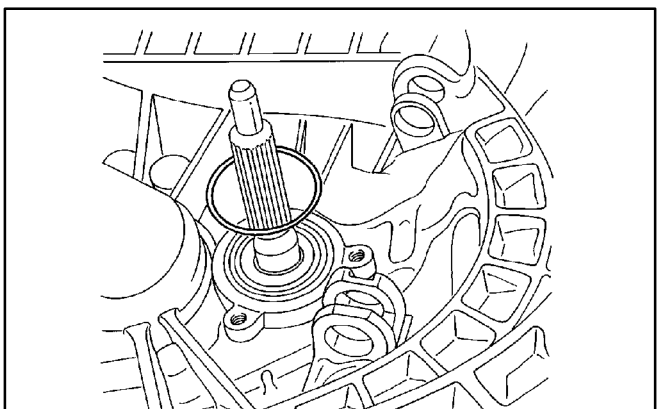


A103C031

13. Remove the input shaft seal from the release bearing guide sleeve.

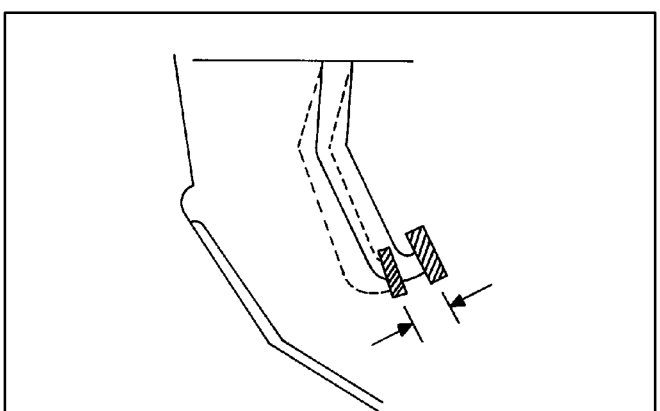
Installation Notice

- Install the input shaft seal into the release bearing guide sleeve. Use input shaft seal installer J–36547 with a hammer.



A103032

14. Remove the O-ring from the groove in the transaxle case.
15. Installation should follow the removal procedure in the reverse order.



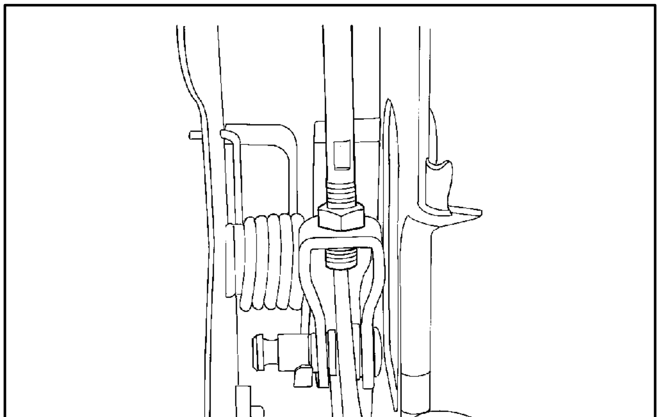
A103C010

CLUTCH PEDAL ADJUSTMENT (HYDRAULIC)

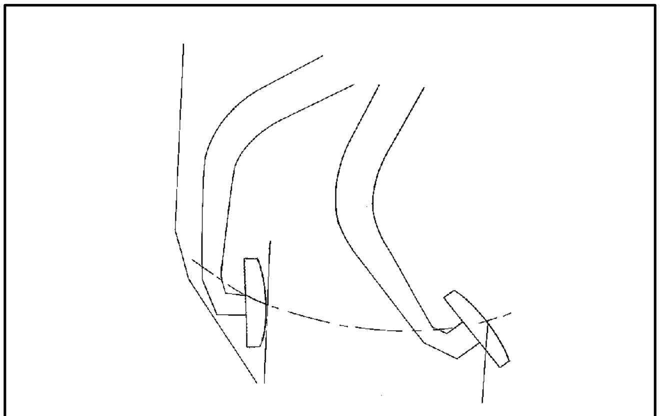
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Adjustment Procedure

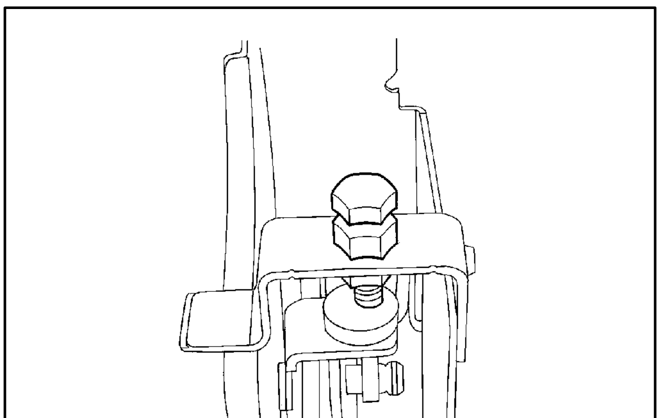
1. Determine the clutch pedal play. Depress the clutch pedal lightly with your hand and measure the distance when you feel resistance.


A103C051

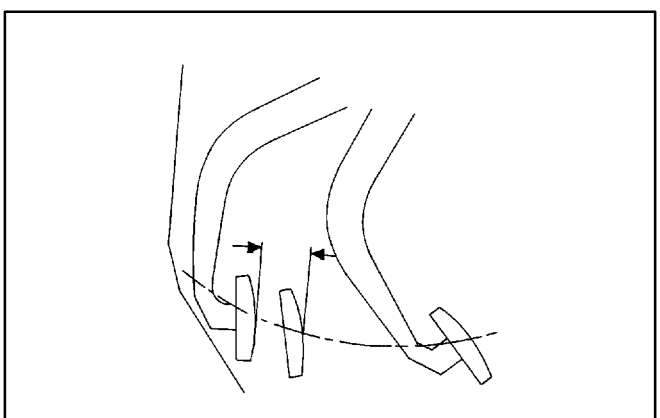
2. Adjust the clutch pedal play. Loosen the lock nut and turn the pushlod. Clutch pedal play should measure 6 to12 mm (0.2 to 0.5 inch). Tighten the locknut after adjustment.


A103C038

3. Measure the clutch pedal travel. Press the clutch pedal all the way to the floor. Measure from the starting position to the ending position.


A103C039

4. Adjust the clutch pedal travel. Loosen the locknut and turn the bolt. Clutch pedal travel should measure more than 130 mm (5.1 inches). Tighten the locknut after adjustment.

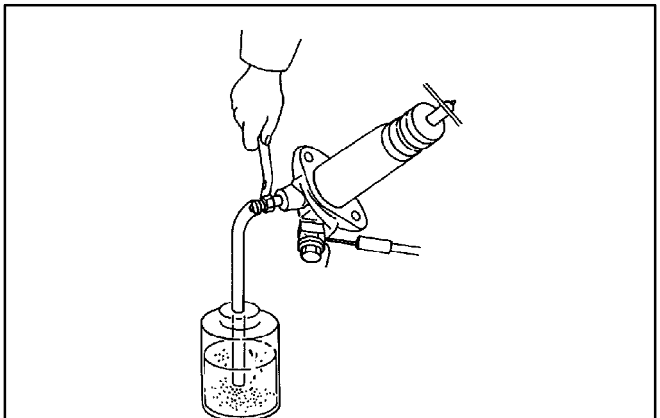

A103C001

CLUTCH RELEASE POINT ADJUSTMENT (HYDRAULIC)

Adjustment Procedure

1. Apply the parking brake.
2. Run the engine at idle speed.
3. While you move the shift lever into the reverse position, depress the clutch pedal slowly and measure the distance between the point when gear noise is not heard and the point the clutch pedal is completely depressed. The distance should be more than 30 mm (1.2 inches).

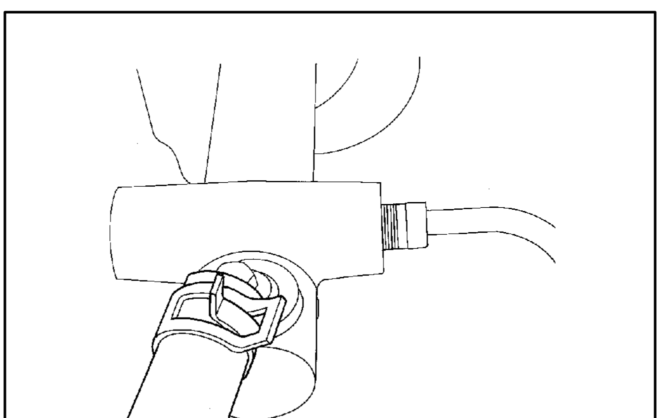
4. If the distance is not more than 30 mm (1.2 inches), check the following:
   - Clutch pedal height
   - Clutch pedal play
   - Air in the system
   - Clutch cover and disk


A103C013

AIR BLEEDING

Notice: Bleed the hydraulic system to remove the air which entered when the pipes were disconnected for repairs. The clutch/brake fluid in the clutch/brake reservoir must be maintained at the MIN level or higher during air bleeding. Right-hand drive vehicles use a separate clutch fluid reservoir.

1. Attach a vinyl hose to the bleeder plug. Place the other end of the vinyl tube in a glass container half–filled with brake fluid.
2. Slowly pump the clutch pedal several times.
3. While you press the clutch pedal, loosen the bleeder screw until the fluid starts to run out. Close the bleeder screw.
4. Repeat Step 3 until there are no air bubbles in the fluid.
5. Fill the reservoir with clutch fluid up to the MAX level.


A103C046

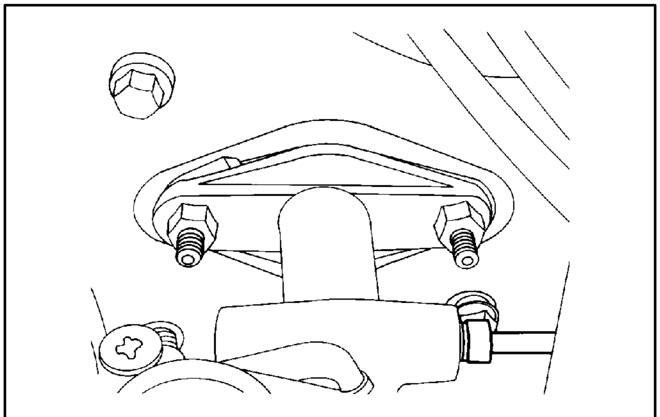
CLUTCH MASTER CYLINDER ASSEMBLY

(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal and Installation Procedure

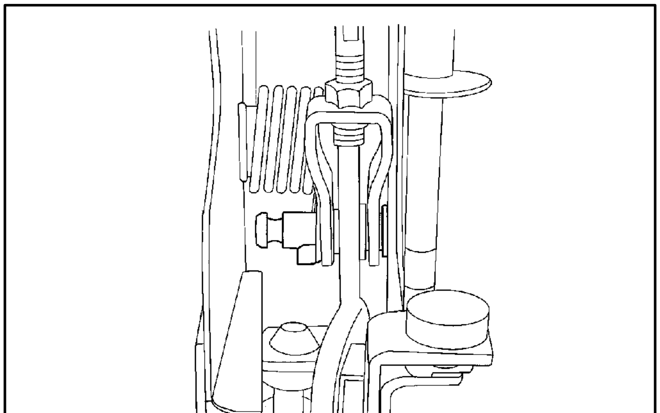
Notice: Before disconnecting the reservoir tank hose, remove the clutch/brake fluid from the reservoir tank. Right–hand drive vehicles use a separate clutch fluid reservoir.

1. Disconnect the negative battery cable.
2. Disconnect the spring clamp on the master cylinder. Remove the reservoir hose.



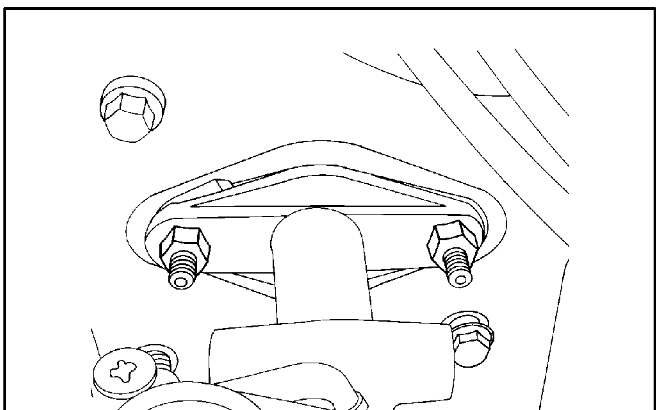
B103C001

3. Disconnect the pipe connected to the master cylinder.



A103C037

4. Remove the locking washer and the piston rod bolt from the clutch pedal and piston rod clevis.
5. Installation should follow the removal procedure in the reverse order.



B103C002

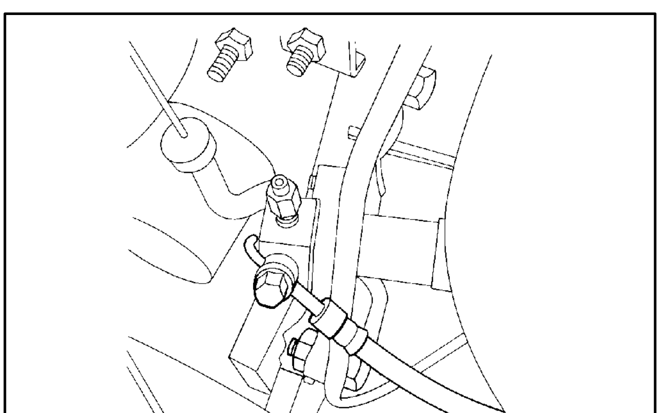
6. Remove the lock nuts on the master cylinder bracket. Remove the master cylinder in the direction of the engine compartment.

Installation Notice

Tightening Torque	22N·m(16lb–ft)

- Bleed the air. Refer to “*Air °leeding*” in this section.
- Adjust the clutch pedal. Refer to “*Clutch Pedal Adjustment*” in this section.

7. Installation should follow the removal procedure in the reverse order.



B103C004

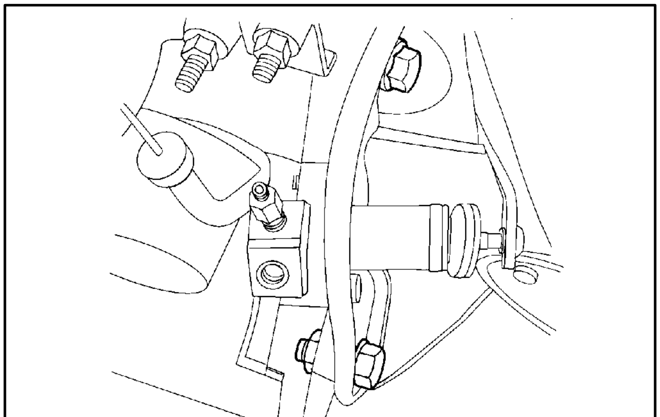
CLUTCH RELEASE CYLINDER ASSEMBLY

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the bolt and disconnect the hose from the clutch release cylinder.

Adjustment Notice:

- Bleed the air. Refer to “*Air °leeding*” in this section.
- Adjust the clutch pedal. Refer to “*Clutch Pedal Adjustment (Hydraulic)*” in this section.
- Fill the reservoir with clutch/brake fluid up to the MAX level.



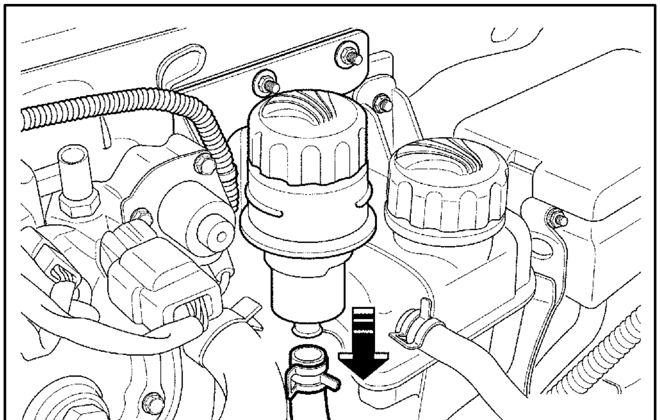
B103C003

3. Remove the clutch release cylinder bolts and remove the release cylinder from the transaxle.

Installation Notice

Tightening Torque	60N·m(44lb–ft)

4. Installation should follow the removal procedure in the reverse order.



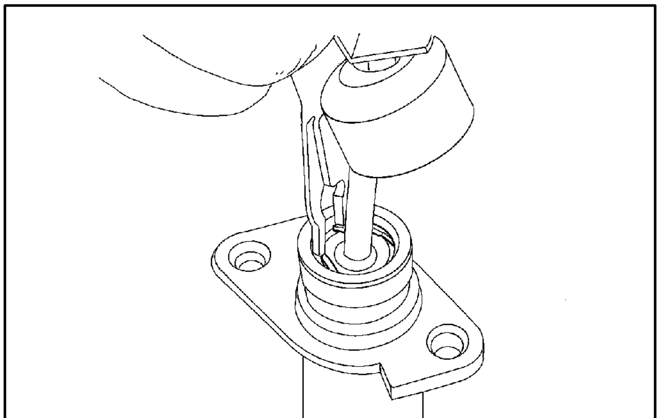
UAA5C030

CLUTCH RESERVOIR

Removal and Installation Procedure

1. Drain the clutch oil
2. Disconnect the reservoir hose and remove the clutch reservoir
3. Installation should follow the removal procedure in the reverse order.

UNIT REPAIR

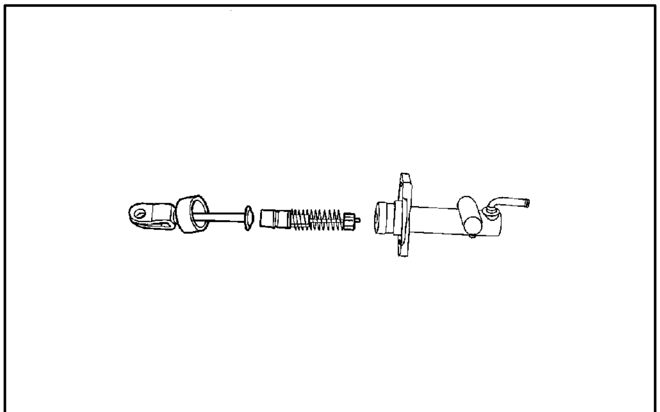


A103C043

CLUTCH MASTER CYLINDER

Disassembly and Assembly Procedure

1. Remove the clutch master cylinder assembly from the vehicle. Refer to "*Clutch Master Cylinder Assem°ly*" in this section.
2. Remove the boot and disconnect the piston stop ring using ring pliers.



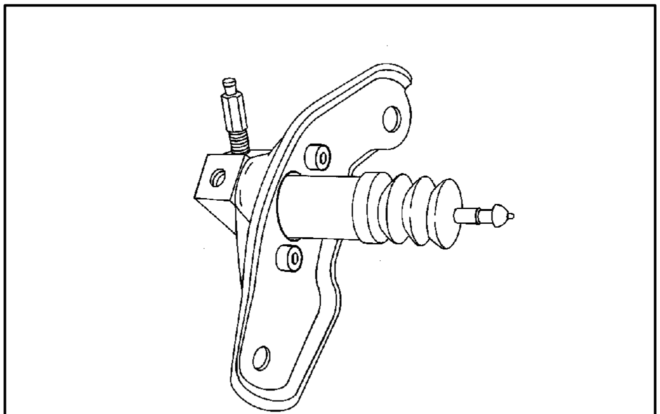
A103C048

3. Remove the push rod assembly and the piston assembly.
4. Inspect the clutch master cylinder wall and the piston for wear. Replace the piston if necessary.
5. Inspect the cup and the piston for wear. Fluid leaks will show wear on the cup and the piston. Replace the cup and the piston if necessary.
6. Inspect the push rod for wear. Repair the pushrod if necessary.

Installation Notice

- Apply clean fluid to the piston assembly cup and insert the piston assembly and the pushrod assembly into the master cylinder body.

7. Assembly should follow the disassembly procedure in the reverse order.

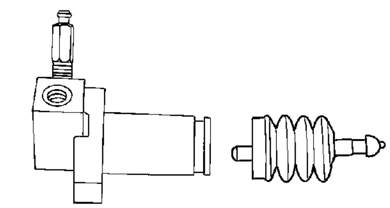


A103C053

CLUTCH RELEASE CYLINDER

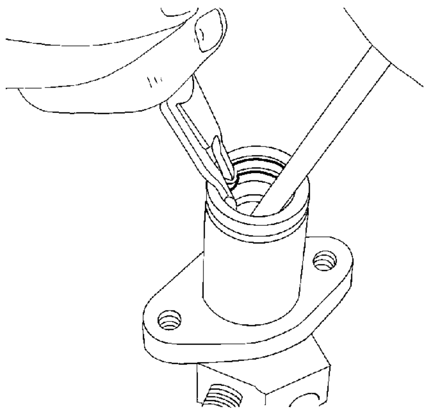
Disassembly and Assembly Procedure

1. Remove the clutch release cylinder assembly from the vehicle. Refer to "*Clutch Release Cylinder Assem°ly*" in this section.
2. Remove the bolts and brackets.



A103C041

3. Remove the boot and the push rod.



A103C042

4. Compress the piston with a driver, and then remove the snap ring with snap ring pliers.
5. Remove the piston assembly.
6. Assembly should follow the disassemly procedure in the reverse order.

Installation Notice

- Apply clean clutch fluid to the piston and the cup.

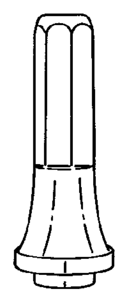
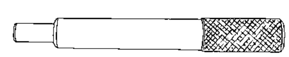
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Clutch Fork to Release Lever Shaft Bolt	35	26	–
Clutch Master Cylinder Locknuts	22	16	–
Clutch Pedal Nut	18	13	–
Pressure Plate to Flywheel Bolts	15	11	–
Release Bearing Guide Sleeve Bolts	5	–	45
Release Cylinder Bolts	60	44	–

SPECIAL TOOLS

SPECIAL TOOLS TABLE

 A103C009	J-36547 Input Shaft Seal Installer	 A103C045	J-42474 Clutch Arbor

SECTION 6A

POWER STEERING SYSTEM

TABLE OF CONTENTS

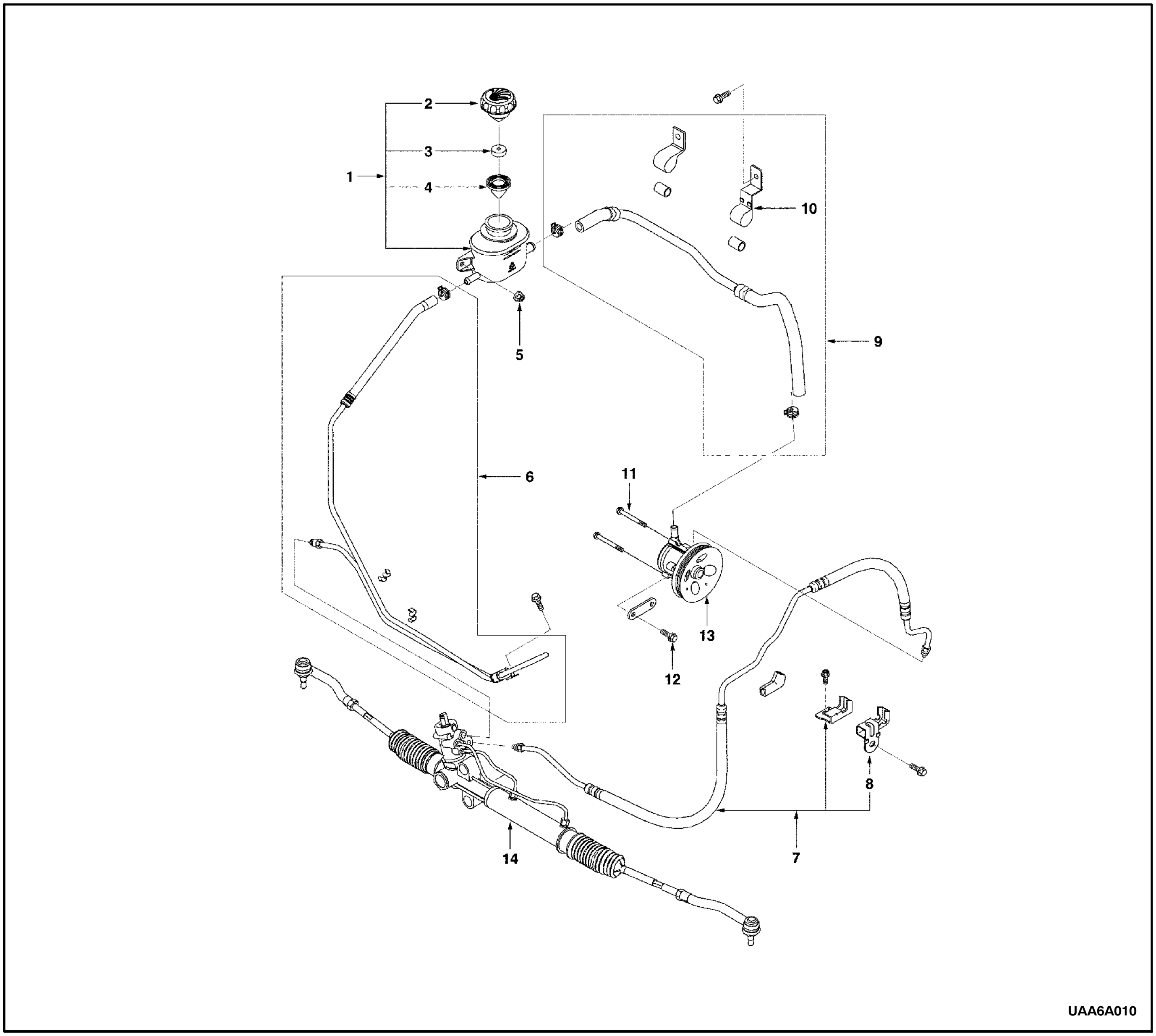
DESCRIPTION AND OPERATION

GENERAL DESCRIPTION

The power steering system consists of three components: the power steering pump, the power steering fluid reservoir and the power steering rack and pinion gear. The power steering pump is a vane-type pump providing hydraulic pressure for the system and is powered by the engine. It draws on the power steering fluid reservoir, which in turn is connected to the power steering gear. A pressure-relief valve inside the flow control valve limits the pump pressure. The power steering rack and pinion gear has a rotary control valve, which directs hydraulic fluid coming from the power steering pump to one side or the other side of the rack piston. The integral rack piston is attached to the rack. The rack piston converts hydraulic pressure to a linear force, which moves the rack to the left or the right. The force is then transmitted through the inner and the outer tie rods to the steering knuckles, which turn the wheels.

COMPONENT LOCATOR

POWER STEERING



1 Power Steering Oil Reservoir
2 Power Steering Oil Reservoir Cap
3 Power Steering Oil Reservoir Sponge
4 Power Steering Oil Reservoir Shield
5 Power Steering Oil Reservoir Nut
6 Return Line
7 Pump Pressure Pipe
8 Clamp
9 Supply Line Hose
10 Clamp
11 Power Steering Pump Bolt
12 Power Steering Pump Bracket Bolt
13 Power Steering Pump
14 Power Steering Gear

DIAGNOSTIC INFORMATION AND PROCEDURES

POWER STEERING SYSTEM PRESSURE TEST

Tools Required

KM–354–B Power Steering Pump Testing Unit

Check the fluid pressure as follows to determine whether the trouble is in the pump or the gear unit.

Test Procedure

1. Check the power steering fluid level and the serpentine accessory drive belt tension. Refer to “Checking and Adding Fluid” in this section and *Section 6B, Power Steering Pump.*
2. Disconnect the high pressure line at the pump. Use a small container to catch any fluid.
3. Connect the hose of the pressure test gauge kit KM–354–B to the power steering pressure hose from the power steering pump.
4. Place the gear selector lever in PARK (automatic transaxle-equipped vehicle) or NEUTRAL (manual transaxle-equipped vehicle). Set the parking brake.
5. Open the gauge valve fully.
6. Start the engine and let it idle.
7. Turn the steering wheel from lock-to-lock several times to warm the fluid to operating temperature.
8. Increase the engine speed to 1,500 rpm.

Notice : The power steering pump could be damaged if the valve is fully closed for more more than 5 seconds.

9. Close the gauge valve fully, and read the pressure. The pump pressure with the valve closed should be between 8,041kPa to 8,728kPa (1,166psi to 1,266psi).
10. Immediately open the gauge valve fully.
11. Turn the steering wheel all the way to the left and the right. If the pressure is within the specified limits, the problem is not in the pump. Check the power steering gear for leaks.
12. Remove the pressure gauge and connect the pressure hose.
13. Do bleeding procedure.

POWER STEERING SYSTEM LEAK TEST

General Procedure

Inspect the following :

- The fluid reservoir for overfill.
- Fluid for aeration and overflow.
- The hoses for loose connections.
- Stub shaft and adjuster seals for leaks.
- The component sealing surfaces for damage.

Important : Verify the exact point of the leak. The point from which the fluid is dripping is not necessarily the point at which the system is leaking. When service is required, clean the leak area upon disassembly, replace the leaking seal, check the component sealing surfaces for damage and reset the torque bolt to specifications. Where required.

External Leak Check

The purpose of this procedure is to pinpoint the location of the leak. In some cases, the leak can be easily located, but seepage-type leaks may be harder to find. To locate seepage leaks, use the following method:

1. With the engine off, wipe dry the complete power steering system.
2. Check the power steering fluid level in the pump’s reservoir. Adjust the fluid level as necessary. Refer to “Checking and Adding Fluid” in this section.

Notice : Do not hold the steering wheel at a stop for any length of time as this can damage the power steering pump.

3. Start the engine. Turn the steering wheel counterclockwise and clockwise from stop to stop several times.
4. Find the exact area of the leak and repair it.

MAINTENANCE

BLEEDING THE POWER STEERING SYSTEM

If the power steering hydraulic system has been serviced, an accurate fluid level reading cannot be obtained until the air is bled from the system. Follow these steps to bleed the air from the system.

1. Turn the wheels all the way to the to the left and add the power steering fluid to the MIN mark on the fluid level indicator.

Notice : When adding fluid or marking a complete fluid change, always use DEXRON®–III power steering fluid. Failure to use the proper fluid will cause hose and seal damage and fluid leaks.

2. Start the engine. With the engine running at fast idle, recheck the fluid level. If necessary, add fluid to bring the level up to the MIN mark.
3. Bleed the system by turning the wheels from side to side without reaching the stop at either end. Keep the fluid level at the MIN mark. The air must be eliminated from the fluid before normal steering action can be obtained.
4. Return the wheels to the center position. Continue running the engine for 2 to 3 minutes.
5. Road test the car to be sure the steering functions normally and is free from noise.
6. Recheck the fluid level as described in steps 1 and 2. Make sure the fluid level is at the MAX mark after the system has stabilized at its normal operating temperature. Add fluid as needed.

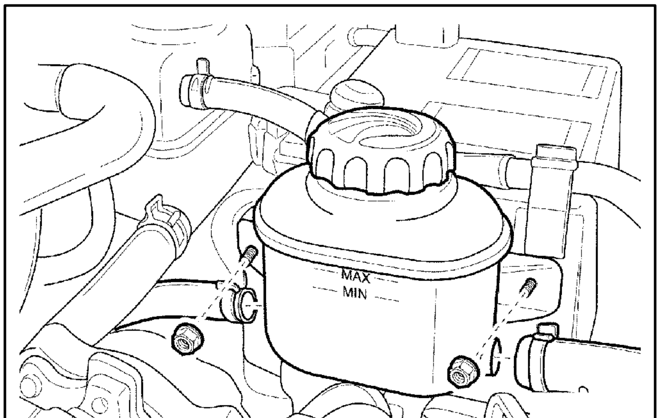
CHECKING AND ADDING FLUID

Notice: When adding fluid or making a complete fluid change, always use DEXRON®–III power steering fluid. Failure to use the proper fluid will cause hose and seal damage and fluid leaks.

1. The power steering fluid level is indicated either by marks on a see-through fluid reservoir or by marks on a fluid level indicator on the fluid reservoir cap.
2. If the fluid is warmed up to 66°C (150°F), the fluid level should be between the MAX and MIN marks. Add fluid as needed.
3. If the fluid is cool, 21°C (70°F), the fluid level should be at the MIN mark. Add fluid as needed.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



UAA6A020

POWER STEERING FLUID RESERVOIR

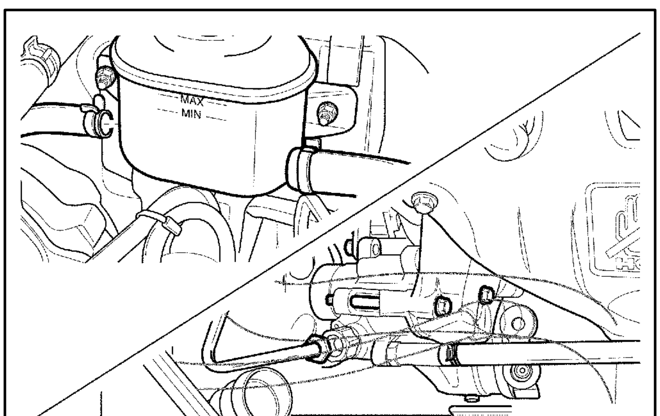
Removal and Installation Procedure

1. Siphon the power steering fluid from the fluid reservoir.
2. Loosen the hose clamps and remove both hoses from the fluid reservoir.
3. Remove the power steering fluid reservoir mounting nuts.
4. Remove the power steering fluid reservoir.

Installation Notice

Tightening Torque	10 N·m (7 lb–ft)

- After installing the fluid reservoir, bleed the power steering system. Refer to “Bleeding the Power Steering System” in this section.



UAA6A030

POWER STEERING PUMP HOSES AND PIPES

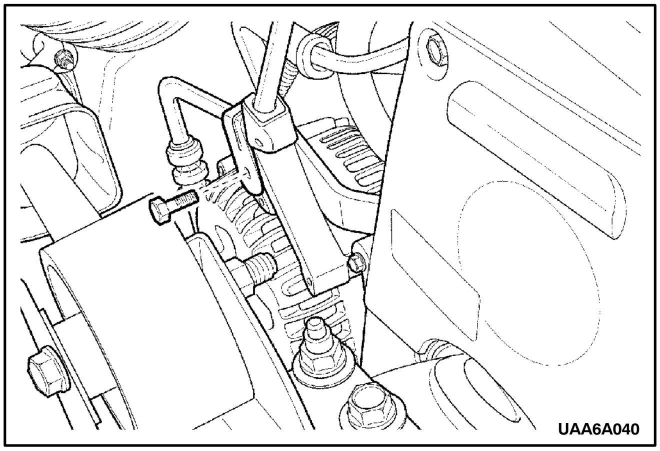
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal and Installation Procedure

1. Siphon the power steering fluid from the fluid reservoir.
2. Disconnect the pressure line pipe from the outlet connection on the power steering pump and return hose from the inlet connection on the power steering fluid reservoir.

Installation Notice

Tightening Torque	28 N·m (21 lb–ft)

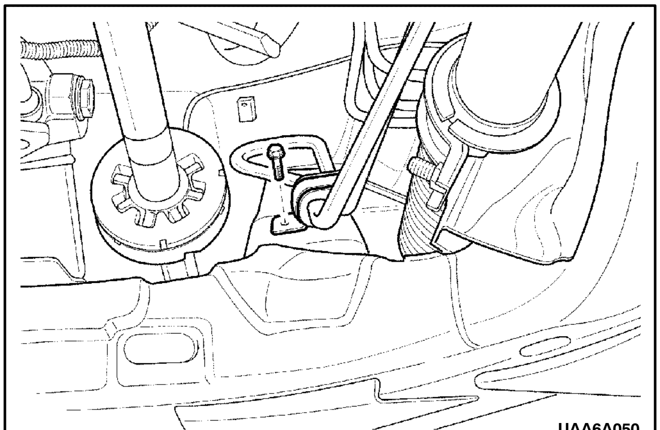


UAA6A040

3. Remove the pressure line pipe bracket bolt from the alternator.

Installation Notice

Tightening Torque	2.0 DOHC: 8 N·m (6 lb–ft) 1.8 SOHC: 25 N·m (18 lb–ft)

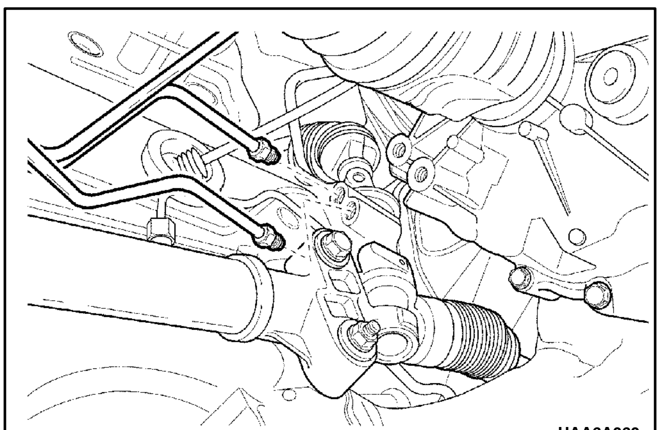


UAA6A050

4. Raise and suitably support the vehicle.
5. Remove the return line bracket bolt from the cross-member.

Installation Notice

Tightening Torque	8 N·m (6 lb–ft)



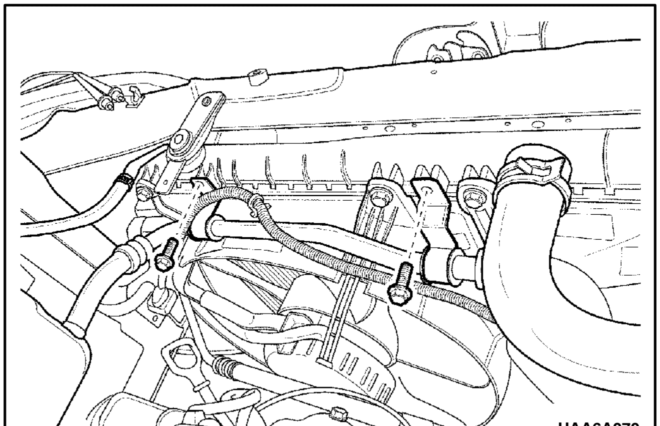
UAA6A060

6. Disconnect the pressure line fitting nut from the power steering gear inlet.
7. Disconnect the return line fitting nut from the power steering gear outlet.
8. Lower the vehicle.
9. Remove the pressure line and the return line from the vehicle.

Installation Notice

Tightening Torque	Power Steering Gear Inlet-to-Pressure Line Fitting Nut	28 N·m (21 lb–ft)
Tightening Torque	Power Steering Gear Outlet-to-Return Line Fitting Nut	28 N·m (21 lb–ft)

- After installing the hoses and pipes, bleed the power steering system. Refer to “Bleeding the Power Steering System” in this section.


UAA6A070

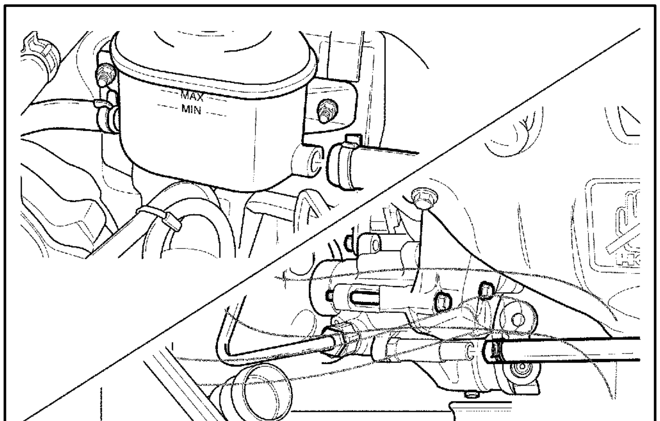
POWER STEERING FLUID SUPPLY HOSE

Removal and Installation Procedure

1. Siphon the power steering fluid from the fluid reservoir.
2. Remove the power steering fluid supply hose bracket bolts from the radiator.

Installation Notice

Tightening Torque	8 N·m (6 lb–ft)



UAA6A080

3. Disconnect the pressure line hose from the inlet connection on the power steering pump and supply hose from the outlet connection on the power steering fluid reservoir.
4. Remove the power steering fluid supply hose from the vehicle.
   - After installing the hose, bleed the power steering system. Refer to “Bleeding the Power Steering System” in this section.

SPECIFICATIONS

GENERAL SPECIFICATIONS

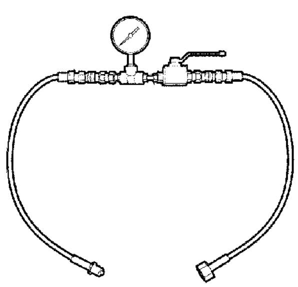
Application	Description
Capacity	1.0 Liter (1.1 qt)
Lubricant	Power Steering Fluid DEXRON®–III

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Power Steering Fluid Reservoir Mounting Nut	10	7	89
Power Steering Pump-to-Pressure Line Pipe Fitting Nut	28	21	–
Alternator-to-Pressure Line Pipe Bracket Bolt (1.8 SOHC)	25	18	–
Alternator-to-Pressure Line Pipe Bracket Bolt (2.0 DOHC)	8	6	71
Crossmember-to-Return Line Bracket Bolt	8	6	71
Power Steering Gear Inlet-to-Pressure Line Fitting Nut	28	21	–
Power Steering Gear Outlet-to-Return Line Fitting Nut	28	21	–
Radiator-to-Supply Hose Bracket Bolt	8	6	71

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 UAA6A090	**KM–354–B Power Steering Pump Testing Unit**

SECTION 6B

POWER STEERING PUMP

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION

The power steering pump is a multivaned hydraulic pump. The serpentine accessory drive belt on the engine drives the power steering pump. The power steering pump provides the hydraulic pressure to the power steering gear.

The power steering gear uses the hydraulic pressure to assist in steering the vehicle. The power steering system uses a remote reservoir in order to make available more space in the engine compartment.

No repair procedures are to be done on the internal components of the power steering pump. The only serviceable components of the power steering pump are the power steering pump pulley and the pump itself.

DIAGNOSTIC INFORMATION AND PROCEDURES

POWER STEERING PUMP DIAGNOSIS

Foaming or Milky Power Steering Fluid (Air in Fluid)

Check	Action
Check for internal leakage in the power steering pump, causing an overflow.	Repair the internal pump leakage. Bleed the system.
Check for a low fluid level.	Repair the internal pump leakage. Bleed the system. Cold temperatures will cause the air bubbles in the system if the fluid level is low.

Low Pressure Due to Power Steering Pump

Check	Action
Check for an external leakage of the power steering pump at the seals.	Replace the seals. Repair the leak. Bleed the system.
Check for a worn serpentine accessory drive belt.	Replace the serpentine accessory drive belt.

Low Pressure Due to Power Steering Gear

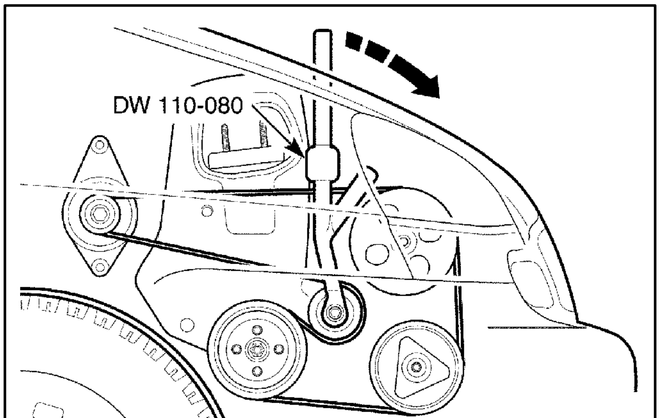
Check	Action
Check for a scored housing bore.	Replace the housing bore.
Check for leakage at the valve rings or the seals.	Repair the leak. Bleed the system.

Groaning Noise in the Power Steering Pump

Check	Action
Check for air in the power steering fluid.	Perform the checks listed in “Foaming or Milky Power Steering Fluid (Air in Fluid)” above.
Check for a low level of power steering fluid.	Repair any internal or external leaks. Bleed the system.
Check for a loose mounting of the power steering pump.	Tighten the pump mounting to specifications.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



UAA6B010

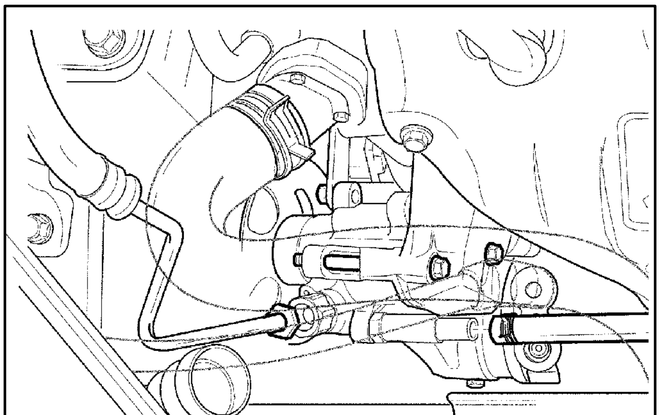
SERPENTINE ACCESSORY DRIVE BELT

Removal and Installation Procedure

Tools Required

DW 110–080 Serpentine Accessory Drive Belt Remover

1. Use a Serpentine Accessory Drive Belt Remover to turn the tensioner bolt clockwise, compressing the tensioner, and releasing the tension on the serpentine accessory drive belt.
2. Remove the serpentine accessory drive belt .



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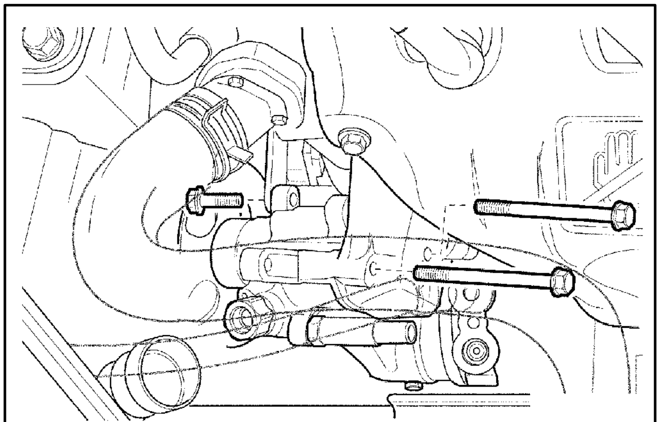
POWER STEERING PUMP ASSEMBLY

Removal and Installation Procedure

1. Remove the serpentine accessory drive belt Refer to “Serpentine Accessory Drive Belt” in this section.
2. Siphon the power steering fluid from the fluid reservoir.
3. Disconnect the pressure line pipe from the outlet connection on the power steering pump and the pressure line hose from the inlet connection on the power steering pump.

Installation Notice

Tightening Torque	28 N·m (21 lb–ft)


UAA6B030

4. Remove the bolt from the front right side of the power steering pump.
5. Remove the power steering pump assembly mounting bolts.
6. Remove the power steering pump assembly.

Installation Notice

Tightening Torque	Power Steering Pump Front Right Side Bolt	25 N·m (18 lb–ft)
Tightening Torque	Power Steering Pump Mounting Bolts	25 N·m (18 lb–ft)

- After installing the power steering pump assembly, bleed the power steering system. Refer to “Bleeding the Power Steering System” in this section.

UNIT REPAIR

POWER STEERING PUMP PULLEY

The power steering pump pulley in this vehicle is not serviceable. If the power steering pump pulley is defective, you must replace the power steering pump assembly.

SPECIFICATIONS

GENERAL SPECIFICATIONS

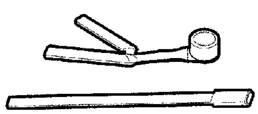
Application	Description
Capacity	1.0 Liter (1.1 qt)
Lubricant	Power Steering Fluid DEXRON®–III
Type	Vane

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Power Steering Pump-to-Pressure Line Pipe Fitting Nut	28	21	–
Power Steering Pump Front Right Side Bolt	25	18	–
Power Steering Pump Mounting Bolt	25	18	–

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 UAA6B040	**DW 110–080 Serpentine Accessory Drive Belt Remover**

SECTION 6C

POWER STEERING GEAR

***CAUTION:** Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.*

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

POWER RACK AND PINION

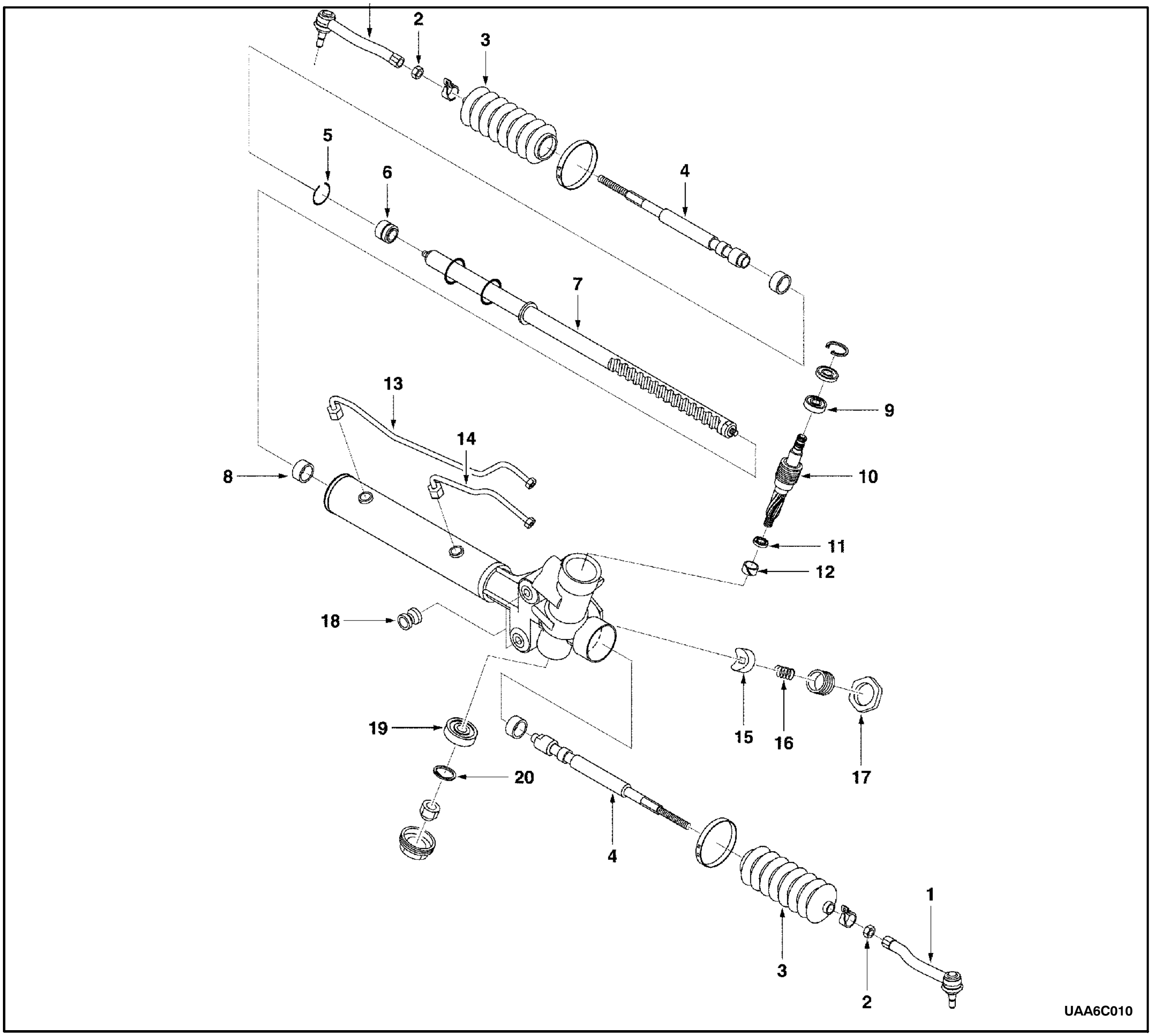
The power steering rack and pinion system has a rotary control valve that directs hydraulic fluid coming from the hydraulic pump to one side or the other side of the rack piston. The integral rack piston is attached to the rack. The rack piston converts hydraulic pressure to a linear force that moves the rack left or right. That force is then transmitted through the tie rods to the steering knuckles, which turn the wheels.

If power rack and pinion steering is not available, manual rack and pinion control is used; however, with this system, more steering effort is required. The movement of the steering wheel is transferred to the pinion. The rotary movement of the pinion is then transferred through the pinion threads, which mesh with teeth on the rack, thereby causing the rack to move in a linear direction.

A vane-type of hydraulic pump provides hydraulic pressure for both steering systems.

COMPONENT LOCATOR

RACK AND PINION GEAR



1	Outer Tie Rod	11	Pinion Shaft Seal
2	Tie Rod End Rock Nut	12	Bushing
3	Rack and Pinion Boot	13	Cylinder Liner Kit
4	Inner Tie Rod	14	Cylinder Liner Kit
5	Bulkhead Retaining Ring	15	Rack Bearing
6	Bushing & Cylinder Bulkhead	16	Adjuster Spring
7	Steering Rack Gear	17	Adjuster Plug
8	Rack Inner Seal	18	Grommet
9	Bearing	19	Pinion Bearing
10	Pinion Gear	20	Retaining Ring

DIAGNOSTIC INFORMATION AND PROCEDURES

POWER STEERING RACK AND PINION GEAR

Hissing Noise

Check	Action
Check the intermediate shaft joints for looseness.	Tighten the intermediate shaft joints.
Check the power steering hose for contact with other components.	Be sure the power steering hose is correctly fitted into the hose clips.

Rattling Noise in Steering Gear

Check	Action
Check the power steering hose for contact with the body.	Be sure the power steering hose is correctly fitted into the hose clips.
Check the steering gear for insufficient lubrication.	Lubricate the steering gear.
Check the steering gear mounting for improper installation.	Tighten the steering gear mounting bracket nuts and bolts.
Check the outer tie rods for improper installation.	Tighten the outer tie rod joints. Replace the outer tie rods.

Poor Return of Steering Wheel to Center

Check	Action
Check the steering wheel for contact with the turn signal housing.	Adjust the turn signal housing.
Check the intermediate shaft joints for binding or looseness.	Replace the intermediate shaft.
Check the power steering pump flow control valve for sticking and improper alignment.	Replace the power steering pump.
Check the wheel alignment.	Align the wheels.
Check the wheel bearings for wear or damage.	Replace the wheel bearings.
Check the intermediate shaft joints for improper installation.	Adjust the intermediate shaft between the steering gear and the steering column. Replace the intermediate shaft.
Check the outer tie rods and the ball joints for binding or looseness.	Tighten the tie rods and the ball joints. Replace the tie rods and the ball joints.
Check the steering gear adjustments.	Perform a straight–ahead check.
Check the steering column shaft seal for rubbing on the shaft.	Replace the dash seal.
Check the steering shaft bearings for binding.	Replace the stub shaft bearings.

Momentary Increase in Effort When Turning the Wheel Quickly

Check	Action
Check the power steering pump for internal leaks.	Replace the power steering pump.
Check the hoses for damage or restricted flow.	Replace the power steering hoses and/or pipes.
Check the power steering fluid level.	Fill the power steering fluid reservoir.
Check the power steering pump flow control valve for sticking and improper operation.	Replace the power steering pump.

Steering Surges or Jerks When Turning with Engine Running

Check	Action
Check the power steering pump for insufficient pressure.	Replace the power steering pump.
Check the power steering pump flow control valve for sticking and improper operation.	Replace the power steering pump.
Check the power steering pump serpentine belt for slippage.	Tighten the power steering serpentine belt.
Check for air contamination in the power steering system.	Bleed the power steering system.

Steering Vibrates During Low Speed or Static Steering

Check	Action
Check for air contamination in the power steering system.	Bleed the power steering system.
Check the power steering pump serpentine belt for looseness.	Tighten the power steering serpentine belt.

Excessive Wheel Kickback or Loose Steering

Check	Action
Check for air contamination in the power steering system.	Bleed the power steering system.
Check the wheel bearings for wear or damage.	Replace the wheel bearings.
Check the steering gear mounting for improper installation.	Tighten the steering gear mounting bracket nuts and bolts.
Check the intermediate shaft joints for improper Installation Note.	Adjust the intermediate shaft between the steering gear and the steering column. Replace the intermediate shaft.
Check the outer tie rods and the ball joints for looseness.	Tighten the tie rods and the ball joints. Replace the tie rods and the ball joints.

Hard Steering or Lack of Assist (Especially During Parking)

Check	Action
Check the intermediate shaft joints for improper installation.	Adjust the intermediate shaft between the steering gear and the steering column. Replace the coupling flange.
Check the power steering pump flow control valve for sticking and improper installation.	Replace the power steering pump.
Check the power steering pump for insufficient pressure.	Replace the power steering pump.
Check the power steering pump for internal leaks.	Replace the power steering pump.
Check for a loose or a worn intermediate shaft.	Tighten the intermediate shaft. Replace the intermediate shaft, as needed.
Check the power steering pump serpentine belt tension.	Tighten the power steering serpentine belt.

POWER STEERING RACK AND PINION GEAR BENCH TESTING

Removal, Setup and Testing Procedure

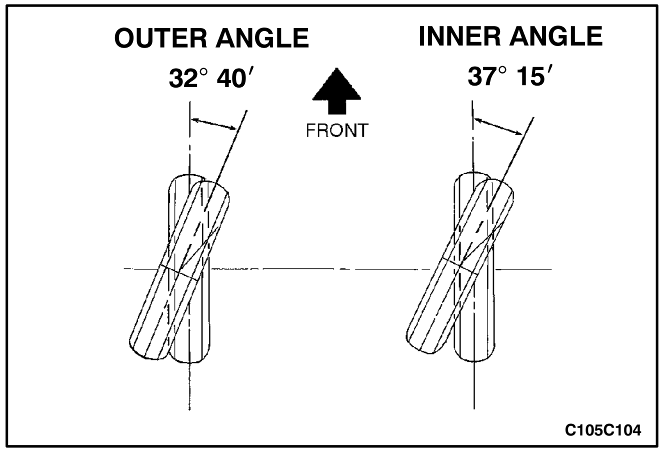
Notice: Pressure checks or pressure and flow checks may also be conducted using this setup.

1. Disconnect and remove the power steering gear. Refer to “Rack and Pinion Assembly” in this section.
2. Place the power steering gear on a bench next to the vehicle.
3. Disconnect the pressure line at the point where the hose connects to the pipe. Extend this line to reach the power steering gear on the bench.
4. Disconnect the return line from the power steering fluid reservoir. Extend this line to reach the power steering gear on the bench.
5. Connect the power steering pipes to the power steering gear.
6. Start the engine and allow it to idle for 10 seconds.
7. Check the power steering fluid level. Refer to *Section 6A, Power Steering System.*
8. Start the engine and turn the rack and pinion stub shaft a full turn in each direction. Hold the shaft against each stop for 5 seconds.
9. Inspect for possible leak points. Refer to *Section 6A, Power Steering System.*

Installation Procedure

1. Stop the engine.
2. Disconnect the power steering pipes from the power steering gear.
3. Remove the extensions and reconnect the pressure and return lines.
4. Install and connect the power steering gear. Refer to “Rack and Pinion Assembly” in this section.
5. Start the engine and allow it to idle for 10 seconds.
6. Check the power steering fluid level. Refer to *Section 6A, Power Steering System.*

STRAIGHT-AHEAD CHECK



After all the necessary operations on the steering gear are completed (removing and installing, disassembling and assembling), check the exact straight-ahead position of the steering in each case.

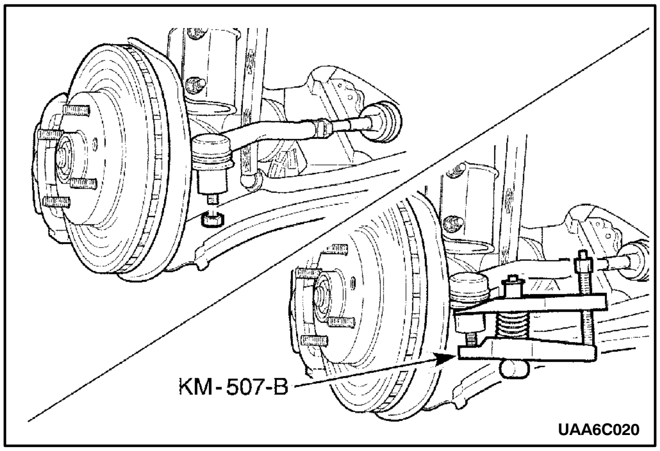
With the vehicle on the floor, place the steering wheel in the straight-ahead position. Mark the centerline of both tires on the floor. Turn the steering wheel all the way to the right and mark the new centerline of both tires on the floor.

Straight-Ahead Check Table

Step	Action	Value(s)	Yes	No
1	Place the steering wheel in the straight-ahead position. Is the wheel in the correct position?	–	Go to *Step 2*	–
2	Is the lower intermediate shaft pinch bolt lying parallel to the steering gear?	–	Go to *Step 3*	Go to *Step 4*
3	Is the steering wheel off center by more than 5 degrees?	–	Go to *Step 5*	Go to *Step 6*
4	The pinion is displaced on the rack. The steering pinion position must be corrected. Is the repair complete?	–	Go to *Step 2*	–
5	Remove steering wheel and center on the spindle splines. Is the repair complete?	–	Go to *Step 3*	–
6	Turn the steering wheel all the way to the right. Measure the inner and the outer angles of the tire centerline compared to the straight-ahead centerline. Are the angles within specifications?	Inner angle: 37^{o} 15′ Outer angle: 32^{o} 40′	System OK	Go to *Step 7*
7	The rack assembly was not assembled correctly. Repair as needed. Is the repair complete?	–	Go to *Step 6*	–

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



RACK AND PINION ASSEMBLY

Tools Required

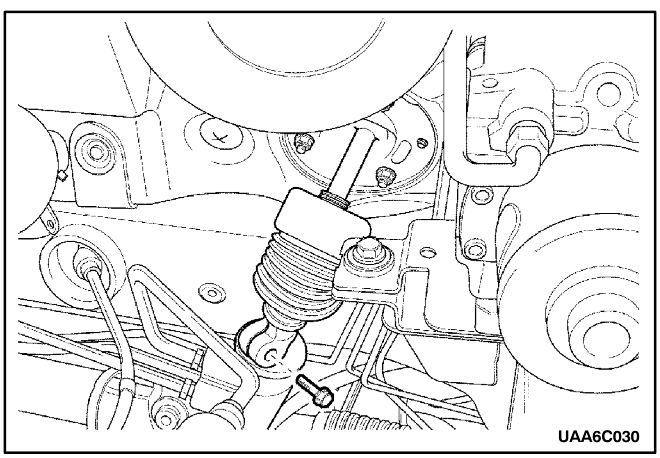
KM–507–B Ball Joint Remover

Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Remove the wheels. Refer to *Section 2E, Tires and*
   - *heels.*
3. Remove the outer tie rod nuts and disconnect the tie rod ends from the knuckle using the ball joint remover KM–507–B. Refer to “Outer Tie Rod” in this section.

Installation Notice

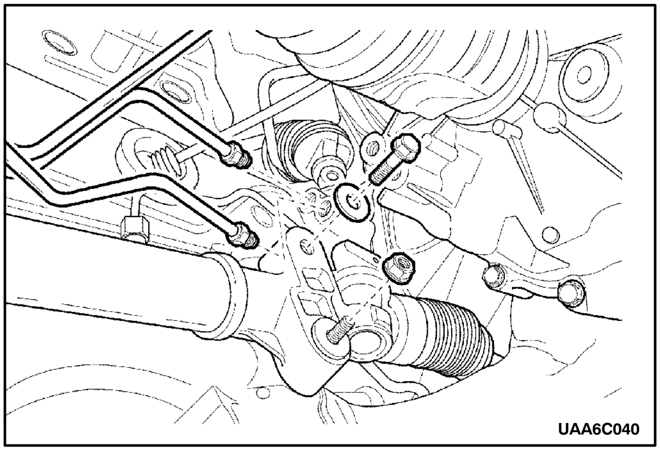
Tightening Torque	50 N·m (37 lb–ft)



4. Remove the lower pinch bolt from the intermediate shaft. Refer to “Intermediate Shaft And Dash Seal” in this section.
5. Remove the return line bracket bolt from the cross-member. Refer to *Section 6A, Power Steering System.*

Installation Notice

Tightening Torque	Intermediate Shaft Lower Pinch Bolt	26 N·m (19 lb–ft)
Tightening Torque	Crossmember-to-Return Line Bracket Bolt	8 N·m (6 lb–ft)



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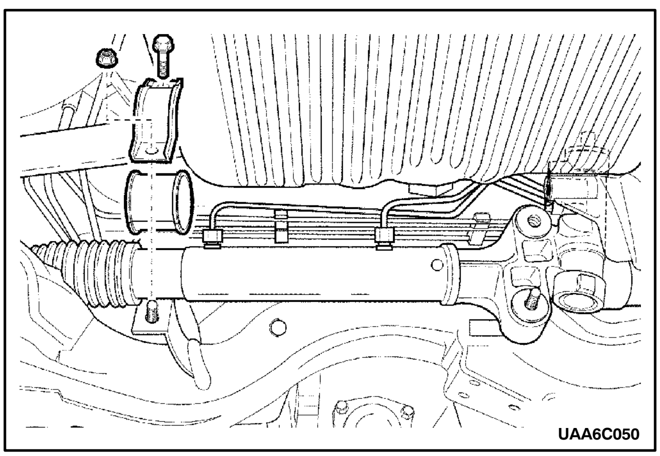
6. Disconnect the return line pipe from the power steering gear outlet. Place a drain pan under the steering gear to catch the power steering fluid.
7. Disconnect the pressure line pipe from the power steering gear inlet.
8. Remove the rack and pinion assembly mounting bolt and nut.

Installation Notice

Tightening Torque	Power Steering Gear Inlet-to-Pressure Line Fitting Nut	28 N·m (21 lb–ft)
Tightening Torque	Power Steering Gear Outlet-to-Return Line Fitting Nut	28 N·m (21 lb–ft)
Tightening Torque	Rack and Pinion Assembly Mounting Bolt	60 N·m (44 lb–ft)
Tightening Torque	Rack and Pinion Assembly Mounting Nut	60 N·m (44 lb–ft)

- After installing the pipes, bleed the power steering system. Refer to “Bleeding the Power Steering System” in this section.



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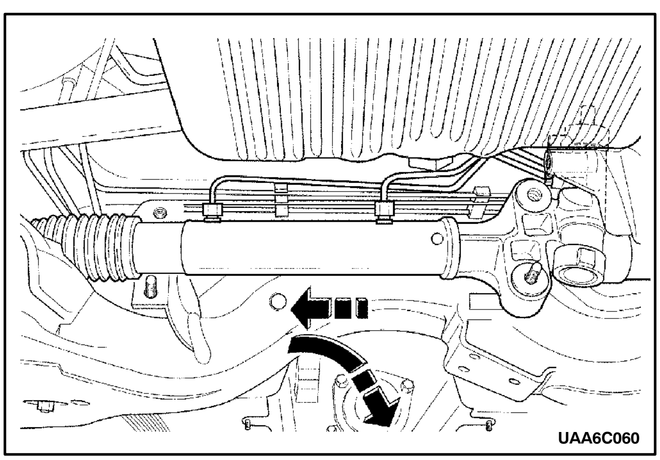
9. Remove the rack and pinion assembly U-clamp mounting bolt and nut.
10. Remove the U-clamp and the bushing.

Installation Notice

Tightening Torque	Rack and Pinion Assembly U-clamp Mounting Bolt	60 N·m (44 lb–ft)
Tightening Torque	Rack and Pinion Assembly U-clamp Mounting Nut	60 N·m (44 lb–ft)



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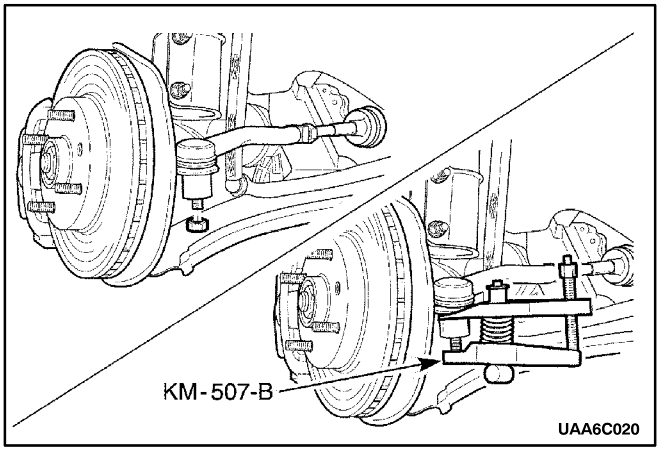
11. Remove the rack and pinion assembly.

Installation Notice

- Do a straight-ahead check. Refer to “Straight-Ahead Check” in this section.
- When adding fluid or marking a complete fluid change, always use DEXRON®–III power steering fluid.



OUTER TIE ROD

Tools Required

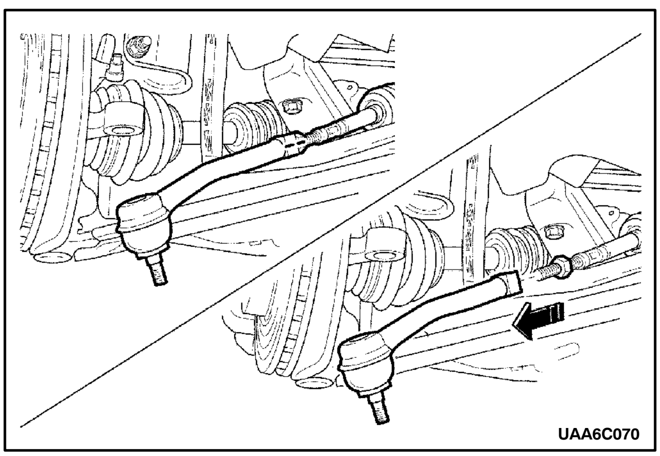
KM–507–B Ball Joint Remover

Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Remove the wheels. Refer to *Section 2E, Tires and • heels.*
3. Remove the outer tie rod nuts and disconnect the tie rod ends from the knuckle using the ball joint remover KM–507–B.

Installation Notice

Tightening Torque	50 N·m (37 lb–ft)

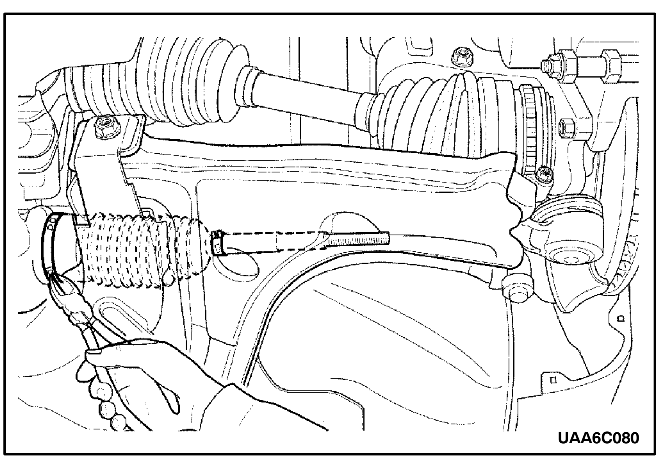


4. Mark the threads on the inner tie rod to aid in repositioning the adjusting nut.
5. Loosen the outer tie rod adjusting nut and remove the outer tie rod by twisting it off the inner tie rod.

Installation Notice

Tightening Torque	64 N·m (47 lb–ft)

- After Installation, perform a front toe adjustment. Refer to *Section 2B, • heel Alignment.*



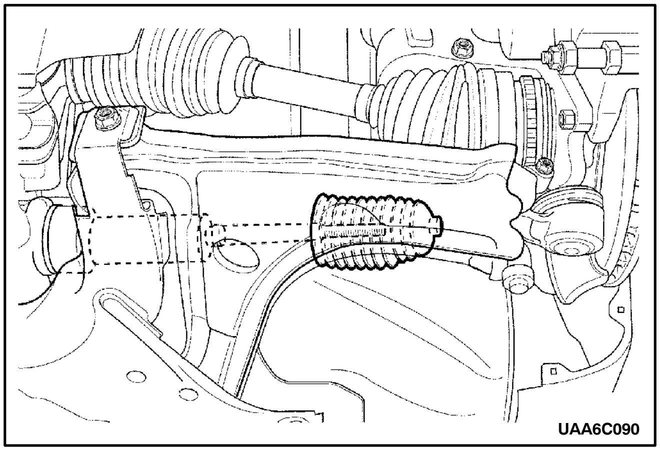
DUST BOOT

Tools Required

KM–J–22610 Dust Boot Clamp Installer

Removal and Installation Procedure

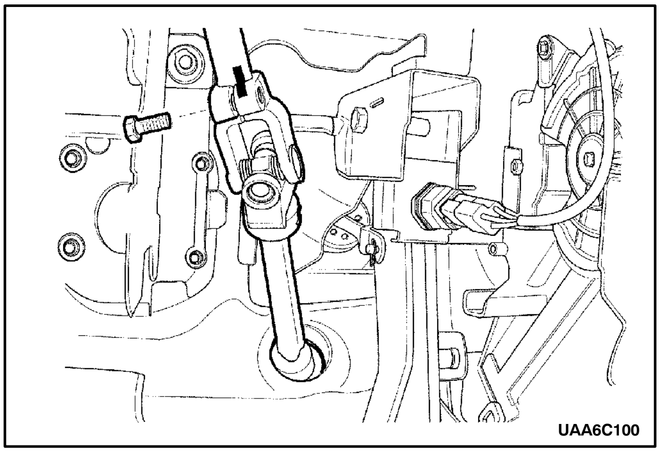
1. Raise and suitably support the vehicle.
2. Remove the wheel. Refer to *Section 2E, Tires and wheels.*
3. Remove the outer tie rod. Refer to “Outer Tie Rod” in this section.
4. Remove the dust boot retaining clamps.



5. Remove the dust boot.

Installation Notice

- After Installation, perform a front toe adjustment. Refer to *Section 2B, • heel Alignment.*



INTERMEDIATE SHAFT AND DASH SEAL

(Left–Hand Drive Shown, Right–Hand Drive Similar)

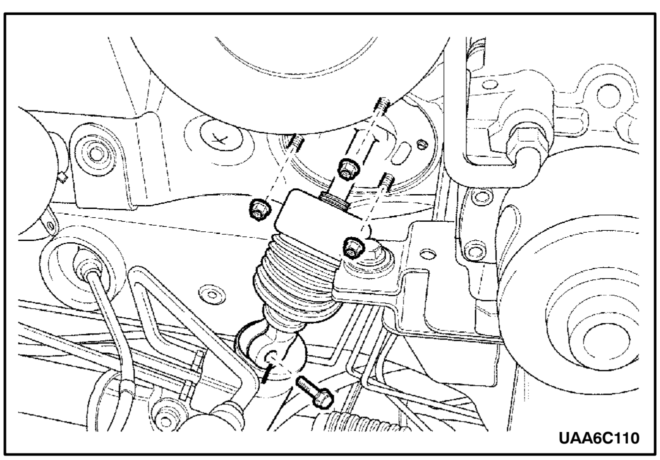
Removal and Installation Procedure

1. Turn the steering wheel until it is horizontal. This is the straight-ahead position. Make a mark on the steering column shaft that lines up with a mark on the intermediate shaft upper universal joint.
2. Remove the upper pinch bolt from the universal joint on the intermediate shaft.

Installation Notice

Tightening Torque	22 N·m (16 lb–ft)

- When attaching the upper universal joint, the marks on the intermediate shaft and on the steering column shaft should line up.

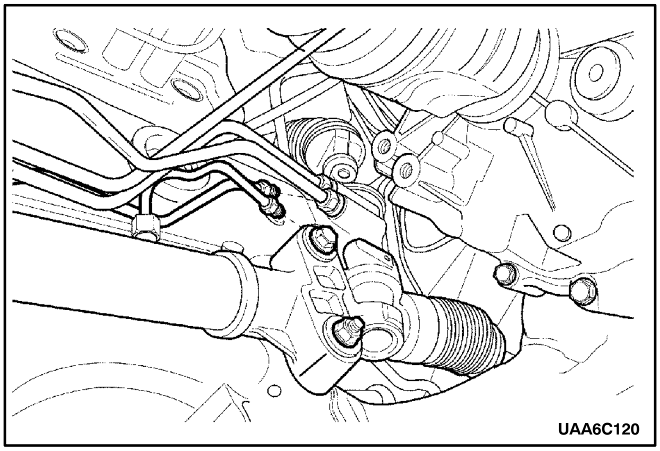


3. Raise and suitably support the vehicle.
4. Make a mark on the stub shaft housing that lines up with a mark on the intermediate shaft lower universal joint.
5. Remove the lower pinch bolt from the universal joint on the intermediate shaft.
6. Remove the nuts from the dash seal.
7. Remove the intermediate shaft.

Installation Notice

Tightening Torque	Dash Seal Nut	6 N·m (4 lb–ft)
Tightening Torque	Intermediate Shaft Lower Pinch Bolt	25 N·m (18 lb–ft)

- When attaching the lower universal joint, the marks on the intermediate shaft and on the stub shaft should line up.
- When attaching the lower and the upper universal joint, the steering wheel must be placed in the straight-ahead position with the spokes pointing down.



HYDRAULIC CYLINDER LINES

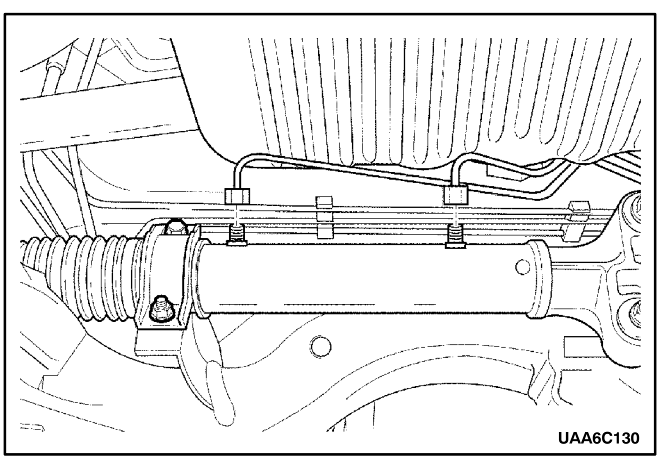
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal and Installation Procedure

1. Siphon the power steering fluid from the power steering fluid reservoir.
2. Raise and suitably support the vehicle.
3. Disconnect the power steering gear hydraulic cylinder pipes from the power steering gear at the valve end. Replace the O-ring seals as needed.

Installation Notice

Tightening Torque	18 N·m (13 lb–ft)



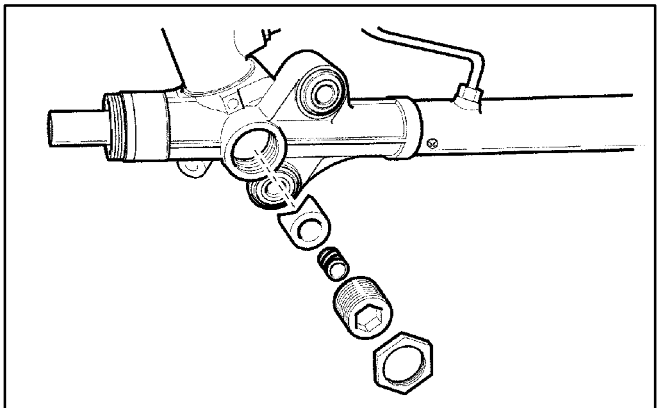
4. Disconnect the power steering gear hydraulic cylinder pipes from the power steering gear at the cylinder end.
5. Remove the steering gear hydraulic cylinder pipes from the vehicle.

Installation Notice

Tightening Torque	27 N·m (20 lb–ft)

- When adding power steering fluid or making a complete change, always use DEXRON®–III power steering fluid. Failure to use the proper fluid will cause hose and seal damage and fluid leaks.
- Fill the reservoir with power steering fluid.
- Inspect for leaks. If there are leaks, correct the cause of the leaks and bleed the system. Refer to *Section 6A, Bleeding the Power Steering System.*

UNIT REPAIR



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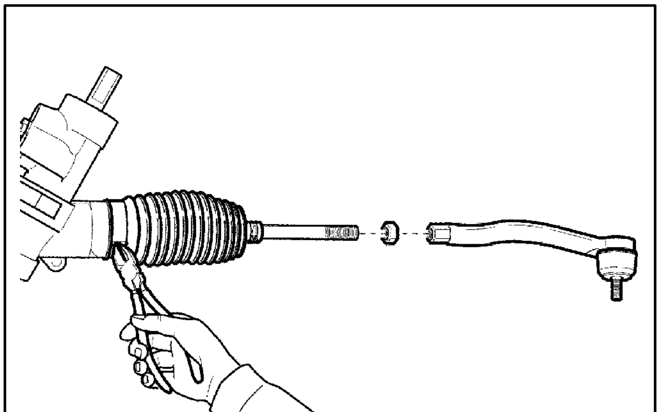
RACK AND PINION

Disassembly and Assembly Procedure

1. Remove the rack and pinion assembly from the vehicle. Refer to “Rack and Pinion Assembly” in this section.
2. Remove the valve and pinion assembly from the rack and pinion steering assembly. Refer to “Valve and Pinion” in this section.
3. Remove the rack bearing assembly from the rack and pinion steering assembly. Refer to “Rack Bearing” in this section.



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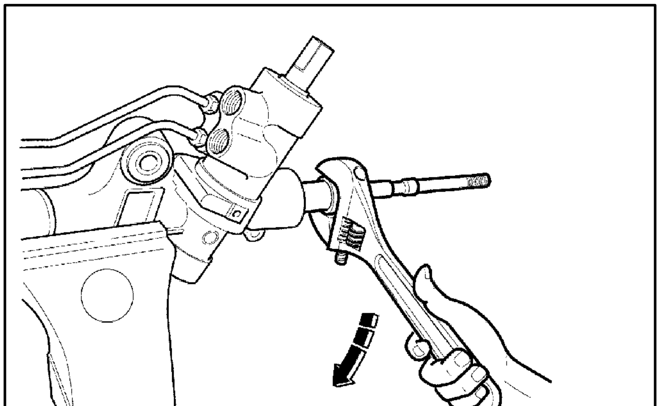
4. Mark the threads on the inner tie rod to aid in repositioning the adjusting nut.
5. Loosen the adjusting nut and remove the outer tie rod nut and the adjusting nut.

Installation Notice

- When installing the outer tie rod nut, the mark on the inner tie rod and adjusting nut should line up.
- After installation, perform a front toe adjustment. Refer to *Section 2B, • heel Alignment.*

6. Remove the dust boot retaining clamps and remove the dust boot.



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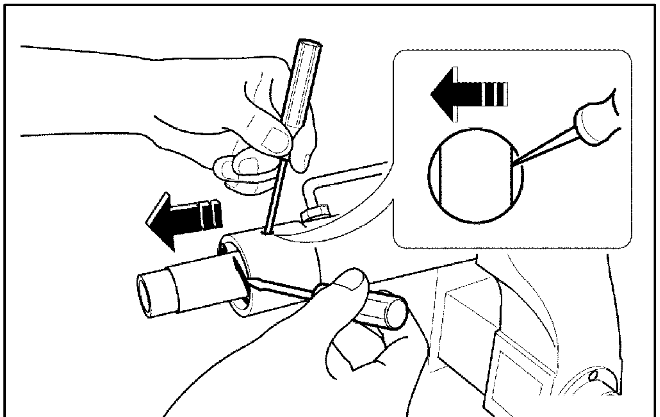
7. Remove the cylinder-side inner tie rod and the pinion-side inner tie rod.

Installation Notice

Tightening Torque	100 N·m (74 lb–ft)

- To prevent the inner tie rods from loosening, use Loctite® 242 (or equivalent) on both inner tie rod connections to secure them to the rack shaft.
- The right and left inner tie rods are unequal in length. Be sure to install the correct inner tie rod on the proper side of the power steering gear.



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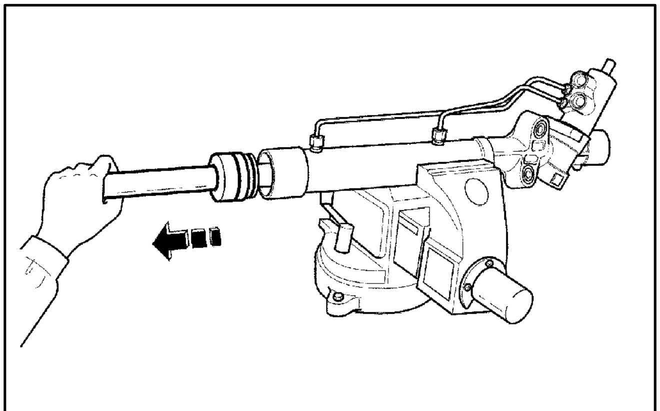
Important : The retaining ring can be released by inserting a small screwdriver through the hole in the side of the housing.

8. Remove the bulkhead inner cylinder retaining ring, the bulkhead inner cylinder, and the rack.

Installation Notice

- Coat all the seals with power steering fluid to ensure proper sealing.



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RACK BEARING

Tools Required

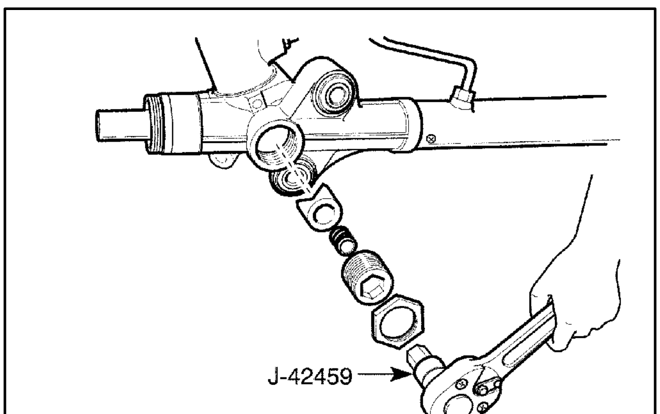
J–42459 Rack Guide Spring Cap Wrench

Removal and Installation Procedure

1. Remove the rack and pinion steering assembly from the vehicle. Refer to "Rack and Pinion Assembly" in this section.
2. Remove the adjuster plug locknut from the adjuster plug, and remove the adjuster plug from the housing with the rack guide spring cap wrench J–42459.
3. Remove the adjuster spring and the rack bearing.

Installation Notice

- Coat the rack bearing, the adjuster spring and the adjuster plug with lithium-based grease.
- With the rack centered, turn the adjuster plug clockwise until a torque of 12 N·m (9 lb–ft) is obtained, then back it off by 50 to 70 degrees.



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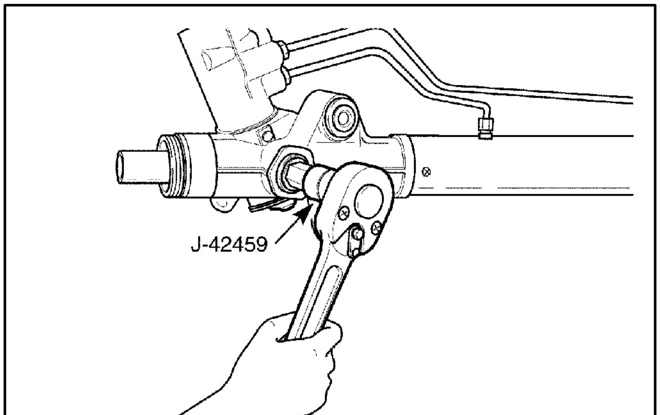
Tightening Torque	12 N·m (9 lb–ft)



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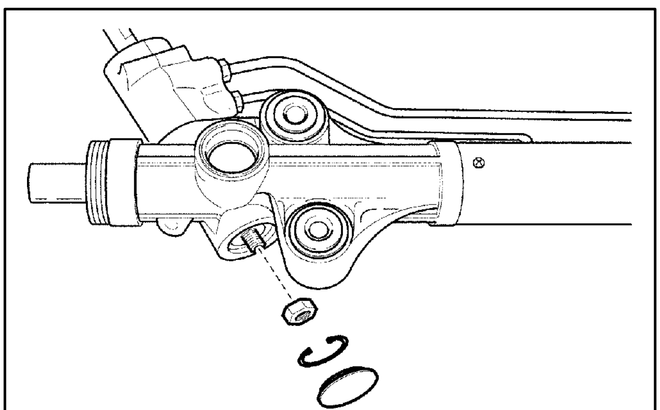
RACK BEARING PRELOAD ADJUSTMENT

Adjustment Procedure

1. Raise and suitably support the vehicle.
2. Center the steering wheel.
3. Remove the power steering gear. Refer to "Rack and Pinion Assembly" in this section.
4. Loosen the locknut and turn the adjuster plug clockwise until a torque of 12 N·m (9 lb–ft) is obtained, then loosen it by 50 to 70 degrees.
5. Tighten the locknut on the adjuster plug while holding the adjuster plug stationary.
6. Install the power steering gear. Refer to "Rack and Pinion Assembly" in this section.
7. Be sure to check the return ability of the steering wheel to center position after adjustment.

Installation Notice

Tightening Torque	12 N·m (9 lb–ft)



UAA6C210

VALVE AND PINION ASSEMBLY

Disassembly and Assembly Procedure

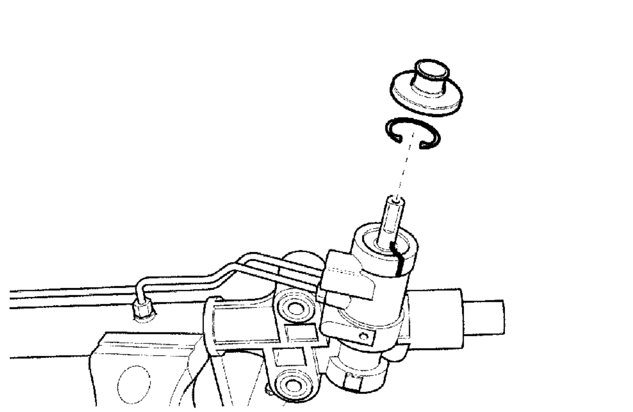
1. Remove the rack and pinion steering assembly from the vehicle. Refer to "Rack and Pinion Assembly" in this section.
2. Remove the dust cover and the retaining ring from the lower end of the housing.

Notice : If the stub shaft is not held, damage to the pinion teeth will occur.

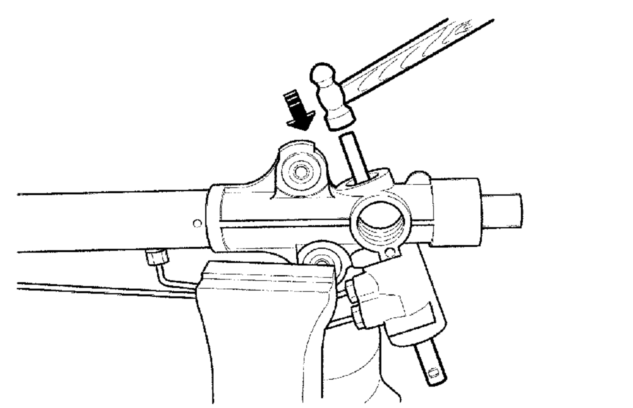
3. While holding the stub shaft with a wrench, remove the locknut from the pinion.

Installation Notice

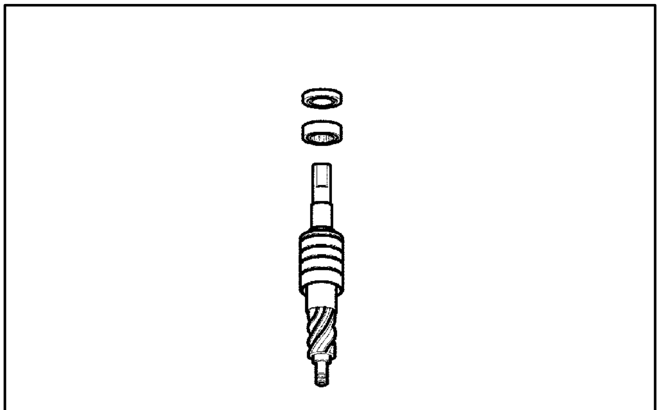
Tightening Torque	30 N·m (22 lb–ft)


UAA6C220

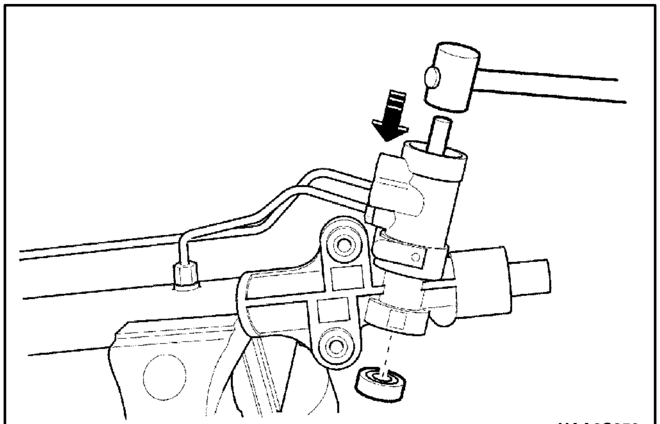
4. With the gear centered, mark the location of the stub shaft notch on the housing to aid in properly installing the pinion and valve assembly.
5. Remove the dust cover and the upper housing retaining ring.


UAA6C230

6. Remove the valve and pinion assembly from the stub shaft housing.


UAA6C240

7. Remove the stub shaft dust seal, the stub shaft bearing annulus assembly.


UAA6C250

8. Remove the pinion bearing from the stub shaft housing.

Installation Notice

- Install the bushing and a new lower pinion valve seal.
- Coat all the seals with power steering fluid to ensure proper sealing.
- When the valve and pinion assembly is fully seated in the housing, be sure the notch in the stub shaft and the mark on the housing line up. If this is not done the vehicle will not pass the straight-ahead check and will have poor steering performance.

SPECIFICATIONS

GENERAL SPECIFICATIONS

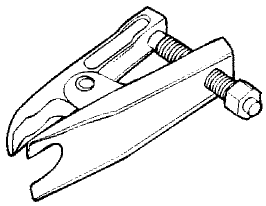
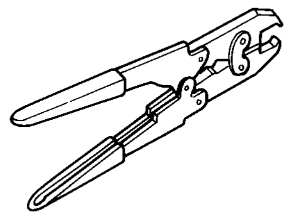
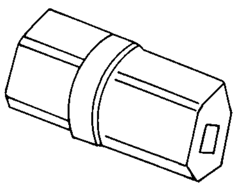
Application		Description
Power Steering Fluid		Power Steering Fluid DEXRON®-III
Capacity		1.0 Liter (1.1 qt)
Type		Rack and Pinion
Grease	Rack	No. 2 Lithium
	Ball Joint	B–0400884

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Knuckle-to-Outer Tie Rod Nut	50	37	–
Intermediate Shaft Lower Pinch Bolt	26	19	–
Intermediate Shaft Upper Pinch Bolt	22	16	–
Crossmember-to-Return Line Bracket Bolt	8	6	71
Power Steering Gear Inlet-to-Pressure Line Fitting Nut	28	21	–
Power Steering Gear Outlet-to-Return Line Fitting Nut	28	21	–
Rack and Pinion Assembly Mounting Bolt	60	44	–
Rack and Pinion Assembly Mounting Nut	60	44	–
Rack and Pinion Assembly U-clamp Mounting Bolt	60	44	–
Rack and Pinion Assembly U-clamp Mounting Nut	60	44	–
Inner Tie Rod Adjusting Nut	64	47	–
Dash Seal Nut	6	4	53
Power Steering Gear Hydraulic Cylinder Pipe-to-Valve End Fitting Nut	18	13	–
Power Steering Gear Hydraulic Cylinder Pipe-to-Cylinder End Fitting Nut	27	20	–
Inner Tie Rod Nut	100	74	–
Adjuster Plug Locknut	12	9	106
Valve and Pinion Locknut	30	22	–

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 UAA2C330	**KM–507–B** **Ball Joint Remover**	 A104A008	**KM–J–22610** **Dust Boot Clamp Installer**
 C105C001	**J–42459** **Rack Guide Spring Cap Wrench**		

SECTION 6E

STEERING WHEEL AND COLUMN

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION

Caution: To ensure the energy-absorbing action of the steering column, it is important to use only the specified screws, bolts, and nuts, tightened to the specified torque.

In addition to the steering function, the steering column provides safety and security.

The energy-absorbing column is designed to compress in a front-end collision to lessen the chance of driver injury.

The ignition switch and the lock are mounted on the column, allowing the ignition and steering operations to be locked to inhibit theft of the car.

The column levers trigger the turn signals, the headlight beams, and the windshield washer and wipers.

A tilt steering column uses a spherical joint to allow the steering wheel to tilt up and down. This enables the driver to adjust the steering wheel to a comfortable position.

Notice: Apply a thin coat of lithium grease to all friction points when reassembling.

The column may be disassembled and reassembled easily.

IGNITION KEY REMINDER

The ignition key reminder alerts the driver that the key is still in the ignition when the driver attempts to exit the vehicle.

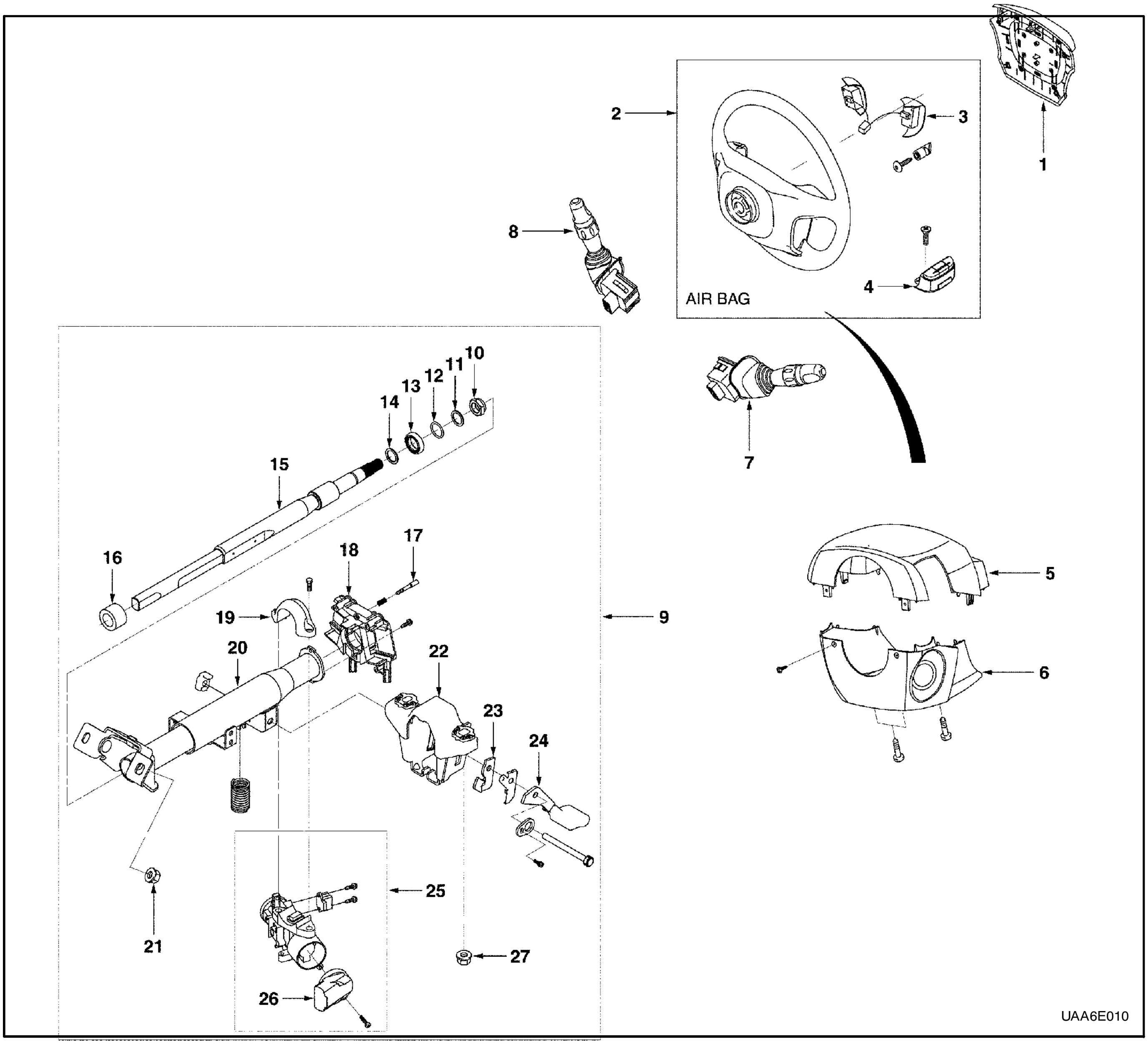
An internal switch in the ignition lock cylinder supplies battery voltage to the reminder chime module when all of the following conditions are true:

- The key is in the ignition switch.
- The ignition is OFF.
- The driver's door is open.

For information on removal and installation of the reminder chime module, refer to *Section 9E, Instrumentation/Driver Information.*

COMPONENT LOCATOR

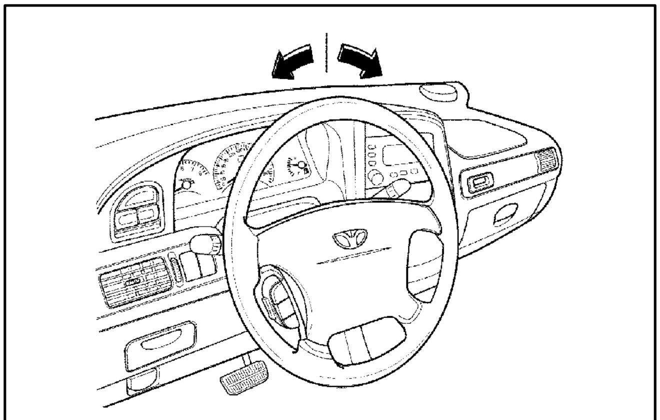
STEERING WHEEL & COLUMN



1 Horn Cap (Airbag Module)
2 Steering Wheel
3 Horn Switch
4 Audio Remote Control Switch
5 Steering Column Upper Cover
6 Steering Column Lower Cover
7 Turn Signal Switch
8 Wiper Switch
9 Steering Column Assembly
10 Steering Wheel Nut
11 Washer
12 Oil-Ring
13 Steering Column Shaft Upper Bearing
14 Snap Ring
15 Steering Column Shaft
16 Steering Column Shaft Lower Bearing
17 Horn Contact
18 Switch Housing
19 Lock Housing Clamp
20 Steering Column Jacket
21 Steering Column Lower Mounting Nut
22 Tilt Column Bracket
23 Lever Stop Bracket
24 Tilt Lever Handle
25 Steering Lock Housing Assembly
26 Ignition Switch
27 Steering Column Upper Mounting Nut

DIAGNOSTIC INFORMATION AND PROCEDURES

STEERING EFFORT INSPECTION



UAA6E020

Inspection Procedure

1. Place a vehicle on the paved flat ground with front wheels in a straight ahead position.
2. Start the engine and run it at 1,000rpm.
3. Using a scale, measure the steering effort in both directions.

Standard	Max. 30mm (1.1811 inch)

Notice : The difference in steering effort of left and right should be within 0.6kg.

STEERING COLUMN DIAGNOSIS

Lock System

Lock System Will Not Unlock

Check	Action
Check the lock cylinder for damage.	Replace the lock cylinder.
Check the ignition switch for lack of free movement.	Lubricate the ignition switch.
Check the steering column housing for binding or damage.	Replace the steering column as needed.

Lock System Will Not Lock

Check	Action
Check the lock cylinder for damage.	Replace the lock cylinder.
Check the ignition switch for a lack of free movement.	Lubricate the ignition switch.
Check the steering column housing for binding or damage.	Replace the steering column as needed.

High Lock Effort

Check	Action
Check the lock cylinder for damage.	Replace the lock cylinder.
Check the ignition switch for lack of free movement.	Lubricate the ignition switch.
Check for extreme misalignment of the housing to the cover.	Realign the cover on the housing. Replace the cover as needed.
Check for a bent ignition switch mounting bracket.	Replace the ignition switch mounting bracket.

Key Cannot Be Removed in the LOCK Position

Check	Action
Check to see that the ignition switch is set correctly.	Reset the ignition switch.
Check the lock cylinder for damage.	Replace the lock cylinder. Reset the ignition switch..

Column

Noise in the Column

Check	Action
Check the steering gear-to-column joints for improper installation.	Tighten the steering shaft universal joint pinch bolts. Replace the steering shaft joints as needed.
Check the steering shaft bearing for wear or damage.	Replace the steering column as needed.
Check the spherical joint for lack of lubrication.	Lubricate the spherical joint.
Check the steering shaft for lack of lubrication.	Lubricate the steering shaft bearing.
Check the shaft lock snap ring for improper seating.	Adjust the shaft lock snap ring. Replace the shaft lock snap ring as needed.

High Steering Shaft Effort

Check	Action
Check the steering shaft bearing for wear or damage.	Replace the steering column as needed.
Check for an improperly installed or deformed dust seal.	Replace the dust seal.
Check for a damaged upper or lower bearing.	Replace the steering column as needed.
Check the steering shaft universal joints for a lack of free movement.	Lubricate the steering shaft universal joints. Replace the steering shaft universal joints as needed.

Lash in the Steering Column

Check	Action
Check the steering column bracket mounting nuts for improper Installation Note.	Tighten the steering column bracket mounting bolts.
Check for broken weld nuts on the steering column jacket.	Replace the steering column as needed.

Loose Steering Wheel

Check	Action
Check for excessive clearance between the holes in the steering wheel support or the housing and the pivot-pin diameters.	Replace the pivot pins with pivot pins of the correct size.
Check to see if the upper bearing is seated correctly in the housing.	Replace the steering column as needed.

Noise When Tilting the Column

Check	Action
Check for worn upper tilt bumpers.	Replace the steering column as needed.
Check for tilt spring binding.	Adjust the tilt spring. Replace the steering column as needed.

Turn Signal/Dimmer Switch

Turn Signal Will Not Stay in the Turn Position

Check	Action
Check the turn signal switch for an improper installation.	Remove and inspect the turn signal switch. Reinstall the switch.
Check the canceling mechanism for broken or missing components.	Replace the canceling mechanism.
Check the turn signal switch housing for foreign material.	Remove any foreign material.

Turn Signal Will Not Cancel

Check	Action
Check the canceling mechanism for broken or missing components.	Replace the canceling mechanism.

Turn Signal/Dimmer Switch Difficult to Operate

Check	Action
Check the turn signal/dimmer switch and turn signal/dimmer switch lever for improper installation.	Remove and inspect the turn signal/dimmer switch and signal/dimmer switch lever. Reinstall the signal/dimmer switch and signal/dimmer switch lever.
Check the signal/dimmer switch housing for foreign material.	Remove any foreign material.

Turn Signal Will Not Indicate Lane Change

Check	Action
Check for a broken lane change pressure pad or a broken spring hanger.	Replace the lane change pressure pad or the spring hanger.
Check for improper functioning of the lane change spring.	Replace the lane change spring.
Check the turn signal switch for improper installation.	Replace the turn signal switch.

No Turn Signal Lights

Check	Action
Check for an inoperative turn signal flasher.	Replace the turn signal flasher.
Check for a faulty turn signal switch.	Replace the turn signal switch.
Check the chassis-to-column connector for an improper connection.	Reconnect the chassis-to-column connector.

Turn Indicator Lights On, but Not Flashing

Check	Action
Check for an inoperative turn signal flasher.	Replace the turn signal flasher.
Check for a faulty turn signal switch.	Replace the turn signal switch.
Check the chassis-to-column connector for an improper connection.	Reconnect the chassis-to-column connector.

Front or Rear Turn Signal Lights Not Flashing

Check	Action
Check for a faulty turn signal switch.	Replace the turn signal switch.
Check the chassis-to-column connector for an improper connection.	Reconnect the chassis-to-column connector.

Turn Signal Lights Flash Very Slowly

Check	Action
Check the chassis-to-column connector for an improper connection.	Reconnect the chassis-to-column connector.

Ignition Switch

Electrical System Will Not Function

Check	Action
Check the ignition switch for damage.	Replace the ignition switch.
Check the ignition switch for improper installation.	Remove and inspect the ignition switch. Reinstall the ignition switch.
Check the ignition switch electrical connector for improper installation.	Reconnect the ignition switch electrical connector. Replace the ignition switch electrical connector.

Ignition Switch Will Not Turn

Check	Action
Check the ignition switch for damage.	Replace the ignition switch.
Check the ignition switch for improper installation.	Remove and inspect the ignition switch. Reinstall the ignition switch.

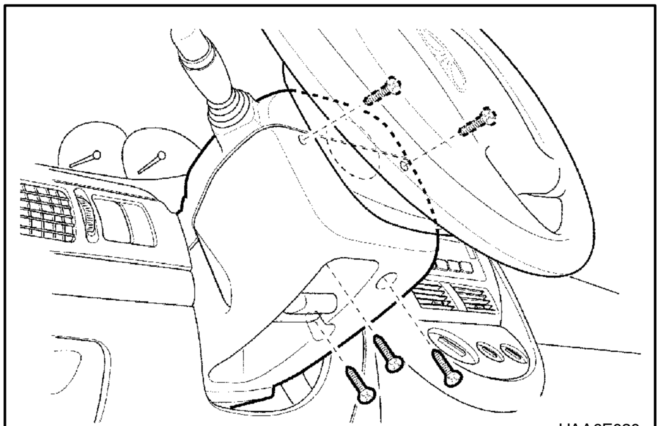
Wiper Control Switch Lever

Switch Inoperative: No LOW, HIGH, INTERMITTENT or WASH

Check	Action
Check the wiper switch for damage.	Replace the wiper control switch.
Check the wiper switch for improper installation.	Remove and inspect the wiper control switch. Reinstall the wiper control switch.
Check the cruise control switch for damage.	Replace the wiper control switch.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

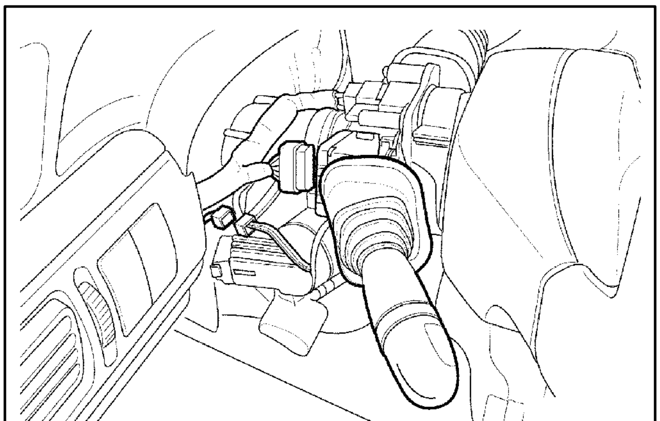


UAA6E030

TURN SIGNAL SWITCH AND LEVER/WIPER SWITCH AND LEVER

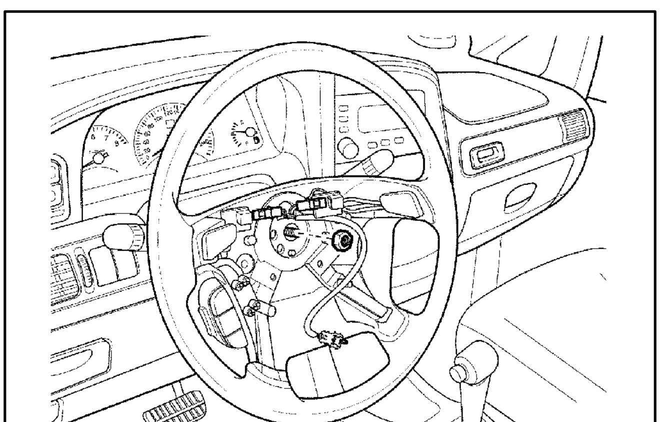
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the upper and the lower steering column cover screws.
3. Remove the upper and the lower steering column cover.



UAA6E040

4. Remove the turn signal switch and the wiper switch by pushing in on the tabs on the top and the bottom of the switch housing.
5. Disconnect the electrical connectors from the turn signal switch and the wiper switch.
6. Remove the turn signal switch and the wiper switch.



UAA6E050

STEERING WHEEL WITH SIR

Tools Required

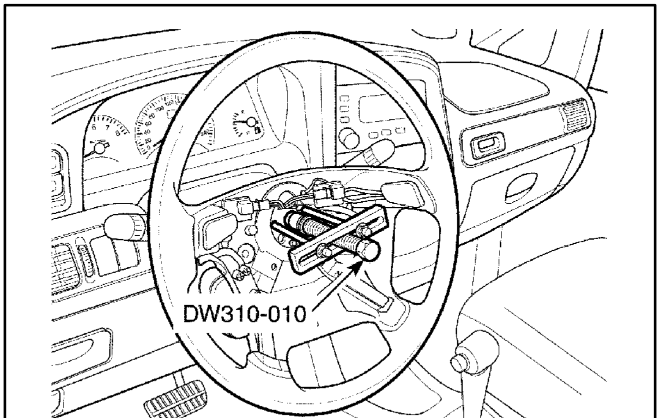
DW 310–010 Steering Wheel Puller

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the SIR module. Refer to *Section 8B, Supplemental Inflatable Restraints.*
3. Remove the steering wheel nut and the connectors.

Installation Notice

Tightening Torque	38 N·m (28 lb–ft)



UAA6E060

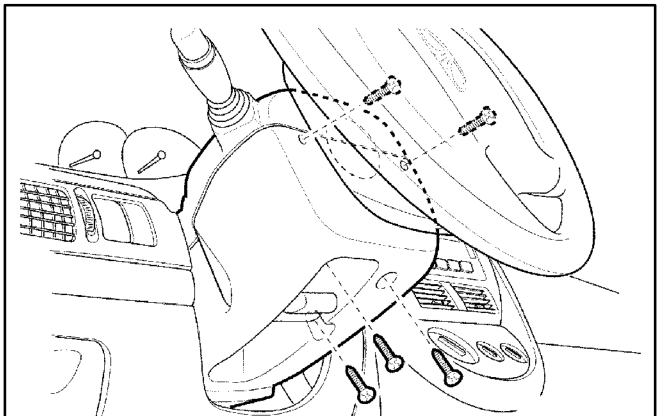
Removal Notice

- In order to install the steering wheel correctly, match mark the steering column shaft to the steering wheel.

4. Remove the steering wheel using the steering wheel puller DW 310–010.

Installation Notice

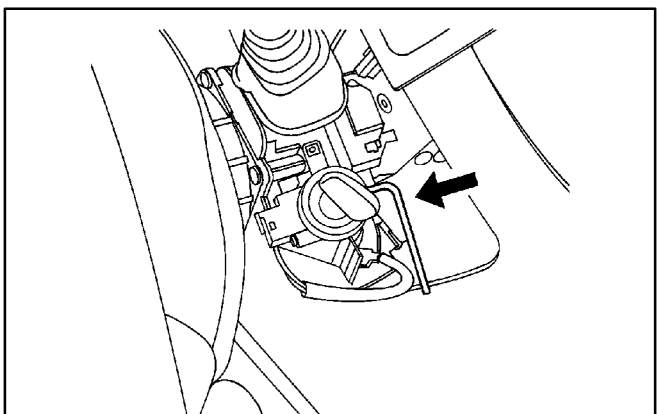
- Align the match marks on the steering wheel and the steering column shaft.


UAA6E030

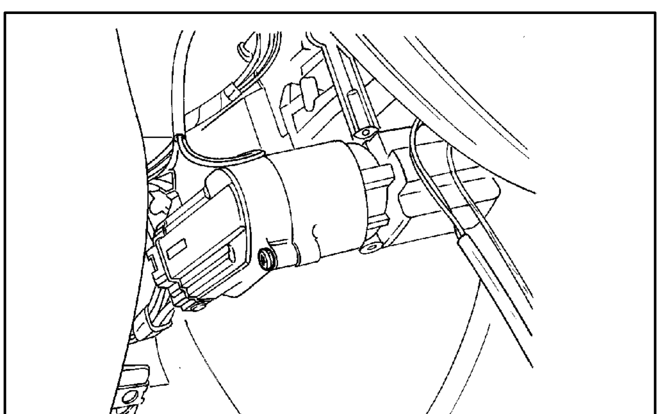
IGNITION LOCK CYLINDER AND SWITCH

Removal and Installation Procedure

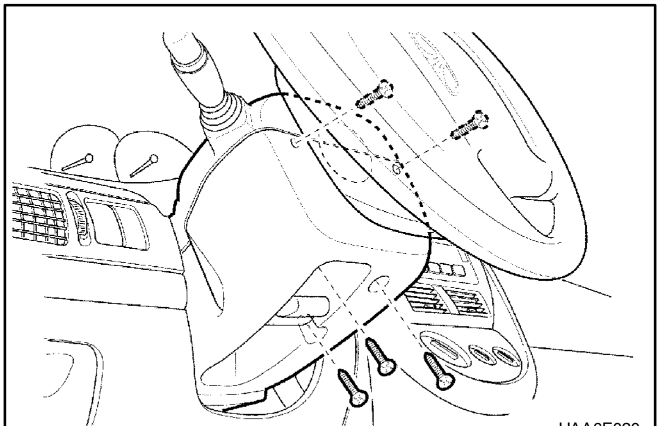
1. Disconnect the negative battery cable.
2. Remove the upper and the lower steering column cover by removing the screws.
3. On vehicles equipped with an immobilizer control unit, disconnect the electrical connector from the immobilizer control unit. Refer to *Section 9T, Immobilizer Anti-Theft System.*


B105E050

4. With the key in the ignition turned to the position designated ACC, remove the lock cylinder by pressing down the detent spring with a 2.5mm allen wrench or other suitable tool, and pulling the lock cylinder out of the switch cylinder housing.


A105E060

5. Remove the ignition switch retaining screw.
6. Disconnect the electrical connector from the ignition switch and remove the ignition switch.



UAA6E030

STEERING COLUMN

(Left–Hand Drive Shown, Right–Hand Drive Similar)

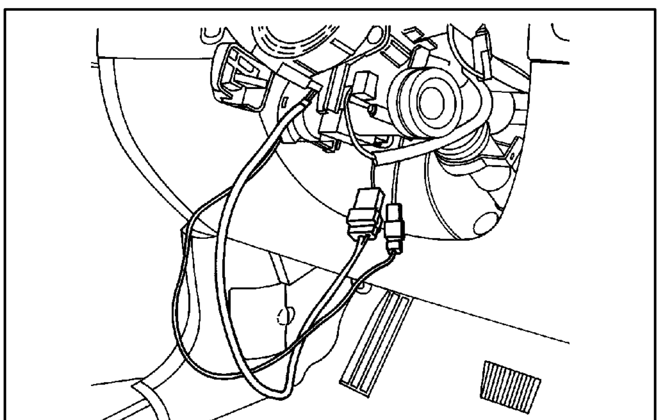
Important : Remove the steering column only if the following conditions exist:

- The steering column requires replacement.
- The steering and the ignition lock housing require replacement.
- Another operation requires the removal of the steering column.

Notice : The steering column is extremely susceptible to damage after it has been removed from the vehicle. Dropping the column assembly on its end or hammering the end of the steering shaft can collapse the steering shaft or loosen the plastic injections which maintain column rigidity. Leaning on the column can cause it to bend or deform. Any of the above damage can impair the column's collapsible design. If it is necessary to remove the steering wheel, use only the specified steering wheel puller.

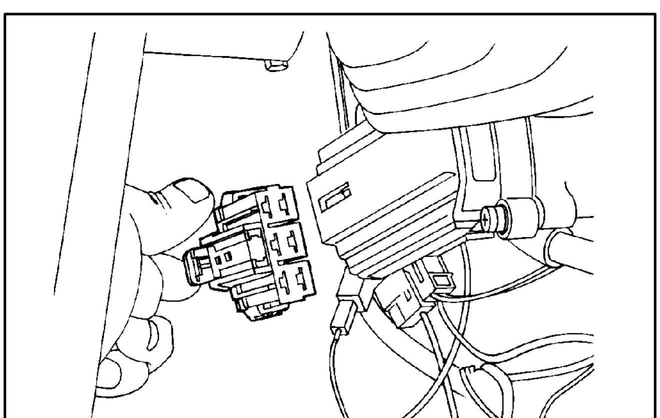
Removal and Installation Procedure

1. Disconnect the negative battery cable and let the vehicle sit for 1 minute to deactivate the airbag.
2. Remove the upper and the lower steering column cover by removing the screws.
3. Remove the lower instrument trim panel. Refer to *Section 9E, Instrumentation/Driver Information.*



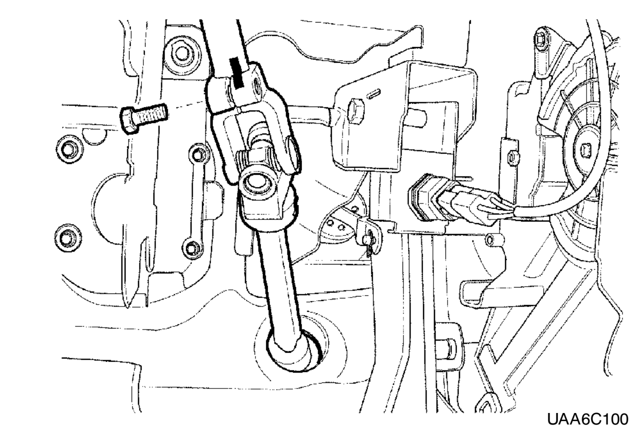
B105E063

4. Disconnect the airbag electrical connections.
5. Remove the immobilizer module, if equipped. Refer to *Section 9T, Immobilizer Anti-Theft system.*



C105E013

6. Disconnect the ignition switch electrical connection.



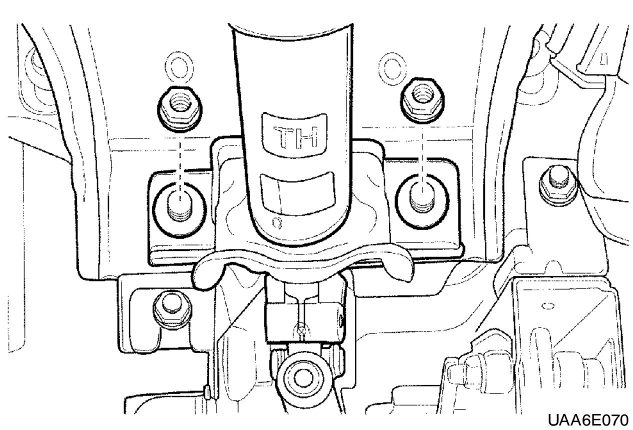
UAA6C100

7. Adjust the steering to the straight-ahead position.
8. Make a mark on the steering column shaft that lines up with a mark on the intermediate shaft upper universal joint.
9. Remove the pinch bolt from the intermediate shaft universal joint.

Installation Notice

Tightening Torque	22 N·m (16 lb–ft)

- When attaching the upper universal joint, the marks on the intermediate shaft and on the steering column shaft should line up.

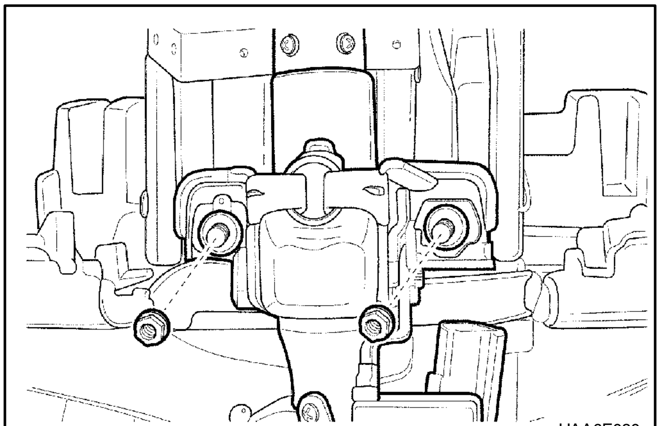


UAA6E070

10. Remove the steering column lower mounting nuts.

Installation Notice

Tightening Torque	23 N·m (17 lb–ft)



UAA6E080

11. Remove the steering column upper mounting nuts that hold the rear bracket of the steering column jacket assembly.
12. Guide the steering column assembly out of the steering shaft flange and carefully lay down the assembly.

Installation Notice

Tightening Torque	23 N·m (17 lb–ft)

- For proper installation of the steering column, be sure the steering wheel spokes are centered diagonally and pointed downward and the front wheels are positioned in the straight-ahead position.
- Provide support for the steering column assembly until the mounting nuts are fastened. Do not let the steering column assembly hang unsupported.

UNIT REPAIR

TILT STEERING COLUMN

The tilt steering column is not unit repair serviceable. If the tilt steering column is defective, you must replace the tilt steering column assembly.

SPECIFICATIONS

GENERAL SPECIFICATIONS

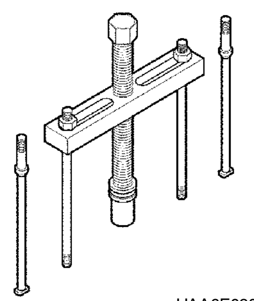
Application	Application		Unit	Description
Steering Wheel	Diameter	With Airbag	mm (inch)	385 (15.2)
		Without Airbag	mm (inch)	385 (15.2)
	Free Play		mm (inch)	Max. 30mm (1.1811 inch)

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Steering Wheel Nut	38	28	–
Intermediate Shaft Upper Pinch Bolt	22	16	–
Steering Column Lower Mounting Nut	23	17	–
Steering Column Upper Mounting Nut	23	17	–

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 UAA6E090	DW 310–010 Steering Wheel Puller

SECTION 7A

HEATING AND VENTILATION SYSTEM

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

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DESCRIPTION AND OPERATION

HEATING AND VENTILATION SYSTEM

The base heater system is designed to provide heating, ventilation, windshield defrosting, side wind defogging and rear seat area.

The heater and fan assembly blower regulates the airflow from the air inlet for further processing and distribution.

The heater core transfers the heat from the engine coolant to the inlet air.

The temperature door regulates the amount of the air that passes through the heater core. The temperature door also controls the temperature of the air by controlling mix of heated air with the ambient air.

The mode door regulates the flow and distribution of the processed air to the heater ducts and to the defroster ducts.

The console mounted heating and ventilation control panel contains three rotary control knobs, and two push control knobs, which operate as follows:

Rotary Temperature Control Knob

- Actuates by cable.
- Raise the temperature of the air entering the vehicle by turning to the right, or the red portion of the knob.

Rotary Blower Control Knob

- Turns ON to operate the blower motor at four speeds.
- Turns OFF to stop the blower.
- Operates completely independently from both the mode control knob and temperature control knob.
- Changes the fan speed in any mode and at any speed.

Rotary Mode Control Knob

- Actuates by cable.
- Regulates the air distribution between the windshield, the instrument panel, and the floor vents.

Intake Air Control Knob

- Operates by electricity.
- Switches between re-circulating the passenger compartment air and bringing outside air into the passenger compartment.
- Is normally in fresh air mode.
- Illuminates the indicator lamp when in the re-circulating mode.

Rear Windshield Defogger Push Knob

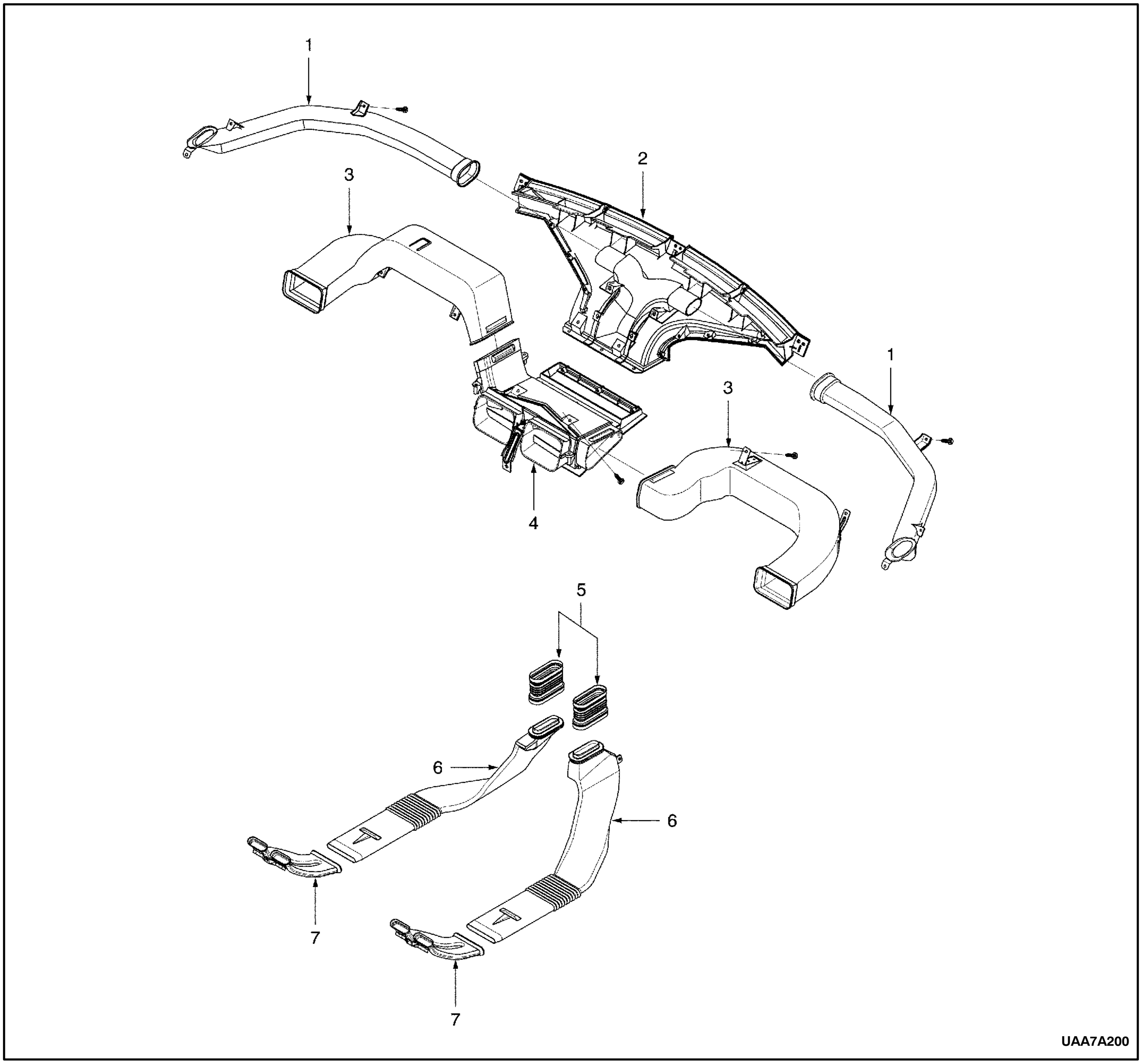
- Controls the rear windshield defogger.
- Turns on the windshield defogger when the push knob is pressed and the indicator lamp is illuminated.

Heater Core

The heater core heats the air before enters the vehicle. Engine coolant is circulated through the core to heat the outside air passing over the fins of the core. The core is functional at all times and may be used to temper conditioned air in the A/C mode as well as in the heat or the vent mode.

COMPONENT LOCATOR

AIRFLOW THROUGH VENTS WITH REAR HEATING DUCT



1 Side Ventilation Duct
2 Front Window Defroster Duct
3 Front Air Distribution Duct
4 Junction Block
5 Rear Heater Duct Connector
6 Rear Heater Duct
7 Rear Heater Duct Extention

DIAGNOSTIC INFORMATION AND PROCEDURES

HEATER SYSTEM

INSUFFICIENT HEATING OR DEFROSTING

Caution: The cooling system is pressurized when hot. Injury can result from removing the coolant reservoir cap before the engine is sufficiently cool.

Step	Action	Value(s)	Yes	No
1	Verify the customer's complaint. Are the customer's concerns verified?	–	Go to *Step 2*	System OK
2	1. Check the coolant level. 2. Check the serpentine accessory drive belt for tension or damage. 3. Check the coolant hoses for leaks or kinks. 4. Check the coolant reservoir cap. Refer to *Section 1D, Engine Cooling.* 5. Repair or replace any defected parts as needed. Is the repair complete?	–	System OK	Go to *Step 3*
3	1. Set the A/C switch OFF on the vehicles equipped with air conditioning. 2. Set the temperature control knob to full hot. 3. Set the blower motor switch on 4. 4. Turn the ignition ON. 5. Check for the airflow from the vent outlet. Is there a heavy airflow from the vent outlet?	–	Go to *Step* 4	Go to *Step 18*
4	Check for change in the airflow at various blower speeds. Does the blower speed increase as the switch is turned from 1 to 4?	–	Go to *Step 5*	Go to "Blower Electrical"
5	1. With the engine sufficiently cool, remove the coolant reservoir cap. 2. Set the blower motor switch on 4. 3. Set the temperature control knob to full hot. 4. Start the engine and idle the engine. 5. Watch for the flow of the coolant. Is the coolant flow visible?	–	Go to *Step 9*	Go to *Step 6*
6	Check the thermostat. Refer to *Section 1D, Engine Cooling.* Does the thermostat installed and seated properly?	–	Go to *Step 7*	Go to *Step 8*
7	Replace the thermostat. Refer to *Section 1D, Engine Cooling.* Is the repair complete?	–	System OK	–
8	Reinstall the thermostat. Is the repair complete?	–	System OK	–

Insufficient Heating or Defrosting (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Install the coolant reservoir cap. 2. With the ignition ON, allow the engine to warm up for about 20 minutes. Drive the vehicle at 48 km/h (30 mph). 3. Use a thermometer to measure the ambient air temperature and the discharge air temperature at the heater outlet. Does the heater output meet the minimum value given?	Refer to *"Temperature Specification"*	Go to *Step 10*	Go to *Step 11*
10	1. Check the vehicle for cold air leaks at the following locations: • Dash. • Heater cases. • Vents. 2. Check under the seat for obstructions. 3. Repair any leaks or obstructions. Are the repairs complete?	–	System OK	–
11	1. Turn the ignition OFF. 2. Turn the temperature control knob to full cold, then rapidly to full hot. 3. Listen for a second of the end of travel range of the control knob Does the door slam?	–	Go to *Step 13*	Go to *Step 12*
12	1. Check the following aspects of the temperature door: • Travel • Cables • Linkage 2. Verify the accuracy of the temperature controls at full hot. 3. Verify the accuracy of the temperature controls at full cold. Is the repair complete?	–	System OK	–
13	1. Set the temperature door to full hot. 2. Start the vehicle 3. Check the temperature of the heater inlet hose and the heater outlet hose by feel. The air temperature around the hoses should be at least 29°C (84°F). Is the heater inlet hose hot and heater outlet hose warm?	–	Go to *Step 19*	Go to *Step 14*
14	Inspect heater hoses for proper installation. Are heater hoses reversed?	–	Go to *Step 15*	Go to *Step 16*
15	Reinstall the heater hoses properly. Is the repair complete?	–	System OK	Go to *Step 17*
16	1. Back flushes the heater core. 2. Drain the cooling system. 3. Replace the coolant. 4. Warm the engine to an average operating temperature. 5. Feel the heater inlet hose and outlet hose. Are the heater inlet hose hot and the heater outlet hose warm?	–	System OK	Go to *Step 17*

Insufficient Heating or Defrosting (Cont'd)

Step	Action	Value(s)	Yes	No
17	Replace heater core. Is the repair complete?	–	System OK	–
18	Recheck the system using the "Control setting/ Correct Results" tests. Refer to *"Improper air Delivery or No Mode Shift"* in this section. Is the repair complete?	–	System OK	Go to *Step 19*
19	Check for airflow from the defroster or the vent outlets. Is there high airflow form the defroster or vent outlets?	–	Go to *Step 20*	Go to *Step 21*
20	Check the heater door at the floor and the vent door to get proper airflow, verify proper operation, and repair as required. Is the repair complete?	–	System OK	–
21	Push the defroster knob. Is the defroster airflow OK?	–	Go to *Step 22*	Go to *Step 23*
22	1. Remove the heater outlet and check for obstructions. 2. Remove any obstructions in the heater outlet. Is the repair complete?	–	System OK	–
23	Check for obstructions in the system at blower inlet and the air filter, if the vehicle equipped with one. Are there any obstructions?	–	Go to *Step 24*	Go to *Step 25*
24	Remove the obstructions in the system at the blower inlet or replace a clogged filter. Are the repairs complete?	–	System OK	–
25	1. Set the blower on 4. 2. Slide the temperature control knob from full hot to full cold. 3. Listen for an airflow change. Does the airflow change?	–	Go to *Step 26*	Go to *Step 27*
26	1. Check the following aspects of the temperature door: • Travel. • Cable. • Linkage. • Control 2. Verify the accuracy of the temperature controls at full hot. 3. Verify the accuracy of the temperature controls at full cold. Is the repair complete?	–	Go to *Step 1*	–
27	1. Check the system for any obstruction between the blower and the system outlets. 2. Remove any obstructions. Is the repair complete?	–	Go to *Step 1*	–

BLOWER ELECTRICAL

Refer to “Non A/C Diagrams” for electrical schematic Diagram of the circuits described in this procedure.

Step	Action	Value(s)	Yes	No
1	Verify the customer’s complaint. Are the customer’s concerns verified?	–	Go to *Step 2*	System OK
2	Does the blower run at any speed?	–	Go to *Step 12*	Go to *Step 3*
3	1. Disconnect the power connector from the blower motor under the dashboard on the passenger side of the vehicle. 2. Turn the ignition ON. 3. Turn the blower ON. 4. Test the voltage on the connector. The terminal connected to the DK BLU/WHT wire is positive and the terminal connected to the BLK wire is negative. Is the voltage within the specified range?	11-14 V	Go to *Step 4*	Go to *Step 5*
4	Replace the blower motor. Is the repair complete?	–	System OK	–
5	Check fuse F20 in the I/P fuse block. Is the fuse blown?	–	Go to *Step 6*	Go to *Step 7*
6	1. Turn the ignition ON. 2. Use a short detector to locate the following possible short: • From the fuse F20 to terminal B3 of blower speed switch. • From the blower speed switch to blower resister block. • From the blower resister block to blower motor. • From the blower switch to blower high relay. 3. Repair any short. 4. Replace any blown fuse. Is the repair complete?	–	System OK	–
7	1. Turn the ignition OFF. 2. Measure the resistance between following terminal 1 of blower motor and body. Does the resistance within specified value?	$\approx 0\ \Omega$	Go to *Step 9*	Go to *Step 8*
8	Repair the open circuit. Is the repair complete?	–	System OK	–
9	Measure the resistance between terminal 3 of blower resister and terminal 2 of blower motor. Is the resistance within specified value?	$\approx 0\ \Omega$	Go to *Step 11*	Go to *Step 10*
10	Repair the open circuit. Is the repair complete?	–	System OK	–

Blower Electrical (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Using ohmmeter, check continuity between terminal B3 of blower speed switch and following terminals. ● At blower switch position 1, terminal 1 of blower resister ● At blower switch position 2, terminal 2 of blower resister ● At blower switch position 3, terminal 4 of blower resister ● At blower switch position 4, terminal 86 of the blower high relay. 2. Repair or replace open circuit, blower switch, or blower resister. Is the repair complete?	–	System OK	–
12	Does the blower run except blower switch position 4?	–	Go to *Step 13*	Go to *Step 14*
13	1. Using ohmmeter, check continuity between terminal B3 of blower speed switch and following terminals. ● At blower switch position 1, terminal 1 of blower resister ● At blower switch position 2, terminal 2 of blower resister ● At blower switch position 3, terminal 4 of blower resister 2. Repair or replace open circuit, blower switch, or blower resister. Is the repair complete?	–	System OK	–
14	Check fuse EF4 in the engine fuse block. Is the fuse blown?	–	Go to *Step 15*	Go to *Step 16*
15	1. Turn the ignition ON. 2. Use a short detector to locate the following possible short: ● From the fuse EF4 to terminal 87 of blower high relay. ● From the terminal 30 of blower high relay to terminal 2 of blower motor. 3. Repair any short. 4. Replace any blown fuse. Is the repair complete?	–	System OK	–
16	Using ohmmeter, measure the resistance between following terminals: ● Terminal A5 of blower switch and terminal 86 of blower high relay. ● Terminal 30 of blower high relay and terminal 2 of blower motor. ● Terminal 85 of blower high relay to ground G102. Is the measurement within the specified value?	≈ 0 Ω	Go to *Step 18*	Go to *Step 17*
17	Repair open circuit. Is the repair complete?	–	System OK	–
18	Replace the blower high relay. Is the repair complete?	–	System OK	–

IMPROPER AIR DELIVERY OR NO MODE SHIFT

This procedure provides a test of all functions of the heater/defroster unit.

1. Warm up the vehicle.
2. Keep the engine running.
3. Perform the tests outlined in the table below and look for the results indicated.

CONTROL SETTINGS			CORRECT RESULTS				
MODE KNOB	**TEMP. CONTROL**	**BLOWER MOTOR SWITCH**	**BLOWER SPEED**	**POWER VENT OUTLET**	**FLOOR OUTLET**	**DEFROST OUTLET**	**SIDE WINDOW OUTLET**
Vent	Cold	Off	Off	No Airflow	No Airflow	No Airflow	No Airflow
Vent	Cold	4	High	Ambient Airflow	No Airflow	No Airflow	No Airflow
Floor	Cold to Hot	4	High	No Airflow	Cold to Hot Airflow	No Airflow	No Airflow
Defroster	Cold to Hot	4	High	No Airflow	No Airflow	Cold to Hot Airflow	Minimum Cold to Hot Airflow

If any of these settings does not procedure the correct results, perform the following diagnostic procedure. Refer to “Non A/C Diagrams” for electrical schematic Diagram of the circuits described in this procedure.

Improper Air Delivery or No Mode Shift

Step	Action	Value(s)	Yes	No
1	Verify the customer’s complaint. Are the customer’s concerns verified?	–	Go to *Step 2*	System OK
2	Examine the affected door in the unit for proper cable attachment. ● Check the actuator connection to the door. ● Check that the cable hose is properly connected. Is the cable connected properly?	–	Go to *Step 4*	Go to *Step 3*
3	Repair as necessary. Is the repair complete?	–	System OK	–
4	1. Disconnect the cable at the door. 2. Check the range of the door travel and the effort required to move it. Does the door move freely through its entire range of the travel so that it can close at both ends of the range?	–	Go to *Step 5*	Go to *Step 3*
5	Check the travel of the cable by turning the control knob. Is the cable travel OK?	–	Go to *Step 6*	Go to *Step 7*
6	1. Reinstall the cable. 2. Recheck the system using “Control settings/Correct Results” test in this procedure. Does the system perform properly?	–	System OK	Go to *Step 9*
7	1. Check the cable attachment at the control. 2. Check for broken control. Is there a problem with the cable attachment or the control?	–	Go to *Step 8*	Go to *Step 9*

Improper Air Delivery or No Mode Shift (Cont'd)

Step	Action	Value(s)	Yes	No
8	Repair the cable attachment or control as necessary. Is the repair complete?	–	System OK	Go to *Step 9*
9	Recheck the system using "Control settings/Correct Results" test in this procedure. Is the repair complete?	–	System OK	Go to *Step 10*
10	Check the airflow from the defroster or the vent outlets. Is there high airflow from the defroster or the vent outlets?	–	Go to *Step 11*	Go to *Step 12*
11	Adjust the heater door at the floor and the vent door to get proper airflow. Is the repair complete?	–	System OK	–
12	Switch the mode knob to defrost. Is the defroster airflow OK?	–	Go to *Step 13*	Go to *Step 14*
13	1. Remove the heater outlet. 2. Check the heater outlet for obstructions. 3. Remove any obstructions in the heater outlet. Is the repair complete?	–	System OK	–
14	Check the blower speeds for change in the airflow. Does the blower speed increase as the control is turned from 1 to 4?	–	Go to *Step 15*	Go to "Blower Electrical"
15	1. Check for obstructions in the system at the blower inlet. 2. Remove any obstructions at blower inlet. Is the repair complete?	–	System OK	Go to *Step 16*
16	1. Set the blower on 4. 2. Rotate the temperature control from hot to full cold. 3. Listen for an airflow change. Does the airflow change?	–	Go to *Step 17*	Go to *Step 18*
17	1. Check the temperature door adjustments, the cables, the linkage, and the control. 2. Adjust the temperature control to full hot. Is the repair complete?	–	System OK	–
18	1. Check the system for any obstruction between the blower and the system outlets. 2. Remove any obstruction between the blower and the system outlets. Is the repair complete?	–	System OK	–

TOO MUCH HEAT

Step	Action	Value(s)	Yes	No
1	Verify the customer's complaint. Are the customer's concerns verified?	–	Go to *Step 2*	System OK
2	Set the mode switch to the floor position. Is there too much heat when the mode switch is in the floor position?	–	Go to *Step 3*	Go to *Step 9*
3	Check for the defroster bleed. Is there objectionable defroster bleed?	–	Go to *Step 4*	Go to *Step 5*
4	1. Check the door travel, the cables, the controls, and the linkage for the heater and the defroster. 2. Adjuster or repair, as required. Is the repair complete?	–	System OK	–
5	1. In vehicles equipped with air conditioning (A/C), set the A/C switch OFF. 2. Set the blower speed to 4. 3. Set the temperature control knob to full hot. 4. Turn the ignition switch to ON. 5. Start the engine. 6. Check for airflow from the floor outlets. 7. Check the floor outlet attachment. Is the airflow high?	–	Go to *Step 6*	Go to *Step 8*
6	Check for a change in airflow at different blower speeds. Does the airflow change as the setting for the blower speed switch is changed?	–	Go to *Step 7*	Go to "Blower Electrical"
7	1. Check the temperature door travel, the cable, and the linkage. 2. Adjust to full hot. 3. Check for full hot. Is the repair complete?	–	System OK	–
8	Adjust or repair the floor/defroster and/or the vent/floor mode. Is the repair complete?	–	System OK	–
9	Set the mode switch to the vent position. Is the problem objectionable bleed?	–	Go to *Step 10*	Go to *Step 15*
10	1. Check the system case for leaks. 2. Check the floor outlet attachment. Are there any problems?	–	Go to *Step 11*	Go to *Step 12*
11	Repair the system case or the floor outlet attachment as required. Is the repair complete?	–	System OK	Go to *Step 12*
12	1. Turn the ignition switch OFF. 2. Turn the temperature control lever to full hot, then rapidly to full cold. Did you hear the door slam just before you reached the end of the control travel?	–	Go to *Step 13*	Go to *Step 14*
13	Adjust the vent door to vent mode. Is the repair complete?	–	System OK	–

Too Much Heat (Cont'd)

Step	Action	Value(s)	Yes	No
14	1. Check the temperature door travel, the cables, and the linkage. 2. Verify the temperature door goes to full cold. 3. Check the temperature door for full hot. Is the temperature door travel correct?	–	System OK	–
15	1. Set the intake air control to fresh air (indicator lamp OFF). 2. Set the temperature control to full cold. 3. Start the vehicle and allow the engine to warm up. 4. Measure the air temperature at the blower inlet, or cowl, and at the vent air outlet inside the vehicle. Is the outlet air more than 5°C (41°F) warmer than the inlet air?	–	Go to *Step 16*	System OK
16	1. Check for hot air leaks from the engine compartment to the blower inlet. 2. Repair as needed. Is the repair complete?	–	System OK	–

CONTROLS

Step	Action	Value(s)	Yes	No
1	Verify the customer's complaint. Are the customer's concerns verified?	–	Go to *Step 2*	System OK
2	Is excessive effort required to move the control?	–	Go to *Step 5*	Go to *Step 3*
3	Does a door move too easily on high blower setting?	–	Go to *Step 4*	System OK
4	1. Replace the control cable. 2. Add a loop to the cable routing to increase the effort required to move a control. 3. Check for instrument panel interference with new cable routing. Does the control operate properly?	–	System OK	Go to *Step 5*
5	Check the cable for improper routing, kinks, wiring interference, or other instrument panel interference. Is any cable problem found?	–	Go to *Step 6*	Go to *Step 7*
6	Repair as needed. Is the repair complete?	–	System OK	–
7	1. Remove the cable from any door that binds on the cable. 2. Cycle the door manually. 3. Check for door binding. Is there any door binding?	–	Go to *Step 8*	Go to *Step 11*
8	Check the door seal for proper installation. Is the door seal OK?	–	Go to *Step 9*	Go to *Step 10*
9	1. Check a binding door for shaft aligN·ment, a bent shaft, a bent door, or a warped case. 2. Repair as need. Is the repair complete?	–	System OK	–
10	Repair the door seal, as needed. Is the repair complete?	–	System OK	–
11	Check the control binding. Does the control bind?	–	Go to *Step 13*	Go to *Step 12*
12	1. Reinstall the cable to the door. 2. Check the clearance for the cable to dash compartments. 3. Repair any interference. Is the repair complete?	–	System OK	–
13	1. Remove the cable from the control. 2. Check the control for binding. Does the control bind?	–	Go to *Step 14*	Go to *Step 15*
14	Replace the control. Is the repair complete?	–	System OK	–
15	Replace the cable. Is the repair complete?	–	System OK	–

BLOWER NOISE

Step	Action	Value(s)	Yes	No
1	Verify the customer's complaint. Are the customer's concerns verified?	–	Go to *Step 2*	System OK
2	1. Sit inside the vehicle. 2. Close the doors and windows. 3. Turn the ignition ON. 4. Start the engine. 5. Set the temperature to full cold. 6. Cycle through the blower speeds, the modes, and the temperature settings in order to find the noise. Is the blower noise constant at high blower speeds or in other modes?	–	Go to *Step 11*	Go to *Step 3*
3	Check for vibrations from the blower motor and fan assembly at each blower speed by feeling the blower motor housing. Did you find excessive vibration?	–	Go to *Step 6*	Go to *Step 4*
4	1. Remove the blower motor and fan assembly. Refer to "Blower Motor" in this section. 2. Check for foreign materials at the opening of the blower inlet. Did you find any foreign materials at the blower inlet?	–	Go to *Step 5*	Go to *Step 6*
5	Remove all foreign materials. Is the repair complete?	–	System OK	Go to *Step* 6
6	1. Examine the blower fan for wear spots, cracked blades, a cracked hub, a loose fan retaining nuts, or bad aligN·ment. 2. Examine the blower case for sports. Did you find any problem?	–	Go to *Step 7*	Go to *Step 9*
7	Repair as required. Is the repair complete?	–	System OK	Go to *Step 8*
8	Replace the motor and fan assembly. Is the repair complete?	–	System OK	Go to *Step 9*
9	If the noise is a click/tick or whine, replace the motor. Is the repair complete?	–	System OK	Go to *Step 10*
10	Reinstall the original motor. Is the problem still present?	–	Go to *Step 11*	System OK
11	1. Set the blower speed on 4. 2. Check full hot to full cold temperature positions in the defroster, floor, and vent modes. Is the noise present in the defrost mode only?	–	Go to *Step 12*	Go to *Step 13*
12	1. Check the ducts for obstructions for foreign materials. 2. Remove any obstructions or foreign materials. 3. Check floor /defroster door seals. 4. Repair or replace as needed. Is the repair complete?	–	System OK	–
13	Is the noise present in the floor mode only?	–	Go to *Step 12*	Go to *Step 14*

Blower Noise (Cont'd)

Step	Action	Value(s)	Yes	No
14	Is the noise present in the vent mode only?	–	Go to *Step 15*	Go to *Step 16*
15	1. Check the ducts for obstruction or foreign materials. 2. Remove any obstructions or foreign materials. 3. Check the vent door seals. 4. Repair or replace as needed. Is the repair complete?	–	System OK	–
16	Is the noise present in all modes, but not all temperature positions?	–	Go to *Step 17*	Go to *Step 18*
17	1. Check the temperature door seals. 2. Repair or replace as needed. Is the repair complete?	–	System OK	–
18	1. Check the system for obstructions for foreign materials between the fan and the temperature door. 2. Repair or replace as needed. Is the repair complete?	–	System OK	Go to *Step 2*

REPAIR INSTRUCTIONS

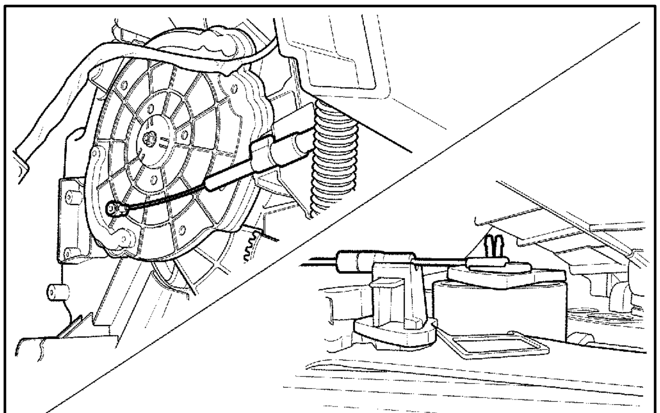
ON–VEHICLE SERVICE

MODE AND TEMPERATURE CONTROL CABLE ADJUSTMENT

Because the cables and the cable housing have fixed lengths, it is impossible to make a mode cable and temperature cable adjustment.

The heater/air distributor case linkage also cannot be adjusted.

If a malfunction is suspected, verify the proper operation of the controller and the mechanical doors for heater/air distributor case assembly.



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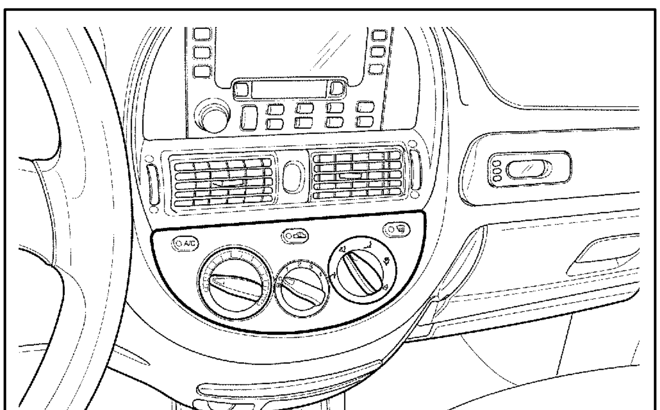
CONTROLLER ASSEMBLY AND CONTROL CABLES

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Slide the cable eyelet off the post on the mode door lever (under the left side of I/P) and unsnap the clip that securing mode door control cable.
3. Slide the cable eyelet off the post on the temperature door lever (under the right side of I/P) and unsnap the clip that securing temperature control cable.



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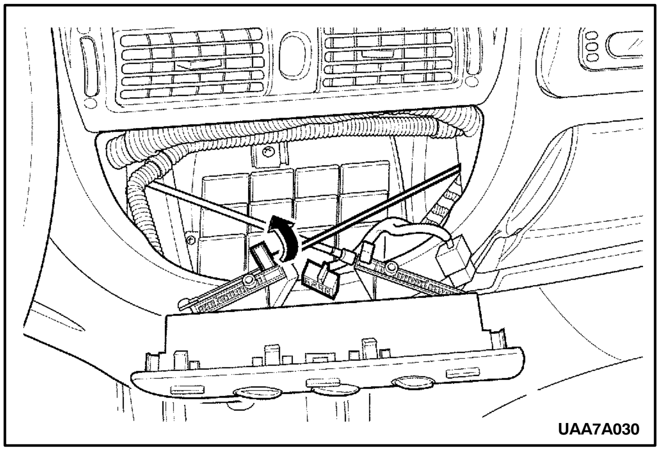
4. Remove the heating and ventilation control (HVC) controller from instrument panel (I/P) by pushing back side of the controller.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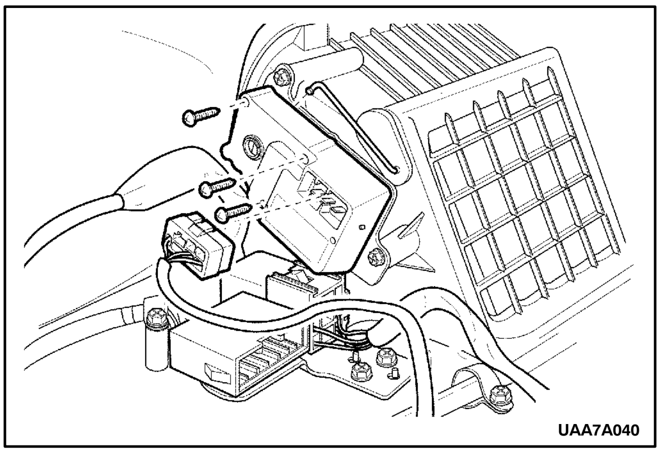
5. Disconnect the electrical connectors.
6. Remove the temperature control cable and mode control cable.
7. Remove the controller assembly.
8. Remove and replace temperature control cable or mode control cable as required.
9. Installation should follow the removal procedure in the reverse order.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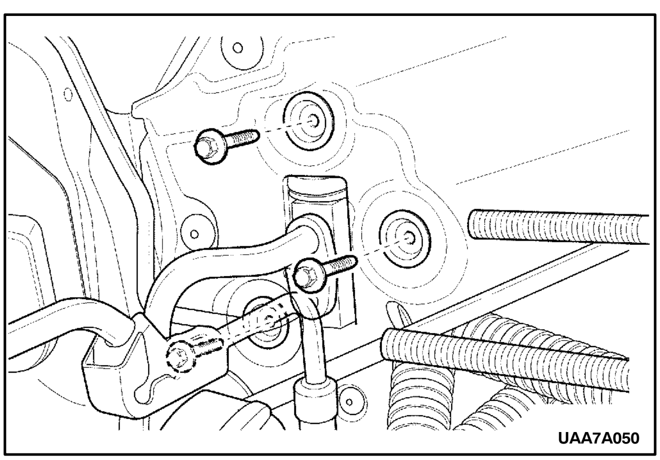
INTAKE AIR DOOR ACTUATOR

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the glove box. Refer to *Section 9E, Instrumentation/Driver Information.*
3. Remove passenger airbag if equipped.

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioner for one minute after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

4. Disconnect the connector to intake air control door actuator.
5. Remove three screws that securing intake air control door actuator to blower unit.
6. Remove the intake air control door actuator by gently snapping the actuator.
7. Installation should follow the removal procedure in the reverse order.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HEATER/AIR DISTRIBUTOR CASE ASSEMBLY

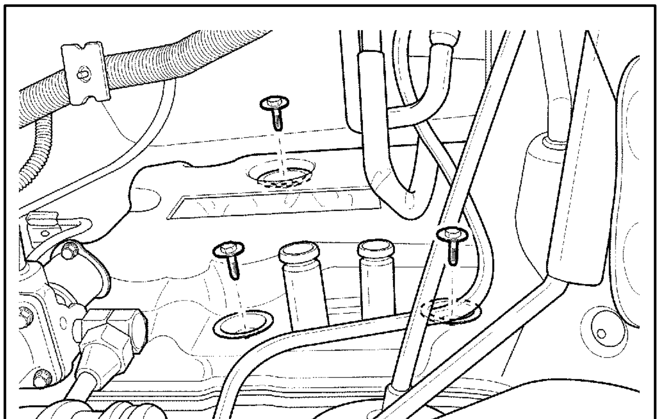
Removal and Installation Procedures

1. Disconnect the negative battery cable.
2. Drain the cooling system. Refer to *Section 1D, Engine Cooling.*
3. Remove the inlet and outlet heater hoses from the firewall.
4. Recover the refrigerant if air conditioning (A/C) system is equipped. Refer to *Section 7B Manual Control Heating, Ventilation, and Air Conditioning System.*

5. Remove high pressure pipe and suction hose on the fire wall, if A/C system is equipped.
6. Remove upper four bolts that securing heater/air distributor case assembly.

Installation Notice

Tightening Torque	4 N·m (35 lb–in)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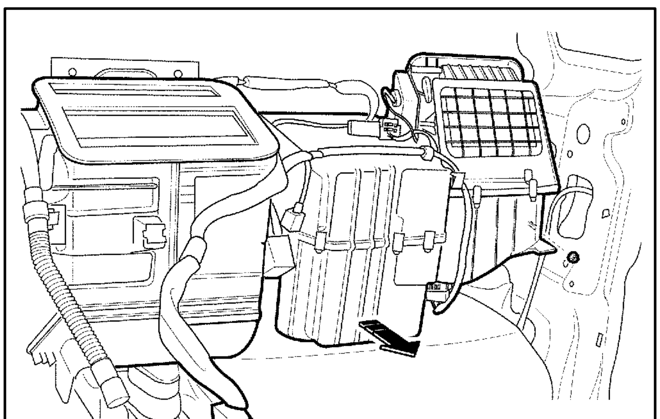
7. Lift the vehicle and remove lower two bolts that securing heater/air distributor case assembly.

Installation Notice

Tightening Torque	4 N·m (35 lb–in)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8. Remove the instrument panel carrier assembly. Refer to *Section 9E, Instrumentation/Driver Information.*
9. Remove one nut that securing heat/air distribution case.

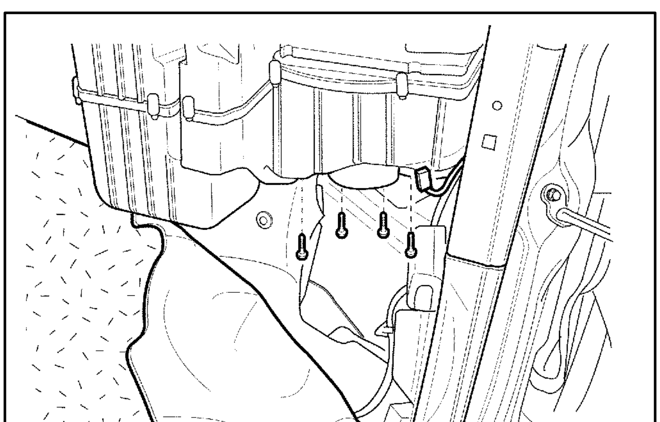
Installation Notice

Tightening Torque	4 N·m (35 lb–in)

10. Remove the heater/air distribution case assembly.
11. Installation should follow the removal procedure in the reverse order.
12. Refill the coolant and refrigerant (if equipped A/C system).

BLOWER MOTOR

Removal and Installation Procedures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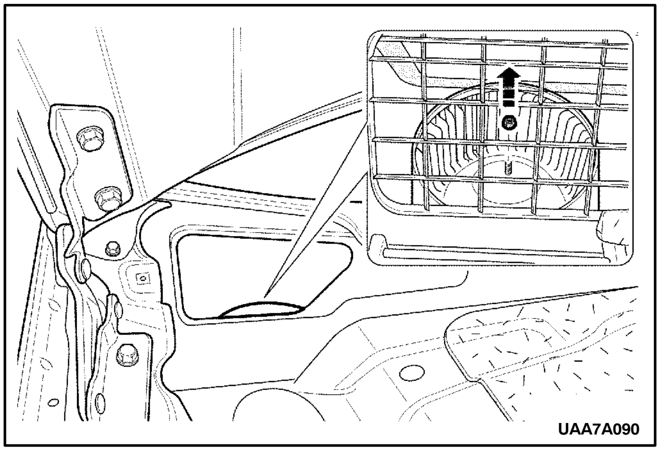
1. Disconnect the negative battery cable.
2. Remove the glove box. Refer to *Section 9E, Instrumentation/Driver Information.*
3. Disconnect the blower motor electrical connector.
4. Remove four screws that secure the motor to the heater/air distributor case. Do not remove the blower motor at this step.



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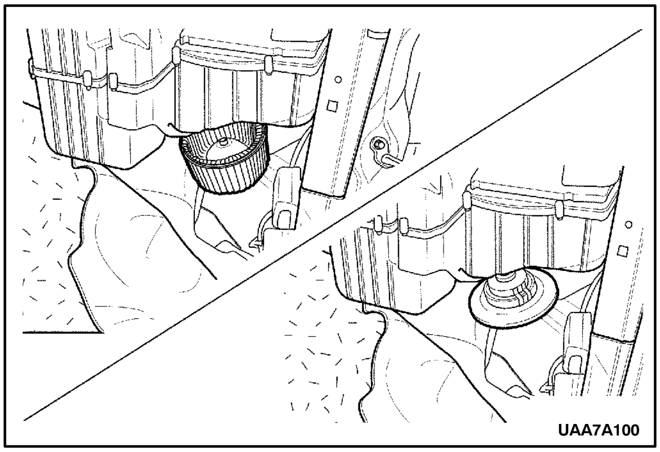
5. Remove the cowl vent grill. Refer to *Section 9R, Body Front End.*
6. Have an assistant to fix the blower fan at inside, remove the nut that securing the fan to blower motor.

Installation Notice

Tightening Torque	2 N·m(18 lb–in)

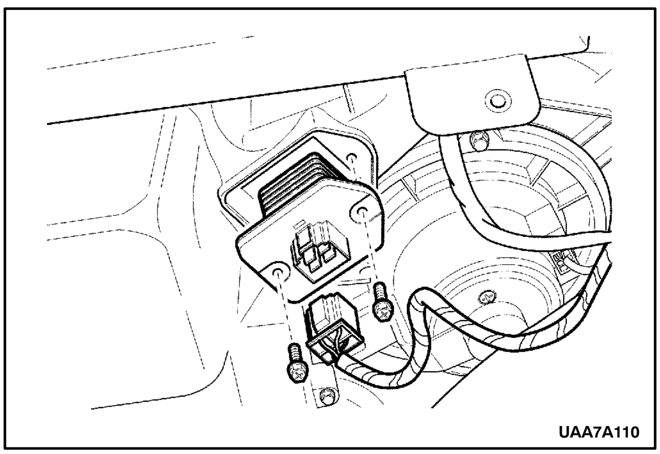


UAA7A100

7. Holding the blower fan from outside, remove the blower motor.
8. Remove the blower motor fan by reclining slightly.
9. Installation should follow the removal procedure in the reverse order.

Installation Notice

After install the blower motor confirm that the blower motor operates properly.

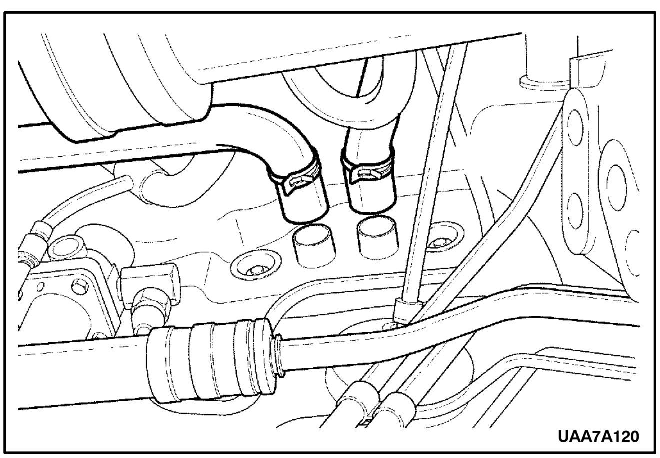


UAA7A110

BLOWER RESISTOR

Removal and Installation Procedures

1. Disconnect the negative battery cable.
2. Remove the glove box lower cover.
3. Disconnect the electrical connector at the resistor.
4. Remove two screws and remove the blower resistor.
5. Installation should follow the removal procedure in the reverse order.

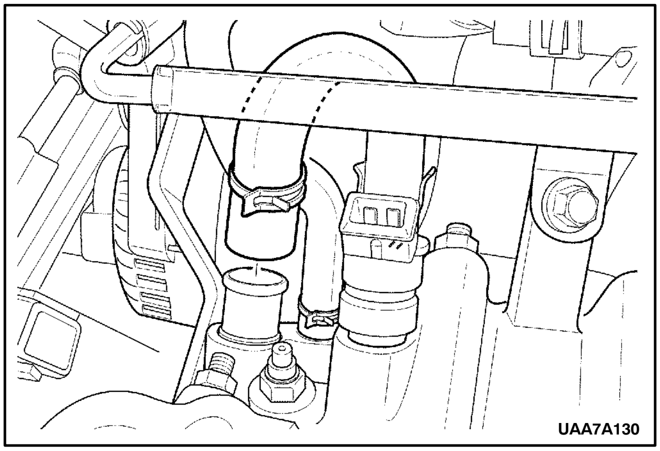


UAA7A120

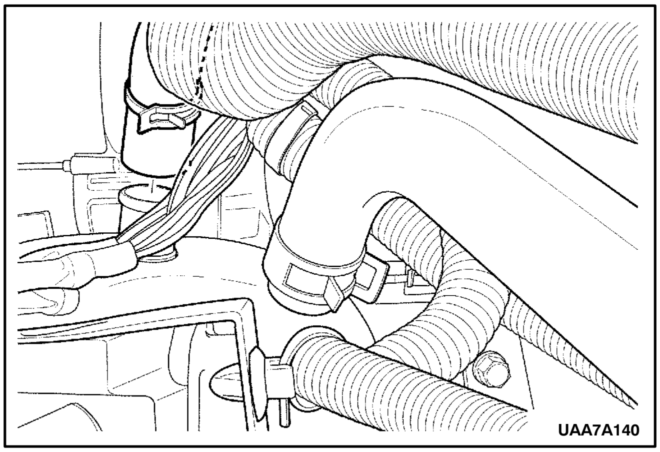
HEATER HOSES

Removal and Installation Procedures

1. Partially drain the cooling system. Refer to *Section 1D, Engine Cooling.*
2. Lift he vehicle.
3. Slide rearward the heater hose clamps at the firewall.
4. Gently twist the hose from the left to right and back again to loosen the bond between the hose and the tube.
5. Remove the end of the hose from the tube.



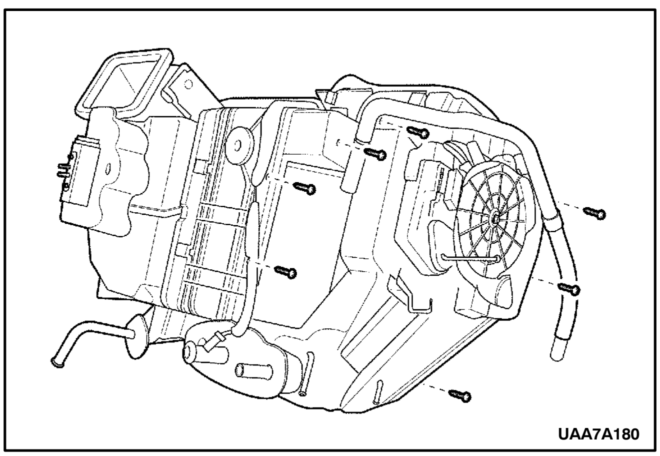
6. Remove the clamp and slide rearward the inlet heater hose at the engine block.
7. Remove the inlet heater hose from the vehicle.



8. Remove the clamp and slide rearward the outlet heater hose.
9. Remove outlet heater hose from the vehicle.
10. Installation should follow the removal procedure in the reverse order.

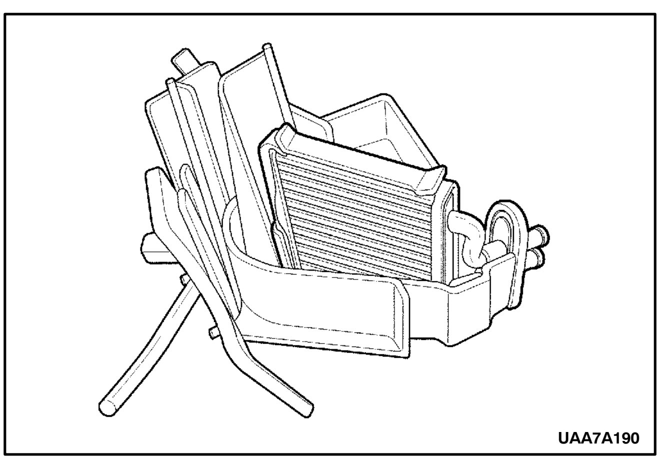
HEATER CORE

Removal and Installation Procedures

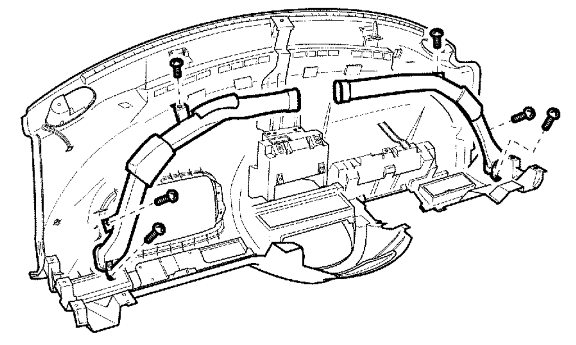


1. Disconnect the negative battery cable.
2. Remove the heater/air distribution case from the vehicle. Refer to “Heater/Air Distribution Case Assembly” in this section.
3. Remove the air mix door motor connector and wiring.
4. Remove lower heater module cover and one clip inside.
5. Remove seven screws and sealing sponges.

Notice: Be careful while removing the sealing materials and replace if damaged.



6. Slowly separate the left and right heater module case and remove the heater core.
7. Installation should follow the removal procedure in the reverse order.

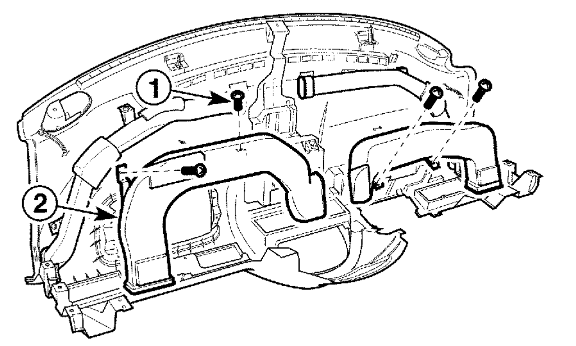


UAA7A150

SIDE VENTILATION DUCT

Removal and Installation Procedures

1. Disconnect the negative battery cable.
2. Remove the instrument panel assembly. Refer to *Section 9E, Instrumentation/Driver Information.*
3. Remove six screws and side ventilation duct.
4. Installation should follow the removal procedure in the reverse order.

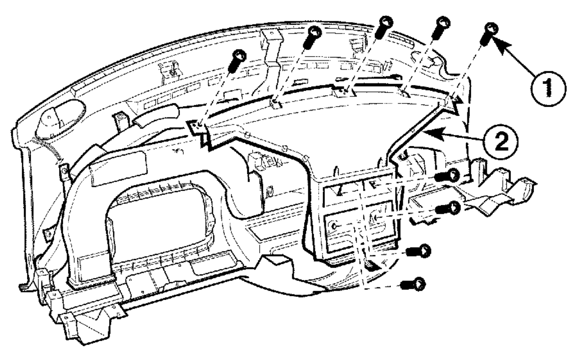


UAA7A160

FRONT AIR DISTRIBUTION DUCT

Removal and Installation Procedures

1. Disconnect the negative battery cable.
2. Remove the instrument panel assembly. Refer to *Section 9E, Instrumentation/Driver Information.*
3. Remove four screws and front air distribution duct.
4. Installation should follow the removal procedure in the reverse order.



UAA7A170

FRONT WINDOW DEFROSTER DUCT

Removal and Installation Procedures

1. Disconnect the negative battery cable.
2. Remove the instrument panel assembly. Refer to *Section 9E, Instrumentation/Driver Information.*
3. Remove nine screws and front window defroster duct.
4. Installation should follow the removal procedure in the reverse order.

REAR HEATER DUCT

This vehicle is equipped with rear seat heater ducts. Should there be no airflow to the rear, look for any obstructions, such as items on the floor under the front seats. Also check for air leaks between the heater/air distributor assembly and the rear ducts.

SPECIFICATIONS

HEATER TEMPERATURE SPECIFICATIONS

Ambient Air Temperature	Heater Outlet Air Temperature
–18°C (0°F)	54°C (129°F)
– 4°C (25°F)	59°C (138°F)
10°C (50°F)	64°C (147°F)
24°C (75°F)	68°C (154°F)

HEATER UNIT

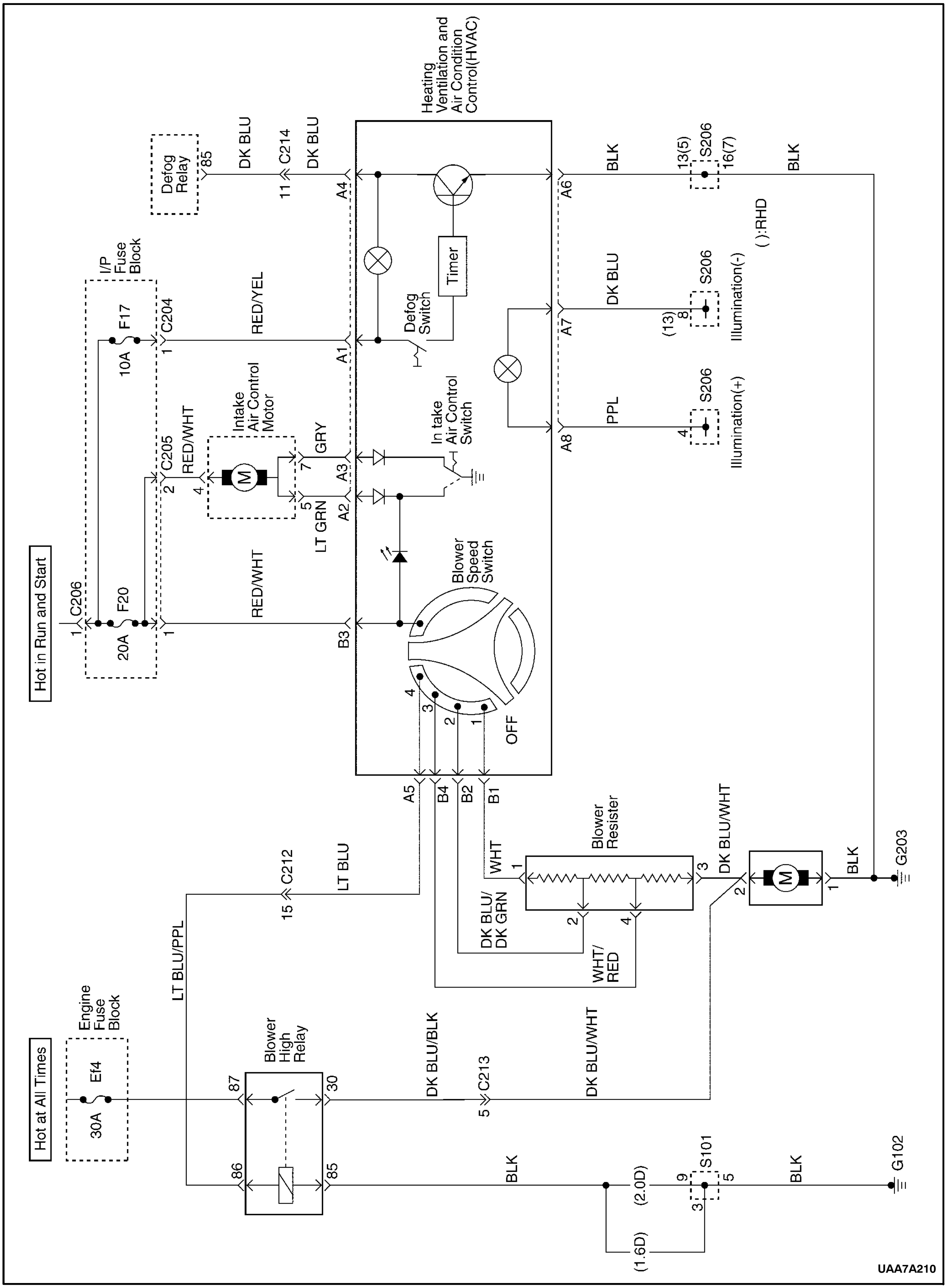
Application	Description
Heating Capacity	7,425 – 9,075 kcal/h
Heater Core Size	200.4 X 168.2 X 25.0

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Blower Fan-to-Blower Motor Nut	2	–	18
Heater/Air Distributor Case Retaining Bolt and Nut	4	–	35

SCHEMATIC AND ROUTING DIAGRAMS

NON-A/C DIAGRAM



SECTION 7B

MANUAL CONTROL HEATING, VENTILATION, AND AIR CONDITIONING SYSTEM

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

AIR CONDITIONING

Vehicle air conditioning is the cooling (refrigeration), heating, and ventilation of the air in the passenger compartment. Refrigeration is accomplished by making practical use of the three laws of nature. These laws of nature and their practical application are as follows:

- Heat transfer
- Latent heat of vaporization
- Effect of pressure on boiling or condensation

Heat Transfer

The principle of heat transfer are that the heat always flow from hot to cold, the rate of heat transfer will increase as the difference in temperature between two objects increases, and the mass of an object remains the same regardless of its heat contents.

Latent Heat of Vaporization

Everything in the world is composed of matter, and the matter exists in one of following states;

- Solid
- Liquid
- Vapor

When a liquid boils, it changes to vapor and absorbs heat without raising the temperature of the resulting vapor.

When the vapor condenses, it changes back to a liquid and gives off heat without lowing the temperature of the resulting liquid.

Effect of Pressure on Boiling or Condensing

When the pressure on the liquid or vapor changes, the boiling point changes. Increasing the pressure increases the boiling point, while the boiling point decreased by decreasing the pressure on the liquid or vapor.

Another effect of the compression is an increase in temperature even though heat has not been added. For example, if you compress the refrigerant R-134a from 206 kPa (30 psi) to 1206 kPa (175 psi) the temperature of vapor will increase from 0°C (32°F) to 54°C (130°F) and boiling point increase. Condensing point also will increase.

THE V5 A/C SYSTEM

The V5 variable displacement compressor, along with the thermal expansion valve on the evaporator, constitutes a largely self regulating system. There is no pressure cycling switch, no high and low pressure cutoff switch. The compressor clutch is controlled by the electronic control module (ECM), which receives data from various engine systems and the pressure transducer located in the high-pressure refrigerant pipe. In normal operation, the clutch is engaged continuously. Should one of the monitored conditions become abnormal, the ECM will disengage the compressor clutch until normal operation is restored. The abnormal conditions under which the ECM will disengage the compressor clutch are the following:

- Wide open throttle
- High engine coolant temperature.
- High engine rpm
- Refrigerant low pressure.
- Refrigerant high pressure.

SYSTEM COMPONENTS – FUNCTIONAL

Compressor

All compressors are belt-driven from the engine crankshaft through the compressor clutch pulley. The compressor pulley rotates without driving the compressor shaft until an electromagnetic clutch coil is energized. When voltage is applied to energize the clutch coil, the clutch plate and hub assembly is drawn rearward toward the pulley. The magnetic force locks the clutch plate and pulley together as one unit to drive the compressor shaft.

As the compressor shaft driven, it compresses the low-pressure refrigerant vapor from evaporator into high-pressure, high temperature vapor. The refrigerant oil that is used to lubricate the compressor is carried with the refrigerant.

Pressure Relief Valve

The compressor is equipped with a pressure relies valve which is placed in the system as a safety factor. Under certain conditions, the refrigerant on the discharge side may exceed the designed operating pressure at approximately at 3171 to 4137 kPa (460 to 600 psi) in an R-134a system. Conditions that might cause this valve to open, such as a defective pressure transducer, an inoperative cooling fan, etc., should be corrected. The refrigerant oil and the refrigerant should be replaced as necessary.

Condenser Core

The condenser assembly in front of the radiator consists of coils, which carry the refrigerant and cooling fins that provide the rapid transfer of heat. The air passing through the condenser cools the high-pressure refrigerant vapor and causes it to condense into a liquid.

Expansion Valve

The expansion valve is attached to the evaporator core, inside the heater/air distributor case under the instrument panel.

The expansion valve can fail in three different positions: open, closed, or restricted.

An expansion valve that fails in open position will result in a noisy A/C compressor or no cooling. The cause can be a broken spring, a broken ball, or excessive moisture in the A/C system. If the spring or the ball are found to be defective, replace the expansion valve. If excessive moisture is found in the A/C system recycle the refrigerant.

An expansion valve that fails in the closed position will result low suction pressure and no cooling. This may be caused by a failed power dome or excessive moisture in the A/C system. If the power dome on the expansion valve is founded to be defective, replace the expansion valve. If excessive moisture is found in the A/C system recycle the refrigerant.

A restricted expansion valve will result in low suction pressure and no cooling. This may be caused by debris in the refrigerant system. If debris is believed to be the cause, recycle the refrigerant, replace the expansion valve, and replace the receiver-drier.

Evaporator Core

The evaporator is a device which cools and dehumidifies the air before it enters the vehicle. High pressure liquid refrigerant flows through the expansion tube (orifice) and becomes a low pressure gas in the evaporator. The heat in the air passing through the evaporator core is transferred to the cooler surface or the core, which cools the air.

As the process of heat transfer from the air to the evaporator core surface is taking place, any moisture (humidity) in the air condenses on the outside surface of the evaporator core and is drained off as water.

Receiver-Drier

The sealed receiver-drier assembly is connected between the condenser and evaporator. It acts as a refrigerant storing container, receiving liquid and some vapor and refrigerant oil from the condenser.

At the bottom of the receiver-drier is the desiccant, which acts as drying agent for the moisture that may have entered the system. An oil bleed hole is located near the bottom of the receiver-drier outlet pipe to provide an oil return path to the compressor. The receiver dryer is serviceable as an assembly.

Heater Core

The heater core heats the air before it enters the vehicle. Engine coolant is circulated through the core to heat the outside air passing over the pin of the core. The core is functional at all times and may be used to temper conditioned air in the A/C mode as well as in heat or the vent mode.

SYSTEM COMPONENTS–CONTROL

Controller

The operation of the A/C system is controlled by the switches and knob on the control head. This console-mounted controller contains following control knobs.

Rotary Temperature Control Kno°

- Actuates by cable.
- Raise the temperature of the air entering the vehicle by sliding to the right, or the red portion of the knob.
- Varies the mix of the fresh air from outside the vehicle with the heated air from inside the vehicle to suit individual performance.

Rotary Mode Control Kno°

- Actuates by cable.
- Regulates the air distribution between the windshield, the instrument panel, and the floor vents.

Rotary Blower Control Kno°

- Turns on to operate the blower motor at four speeds.
- Turns OFF to stop the blower.
- Operates completely independently from both the mode control knob and temperature control knob.
- Changes the fan speed in any mode and at any speed.

Push Inlet Air Control Kno°

- Operates by electricity.
- Switches between recirculating the passenger compartment air and bringing outside air into the passenger compartment.
- Is normally in fresh air mode.
- Illuminates the indicator lamp when in the recalculating mode.

Push A/C Kno°

- Controls the A/C
- Turns the A/C ON when the knob is pressed and the indicator lamp is illuminated. (The rotary blower control knob must be in one of the its four positions for the A/C to function).

Pressure Transducer

Pressure transducer switching incorporates the functions of the high-pressure and the low-pressure cutout switches along with the fan cycling switch. The pressure transducer is located in high side liquid refrigerant line between the right strut tower and the air cleaner assembly. The output from this pressure transducer goes to the ECM which controls the compressor function based on the pressure signal.

Wide–Open Throttle (WOT) Compressor Cutoff

During full throttle acceleration, the throttle position (TP) sensor sends a signal to the ECM, which then controls the compressor clutch.

V5 COMPRESSOR–GENERAL DESCRIPTION

Vehicles using the V5 compressor may have differences between installations in the mounting brackets, the drive system, the pulleys, the connections, and the system capacities. Basic overhaul procedures are similar between the compressors used on different vehicles.

When servicing the compressor, keep dirt and foreign material from getting on or into the compressor parts and the system. Clean tools and a clean work area are important for proper service. The compressor connections and outside of the compressor should be cleaned before performance of any on-vehicle repairs and before removal of the compressor. The parts must be kept clean at all times and any parts that are to be reassembled should be cleaned with trichloroethane, naphtha, stoddard solvent, kerosene or equivalent solvents and dried with dry air. Use only lint-free cloths to wipe the parts.

The operations described are based on bench overhaul with the compressor removed from the vehicle, except as noted. They have been prepared in the order of accessibility of the components. When a compressor is removed from the vehicle for servicing, the amount of oil remaining the compressor should be drained, measured and recorded. This should then be discarded and new polyalkaline glycol (PAG) refrigerant oil added to the compressor.

Important: the oil drain plug must be removed and the oil drained through the plug opening to insure complete draining of oil from the compressor.

V5 COMPRESSOR–OPERATION

The V5 is a variable displacement compressor that can match the automotive air conditioning demand under all conditions without cycling. The basic compressor mechanism is a variable angle wobble-plate with seven axially oriented cylinders. The center of the control of the compressor displacement is a billows-actuated control valve located in the rear head of the compressor that senses compressor suction pressure.

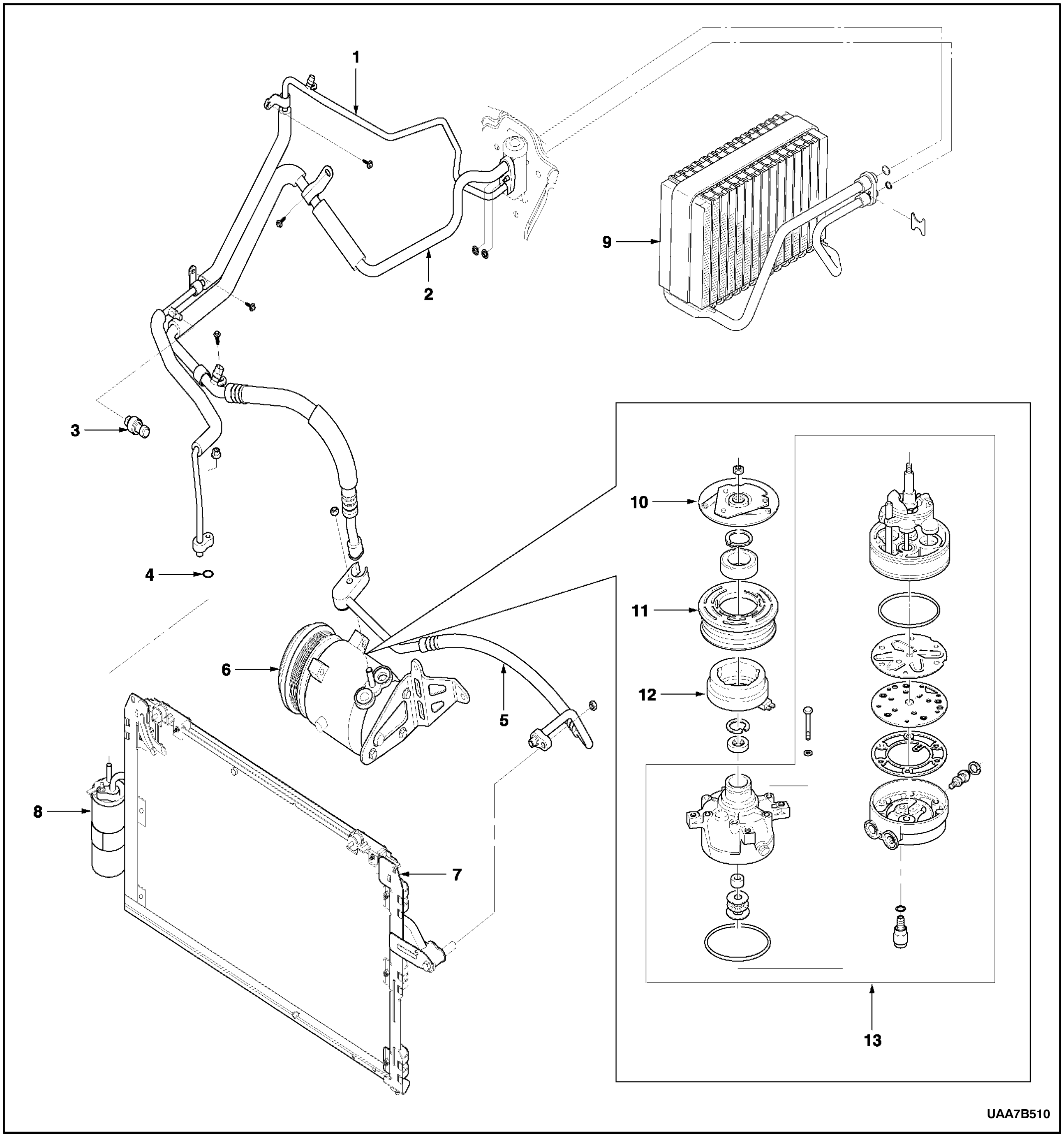
The wobble-plate angle and the compressor displacement are controlled by the crankcase suction pressure differential. When the A/C capacity demand is high, the suction pressure will be above the control point. The valve will maintain a bleed from crankcase to suction. With no crankcase suction pressure differential, the compressor will have maximum displacement.

When the A/C capacity demand is lower and the suction pressure reaches the control point, the valve will bleed discharge gas in the crankcase and close off a passage from the crankcase to suction plenum. The angle of the wobble-plate is controlled by a force balance of seven pistons. A slight elevation of the crankcase suction pressure differential creates total force on the piston resulting in a movement about the wobble-plate pivot pin that reduces the plate angle.

The compressor has a unique lubrication system. The crankcase suction bleed is routed through the rotating wobble-plate for lubrication of wobble-plate bearing. The rotation acts as an oil separator that removes some of the oil from the crankcase suction bleed, rerouting it to the crankcase where it can lubricate the compressor mechanism.

COMPONENT LOCATOR

A/C SYSTEM COMPONENTS



1 High Pressure Pipe
2 Suction Hose
3 Evaporator
4 Discharge Hose
5 Condenser
6 Receiver-Drier
7 Compressor
8 A/C Pressure Sensor

DIAGNOSTIC INFORMATION AND PROCEDURES

GENERAL DIAGNOSIS

For general diagnosis of heating and ventilation including blower motor and controller, refer to *Section 7A, Heating and Ventilation System.*

TESTING THE REFRIGERANT SYSTEM

If you suspect a problem in the refrigerant system, check for the following condition:

1. Check the outer surfaces of the radiator and the condenser cores to be sure that the airflow is not blocked by dirt leaves, or other foreign material. Check between the condenser and the radiator, as well as all outer surfaces.
2. Check for restrictions or kinks in the condenser core, the hoses, and the pipes.
3. Check the operation of the blower fan.
4. Check all the air ducts for leaks or restrictions. Low airflow rate may indicate a restricted evaporator core.
5. Check for slippage of the compressor clutch.
6. Check the drive belt tension.

INSUFFICIENT COOLING “QUICK CHECK” PROCEDURE

Perform the following “hand feel” procedure to get a quick idea of whether the A/C system has the proper charge of refrigerant-R134a. the air temperature must be above 21°C (70°F) for most models.

1. Warm up the engine. Run the engine at idle.
2. Open the hood and all the doors.
3. Set the A/C switch to the ON position.
4. Set the temperature control to the full cold position.
5. Set the blower speed switch on setting 4.
6. “Hand-feel” the temperature of the evaporator outlet pipe. The pipe should be cold.
7. Check for other problems. Refer to “Testing the Refrigerant System” in this section.
8. Check leaks the system. Refer to “Leak Testing the Refrigerant System” in this section. If you find a leak, discharge the system and repair the leak as required. After completing the repair, evacuate and charge the system.
9. If there is no leak, refer to “Insufficient Cooling Diagnosis” in this section.

A/C PERFORMANCE TEST

RELATIVE HUMIDITY (%)	AMBIENT AIR TEMPERATURE °C °F	LOW SIDE PRESSURE kPa psig	ENGINE SPEED (RPM)	CENTER DUCT AIR TEMPERATURE °C °F	HIGH SIDE PRESSURE kPa psig
20	21 (70) 27 (81) 32 (90) 38 (100)	200 (29) 200 (29) 207 (30) 214 (31)	2000	4 (39) 7 (45) 9 (48) 14 (57)	1034 (150) 1310 (190) 1689 (245) 2103 (305)
30	21 (70) 27 (81) 32 (90) 38 (100)	200 (29) 207 (30) 214 (31) 221 (32)	2000	6 (43) 8 (46) 11 (52) 16 (61)	1034 (150) 1413 (205) 1827 (265) 2241 (325)
40	21 (70) 27 (81) 32 (90) 38 (100)	200 (29) 207 (30) 221 (32) 269 (39)	2000	7 (45) 9 (48) 13 (55) 18 (64)	1138 (165) 1482 (215) 1931 (280) 2379 (345)
50	21 (70) 27 (81) 32 (90) 38 (100)	207 (30) 221 (32) 234 (34) 276 (40)	2000	8 (46) 12 (54) 15 (59) 21 (70)	1241 (180) 1620 (235) 2034 (295) 2413 (350)
60	21 (70) 27 (81) 32 (90) 38 (100)	207 (30) 228 (33) 248 (36) 296 (43)	2000	9 (48) 13 (55) 17 (63) 23 (73)	1241 (180) 1655 (240) 2068 (300) 2482 (360)
70	21 (70) 27 (81) 32 (90) 38 (100)	207 (30) 234 (34) 262 (38) 303 (44)	2000	10 (50) 14 (57) 18 (64) 24 (75)	1276 (185) 1689 (245) 2103 (305) 2517 (365)
80	21 (70) 27 (81) 32 (90)	207 (30) 234 (34) 269 (39)	2000	10 (50) 15 (59) 19 (66)	1310 (190) 1724 (250) 2137 (310)
90	21 (70) 27 (81) 32 (90)	207 (30) 248 (36) 290 (42)	2000	10 (50) 17 (63) 22 (72)	1379 (200) 1827 (265) 2275 (330)

PRESSURE-TEMPERATURE RELATIONSHIP OF R-134A

TEMPERATURE °C (°F)*	PRESSURE kPa (psig)*	TEMPERATURE °C (°F)*	PRESSURE kPa (psig)*
–8.89 (16)	105.70 (15.33)	37.78 (100)	856.84 (124.27)
–7.78 (18)	114.87 (16.66)	38.89 (102)	886.56 (128.58)
–6.67 (20)	124.32 (18.03)	40.00 (104)	916.35 (132.98)
–5.56 (22)	134.11 (19.45)	41.11 (106)	947.92 (137.48)
–4.44 (24)	144.24 (20.92)	42.22 (108)	979.64 (142.08)
–3.33 (26)	154.65 (22.43)	43.33 (110)	1012.11 (146.79)
–2.22 (28)	165.48 (24.00)	44.44 (112)	1045.21 (151.59)
–1.11 (30)	176.65 (25.62)	45.56 (114)	1079.14 (156.51)
0.00 (32)	188.16 (27.29)	46.67 (116)	1113.75 (161.53)
1.11 (34)	200.02 (29.01)	47.78 (118)	1149.12 (166.66)
2.22 (36)	212.30 (30.79)	48.89 (120)	1185.18 (171.89)
3.33 (38)	224.98 (32.63)	50.00 (122)	1222.07 (177.24)
4.44 (40)	238.08 (34.53)	51.11 (124)	1259.72 (182.70)
7.22 (45)	272.49 (39.52)	52.22 (126)	1298.12 (188.27)
10.00 (50)	309.58 (44.90)	53.33 (128)	1337.35 (193.96)
12.77 (55)	349.51 (50.69)	54.44 (130)	1377.35 (199.76)
15.56 (60)	392.33 (56.90)	57.22 (135)	1480.91 (214.78)
18.33 (65)	438.18 (63.55)	60.00 (140)	1589.57 (230.54)
21.11 (70)	487.27 (70.67)	62.78 (145)	1703.62 (247.08)

* All values rounded to two decimal places.

EVAPORATOR RANGE: From –6.67 to 7.22°C (20 to 45°F), the temperatures represent the gas temperatures inside the coil and not on the coil surfaces. Add 1.67 to 5.56°C (3 to 10°F) the temperature for coil and air-off temperatures.

CONDENSER RANGE: From 110 to 160°F, temperatures are not ambient. Add 19.4 to 22.2°C (35 to 40°F) for proper heat transfer, then refer to the pressure chart.

Example: 32°C (90°F) ambient temperature
\+ 22°C (40°F)
54°C (130°F)

Condenser temperature = 1379 kPa (200 psig)
Based on 48.3 km/h (30 mph) air flow.

LEAKING TESTING THE REFRIGERANT SYSTEM

Test for leaks whenever you suspect a refrigerant leak in the system. You should also test for leaks whenever you perform a service operation, which results in disturbing the lines or the connections. Leaks are commonly found at the refrigerant fittings or at the connections. Leaks are commonly caused by the following problems:

- Improper torque.
- Damaged O-ring seals.
- Dirt or lint on the O-ring seals.

Liquid Leak detectors

Use a liquid leak detector solution on locations such as fittings. Apply the solution to the area in question with the swab that is supplied with the solution. Look for bubbles to appear. This will indicate the existence and location of any leak.

For areas where that are not practical, such as sections of the evaporator and the condenser, an electrical leak detector is more useful.

Electronic Leak Detectors

Follow the manufacturer's instructions for calibration, operation, and maintenance of an electronic leak detector.

Battery condition is especially important to the accuracy of a portable model. Set the detector to R-134a before beginning the test.

Important: Electronic leak detectors are sensitive to windshield washing solutions, solvents and cleaners, and certain vehicle adhesives.

Surfaces must be clean to prevent false readings. Make sure that all surfaces are dry to prevent damage to the detector.

General Testing Instructions

- Follow the entire path of the refrigerant system.
- Completely circle each joint at 25 to 50 mm (1 to 2 inches) per second.
- Hold the probe tip within 6 mm (1/4 inch) of the surface.
- Do not block the air intake.

The audible tone changes from 1 to 2 clicks per second into a solid alarm if there is a leak. Adjust the balance control to maintain 1 to 2 clicks per second.

Test all of the following areas, even after one leak has been confirmed:

- Evaporator inlet and outlet.
- Receiver-drier inlet and outlet.
- Condenser inlet and outlet.
- Brazed and welded areas.
- Damaged areas.
- Hose couplings.
- Compressor rear head.
- All fittings and joints.

Testing Refrigerant Charge Ports/Access Valves

The sealing caps provide protection for the refrigerant charge ports. Make sure that these caps are not missing or loose. Always use the correct cap for each port.

Testing the Evaporator Core

Leaks in the evaporator core are difficult to find. Test the evaporator core using the following procedure:

1. Run the blower fan at speed setting 4 for at least 15 minutes.
2. Turn the blower to OFF.
3. Wait for 10 minutes.
4. Remove the blower motor resistor. Refer to "Blower Motor Resistor" in this section.
5. Insert the leak detector probe as close as possible to the evaporator core. The detector will indicate a leak with a solid alarm.
6. Use a flashlight to search for refrigerant oil in the core surface.

Testing the Compressor Shaft Seal

1. Blow shop air behind and in front of the compressor clutch/pulley for at least 15 seconds.
2. Wait 1 to 2 minutes.
3. Probe the area in front of the pulley. If the detector emits a solid alarm, there is a leak

V5 SYSTEM AIR CONDITIONING DIAGNOSIS

INSUFFICIENT COOLING DIAGNOSIS

Test Description

The number(s) below refer to step(s) on the diagnostic table.

13. See the first Important below.

32. See the second Important below.

Important: Perform this test under garage conditions with the air temperature at 21–32°C (70–90°F), and no sun load. Follow this test carefully for accurate results.

Important: Perform this test exactly as described to obtain accurate results.

Insufficient Cooling Diagnosis

Step	Action	Value	Yes	No
1	Record the customer's complaint. Can you verify the customer's complaint?	–	Go to *Step 2*	System OK
2	1. Check the A/C fuse EF24. 2. Check the blower fan operation. 3. Check the engine cooling fan operation. 4. Check the A/C compressor belt. 5. Check the A/C condenser for restricted air flow. 6. Check the coil connection. 7. Repair or replace any components, as needed. 8. Check the discharge air temperature with the A/C turned ON. Is the discharge air temperature normal?	At least 7°C (12°F) below ambient air temperature	System OK	Go to *Step 3*
3	1. Turn the ignition to LOCK. 2. Connect the high- and low-pressure gauges. Are both pressures within the specified value?	69-345 kPa (10-50 psi)	Go to *Step 4*	Go to *Step 5*
4	1. Check the A/C system for leaks. 2. Repair any refrigerant leaks, as needed. 3. Recover, evacuate, and recharge the A/C system. 4. Observe the two pressure gauges. Are both pressures above the specified value?	345 kPa (50 psi)	Go to *Step 7*	–
5	Observe the two pressure gauges. Are both pressures below the specified value?	69 kPa (10 psi)	Go to *Step 6*	Go to *Step 7*
6	1. Add 0.45 kg (1 pound) of refrigerant R-134a. 2. Check the A/C system for leaks. 3. Repair any refrigerant leaks, as needed. 4. Recover, evacuate, and recharge the A/C system. 5. Observe the two pressure gauges. Are both pressures above the specified value?	345 kPa (50 psi)	Go to *Step 7*	–
7	1. Start the engine and allow it to run at idle. 2. Set the A/C controls to the following positions: • The A/C to ON. • The intake air control switch to fresh air (indicator lamp OFF). • The blower motor to 4. • The temperature control knob to full cold. Does the A/C compressor clutch engage?	–	Go to *Step 8*	Go to *Step 10*

Insufficient Cooling Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Check for a knocking noise from the A/C compressor. 2. Cycle the A/C compressor ON and OFF in order to verify the source of the noise. Do you hear a loud knocking noise?	–	Go to *Step 9*	Go to *Step 13*
9	1. Recover the A/C system refrigerant. 2. Replace the A/C compressor. 3. Evacuate and recharge the A/C system. 4. Check the A/C system for leaks. Is the compressor running normally?	–	Go to *Step 13*	–
10	1. Turn the ignition to LOCK. 2. Disconnect the A/C compressor clutch coil connector. 3. Connect a jumper wire from ground to one A/C compressor clutch coil terminal. 4. Connect a fused jumper wire from the positive battery terminal to the other A/C compressor clutch coil terminal. Does the A/C clutch engage?	–	Go to *Step 11*	Go to *Step 12*
11	Repair the electrical circuit to the A/C compressor clutch coil. Does the A/C clutch engage?	–	Go to *Step 8*	–
12	Replace the A/C compressor clutch coil. Does the A/C clutch engage?	–	Go to *Step 8*	–
13	**Important:** perform this test under garage conditions; 21 – 32°C (70 – 90°F) and no sun load. Follow this test carefully for accurate results. 1. Close all of the vehicle's windows and doors. 2. Set the A/C controls to the following positions: • The A/C switch to ON position. • The intake air control switch to fresh air. • The blower motor to 4. • The temperature control knob to full cold. 3. Start the engine and allow it to run at idle for 5 minutes. 4. Check the discharge air temperature. Is there a noticeable difference in the temperature of the evaporator inlet and outlet pipes?	–	Go to *Step 15*	Go to *Step 14*
14	1. Turn the ignition to LOCK. 2. Recover the A/C system refrigerant. 3. Examine the high-pressure pipe for an obstruction. 4. Examine the expansion valve for an obstruction or a malfunction. 5. Repair the obstruction or replace the expansion valve, as needed. 6. Evacuate and recharge the A/C system. 7. Check the A/C system for leaks. 8. Note the discharge air temperature with the A/C ON. Is the discharge temperature normal?	At least 7°C (12°F) below ambient air temperature	Go to *Step 15*	Go to *Step 16*

Insufficient Cooling Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
15	1. Record the high- and low-side pressures after the A/C system has been operating for 5 minutes or more with the engine cooling fan ON. 2. Locate the intersection of the high- and low-side pressures. Refer to "Low- and High-Side Pressure Relationship Chart" in this section. Do the high- and low-side pressures intersect in the white area of the chart?	–	System OK	Go to *Step 16*
16	Check the high- and low-side. Do the high- and low-side pressures intersect in the gray area of the chart?	–	Go to *Step 17*	Go to *Step 20*
17	Feel the liquid pipe between the condenser and the expansion valve. Is the pipe cold?	–	Go to *Step 18*	Go to *Step 19*
18	1. Examine the condenser for any restriction of the airflow. 2. Check the cooling fans for proper operation. 3. Remove the restriction or repair the fan(s) as required. Is the pipe temperature normal now?	–	Go to *Step 13*	–
19	1. Recover, evacuate, and recharge the A/C system. 2. Check the A/C system for leaks. Is the system leak tight?	–	Go to *Step 13*	–
20	Observe the readings on the pressure gauges. Are the A/C compressor high and low side pressure within the specified value of each other?	207 kPa (30 psi)	Go to *Step 21*	Go to *Step 26*
21	1. Run the engine at 3,000 rpm. 2. Set the A/C controls to the following positions: • The A/C switch to ON position. • The intake air control switch to fresh. (indicator lamp OFF). • The blower motor to 4. • The temperature control knob to full cold. 3. Close all of the vehicle's windows and doors. 4. Turn the A/C switch ON and OFF every 20 seconds for 3 minutes. Are the A/C compressor high and low side pressure within the specified value of each other?	207 kPa (30 psi)	Go to *Step 22*	Go to *Step 13*
22	Observe the pressure rise on both gages and the temperatures of both the compressor suction pipe and the discharge pipe. Is the pressure rise on both gauges slow and the suction pipe warm with the discharge pipe hot?	–	Go to *Step 25*	Go to *Step 23*
23	1. Turn the ignition switch to LOCK. 2. Check that the compressor clutch is disengaged. 3. Attempt to turn the clutch driver (not the pulley). Can you turn the clutch driver freely by hand?	–	Go to *Step 25*	Go to *Step 24*
24	1. Start the engine. 2. Observe the low-side pressure gauge while running the engine between 3000 and 3800 rpm. Does the low-side pressure rise rapidly?	–	Go to *Step 32*	Go to *Step 25*

Insufficient Cooling Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
25	1. Recover the A/C system refrigerant. 2. Replace the A/C compressor. 3. Evacuate and recharge the A/C system. Is the compressor functioning normally?	–	Go to *Step 13*	–
26	Check the low-side pressure. Is the low-side pressure within the specified value?	172-241 kPa (27-38 psi)	Go to *Step 27*	Go to *Step 32*
27	Feel the high–side pipe leading up to the expansion valve connecting block. Is the pipe cold before the connecting block?	–	Go to *Step 28*	Go to *Step 29*
28	Check for a restriction in the high-side pipe before the expansion valve. Repair or replace the high-side pipe. Is the pipe performing normally?	–	Go to *Step 13*	–
29	Add the specified amount of the refrigerant to the A/C system. Does the cooling performance improve?	0.40 kg (14 ounces)	Go to *Step 30*	Go to *Step 31*
30	1. Check the A/C system for leaks. 2. Repair any refrigerant leaks as needed. 3. Evacuate and recharge the A/C system. 4. Check again the A/C system for leaks. Is the system leak free?	–	Go to *Step 13*	–
31	1. Recover the refrigerant. 2. Check the expansion valve for obstructions. 3. Repair or replace the expansion valve as required. 4. Evacuate and recharge the A/C system. 5. Check again the A/C system for leaks. Is the system leak free?	–	Go to *Step 13*	–
32	**Important:** perform this test exactly as described to obtain accurate results. 1. Run the engine for 5 minutes at 2,000 rpm. 2. Set the A/C controls to the following positions: • The A/C switch to the ON position. • The intake air control switch to recirculation (indicator lamp ON). • The blower motor to 1. • The temperature control knob to full cold. 3. Close all of the vehicle's windows and doors. 4. Open the vehicle hood. Is the low-side pressure within the specified value?	172-241 kPa (25-35 psi)	Go to *Step 13*	Go to *Step 33*
33	1. Recover the A/C system refrigerant. 2. Replace the A/C compressor control valve. 3. Evacuate and recharge the A/C system. 4. Check the A/C system for leaks. Is the system free from leaks?	–	Go to *Step 13*	–

COMPRESSOR MAGNETIC CLUTCH DOES NOT ENGAGE

Refer to "Manual Control A/C Diagram" for the electrical schematic diagram of the circuits described in the procedure.

Step	Action	Value	Yes	No
1	1. Disconnect the A/C compressor magnetic clutch connector. 2. Turn the ignition switch to ON. 3. Turn the A/C on. 4. Measure the voltage between terminal 1 of A/C compressor magnetic clutch connector and ground. Is the voltage within the specified value?	11–14 V	Go to *Step 2*	Go to *Step 5*
2	Measure the resistance between terminal 2 and ground. Is the resistance equal to the specified value?	≈ 0Ω	Go to *Step 4*	Go to *Step 3*
3	Repair open circuit between terminal 2 of A/C compressor magnetic clutch and ground. Is the repair complete?	–	System OK	–
4	Repair A/C compressor magnetic clutch or replace the compressor assembly. Is the repair complete?	–	System OK	–
5	Check the fuse EF24. Is the fuse blown?	–	Go to *Step 6*	Go to *Step 7*
6	Repair short circuit between fuse EF24 and terminal 1 of A/C compressor magnetic clutch connector. Is the repair complete?	–	System OK	–
7	1. Turn the ignition switch to ON. 2. Turn the A/C ON. 3. Using the test lamp, check terminal 86 and terminal 85 of the A/C compressor clutch. Dose the test lamp illuminate?	–	Go to *Step 9*	Go to *Step 8*
8	Repair open circuit in power supply circuit including fuse F17 and A/C compressor relay. Is the repair complete?	–	System OK	–
9	1. Disconnect the ECM connector. 2. Measure resistance between terminal K29 (MR-140) /A15 (ITMS-6F) /41(SIRIUS D4) of ECM and terminal 85 of A/C compressor relay. Is the resistance equal to the specified value?	≈ 0Ω	Go to *Step 11*	Go to *Step 10*
10	Repair open circuit between terminal 85 of A/C compressor relay and specific terminal of the ECM. Is the repair complete?	–	System OK	–
11	Replace the ECM. Is the repair complete?	–	System OK	–

SYMPTOM DIAGNOSIS

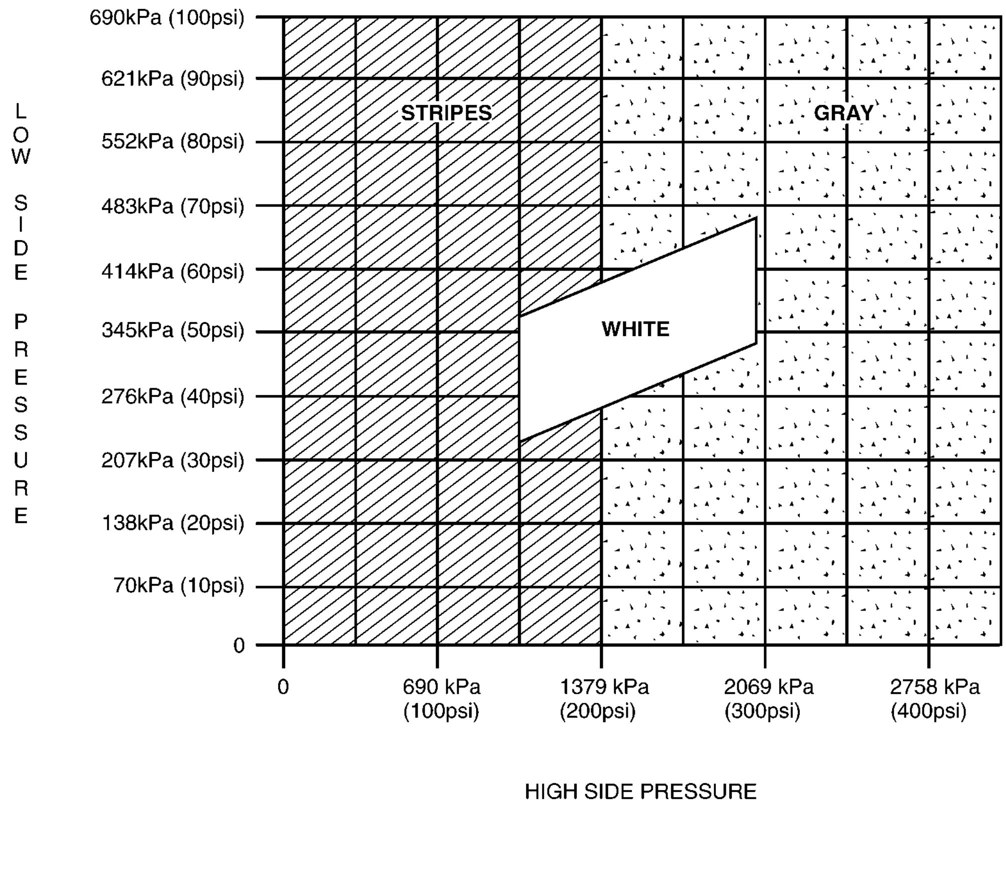
PRESSURE TEST CHART (R-134A SYSTEM)

TEST RESULTS	RELATED SYMPTOMS	PROBABLE CAUSE	REMEDY
Discharge (high) pressure abnormally high	After stopping the compressor, the pressure drops about 299 kPa (28 psi) quickly, then falls gradually.	There is air in the system.	Recover, evacuate and recharge the system with the specified amount of refrigerant.
	The condenser is excessively hot.	There is excessive refrigerant in the system.	Recover, evacuate and recharge the system with the specified amount of refrigerant.
	Reduced or no air flow through the condenser.	The condenser or the radiator fins are clogged.	Clean the condenser or the radiator fins.
		The condenser or the radiator fan is not working properly.	• Check the voltage and the fan rpm. • Check the fan direction.
	Line to the condenser is excessively hot.	Restricted flow of refrigerant in the system	Locate and repair the restriction.
Discharge (high) pressure abnormally low	The condenser is not hot.	Insufficient refrigerant in the system.	• Check the system for a leak. • Charge the system.
	High and low pressures are balanced soon after stopping the compressor. Low side pressure is higher than normal.	Faulty compressor pressure relief valve.	Repair or replace the compressor.
		Faulty compressor seal.	
	The outlet of the expansion valve is not frosted, low pressure gauge indicates vacuum.	Faulty expansion valve.	Replace the expansion valve.
		Moisture in the system.	Recover, evacuate, and recharge the system.
Suction pressure abnormally low	The condenser is not hot.	Insufficient refrigerant in the system.	Repair the leaks. Recover, evacuate and recharge the system.
	The expansion valve is not frosted and the low pressure line is not cold. Low pressure gauge indicates a vacuum.	Frozen expansion valve.	Replace the expansion valve.
		Faulty expansion valve.	
	Discharge temperature is low and the air flow from the vents is restricted.	The evaporator is frozen.	Clear the restricted evaporator case drain.
	The expansion valve is frosted.	The expansion valve is clogged.	Clean or replace the expansion valve.
	The receiver-drier outlet is cool and the inlet is warm.	The receiver–drier is clogged.	Replace the receiver-drier.
Suction pressure abnormally high	The low pressure hose and check joint are cooler than the temperature around the evaporator.	The expansion valve is opened for too long.	Replace the expansion valve.
		A capillary tube is loose.	

Pressure Test Chart (R-134a System) (Cont'd)

TEST RESULTS	RELATED SYMPTOMS	PROBABLE CAUSE	REMEDY
Suction pressure abnormally high	The suction pressure is lowered when the condenser is cooled by water.	There is excessive refrigerant in the system.	Recover, evacuate, and recharge the system.
	The high and low pressure are equalized as soon as the compressor is stopped and both gauges fluctuate while the compressor is running.	A gasket is faulty.	Repair or replace the compressor.
		The high pressure valve is faulty.	
		Foreign particles are stuck in the high pressure valve.	
Suction and discharge pressure abnormally high	There is reduced airflow through the condenser.	The condenser or the radiator fins are clogged.	Clean the condenser and the radiator.
		The radiator cooling fans are not working properly.	• Check the voltage and the radiator cooling fan rpm. • Check the fan direction.
	The condenser is excessively hot.	There is excessive refrigerant in the system.	Recover, evacuate, and recharge the system.
Suction and discharge pressure abnormally low	The low pressure hose and metal end areas are cooler than the evaporator.	There is clogged or kinked low pressure hose.	Repair or replace the low pressure hose.
	The temperature around the expansion valve is low compared to that around the receiver/drier.	The high pressure line is clogged.	Repair or replace the high pressure line.
Refrigerant leaks	The compressor clutch is dirty.	The compressor shaft seal is leaking.	Repair or replace the compressor.
	The compressor bolts are dirty.	Leaking around a compressor housing bolt.	Tighten the bolt(s) or replace the compressor.
	The compressor gasket is wet with oil.	The compressor gasket is leaking.	Repair or replace the compressor.

LOW AND HIGH SIDE PRESSURE RELATIONSHIP CHART



REPAIR INSTRUCTIONS

GENERAL A/C SYSTEM SERVICE PROCEDURES

O-RING REPLACEMENT

Important: Even though O-rings may look identical, it is extremely important that only recommended service replacement air conditioning O-rings be used, or excessive leakage of the refrigerant may occur.

Important: Always slip the O-ring onto the flange tube to ensure proper locating and sealing.

Install new DAEWOO approved service replacement air conditioning O-rings whenever a joint or a fitting is disassembled, except when the O-rings are provided on new components.

When replacing O-rings on an air conditioning component or a joint connection, the fitting design should be identified to ensure installation of the correct air conditioning service replacement O-ring. Some joint connections and components will implement a “captured” O-ring design fitting that uses a groove to retain the O-ring. Others do not have a groove and use a “non-captured” or “standard” O-ring. Assembly and tightening procedures are the same for both designs, but the O-rings are different.

Before installation, verify that both O-rings and fittings have not been nicked or deformed. Deformed or nicked parts must be replaced. Failure to use the proper service replacement parts and procedures may result in excessive refrigerant leakage.

HANDLING REFRIGERANT

Caution: Always work in a well-ventilated area and avoid breathing any refrigerant fumes. If you have difficulty breathing, seek medical attention immediately. If refrigerant comes in contact with any part of your body, flush the exposed area with water. If a rash or pain develops, seek medical attention.

Air conditioning systems contain refrigerant. This is a chemical mixture which requires special handling procedures to avoid personal injury.

Always wear goggles and wrap a clean cloth around the fittings, the valves, and the connections when performing work that involves opening the refrigerant system. Do not weld or steam clean on or near any vehicle-installed air conditioning lines or components.

All refrigerant drums are shipped with a heavy metal screw cap. The purpose of the cap is to protect the valve and the safety plug from damage. It is good practice to replace the cap after each use of the drum.

If it is necessary to transport or carry any container of refrigerant in a vehicle, do not carry it in the passenger compartment.

HANDLING OF REFRIGERANT LINES AND FITTINGS

Notice: Using too low or too high a torque when tightening a fitting can result in loose joints or deformed joint parts.

Both conditions can result in refrigerant leakage.

- Keep all metal tubing lines free of dents or kinks. Any line restrictions will cause the loss of system capacity.
- Never bend a flexible hose line to a radius of less than four times the diameter of the hose.
- Never allow a flexible hose line to come within 63.5 mm (2–1/2 inches) of the exhaust manifold.
- Inspect flexible hose lines regularly for leaks or brittleness.
- Replace flexible hose lines with new lines if there are signs of deterioration or leaking.
- Discharge the refrigeration system of all refrigerants before disconnecting any fitting in the refrigeration system.
- Proceed very cautiously regardless of the gauge readings.
- Open the fittings very slowly.
- Keep your face and your hands away from the fitting so that you will not be injured if there happens to be liquid refrigerant in the line.
- If pressure is noticed when loosening a fitting, allow the pressure to bleed off as described in “Discharging, Adding Oil, Evacuating and Charging Procedures for A/C System” in this section.
- Cap or tape any refrigerant line immediately after it is opened. This will prevent the entrance of moisture and dirt, which can cause internal compressor wear or plugged lines in the condenser, the evaporator core, the expansion valve or the compressor inlet screens.

Important: Use two proper wrenches to connect the O-ring fittings.

- Back up the opposing fitting to prevent the distortion of the connecting lines or the components.
- Back up both the swaged fitting on the flexible hose connections and the coupling to which it is attached with two wrenches to prevent turning the fitting and damaging the ground seat.
- Keep the O-rings and the seats in perfect condition. A burr or a piece of dirt may cause a refrigerant leak.
- Dip new O-rings in clean polyalkalene glycol (PAG) refrigerant oil before installation.

MAINTAINING CHEMICAL STABILITY IN THE REFRIGERATION SYSTEM

The efficient operation and life of the air conditioning system is dependent upon the chemical stability of the refrigeration system. When foreign materials, such as dirt, air, or moisture, contaminate the refrigeration system, they will change the stability of the refrigerant and the polyalkalene glycol (PAG) compressor oil. They will also affect the pressure-temperature relationship, reduce efficient operation, and can possibly cause interior corrosion and abnormal wear of moving parts.

- Observe the following practices to ensure chemical stability in the system:
- Wipe away dirt or oil at and near any connection before opening that connection. This will reduce the chance of dirt entering the system.
- Cap, plug, or tape both sides of a connection as soon as possible after opening the connection. This will prevent the entry of dirt, foreign material, and moisture.
- Keep all tools clean and dry, including the manifold gauge set and all replacement parts.
- Use a clean and dry transfer device and container to add PAG refrigerant oil. This will ensure that the oil remains as moisture-free as possible. Refer to "Discharging, Adding Oil, Evacuating and Charging Procedures for A/C System" in this section.
- When opening an A/C system, have everything needed to perform all operations ready. Do not leave the A/C system open any longer than necessary.
- Evacuate and recharge any A/C system that has been opened. Refer to "Discharging, Adding Oil, Evacuating and Charging Procedures for A/C System" in this section for the instructions to perform this procedure properly.

All service parts are dehydrated and sealed before shipping. They should remain sealed until just before making connections. All the parts should be at room temperature before uncapping. This prevents condensation of moisture from the air from entering the system. Reseal all parts as soon as possible if the caps have been removed but the connections cannot be made promptly.

DISCHARGING, ADDING OIL, EVACUATING, AND CHARGING PROCEDURES FOR A/C SYSTEM

Caution: Use only refillable refrigerant tanks that are authorized for the charging station being used. The use of other tanks may cause personal injury or void the warranty. Refer to the manufacturer's instructions for the charging station.

Caution: To avoid personal injury, always wear goggles and gloves when performing work that involves opening the refrigeration system.

A charging station discharges, evacuates, and recharges an air conditioning (A/C) system with one hookup.

Filtering the refrigerant during the recovery cycle together with filtering during the evacuation cycle ensures a supply of clean, dry refrigerant for A/C system charging.

Notice:

- Never use the R-134a charging station on a system charged with R-12. The refrigerants and the oils from each system are not compatible and must never be mixed, in even the smallest amount. Mixing refrigerant residue will damage the equipment.
- Never use adapters which convert from one size fitting to another. Such use allows contamination, which may cause system failure.

Charging Station Setup and Maintenance

There are many charging stations available. All perform the various tasks required to discharge the system and recover refrigerant, evacuate the system, add a measured amount of oil, and recharge an air conditioning system with a measured amount of refrigerant. Refer to the manufacturer's instructions for all initial setup procedures and all maintenance procedures.

Control Panel Functions

A charging station will have controls and indicators to allow the operator to control and monitor the operation in progress. Refer to the manufacturer's instructions for details. These can be expected to include the following:

1. Main Power Switch
   - Supplies electrical power to the control panel.
2. Display
   - Shows the time programmed for vacuum.
   - Shows the weight of the refrigerant programmed for recharging.
   - Refer to the manufacturer's instructions for detailed programming information.
3. Low-Side Manifold Gauge
   - Shows the system's low-side pressure.
4. High-Side Manifold Gauge
   - Shows the system's high-side pressure.
5. Control Panel
   - Controls the various operating functions.
6. Low-Side Valve
   - Connects the low side of the A/C system to the unit.
7. Moisture Indicator
   - Shows whether the refrigerant is wet or dry.
8. High-Side Valve
   - Connects the high side of the A/C system to the unit.

Refrigerant Recovery

Important: Use only a refrigerant tank that is designed for the charging station in use. The unit's overfill limitation mechanism is calibrated specifically for use with this tank. The tank's valves are also manufactured specifically for this unit.

1. Attach the high-side hose with the quick disconnect coupler to the high-side fitting of the vehicle's A/C system.
2. Open the coupler valve.
3. Attach the low-side hose with the quick disconnect coupler to the low-side fitting of the vehicle's A/C system.
4. Open the coupler valve.
5. Check the high-side and the low-side gauges on the unit's control panel to ensure that the A/C system has pressure. If there is no pressure, there is no refrigerant in the system to recover.

Important: If there is no refrigerant in the system, do not continue with the recovery operation. Under this condition, this would draw air into the recovery tank.

6. Open both the high-side and the low-side valves.
7. Open the gas and the liquid valves on the tank.
8. Drain any oil that may be in the oil separator.
9. Close the oil drain valve.
10. Plug the unit into the proper voltage outlet.
11. Turn on the main power switch.

Notice: Never reuse refrigerant oil. Damage to the A/C system may result. Dispose of the refrigerant oil properly.

12. Begin the recovery process. Refer to the manufacturer's instructions for the charging station in use.

Important: Some A/C system polyalkalene glycol (PAG) lubricating oil may be removed with the refrigerant during recovery. The amount of oil removed varies. A charging station separates the oil from the refrigerant and provides a means of determining how much oil was removed. Replace the same amount of oil when recharging the system.

Refer to the manufacturer's instructions for the charging station in use.

13. Wait 5 minutes, then check the control panel low-side gauge. If the A/C has maintained vacuum, the recovery is complete.
14. If the low-side gauge pressure rises above zero, there is more refrigerant in the system. Recover the additional refrigerant. Repeat this step until the system maintains vacuum for 2 minutes.

Important: If the control indicator shows that the refrigerant tank is full during the recovery process and the unit shuts off, install an empty unit tank to store the refrigerant needed for steps later in the procedure. Do not use any other type of tank.

Evacuation

The unit tank must contain a sufficient amount of R-134a refrigerant for charging. Check the amount of refrigerant in the tank. If there is less than 3.6 kg (8 pounds) of refrigerant, add new refrigerant to the tank. Refer to the manufacturer's instructions for adding refrigerant.

1. Verify that the high-side and the low-side hoses are connected to the A/C system. Open both the high-side and the low-side valves on the unit's control panel.
2. Open both the gas and the liquid valves on the tank.

Important: Refer to the manufacturer's instructions for the charging station in use. It is necessary to evacuate the system before recharging it with new or recycled refrigerant.

3. Start the vacuum pump and begin the evacuation process. Non-condensable gases (mostly air) are vented from the tank automatically during the recycling process. The pressure being released may be heard.
4. Check for leaks in the system. Refer to the manufacturer's instructions for the charging station in use.

Important: Change the vacuum pump oil frequently. Refer to the manufacturer's instructions for the charging station in use.

A/C System Oil Charge Replenishing

Any oil removed from the A/C system during the recovery process must be replenished at this time.

1. Use the correct graduated bottle of polyalkalene glycol (PAG) oil for the R-134a system.

Important: Refer to the manufacturer's instructions for the charging station in use. Add the proper amount of PAG oil to the system.

2. Close the valve when the required oil charge has been pulled into the system.

Charging

Important: Evacuate the A/C system before charging.

1. Close the low-side valve on the control panel.
2. Open the high-side valve on the control panel.
3. Refer to the manufacturer's instructions for the charging station in use.
4. Enter the amount of refrigerant needed to charge the A/C, making sure to use the correct system of measurement, i.e. kilogram (kg) or pound (lb).
5. Begin the charging process.

Successful Transfer Complete

1. Close the high-side valve on the unit's control panel. Both valves should be closed.
2. Start the vehicle and the A/C system.
3. Let the engine run until the readings on the high-side and low-side gauges stabilize.
4. Compare the readings to the system specifications.
5. Check the evaporator outlet temperature to ensure that the A/C system is operating within the system specifications.
6. Keep the A/C running.
7. Close the high-side coupler valve.
8. Disconnect the high-side hose from the vehicle.
9. Open the high-side and low-side valves on the control panel.
10. The system will quickly draw in refrigerant from both hoses through the low-side hose.
11. Close the low-side coupler valve.
12. Disconnect the low-side hose from the vehicle.

Unsuccessful Transfer

Sometimes the total charge does not transfer into the A/C system. There are two reasons why this may occur:

1. The pressure in the unit's tank and the pressure in the A/C system are roughly equal.
   - This will cause the transfer to proceed too slowly.
   - Refer to the manufacturer's instructions for the charging station in use.
2. There was not enough refrigerant in the unit's tank to transfer the full charge.
   - It is necessary to recover the partial charge of refrigerant from the vehicle and then evacuate and charge the A/C system again.
   - Refer to the manufacturer's instructions for the charging station in use.

ON VEHICLE SERVICE

CONTROL ASSEMBLY AND CONTROL CABLE

Refer to *Section 7A, Heating and Ventilation System (Without Air Conditioning).*

BLOWER MOTOR

Refer to *Section 7A, Heating and Ventilation System (Without Air Conditioning).*

BLOWER RESISTOR

Refer to *Section 7A, Heating and Ventilation System (Without Air Conditioning).*

INTAKE AIR DOOR ACTUATOR

Refer to *Section 7A, Heating and Ventilation System (Without Air Conditioning).*

HEATER HOSES

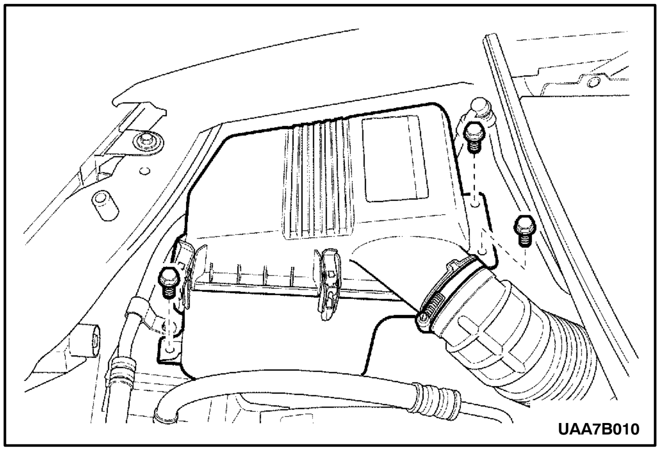
Refer to *Section 7A, Heating and Ventilation System (Without Air Conditioning).*

HEATER CORE

Refer to *Section 7A, Heating and Ventilation System (Without Air Conditioning)*

HEATER/AIR DISTRIBUTOR CASE ASSEMBLY

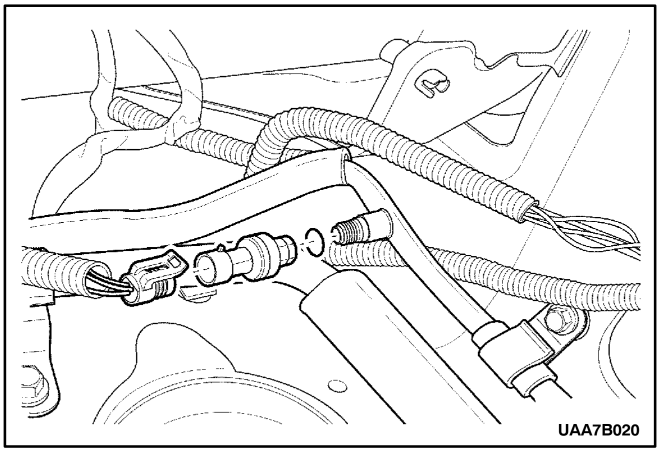
Refer to *Section 7A, Heating and Ventilation System (Without Air Conditioning)*



A/C PRESSURE SENSOR

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Recover the refrigerant. Refer to "Discharging, Adding Oil, Evacuating and Charging Procedure for A/C System" in this section.
3. Remove air cleaner hose clamp.
4. Remove three bolt that securing air cleaner housing and remove air cleaner housing.

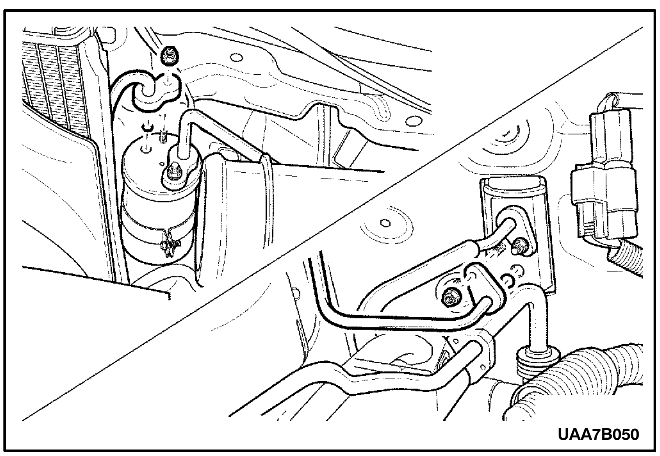


5. Disconnect the pressure sensor connector.
6. Remove the pressure sensor.

Installation Notice

Tightening Torque	7 N·m (62 lb–in)

7. Installation should follow the removal procedure in the reverse order.
8. Evacuate and recharge the A/C system. Refer to "Discharging, Adding Oil, Evacuation, and Charging Procedures for A/C System" in this section.



HIGH PRESSURE PIPE

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Recover the refrigerant. Refer to "Discharging, Adding Oil, Evacuating and Charging Procedure for A/C System" in this section.
3. Remove air cleaner housing assembly. Refer to *Section 1B, Engine Mechanical.*
4. Remove the nut on the flange of receiver-drier.

Installation Notice

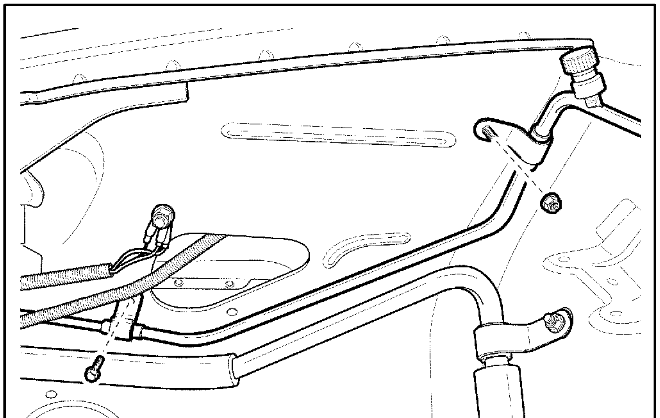
Tightening Torque	14 N·m (10 lb–ft)

5. Remove O-ring and discard it.
6. Remove A/C pressure sensor. Refer to "A/C Pressure Sensor" in this section.
7. Remove two nuts on the flange of evaporator.

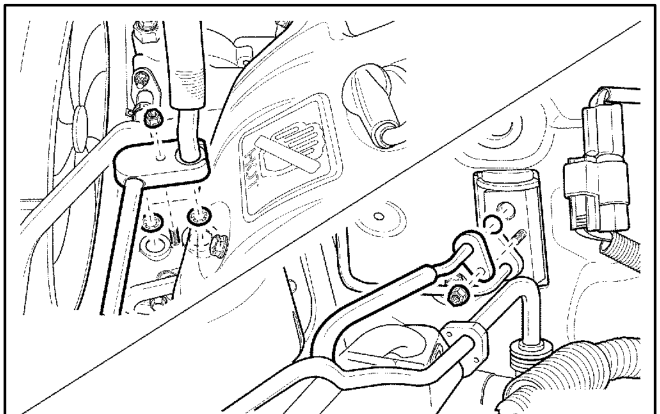
Installation Notice

Tightening Torque	14 N·m (10 lb–ft)

8. Remove O-ring and discard it.


UAA7B060

9. Remove one bolt and nut that securing the high pressure pipe.
10. Remove the high pressure pipe(receiver-drier-to-evaporator).
11. Installation should follow the removal procedure in the reverse order.
12. Evacuate and recharge the A/C system. Refer to “Discharging, Adding Oil, Evacuation, and Charging Procedures for A/C System” in this section.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SUCTION HOSE

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Recover the refrigerant. Refer to “Discharging, Adding Oil, Evacuating and Charging Procedure for A/C System” in this section.
3. Remove the snorkel and air cleaner housing. Refer to *Section 1B, Engine Mechanical.*
4. Remove one nut on the flange of the compressor.

Installation Notice

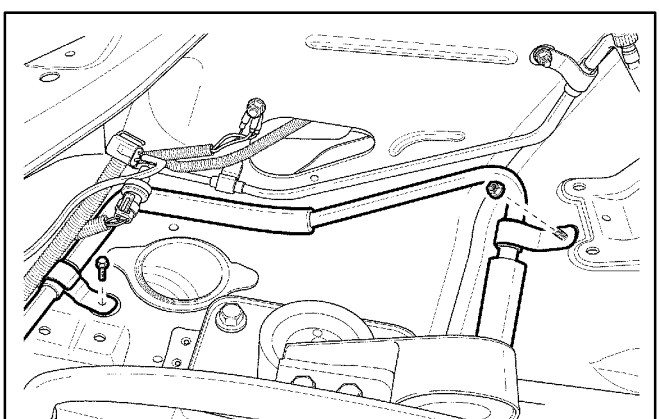
Tightening Torque	33 N·m (24 lb–ft)

5. Remove the sealing washer and discard it.
6. Remove two nuts on the flange of evaporator.

Installation Notice

Tightening Torque	14 N·m (10 lb–ft)

7. Remove O-ring and discard it.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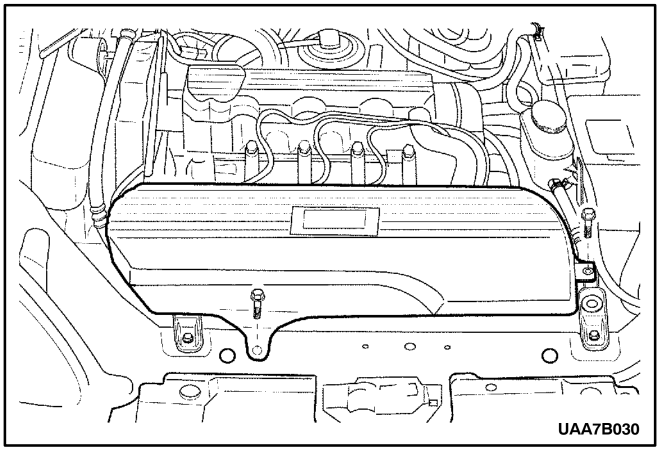
8. Remove one bolt and one nut that securing discharge hose.

Installation Notice

Tightening Torque	4 N·m (35 lb–in)

9. Installation should follow the removal procedure in the reverse order.
10. Evacuate and recharge the A/C system. Refer to “Discharging, Adding Oil, Evacuation, and Charging Procedures for A/C System” in this section.



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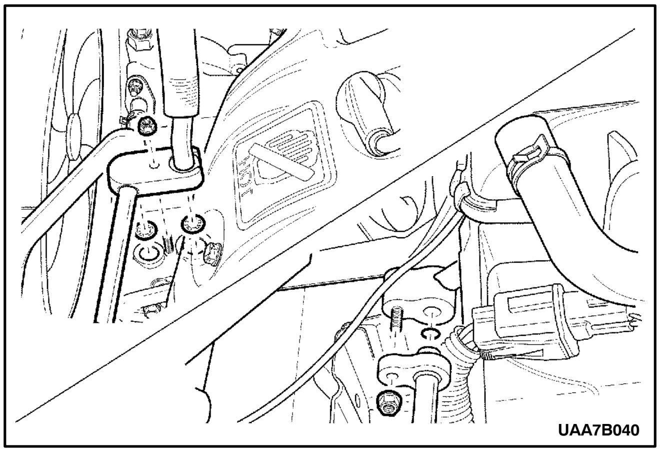
DISCHARGE HOSE

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Recover the refrigerant. Refer to “Discharging, Adding Oil, Evacuating and Charging Procedure for A/C System” in this section.
3. Remove two bolts and the air inlet duct. Refer to *Section 1B, Engine Mechanical.*

Installation Notice

Tightening Torque	8 N·m (71 lb–in)



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4. Remove the nut on the flange of compressor and sealing washer.

Installation Notice

Tightening Torque	33 N·m (24 lb–ft)

5. Remove the nut on the flange of condenser.

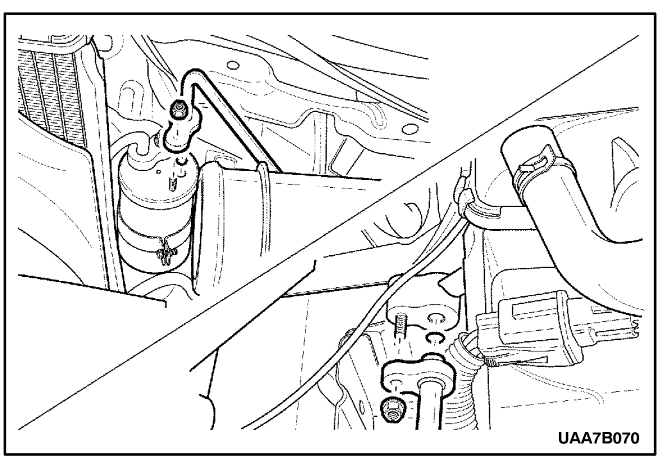
Installation Notice

Tightening Torque	16 N·m (12 lb–ft)

6. Remove O-ring and discard it.

UAA7B430

7. Remove the high pressure pipe.
8. Installation should follow the removal procedure in the reverse order.
9. Evacuate and recharge the A/C system. Refer to “Discharging, Adding Oil, Evacuation, and Charging Procedures for A/C System” in this section.



UAA7B070

CONDENSER

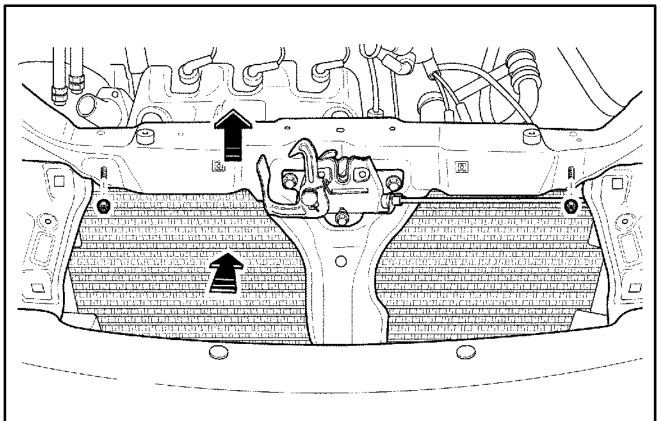
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Recover the refrigerant. Refer to “Discharging, Adding Oil, Evacuating and Charging Procedure for A/C System” in this section.
1. Remove the radiator. Refer to *Section 1D, Engine Cooling.*
2. Remove two nuts on the flange of the A/C pipe line, on both side of the condenser.

Installation Notice

Tightening Torque	to Discharge Hose	16 N·m (12 lb–ft)
	to Receiver-Drier	14 N·m (10 lb–ft)

3. Remove O-rings and discard them.



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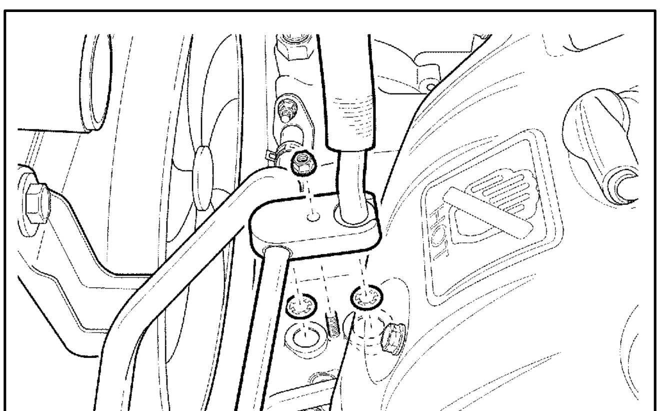
4. Remove two condenser-retaining nuts.

Installation Notice

Tightening Torque	4 N·m (35 lb–in)

5. Installation should follow the removal procedure in the reverse order.
6. Evacuate and recharge the A/C system. Refer to "Discharging, Adding Oil, Evacuation, and Charging Procedures for A/C System" in this section.



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COMPRESSOR

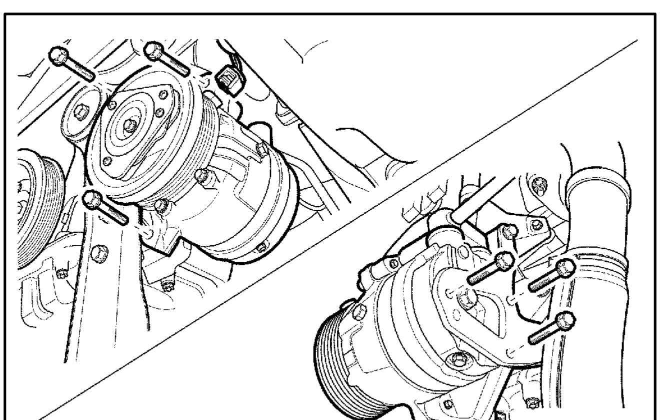
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Recover the refrigerant. Refer to "Discharging, Adding Oil, Evacuating and Charging Procedure for A/C System" in this section.
3. Remove serpentine accessory drive belt.
4. Remove the nut and suction/discharge hose from compressor.

Installation Notice

Tightening Torque	33 N·m (24 lb–ft)

5. Remove two sealing washer and discard it.



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6. Lift the vehicle and support safely.
7. Remove engine under cover. Refer to *Section 9N, Frame and Underbody.*
8. Disconnect the compressor clutch connector
9. Remove the three front compressor mounting bolts.

Installation Notice

Tightening Torque	38 N·m (28 lb–ft)

10. Remove the three rear compressor mounting bolts.

Installation Notice

Tightening Torque	22 N·m (16 lb–ft)

11. Remove the compressor.

12. Drain the oil from the compressor into a container.
    - Remove the drain plug and drain the oil the opening.
    - Drain the oil from the suction port and the discharge port of the compressor.
    - Measure the amount of oil drained. Discard the used oil.

Installation Notice: Add oil to the compressor. Use the exact amount of oil that was drained from the compressor.

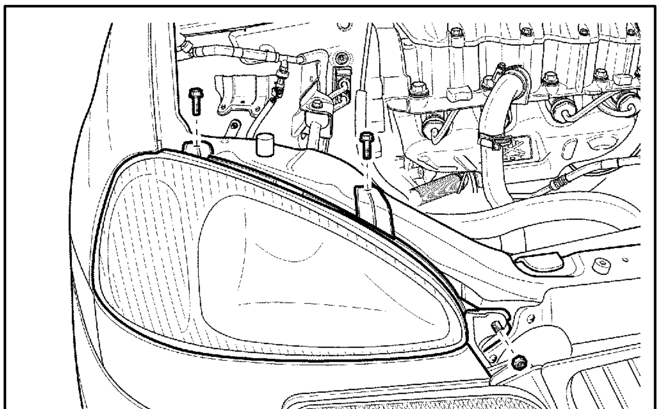
Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

13. Installation should follow the removal procedure in the reverse order.
14. Evacuate and recharge the A/C system. Refer to “Discharging, Adding Oil, Evacuation, and Charging Procedures for A/C System” in this section.

RECEIVER-DRIER

Removal and Installation Procedure



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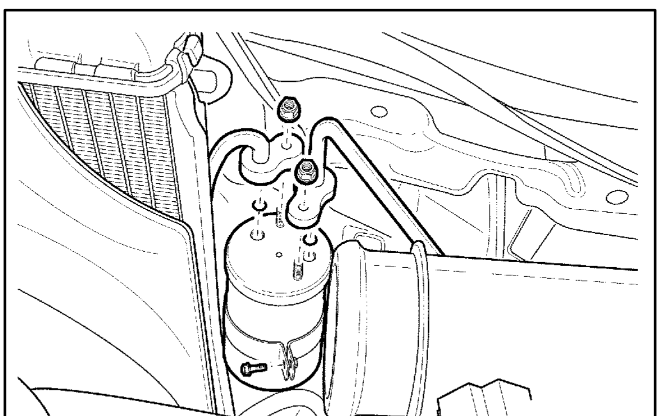
1. Disconnect the negative battery cable.
2. Recover the refrigerant. Refer to “Discharging, Adding Oil, Evacuating and Charging Procedure for A/C System” in this section.
3. Remove two bolts and one nut of right side head lamp.
4. Remove head lamp.



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5. Remove two nuts on the flange of high pressure pipes from the top of the receiver-drier

Installation Notice

Tightening Torque	14 N·m (10 lb–ft)

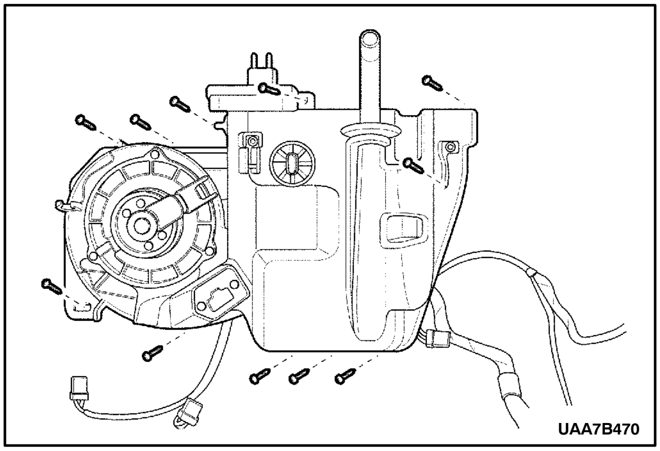
6. Remove O-ring and discard it
7. Loosen the bolt securing the receiver-dryer band clamp.
8. Remove the receiver-drier.
9. Cap the open connections to prevent contamination.
10. Drain the oil from the receiver-dryer into a container. Measure the amount of oil drained from the receiver/dryer. Discard this used oil.

Installation Notice: Add oil to the compressor. Use the exact amount of oil that was drained from the receiver-drier.

11. Installation should follow the removal procedure in the reverse order.

Important: Do not uncap the new unit until just prior to installation.

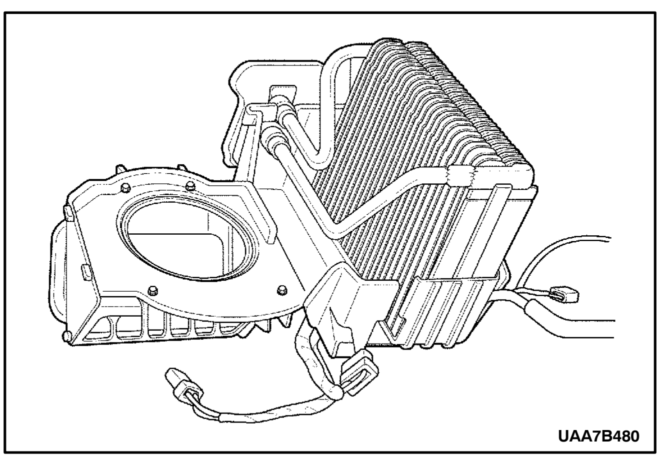
12. Evacuate and recharge the A/C system. Refer to "Discharging, Adding Oil, Evacuation, and Charging Procedures for A/C System" in this section.



EVAPORATOR CORE

Removal and Installation Procedure

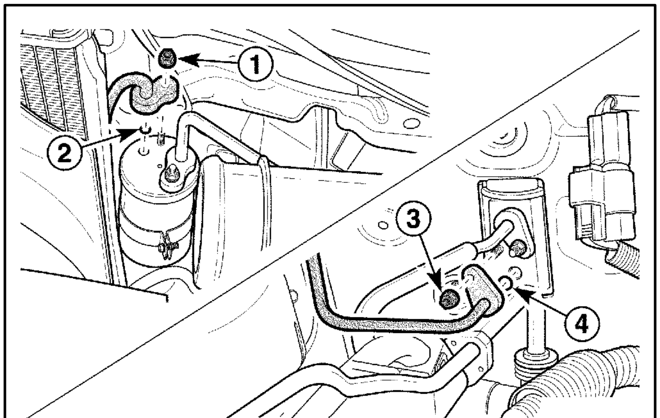
1. Disconnect the negative battery cable.
2. Recover the refrigerant. Refer to "Discharging, Adding Oil, Evacuating and Charging Procedure for A/C System" in this section.
3. Remove the heater/air distributor case assembly. Refer to *Section 7A, Heating and Ventilation System.*
4. Remove wiring on the heater module.
5. Disconnect connectors for blower motor, blower resister or power transistor, air mix door motor, and mode control motor.
6. Remove five screws and two clips and separate heater module from evaporator/blower module.
7. Remove A/C filter.



8. Remove 11 screws and two clips that fastening upper and lower case.
9. Separate upper and lower case and remove evaporator with expansion valve.
10. Remove expansion valve.

Notice: Be careful not to damage the sealing material. If damaged change with new equivalent material.

11. Installation should follow the removal procedure in the reverse order.
12. Evacuate and recharge the A/C system. Refer to "Discharging, Adding Oil, Evacuation, and Charging Procedures for A/C System" in this section.



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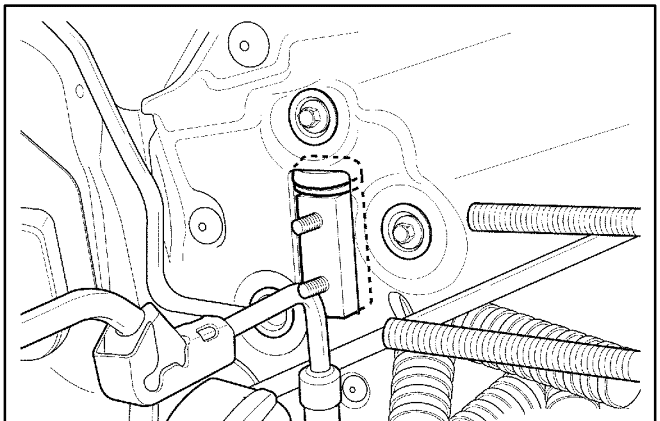
A/C EXPANSION VALVE

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Recover the refrigerant. Refer to “Discharging, Adding Oil, Evacuating and Charging Procedure for A/C System” in this section.
3. Remove two nuts on the evaporator flange.

Installation Notice

Tightening Torque	14 N·m (10 lb–ft)


UAA7B500

4. Remove two stud bolts and expansion valve.
5. Remove O-rings and discard them.

Installation Notice

Tightening Torque	14 N·m (10 lb–ft)

6. Installation should follow the removal procedure in the reverse order.
7. Evacuate and recharge the A/C system. Refer to “Discharging, Adding Oil, Evacuation, and Charging Procedures for A/C System” in this section.

UNIT REPAIR

V5 AIR CONDITIONING COMPRESSOR OVERHAUL

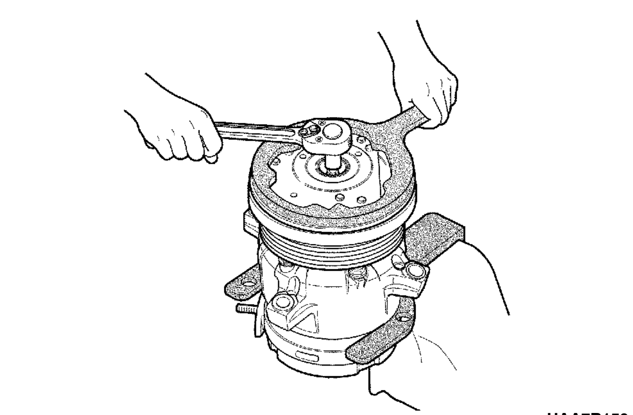
CLUTCH PLATE AND HUB ASSEMBLY

Tools Required

J–33013–B Hub and Drive Plate Remover and Installer

J–33027 Clutch Hub Holding Tool

J–34992 Compressor Holding Fixture



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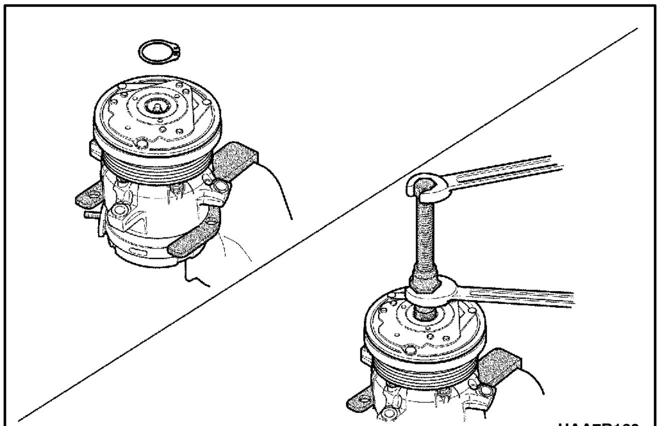
Disassem° ly and Assem° ly Procedure

1. Remove the compressor. Refer to “Compressor” in this section.
2. Install the compressor holding fixture J–34992 to the compressor and hold the compressor holding fixture using a bench vise.
3. Use the clutch hub holding tool J–33027 to keep the clutch drive plate and the hub assembly from turning.
4. Remove the shaft nut.



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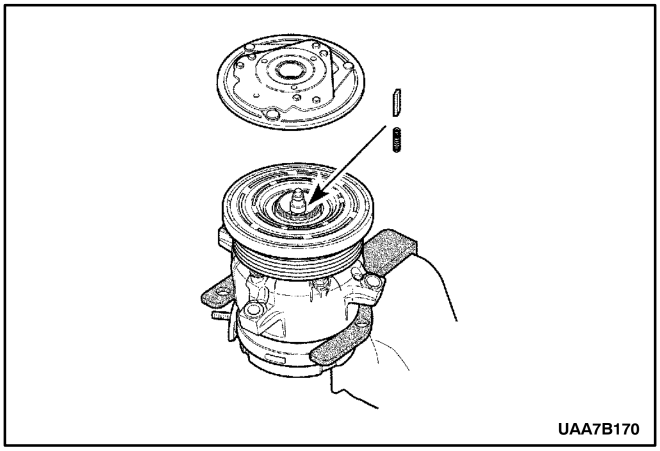
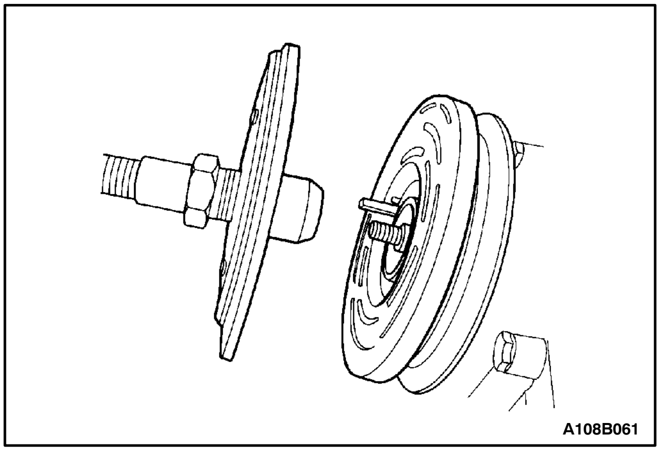
5. Remove snap ring.
6. Thread the hub and drive plate remover and installer J–33013–B into the hub. Hold the body of the remover with a wrench and turn the center screw into the remover body to remove the clutch drive plate and the hub assembly.



7. Remove the clutch hub key. Retain the key for assembly.

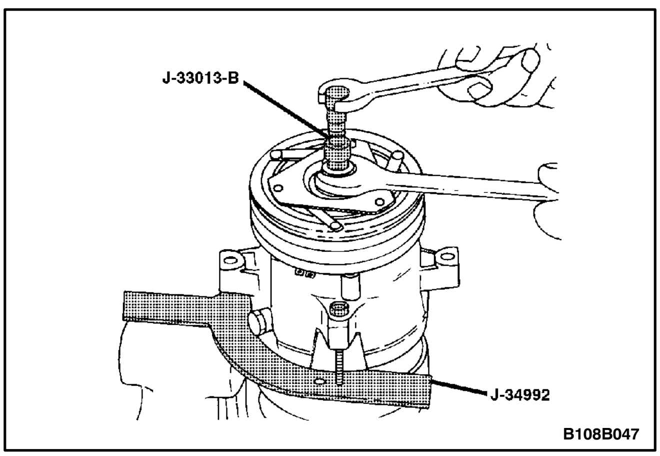


Assem° ly Procedure

1. Install the clutch hub key into the hub keyway. Allow the key to project approximately 3.2 mm (1/8 inch) out of the keyway. The hub key is curved slightly to provide an interference fit in the hub key groove.
2. Be sure the frictional surface of the clutch plate and the pulley rotor are clean before installing the clutch drive plate and the hub assembly.

Notice: Do not drive or pound on the clutch hub or the shaft. Internal damage to the compressor may result.

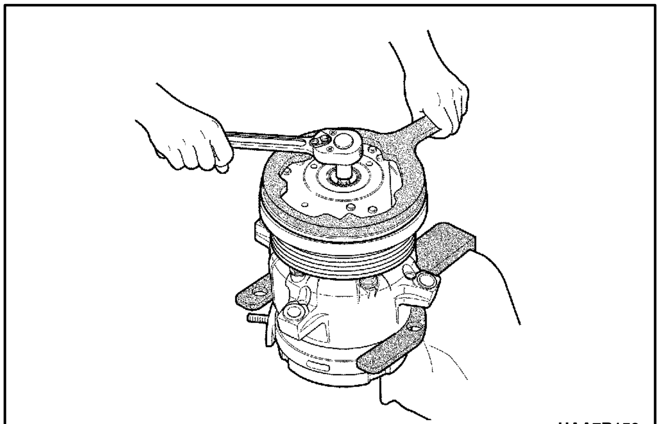
3. Align the clutch hub key with the shaft keyway. Place the clutch drive plate and the hub assembly onto the compressor shaft.



4. Remove the hub and drive plate remover and installer J–33013–B center bolt and reverse the body direction on the center bolt. The body of the hub and drive plate remove and installer J–33013–B should be backed off sufficiently to allow the center bolt to be threaded onto the end of the compressor shaft.

Important: If the center bolt is threaded fully onto the end of the compressor shaft, or if the body of the hub and drive plate remover and installer J–33013–B is held and the center bolt is rotated, the key will wedge and could break the clutch drive plate and the hub assembly.

5. Install the hub and drive plate remover and installer J–33013–B and the bearing onto the clutch drive plate. Thread the center bolt onto the compressor shaft.
6. Hold the center bolt with a wrench. Tighten the hex portion of the hub and drive plate remover and installer J–33013–B body to press the hub onto the shaft. Tighten the body several turns.
7. Remove the hub and drive plate remover and installer J–33013–B and check to see that the clutch hub key is still in place in the key way before installing the clutch drive plate and the hub assembly to its final position. The air gap between frictional surfaces of the clutch drive plate and the clutch pulley rotor should be 0.38 to 0.64 mm (0.015 to 0.025 inch).



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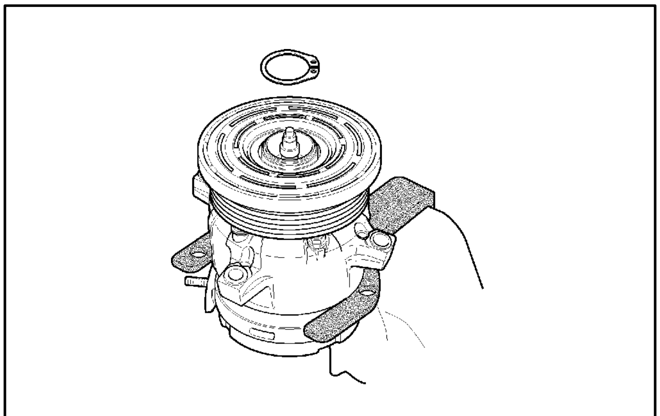

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8. Remove the hub and drive plate remover and installer J–33013–B. Check for proper positioning of the clutch hub key. It should be even or slightly above the clutch hub.
9. Install the shaft nut.

Tightening Torque	17 N·m (13 lb–ft)

10. Spin the pulley rotor by hand to verify that the pulley is not rubbing the clutch drive plate.
11. Remove the compressor from the bench vise and remove the J–34992 compressor holding fixture on the compressor.
12. Install the compressor. Refer to “Compressor” in this section.

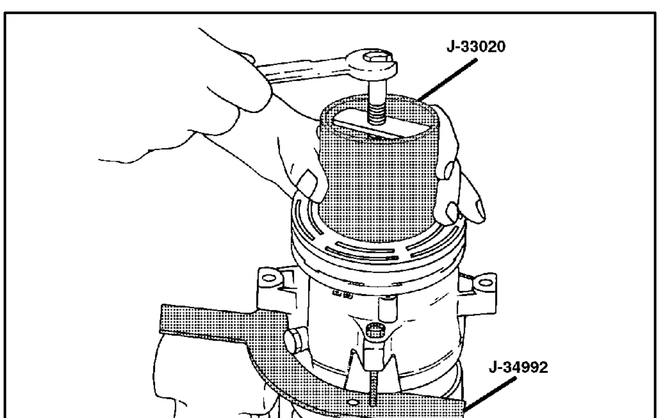
CLUTCH ROTOR AND BEARING

Tools Required

J–9398–A Bearing Remover
J–9481 Bearing Installer
J–33020 Pulley Puller
J–33023–A Puller Pilot
J–33019 Bearing Staking Tool Set
Includes: J–33019–1 Bearing Staking Guide
Includes: J–33019–2 Bearing Staking Pin
J–33017 Pulley Rotor and Bearing Assembly Installer
J–8433–1 Puller Crossbar
J–34992 Compressor Holding Fixture
J–8092 Driver Handle
J–8433–3 Forcing Screw

Disassem° ly Procedure

1. Disconnect the negative battery cable.
2. Recover the refrigerant. Refer to “Discharging, Adding Oil, Evacuating, and Charging for A/C System” in this section.
3. Remove the compressor. Refer to “Compressor” in this section.
4. Remove the clutch drive plate and the hub assembly. Refer to “Clutch Plate and Hub Assembly” in this section.
5. Remove the pulley rotor and the bearing assembly retaining ring using the snap ring pliers.



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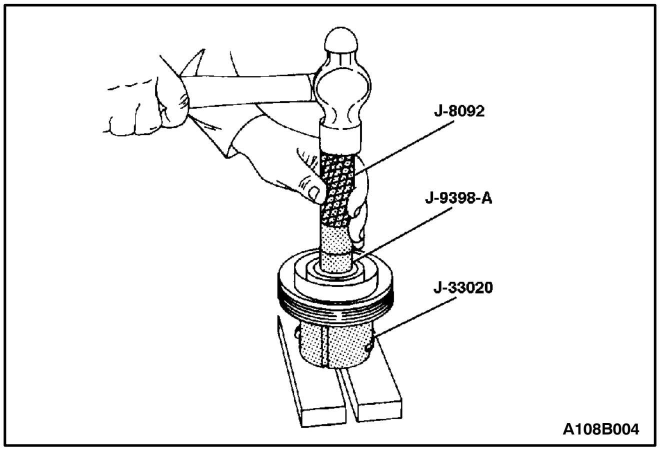
6. Install the pulley puller J–33020 into the inner circle of slots in the pulley rotor. Turn the pulley puller J–33020 clockwise in the slots to engage the puller tangs with the segments between the slots in the rotor.
7. Hold the pulley puller J–33020 in place and tighten the puller bolt against the compressor shaft to remove the pulley rotor and the bearing assembly.

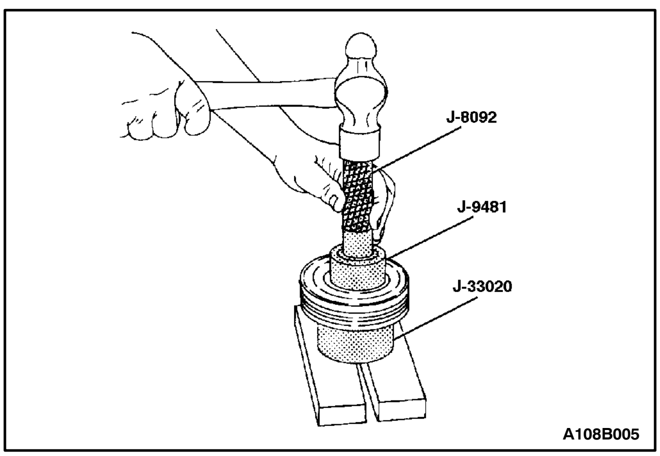


Notice: The rotor hub must be properly supported to prevent damage to the pulley rotor during bearing removal.

8. Remove the puller bolt from the pulley puller J–33020. With the puller tangs still engaged in the rotor slots, invert the assembly onto a solid flat surface or blocks.

Notice: It is not necessary to remove the staking in front of the bearing to remove the bearing. It will be necessary to file away the old stake metal for proper clearance for the new bearing to be installed into the rotor bore or the bearing may be damaged.

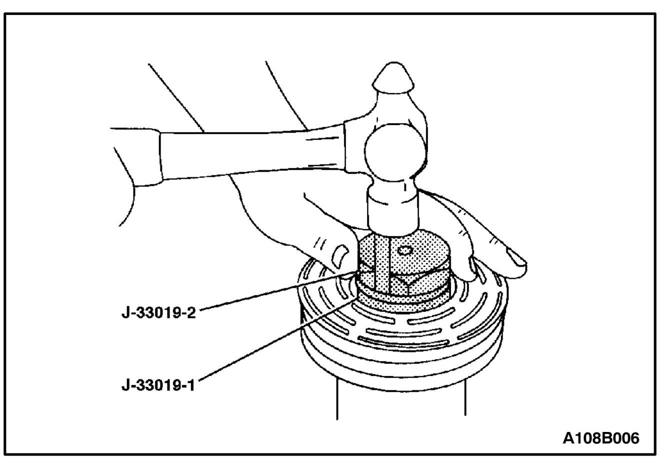
9. Drive the bearing out of the rotor hub with the bearing remover J–9398–A and the driver handle J–8092.



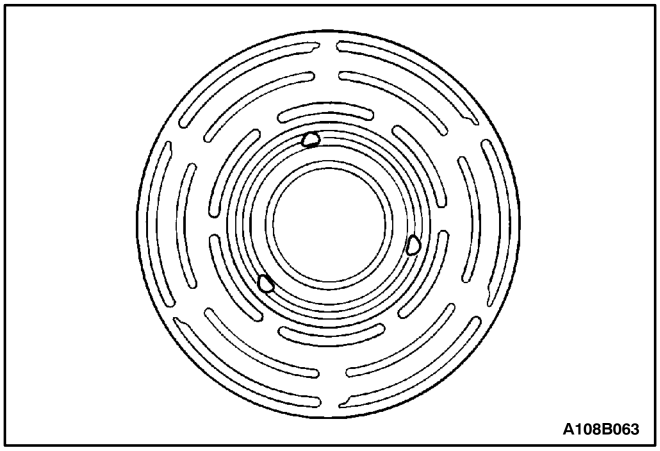
Assem° ly Procedure

Notice: Do not support the rotor by resting the pulley rim on a flat surface during the bearing installation or the rotor face could be damaged.

1. Invert the pulley rotor and place it on a support block to fully support the rotor hub during bearing installation.
2. Align the new bearing squarely in the pulley bore. Use the bearing installer J–9481 and the driver handle J–8092, drive the bearing fully into the pulley bore.

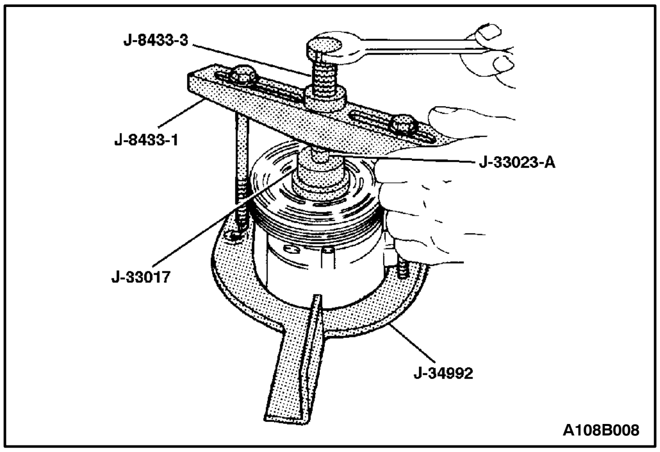


3. Place the bearing staking guide J–33019–1 and the bearing staking pin J–33019–2 in the rotor hub core. Shift the rotor and bearing assembly on the block to give full support to the hub under the staking pin location. A heavy–duty rubber band may be used to hold the staking tool pin in the guide. The pin should be properly positioned in the guide after each impact on the pin.

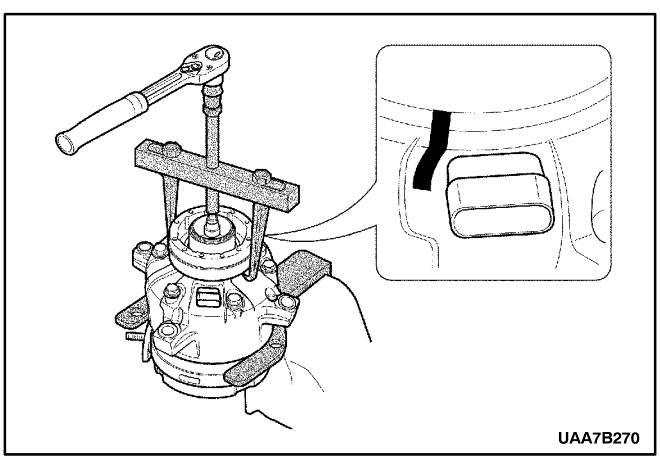


Caution: When striking the pin with a hammer, take care to avoid personal injury.

4. Strike the pin with a hammer until a metal stake, similar to the original, is formed down to, but not touching, the bearing. The metal stake should not contact the outer race of the bearing to avoid the possibility of distorting the outer race. Stake in three places, each 120 degrees apart.



5. With the compressor mounted to the holding fixture J–34992, position the rotor and the bearing assembly on the compressor housing.
6. Position the pulley rotor and bearing assembly installer J–33017 and the puller pilot J–33023–A directly over the inner race of the bearing.
7. Position the puller crossbar J–8433–1 center forcing bolt on the puller pilot J–33023–A and assemble the two through–bolts and the washers through the puller crossbar J–8433–1 slots. Thread them into the holding fixture. The thread of the through–bolts should engage the full thickness of the fixture.
8. Tighten the center forcing screw J–8433–3 in the puller crossbar J–8433–1 to force the pulley rotor and the bearing assembly onto the compressor housing.
9. Install the rotor and the bearing assembly retainer ring using the snap ring pliers.
10. Reinstall the clutch drive plate and hub assembly. Refer to “Clutch Drive Plate and Hub Assembly” in this section.
11. Install the compressor. Refer to “Compressor” in this section.
12. Connect the negative battery cable.
13. Evacuate and recharge the A/C system. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C System” in this section.



CLUTCH COIL

Tools Required

J–8433–1 Puller Crossbar

J–8433–3 Forcing Screw

J–33023–A Puller Pilot

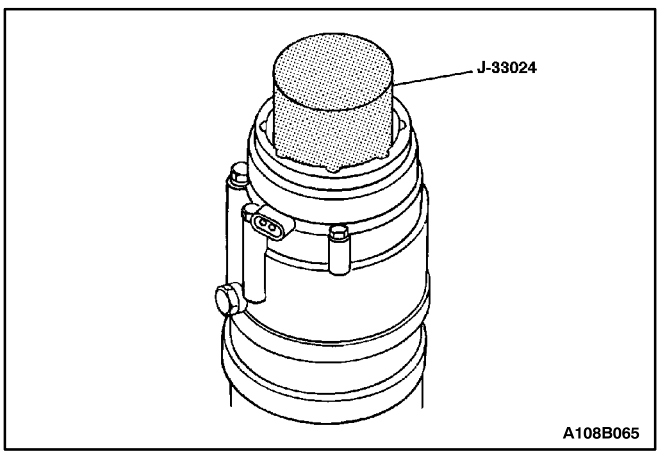
J–33024 Clutch Coil Installer Adapter

J–33025 Clutch Coil Puller Legs

J–34992 Compressor Holding Fixture

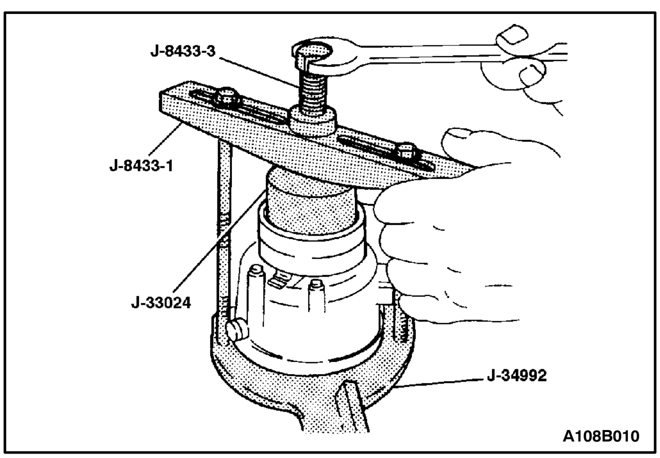
Disassem° ly Procedure

1. Disconnect the negative battery cable.
2. Recover the refrigerant. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C System” in this section.
3. Remove the compressor. Refer to “Compressor” in this section.
4. Remove the clutch plate and hub assembly. Refer to “Clutch Plate and Hub Assembly” in this section.
5. Remove the clutch rotor and bearing. Refer to “Clutch Rotor and Bearing” in this section.
6. Mark the clutch coil terminal location on the compressor housing.
7. Install the puller pilot J–33023–A on the compressor housing. Also install the puller crossbar J–8433–1 with the clutch coil puller legs J–33025.
8. Tighten the forcing screw J–8433–3 against the puller pilot J–33023–A to remove the clutch coil.



Assem° ly Procedure

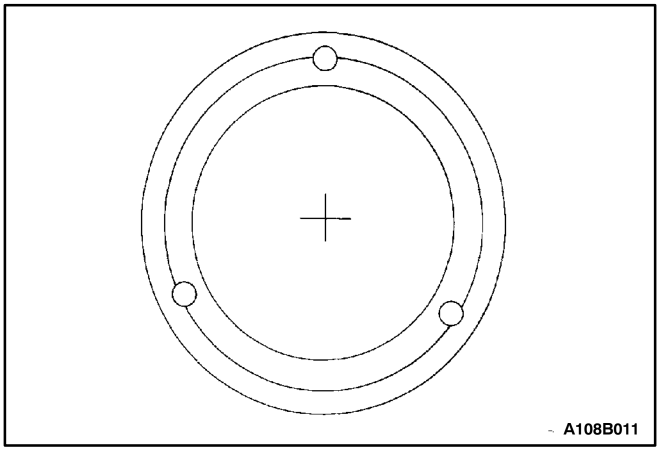
1. Place the clutch coil assembly on the compressor housing with the terminals positioned at the “marked” location.
2. Place the clutch coil installer adapter J–33024 over the internal opening of the clutch coil housing and align the clutch coil installer adapter J–33024 with the compressor housing.



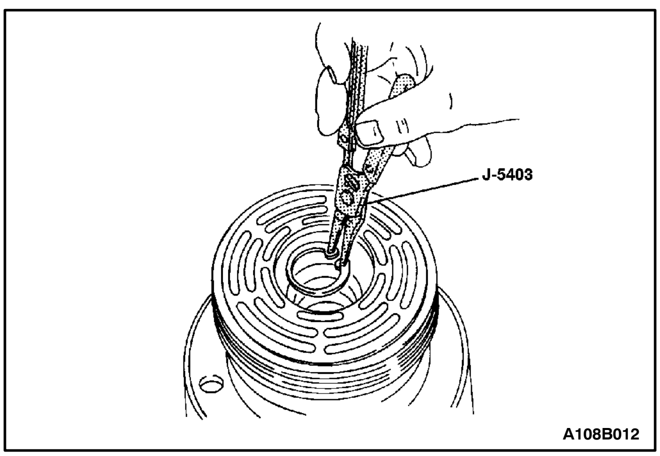
3. Center the puller crossbar J–8433–1 in the countersunk center hole of the clutch coil installer adapter J–33024. Install the compressor holding fixture J–34992, the through-bolts, and the washers through the crossbar slots. Thread the through-bolts into the holding fixture to the full thickness of the holding fixture.

Important: Be sure the clutch coil and the installer stay “in-line” during installation.

4. Turn the forcing screw J–8433–3, or use a suitable vise, to force the clutch coil onto the compressor housing.



5. When the clutch coil is fully seated on the compressor housing, use a 3 mm (1/8 inch) diameter drift punch and stake the housing at three places, each 120 degrees apart, to ensure that the clutch coil will remain in position. Stake point size should be only one-half the area of the punch tip and approximately 0.28 to 0.35 mm (0.010 to 0.015 inch) deep.
6. Install the clutch rotor and bearing assembly. Refer to “Clutch Rotor and Bearing” in this section.
7. Install the clutch plate and hub assembly. Refer to “Clutch Plate and Hub Assembly” in this section.
8. Install the compressor. Refer to “Compressor” in this section.
9. Connect the negative battery cable.
10. Evacuate and recharge the A/C system. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C System” in this section.



SHAFT SEAL REPLACEMENT

Tools Required

J–9553–1 O-Ring Remover

J–23128–A Seal Seat Remover and Installer

J–33011 O-Ring Installer

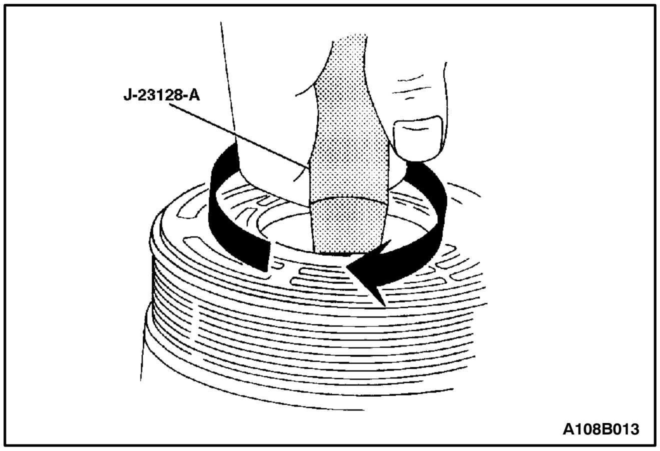
J–34614 Shaft Seal Protector

Important: A shaft seal should not be replaced because a small amount of oil is found on the adjacent surface. The seal is designed to leak some oil for lubrication purposes. A shaft seal should only be changed when a large amount of sprayed oil is found. Then, only after actual refrigerant leakage is found by using an approved leak detection procedure. Refer to “Leak Testing the Refrigerant System” in this section.

Should a compressor shaft seal ever have to be replaced, the receiver-dryer in this system must also be removed from the vehicle. The oil in the receiver-dryer must then be drained, measured and replaced. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C System” in this section.

Disassem°ly Procedure

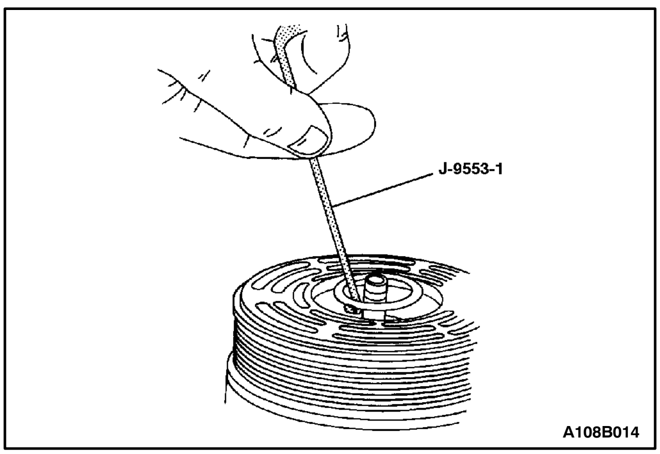
1. Disconnect the negative battery cable.
2. Recover the refrigerant. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C System” in this section.
3. Loosen and reposition the compressor in the mounting brackets.
4. Remove the clutch drive plate and hub assembly from the compressor. Refer to “Clutch Plate and Hub Assembly” in this section.
5. Use the snap ring pliers J–5403 to remove the shaft seal retaining ring.



A108B013

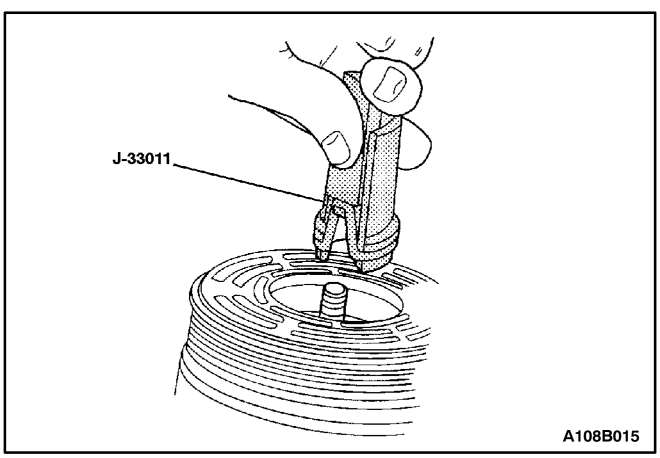
Notice: Any dirt or foreign material that enters the compressor may cause damage.

6. Thoroughly clean the inside of the compressor housing area surrounding the shaft, the exposed portion of the seal, the shaft itself and the O-ring groove.
7. Fully engage the knurled tangs of the seal seat remover and installer J–23128–A into the recessed portion of the seal by turning the handle clockwise. Remove and discard the seal from the compressor with a rotating-pulling motion. The handle should be hand-tightened securely. Do not use a wrench or pliers to tighten the handle.



A108B014

8. Remove and discard the O-ring from the compressor neck using the O-ring remover J–9553–1.
9. Thoroughly clean the seal O-ring groove in the compressor housing.
10. Inspect the shaft and the inside of the compressor housing neck for dirt or foreign material. These parts must be perfectly clean before installing any new parts.



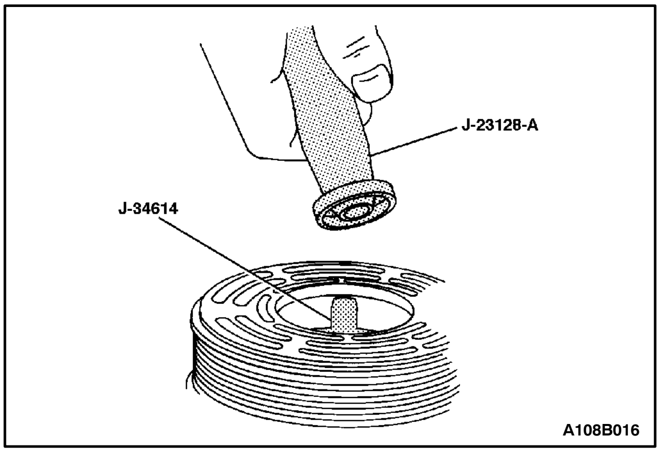
A108B015

Assem°ly Procedure

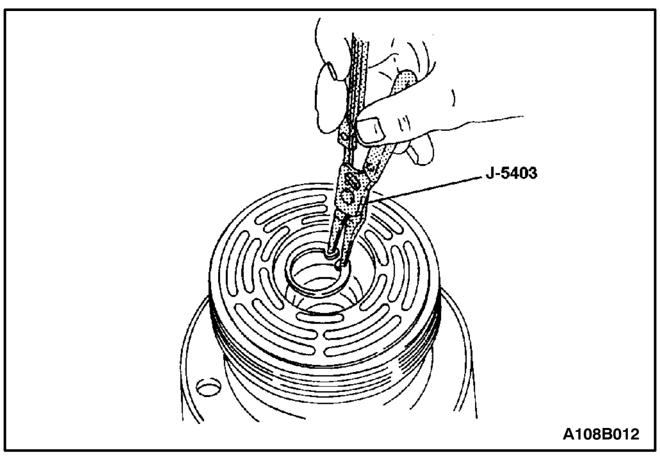
Important: Seals must not be reused. Always use a new specification service seal kit. Be sure that the seal to be installed is not scratched or damaged in any way. The seal must be free of lint and dirt that may damage the seal surface or prevent proper sealing.

1. Dip the new seal O-ring in clean polyalkalene glycol (PAG) refrigerant oil and assemble the O-ring onto the O-ring installer J–33011.
2. Insert the O-ring installer J–33011 into the compressor neck until the installer “bottoms.” Lower the moveable slide of the O-ring installer J–33011 to release the O-ring into the seal O-ring lower groove.

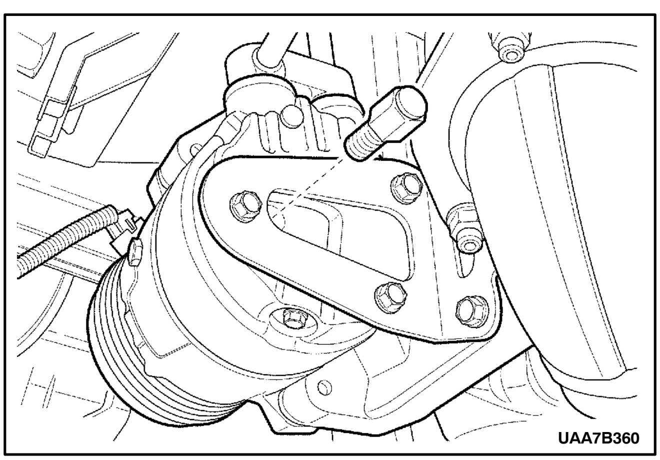
(The top groove of the compressor neck is for the shaft seal retainer ring.) Rotate the installer to seat the O-ring and then remove the installer.



3. Attach the shaft lip seal to the seal seat remover and installer J–23128–A. Dip the seal in clean PAG oil.
4. Install the shaft seal protector J–34614 in the seal. Place it over the shaft and push the seal into place with a rotary motion.



5. Use the snap ring pliers J–5403 to install the shaft seal retaining ring with its flat side against the seal.
6. Remove any excess oil around the shaft and the inside of the compressor housing neck.
7. Install the clutch plate and hub assembly. Refer to “Clutch Plate and Hub Assembly” in this section.
8. Reposition the compressor in its mounting.
9. Adjust the tension on the drive belt.
10. Connect the negative battery cable.
11. Evacuate and recharge the A/C system. Refer to “Discharging, Adding Oil, Evacuating and Charging Procedures for A/C System” in this section.
12. Perform a leak test of the system. Refer to “Leak Testing the Refrigerant System” in this section.



PRESSURE RELIEF VALVE

Disassem° ly Procedure

1. Recover the refrigerant. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C System” in this section.
2. Raise the vehicle.
3. Remove the pressure relief valve.
4. Clean the valve seat area.

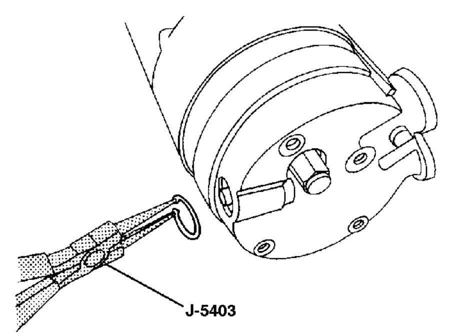
Assem° ly Procedure

1. Lubricate the O-ring of the new pressure relief valve with new polyalkalene glycol (PAG) oil.
2. Install the new valve.

Installation Notice

Tightening Torque	17 N·m (12 lb–ft)

3. Lower the vehicle.
4. Evacuate and recharge the system. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C System” in this section.



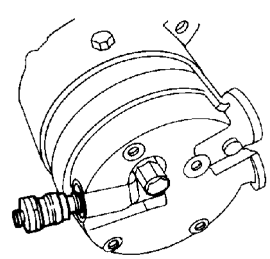
A108B018

CONTROL VALVE ASSEMBLY

Tools Required

Disassem° ly Procedure

1. Recover the refrigerant. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C System” in this section.
2. Remove the control valve retaining ring using the snap ring pliers.
3. Remove the control valve assembly.


A108B019

Assem° ly Procedure

1. Coat all the O-rings with clean polyalkalene glycol (PAG) oil.
2. Push the control valve in place using thumb pressure.
3. Use the snap ring pliers J–5403 to install the valve retaining ring. The high point of the curved sides must be against the valve housing. Be sure the retaining ring is properly seated in the ring groove.
4. Evacuate and recharge the A/C system. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C System” in this section.

SPECIFICATIONS

COOLING CAPACITY

Application	Description
Type	Air mix type
Max. Capacity	4,500 kcal/h (17857 Btu/h)
Max. Blowing Capacity	7.0m2/min
Refrigerant	R–134a
Refrigerant capacity	750 ± 20 g (RHD: 820 ± 20 g)

COMPRESSOR

Application	Description
Model	V5
Type	Wobble Plate Variable Displacement
Displacement	9.8 – 151 cc (0.6 – 9.21 cu in)/rev
Capacity (at 2000 R.P.M)	7415 W(25300 BTU/hr)
Oil	220ml (Synthetic Oil)
High Pressure Relief Valve	3171 – 4137 kPa (460 – 600 psi)
Control Valve	290 ± 7 kPa (42 ± 1 psi)

CONDENSER

Application	Description
Type	Parallel type(Multi Flow Condenser)
Capacity	11400 kcal/h (45239 Btu/h)
Size	607.6 x 369.2 x 20

RECEIVER–DRIER

Application	Description
Desiccant	XH–9 or equivalent (30g)
Type	Aluminum type
Capacity	250 cc (15.3 cu in)

A/C PRESSURE SENSOR

Application	Description
High(Gauge Pressure)	ON: 2115 kPa (307 psi) OFF: 2936 kPa (426 psi)
Low(Gauge Pressure)	ON: 230 kPa (33 psi) OFF: 192 kPa (28 psi)

EVAPORATOR

Application	Description
Type	Tank laminated
Size	263.0 x 197.6 x 88.9
Capacity	6300 kcal/h (25000Btu/h)

HEATER UNIT

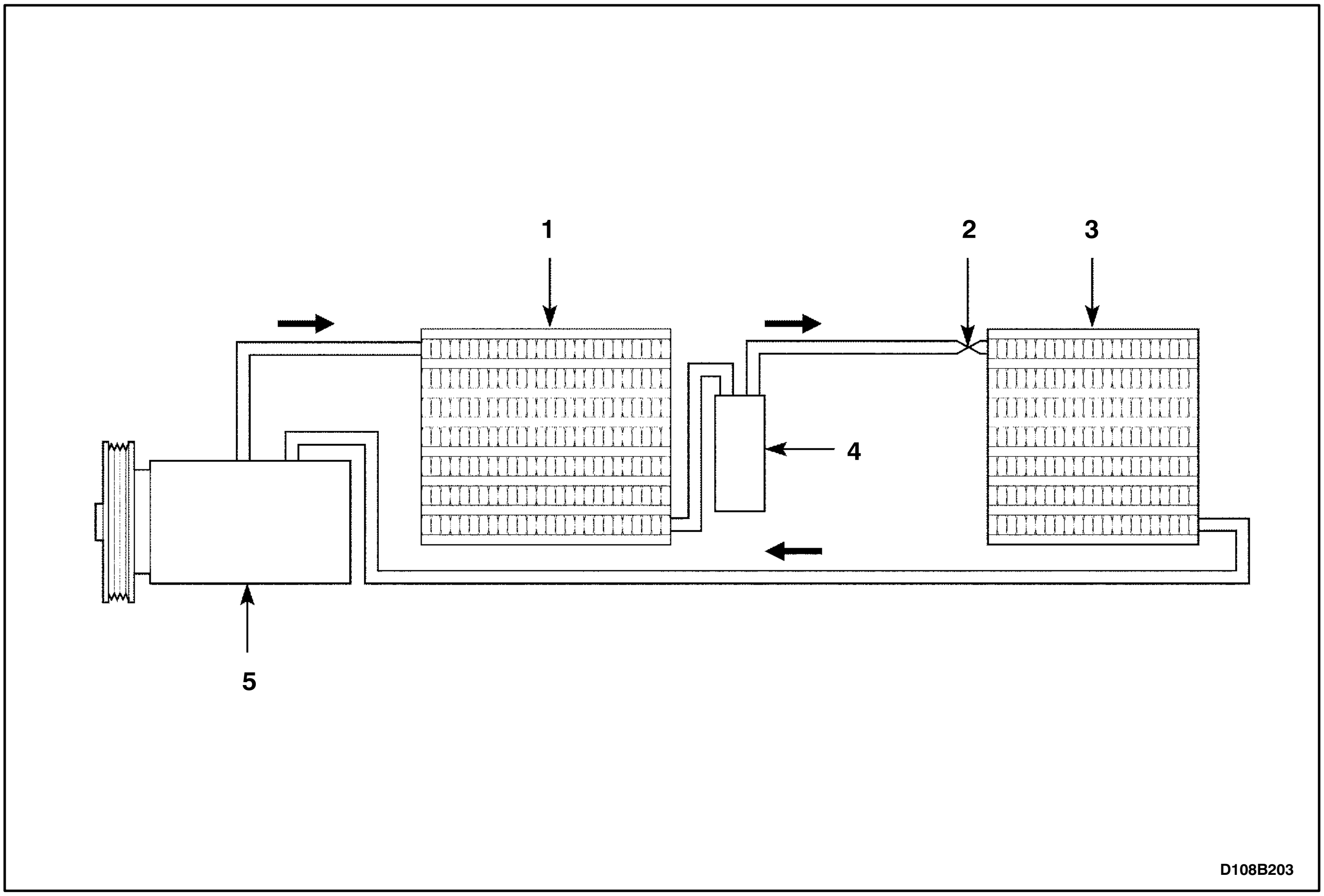
Application	Description
Heating Capacity	8250 kcal/h (32739 Btu/h)
Heater Core Size	200.4 x 168.2 x 25.0

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	L° -Ft	L° -In
A/C Pressure Sensor	7	–	62
Receiver-Drier Flange Nut	16	12	–
Expansion Valve-to-High Pressure Pipe Nut	14	10	–
Suction/Discharge Hose-to-Compressor Nut	33	24	–
Suction Hose-to-Expansin Valve Nut	14	10	–
Suction Hose retaining Clamp Nut	4	–	35
Air Cleaner Snorkel Bolt	8	–	71
Discharge Hose-to-Condenser Nut	16	12	–
Condenser-to-Receiver-Drier Nut	14	10	–
Condenser Retaining Nut	4	–	35
Compressor Front Mounting Bolt	38	28	–
Compressor Rear Mounting Bolt	22	16	–
Compressor Drain Plug	20	15	–
Expansion Valve Stud Bolts	14	10	–

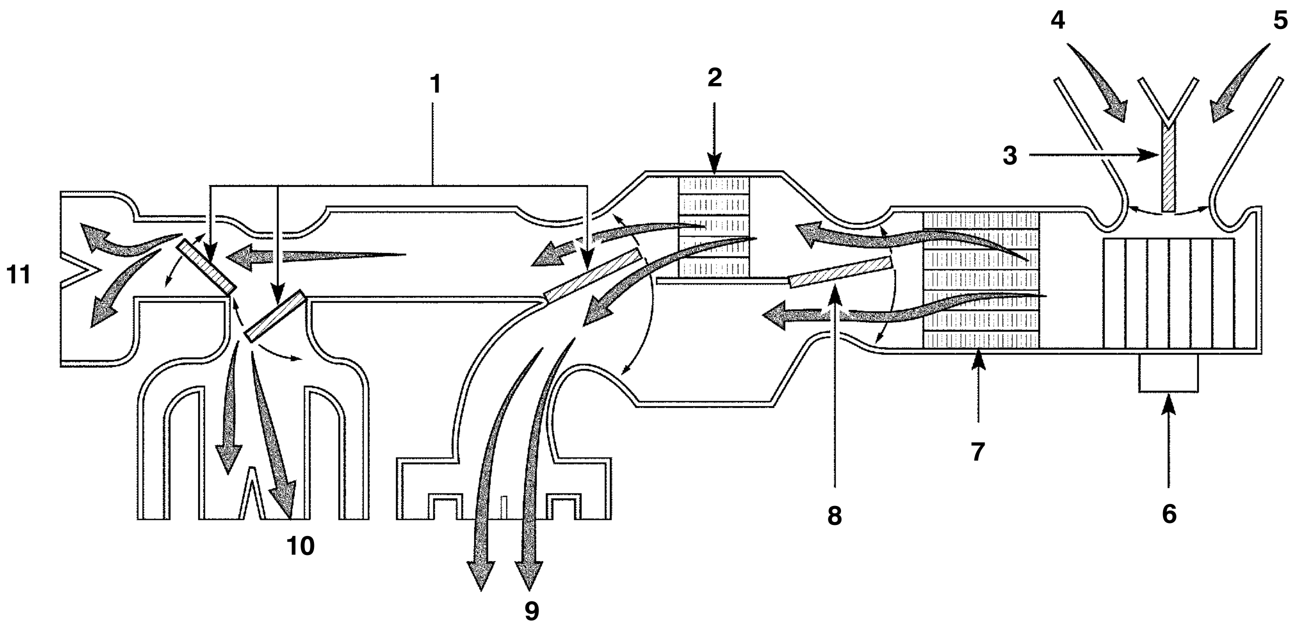
SCHEMATIC AND ROUTING DIAGRAMS

A/C SYSTEM – TYPICAL



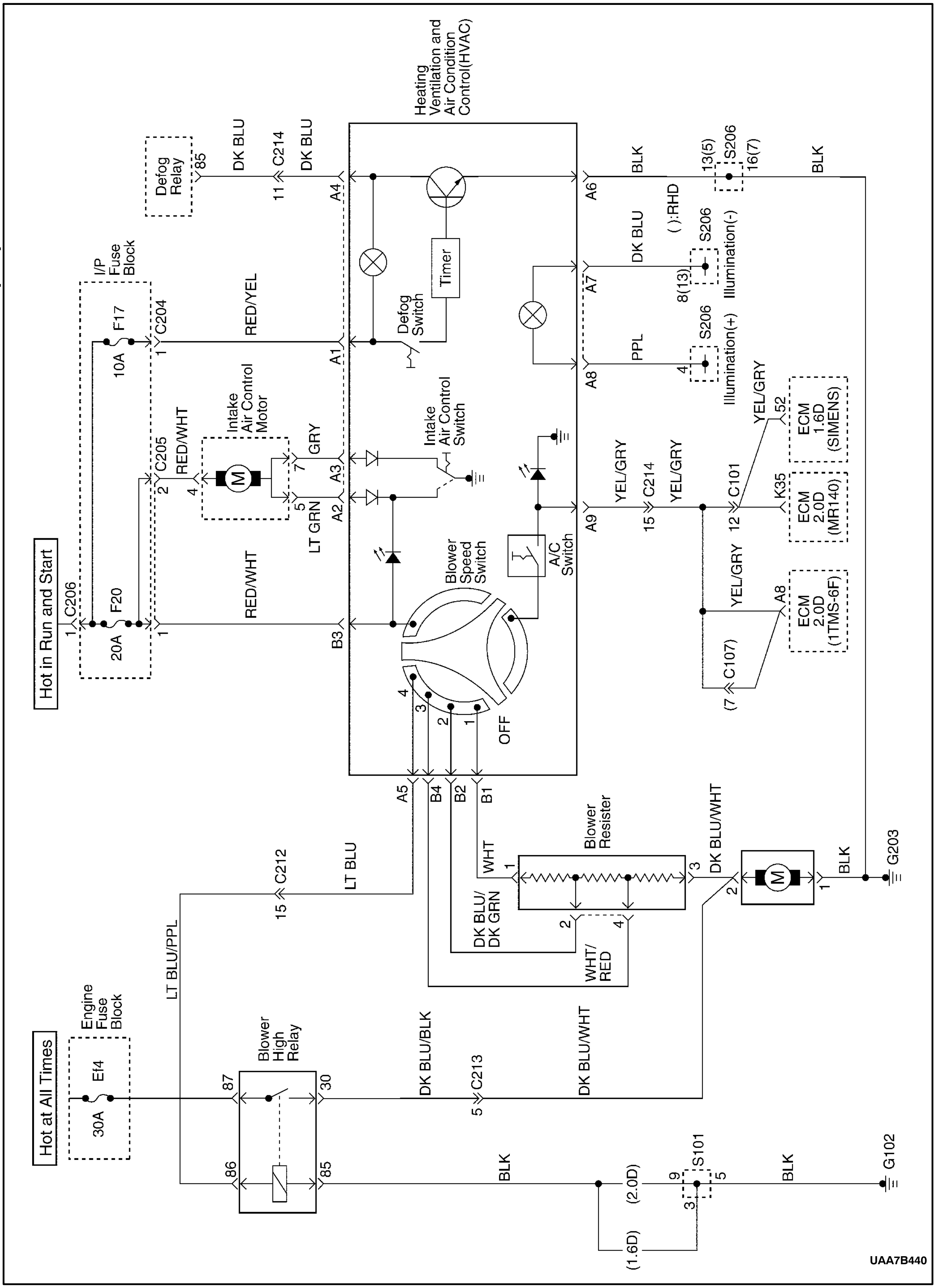
1 Condenser
2 Expansion Valve
3 Evaporator
4 Receiver-Dryer
5 Compressor

AIRFLOW – TYPICAL

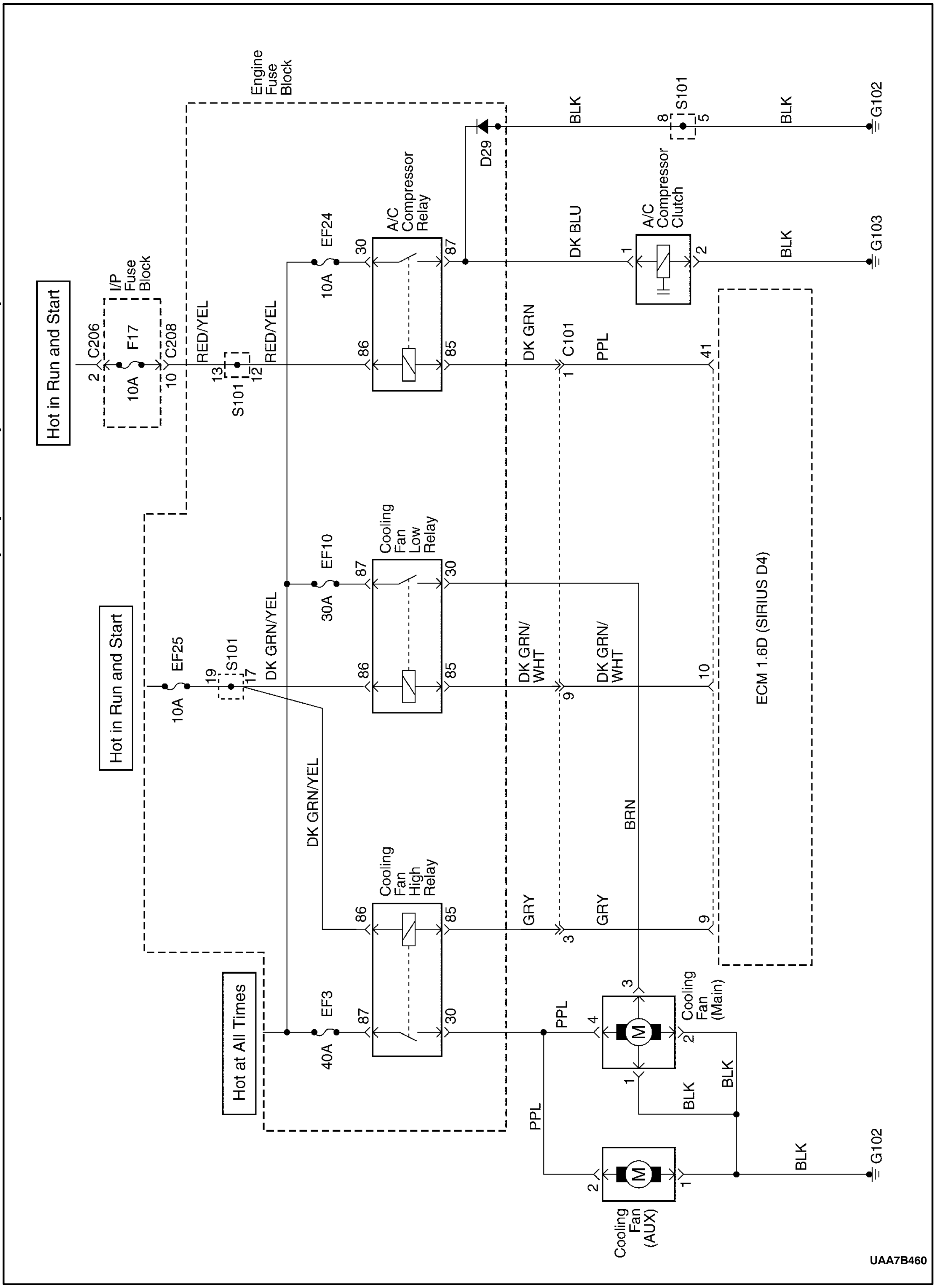


1 Mode Door
2 Heater Core
3 Fresh Air/Recalculation Air Door
4 Inside Air Inlet
5 Outside Air Inlet
6 Blower
7 Evaporator (A/C Only)
8 Heater (Air Mix) Door
9 Foot Outlets
10 Vent Outlets
11 Defroster Outlets

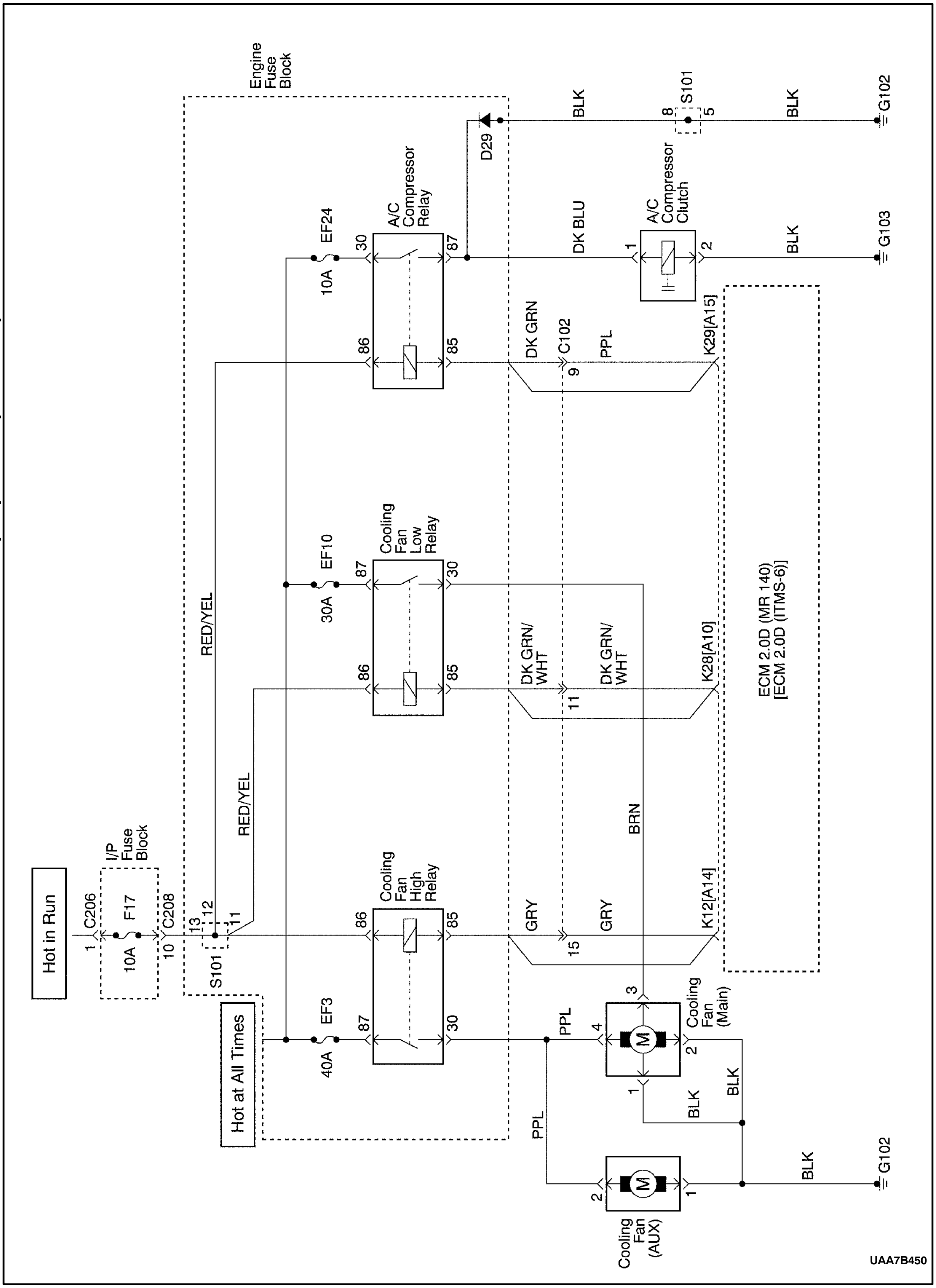
MANUAL CONTROL A/C DIAGRAM (1/4)



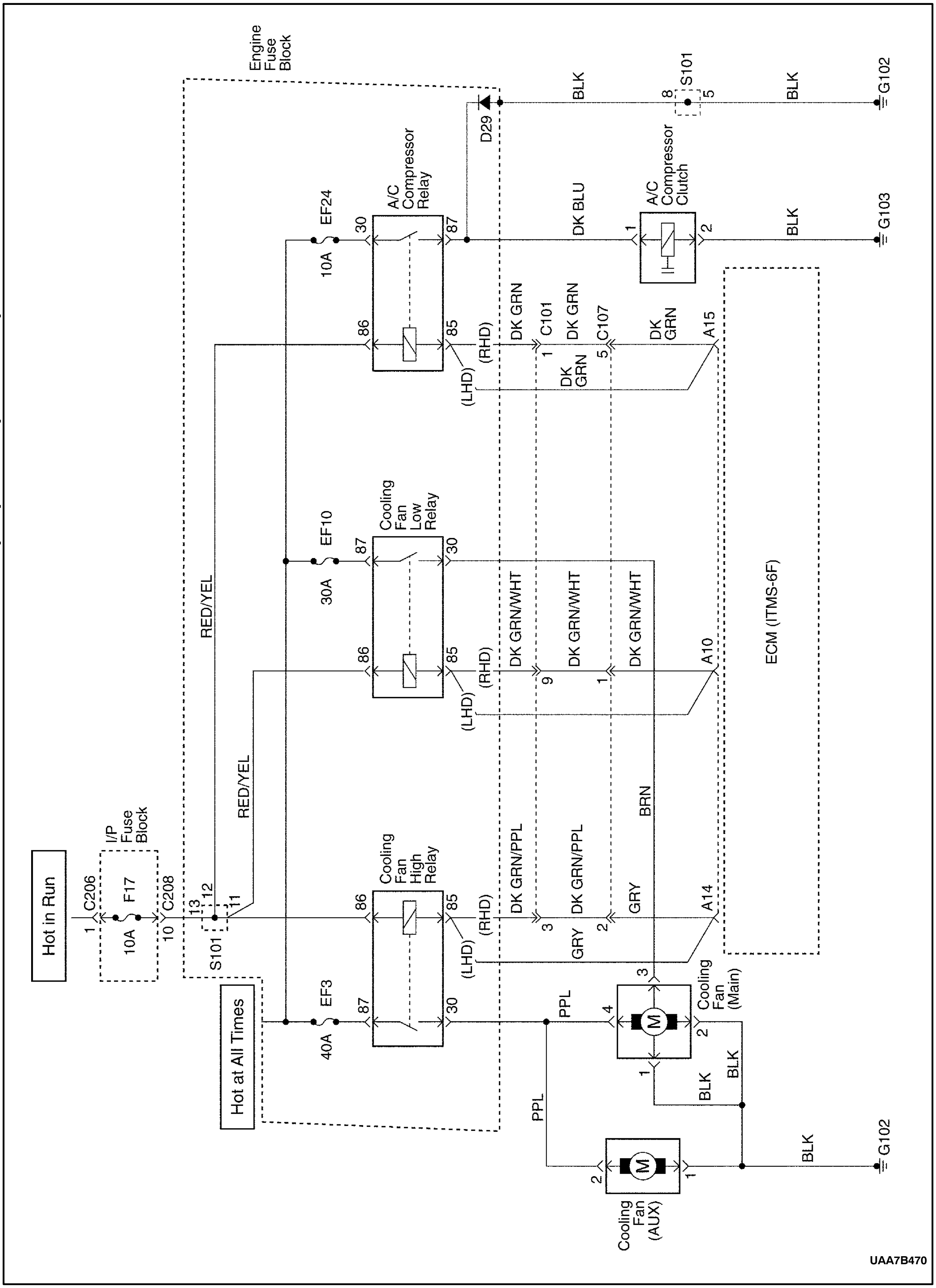
MANUAL CONTROL A/C DIAGRAM (2/4)–1.6D (SIRIUS D4)



MANUAL CONTROL A/C DIAGRAM (3/4)–2.0L (MR–140)

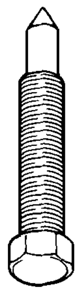
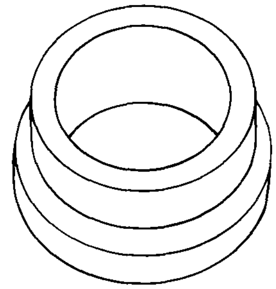
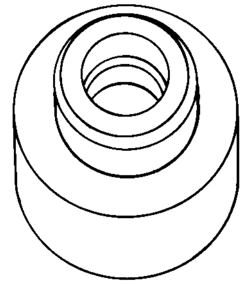
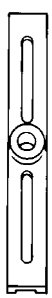
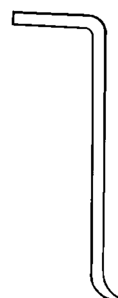
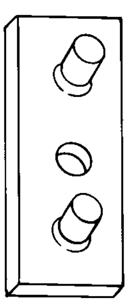
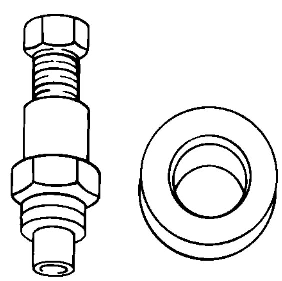


MANUAL CONTROL A/C DIAGRAM (4/4)–2.0L (ITMS–6F)

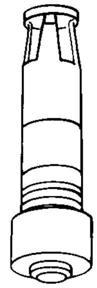
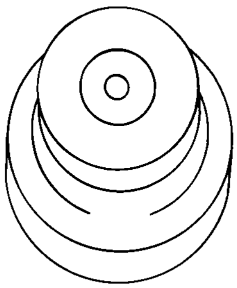
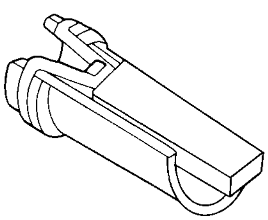
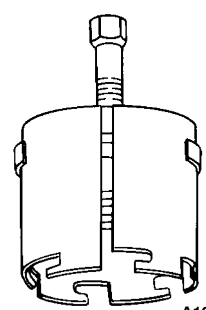


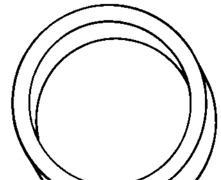
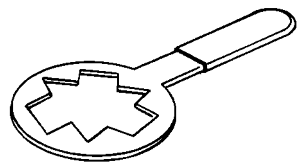
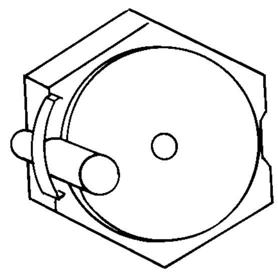
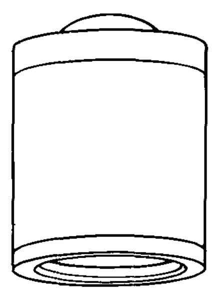
SPECIAL TOOLS

SPECIAL TOOLS TABLE

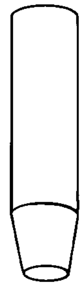
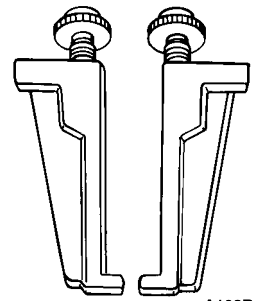
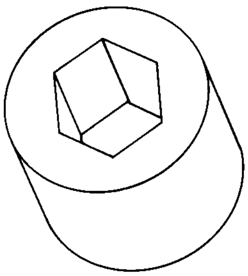
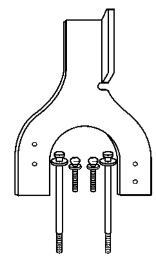
 A108B082	**●-8433-3 Forcing Screw**	 A108B084	**●-9398-A Bearing Remover**
 A108B080	**●-8092 Driver Handle**	 A108B085	**●-9481 Bearing Installer**
 A108B081	**●-8433-1 Puller Cross° ar**	 A108B086	**●-9553-1 O-Ring Remover**
 A108B087	**●-9625-A Pressure Test Set Connector**	 A108B091	**●-33013-B Hu° and Drive Plate Remover and Installer**

SPECIAL TOOLS TABLE (Cont'd)

 A108B088	**●-23128-A** **Seal Seat Remover and Installer**
 A108B098	**●-33023-A** **Puller Pilot**
 A108B090	**●-33011** **O-Ring Installer**
 A108B095	**●-33020** **Pulley Puller**

 A108B093	**●-33017** **Pulley Rotor and Bearing Assem°ly Installer**
 A108B102	**●-33027** **Clutch Hu°** **Holding Tool**
 A108B094	**●-33019** **Bearing Staking Tool Set** Includes: **●-33019-1** **Bearing Staking Guide** **●-33019-2** **Bearing Staking Pin**
 A108B099	**●-33024** **Clutch Coil Installer Adapter**

SPECIAL TOOLS TABLE (Cont'd)

 A108B096	**●-34614 Shaft Seal Protector**	 A108B100	**●-33025 Clutch Coil Puller Legs**
 A108B097	**●-33022 Shaft Nut Socket**	 A108B101	**●-34992 Compressor Holding Fixture**

SECTION 7D

AUTOMATIC TEMPERATURE CONTROL HEATING, VENTILATION, AND AIR CONDITIONING SYSTEM

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

THE V5 FULL AUTOMATIC TEMPERATURE CONTROL (FATC) SYSTEM

The full automatic temperature control (FATC) uses the integrated control panel as the driver's interface to the system. The FATC receives driver's input signal and various input signal from sensors and controls the actuators to maintain driver's desired room temperature.

Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System* for general Information details for the following:

- System Components – Functional.
- The V5 A/C System.
- V5 Compressor – Operation.
- V5 Compressor – General Description.

SYSTEM COMPONENTS–CONTROL

Controller

The operation of the A/C system is controlled by the switched on the control head. This console-mounted controller consist of control knobs and a vacuum fluorescent display (VFD) indicating the status of the control settings selected.

Temperature Control Switch

- Raise the temperature of the air entering the vehicle by pressing upper part of the switch, with the red arrow pointing upward.
- Lower the temperature of the air entering the vehicle by pressing lower part of the switch, with the blue arrow pointing downward.
- Actuate the air mix door by an electrical motor.
- Varies the mix of the air passing through the heater core with the air bypassing the core.
- Each press of the switch changes the set temperature by increments of 0.5°C(1°F) this is shown in the temperature window on the function display.

AUTO Switch

Maintains the set temperature automatically. In this mode, the full automatic temperature control (FATC) system controls the following:

- The air mix door motor.
- The mode door motor.
- The blower motor speed.
- The intake air door motor.
- A/C ON/OFF.

OFF Switch

Turns the automatic air conditioning and fan control off.

MODE Switch

Allows manual selection of the airflow direction.

- Selection is shown on the function display.
- Each time the MODE switch is pressed, the next function is displayed.

Intake Air Control Switch

Switches between fresh air intake, the default, and recirculating air. Airflow arrows on the display indicate the mode in effect.

A/C Switch

Allows manual selection and control of the air conditioning function.

Rear Window and Side Rear View Mirror Defroster Switch

Defrost rear window and side rear view mirror. When pressed, it operates for 8 to 12 minutes by the timer in the controller.

Defrost Switch

Cause the mode motor to direct all air to the windshield and aide window outlets for maximum defrosting.

- Mode: Defroster
- Intake Air: Fresh
- A/C: ON (If the outside temperature is below than 1.5°C, the A/C would not operate.)

Fan Control Switch

Allow manual selection among six–fan speeds.

Vacuum Fluorescent Display (VFD)

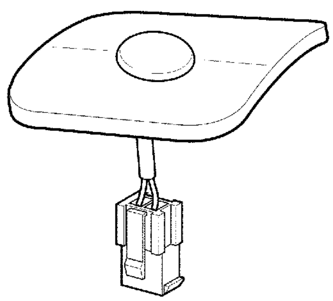
- Temperature setting – Indicates the temperature set with temperature control knob.
- Auto status – Indicates whether the system is operating in the full automatic mode or manual mode.
- A/C – A snowflake icon indicating whether the A/C is On or OFF.
- Intake Air – Indicates whether the intake air is fresh (from outside) or recircurating.
- Mode – Indicated by icon, the mode chosen by the system is shown by illumination of arrow indicating the air path.
- Defrost – Indicates whether the defroster is ON or not.
- Fan speed – Indicates the fan speed by illuminating a bar based segment from low to high speed by adding additional segments.

Pressure Transducer

Pressure transducer switching incorporates the functions of the high-pressure and the low-pressure cutout switches along with the fan cycling switch. The pressure transducer is located in the high-side liquid refrigerant line between the right strut and the air cleaner assembly. The output from this pressure traducer goes to the electronic control module (ECM), which controls the compressor function based on the pressure signal.

Sun Sensor

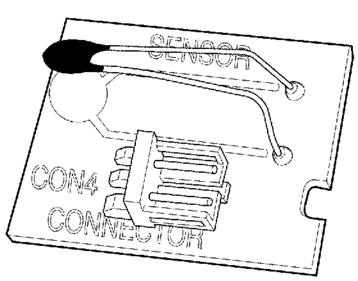
Sun sensor is a photo diode that detects lights. Resistance of the diode can be measured as current by using voltmeter according to increasing sun loads. If the sun sensor is error, no sun load will be substitute.



UAA7D010

In–Car Sensor

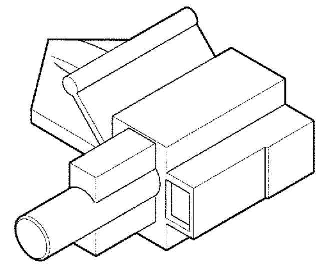
In-car sensor located in left side of full automatic temperature control (FATC) controller, is a sensor that detects the interior air temperature and a thermistor that decreases its resistance when temperature up and increases when temperature down. If there is open or short in the sensors, 25°C (77°F) will be substitute.



UAA7D020

Ambient Sensor

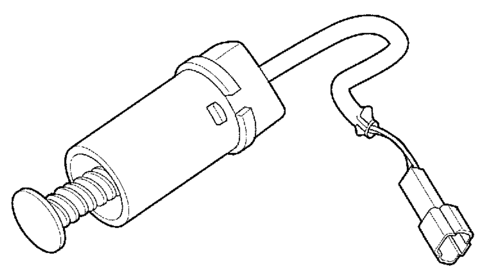
Ambient sensor is a thermistor that decreases its resistance when temperature up and increases when temperature down and it detects ambient air temperature. If there is open or short in the sensors, 25°C (77°F) will be substitute. The sensor is located in the left back side of front bumper.



UAA7D030

Coolant Temperature Sensor

Coolant temperature sensor is a thermistor that decreases its resistance when temperature up and increases when temperature down. It detects coolant temperature to operate the blower speed at low when the coolant temperature is less than 50°C (122°F). If the coolant temperature sensor is open or short, 100°C (212°F) will be substitute.



UAA7D040

Mode Control Motor

The mode control motor is located in heater/air distribution case assembly and selects vents by the signal of the FATC.

Intake Air Control Motor

The Intake air control motor is located outside of evaporator case and changes intake airflow recircuration or fresh by the signal of the FATC.

Air Mix Door Motor

The air mix door motor is located on left side of heater module. The air mix door motor controls the exhaust air temperature by the signal of the FATC.

SPECIFIC OPERATION OF V5 FATC

There are several specific operation modes in this fully automatic temperature controller (FATC).

Max Cold Mode

When the temperature set at “LO” (18°C[64.4°F]) the controller start max cold mode and control air conditioning system as below.

- Mode: Vent
- Intake Air: Recirculation
- Blower Speed: Max high
- A/C: ON
- Air Mix Door: Closed.

Max Hot Mode

When the temperature set at “HI” (32°C[90°F]) the controller start max hot mode and control air conditioning system as below.

- Mode: Floor
- Intake Air: Fresh
- Blower Speed: Auto high
- Air Mix Door: Fully open.

Wiper Related Operation

When operating the wiper, the controller turns A/C ON and changes the intake air mode to fresh with one minute time delay from first wiper operation if FATC is operated in AUTO mode.

Wide–Open Throttle (WOT) Compressor Cutoff

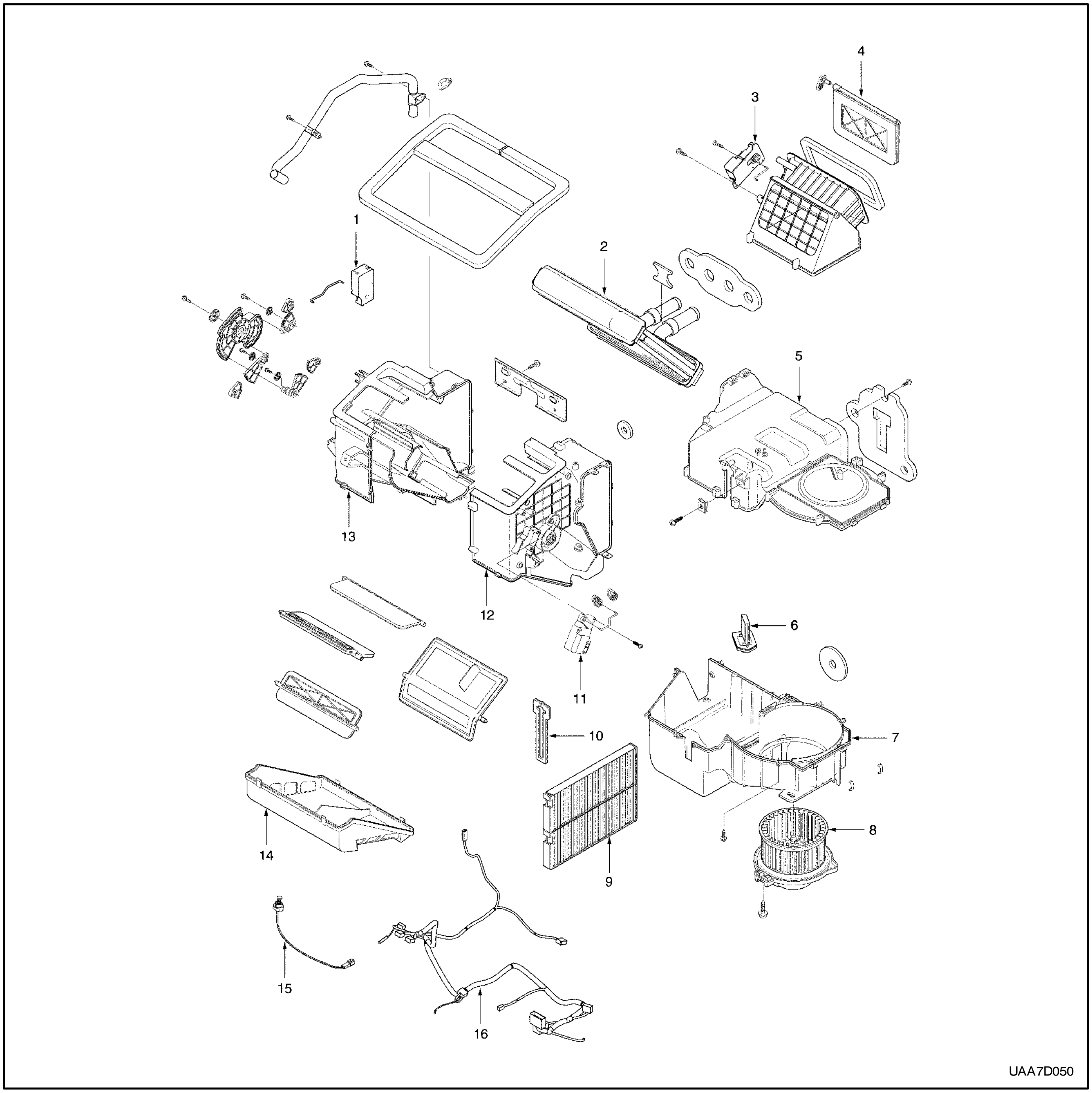
During full–throttle acceleration, the throttle position (TP) sensor sends a signal to the ECM, which then controls the compressor clutch.

High RPM Cutoff

As engine rpm approached the maximum limit, the ECM will disengage the compressor clutch until the engine slows the a lower rpm.

COMPONENT LOCATOR

FULL AUTOMATIC TEMPERATURE CONTROL



1 Mode Control Motor
2 Heater Core
3 Intake Air control Motor
4 Intake Air Control Door
5 A/C Module Upper Case
6 Power Transistor
7 A/C Module Lower Case
8 Blower Motor
9 A/C Filter
10 A/C Filter Cover
11 Air Mix Door Motor
12 Heater Module Right Case
13 Heater Module Left Case
14 Heater Module Lower Case
15 Coolant Temperature Sensor
16 Wiring Harness

DIAGNOSTIC INFORMATION AND PROCEDURES

GENERAL A/C DIAGNOSIS

Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System* for details of the following procedures:

- A/C Performance Test.
- Insufficient Cooling "Quick Check" Procedure.
- Insufficient Cooling Diagnosis.
- Leaking Testing the Refrigerant System.
- Low-and High-Side Pressure Relationship Chart.
- Pressure Test Chart (R–134a System).
- Pressure-Temperature Relationship of R–134a.
- Testing the Refrigerant system.

V5 SYSTEM AIR CONDITIONING AND FULL AUTOMATIC TEMPERATURE CONTROL (FATC)

SELF–DIAGNOSTIC CIRCUIT CHECK

The Daewoo full automatic temperature control (FATC) air conditioning controller contains a self-diagnosis function to aid in finding any problem with the system. If the FATC detects some errors it will blink the temperature display screen for 5 seconds when the ignition switch is ON.

To enter the diagnostic mode, perform the following procedure.

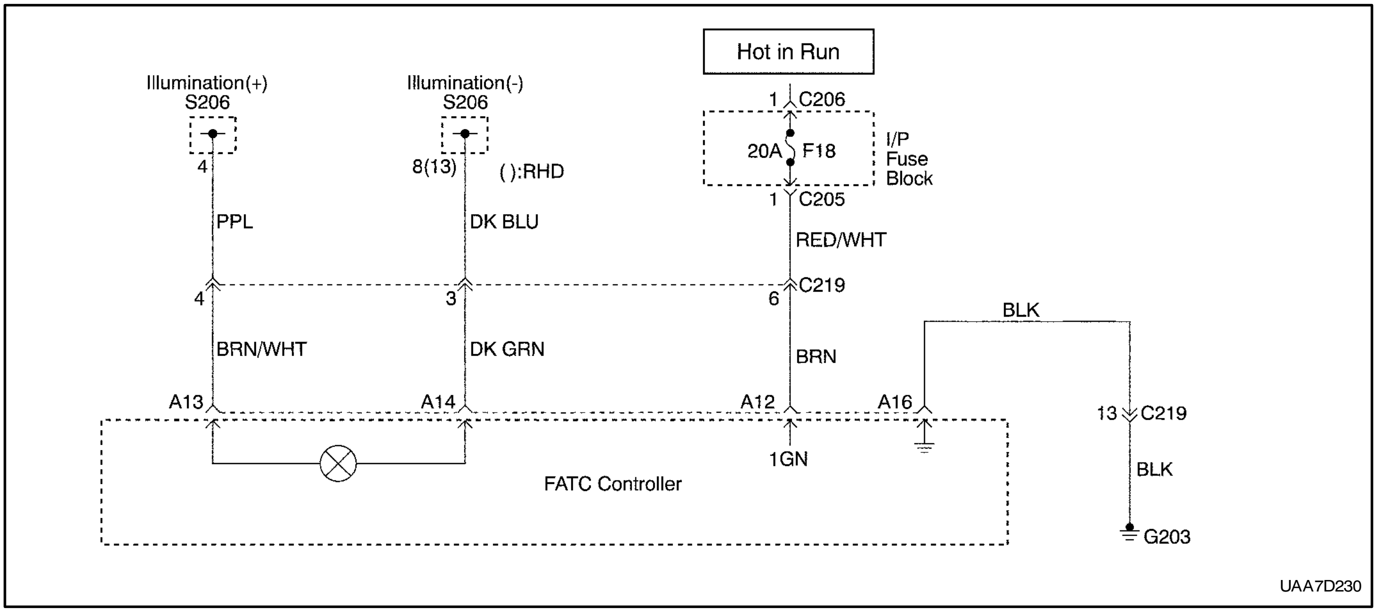
1. Turn the ignition switch ON.
2. Set the temperature control to 26°C (79°F).
3. Within 3 seconds, push the AUTO and the OFF switches simultaneously, more than three times.
4. Check the diagnostic trouble code (DTC) in the temperature indicator screen blinks. If there are no diagnostic trouble code (DTC) set, the screen will display 00.
5. When the FATC controller indicates a DTC, proceed to the table for the DTC.
6. Push the OFF switch to return the controller to its normal function.

DTC	Description
00	Normal (No Error)
01	In-car sensor error
02	Ambient air temperature sensor error
03	Coolant temperature sensor error
04	Air mix door error
05	Sun sensor error
06	Power transistor error
07	Max high relay error
08	Internal (MICOM) error

Fault Safety Function

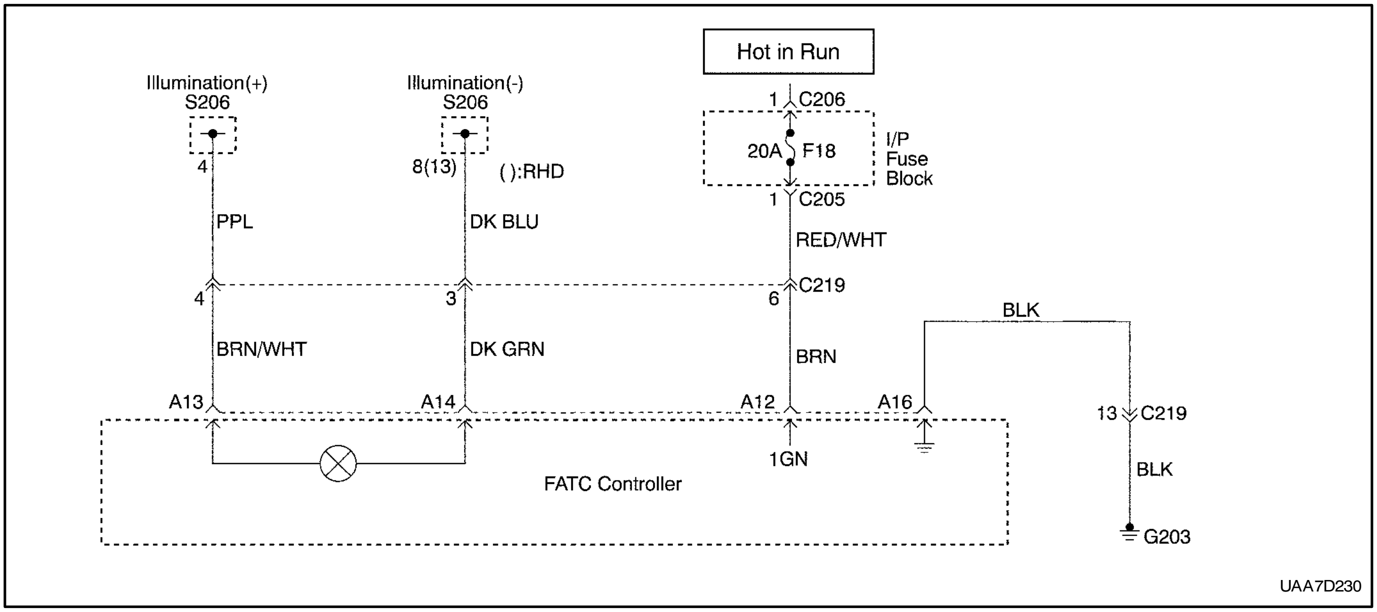
FATC air conditioner not only performs self–diagnosis but also has safety function against faults. If there is open or short in the sensors or potentiometer of temperature door some specific value will be substitute.

Item	DTC	Fault Safety Function
In-Car Sensor	1	25°C will be substituted as temperature of inside of vehicle.
Ambient Temperature Sensor	2	25°C will be substituted as ambient temperature.
Coolant Temperature Sensor	3	Sensor ON. 100°C will be substitute as coolant temperature.
Sun Sensor	5	Zero (0) will be substituted as sun load.



FULL AUTOMATIC TEMPERATURE CONTROL (FATC) DOES NOT OPERATE WHEN THE IGNITION IS ON

Step	Action	Value(s)	Yes	No
1	Check the fuse F18. Are the fuses blown?	–	Go to *Step 2*	Go to *Step 3*
2	Repair any short circuit and replace the blown fuses. Is the repair complete?	–	System OK	–
3	1. Remove the controller. 2. Turn the ignition switch to ON. 3. Measure the voltage between terminal A12 and A16 of the connectors Is the voltage within specified value?	11–14 v	Go to *Step 4*	Go to *Step 5*
4	1. Check the connector and controller for damages. 2. Repair the damaged parts or replace the controller. Is the repair complete?	–	System OK	–
5	Measure the resistance between terminal A16 of the connector and ground. Is the resistance within specified value?	≈ 0 Ω	Go to *Step 6*	Go to *Step 7*
6	Repair open circuit between fuse F18 and terminal A12. Is the repair complete?	–	System OK	–
7	Repair open circuit between terminal A16 and ground. Is the repair complete?	–	System OK	–



CONTROLLER DOES NOT ILLUMINATE WHEN LIGHT SWITCH IS ON

Step	Action	Value(s)	Yes	No
1	Check other instrument light. Are those lights also off?	–	Go to *Section 9E, Instrumentation/ Driver Information*	Go to *Step 2*
2	1. Remove the controller. 2. Turn the light switch ON. 3. Measure the voltage between terminal A13 of the controller and ground. Is the voltage within the specified value?	11–14 v	Go to *Step 4*	Go to *Step 3*
3	Repair the wiring harness between splice S206 and terminal A13 of the controller connector or between splice S206 and terminal A14 of the controller connector. Is the repair complete?	–	System OK	–
4	Check the illumination bulb. Is the bulb burned out?	–	Go to *Step 5*	Go to *Step 6*
5	Is the repair complete? System OK	–	System OK	–
6	Replace the controller. Is the repair complete?	–	System OK	–

NO HOT AIR FROM BLOWER

Step	Action	Value(s)	Yes	No
1	Check the coolant level. Is the coolant level correct?	–	Go to *Step 3*	Go to *Step 2*
2	Add coolant as needed. Is the heater operating?	–	System OK	Go to *Step 3*
3	1. Turn the ignition to ON. 2. Observe the temperature indication screen of the controller. Does the digit flash?	–	Go to *Step 4*	Go to *Step 5*
4	Run a self diagnosis circuit check. Does the display indicate a defect code?	–	Go to the specific DTC table.	Go to *Step 7*
5	Observe the blower motor operation. Is the blower motor functioning at all?	–	Go to *Step 6*	Go to "Blower Motor Does Not Run at All"
6	Use the blower push switch to cycle the blower through its different speeds. Does the motor function at different speeds?	–	Go to *Step 7*	Go to "DTC 6 Power Transistor Error"
7	1. Run the blower and operate the MODE push switch manually. 2. Check for airflow out the various outlets. Does the air flow from the different outlets as it should?	–	Go to *Step 9*	Go to *Step 8*
8	1. Remove the heater outlet and check for obstructions. 2. Remove any obstructions found. Is the heater operating?	–	System OK	Go to *Step 9*
9	Observe the air mix door motor while changing the temperature setting from LO to HI and then from HI to LO. Is the air mix door actuator functioning properly?	–	Go to *Step 10*	Go to "DTC 4 Air Mix Door Error"
10	Check the coolant hoses for leaks or kinks. Are the coolant hoses in good condition?	–	Go to *Step 12*	Go to *Step 11*
11	Repair any problem with the coolant hoses. Is the heater operating?	–	System OK	Go to *Step 12*
12	Check the coolant reservoir cap. Is the coolant tank cap in good condition?	–	Go to *Step 14*	Go to *Step 13*
13	Repair or replace the coolant reservoir cap, as needed. Is the heater operating?	–	System OK	Go to *Step 14*
14	1. Turn the A/C switch to OFF. 2. Set the temperature control to HI. 3. Set the blower motor speed to full high (all segments illuminated on the display). 4. Remove the coolant reservoir cap. 5. Start the vehicle and run the engine at idles. 6. Watch for the flow of the coolant when the thermostat opens. Does the coolant flow?	–	Go to *Step 16*	Go to *Step 15*

No Hot Air From Blower (Cont'd)

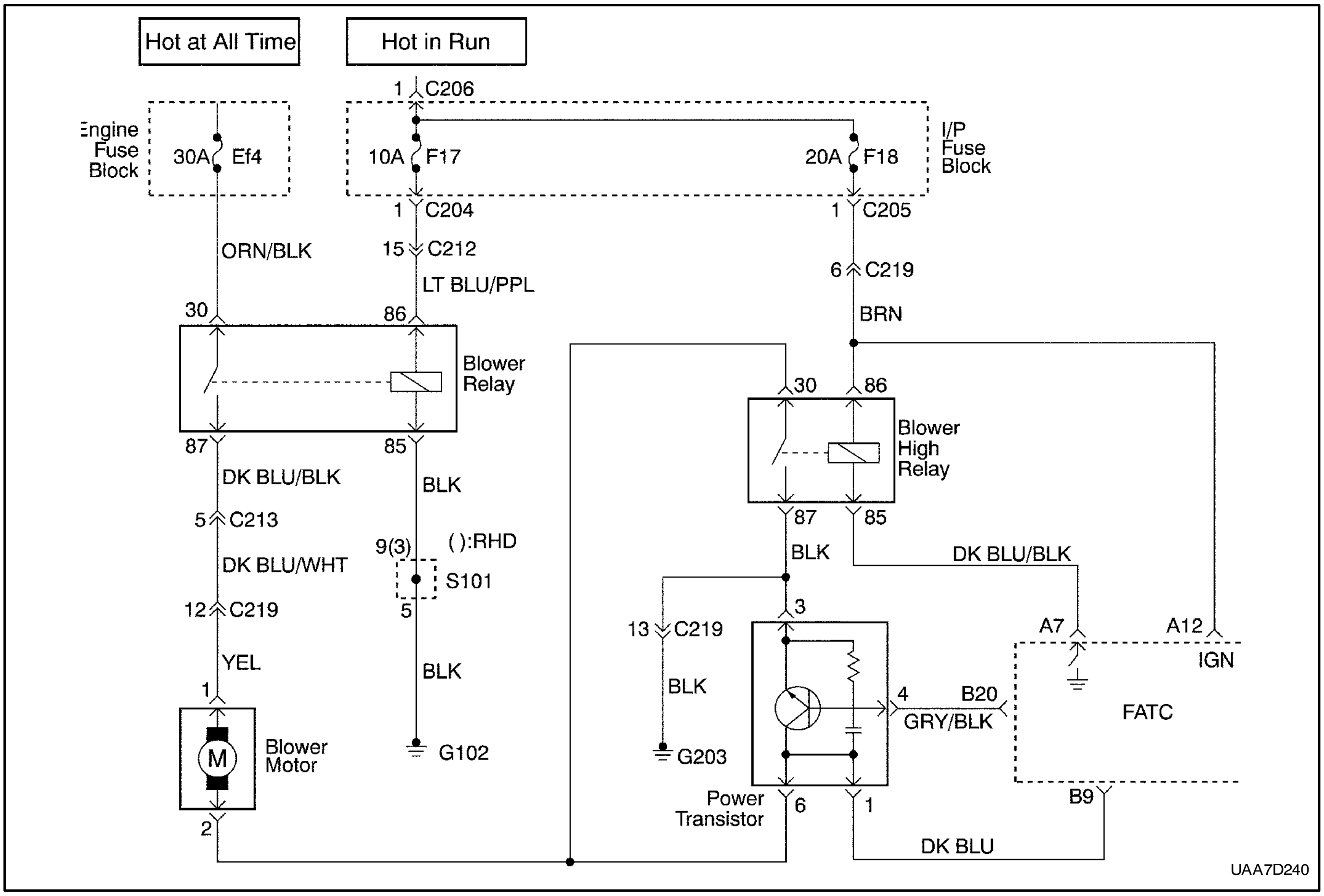
Step	Action	Value(s)	Yes	No
15	1. Check for • A faulty thermostat. • A failed coolant pump impeller. • A restriction in the cooling system. 2. Make repairs, as needed. Is the repair complete?	–	System OK	–
16	Check the temperature of the heater inlet and outlet hoses by feel. Is the heater inlet hose hot and the outlet hose warm?	–	Go to *Step 18*	Go to *Step 17*
17	Back flush or replace the heater core. Is the repair complete?	–	System OK	–
18	Check the vehicle for cold air leaks at the • Dash. • Heater cases. • Vents. Are any leaks found?	–	Go to *Step 19*	Go to *Step 20*
19	Repair any cold air leaks. Is the repair complete?	–	System OK	–
20	Check the coolant temperature sensor using the tests in "DTC 3 Coolant Temperature Sensor Error." Is there a problem indicated in the sensor, the sensor wiring or the controller?	–	Go to *Step 21*	Go to *Step 22*
21	Repair, or replace the sensor, the wiring, or the controller as required. Is the repair complete?	–	System OK	–
22	Check the in-car sensor using the tests in "DTC 1 In-Car Sensor Error." Is there a problem indicated in the sensor, the sensor wiring, or the controller?	–	Go to *Step 23*	Go to *Step 24*
23	Repair or replace the sensor, the wiring, or the controller as required. Is the repair complete?	–	System OK	–
24	Check the ambient air temperature sensor using the tests in "DTC 2 Ambient Air Temperature Sensor Error." Is there a problem indicated in the sensor, the sensor wiring, or the controller?	–	Go to *Step 25*	Go to *Step 26*
25	Repair, or replace the sensor, the wiring, or the controller as required. Is the repair complete?	–	System OK	–
26	Check the sun sensor using the tests in "DTC 5 Sun Sensor Error." Is there a problem indicated in the sensor, the sensor wiring or the controller?	–	Go to *Step 27*	Go to *Step 28*
27	Repair or replace the sensor, the wiring, or the controller as required. Is the repair complete?	–	System OK	–
28	Replace the FATC controller. Is the repair complete?	–	System OK	–

NO COOL AIR FROM BLOWER

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to ON. 2. Observe the temperature indication screen of the controller. Does the digit flash?	–	Go to *Step 2*	Go to *Step 3*
2	Run a self-diagnosis circuit check. Does the display indicate a defect code?	–	Go to the specific DTC table that indicates.	Go to *Step 7*
3	Observe the blower motor operation. Is the blower motor functioning at all?	–	Go to *Step 4*	Go to “Blower Motor Does Not Run at All”
4	Use the blower push switch to cycle the blower through its different speeds. Does the motor function at different speeds?	–	Go to *Step 5*	Go to “DTC 6 Power Transistor Error”
5	1. Run the blower and operate the MODE push switch manually. 2. Check for airflow out the various outlets. Does the air flow from the different outlets as it should?	–	Go to *Step 7*	Go to *Step 6*
6	1. Remove the heater outlet and check for obstructions. 2. Remove any obstructions found. Is the heater operating?	–	System OK	Go to *Step 9*
7	Observe the air mix door actuator while changing the temperature setting from LO to HI and then from HI to LO. Is the air mix door actuator functioning properly?	–	Go to *Step 8*	Go to “DTC 4 Air Mix Door Error”
8	Perform the checks found in “Insufficient Cooling Diagnosis.” Is the system operating normally now?	–	System OK	Go to *Step 9*
9	Place the controller in the AUTO mode. Is smoke taken into the intake port of the in-car sensor?	–	Go to *Step 12*	Go to *Step 10*
10	Check the intake hose for the in-car sensor. Is the hose in good condition?	–	Go to *Step 12*	Go to *Step 11*
11	Repair or replace the intake hose. Is the repair complete?	–	System OK	–
12	Check the in-car sensor using the tests in “DTC 1 In-Car Sensor Error.” Is there a problem indicated in the sensor, the sensor wiring or the controller?	–	Go to *Step 13*	Go to *Step 14*
13	Repair, or replace the sensor, the wiring, or the controller as required. Is the repair complete?	–	System OK	–
14	Check the ambient air temperature sensor using the tests in “DTC 2 Ambient Air Temperature Sensor Error.” Is there a problem indicated in the sensor, the sensor wiring or the controller?	–	Go to *Step 15*	Go to *Step 16*

No Cool Air From Blower (Cont'd)

Step	Action	Value(s)	Yes	No
15	Repair, or replace the sensor, the wiring, or the controller as required. Is the repair complete?	–	System OK	–
16	Check the sun sensor using the tests in "DTC 5 Sun Sensor Error." Is there a problem indicated in the sensor, the sensor wiring or the controller?	–	Go to *Step 17*	Go to *Step 18*
17	Repair, or replace the sensor, the wiring, or the controller as required. Is the repair complete?	–	System OK	–
18	Perform the coolant temperature sensor test. Is the coolant temperature sensor malfunctioning?	–	Go to *Step 19*	Go to *Step 20*
19	Replace the coolant temperature sensor. Is the repair complete?	–	System OK	–
20	Replace the FATC controller. Is the repair complete?	–	System OK	–



BLOWER MOTOR DOES NOT RUN AT ALL

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to ON. 2. Observe the temperature indication screen of the controller. Does the digit go on and off?	–	Go to *Step 2*	Go to *Step 3*
2	Run a self–diagnosis circuit check. Does the display indicate a defect code?	–	Go to specific DTC table that indicate	–
3	Check fuse F17 in the I/P fuse block and fuse EF4 in the engine fuse block. Are fuses F17 and EF4 in good condition?	–	Go to *Step 5*	Go to *Step 4*
4	Repair any short circuit and replace blown fuse. Is the repair complete?	–	System OK	–
5	1. Turn the ignition switch to ON. 2. Measure the voltage between ground and terminal 87 of blower relay. Is the voltage within the specified value?	11–14V	Go to *Step 13*	Go to *Step 6*
6	Measure the voltage between ground and terminal 86 of blower relay. Is the voltage within the specified value?	11–14V	Go to *Step 8*	Go to *Step 7*

Blower Motor Does Not Run At All (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Turn the ignition to OFF. 2. Check the circuit between terminal 86 of the blower relay to F17 in the I/P fuse block. 3. Repair any problem found in the wiring or terminals at the relay socket or connectors. Is the repair complete?	–	System OK	–
8	1. Turn the ignition ON. 2. Measure voltage between terminal 30 of the blower relay and ground. Is the voltage within the specified value?	11–14V	Go to *Step 10*	Go to *Step 9*
9	Repair open circuit between terminal 30 of the blower relay and fuse EF4. Is the repair complete?	–	System OK	–
10	1. Turn the ignition switch to OFF. 2. Using an ohmmeter, measure the resistance between terminal 85 of the blower relay and ground. Is the resistance within the specified value?	≈ 0 Ω	Go to *Step 12*	Go to *Step 11*
11	Repair open circuit between terminal 85 of the blower relay and ground. Is the repair complete?	–	System OK	–
12	Replace the blower relay Is the repair complete?	–	System OK	–
13	1. Turn the ignition switch to OFF. 2. Disconnect the blower motor connector. 3. Turn the ignition switch to ON. 4. Measure voltage between terminal 2 (YEL) and ground. Is the voltage within the specified value?	11–14V	Go to *Step 15*	Go to *Step 14*
14	Check circuit from blower relay to blower motor and repair as needed. Is the repair complete?	–	System OK	–
15	Measure the resistance between the connector terminals on the blower motor. Is the resistance equal to the specified value?	≈ 0.5 Ω	Go to *Step 17*	Go to *Step 16*
16	Replace the blower motor. Is the repair complete?	–	System OK	–
17	Measure the resistance of the circuit between terminal 1 of the blower connector and terminal 30 of the blower high relay and terminal 6 of the power transistor. Is the resistance equal to the specified value?	≈ 0 Ω	Go to *Step 19*	Go to *Step 18*
18	Repair the problem in the circuit. Is the repair complete?	–	System OK	–
19	Measure the resistance of the circuit from terminal 3 of the power transistor connector and terminal 87 of the high blower relay to ground. Is the resistance equal to the specified value?	≈ 0 Ω	Go to *Step 21*	Go to *Step 20*

Blower Motor Does Not Run At All (Cont'd)

Step	Action	Value(s)	Yes	No
20	1. Trace the circuit from terminal 3 of the power transistor connector and terminal 87 of the blower high relay to ground G203. 2. Repair any problem found in the wiring, connector or ground. Is the repair complete?	–	System OK	–
21	Replace power transistor. Is the repair complete?	–	System OK	Go to *Step 22*
22	Replace the FATC controller. Is the repair complete?	–	System OK	–

MODE CONTROLS DO NOT WORK

Refer to "Full Automatic Temperature Control Diagram" for the electrical schematic diagram of the circuits described in the procedure.

Mode Controls Do Not Work

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to ON. 2. Measure the voltage between terminal 2 and ground. Is the voltage within the specified value?	11–14V	Go to *Step 3*	Go to *Step 2*
2	1. Check the connector and the circuit for any wiring or terminal problems. 2. Repair any problems found. Is the repair complete?	–	System OK	–
3	1. Using the Motor Control Table, measure the voltages at the specified terminals of the specified motor connectors. 2. Change the mode settings and observe the voltage changes. Are the voltages equal to the specified values?	See the "Motor Control Table"	Go to *Step 4*	Go to *Step 5*
4	Replace the mode control actuator. Is the repair complete?	–	System OK	–
5	1. Using the Motor Control Table, measure the voltages at the specified terminals of the specified controller connectors. 2. Change the mode settings and observe the voltage changes. Are the voltages equal to the specified values?	See the "Motor Control Table"	Go to *Step 6*	Go to *Step 7*
6	1. Check the wiring harness and connectors between the controller and the motor that is not performing properly. 2. Repair or replace the wiring harness or the defective terminal. Is the repair complete?	–	System OK	–
7	Check the connector at the controller. Is there a defective terminal?	–	Go to *Step 8*	Go to *Step 9*
8	Repair or replace the terminal. Is the repair complete?	–	System OK	–
9	Replace the controller. Is the repair complete?	–	System OK	–

Motor Control Table

Mode Setting	Connector Terminal (Controller / Motor)				
	B1/6	B2/7	B3/5	B4/4	B5/3
Vent	0 V	11–14 V	11–14 V	11–14 V	11–14 V
Bi-Level	11–14 V	0 V	11–14 V	11–14 V	11–14 V
Foot	11–14 V	11–14 V	0 V	11–14 V	11–14 V
Foot/Defrost	11–14 V	11–14 V	11–14 V	0 V	11–14 V
Defrost	11–14 V	11–14 V	11–14 V	11–14 V	0 V

AIR SOURCE SELECTION NOT CONTROLLED

Refer to “Full Automatic Temperature Control A/C Diagram” for the electrical schematic diagram of the circuits described in the procedure.

Air Source Selection Not Controlled

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to ON. 2. Measure the voltage between terminal 4 and ground. Is the voltage within the specified value?	11–14V	Go to *Step 3*	Go to *Step 2*
2	1. Check the connector and the circuit for any wiring or terminal problems. 2. Repair any problems found. Is the repair complete?	–	System OK	–
3	1. Using the Intake Air Actuator Control Table, measure the voltages at the specified terminals of the specified motor connectors. 2. Change the mode settings and observe the voltage changes. Are the voltages equal to the specified values?	See the “Intake Air Control Actuator Table”	Go to *Step 4*	Go to *Step 5*
4	Replace the mode control actuator. Is the repair complete?	–	System OK	–
5	1. Using the Intake Air Actuator Control Table, measure the voltages at the specified terminals of the specified controller connectors. 2. Change the mode settings and observe the voltage changes. Are the voltages equal to the specified values?	See the “Intake Air Control Actuator Table”	Go to *Step 6*	Go to *Step 7*
6	1. Check the wiring harness and connectors between the controller and the motor that is not performing properly. 2. Repair or replace the wiring harness or the defective terminal. Is the repair complete?	–	System OK	–
7	Check the connector at the controller. Is there a defective terminal?	–	Go to *Step 8*	Go to *Step 9*
8	Repair or replace the terminal. Is the repair complete?	–	System OK	–
9	Replace the controller. Is the repair complete?	–	System OK	–

Intake Air Control Actuator Table

Intake Setting	Connector Terminal (Controller / Motor)		
	B8/5	A2/6	B7/7
Recirculate	11–14 V	11–14 V	0 V
1/3 Fresh	11–14 V	0 V	11–14 V
Fresh	0 V	11–14 V	11–14 V

COMPRESSOR MAGNETIC CLUTCH DOES NOT ENGAGE

Refer to “Full Automatic Temperature Control Diagram” for the electrical schematic diagram of the circuits described in the procedure.

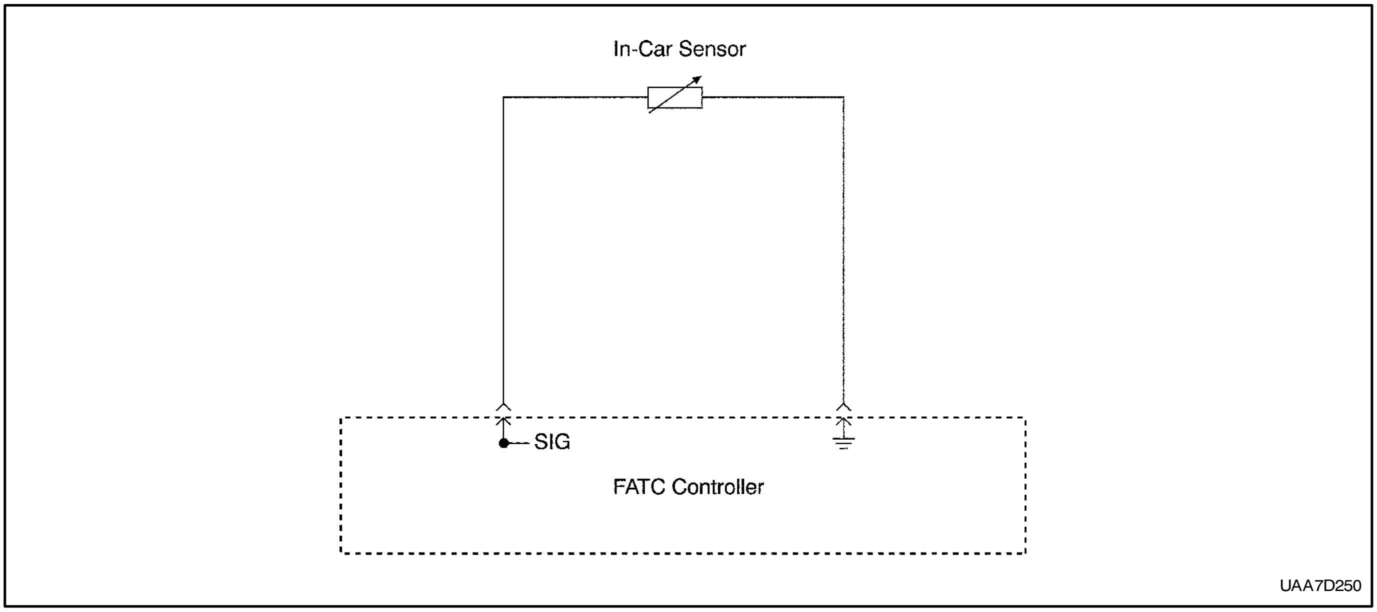
Compressor Magnetic Clutch Does not Engage

Step	Action	Value(s)	Yes	No
1	1. Disconnect the compressor magnetic clutch connector. 2. Turn the ignition switch to ON. 3. Turn the A/C on. 4. Measure the voltage between compressor magnetic clutch connector and ground. Is the voltage within the specified value?	11–14 V	Go to *Step 2*	Go to *Step 3*
2	Repair compressor magnetic clutch or replace the compressor assembly. Is the repair complete?	–	System OK	–
3	Check the fuse EF24. Is the fuse blown?	–	Go to *Step 4*	Go to *Step 5*
4	Repair short circuit between fuse EF24 and terminal 1 of compressor magnetic clutch connector. Is the repair complete?	–	System OK	–
5	1. Turn the ignition switch to ON. 2. Measure voltage at following terminals and ground. • Terminal 87 of A/C compressor relay • Terminal 85 of A/C compressor relay Are both voltages within the specified value?	11–14 V	Go to *Step 9*	Go to *Step 6*
6	Are both voltages equal to specified value?	0 V	Go to *Step 7*	Go to *Step 8*
7	1. Check fuse F17 in I/P fuse block. 2. If blown, repair any short wire and replace the fuse. 3. Check the wire from fuse F17 to terminal 86 of A/C compressor relay and repair or replace as needed Is the repair complete?	–	System OK	–
8	Check the terminal of compressor relay and replace it as needed. Is the repair complete?	–	System OK	–
9	1. Turn the ignition switch to OFF. 2. Measure resistance between terminal 87 of A/C compressor relay and magnetic terminal 1 of A/C compressor clutch. Is the resistance equal to specified value?	≈ 0 Ω	Go to *Step 11*	Go to *Step 10*
10	Repair open circuit. Is the repair complete?	–	System OK	–
11	1. Disconnect the connector of compressor magnetic clutch. 2. Measure the resistance between terminal 2 of A/C compressor magnetic clutch and ground. Is the measurement within the specified value?	≈ 0 Ω	Go to *Step 13*	Go to *Step 2*
12	Repair open circuit between terminal 2 of the A/C compressor magnetic clutch and ground. Is the repair complete?	–	System OK	–

Compressor Magnetic Clutch Does not Engage (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. Turn the ignition switch to OFF. 2. Measure resistance between terminal 85 of A/C compressor relay and following ECM terminal • Terminal K29 for 2.0L (MR–140) • Terminal A15 for 2.0L (ITMS–6) • Terminal 41 for 1.6D (SIRIUS D4) Is the resistance equal to specified value?	≈ 0 Ω	Go to *Step 15*	Go to *Step 14*
14	Repair open circuit. Is the repair complete?	–	System OK	–
15	Replace the ECM. Is the repair complete?	–	System OK	–

DIAGNOSTIC TROUBLE CODES



DIAGNOSTIC TROUBLE CODE (DTC) 1
IN-CAR SENSOR ERROR

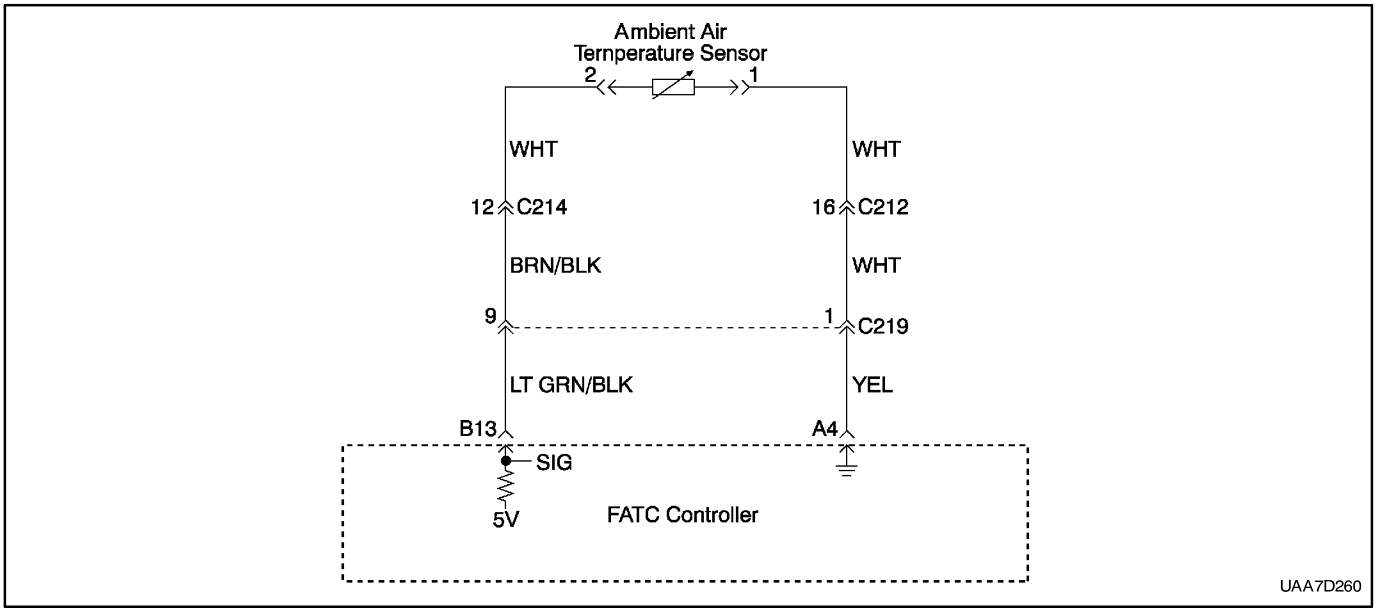
This code will set if the output of the in-car sensor indicates a probable short circuit or an open in the sensor or the associated wiring harness, or a malfunction of the FATC controller.

DTC 1 – In-Car Sensor Error

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the in-car sensor from the FATC controller. 3. Examine the wiring from sensor to the connector and the connector for any signs of damage. 4. Measure the resistance between the in-car sensor connector terminals. Is there any sign of damage in the wiring or connector, or the resistance outside of the specified value at 20 to 25°C (68 to 70°F)?	2600-2100 Ω	Go to *Step 2*	Go to *Step 3*
2	Repair damaged wiring or connector, or replace the in–car sensor. Is the repair complete?	–	System OK	–
3	1. Turn the ignition switch ON. 2. Measure the voltage between two connector terminals on the controller. Is the voltage equal to the specified value?	> 4 v	Go to *Step 7*	Go to *Step 4*
4	Check the terminals on the in-car sensor connector. Is any problem found with the connector?	–	Go to *Step 5*	Go to *Step 6*
5	Repair the in-car sensor connector terminals or replace the in-car sensor or FATC controller as required. Is the repair complete?	–	System OK	–

DTC 1 – In-Car Sensor Error (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Reconnect the in-car sensor to the controller. 2. Turn the ignition switch to ON. 3. Observe the temperature display screen. Does the display indicate the continuing presence of a DTC 1 condition?	–	Go to *Step 7*	System OK
7	Replace the FATC controller. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 2
AMBIENT AIR TEMPERATURE SENSOR ERROR

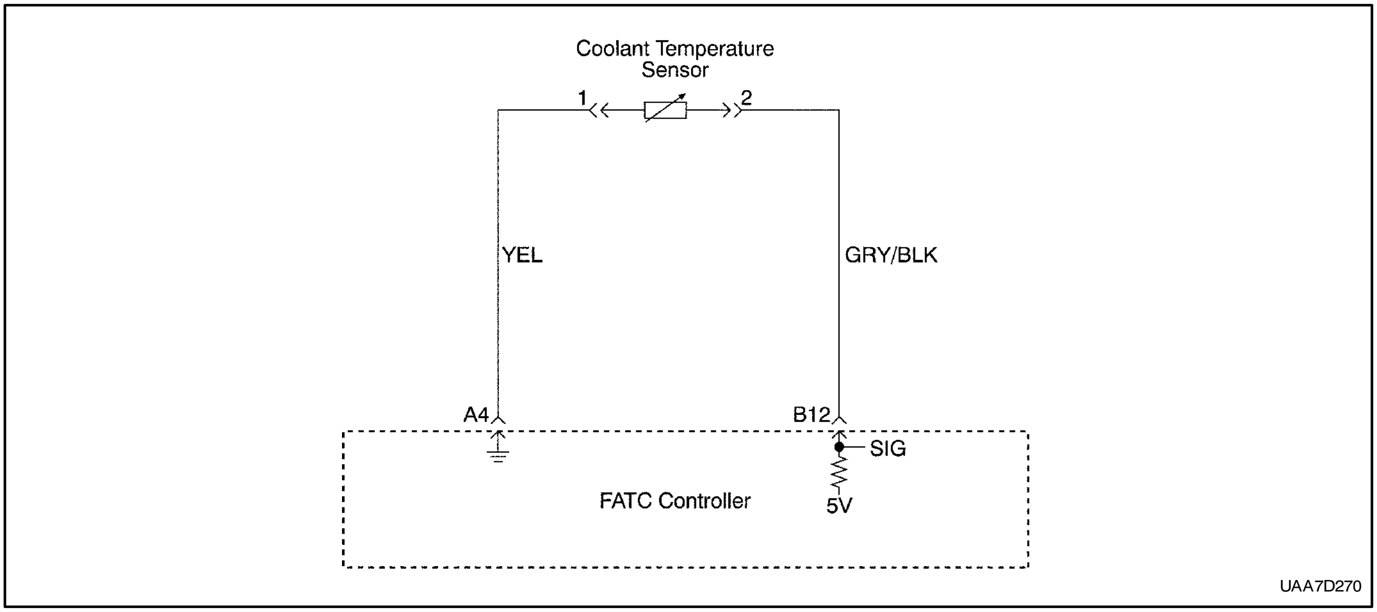
This code will set if the output of the ambient air temperature sensor indicates a probable short circuit or an open in the sensor or the associated wiring harness, or a malfunction of the FATC controller.

DTC 2 – Ambient Air Temperature Sensor Error

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the ambient air temperature sensor connector from front bumper harness located behind of front bumper. 3. Measure the resistance between the ambient air temperature sensor connector terminals. Is there any sign of damage in the wiring or connector, or the resistance outside of the specified value at 20 to 25°C (68 to 70°F)?	2600-2100 Ω	Go to *Step 5*	Go to *Step 2*
2	1. Remove ambient air temperature sensor. 2. Examine the wiring for any open or short and the connector for any damage. Is there a problem with the wiring or the connector?	–	Go to *Step 3*	Go to *Step 4*
3	Repair the problem found in the ambient air temperature sensor wiring or connector. Is the repair complete?	–	System OK	–
4	Replace the ambient air temperature sensor. Is the repair complete?	–	System OK	–
5	1. Turn the ignition switch to ON. 2. Measure voltage between two terminals in the ambient air temperature sensor connector on the front bumper. Is the voltage equal to the specified value?	> 4 V	Go to *Step 7*	Go to *Step 6*

DTC 2 – Ambient Air Temperature Sensor Error (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Reconnect the ambient air temperature sensor to the connector. 2. Turn the ignition switch to ON. 3. Observe the temperature display screen on the controller. Does the display indicates the continuing presence of a DTC 2 condition?	–	Go to *Step 8*	System OK
7	1. Pull the FATC controller from the instrument panel, leaving the wiring harness connected. 2. Measure the voltage between terminals B13 and A4 by back probing the connectors. Is the voltage equal to the specified value?	> 4 V	Go to *Step 8*	Go to *Step 9*
8	Replace the FATC controller. Is the repair complete?	–	System OK	–
9	1. Trace the wiring for ambient air temperature sensor from FATC controller to ambient air temperature sensor connector. 2. Repair any open or high resistance condition in the wiring or connector terminal. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 3
COOLANT TEMPERATURE SENSOR ERROR

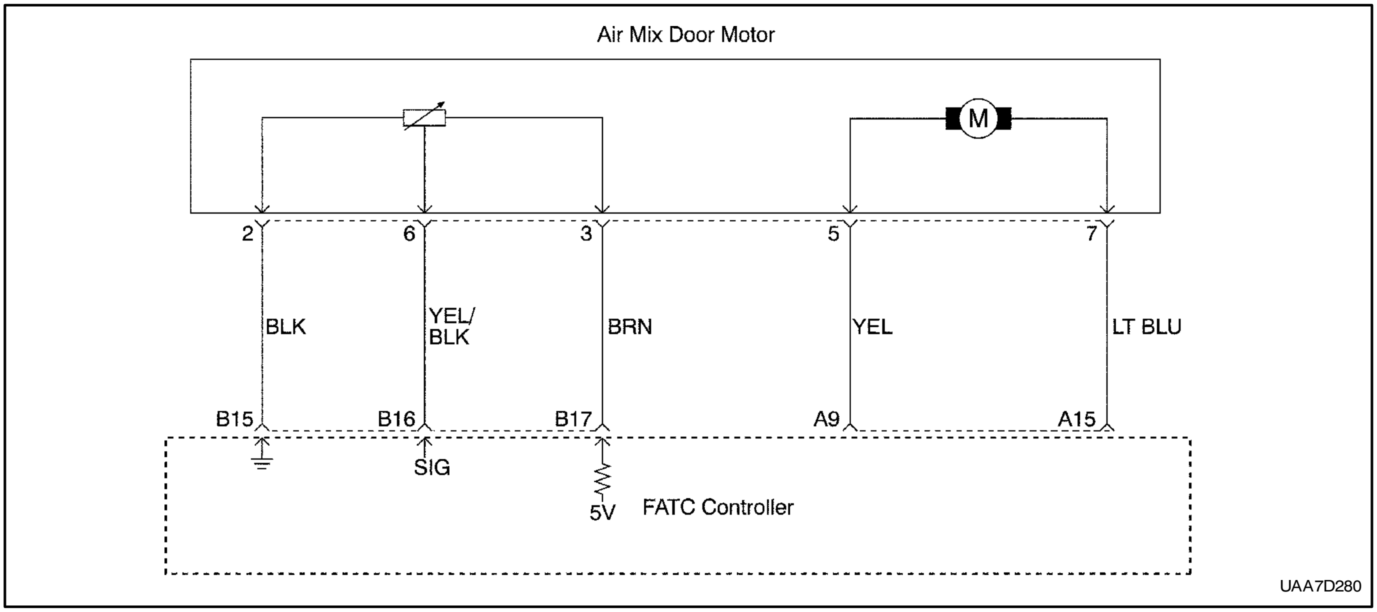
This code will set if the output of the coolant temperature sensor indicates a probable short circuit or an open in the sensor or the associated wiring harness, or a malfunction of the FATC controller.

DTC 3 – Coolant Temperature Sensor Error

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the coolant temperature sensor connector from the FATC harness. 3. Examine the wiring from sensor to the connector and examine the connector for any sign of damage. 4. Measure the resistance between the coolant temperature sensor connector terminals. Is there any sign of damage in the wiring or connector, or the resistance outside of the specified value at 20 to 25°C (68 to 70°F)?	2600-2100 Ω	Go to *Step 2*	Go to *Step 3*
2	Repair the damaged wiring or the connector, or replace the coolant temperature sensor as required. Is the repair complete?	–	System OK	–
3	1. Turn the ignition switch to ON. 2. Measure voltage between two terminals in the coolant temperature sensor connector on the FATC harness. Is the voltage equal to the specified value?	> 4 V	Go to *Step 7*	Go to *Step 4*
4	Check the terminals on the coolant temperature sensor connector. Is any problem found with the connector?	–	Go to *Step 5*	Go to *Step 6*
5	Repair the connector terminals or replace the coolant temperature sensor or FATC controller as required. Is the repair complete?	–	System OK	–

Code 3 – Coolant Temperature Sensor Error (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Reconnect the coolant temperature sensor to the connector. 2. Turn the ignition switch to ON. 3. Observe the temperature display screen on the controller. Does the display indicates the continuing presence of a DTC 3 condition?	–	Go to *Step 9*	System OK
7	1. Pull the FATC controller from the instrument panel, leaving the wiring harness connected. 2. Measure the voltage between terminals B12 and A4 by back probing the connectors. Is the voltage equal to the specified value?	> 4 V	Go to *Step 8*	Go to *Step 9*
8	Replace the FATC controller. Is the repair complete?	–	System OK	–
9	1. Trace the wiring for coolant temperature sensor from FATC controller to coolant temperature sensor connector. 2. Repair any open or high resistance condition in the wiring or connector terminal. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 4
AIR MIX DOOR ERROR

This code will set if the output of the air mix door indicates that the door opening angle is out of range or does not change value when the door should not be moving. This would indicate a probable short circuit or an open in the air mix door or the associated wiring harness, a door motor that is not operating or a malfunction of the FATC controller.

DTC 4 – Air Mix Door Error

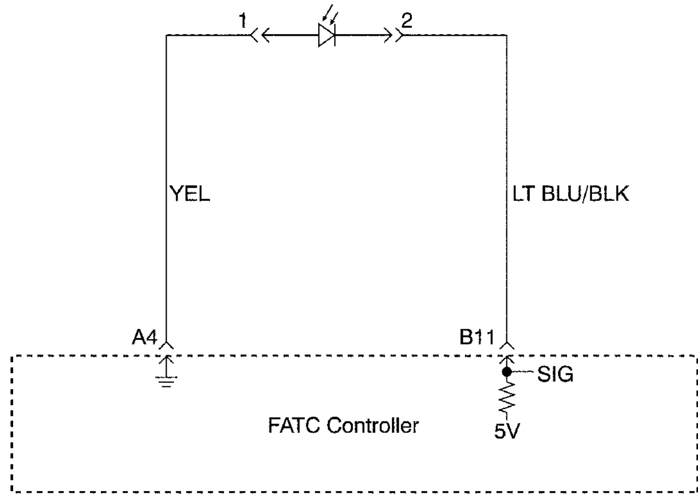
Step	Action	Value(s)	Yes	No
1	1. Disconnect the I/P wiring harness connector from the air mix door motor. 2. Use an ohmmeter to measure the resistance between terminals 5 and 7 on the air mix door motor. Does the measured resistance indicate an open or a shorted condition?	Open = ∞, Short = ≈ 0 Ω	Go to *Step 4*	Go to *Step 2*
2	Measure the resistance between terminals 2 and 3 on the air mix door motor. Is the resistance equal to the value specified?	≈ 3000 Ω	Go to *Step 3*	Go to *Step 4*
3	Measure the resistance between terminals 6 and 2 and between terminals 6 and 3 on the air mix door motor. Do these resistance add to approximately the value measured between terminals 2 and 3?	≈ 3000 Ω	Go to *Step 5*	Go to *Step 4*
4	Replace the air mix door motor. Is the repair complete?	–	System OK	–
5	Check the connector terminals at the air mix door motor and the wiring in the FATC harness. Is there a problem with any terminal on either the harness connector or the motor connector or the wiring?	–	Go to *Step 6*	Go to *Step 7*
6	Repair the problem found with a connector terminal or the wiring, or replace the motor as required. Is the repair complete?	–	System OK	–

DTC 4 – Air Mix Door Error (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Remove the FATC controller from the instrument panel. 2. Disconnect the harness connectors from the FATC controller. 3. Examine the connector terminals on the harness connectors and the controller connectors and the harness wiring. Is there a problem with any of these connectors or the wiring?	–	Go to *Step 8*	Go to *Step 9*
8	Repair the problem found with a connector terminal or wiring. Is the repair complete?	–	System OK	–
9	Check continuity in the harness between the controller connectors and the air mix door motor connector. ● Controller terminal A15 to motor terminal 7. ● Controller terminal A9 to motor terminal 5. ● Controller terminal B15 to motor terminal 2. ● Controller terminal B16 to motor terminal 6. ● Controller terminal B17 to motor terminal 3. Does the continuity equal the specified value?	≈ 0 Ω	Go to *Step 10*	Go to *Step 11*
10	Repair the continuity problem. Is the repair complete?	–	System OK	–
11	1. Reconnect the air mix door motor to the FATC harness. 2. Reconnect the FATC harness connectors to the controller. 3. Turn the ignition to ON. 4. Measure the voltage between ground and terminal B16 at the controller by backprobing the connector. Is the voltage equal to the specified value?	< 4 V	Go to *Step 12*	Go to *Step 14*
12	1. Set the temperature controller to LO. 2. Connect a voltmeter between ground and terminal A9 at the controller. It should display about 12 v. 3. Raise the temperature setting on the controller to HI. Does the voltage equal the specified value?	Drops from 12 V to 0 V	Go to *Step 13*	Go to *Step 15*
13	1. Connect a voltmeter between ground and terminal A15 at the controller. It should display about 12 v. 2. Change the temperature setting to LO. Does the voltage equal the specified value?	Drops from 12 V to 0 V	Go to *Step 20*	Go to *Step 15*
14	1. Recheck the wiring harness and the connector terminals associated with controller terminals B15, B16, and B17, and air mix door motor terminals 2, 6, and 3. 2. Repair any problem found. Is the repair complete?	–	System OK	–
15	Recheck all wiring circuits between the controller and the air mix door motor. Is there a problem in the wiring or the connectors?	–	Go to *Step 16*	Go to *Step 17*

DTC 4 – Air Mix Door Error (Cont'd)

Step	Action	Value(s)	Yes	No
16	Repair the problem in the wiring between the FATC controller and the air mix door motor. Is the repair complete?	–	System OK	–
17	Recheck the air mix door motor. Is there a problem in the air mix door motor?	–	Go to *Step 18*	Go to *Step 19*
18	Replace the air mix door motor. Is the repair complete?	–	System OK	–
19	Replace the controller. Is the repair complete?	–	System OK	–
20	Observe the operation of the air mix door when the temperature setting is changed. Does the door move normally?	–	Go to *Step 22*	Go to *Step 21*
21	Repair or replace the air mix door. Is the repair complete?	–	System OK	–
22	Observe the operation of the air mix door motor when the temperature setting is changed. Does the motor operate normally?	–	Go to *Step 24*	Go to *Step 23*
23	Replace the air mix door motor. Is the repair complete?	–	System OK	–
24	Reconnect everything and test the system. Does DTC 4 reset?	–	Go to *Step 25*	System OK
25	Replace the FATC controller. Is the repair complete?	–	System OK	–

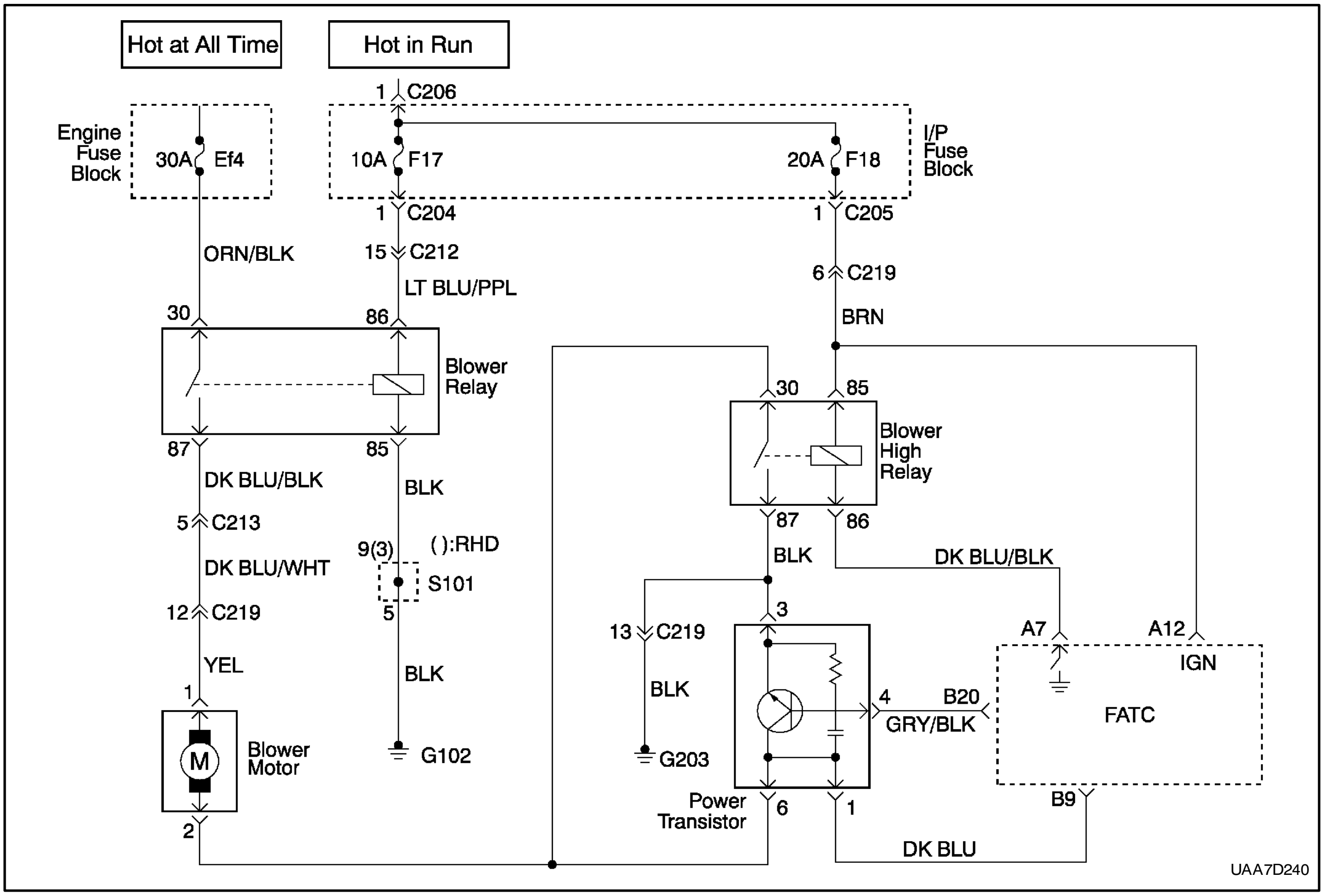


DIAGNOSTIC TROUBLE CODE (DTC) 5
SUN SENSOR ERROR

This code will set if the output of the sun sensor indicates a probable short circuit or an open in the sensor or the associated wiring harness, or a malfunction of the FATC controller.

DTC 5 – Sun Sensor Error

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Lift the sun sensor from top of the dashboard. 3. Secure the FATC harness below the sun sensor connector so it cannot fall through the opening in the top of the dashboard. 4. Disconnect the sun sensor from the FATC harness. 5. Examine the wiring from sensor to the connector and the connector for any signs of damage. 6. Measure the resistance between the sun sensor connector terminals. Is there any sign of damage in the wiring or connector?	–	Go to *Step 2*	Go to *Step 3*
2	Repair damaged wiring or connector, or replace the sun sensor. Is the repair complete?	–	System OK	–
3	1. Remove the FATC controller from the instrument panel, leaving the wiring harness connected. 2. Measure the voltage terminal A4 and B11 by backprobing the connectors. Is the voltage equal to the specified value?	2–5 V	Go to *Step 5*	Go to *Step 4*
4	Repair open or short circuit, and connector terminals as required. Is the repair complete?	–	System OK	–
5	Replace the FATC controller. Is the repair complete?	–	System OK	–

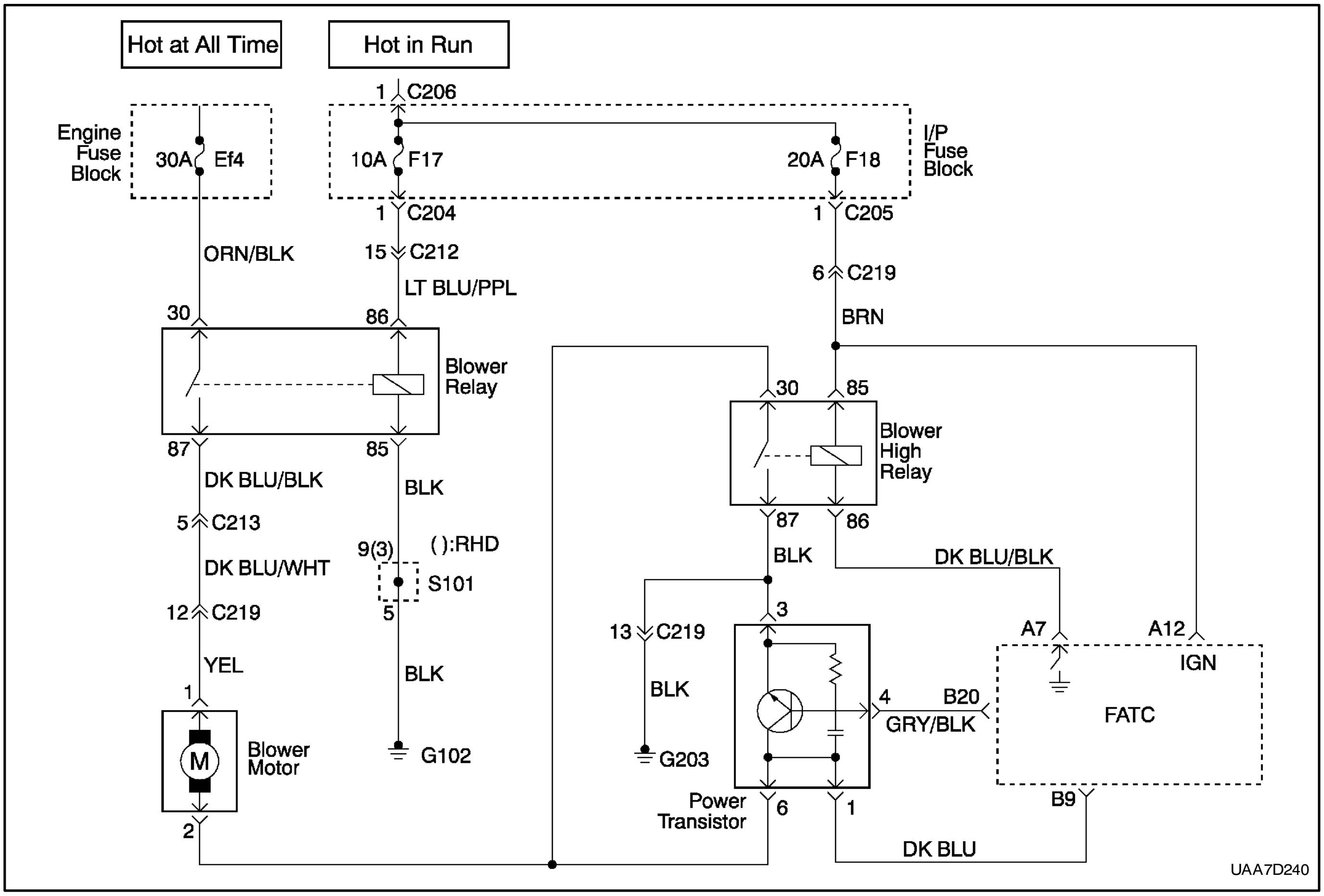


DIAGNOSTIC TROUBLE CODE (DTC) 6 POWER TRANSISTOR ERROR

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the FATC controller connectors. 3. Disconnect power transistor connector. 4. Measure the resistance between terminal 4 of power transistor and terminal B20 of FATC controller. Is the resistance equal to the specified value?	≈ 0 Ω	Go to *Step 2*	Go to *Step 6*
2	Measure the resistance between terminal 1 of power transistor and terminal B9 of FATC controller. Is the resistance equal to the specified value?	≈ 0 Ω	Go to *Step 3*	Go to *Step 6*
3	1. Reconnect power transistor connector and FATC connectors. 2. Turn the ignition switch to ON. 3. Measure the voltage between ground and terminal B9 of the FATC controller while changing the blower speed from 1 to 5 manually. Do the voltages measured match approximately the specified values within ±0.5 V?	1: 8.8 V 2: 6.8 V 3: 4.8 V 4: 2.8 V 5: 0 V	Go to *Step 4*	Go to *Step 5*
4	Replace the FATC controller. Is the repair complete?	–	System OK	–

DTC 6 – Power Transistor Error (Cont'd)

Step	Action	Value(s)	Yes	No
5	Measure the resistance between terminal 6 of the power transistor and terminal 1 of the blower motor. Does the resistance equal to the specified value?	≈ 0 Ω	Go to *Step 7*	Go to *Step 6*
6	Repair or replace the wiring harness. Is the repair complete?	–	System OK	–
7	Check the wiring harness of the blower motor and power supply. ● Check the blower motor relay. ● Check fuse EF4. Is there any problem in the wiring, the relay, or the fuse?	–	Go to *Step 9*	Go to *Step 8*
8	Replace the power transistor. Is the repair complete?	–	System OK	–
9	Repair or replace the wiring harness, the relay, or the fuse as required. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 7 MAX–HIGH RELAY ERROR

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to ON. 2. Set the blower speed for 5th speed manually. 3. Measure the voltage at terminal A7 and ground. Is the voltage approximately equal to the specified value?	≈ 0 V	Go to *Step 3*	Go to *Step 2*
2	Replace the FATC controller. Is the repair complete?	–	System OK	–
3	1. Check the wiring harness associated with blower high relay and terminals. 2. Repair any defects found. Is the repair complete?	–	System OK	Go to *Step 4*
4	Replace blower high relay. Is the repair complete?	–	System OK	–

DIAGNOSTIC TROUBLE CODE (DTC) 8
INTERNAL ERROR (MICOM)

Step	Action	Value(s)	Yes	No
1	1. Remove the FATC controller from the instrument panel. 2. Disconnect the FATC connectors. 3. Examine the connector terminals on the harness connectors and the controller connectors and the harness wiring. Is there any problem with the connector or terminals?	–	Go to *Step 2*	Go to *Step 3*
2	1. Repair any damaged connector or terminals or replace it as required. 2. Reconnect the FATC connectors. 3. Turn the ignition switch to ON. 4. Observe the temperature display screen on the controller. Does the display indicates the continuing presence of a DTC 8 condition?	–	Go to *Step 2*	System OK
3	Replace the FATC controller. Is the repair complete?	–	System OK	–

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

GENERAL A/C SYSTEM SERVICE PROCEDURES

GENERAL SERVICE PROCEDURES

Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System*, for details of the following Procedures:

- Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C System.
- Handling of Refrigerant Lines and Fittings.
- Handling Refrigerant.
- Maintaining Chemical Stability in the Refrigeration System.
- O-Ring Replacement.

SERVICEABLE COMPONENTS

COMMON HVAC COMPONENTS

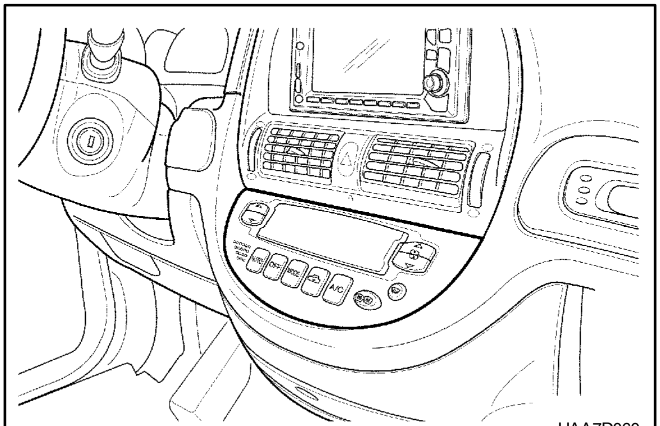
Those components used in non-automatic systems are covered in other section of this manual.

Refer to *Section 7A, Heating and Ventilation System* for the following procedures:

- Blower Motor
- Heater Hoses
- Intake Air Door Actuator.
- Heater/Air Distributor Case Assembly

Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System* for the following procedures:

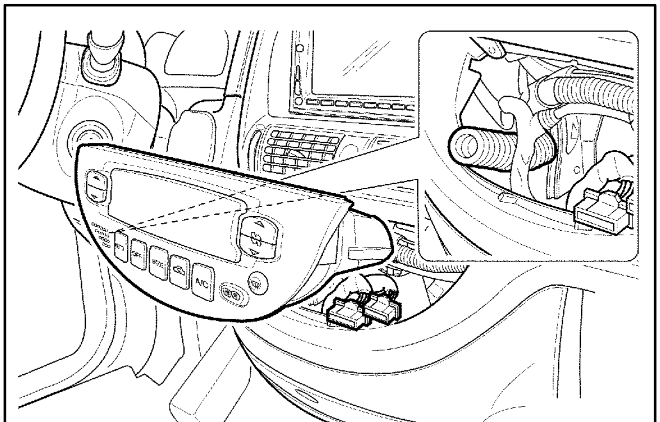
- A/C Pressure Transducer
- High Pressure Pipe (Compressor-to-Condenser)
- High Pressure Pipe (Receiver-Drier-to-Evaporator)
- Compressor.
- Condenser.
- Suction Hose.
- Discharge Hose.
- Receiver-Dryer.
- Evaporator Core.


UAA7D060

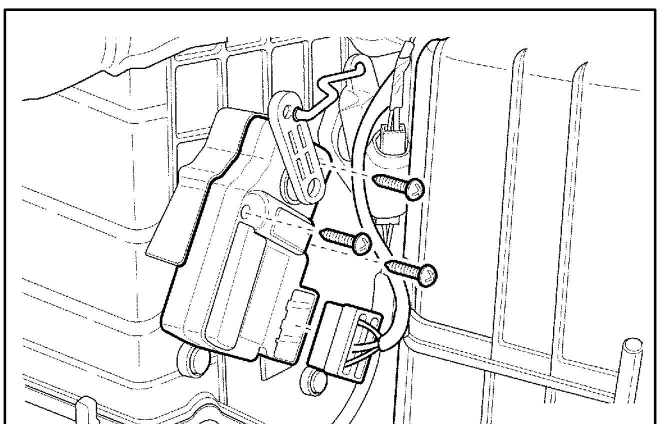
FULL AUTOMATIC TEMPERATURE CONTROL (FATC) CONTROLLER ASSEMBLY

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the full automatic temperature control (FATC) controller by pushing from back side of the controller.


UAA7D070

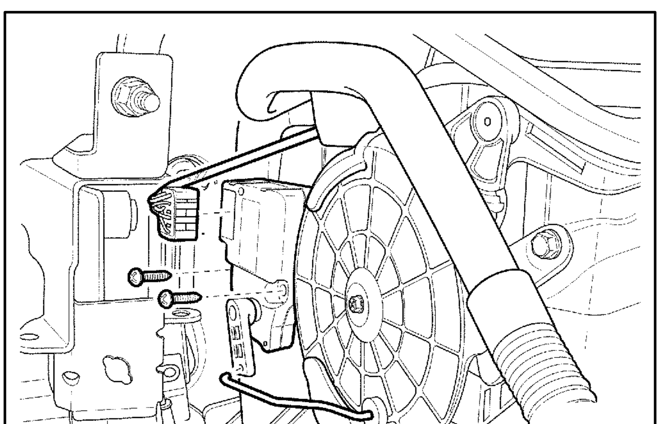
3. Pull out the unit to gain access to the rear.
4. Remove the air inspiration duct of in-car sensor.
5. Disconnect the electrical connectors.
6. Remove the FATC controller assembly.
7. Installation should follow the removal procedure in the reverse order.


UAA7D080

AIR MIX DOOR ACTUATOR

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the glove box. Refer to *Section 9E, Instrumentation/Driver Information*.
3. Ply off the connecting rod of air mix door actuator.
4. Disconnect the electrical connectors.
5. Remove three screws that securing the air mix door actuator.
6. Remove the air mix door actuator.
7. Installation should follow the removal procedure in the reverse order.

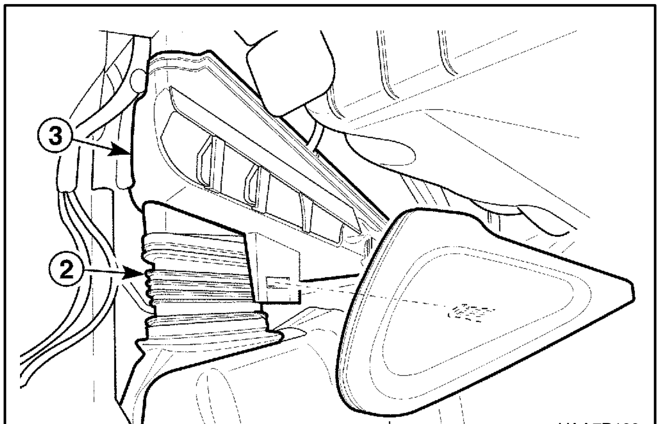

UAA7D090

MODE CONTROL DOOR ACTUATOR

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the driver's knee bolster or lower cover.
3. Ply off the connecting rod of mode control door actuator.
4. Disconnect the connector to mode control door actuator.
5. Remove three screws that securing mode control door actuator to heater/air distributor case.

6. Remove the mode control door actuator by gently snapping the actuator.
7 Installation should follow the removal procedure in the reverse order.

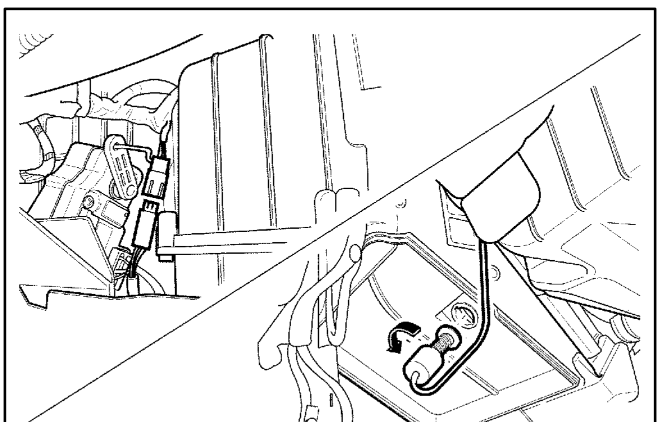


UAA7D100

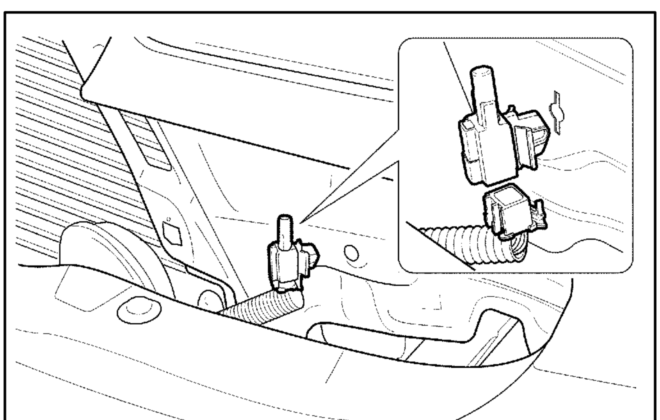
COOLANT TEMPERATURE SENSOR

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the glove box. Refer to *Section 9E, Instrumentation/Driver Information*.
3. Remove console extension.
4. Remove air distribution connector tube,
5. Remove the lower cover of heater/air distribution case assembly.


UAA7D110

6. Disconnect the connector to coolant temperature sensor.
7. Remove coolant temperature sensor.
8. Installation should follow the removal procedure in the reverse order.


UAA7D120

AMBIENT AIR TEMPERATURE SENSOR

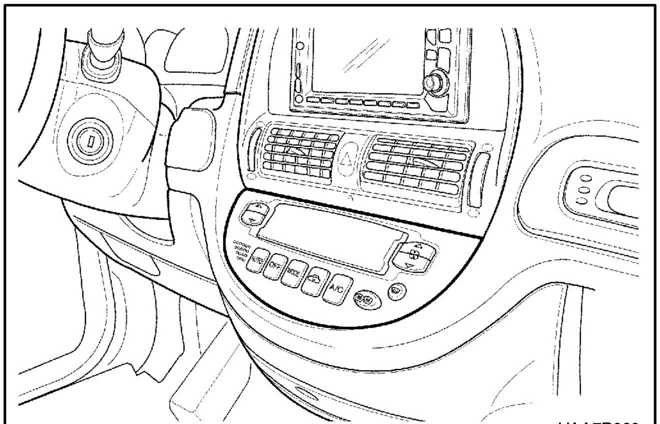
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the radiator grill.
3. Remove the fixing clip for ambient temperature sensor.
4. Disconnect the ambient temperature sensor connector.
5. Remove ambient temperature sensor.

Installation Notice

The head of ambient temperature sensor should positioned upright.

6. Installation should follow the removal procedure in the reverse order.

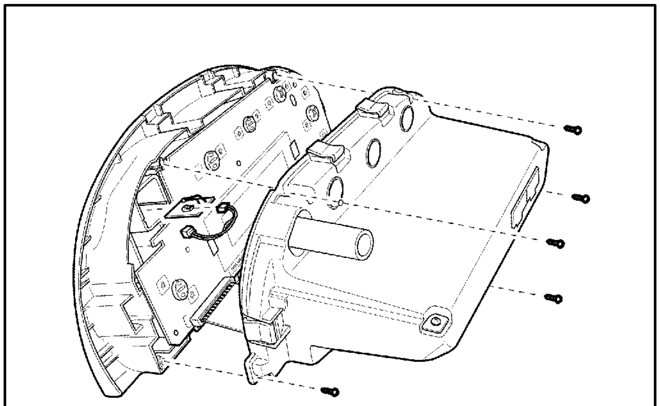


UAA7D060

IN–CAR TEMPERATURE SENSOR

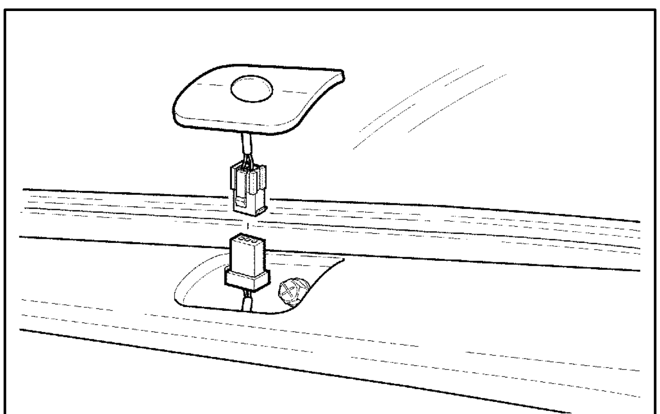
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the FATC controller. Refer to “Full Automatic Temperature Control (FATC) Controller Assembly” in this section.



UAA7D130

3. Remove five screws and the in-car sensor.
4. Installation should follow the removal procedure in the reverse order.



UAA7D140

SUN SENSOR

Removal and Installation Procedure

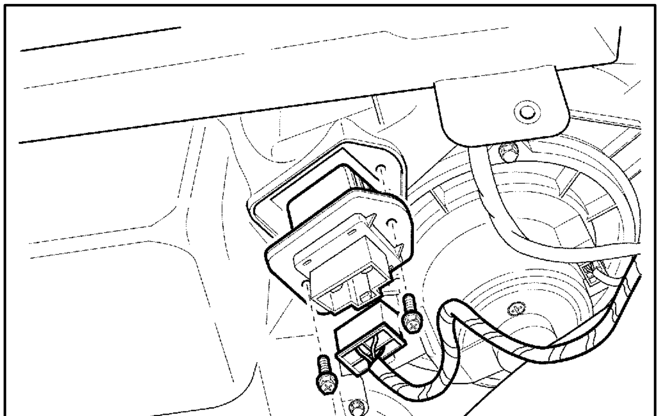
1. Disconnect the negative battery cable.
2. Ply off the sun sensor from the instrument panel.
3. Disconnect the sun sensor connector and remove the sun sensor.
4. Installation should follow the removal procedure in the reverse order.

UAA7D150

HIGH BLOWER RELAY

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the glove box. Refer to *Section 9E, Instrumentation/Driver Information*.
3. Remove high blower relay.
4. Installation should follow the removal procedure in the reverse order.

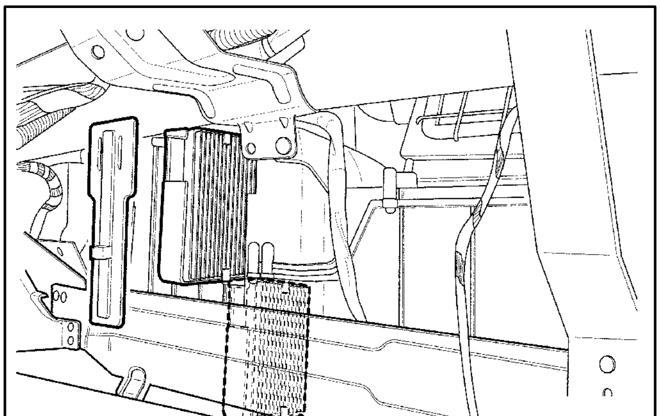


UAA7D160

POWER TRANSISTOR

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the lower cover of glover box. Refer to *Section 9E, Instrumentation/Driver Information.*
3. Disconnect the power transistor connector.
4. Remove two screws that securing power transistor then remove power transistor.
5. Installation should follow the removal procedure in the reverse order.



UAA7D170

AIR FILTER

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the glove box. Refer to *Section 9E, Instrumentation/Driver Information*.
3. Remove the air filter cover by sliding upward.
4. Remove the air filter.

Note: Air filter is divided two parts, replace as set.

5. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

COOLING CAPACITY

Application	Description
Type	Air mix type
Max. Capacity	4,500 kcal/h (17857 Btu/h)
Max. Blowing Capacity	7.0m2/min
Refrigerant	R–134a
Refrigerant capacity	750 ± 20 g (RHD: 820 ± 20 g)

COMPRESSOR

Application	Description
Model	V5
Type	Wobble Plate Variable Displacement
Displacement	9.8 – 151 cc (0.6 – 9.21 cu in)/rev
Capacity (at 2000 R.P.M)	7415 W(25300 BTU/hr)
Oil	220ml (Synthetic Oil)
High Pressure Relief Valve	3171 – 4137 kPa (460 – 600 psi)
Control Valve	290 ± 7 kPa (42 ± 1 psi)

CONDENSER

Application	Description
Type	Parallel type(Multi Flow Condenser)
Capacity	11400 kcal/h (45239 Btu/h)
Size	607.6 x 369.2 x 20

RECEIVER–DRIER

Application	Description
Desiccant	XH–9 or equivalent (30g)
Type	Aluminum type
Capacity	210 cc (12.8 cu in)

A/C PRESSURE SENSOR

Application	Description
High(Gauge Pressure)	ON: 2115 kPa (307 psi) OFF: 2936 kPa (426 psi)
Low(Gauge Pressure)	ON: 230 kPa (33 psi) OFF: 192 kPa (28 psi)

EVAPORATOR

Application	Description
Type	Tank laminated
Size	263.0 x 197.6 x 88.9
Capacity	6300 kcal (25000 BTU/h)

HEATER UNIT

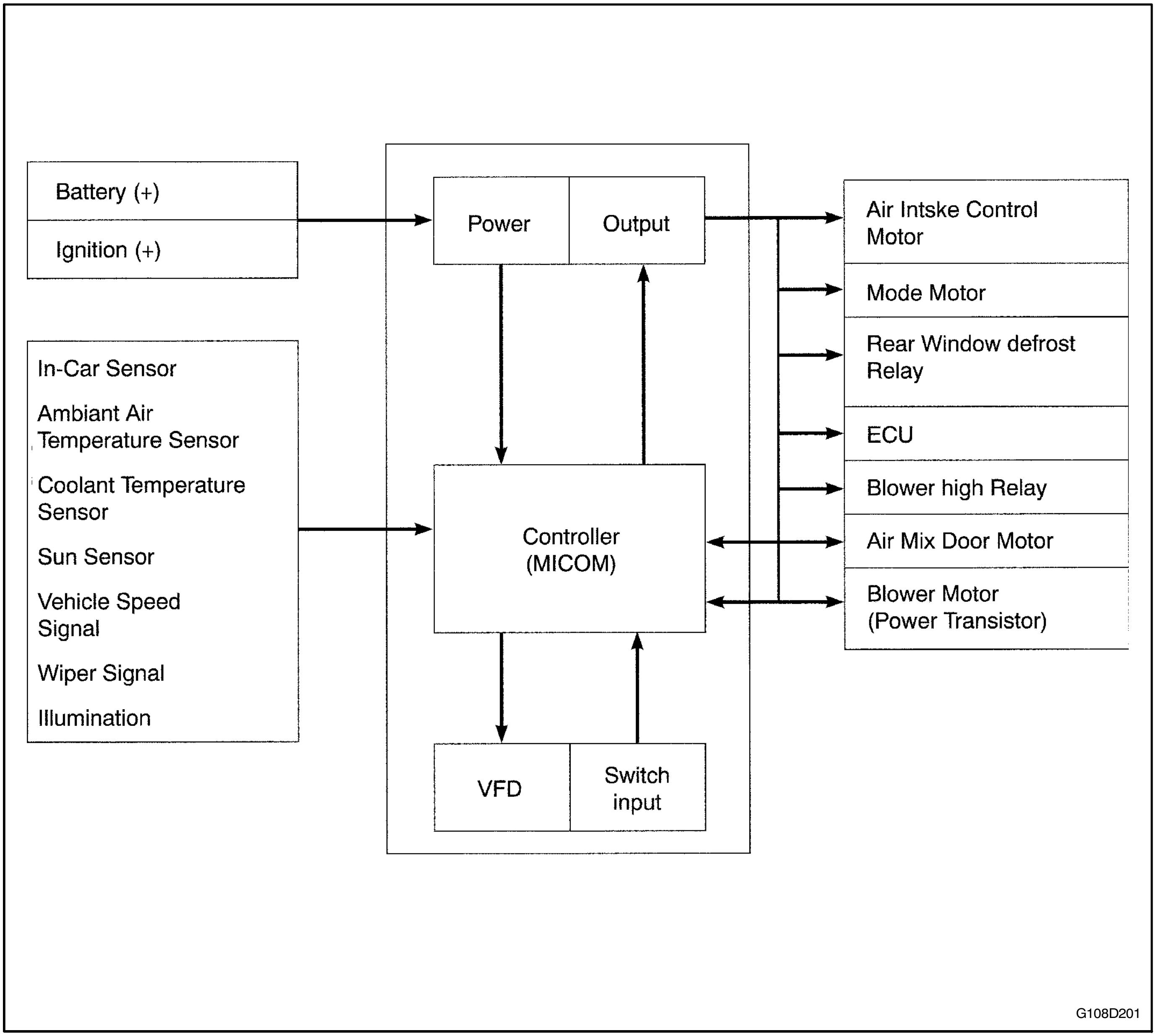
Application	Description
Heater Core Type	2–Row
Heating Capacity	8250 kcal/h(32729 BTU/h)
Heater Core Size	200.4 x 168.2 x 25.0

SENSORS

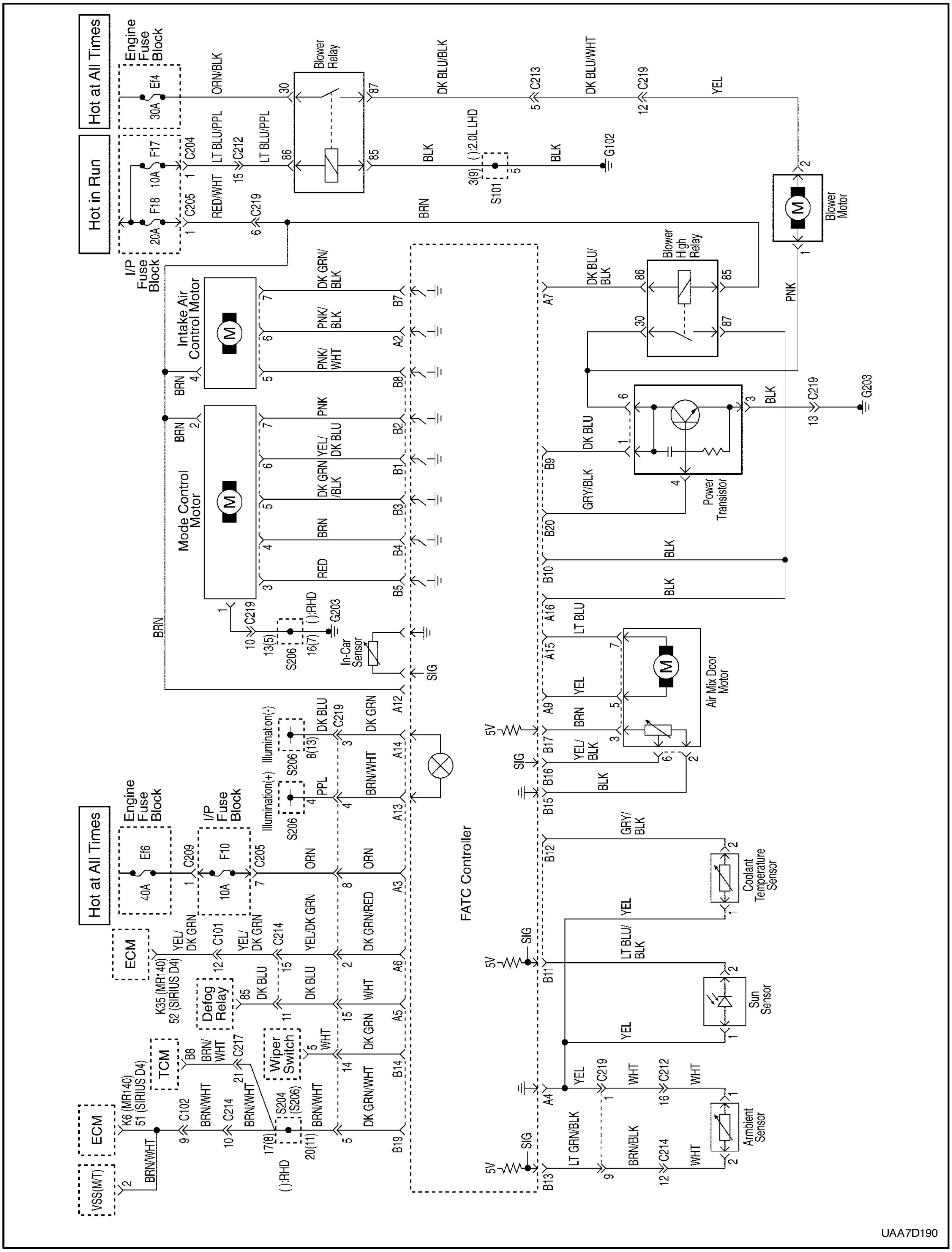
Sensor Name	Resistance(Ω,at 25°C)	Voltage (V)	Current (mA)
In–Car Temperature Sensor	2140~2220	5	3
Ambient Temperature Sensor	2140~2220	5	3
Coolant Temperature Sensor	2140~2220	5	3

SCHEMATIC AND ROUTING DIAGRAMS

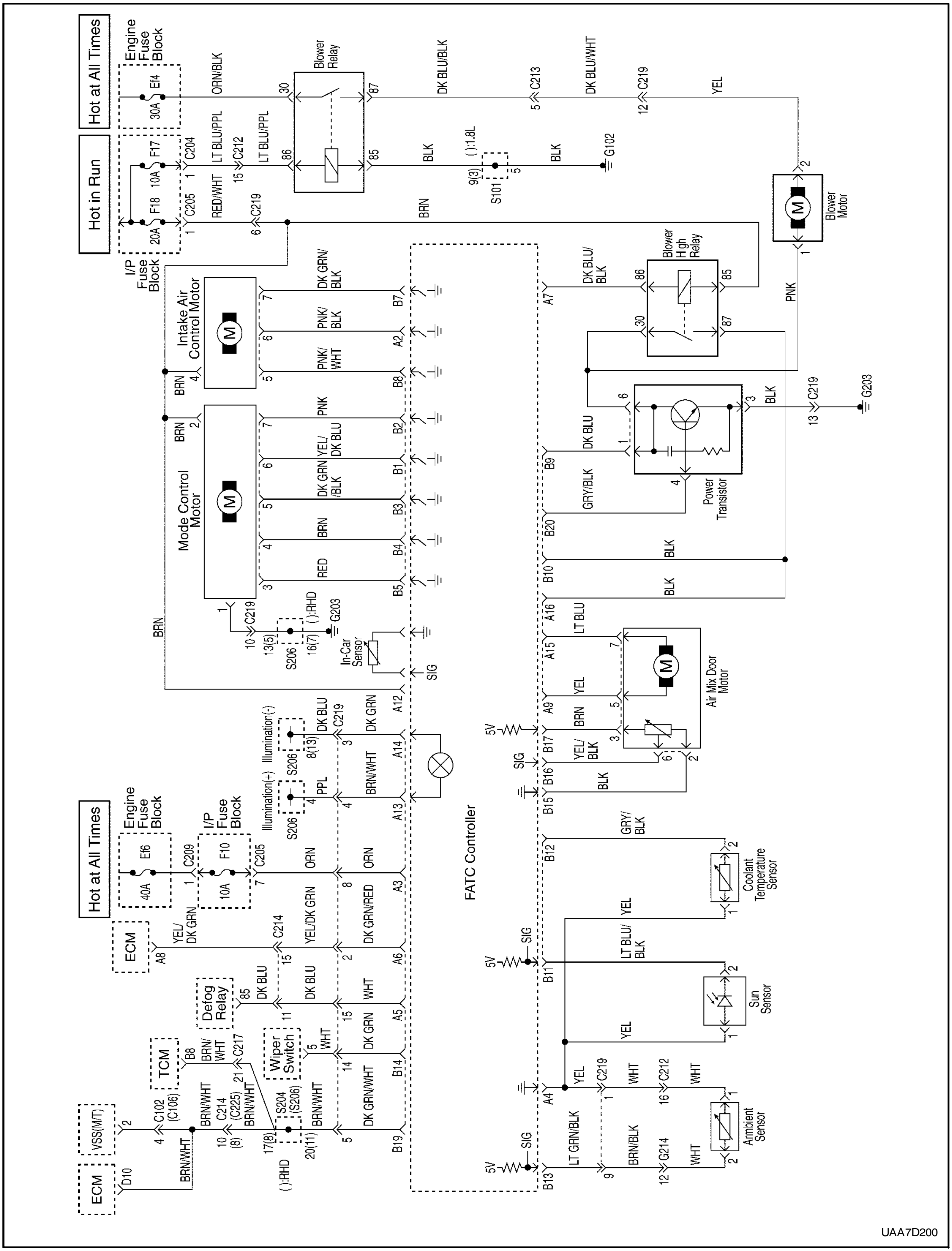
FULL AUTOMATIC TEMPERATURE CONTROL – INPUT/OUTPUT



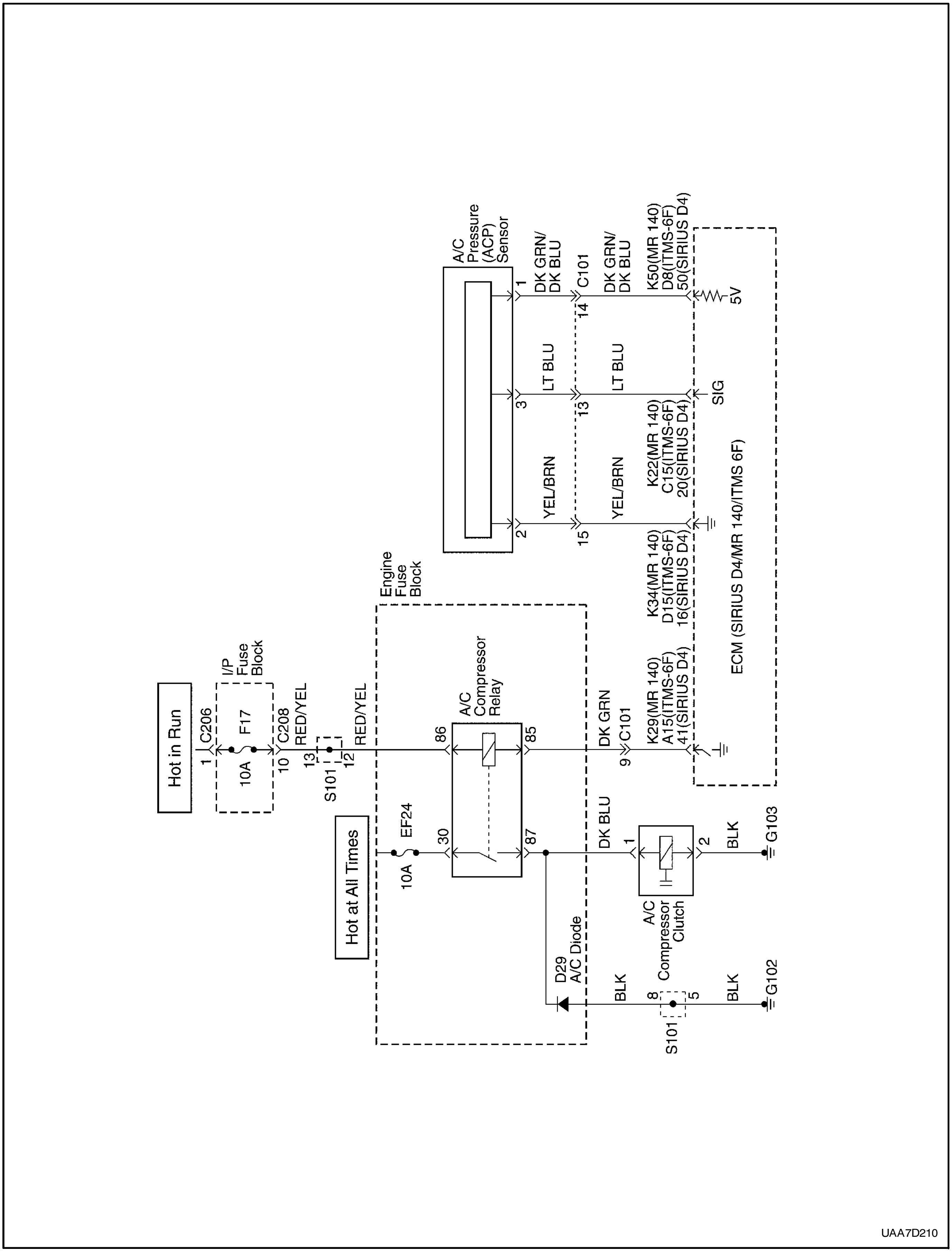
FULL AUTOMATIC TEMPERATURE CONTROL (1/2)– 2.0L (MR–140) AND 1.6D (SIMENS)



FULL AUTOMATIC TEMPERATURE CONTROL (2/2)– 2.0L (ITMS–6F)



FULL AUTOMATIC TEMPERATURE CONTROL – COMPRESSOR



SECTION 8A

SEAT BELTS

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

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DESCRIPTION AND OPERATION

DRIVER SEAT BELT WARNING

The driver's seat belt incorporates a seat belt warning lamp in the instrument cluster and chime to remind the driver if the seat belt is not fastened when the ignition is turned ON. The seat belt warning chime will go out after about six seconds, but the seat belt warning lamp will illuminate until fastening the seat belt.

THREE-POINT FRONT SEAT BELT

The front seat belts have four different option.

Emergency Locking Retractor (ELR)

The ELR seat belt is always unlocked, allowing the passenger freedom of movement, except in emergencies such as rapid deceleration, rapid acceleration, or hard cornering maneuvers.

Webbing Locking Retractor (WLR)

The WLR seat belt is mostly the same as ELR seat belt that always unlocked, allowing the passenger freedom of movement. In emergencies such as rapid deceleration, rapid acceleration, or hard cornering maneuvers, it locks retractor and clamp seat belt webbing additionally.

Emergency Locking Retractor (ELR) with Pretensioner

At normal condition, this type of seat belt operates as ELR seat belt. This seat belt contains an electronically controlled pyrotechnic retractor, pretensioner, which reduces seat belt slack when it activated in a head–on or angled front collision. The front seat belt must be replaced after an accident that causes its activation.

Emergency Locking Retractor (ELR) with Pretensioner and Load Limiter

This type of seat belts are standard for western Europe. Normally the seat belt operates in the ELR with pretensioner. However, when it activated, the pretensioner reduce belt slack, and load limiter will give some buffer for reaction of body for safety.

THREE–POINT REAR OUTBOARD SEAT BELT

The rear outboard seat belt has three optional parts. Refer to "Three-Point Front Seat Belt" in this section for details.

- Emergency Locking Retractor (ELR)
- Emergency Locking Retractor (ELR) with Pretensioner
- Emergency Locking Retractor (ELR) with Pretensioner and Load Limiter

TWO-POINT LAP REAR CENTER SEAT BELT

The two-point lap rear center seat belt is a single continuous length of webbing. The webbing is routed from the anchor through latch plate and into a single buckle.

OPERATIONAL AND FUNCTIONAL CHECKS

Caution:

- Keep sharp objects and potentially damaged objects away from seat belts.
- Avoid bending or damaging any portion of buckle or the latch plate.
- Do not breach or dye the belt webbing. Use only mild soap and water in order to clean the belts.
- When installing the seat belt anchor bolts and screws, start the bolts and screws by hand in order to prevent cross-threading.
- Do not attempt any repairs on the retractor mechanisms or covers. Replace any defective assemblies with new assemblies.
- Replace any belts that are cut or damaged in any way.

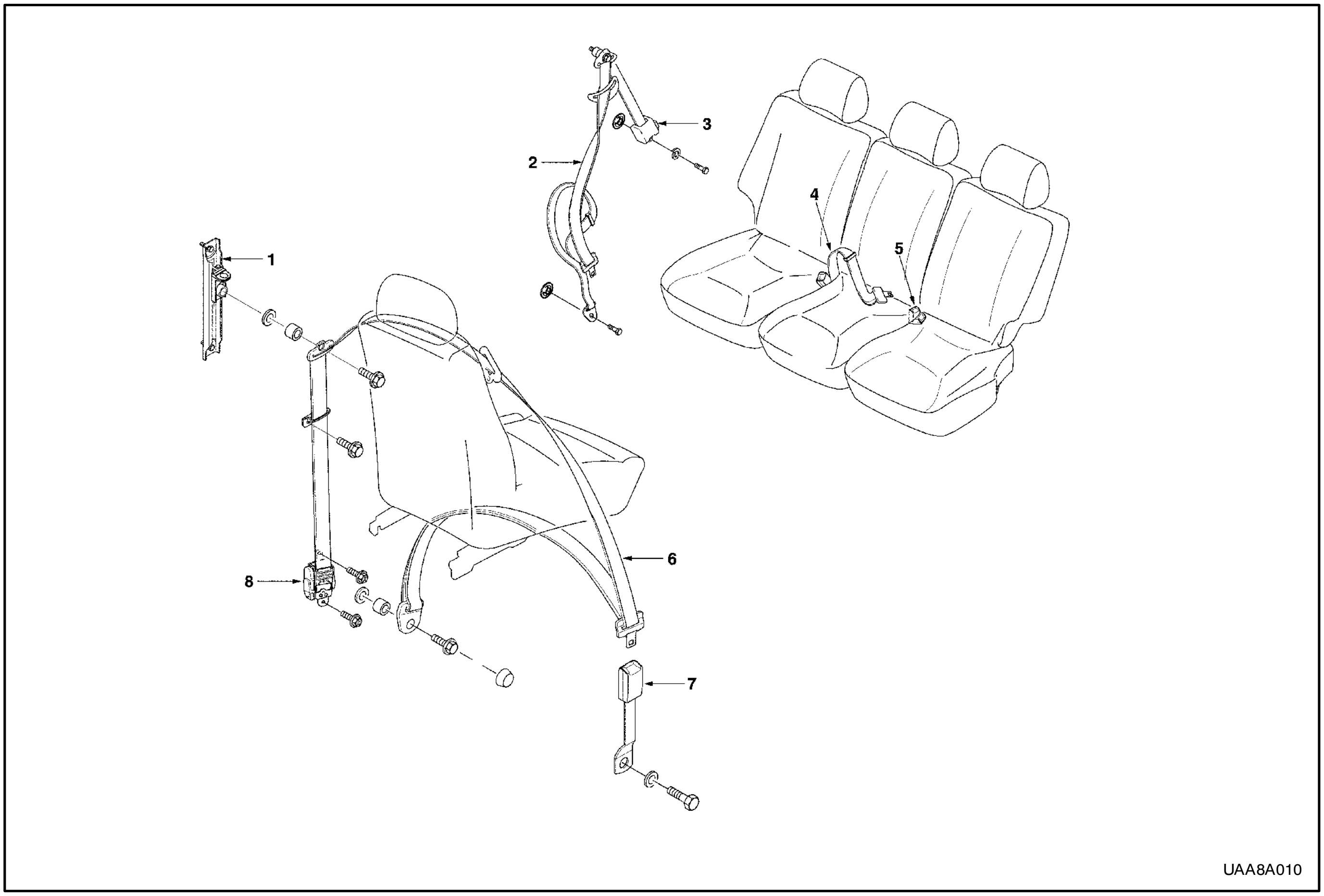
1. Inspect all seat anchor bolts and screws in order to verify that they are secure.
2. Inspect the seat belt buckle. The buckle must lock and unlock easily.
3. After inserting the latch into the buckle, tug sharply on the belt. The buckle must remain locked.
4. Fully extend the shoulder belt portion to make sure that there is no twisting or tears in the belt.
5. Let the shoulder belt retract fully. The belt should retract easily.

CHILD SEAT TETHER ANCHOR

There are three child seat tether anchors located rear back panel, is provided to hold the child seat firmly.

COMPONENT LOCATOR

SEAT BELTS



1 Front Seat Belt Height Adjuster
2 Three-Point Rear Out Board Seat Belt
3 Rear Seat Belt Retractor
4 Two-Point Lap Rear Center Seat Belt
5 Rear Seat Belt Buckle
6 Three-Point Front Seat Belt
7 Front Seat Belt Buckle
8 Front Seat Belt Retractor or Pretensioner

DIAGNOSTIC INFORMATION AND PROCEDURES

DRIVER SEAT BELT WARNING

Diagnostic Aids

The chime module is located under right side of A-pillar.

Seat Belt Warning Lamp Does Not Turn On at Any Time

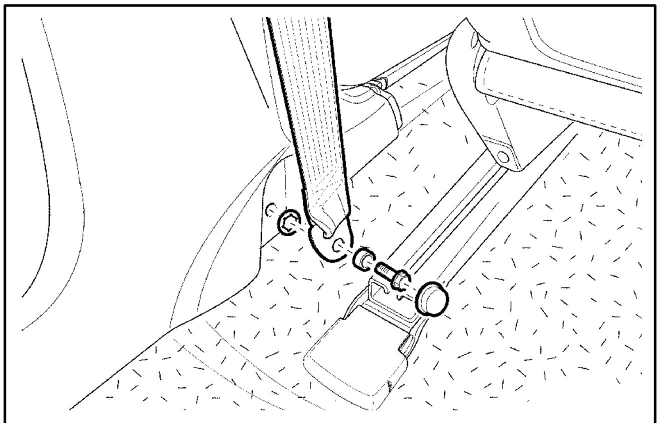
Step	Action	Value(s)	Yes	No
1	1. Unbuckle the seat belt. 2. Close the door of the vehicle. 3. Turn the ignition ON. Is the seat belt warning chime OK?	–	Go to *Step 2*	Go to “Seat Belt Warning Chime Does Not Work”
2	1. Disconnect the seat belt switch connector, located under the driver's seat. 2. Connect a jumper between terminals on the harness side of the seat belt switch connector. 3. Turn the ignition switch to ON. Does the seat belt warning lamp turn on?	–	Go to *Step 3*	Go to *Step 4*
3	Replace the seat belt switch. Is the repair complete?	–	System OK	–
4	1. Turn the ignition switch to OFF. 2. Disconnect the driver's seat belt switch connector. 3. Using an ohmmeter, measure the resistance between the ground and terminal 2 of seat belt switch connector. Is the resistance equal to the specified value?	≈ 0 Ω	Go to *Step 6*	Go to *Step 5*
5	Repair open circuit between terminal 2 of the seat belt switch and ground. Is the repair complete?	–	System OK	–
6	1. Remove instrument cluster. 2. Check the seat belt warning lamp bulb. Is the bulb OK?	–	Go to *Step 8*	Go to *Step 7*
7	Replace the warning lamp bulb. Is the repair complete?	–	System OK	–
8	Check the voltage terminal A20 of the instrument cluster. Is the voltage equal to the specified value?	11–14 V	Go to *Step 10*	Go to *Step 9*
9	Repair open circuit between terminal A20 of the instrument cluster and fuse F16. Is the repair complete?	–	System OK	–
10	Repair open circuit between terminal A1 of the instrument cluster and terminal 1 of the seat belt switch. Is the repair complete?	–	System OK	–

Seat Belt Warning Chime Does Not Work

Step	Action	Value(s)	Yes	No
1	1. Leave the seat belt unbuckled. 2. Close the door of the vehicle. 3. Turn the ignition ON. Is the seat belt warning lamp ON?	–	Go to *Step 2*	Go to *Step 4*
2	1. Turn the head lamp ON. 2. Open the door. Does the chime work.	–	Go to *Step 3*	Go to *Step 4*
3	Repair open circuit between terminal 2 of S204 and terminal 1 of chime module. Is the repair complete?	–	System OK	–
4	Check the warning chime fuse F16. Is the fuse F16 blown?	–	Go to *Step 6*	Go to *Step 5*
5	Check for a short circuit and repair if necessary. Replace the fuse. Is the repair complete?	–	System OK	–
6	1. Turn the ignition switch to ON. 2. Check the voltage at fuse F16. Is the voltage equal to the specified value?	11–14 V	Go to *Step 8*	Go to *Step 7*
7	Repair open power supply circuit for fuse F16. Is the repair complete?	–	System OK	–
8	1. Turn the ignition switch to OFF. 2. Disconnect the chime module connector. 3. Measure the resistance between terminal 8 of chime module and fuse F16 Is the resistance equal to the specified value?	≈ 0 Ω	Go to *Step 10*	Go to *Step 9*
9	Repair open circuit between terminal 8 of the chime module and fuse F16. Is the repair complete?	–	System OK	–
10	With disconnected the chime module connector, measure the resistance between terminal 5 of chime module and ground. Is the resistance equal to the specified value?	≈ 0 Ω	Go to *Step 12*	Go to *Step 11*
11	Repair open circuit between terminal 5 of the chime module and ground. Is the repair complete?	–	System OK	–
12	Replace the chime module. Is the repair complete?	–	System OK	–

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



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THREE-POINT FRONT SEAT BELT

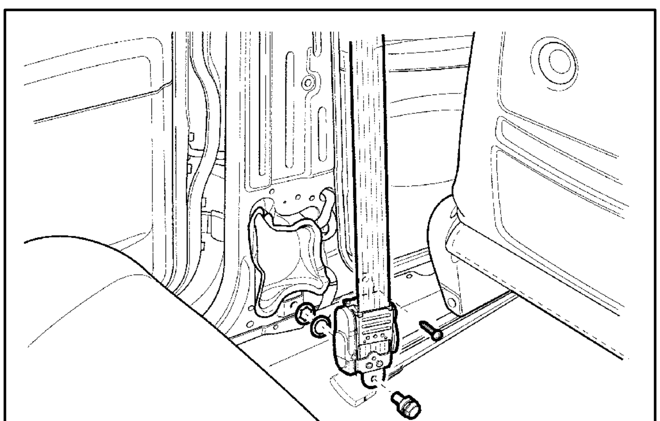
Caution: If the pretensioner is equipped, the sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioner for one minute after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Removal and Installation Procedure

1. Turn the ignition switch to LOCK and remove the key.
2. Remove the plastic cap to reveal the lower B-pillar seat belt anchor
3. Remove the bolt, spacer, washer and the lower B-pillar seat belt anchor.

Installation Notice

Tightening Torque	38 N·m(28 lb–ft)



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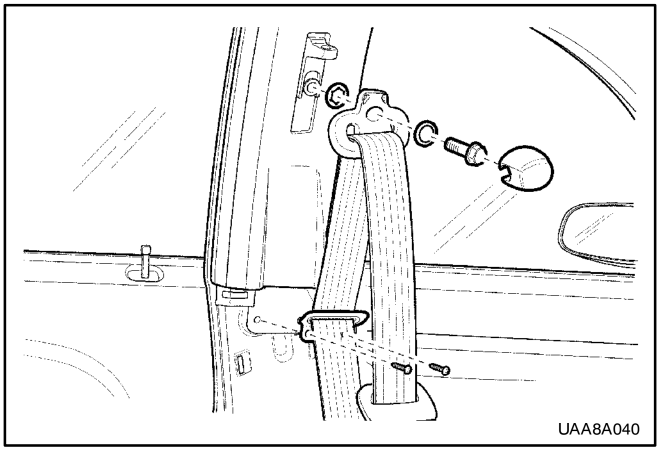
4. Remove the B-pillar lower trim panel. Refer to *Section 9G, Interior Trim.*
5. Disconnect the pretensioner connector, if equipped.
6. Remove the bolt, screw, washers and the seat belt retractor (pretensioner).

Installation Notice

Tightening Torque	38 N·m(28 lb–ft)

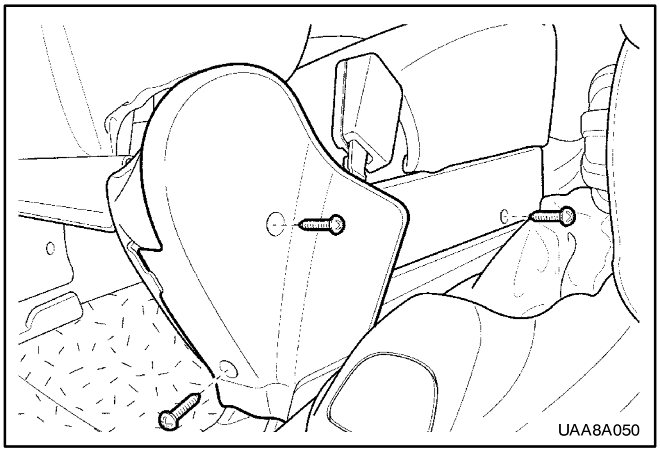


7. Remove screws and seat belt guide.
8. Remove the plastic cap to reveal the upper B-pillar seat belt anchor.
9. Remove the bolt, washers and B-pillar seat belt anchor.

Installation Notice

Tightening Torque	38 N·m(28 lb–ft)

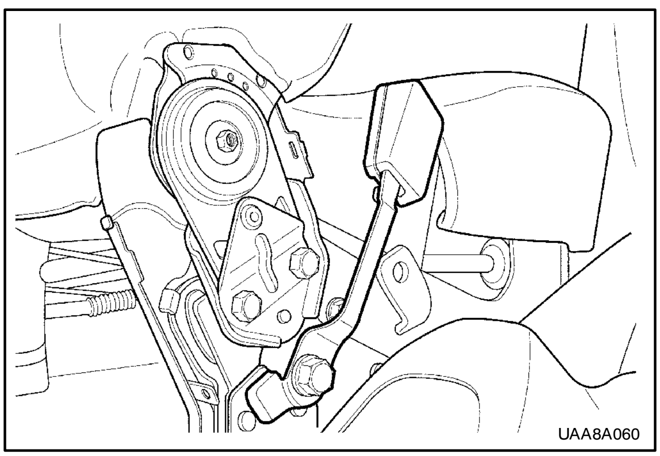
10. Installation should follow the removal procedure in the reverse order.



FRONT SEAT BELT BUCKLE

Removal and Installation Procedure

1. Remove the plastic caps and three screws.
2. Remove the seat belt buckle cover.

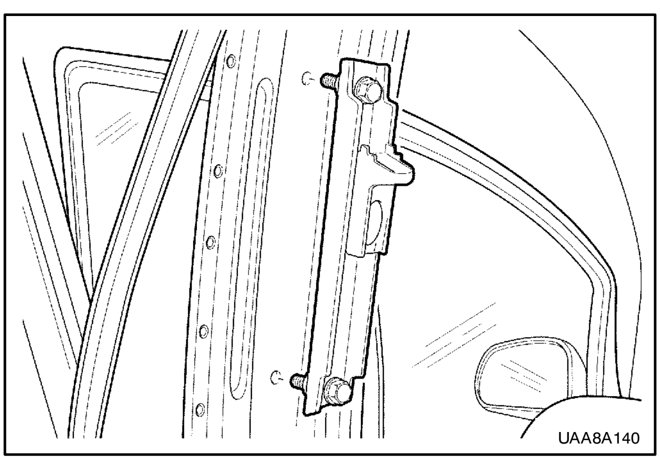


3. Disconnect the seat belt warning lamp connector, for driver seat.
4. Remove the bolt, washer and buckle.

Installation Notice

Tightening Torque	38 N·m(28 lb–ft)

5. Installation should follow the removal procedure in the reverse order.



FRONT SEAT BELT HEIGHT ADJUSTER

Removal and Installation Procedure

1. Disconnect negative battery cable.
2. Remove the lower B-pillar trim. Refer to *Section 9G, Interior trim*.
3. Remove screws and seat belt guide.
4. Remove the front seat belt upper B-pillar anchor bolt.

Installation Notice

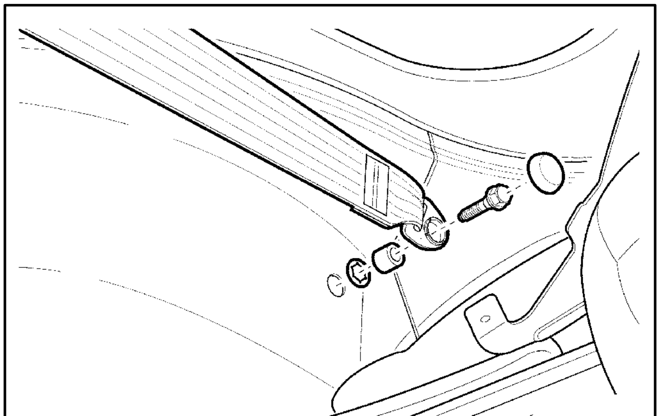
Tightening Torque	38 N·m(28 lb–ft)

5. Remove the upper B-pillar trim.
6. Remove the bolts and seat belt height adjuster.

Installation Notice

Tightening Torque	20 N·m(15 lb–ft)

7. Installation should follow the removal procedure in the reverse order.



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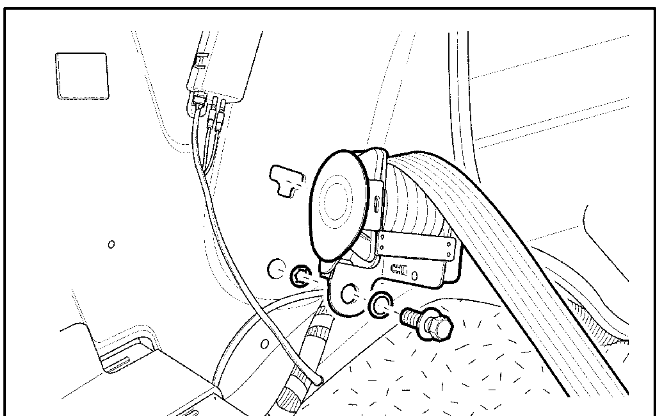
THREE-POINT REAR OUT BOARD SEAT BELT

Removal and Installation Procedure

1. Remove the plastic cap to reveal the seat belt lower anchor bolt.
2. Remove the bolt, washer, spacer and lower anchor bolt.

Installation Notice

Tightening Torque	38 N·m(28 lb–ft)

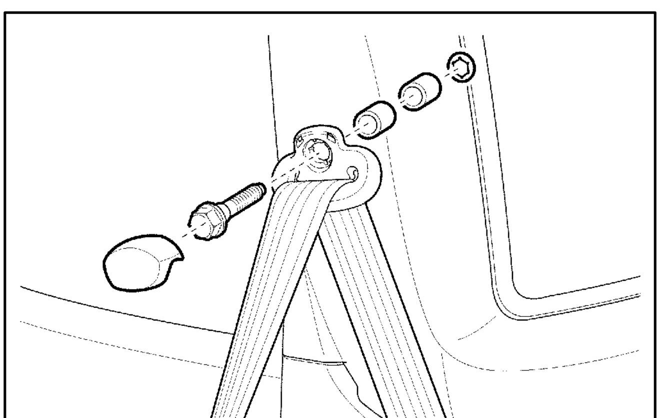


UAA8A080

3. Remove the lower quarter trim panel. Refer to *Section 9G, Interior **Trim**.*
4. Remove the bolt, washers, screw and seat belt retractor.

Installation Notice

Tightening Torque	38 N·m(28 lb–ft)



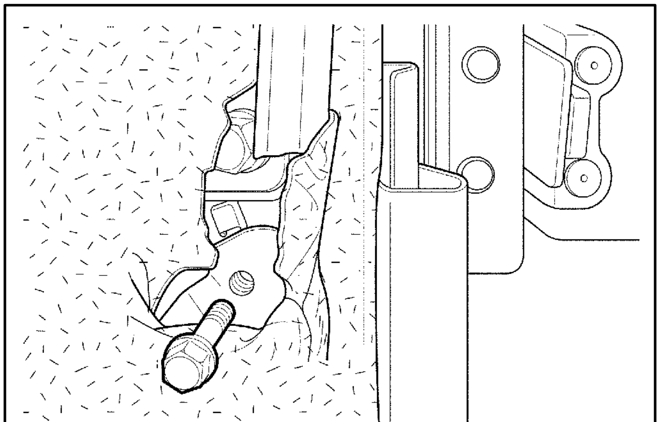
UAA8A090

5. Remove the plastic cap to reveal the bolt.
6. Remove the bolt, spacers, washer and upper anchor.

Installation Notice

Tightening Torque	38 N·m(28 lb–ft)

7. Installation should follow the removal procedure in the reverse order.


UAA8A100

TWO-POINT LAP REAR CENTER SEAT BELT AND BUCKLE

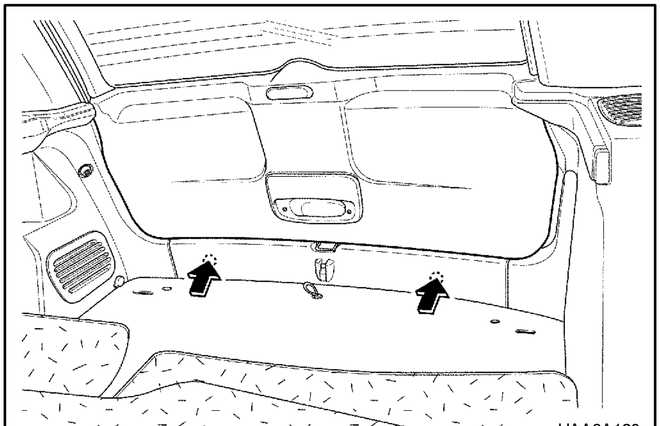
Removal and Installation Procedure

1. Fold the rear center seat.
2. Open the seat cover to reveal the seat belt buckle.
3. Remove the bolts, washer and the seat belt buckle.

Installation Notice

Tightening Torque	38 N·m(28 lb–ft)

4. Installation should follow the removal procedure in the reverse order.


UAA8A120

CHILD SEAT TETHER ANCHOR

Removal and Installation Procedure

1. Open the tether anchor access cap.
2. Remove the bolt and the tether anchor.

Installation Notice

Tightening Torque	19 N·m(14 lb–ft)

3. Installation should follow the removal procedure in the reverse order.

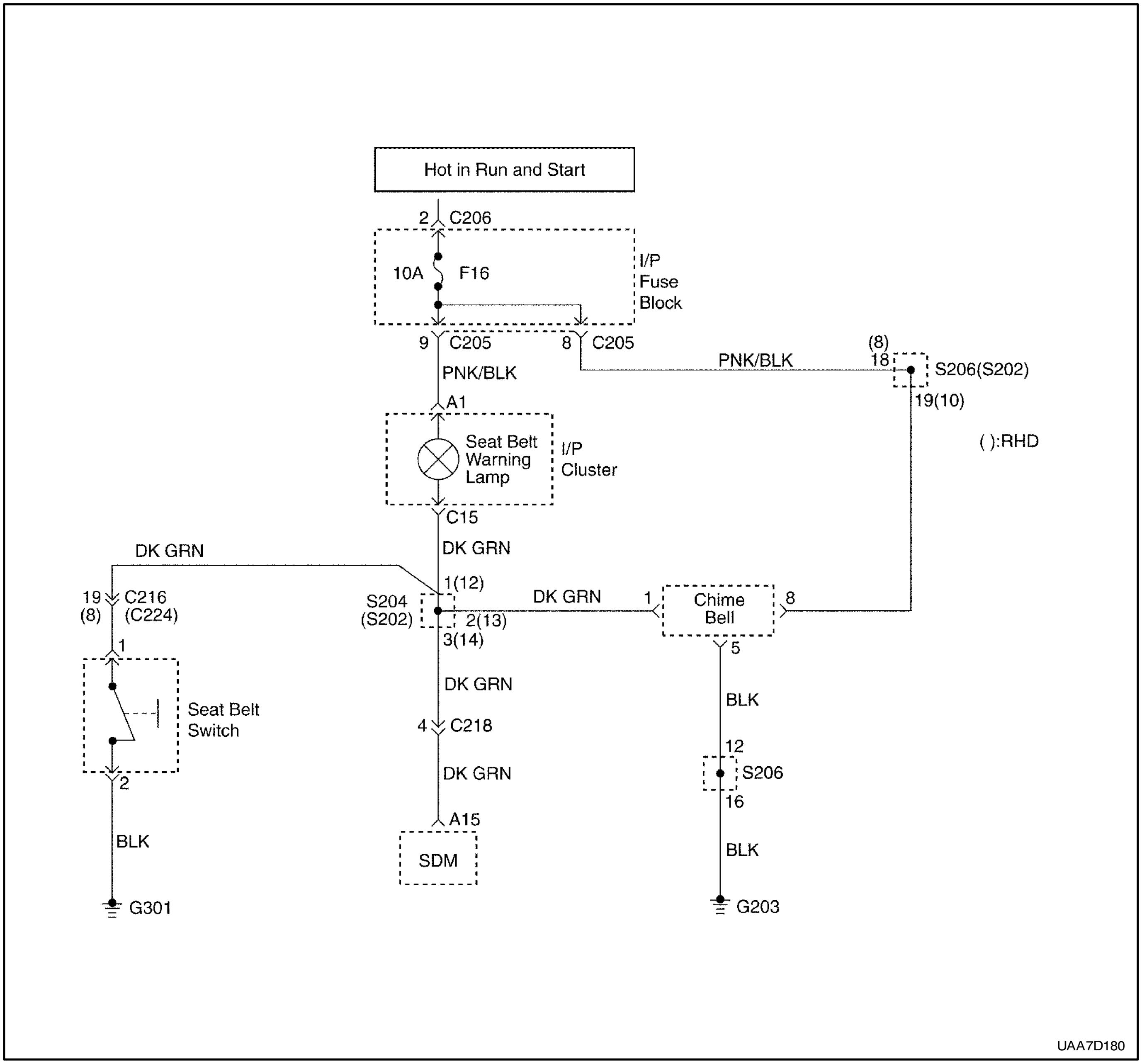
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Child Seat Tether Anchor Bolt	19	14	–
Seat Belt Anchor Bolt	38	28	–
Seat Belt Height Adjuster Bolts	20	15	–
Seat Belt Retractor Bolt	38	28	–

SCHEMATIC AND WIRING DIAGRAMS

DRIVER SEAT BELT WARNINGS



SECTION 8B

SUPPLEMENTAL RESTRAINTS SYSTEM

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

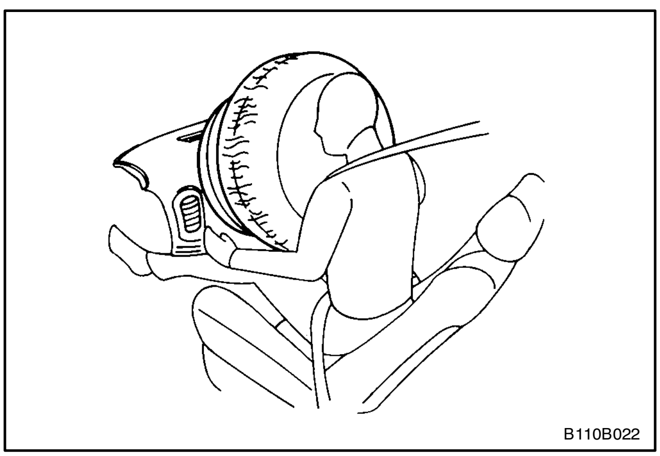
The supplemental restraint system (SRS) is safety device used in conjunction with the seat belts. The air bag does not replace the function of the seatbelt. The driver and the passengers must always fasten their seat belts adjust them for a proper fit.

The SRS is designed to protect the driver and the front seat passenger in the event of a significant frontal impact to the vehicle. The airbags deploy if the force is applied from a direction within 30 degrees of the vehicle's centerline.

The SRS system consists of a

- Driver side airbag module.
- Passenger side airbag module.
- Driver's and front passengers seat belt pretensioners (and load limiter for some model).
- Sensing and diagnostic module (SDM).
- Clock spring.
- Wire harness and connectors.
- AIRBAG indicator on the instrument cluster.

There are two to four separate deployment loops in the SRS system. The term "loop" is used because current leaves the SDM and returns to the SDM during deployment or testing. First loop is the circuit from SDM to the driver airbag and back to the SDM. Second loop is the circuit from the SDM to the passenger airbag and back to the SDM. The third and fourth loops are for right and left pretensioners.



AIRBAG MODULES

Driver Airbag Module

Caution: Tempering with driver side airbag module creates the risk of an injury from unexpected deployment. Therefore, the driver side airbag module should never be disassembled.

The driver airbag module is under the center pad of the steering wheel. The driver airbag module contains an igniter charger and a gas generator to inflate the folded airbag.

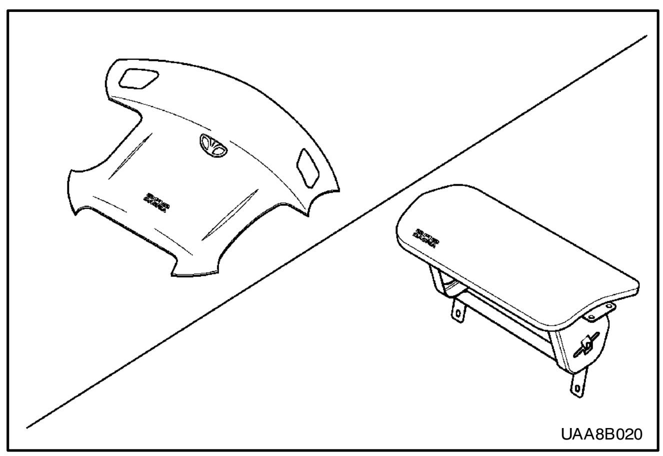
The airbag contains a shorting bar, which short-circuit the driver high circuit to driver low circuit when the connector is disconnected. The shorting bar prevents current from traveling through the driver airbag module during servicing. The shorting bar is disengaged when the connector is connected.

Passenger Airbag Module

Caution: Tempering with passenger side airbag module creates the risk of an injury from unexpected deployment. Therefore, the passenger side airbag module should never be disassembled.

The passenger airbag module is on the passenger side of the instrument panel. The passenger airbag module contains an igniter charge and a gas generator to inflate the folded airbag.

The airbag contains a shorting bar, which short-circuit the passenger high circuit to passenger low circuit when the connector is disconnected. The shorting bar prevents current from traveling through the passenger airbag module during servicing. The shorting bar is disengaged when the connector is connected.



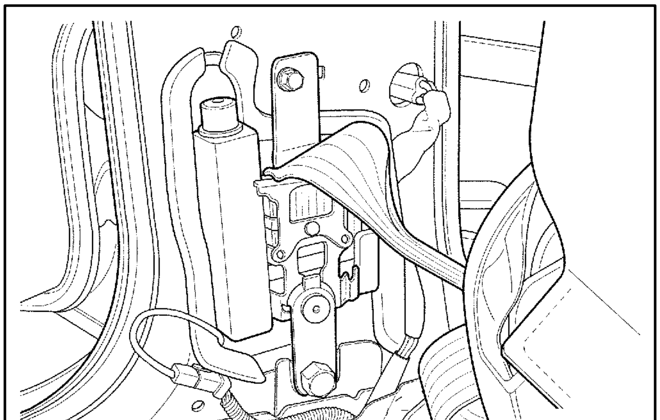
FRONT SEAT BELT PRETENSIONERS

Caution: Tempering with seat belt pretensioner creates the risk of an injury from unexpected deployment. Therefore, the seat belt pretensioner should never be disassembled.

The seat belt pretensioners (with load limiter for some vehicles) are assembled with each front seat belt retractor to retract the seat belt webbing when accounted a frontal collision. The seat belt pretentioners are controlled by sensing and diagnostic Module (SDM).

The seat belt pretensioner contains an igniter charge and a gas generator to pull the seat belt webbing. The seat belt pretensioner must be replaced after an accident that causes its activation.

The seat belt pretensioner also contains a shorting bar to prevent current from traveling through the seat belt pretensioner during servicing. The shorting bar is disengaged when the connector is connected.



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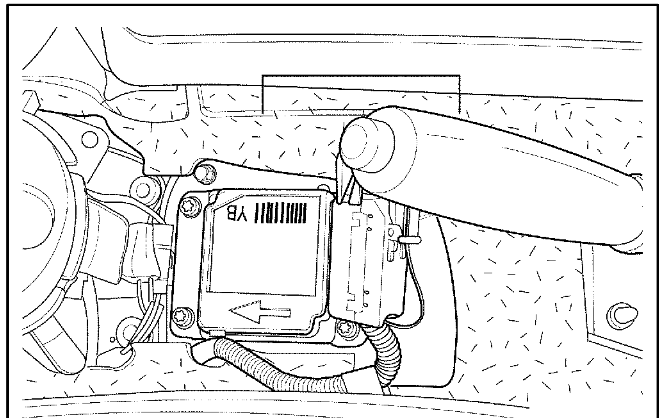
SENSING AND DIAGNOSTIC MODULE (SDM)

Caution: During the service procedures, be careful when handling the SDM. Never shake or jar the SDM. Never apply power to SRS when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts and grounding nut must be fully tightened. Failure to follow these precautions could cause deployment and result in personal injury.

The SDM located on floor beneath the floor console assembly. The SDM performs the following functions:

- Monitors the supplemental restraint system (SRS) electrical components and sets a diagnostic trouble code (DTC) when malfunction is detected.
- Records any faults that are discovered.
- Displays SRS diagnostic trouble codes and system status information when connected to a scan tool.
- Illuminates the AIRBAG indicator to alert the driver to any fault.
- Provides a reserve power source to deploy the airbags and pretensioners if an accident has disabled the normal power source.
- Monitor vehicle velocity changes to detect frontal impacts, which are severe enough to warrant deployment.
- Causes current to flow through the airbag modules and pretensioner to cause deployment if a frontal impact of sufficient force is detected.

The SDM contains no user-serviceable parts.



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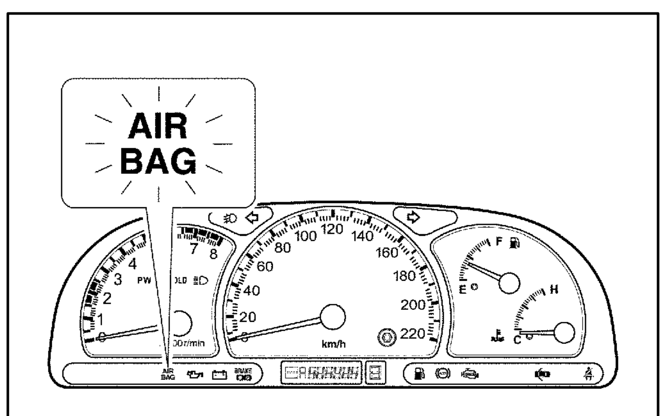
AIRBAG WARNING LAMP

The instrument cluster contains an airbag warning indicator bulb to verify the operation of the AIRBAG indicator and sensing and diagnostic module (SDM). The SDM performs a turn-on test when the ignition is turned ON. The SDM flashes the AIRBAG indicator seven times by supplying an intermittent ground to the indicator lamp circuit. After flashing seven times, the AIRBAG indicator will turn off if no more malfunctions have been detected.

If the SDM has detected malfunctions In the internal or external circuits, which could potentially affect the operation of the supplemental restraint system (SRS), the AIRBAG indicator stays on. Some malfunctions could result in non-deployment when necessary or deployment under conditions which would no normally result in deployment.

When the SDM is not properly attached to its connector, the airbag circuit is shorted to ground because there is a shorting bar within the SDM electronic connector. The shorting bar is disengaged when proper connection is made, but if a poor connection exists the SDM connector supplies a ground to the AIRBAG indicator in dependently of the SDM, and the AIRBAG indicator turns on.



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CLOCK SPRING

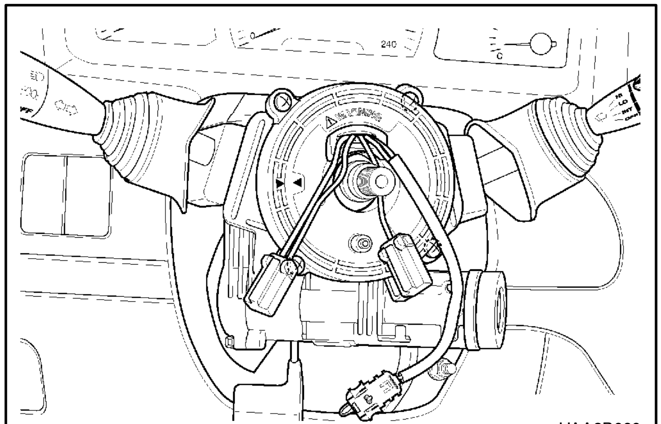
Caution: Disassembling the clock spring can cause injury or cause the clock spring to malfunction.

Caution: Over-rotating the clock spring without the steering wheel in position could damage the clock spring and result in an inoperative driver airbag.

There is a coil assembly in the steering which is referred to as a clock spring because of its internal resemblance to the type of spring used in a mechanical clock. The clock spring should never be disassembled, and there is no timekeeping function. The clock spring contains two or three current-carrying coils. One of the current-carrying coils maintains continuous contact within the driver deployment loop while the steering wheel is rotated. The clock spring also contains coils that maintain continuous contact for horn and remote audio control switch circuit.

Turning the steering wheel in one direction tightens the coil, and turning the steering wheel in the opposite direction loosens the coil. Do not turn the clock spring when the steering wheel is not attached. Refer to "Clock Spring" in this section for proper installation of the clock spring.

The clock spring also includes the wiring and the connectors for the horn circuit and the driver airbag circuit. A yellow two-way connector on the lower steering column is attached to the clock spring wiring. The airbag side of the yellow connector contains a shorting bar which connects the driver high circuit to driver low circuit when the connector is disconnected. The shorting bar prevents current from travelling through the driver airbag module during servicing. The shorting bar disengaged when the clock spring connector is connected.



UAA8B060

WIRING HARNESS CONNECTORS

If the sensing and diagnostic module (SDM) electrical connector is not attached properly, a built in shorting bar will connect the wire from airbag warning lamp with the SDM ground wire. This turns on the AIRBAG indicator.

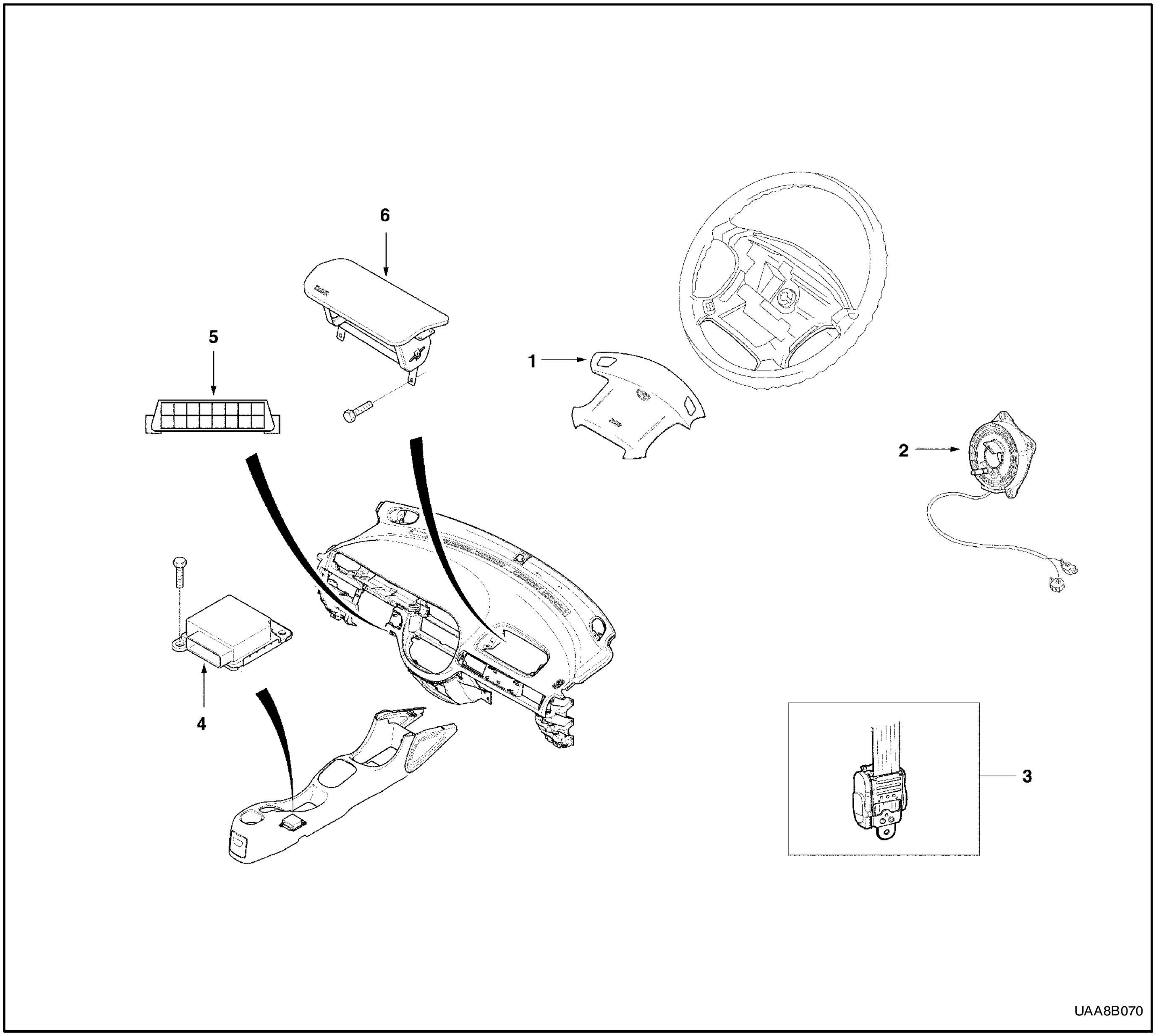
To prevent deployment during servicing, additional shorting bars are located in following locations:

- The clock spring electrical connector at the lower steering column.
- The passenger airbag module.
- The driver airbag module.
- The seat belt pretensioners.

The shorting bar is only a backup safety device. Always disable the supplemental restraints system (SRS) before beginning any service procedure.

COMPONENT LOCATOR

SRS COMPONENT AND WIRING LOCATION VIEW



1 Driver Airbag Module
2 Clock Spring
3 Pretensioner
4 Sensing And Diagnostic Module (SDM)
5 Data Link Connector (DLC)
6 Passenger Airbag Module

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC TROUBLE CODES (DTC)

When the sensing and diagnostic module (SDM) detects any problem it illuminates the AIRBAG warning indicator and stores the diagnostic trouble codes (DTCs). The supplemental restraint system (SRS) Diagnostic System Check must always be the starting point for any SRS diagnosis. The Diagnostic System Check reveals diagnostic trouble codes (DTCs) through the use of scan tool. It also checks for proper AIRBAG warning lamp operation.

The two types of DTCs that may be recorded are as follows:

1. Active DTCs represent malfunction being detected during the current ignition cycle. Active DTCs are stored in random access memory (RAM).
2. Historic DTCs represent malfunctions detected since the last time the historic memory was cleared.

   Historic DTCs are stored in the electrically erasable programmable read-only memory (EPPROM)

Diagnostic Trouble Code Table

DTC	Description
16	Passenger Deployment Loop Shorted
17	Passenger Deployment Loop Open
18	Passenger Deployment Loop Voltage Out of Range
22	Driver Deployment Loop Shorted
24	Driver Deployment Loop Open
26	Driver Deployment Loop Voltage Out of Range
51	Deployment Commanded
53	Deployment Commanded with Loop Faults Present
57	Right Side Belt Pretensioner Deployment Loop Shorted
58	Right Side Belt Pretensioner Deployment Loop Open
59	Right Side Belt Pretensioner Deployment Loop Voltage Out of Range
61	AIRBAG Warning Lamp Failure
64	Left Side Belt Pretensioner Deployment Loop Shorted
65	Left Side Belt Pretensioner Deployment Loop Open
66	Left Side Belt Pretensioner Deployment Loop Voltage Out of Range
71	Internal Sensing and Diagnostic Module (SDM) Failure

SCAN TOOL DIAGNOSTICS

A scan tool can read serial data from terminal 9 of the data link connector (DLC). The scan tool is used to read diagnostic trouble codes (DTCs), and to clear some DTCs after a repair is completed. By design, DTC 51 and 53 cannot be cleared. And the DTC 61 cannot cleared for the ignition cycle once the DTC has been detected by the SDM.

To use the scan tool, turn the ignition OFF, connect the scan tool to the DLC, and turn the ignition switch to ON. Follow the instructions in the scan tool manual. The SDM sends serial data from terminal A4 of the SDM to terminal 9 of the DLC.

USE OF SPECIAL TOOLS

Use a scan tool to read and clear diagnostic trouble codes (DTCs). A connector adapter kit provides jumper wires and terminal adapters to make it easier to test small terminals. In diagnostic testing, use load tool or dummy resistance to substitute for airbag modules.

SRS DIAGNOSTIC SYSTEM CHECK

Notice: If the vehicle interior has been exposed to extensive water intrusion such as water leaks, driving through high water, flooding, or other caucuses, the sensing and diagnostic module (SDM) and SDM connector may be need to be replaced. With ignition OFF, inspect the area around the SDM, including the carpet. If any significant soaking or evidence of previous soaking is detected, the water must be removed, water damage repaired, and the SDM and SDM connector must be replaced. Before attempting any of these repairs, the supplemental restraint system (SRS) must be disabled. Refer to "Disabling the SRS" and "Sensing and Diagnostic Module (SDM)" in this section for instructions on how to disable the SRS and replace the SDM.

The SRS Diagnostic System Check must always be the starting point for any SRS diagnosis. The Diagnostic System Check reveals diagnostic trouble codes (DTCs) through the use of scan tool.

The diagnostic procedures used in this section are designed to find and repair SRS conditions. To get the best results, it is important to use the diagnostic charts and follow the sequence listed below.

1. Perform the SRS Diagnostic System Check, which reveals diagnostic trouble codes (DTCs) through the use of scan tool. It also checks for proper AIRBAG indicator operation.
2. Refer to the proper diagnostic chart as directed by SRS Diagnostic System Check. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis, and incorrect parts replacement.
3. Repeat the SRS Diagnostic System Check after any repair or diagnostic procedures have been performed to ensure that the repair has been made correctly and that no other malfunction exists.

Circuit Description

When the ignitions witch is first turned to ON, ignition voltage is supplied from airbag fuse to the SDM at input terminal A1. The SDM responds by flashing the AIRBAG indicator seven times and then turning it off while the SDM performs tests on the SRS.

Diagnostic Aids

The order in which DTCs are diagnosed is very important. Failure to diagnose the DTCs in the order specified may result in extended diagnostic time, incorrect diagnosis, and incorrect parts replacement.

SRS Diagnostic System Check

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedure, be very careful when handling the SDM. Never strike or jar the SDM. Never power the supplemental restraints system (SRS) when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened, and the arrow on the SDM must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to ON. 2. Observe the AIRBAG indicator as the ignition is being turned ON. Does the indicator flashes seven times?	–	Go to *Step 2*	Go to *Step 6*
2	Observe the AIRBAG indicator after the ignition has been turned ON. Does the AIRBAG indicator turn OFF?	–	Go to *Step 10*	Go to *Step 3*

SRS Diagnostic System Check (Cont'd)

Step	Action	Value(s)	Yes	No
3	1. Turn the ignition to LOCK and remove the key. 2. Connect the scan tool to the data link connector (DLC). Follow the directions given in the scan tool manual. 3. Turn the ignition to ON. 4. Request SRS DTC display with the scan tool. 5. Record all DTCs, indicating each as either a current or a history DTC. Are only history DTCs displayed?	–	Refer to the DTC chart for any DTC that was set, and refer to the Diagnostic Aids for that specific DTC	Go to *Step 4*
4	Check the recorded DTCs. Are current DTCs 18, 24, 51, or 53 set?	–	Go to the DTC chart indicated by any of these three codes	Go to *Step 5*
5	Check the recorded DTCs. Are there any other current DTCs shown?	–	Diagnose the remaining current DTCs from lowest number to highest	Refer to the DTC chart for any history DTC that was set, and refer to "Diagnostic Aids" for that specific DTC
6	Observe the AIRBAG indicator after the ignition has been turned ON. Does the AIRBAG indicator stay on?	–	Go to "Airbag Warning Lamp Stays on with Ignition Switch ON"	Go to *Step 7*
7	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the sensing and diagnostic module (SDM) connector. 3. Check the AIRBAG indicator bulb and circuit. Are the bulb and bulb circuit in good condition?	–	Go to *Step 9*	Go to *Step 8*
8	1. Replace the bulb or repair the bulb circuit. 2. Connect SDM connector and ensure that all components are properly mounted. Is the repair complete?	–	Go to *Step 1*	–
9	1. Turn the ignition to LOCK and remove the key. 2. Disable the SRS. 3. Replace the SDM. The arrow on the SDM must be pointing toward the front of the vehicle. 4. Enable the SRS and ensure that all components are properly mounted. Is the repair complete?	–	Go to *Step 1*	–
10	1. Turn the ignition to LOCK and remove the key. 2. Connect the scan tool to DLC. Follow the direction given in the scan tool manual. 3. Turn the ignition switch to ON. 4. Request SRS DTC display with scan tool. 5. Record all history DTCs. Are any SRS DTCs displayed?	–	Go to *Step 11*	System OK

SRS Diagnostic System Check (Cont'd)

Step	Action	Value(s)	Yes	No
11	Turn the ignition to OFF. Is DTC 71 set?	–	Go to "DTC 71 Internal SDM Failure"	Refer to the DTC chart for any history DTC that was set, and refer to "Diagnostic Aids" for that specific DTC

SENSING AND DIAGNOSTIC MODULE (SDM) INTEGRITY CHECK

The following diagnostic chart must be used when all circuitry outside the sensing and diagnostic module (SDM) has been found to operate properly, as indicated by following the appropriate diagnostic trouble code (DTC) chart. The chart verifies the need for SDM replacement.

Circuit Description

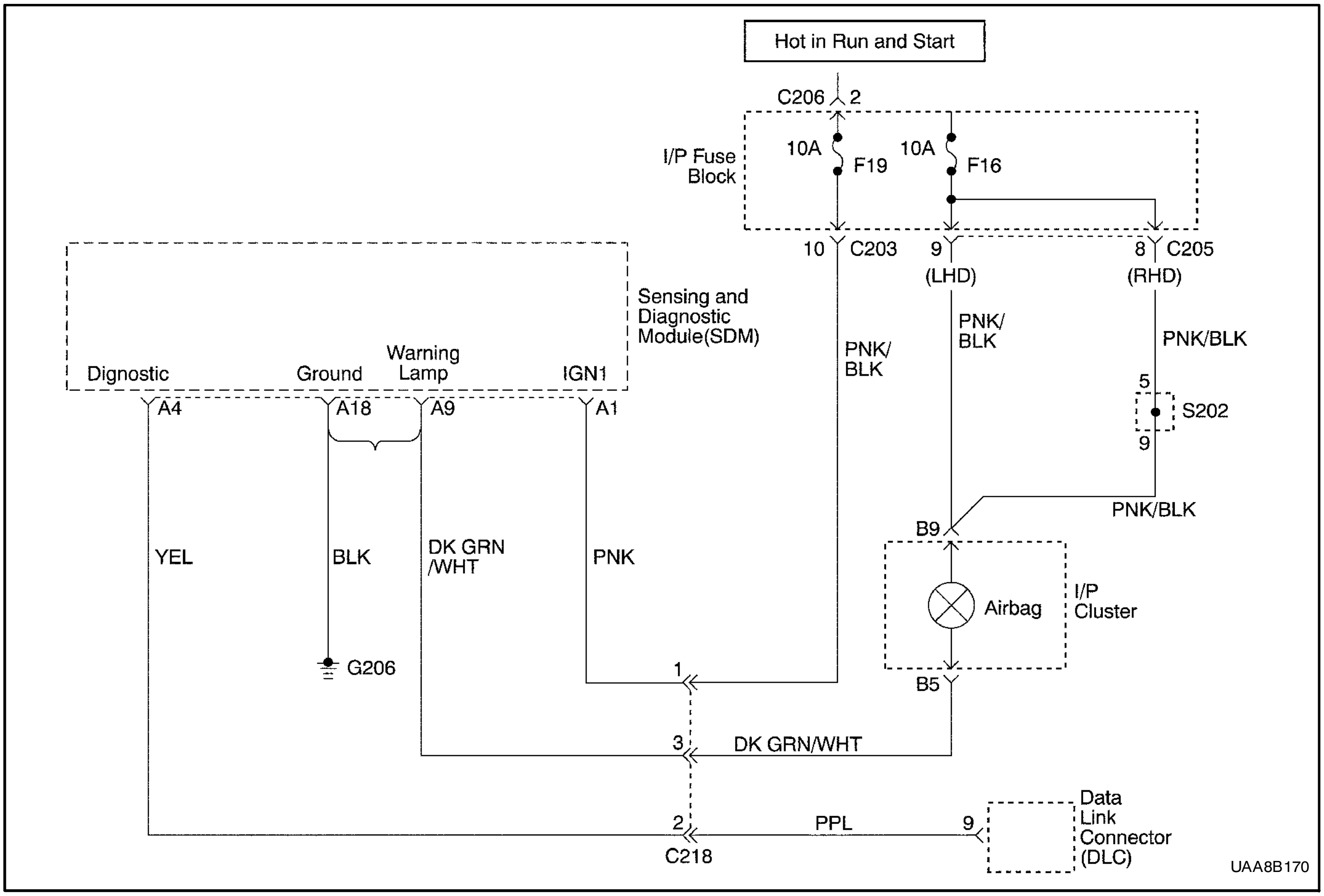
When the SDM recognizes ignition voltage greater then 9 volts at terminal A1 of the SDM, the AIRBAG indicator flashes seven times to verify operation. At this time the SDM performs turn-on tests followed by resistance measurement tests and continues monitoring tests. When malfunction is detected, the SDM sets a current DTC and illuminates the AIRBAG indicator. When the malfunction is no longer detected and/or the ignition switch is cycled, the SDM will clear current DTCs and move them to a history file, except for the DTCs 51, 53 and sometimes 71. DTCs 51 and 53 will not clear using a scan tool because these codes require replacement of SDM. The SDM must be replaced only after the malfunction that set the DTC has been repaired.

Sensing and Diagnostic Module (SDM) Integrity Check

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedure, be very careful when handling the SDM. Never strike or jar the SDM. Never power the supplemental restraints system (SRS) when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened and the arrow on SDM must be pointing toward the front of the vehicle to ensure proper operation of the SRS operation. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition to LOCK and remove the key. 2. Connect all SRS components, and ensure that all components are properly mounted. 3. Ensure that the ignition switch has been off for at least 30 seconds. 4. Observe the AIRBAG indicator as the ignition is turned ON. Does the indicator lamp flashes seven times and then turn off?	–	Clear the SRS DTCs and go to "Diagnostic System Check"	Go to *Step 2*
2	1. Turn the ignition to LOCK and remove the key. 2. Connect the scan tool to DLC. Follow the directions given in the scan tool manual. 3. Turn the ignition to ON. 4. Request SRS DTC display with the scan tool. Is the same DTC displayed that was previously occurring when the SRS Diagnostic System Check was previously performed?	–	Go to *Step 3*	Go to the table for the DTC indicated
3	1. Clear SRS DTCs. 2. Turn the ignition OFF for at least 30 seconds. 3. Observe the AIRBAG indicator as the ignition is turned ON. Does the AIRBAG indicator flashes seven times and turn off?	–	System OK	Go to *Step 4*
4	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the SDM connector. 3. Replace the SDM. 4. Connect SDM connector and ensure that all components are properly mounted. Is the repair complete?	–	Go to "Diagnostic System Check"	–



AIRBAG WARNING LAMP STAYS ON WITH IGNITION SWITCH ON

Circuit Description

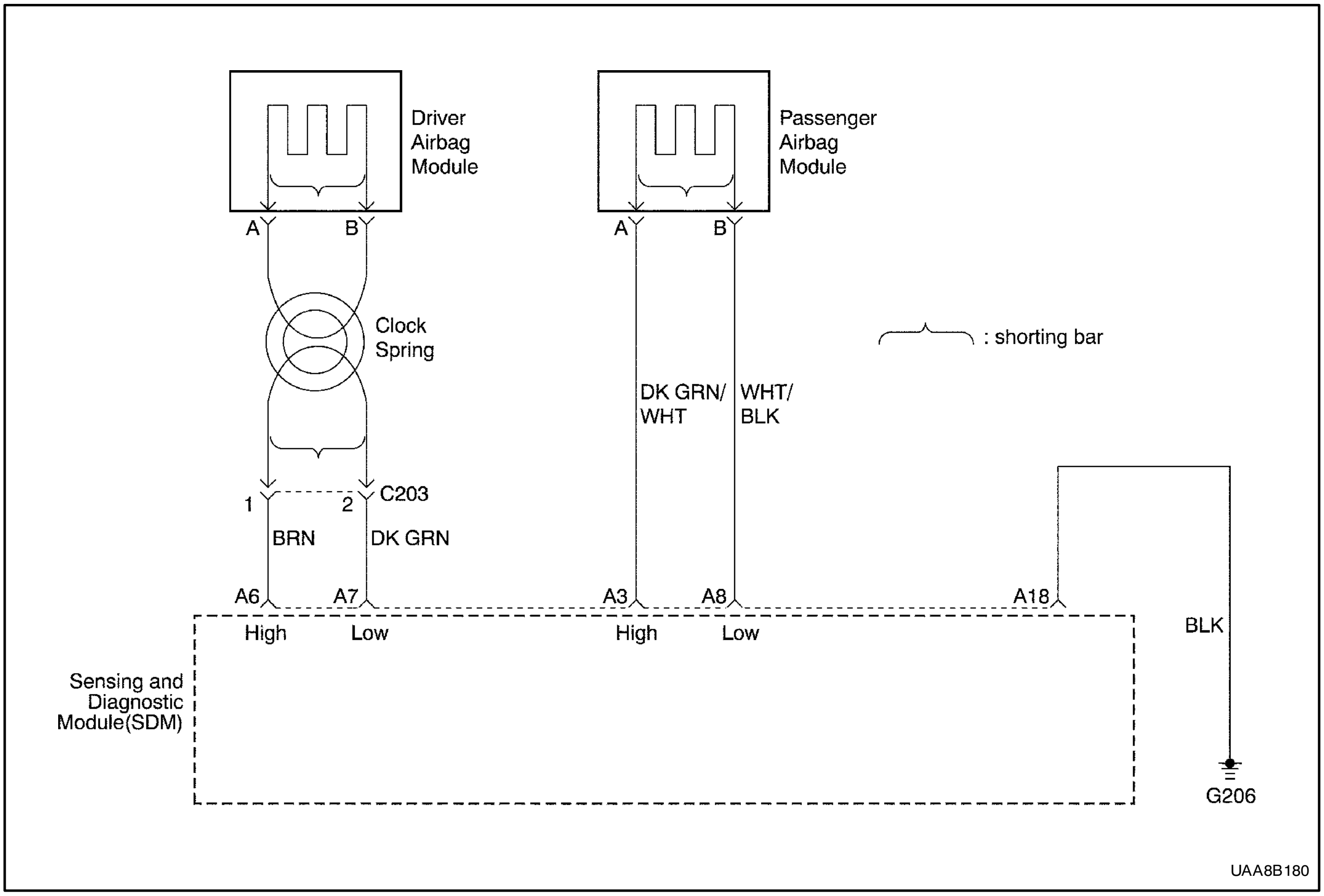
The AIRBAG indicator will stay on if the sensing and diagnostic module (SDM) connector is not securely attached to the SDM. There is a shorting bar in SDM connector which completes the circuit between the indicator lamp circuit and ground. The shorting bar is disengaged when the connector is properly attached.

When the ignition switch is first turned to ON, ignition voltage applied to the instrument fuse for the indicator lamp and also to the airbag fuse for input terminal A1. If ignition voltage is outside the range of 9 to 16 volts, the AIRBAG indicator will come on and stay on with no DTCs set. A short ground between the SDM and the indicator lamp could also cause the AIRBAG indicator to stay on.

Airbag Warning Lamp Stays On With Ignition Switch On

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Step	Action	Value(s)	Yes	No
1	Check the SDM connector to verify that it is properly connected to the SDM. Is the SDM connector properly connected?	–	Go to *Step 3*	Go to *Step 2*
2	Connect the SDM connector. Is the repair complete?	–	System OK	–
3	1. Turn the ignition OFF. 2. Disconnect the SDM connector 3. Turn the ignition ON. 4. Check the voltage at SDM connector terminal A1. Is the ignition voltage greater than the specified value?	9 V	Go to "SDM Integrity Check"	Go to *Step 4*
4	1. Turn the ignition ON. 2. Check the voltage supply to the airbag fuse F19. Is the voltage within the specified value?	9–16 V	Go to *Step 6*	Go to *Step 5*
5	Repair the power supply to the airbag fuse. Is the repair complete?	–	System OK	–
6	Check the airbag fuse. Is the fuse in good condition?	–	Go to *Step 8*	Go to *Step 7*
7	Replace the airbag fuse F19. Is the repair complete?	–	System OK	–
8	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the SDM connector. 3. Check for open circuit between terminal A1 of the SDM and the airbag fuse F19. Is there an open circuit?	–	Go to *Step 9*	Go to *Step 10*
9	Repair the open circuit between the SDM and airbag fuse F19. Is the repair complete?	–	System OK	–
10	Repair the short to ground circuit between the AIRBAG indicator lamp and terminal A9 of the SDM. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 16 PASSENGER DEPLOYMENT LOOP SHORTED

Circuit Description

When the ignition switch is turned to ON, the sensing and diagnostic module (SDM) will perform turn-on test to diagnose critical malfunctions within SDM itself. Upon passing these test ignition and deployment loop voltages are measured to ensure that they are within their respective normal voltage ranges. The SDM then proceeds with the resistance measurement test. Passenger low (terminal A8) is grounded through a current sink, and the passenger current source is connected to passenger high (terminal A3) to allow a known amount of current to flow. By monitoring the voltage difference between the passenger low (terminal A8) and passenger high (terminal A3), the SDM calculates the combined resistance of passenger inflator module, wiring harness, and connector terminal contacts.

DTC 16 Will Set When

The resistance of the passenger deployment loop is below a specified value. The test run once each ignition cycle during the resistance measurement test when

- The resistance between passenger high and passenger low is less then 1.2 ohms for 500 milliseconds.
- Ignition voltage is within a specified value.

Action Taken

The SDM will turn on the AIRBAG indicator and set diagnostic trouble code (DTC) 16.

DTC 16 Will Clear When

- The resistance between passenger high and passenger low is higher then 1.2 ohms for 500 milliseconds.
- The ignition switch is turned OFF.
- The scan tool CLEAR CODES command is received.

Diagnostic Aids

All intermittent condition is likely to be the caused by a short between the passenger high and low circuits, a short between passenger high and driver high circuits, or a short between passenger high and the driver low circuit. The problem could also be a malfunctioning shorting bar in passenger airbag connector, which would require replacement of passenger airbag module. The test for this DTC is run only while the AIRBAG indicator is performing the turn-on test. When a scan tool CLEAR CODES command is issued and the malfunction is still present, the DTC will not reappear until next ignition cycle.

DTC 16 – Passenger Deployment Loop Shorted

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedure, be very careful when handling the SDM. Never strike or jar the SDM. Never power the supplemental restraints system (SRS) when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened, and the arrow on the SDM must be pointing toward of the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Step	Action	Value(s)	Yes	No
1	Perform the SRS Diagnostic System Check. Is the SRS Diagnostic System Check complete?	–	Go to *Step 2*	–
2	1. Turn the ignition to LOCK and remove the key. 2. Connect the scan tool to the Data Link Connector (DLC). 3. Turn the ignition ON. Is DTC 22 also current?	–	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the yellow airbag connectors at the steering column, at the passenger airbag and connector C221. 3. Repair the short between the driver airbag high circuit and the passenger airbag high circuit. 4. Make sure all SRS components are reconnected and all components are properly mounted. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–
4	1. Turn the ignition to LOCK and remove the key. 2. Make sure the passenger airbag module yellow two-way connector is seated properly. Is the yellow two-way passenger airbag connector seated properly?	**2** 0V	Go to *Step 6*	Go to *Step 5*
5	1. Seat the passenger airbag yellow two–way connector. 2. Make sure all SRS components are reconnected and all components are properly mounted. Is the repair complete?	**2** 0V	Go to “SRS Diagnostic System Check”	–
6	1. Temporarily disconnect the passenger airbag, the yellow clock spring connector on the steering column and connector C221. 2. Check for a short between the passenger high and passenger low circuits. ● Refer to “Diagnostic Illustration 2” in this section. Is there a short between the passenger high and low circuits?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the short between the passenger high circuit and the passenger low circuit. 2. Make sure all SRS components are reconnected and all components are properly mounted. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–

DTC 16 – Passenger Deployment Loop Shorted (Cont'd)

Step	Action	Value(s)	Yes	No
8	Check for a short between the passenger high and driver low circuits. • Refer to "Diagnostic Illustration 3" in this section. Is there a short between the passenger high and driver low circuits (SDM terminals A3 and A7)?	–	Go to *Step 9*	Go to *Step 10*
9	1. Repair the short between the passenger high circuit and the driver low circuit. 2. Make sure all SRS components are reconnected and all components are properly mounted. 3. Command CLEAR CODES with the scan tool. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–
10	1. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 2. Connect all SRS components, and ensure that all components are properly mounted. 3. Perform the SRS Diagnostic System Check. Is DTC 16 still current?	–	Go to *Step 11*	System OK
11	1. Disconnect the passenger airbag electrical connector. 2. Replace the passenger airbag module. 3. Make sure all SRS components are reconnected and all components are properly mounted. 4. Command CLEAR CODES with the scan tool. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–

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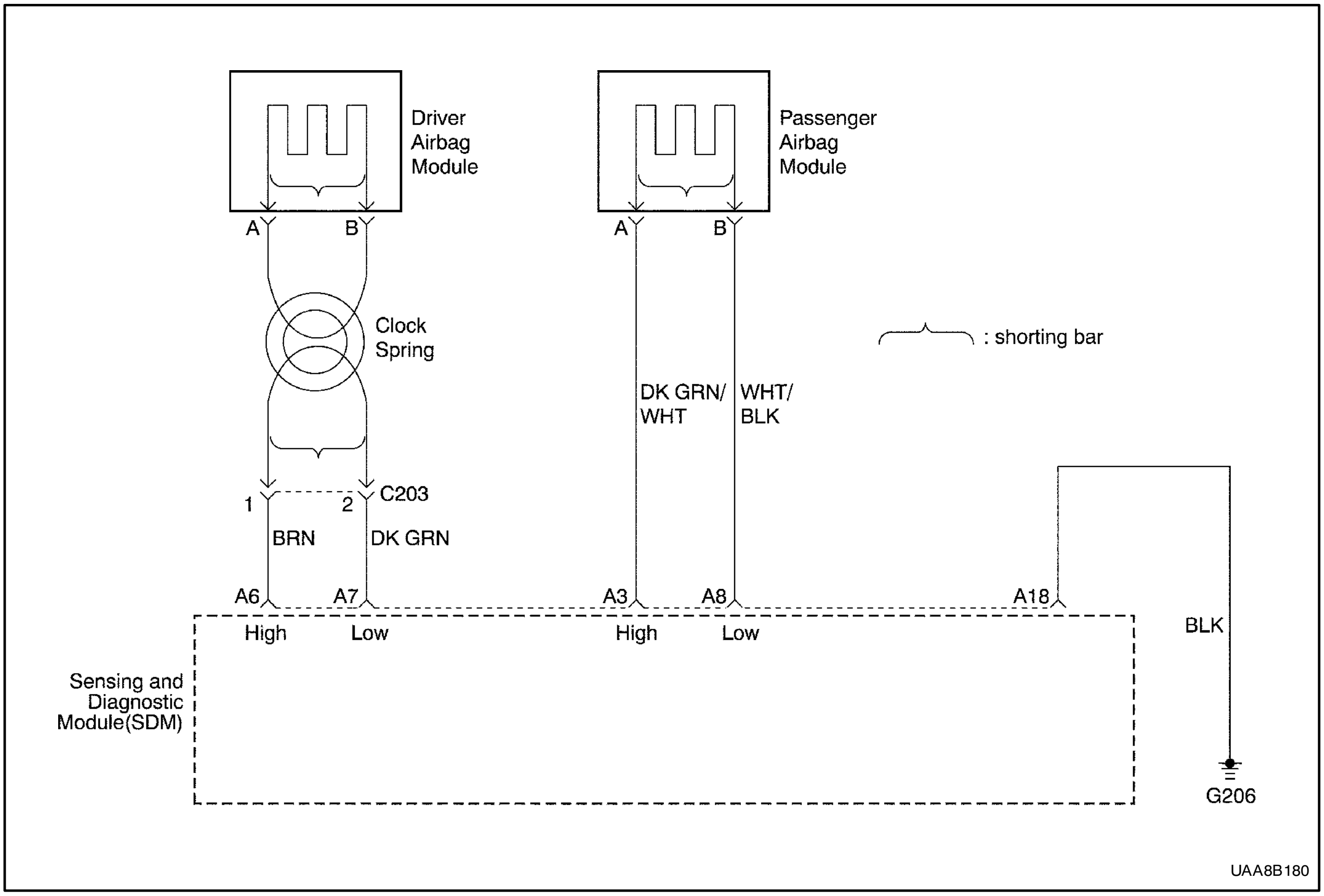

DIAGNOSTIC TROUBLE CODE (DTC) 17 PASSENGER DEPLOYMENT LOOP OPEN

Circuit Description

When the ignition switch is turned to ON, the sensing and diagnostic module (SDM) will perform tests to diagnose critical malfunctions within itself. After passing these tests, ignition and deployment loop voltages are measured to ensure that they are within their respective normal voltage ranges. The SDM then proceeds with the resistance measurement test. Passenger low terminal A8 is grounded through a current sink, and the passenger current source is connected to the passenger high terminal to allow a known amount of current to flow. By monitoring the voltage difference between passenger high and passenger low, the SDM calculates the combined resistance of the passenger inflator module, the harness wiring, and the connector terminal contacts.

DTC 17 Will Set When

- Resistance of the passenger deployment loop is higher than 4.5 ohms for 500 milliseconds.
- Voltage at passenger high is less than 2 volts and resistance of the passenger deployment loop is equal to or higher than 4.5 ohms for 500 milliseconds.
- Ignition voltage is within a specified value.

Action Taken

The SDM will turn on the AIRBAG indicator and set a diagnostic trouble code (DTC) 17.

DTC 17 Will Clear When

- The resistance between passenger high and passenger low is less than 4.5 ohms for 500 milliseconds.
- Voltage at passenger high is higher than 2 volts and resistance of the passenger deployment loop is less than 4.5 ohms for 500 milliseconds.
- The ignition switch is turned OFF.
- The scan tool CLEAR CODES command is received.

Diagnostic Aids

An intermittent condition is likely to be caused by a poor connection, either at the passenger airbag connector or at terminals A3 and A8 of the SDM. An open wire in the passenger deployment loop will also set DTC 17.

DTC 17 – Passenger Deployment Loop Open

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedure, be very careful when handling the SDM. Never strike or jar the SDM. Never power the supplemental restraints system (SRS) when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened and the arrow on the SDM must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Step	Action	Value(s)	Yes	No
1	Perform the SRS Diagnostic System Check. Is the SRS Diagnostic System Check complete?	–	Go to *Step 2*	–
2	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the passenger airbag connector. 3. Inspect the terminals for damage or improper connection. 4. Repair any damaged pins or terminals on the wiring harness side of the connector. If the airbag side of the connector is damaged, the passenger airbag must be replaced. 5. If no damage was found, connect the passenger airbag yellow two-way connector and make sure it is seated properly. 6. Turn the ignition ON. Is DTC still current?	–	Go to *Step 3*	System OK
3	1. Turn the ignition to LOCK and remove the key. 2. Temporarily disconnect the two-way yellow connectors at the passenger airbag. 3. Check terminals A3 and A8 at the SDM. Are there any loose wires or damaged pins or terminals?	–	Go to *Step 4*	Go to *Step 5*
4	1. Repair any loose or damaged pins or SDM terminals. 2. Make sure all SRS components are reconnected and all components are properly mounted. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–
5	Check for an open circuit between the SDM and the passenger airbag connector. • Refer to "Diagnostic Illustration 1" in this section. Is there an open circuit?	–	Go to *Step 6*	Go to *Step 7*
6	1. Repair the open circuit between the SDM and the passenger inflator module. 2. Make sure all SRS components are reconnected and all components are properly mounted. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–
7	1. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 2. Connect all SRS components, and ensure that all components are properly mounted. 3. Perform the SRS Diagnostic System Check. Is DTC 17 still current?	–	Go to *Step 8*	System OK

DTC 17 – Passenger Deployment Loop Open (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the yellow connector at the passenger airbag. 3. Replace the passenger airbag module. 4. Make sure all SRS components are reconnected and all components are properly mounted. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–

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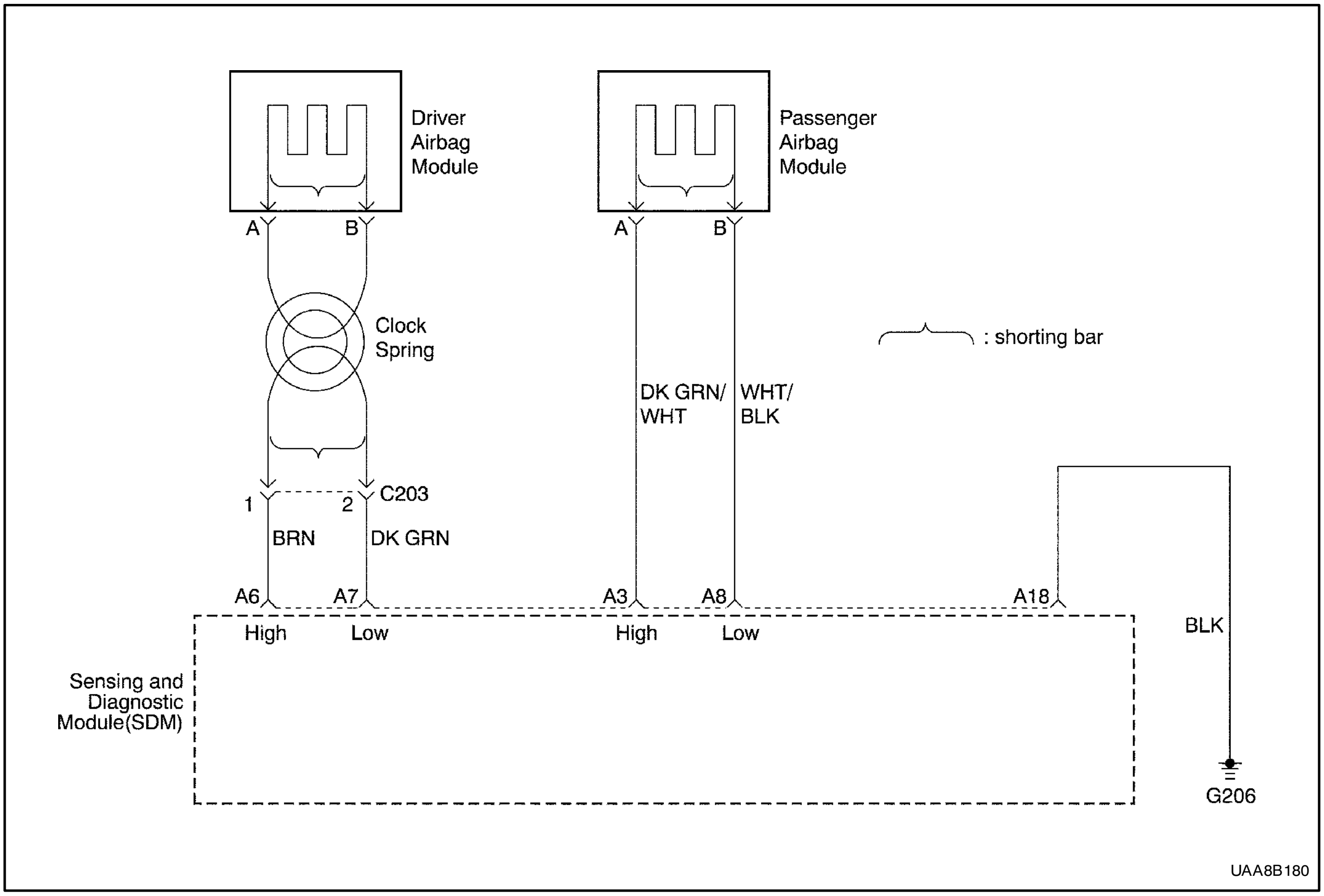

DIAGNOSTIC TROUBLE CODE (DTC) 18 PASSENGER DEPLOYMENT LOOP VOLTAGE OUT OF RANGE

Circuit Description

When the ignition switch is turned to ON, the sensing and diagnostic module (SDM) will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, ignition and deployment loop voltages are measured to ensure that they are within their respective normal voltage ranges. The SDM monitors the voltages at the driver low (terminal A7) and the passenger low (terminal A8) to detect shorts to ground or voltage in the deployment loops.

DTC 18 Will Set When

- Ignition voltage is within a specified value.
- Voltage at the passenger high is higher than 6 volts for 500 milliseconds.
- Voltage at passenger high is less than 2 volts and the resistance of passenger deployment loop is less than 4.5 ohms for 500 milliseconds.

Action Taken

- The SDM will turn on the AIRBAG indicator and set a DTC 18.
- The SDM will disable the passenger deployment resistance test.

DTC 18 Will Clear When

- Voltage at the passenger high is less than 6 volts for 500 milliseconds.
- Voltage at passenger high is higher than or equal to 2 volts and the resistance of passenger deployment loop is less than 4.5 ohms for 500 milliseconds.
- The ignition switch is turned OFF.
- The scan tool CLEAR CODES command is received.

Diagnostic Aids

Carefully inspect the wires in the passenger loop for cutting or chafing.

DTC 18 – Passenger Deployment Loop Voltage Out of Range

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedure, be very careful when handling the SDM. Never strike or jar the SDM. Never power the supplemental restraints system (SRS) when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened, and the arrow on the SDM must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Step	Action	Value(s)	Yes	No
1	Perform the SRS Diagnostic System Check. Is the SRS Diagnostic System Check complete?	–	Go to *Step 2*	–
2	Visually inspect the wires to the passenger airbag, including the connector of the passenger airbag. Is there any evidence of rubbing, damage, or chafing?	–	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition to LOCK and remove the key. 2. Temporarily disconnect the passenger airbag, the yellow clock spring connector on the steering column and connector C221. 3. Replace any damaged wiring, terminals, or harnesses. 4. Replace the SDM. The arrow must be pointing to the front of the vehicle. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–
4	1. Turn the ignition OFF. 2. Disconnect the passenger airbag, the yellow clock spring connector on the steering column and connector C221. 3. Disconnect the SDM. 4. Using a digital multimeter, measure resistance at the SDM harness connector between terminal A3 and terminal A18 (ground). ● Refer to “Diagnostic Illustration 4” in this section. Is the resistance equal to the specified value? 5. Turn the ignition ON. 6. Using a digital multimeter, measure voltage at the SDM harness connector between terminal A3 and terminal A18 (ground). ● Refer to “Diagnostic Illustration 6” in this section. Is the voltage below the specified value?	∞ 1.0 V	Go to *Step 6*	Go to *Step 5*
5	1. Repair the short to ground between the passenger high circuit and ground/voltage. 2. Replace the SDM. The arrow must be pointing to the front of the vehicle. Is the repair complete?	–	Go to *Step 6*	–

DTC 18 – Passenger Deployment Loop Voltage Out of Range (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Disconnect the SDM. 2. Measure the resistance at the SDM connector between terminal A8 and terminal A18 (ground). ● Refer to "Diagnostic Illustration 5" in this section. Is the resistance equal to the specified value? 3. Turn the ignition ON. 4. Using a digital multimeter to measure the voltage at the SDM connector terminal A8 and terminal A18 (ground). ● Refer to "Diagnostic Illustration 7" in this section. Is the voltage above the specified value?	∞ 1.0 V	Go to *Step 8*	Go to *Step 7*
7	1. Repair the short to ground/voltage between the passenger low circuit and ground. 2. Replace the SDM. The arrow must be pointing to the front of the vehicle. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–
8	1. Replace the passenger airbag. 2. Replace the SDM. The arrow must be pointing to the front of the vehicle. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–

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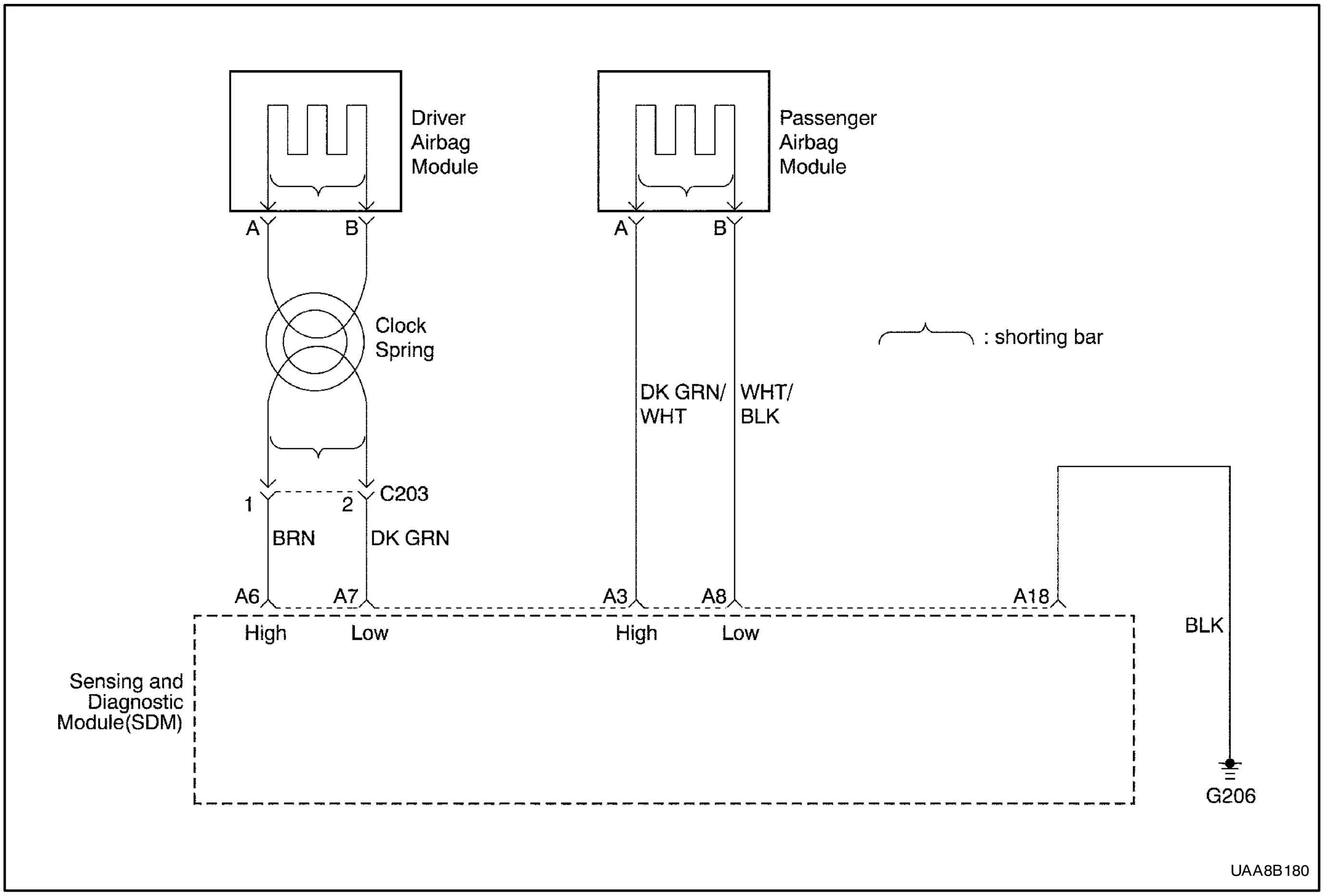

DIAGNOSTIC TROUBLE CODE (DTC) 22
DRIVER DEPLOYMENT LOOP SHORTED

Circuit Description

When the ignition switch is turned to ON, the sensing and diagnostic module (SDM) will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, ignition and deployment loop voltages are measured to ensure that they are within their respective normal voltage ranges. The SDM then proceeds with the resistance measurement test. Driver low terminal A3 is grounded through a current sink, and the driver current source is connected to the driver high terminal A6 to allow a known amount of current to flow. By monitoring the voltage difference between driver high and driver low, the SDM calculates the combined resistance of the driver inflator module, the clock spring, the harness wiring, and the connector terminal contacts.

DTC 22 Will Set When

- Resistance of the driver deployment loop is less than 1.7 ohms for 500 milliseconds.
- Ignition voltage is within a specified value.

Action Taken

The SDM will turn on the AIRBAG indicator and set a diagnostic trouble code (DTC) 22.

DTC 22 Will Clear When

- Resistance of the driver deployment loop is higher than or equal to 1.7 ohms for 500 milliseconds.
- The ignition switch is turned OFF.
- The scan tool CLEAR CODES command is received.

Diagnostic Aids

An intermittent condition is likely to be caused by a short between driver high and driver low or between driver high and passenger low. This condition could also be caused by a faulty clock spring or a faulty shorting bar in the clock spring steering column connector. The test for this DTC is run only while the AIRBAG indicator is performing the turn-on test. When a scan tool CLEAR CODES command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 22 – Driver Deployment Loop Shorted

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedure, be very careful when handling the SDM. Never strike or jar the SDM. Never power the supplemental restraints system (SRS) when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened, and the arrow on the SDM must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Step	Action	Value(s)	Yes	No
1	Perform the SRS Diagnostic System Check. Is the SRS Diagnostic System Check complete?	–	Go to *Step 2*	–
2	1. Turn the ignition to LOCK and remove the key. 2. Connect the scan tool to the Data Link Connector (DLC). 3. Turn the ignition ON. 4. Is DTC 16 also current?	–	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the passenger airbag, the yellow clock spring connector on the steering column and connector C221. 3. Repair the short from driver high to passenger high. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–
4	1. Disconnect the clock spring yellow two–way connector located on the steering column. 2. Inspect the connector for damage. Is a faulty component, connector, terminal, or wire detected?	–	Go to *Step 5*	Go to *Step 6*
5	1. Replace the faulty connector, component, terminal or wire. 2. Connect all SRS components. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–
6	Visually check the SDM connector terminals A6 and A7 for shorted terminals or wires. Is a problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Replace the shorted terminals or wires. 2. Connect all SRS components. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–
8	1. With the SDM disconnected, use an ohmmeter to check the SDM harness connector for a short between terminal A6 (driver high) and terminal A8 (passenger low). • Refer to “Diagnostic Illustration 10” in this section. Is there a short between driver high and passenger low?	0 W	Go to *Step 9*	Go to *Step 10*
9	1. Repair the short circuit. 2. Connect all SRS components. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–

DTC 22 – Driver Deployment Loop Shorted (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Remove the driver airbag. 2. Reconnect the yellow clock spring connector on the steering column. 3. At the SDM connector, use an ohmmeter to check for a short between terminal A6 (driver high) and terminal A7 (driver low). ● Refer to "Diagnostic Illustration 11" in this section. Is there a short circuit between the driver high and driver low circuits?	0 **W**	Go to *Step 12*	Go to *Step 11*
11	1. Replace the driver airbag. 2. Connect all SRS components. 3. Perform the Diagnostic System Check. Is DTC 22 still current?	–	Go to *Step 15*	System OK
12	1. Disconnect the yellow clock spring connector on the steering column. 2. At the SDM connector, use an ohmmeter to check for a short between terminal A6 (driver high) and terminal A7 (driver low). ● Refer to "Diagnostic Illustration 11" in this section. Is there a short circuit between the driver high and driver low circuits?	0 **W**	Go to *Step 14*	Go to *Step 15*
13	1. Turn the steering wheel to the straight-ahead position. 2. Disconnect the passenger airbag and the yellow clock spring connector on the steering column. 3. Replace the clock spring. 4. Connect all SRS components. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–
14	Repair the shorted driver high and driver low wires between the SDM and the clock spring. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–
15	1. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 2. Connect all SRS components, and ensure that all components are properly mounted. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–

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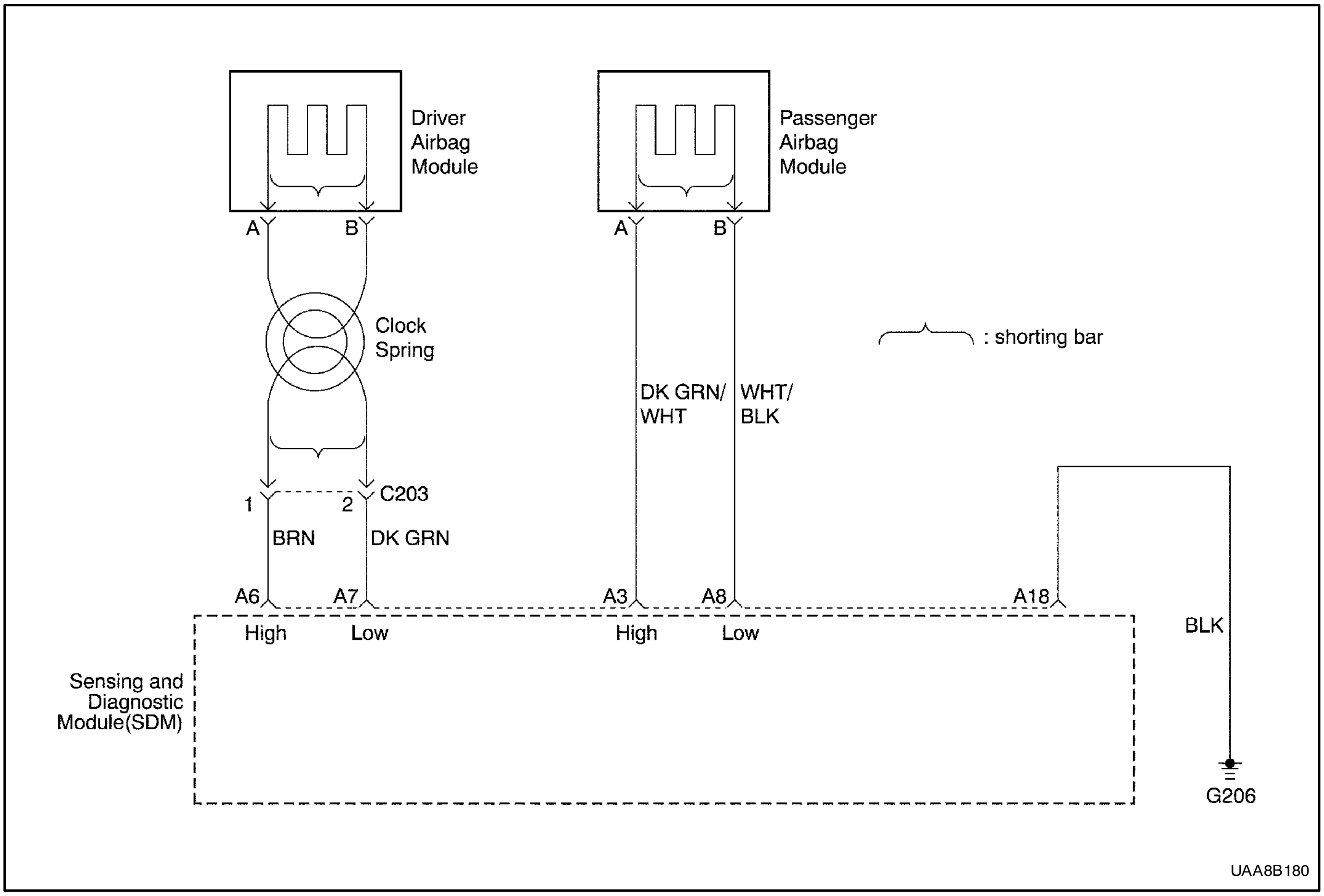

DIAGNOSTIC TROUBLE CODE (DTC) 24
DRIVER DEPLOYMENT LOOP VOLTAGE OUT OF RANGE

Circuit Description

When the ignition switch is turned to ON, the sensing and diagnostic module (SDM) will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, ignition and deployment loop voltages are measured to ensure that they are within their respective normal voltage ranges. The SDM monitors the voltages at the driver low (terminal A7) and passenger low (terminal A8) to detect shorts to ground or voltage in the deployment loops.

DTC 24 Will Set When

- Voltage at driver high is higher than 6 volts for 500 milliseconds.
- Voltage at driver high is less than 2 volts and the resistance of driver deployment loop is less than 4.5 ohms for 500 milliseconds.
- Ignition is within the normal operating voltage range.

Action Taken

- The SDM will turn on the AIRBAG indicator and set a diagnostic trouble code 24.
- The SDM will disable he driver deployment loop resistance test.

DTC 24 Will Clear When

- Voltage at driver high is less than or equal to 6 volts for 500 milliseconds.
- Voltage at driver high is higher than or equal to 2 volts and the resistance of driver deployment loop is less than 4.5 ohms for 500 milliseconds.
- The ignition switch is turned OFF.
- The scan tool CLEAR CODES command is received.

Diagnostic Aids

Carefully inspect the wires in the driver loop for cutting or chafing.

Important: A careful inspection of the circuits and components indicated on the DTC 24 chart is essential to ensure that the replacement SDM will not be damaged. When DTC 24 has been set, it is necessary to replace the SDM.

DTC 24 – Driver Deployment Loop Voltage Out of Range

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedures, be very careful when handling the SDM. Never strike or jar the SDM. Never power up the SRS when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened, and the SDM arrow must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Important: A careful inspection of the circuits and components indicated on the DTC 24 chart is essential to ensure that the replacement SDM will not be damaged. When DTC 24 has been set, it is necessary to replace the SDM.

Step	Action	Value(s)	Yes	No
1	Perform the SRS Diagnostic System Check. Is the SRS Diagnostic System Check complete?	–	Go to *Step 2*	–
2	1. Turn the ignition to LOCK and remove the key. 2. Disconnect passenger airbags, the yellow clock spring connector on the steering column and connector C221. 3. Visually inspect the driver airbag circuit and connectors, especially at the SDM. Is there any evidence of rubbing, damage, or chafing?	–	Go to *Step 3*	Go to *Step 4*
3	1. Repair the damaged wires or connectors. 2. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 3. Connect all SRS components. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–
4	1. Disconnect the yellow clock spring connector on the steering column if it was not previously disconnected. 2. At the SDM connector, use an ohmmeter to check for a short between terminal A6 (driver high) and terminal A18 (ground). • Refer to “Diagnostic Illustration 12” in this section. Is the resistance equal to the specified value?	∞	Go to *Step 6*	Go to *Step 5*
5	1. Repair the short to ground in the driver high circuit between the clock spring connector and the SDM. 2. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 3. Connect all SRS components. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–
6	Measure the resistance at the SDM connector between terminal A7 (drive low) and terminal A18 (ground). • Refer to “Diagnostic Illustration 13” in this section. Is the resistance equal to the specified value?	∞	Go to *Step 8*	Go to *Step 7*

DTC 24 – Driver Deployment Loop Voltage Out of Range (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Repair the short to ground in the driver low circuit between the SDM and the clock spring connector. 2. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 3. Connect all SRS components. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–
8	1. Temporarily remove the driver airbag. 2. Connect the yellow clock spring connector on the steering column. 3. At the SDM connector, use an ohmmeter to check for a short between terminal A6 (driver high) and terminal A18 (ground). • Refer to "Diagnostic Illustration 12" in this section. Is the resistance equal to the specified value? 4. Turn the ignition ON. 5. Using a digital multimeter, measure the voltage between terminal A6 (driver high) and terminal A18 (ground). • Refer to "Diagnostic Illustration 14" in this section. Is the voltage below the specified value?	∞ 5.0 V	Go to *Step 10*	Go to *Step 9*
9	1. Turn the ignition to LOCK and remove the key. 2. Turn the steering wheel to the straight–ahead position. 3. Disconnect the yellow clock spring connector on the steering column. 4. Replace the clock spring. 5. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 6. Connect all SRS components. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–
10	1. Measure the resistance at the SDM connector between terminal A7 (drive low) and terminal A18 (ground). • Refer to "Diagnostic Illustration 13" in this section. Is the resistance equal to the specified value? 2. Turn the ignition ON. 3. Measure the voltage at the SDM connector between terminal A7 (drive low) and terminal A18 (ground). • Refer to "Diagnostic Illustration 15" in this section. Is the voltage below the specified value?	∞ 5.0 V	Go to *Step 11*	Go to *Step 9*
11	1. Disconnect the yellow clock spring connector on the steering column. 2. Replace the driver airbag. 3. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 4. Connect all SRS components. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–

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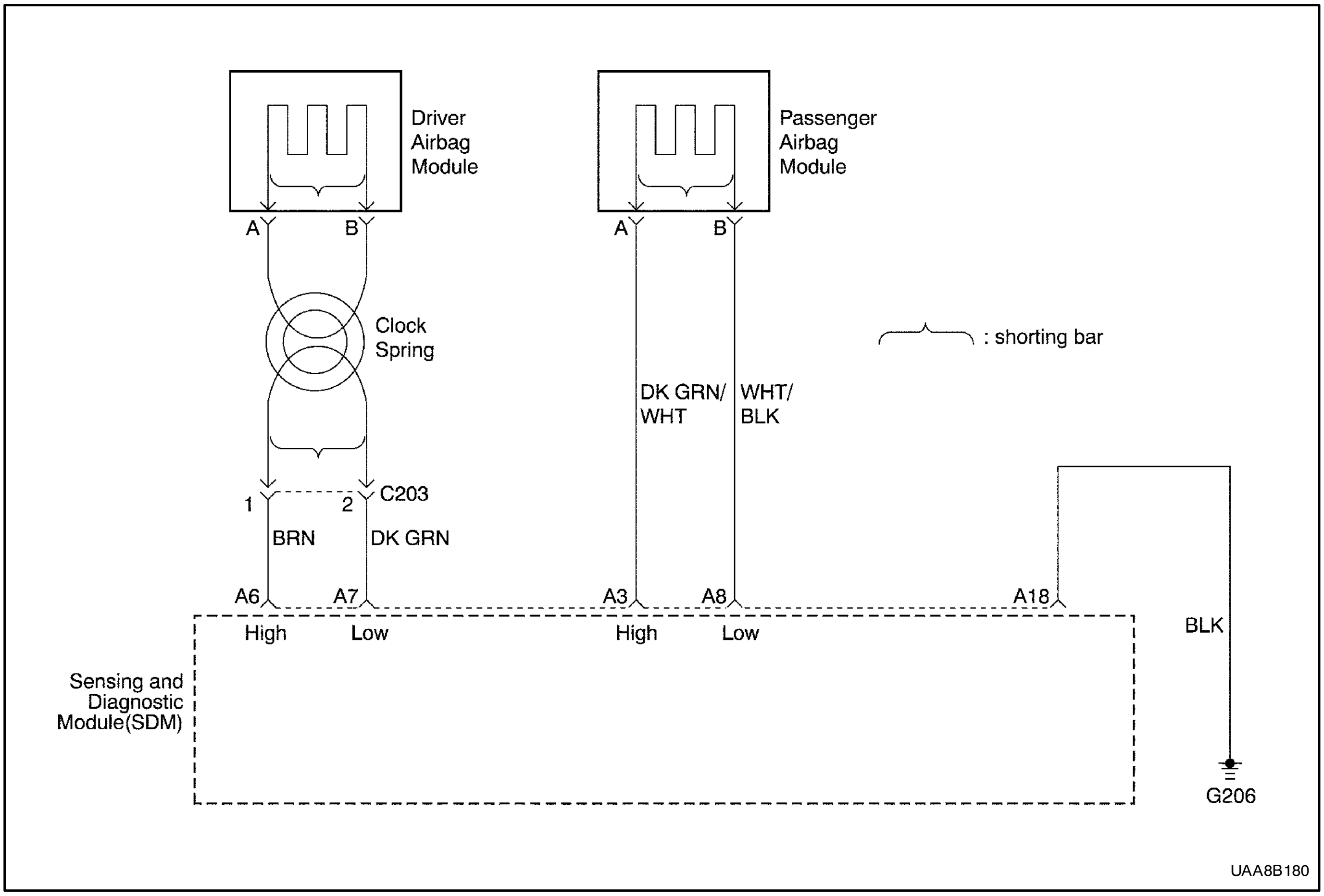

DIAGNOSTIC TROUBLE CODE (DTC) 26
DRIVER DEPLOYMENT LOOP OPEN

Circuit Description

When the ignition switch is turned to ON, the sensing and diagnostic module (SDM) will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, ignition and deployment loop voltages are measured to ensure that they are within their respective normal voltage ranges. The SDM then proceeds with the resistance measurement test. Driver low terminal A7 is grounded through a current sink, and the driver current source is connected to the driver high terminal to allow a known amount of current to flow. By monitoring the voltage difference between driver high and driver low, the SDM calculates the combined resistance of the driver inflator module, the harness wiring, and the connector terminal contacts.

DTC 26 Will Set When

- Resistance of the driver deployment loop is higher than 4.5 ohms for 500 milliseconds.
- Voltage at the driver high is less than 2 volts and the resistance of the driver deployment loop is higher than or equal to 4.5 ohms for 500 milliseconds.
- Ignition voltage is within normal operation range.

Action Taken

The SDM will turn on the AIRBAG indicator and set a diagnostic trouble code (DTC) 26.

DTC 26 Will Clear When

- Resistance of the driver deployment loop is less than or equal to 4.5 ohms for 500 milliseconds.
- Voltage at the driver high is higher than 2 volts and the resistance of the driver deployment loop is less than 4.5 ohms for 500 milliseconds.
- The ignition switch is turned OFF.
- The scan tool CLEAR CODES command is received.

Diagnostic Aids

An intermittent condition is likely to be caused by a poor connection, either at the driver airbag or clock spring connectors or SDM terminals A6 and A7. An open wire in the driver deployment loop will also set DTC 26. To test for a faulty clock spring, clear the DTCs, then turn the steering wheel back and forth with the ignition switch ON. If the AIRBAG indicator comes on and DTC 26 has set again, it is likely that the clock spring is faulty.

DTC 26 – Driver Deployment Loop Open

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedures, be very careful when handling the SDM. Never strike or jar the SDM. Never power up the SRS when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened, and the SDM arrow must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Important: Avoid deforming the terminals of the clock spring-to-airbag connector.

Step	Action	Value(s)	Yes	No
1	Perform the SRS Diagnostic System Check. Is the SRS Diagnostic System Check complete?	–	Go to *Step 2*	–
2	1. Turn the ignition to LOCK and remove the key. 2. Make sure the clock spring yellow two-way connector (located on the steering column) is seated properly. Is the yellow clock spring connector seated properly?	–	Go to *Step 4*	Go to *Step 3*
3	1. Seat the clock spring yellow two-way connector. 2. Make sure all SRS components are reconnected and all components are properly mounted. 3. Turn the ignition ON. Is DTC 26 still current?	–	Go to *Step 4*	Go to “SRS Diagnostic System Check”
4	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the yellow clock spring connector on the steering column. 3. Connect a jumper between the terminals on the SDM side of the clock spring connector. • Refer to “Diagnostic Illustration 8” in this section. 4. Turn the ignition ON. Is DTC 26 still current?	–	Go to *Step 9*	Go to *Step 5*
5	1. Turn the ignition to LOCK and remove the key. 2. Examine the connection at the driver airbag. Is the driver airbag connector seated properly?	–	Go to *Step 7*	Go to *Step 6*
6	1. Properly seat the connector to the driver airbag. 2. Connect the yellow clock spring connector on the lower steering column. 3. Turn the ignition ON. Is DTC 26 still current?	–	Go to *Step 7*	Go to “SRS Diagnostic System Check”
7	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the yellow clock spring connector on the steering column. 3. Temporarily remove the driver airbag. 4. Connect a jumper between the terminals of the clock spring-to-driver airbag connector. • Refer to “Diagnostic Illustration 9” in this section. 5. Use an ohmmeter to check the continuity of clock spring. Is the wire open?	–	Go to *Step 9*	Go to *Step 8*

DTC 26 – Driver Deployment Loop Open (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the yellow clock spring connector on the steering column. 3. Replace the driver airbag. 4. Connect all SRS components and the scan tool. 5. Turn the ignition ON. Is DTC 26 still current?	–	Go to *Step 1*	Go to "SRS Diagnostic System Check"
9	1. Turn the ignition to LOCK and remove the key. 2. Turn the steering wheel to the straight-ahead position. 3. Disconnect the yellow clock spring connector on the steering column. 4. Replace the clock spring. 5. Connect all SRS components and the scan tool. 6. Turn the ignition ON. Is DTC 26 still current?	–	Go to *Step 1*	Go to *Step 10*
10	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the passenger airbag, the yellow clock spring connector on the steering column, and the connector C221. 3. Disconnect the SDM connector. 4. Examine the pins and terminals at the SDM terminals A6 and A7. Are there any loose wires or backed-out terminals?	–	Go to *Step 11*	Go to *Step 12*
11	1. Repair any loose wires or damaged pins or terminals. 2. Connect all SRS components and the scan tool. 3. Turn the ignition ON. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–
12	Use an ohmmeter to check both driver deployment wires for an open circuit between the SDM connector (terminals A6 and A7) and the clock spring connector. • Refer to "Diagnostic Illustration 16" in this section. Is either wire open?	∞	Go to *Step 13*	Go to *Step 14*
13	1. Replace any open wires between the SDM and the clock spring. 2. Connect all SRS components and the scan tool. 3. Turn the ignition ON. Is DTC 26 still current?	–	Go to *Step 14*	–
14	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the passenger airbag, the yellow clock spring connector on the steering column and connector C221. 3. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 4. Connect all SRS components, and ensure that all components are properly mounted. 5. Command CLEAR CODES with the scan tool. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–

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DIAGNOSTIC TROUBLE CODE (DTC) 51 DEPLOYMENT COMMANDED

Circuit Description

The sensing and diagnostic module (SDM) contains a sensing device which converts vehicle velocity changes to an electrical signal. The electrical signal generated is processed by the SDM and then compared to a value stored in memory. When the generated signal exceeds the stored value, additional signal processing is performed and the generated signals are compared to signals stored in memory. When two of the generated signals exceed the stored values, the SDM will cause sufficient current to flow through the inflator modules to deploy the airbags and cause DTC 51 to be set.

DTC 51 Will Set When

The SDM detects a frontal crash within 30 degrees of the centerline of the vehicle, of sufficient force to warrant deployment of the airbags.

Action Taken

The SDM turns on the AIRBAG indicator, records crash data, and sets a DTC 51.

DTC 51 Will Clear When

The SDM is replaced. This code cannot be cleared with a scan tool.

DTC 51 – Deployment Commanded

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedure, be very careful when handling the SDM. Never strike or jar the SDM. Never power the supplemental restraints system (SRS) when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened, and the arrow on the SDM must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Step	Action	Value(s)	Yes	No
1	Perform the SRS Diagnostic System Check. Is the SRS Diagnostic System Check complete?	–	Go to *Step 2*	–
2	1. Turn the ignition to LOCK and remove the key. 2. Check for deployed airbags. Have the airbags deployed?	–	Go to *Step 3*	Go to *Step 4*
3	1. Remove the airbag fuse. 2. Turn the steering wheel to the straight-ahead position. 3. Perform inspections and replace components as directed in "Repairs and Inspections Required After An Accident" in this section. 4. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 5. Connect all SRS components, and ensure that all components are properly mounted. 6. Reinstall the airbag fuse. 7. Use a scan tool to clear SRS trouble codes. Are the repairs complete?	–	Go to "SRS Diagnostic System Check"	–

DTC 51 – Deployment Commanded (Cont'd)

Step	Action	Value(s)	Yes	No
4	Inspect the front of the vehicle and undercarriage for signs of impact. Are there any signs of impact?	–	Go to *Step 3*	Go to *Step 5*
5	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the passenger airbag, the yellow clock spring connector on the steering column, and connector C221. 3. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 4. Connect all SRS components, and ensure that all components are properly mounted. Are the repairs complete?	–	Go to "SRS Diagnostic System Check"	–

DIAGNOSTIC TROUBLE CODE (DTC) 53
DEPLOYMENT COMMANDED WITH LOOP FAULTS PRESENT

Circuit Description

The sensing and diagnostic module (SDM) contains a sensing device which converts vehicle velocity changes to an electrical signal. The electrical signal generated is processed by the SDM and then compared to a value stored in memory. When the generated signal exceeds the stored value, additional signal processing is performed and the generated signals are compared to signals stored in memory. When two of the generated signals exceed the stored values, the SDM will cause sufficient current to flow through the inflator modules to deploy the airbags. DTC 53 is set instead of DTC 51 when a deployment occurs while an inflator circuit fault is present that could possibly result in a no deployment situation in one or both inflator modules.

DTC 53 Will Set When

- The SDM detects a frontal crash within to 30 degrees from the centerline of the vehicle, of sufficient force to warrant deployment of the airbags.
- An inflator circuit fault is present.

Action Taken

The SDM turns ON the AIRBAG indicator, records crash data, and sets a DTC 53.

DTC 53 Will Clear When

The SDM is replaced. This code cannot be cleared with a scan tool.

DTC 53 – Deployment Commanded with Loop Faults Present

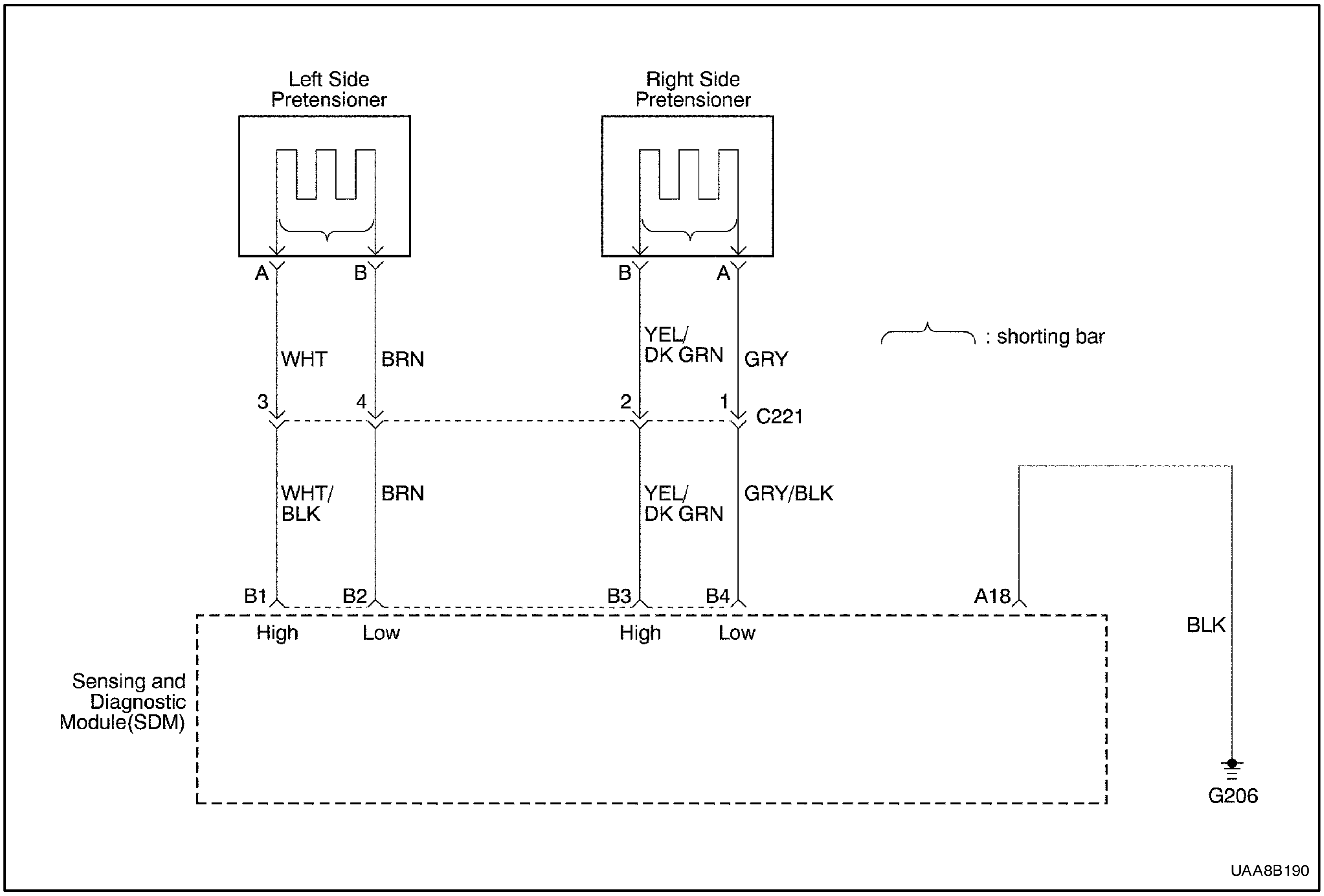
Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedure, be very careful when handling the SDM. Never strike or jar the SDM. Never power the supplemental restraints system (SRS) when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened, and the arrow on the SDM must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Step	Action	Value(s)	Yes	No
1	Perform the SRS Diagnostic System Check. Is the SRS Diagnostic System Check complete?	–	Go to *Step 2*	–
2	1. Turn the ignition to LOCK and remove the key. 2. Check for deployed airbags. Have the airbags deployed?	–	Go to *Step 3*	Go to *Step 4*
3	1. Remove the airbag fuse. 2. Turn the steering wheel to the straight–ahead position. 3. Perform inspections and replace components as directed in “Repairs and Inspections Required After an Accident” in this section. 4. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 5. Connect all SRS components, and ensure that all components are properly mounted. 6. Reinstall the airbag fuse. 7. Use a scan tool to clear SRS trouble codes. Are the repairs complete?	–	Go to “SRS Diagnostic System Check”	–

DTC 53 – Deployment Commanded with Loop Faults Present

Step	Action	Value(s)	Yes	No
4	Inspect the front of the vehicle and undercarriage for signs of impact. Are there any signs of impact?	–	Go to *Step 3*	Go to *Step 5*
5	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the passenger airbag, and the yellow clock spring connector on the steering column and the connector C221. 3. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 4. Connect all SRS components, and ensure that all components are properly mounted. Are the repairs complete?	–	Go to “SRS Diagnostic System Check”	–



DIAGNOSTIC TROUBLE CODE (DTC) 57
RIGHT SIDE BELT PRETENSIONER DEPLOYMENT LOOP SHORTED

Circuit Description

When the ignition switch is turned to ON, the sensing and diagnostic module (SDM) will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, ignition and deployment loop voltages are measured to ensure that they are within their respective normal voltage ranges. The SDM then proceeds with the resistance measurement test. right side belt pretensioner low terminal B3 is grounded through a current sink, and the right side belt pretensioner current source is connected to the right side belt pretensioner high terminal to allow a known amount of current to flow. By monitoring the voltage difference between the right side belt pretensioner high and right side belt pretensioner low terminals, the SDM calculates the combined resistance of the right side belt pretensioner inflator module, harness wiring, and connector terminal contacts.

DTC 57 Will Set When

- Resistance of the right side belt pretensioner deployment loop is less than 1.2 ohms for 500 milliseconds.
- Ignition voltage is within normal operation range.

Action Taken

The SDM will turn ON the AIRBAG indicator and set a diagnostic trouble code (DTC) 57.

DTC 57 Will Clear When

- Resistance of the right side belt pretensioner deployment loop is higher than or equal to 1.2 ohms for 500 milliseconds.
- The ignition switch is turned OFF.
- The scan tool CLEAR CODES command is received.

Diagnostic Aids

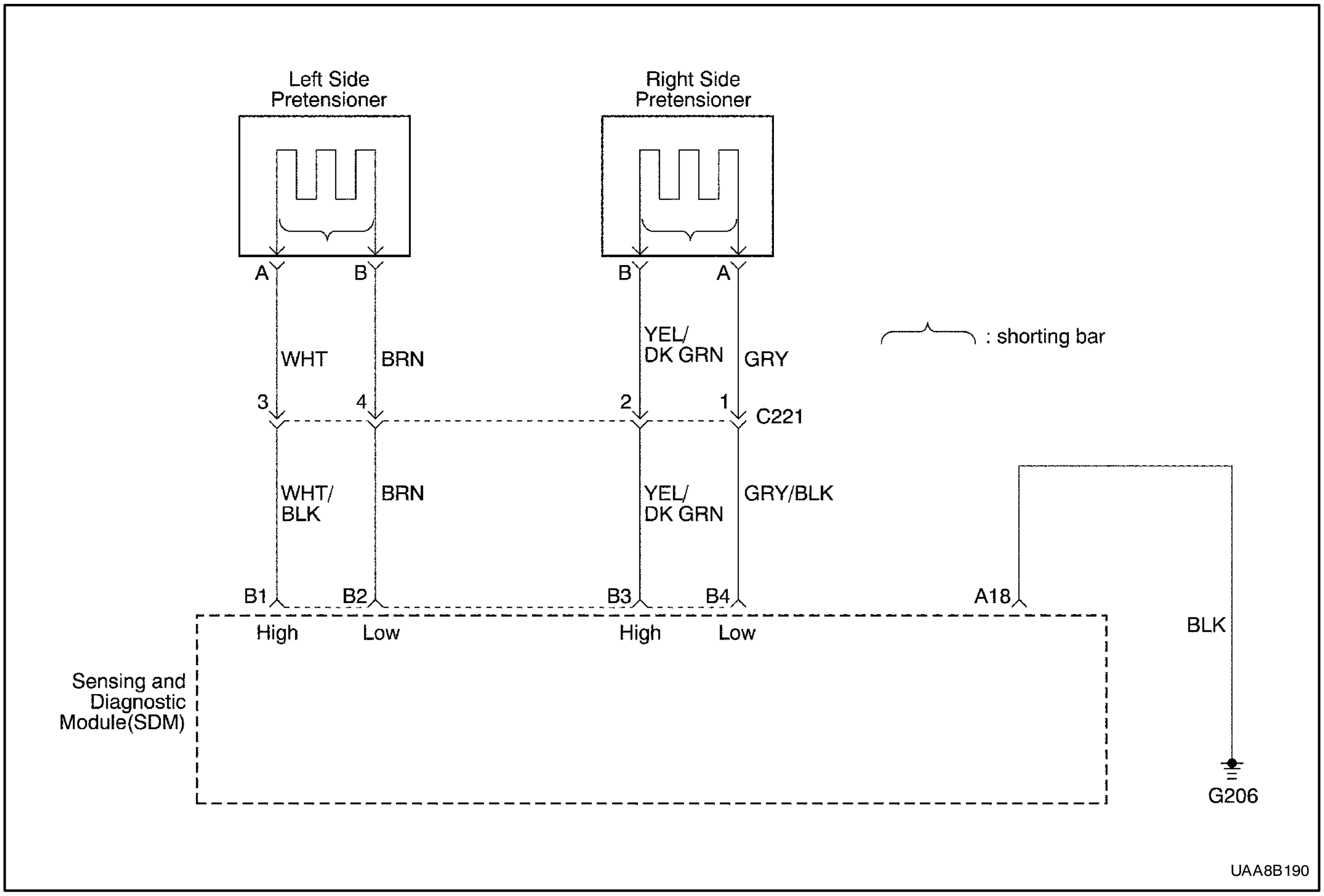
An intermittent condition is likely to be caused by a short between the right side belt pretensioner high and low circuits, a short between the right side belt pretensioner high circuit and the left side belt high circuit, a short on C221 or a short between the right side belt pretensioner high circuit and the left side belt low circuit. The problem could also be a malfunctioning shorting bar in the right side belt pretensioner airbag connector, which would require replacement of the right side belt pretensioner airbag module. The test for this DTC is run only while the AIRBAG indicator is performing the turn-on test. When a scan tool CLEAR CODES command is issued while the malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 57 – Right Side Belt Pretensioner Deployment Loop Shorted

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedure, be very careful when handling the SDM. Never strike or jar the SDM. Never power the supplemental restraints system (SRS) when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened, and the arrow on the SDM must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Step	Action	Value(s)	Yes	No
1	Perform the SRS Diagnostic System Check. Is the SRS Diagnostic System Check complete?	–	Go to *Step 2*	–
2	1. Turn the ignition to LOCK and remove the key. 2. Connect the scan tool to the Data Link Connector (DLC). 3. Turn the ignition ON. Is DTC 64 also current?	–	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the yellow airbag connectors at the steering column, passenger airbag and connector C221. 3. Repair the short between the right side belt pretensioner high circuit and the left side belt pretensioner high circuit. 4. Make sure all SRS components are reconnected and all components are properly mounted. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–
4	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the connector C221 and the right side belt pretensioner connector. 3. Measure the resistance between terminal A and B of right side belt pretensioner. ● Refer to "Diagnostic illustration 17" in this section. Is the resistance equal to specified value?	∞	Go to *Step 5*	Go to *Step 7*
5	1. Replace the sensing and diagnostic module (SDM). The arrow must be pointing to the front of the vehicle. 2. Connect all the wiring connector. 3. Clear all trouble code with scanner. Is the repair complete?	–	System OK	Go to *Step 6*
6	Replace the right side belt pretensioner. Is the repair complete?	–	System OK	–
7	Repair the short between the right side belt pretensioner high circuit and the right side belt pretensioner low circuit or replace the wiring harness. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–



DIAGNOSTIC TROUBLE CODE (DTC) 58
RIGHT SIDE BELT PRETENSIONER DEPLOYMENT LOOP OPEN

Circuit Description

When the ignition switch is turned to ON, the sensing and diagnostic module (SDM) will perform tests to diagnose critical malfunctions within itself. After passing these tests, ignition and deployment loop voltages are measured to ensure that they are within their respective normal voltage ranges. The SDM then proceeds with the resistance measurement test. Right side belt pretensioner low terminal B3 is grounded through a current sink, and the right side belt pretensioner current source is connected to the right side belt pretensioner high terminal to allow a known amount of current to flow. By monitoring the voltage difference between right side belt pretensioner high and right side belt pretensioner low, the SDM calculates the combined resistance of the right side belt pretensioner inflator module, the harness wiring, and the connector terminal contacts.

DTC 58 Will Set When

- Resistance of the right side belt pretensioner deployment loop is higher than 4.5 ohms for 500 milliseconds.
- Voltage at right side pretensioner high is less than 2 volts and resistance of right side pretensioner deployment loop is higher than or equal to 4.5 ohms for 500 milliseconds.
- Ignition voltage id within normal operation range.

Action Taken

The SDM will turn on the AIRBAG indicator and set a diagnostic trouble code (DTC) 58.

DTC 58 Will Clear When

- Resistance of the right side belt pretensioner deployment loop is less than or equal to 4.5 ohms for 500 milliseconds.
- Voltage at right side pretensioner high is higher than 2 volts and resistance of right side pretensioner deployment loop is less than 4.5 ohms for 500 milliseconds.
- The ignition switch is turned OFF.
- The scan tool CLEAR CODES command is received.

Diagnostic Aids

An intermittent condition is likely to be caused by a poor connection at the right side belt pretensioner connector, connector C221, or at terminals B3 and B4 of the SDM. An open wire in the right side belt pretensioner deployment loop will also set DTC 58.

DTC 58 – Right Side Belt Pretensioner Deployment Loop Open

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedure, be very careful when handling the SDM. Never strike or jar the SDM. Never power the supplemental restraints system (SRS) when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened, and the arrow on the SDM must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Step	Action	Value(s)	Yes	No
1	Perform the SRS Diagnostic System Check. Is the SRS Diagnostic System Check complete?	–	Go to *Step 2*	–
2	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the right side belt pretensioner airbag connector. 3. Inspect the terminals for damage or improper connection. 4. Repair any damaged pins or terminals on the wiring harness side of the connector. If the pigtail or connector of the belt pretensioner is damaged, the right side belt pretensioner must be replaced. 5. If no damage was found, connect the right side belt pretensioner connector and make sure it is seated properly. 6. Turn the ignition ON. Is DTC still current?	–	Go to *Step 3*	System OK
3	1. Turn the ignition to LOCK and remove the key. 2. Temporarily disconnect the right side belt pretensioner. 3. Check terminals B3 and B4 at the SDM and terminal 2 and 1 at the C221. Are there any loose wires or damaged pins or terminals?	–	Go to *Step 4*	Go to *Step 5*
4	1. Repair any loose or damaged pins or SDM terminals. 2. Make sure all SRS components are reconnected and all components are properly mounted. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–
5	Check for an open circuit between the SDM and the right side belt pretensioner connector. • Refer to "Diagnostic Illustration 18" in this section. Is there an open circuit?	∞	Go to *Step 6*	Go to *Step 7*
6	1. Repair the open circuit between the SDM and the right side belt pretensioner module. 2. Make sure all SRS components are reconnected and all components are properly mounted. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–

DTC 58 – Right Side Belt Pretensioner Deployment Loop Open (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 2. Connect all SRS components, and ensure that all components are properly mounted. 3. Perform the SRS Diagnostic System Check. Is DTC 58 still current?	–	Go to *Step 8*	System OK
8	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the connector at the right side belt pretensioner. 3. Replace the right side belt pretensioner module. 4. Make sure all SRS components are reconnected and all components are properly mounted. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–

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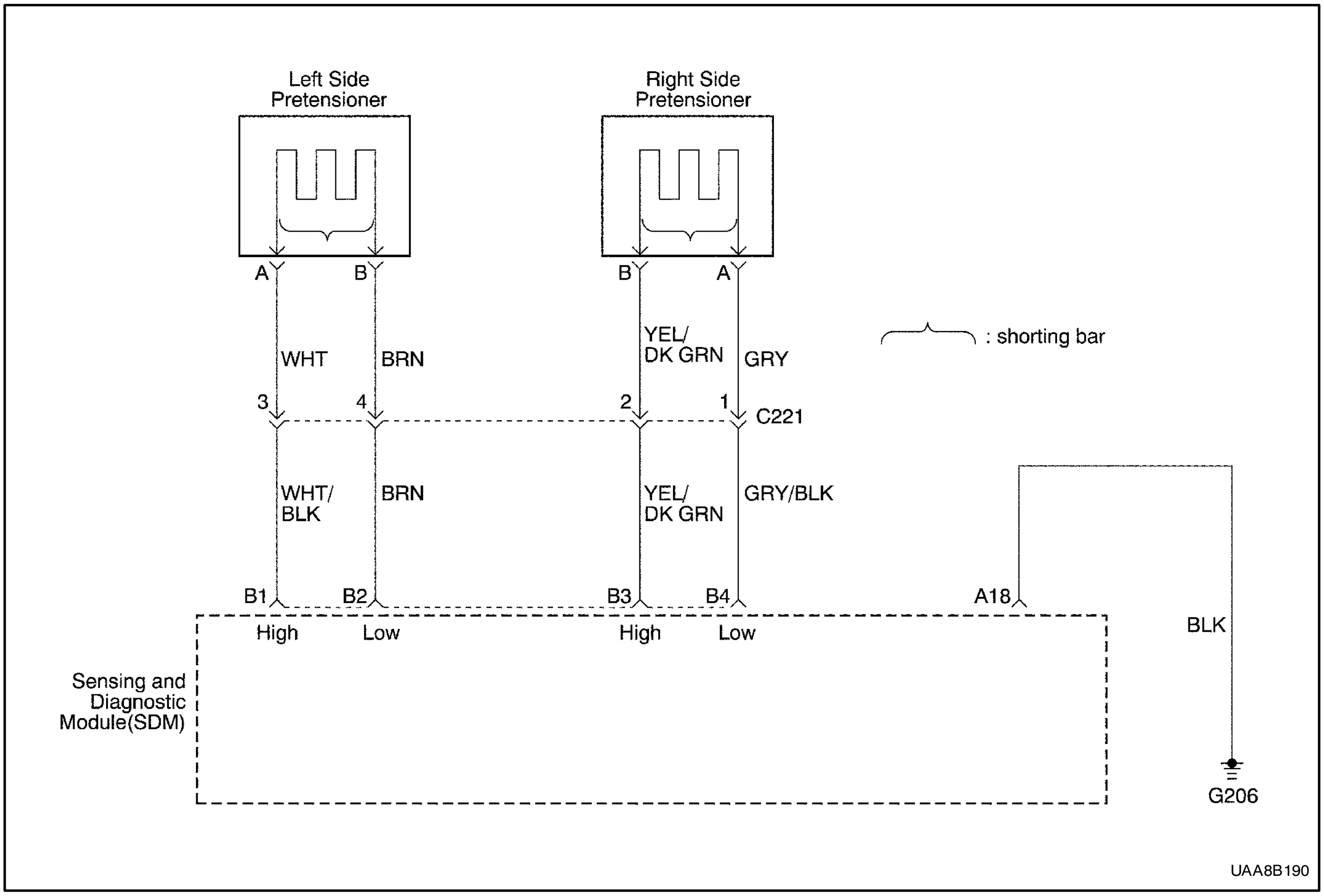

DIAGNOSTIC TROUBLE CODE (DTC) 59
RIGHT SIDE BELT PRETENSIONER DEPLOYMENT LOOP VOLTAGE OUT OF RANGE

Circuit Description

When the ignition switch is turned to ON, the sensing and diagnostic module (SDM) will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, ignition and deployment loop voltages are measured to ensure that they are within their respective normal voltage ranges. The SDM monitors the voltages at the right side belt pretensioner low terminal (terminal B3) and the left side belt pretensioner low terminal (terminal B2) to detect shorts to ground or voltage in the deployment loops.

DTC 59 Will Set When

- Voltage at the right side belt pretensioner high terminal is higher than 6 volts for 500 milliseconds.
- Voltage at the right side belt pretensioner high terminal is less than 2 volts and the resistance of the right side pretensioner deployment loop is less than 4.5 ohms for 500 milliseconds.
- Ignition voltage id within normal operation range.

Action Taken

- The SDM will turn on the AIRBAG indicator and set a DTC 59.
- The SDM will disable the right side pretensioner resistance test.

DTC 59 Will Clear When

- Voltage at the right side belt pretensioner high terminal is less than or equal to 6 volts for 500 milliseconds.
- Voltage at the right side belt pretensioner high terminal is higher than or equal to 2 volts and the resistance of the right side pretensioner deployment loop is less than 4.5 ohms for 500 milliseconds.
- The ignition key is turned to OFF.
- The scan tool CLEAR CODES command is received.

Diagnostic Aids

Carefully inspect the wires in the right side belt pretensioner loop for cutting or chafing. If the wiring pigtail of the right side belt pretensioner is damaged, the right side belt pretensioner module must be replaced.

DTC 59 – Right Side Belt Pretensioner Deployment Loop Voltage Out of Range

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedure, be very careful when handling the SDM. Never strike or jar the SDM. Never power the supplemental restraints system (SRS) when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened, and the arrow on the SDM must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Important: A careful inspection of the circuits and components indicated on the DTC 59 chart is essential to ensure that the replacement SDM will not be damaged. When DTC 59 has been set, it is necessary to replace the SDM.

Step	Action	Value(s)	Yes	No
1	Perform the SRS Diagnostic System Check. Is the SRS Diagnostic System Check complete?	–	Go to *Step 2*	–
2	Visually inspect the wires to the right side belt pretensioner including the pigtail to the right side belt pretensioner. Is there any evidence of rubbing, damage, or chafing?	–	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition to LOCK and remove the key. 2. Temporarily disconnect the passenger airbag, the yellow clock spring connector on the steering column and connector C221. 3. Replace any damaged wiring, terminals, or harnesses. The right side belt pretensioner will require replacement if the pigtail wire harness has been damaged. 4. Replace the SDM. The arrow must be pointing to the front of the vehicle. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–
4	1. Turn the ignition OFF. 2. Disconnect the passenger airbag, the yellow clock spring connector on the steering column and connector C221. 3. Disconnect the SDM. 4. Using a digital multimeter, measure resistance between terminal A and/or B of belt pretensioner and ground. ● Refer to “Diagnostic Illustration 19” in this section. Is the resistance equal to the specified value?	∞	Go to *Step 6*	Go to *Step 5*
5	1. Repair the short to ground between the belt pretensioner circuit and ground or replace the wiring harness. 2. Replace the SDM. The arrow must be pointing to the front of the vehicle. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–
6	1. Disconnect the SDM. 2. Turn the ignition to ON. 3. Measure the voltage between terminal A and/or B of belt pretensioner and ground. ● Refer to “Diagnostic Illustration 20” in this section. Is the voltage equal to the specified value?	0 V	Go to *Step 5*	Go to *Step 7*

DTC 59 – Right Side Belt Pretensioner Deployment Loop Voltage Out of Range (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Replace the SDM. The arrow must be pointing to the front of the vehicle. 2. Install the scan tool to the data link connector (DLC). 3. Clear the trouble code. 4. Perform the SRS Diagnostic System Check. Is DTC 59 still current?	–	Go to step 8	System OK
8	1. Replace the right side belt pretensioner. 2. Replace the SDM. The arrow must be pointing to the front of the vehicle. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–

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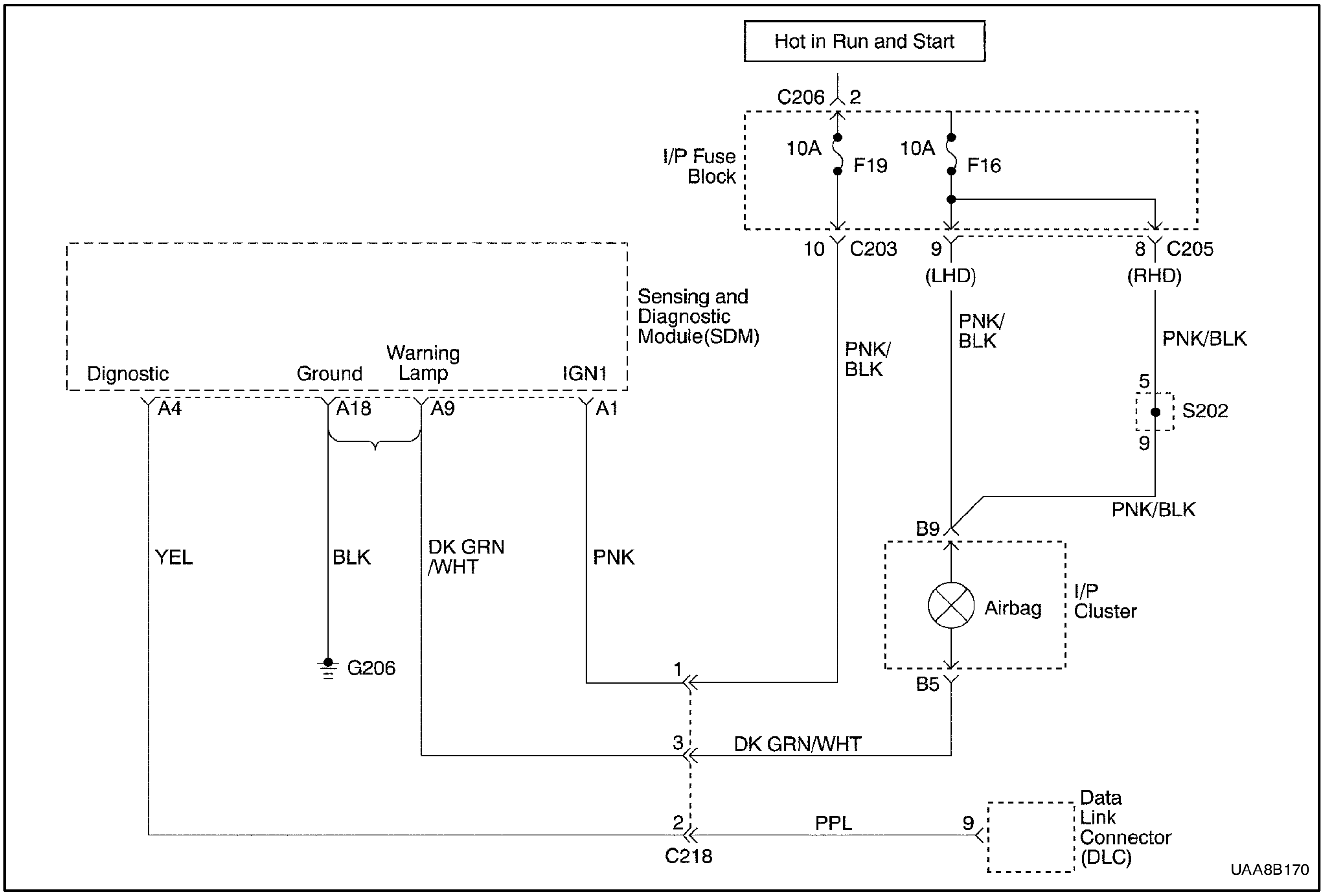

DIAGNOSTIC TROUBLE CODE (DTC) 61
AIRBAG WARNING LAMP FAILURE

Circuit Description

When the ignition switch is first turned ON, ignition voltage is applied to the indicator lamp and also to the sensing and diagnostic module (SDM) input terminal A1. The SDM responds by flashing the instrument cluster AIRBAG indicator seven times. If the SDM cannot detect voltage on the indicator circuit, a DTC 61 will be set.

The SDM also attempts to turn on the AIRBAG indicator, but the indicator will not turn on if inputs have been correctly processed.

DTC 61 Will Set When

During continuous monitoring, the SDM fails to detect voltage at terminal A9, the input terminal for the AIRBAG indicator, for 500 milliseconds.

Action Taken

The SDM attempts to turn on the AIRBAG indicator, and it sets a DTC 61.

DTC 61 Will Clear When

- The ignition switch is turned OFF.
- The problem is repaired.

DTC 61 – AIRBAG Warning Lamp Failure

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedure, be very careful when handling the SDM. Never strike or jar the SDM. Never power the supplemental restraints system (SRS) when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened, and the arrow on the SDM must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Step	Action	Value(s)	Yes	No
1	Perform the SRS Diagnostic System Check. Is the SRS Diagnostic System Check complete?	–	Go to *Step 2*	–
2	Check the instrument panel fuse F16. Is fuse F16 blown?	–	Go to *Step 3*	Go to *Step 4*
3	1. Check for a short circuit and repair if necessary. 2. Replace the fuse. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–
4	1. Turn the ignition ON. 2. Check the power supply to fuse F16. Is the voltage equal to the specified value?	11–14 V	Go to *Step 6*	Go to *Step 5*
5	Repair the power supply to fuse F16. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–
6	1. Remove the instrument cluster. 2. Check the AIRBAG indicator bulb. Is the bulb in good condition?	–	Go to *Step 8*	Go to *Step 7*
7	Replace the AIRBAG indicator bulb. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–
8	1. Turn the ignition ON. 2. Check the voltage at instrument cluster connector B9. Is the voltage at B9 equal to the specified value?	11–14 V	Go to *Step 10*	Go to *Step 9*
9	Repair the open circuit between the instrument panel fuse F16 and instrument cluster connector B9. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–
10	Test the instrument cluster printed circuit for continuity between connectors B9 and B10. Is there continuity between B9 and B10 on the printed circuit?	–	Go to *Step 12*	Go to *Step 11*
11	Replace the instrument cluster. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–

DTC 61 – AIRBAG Warning Lamp Failure (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the passenger airbag, the yellow clock spring connector on the steering column, and connector C221. 3. Disconnect the SDM electrical connector. 4. Turn the ignition ON. 5. Check the voltage at terminal A9 of the SDM connector. Is the voltage equal to the specified value?	11–14 V	Go to *Step 14*	Go to *Step 13*
13	Repair the open circuit between the instrument cluster and the SDM connector terminal A9. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–
14	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the passenger airbag, the yellow clock spring connector on the steering column and connector C221. 3. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 4. Connect all SRS components, and ensure that all components are properly mounted. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–

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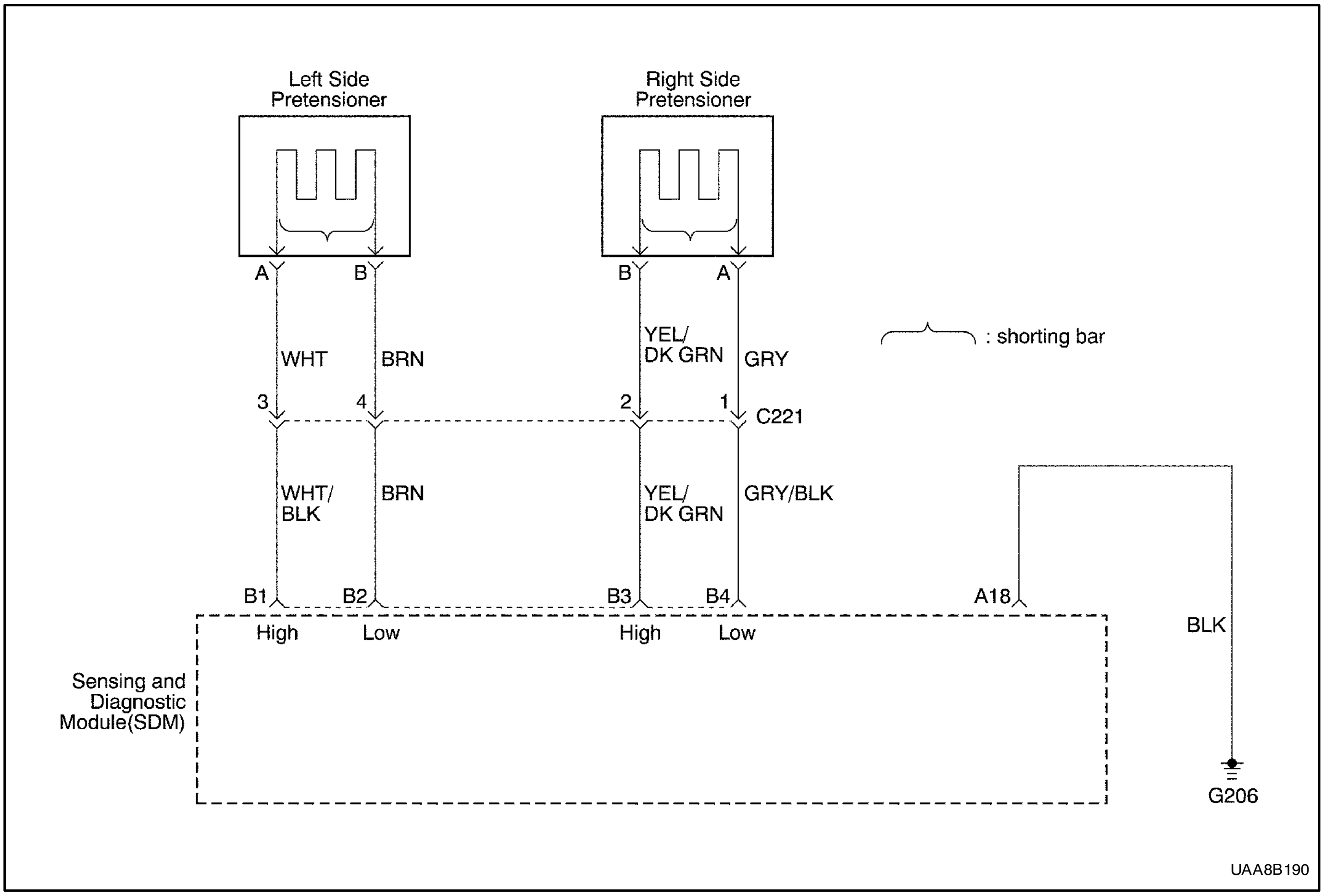


DIAGNOSTIC TROUBLE CODE (DTC) 64
LEFT SIDE BELT PRETENSIONER DEPLOYMENT LOOP SHORTED

Circuit Description

When the ignition switch is turned to ON, the sensing and diagnostic module (SDM) will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, ignition and deployment loop voltages are measured to ensure that they are within their respective normal voltage ranges. The SDM then proceeds with the resistance measurement test. Left side belt pretension low terminal B2 is grounded through a current sink, and the left side belt pretensioner current source is connected to the left side belt pretensioner high terminal to allow a known amount of current to flow. By monitoring the voltage difference between the left side pretensioner high and left side belt pretensioner low terminals, the SDM calculates the combined resistance of the left side belt pretensioner harness wiring, and connector terminal contacts.

DTC 64 Will Set When

- Resistance of the left side belt pretensioner loop is less than 1.2 ohms for 500 milliseconds.
- Ignition voltage is within the normal operation range.

Action Taken

The SDM will turn ON the AIRBAG indicator and set a diagnostic trouble code (DTC) 64.

DTC 64 Will Clear When

- Resistance of the left side belt pretensioner loop is higher than or equal to 1.2 ohms for 500 milliseconds.
- The ignition switch is turned OFF.
- The scan tool CLEAR CODES command is received.

Diagnostic Aids

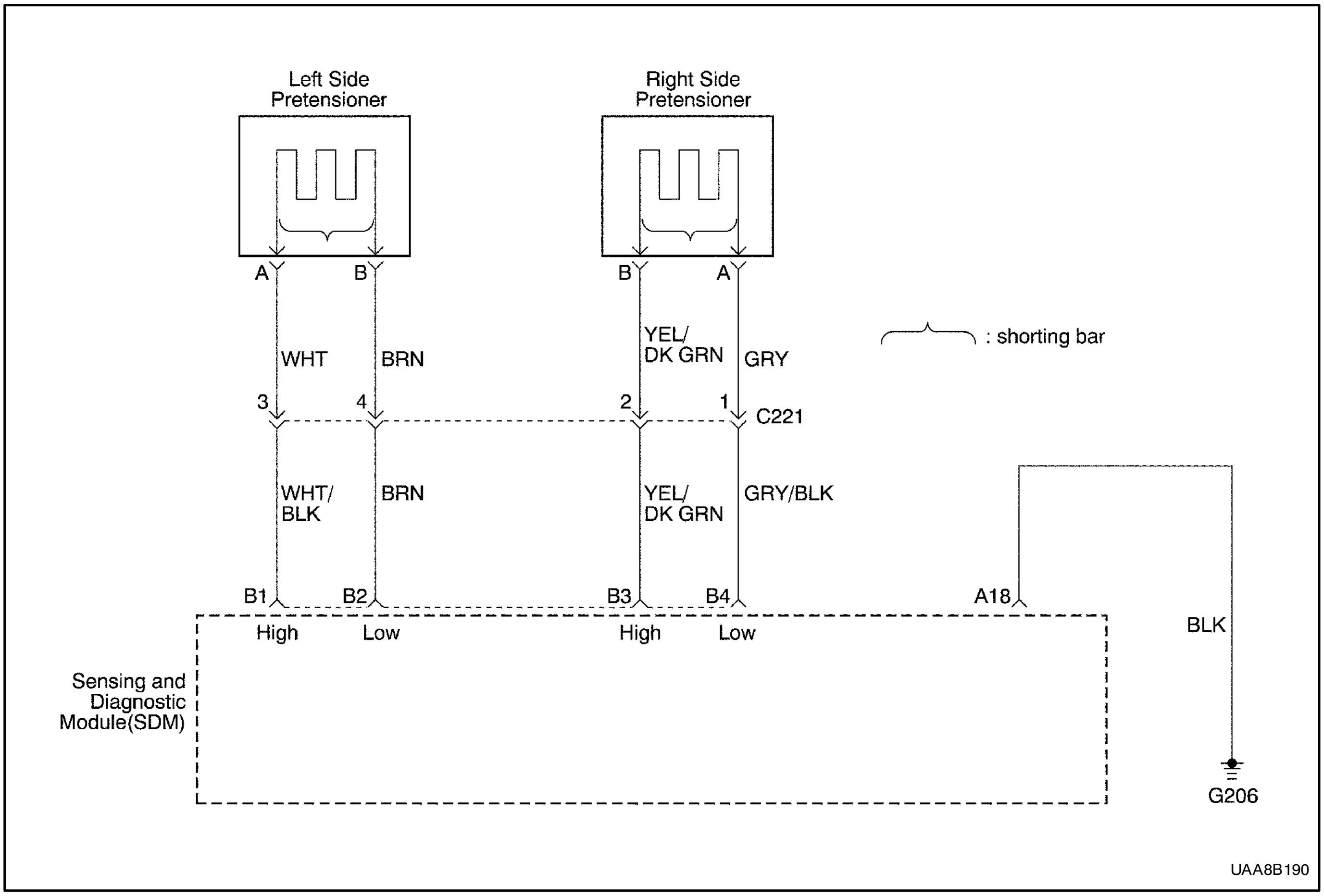
An intermittent condition is likely to be caused by a short between the left side belt pretensioner high and low circuits, a short on C221 or a short between the left side belt pretensioner high circuit and the right side belt high circuit, or a short between the left side belt pretensioner high circuit and the right side belt low circuit. The problem could also be a malfunctioning shorting bar in the left side belt pretensioner connector, which would require replacement of the left side belt pretensioner. The test for this DTC is run only while the AIRBAG indicator is performing the turn-on test. When a scan tool CLEAR CODES command is issued while the malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 64 – Left Side Belt Pretensioner Deployment Loop Shorted

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedure, be very careful when handling the SDM. Never strike or jar the SDM. Never power the supplemental restraints system (SRS) when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened, and the arrow on the SDM must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Step	Action	Value(s)	Yes	No
1	Perform the SRS Diagnostic System Check. Is the SRS Diagnostic System Check complete?	–	Go to *Step 2*	–
2	1. Turn the ignition to LOCK and remove the key. 2. Connect the scan tool to the Data Link Connector (DLC). 3. Turn the ignition ON. Is DTC 57 also current?	–	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the yellow airbag connectors at the steering column, passenger airbag, connector C221 and at left side belt pretensioner connector. 3. Repair the short between the left side belt pretensioner high circuit and the right side belt pretensioner airbag high circuit. 4. Make sure all SRS components are reconnected and all components are properly mounted. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–
4	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the connector C221 and the left side belt pretensioner connector. 3. Measure the resistance between terminal A and B of left side belt pretensioner. • Refer to “Diagnostic illustration 17” in this section. Is the resistance equal to specified value?	∞	Go to *Step 5*	Go to *Step 7*
5	1. Replace the sensing and diagnostic module (SDM). The arrow must be pointing forward the front of the vehicle. 2. Connect all the wiring connector. 3. Clear all trouble code with scanner. Is the repair complete?	–	System OK	Go to *Step 6*
6	Replace the left side belt pretensioner. Is the repair complete?	–	System OK	–
7	Repair the short between the left side belt pretensioner high circuit and the left side belt pretensioner low circuit or replace the wiring harness. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–



DIAGNOSTIC TROUBLE CODE (DTC) 65
LEFT SIDE BELT PRETENSIONER DEPLOYMENT LOOP OPEN

Circuit Description

When the ignition switch is turned to ON, the sensing and diagnostic module (SDM) will perform tests to diagnose critical malfunctions within itself. After passing these tests, Ignition 1 and deployment loop voltages are measured to ensure that they are within their respective normal voltage ranges. The SDM then proceeds with the resistance measurement test. Left side belt pretensioner low terminal B2 is grounded through a current sink, and the left side belt pretensioner current source is connected to the left side belt pretensioner high terminal to allow a known amount of current to flow. By monitoring the voltage difference between left side belt pretensioner high and left side belt pretensioner low, the SDM calculates the combined resistance of the left side belt pretensioner inflator module, the harness wiring, and the connector terminal contacts.

DTC 65 Will Set When

- Resistance of the left side belt pretensioner deployment loop is higher than 4.5 ohms for 500 milliseconds.
- Voltage at left side belt pretensioner high terminal is less than 2 volts and the resistance of the left side belt pretensioner is higher than or equal to 4.5 ohms for 500 milliseconds.
- Ignition voltage is within the normal operation range.

Action Taken

The SDM will turn on the AIRBAG indicator and set a diagnostic trouble code (DTC) 65.

DTC 65 Will Clear When

- Resistance of the left side belt pretensioner deployment loop is less than or equal to 4.5 ohms for 500 milliseconds.
- Voltage at left side belt pretensioner high terminal is higher than 2 volts and the resistance of the left side belt pretensioner is less than 4.5 ohms for 500 milliseconds.
- The ignition switch turned to OFF.
- The scan tool CLEAR CODES command received.

Diagnostic Aids

An intermittent condition is likely to be caused by a poor connection, at the left side belt pretensioner connector, connector C221, or at terminals B1 and B2 of the SDM. An open wire in the left side belt pretensioner deployment loop will also set DTC 65.

DTC 65 – Left Side Belt Pretensioner Deployment Loop Open

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedure, be very careful when handling the SDM. Never strike or jar the SDM. Never power the supplemental restraints system (SRS) when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened, and the arrow on the SDM must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Step	Action	Value(s)	Yes	No
1	Perform the SRS Diagnostic System Check. Is the SRS Diagnostic System Check complete?	–	Go to *Step 2*	–
2	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the left side belt pretensioner airbag connector. 3. Inspect the terminals for damage or improper connection. 4. Repair any damaged pins or terminals on the wiring harness side of the connector. If the pigtail or connector of the belt pretensioner is damaged, the left side belt pretensioner must be replaced. 5. If no damage was found, connect the left side belt pretensioner connector and make sure it is seated properly. 6. Turn the ignition ON. Is DTC still current?	–	Go to *Step 3*	System OK
3	1. Turn the ignition to LOCK and remove the key. 2. Temporarily disconnect the left side belt pretensioner. 3. Check terminals B1 and B2 at the SDM and terminal 3 and 4 at the C221. Are there any loose wires or damaged pins or terminals?	–	Go to *Step 4*	Go to *Step 5*
4	1. Repair any loose or damaged pins or SDM terminals. 2. Make sure all SRS components are reconnected and all components are properly mounted. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–
5	1. Check for an open circuit between the SDM and the left side belt pretensioner connector. • Refer to "Diagnostic Illustration 21" in this section. Is there an open circuit?	∞	Go to *Step 6*	Go to *Step 7*
6	1. Repair the open circuit between the SDM and the left side belt pretensioner module. 2. Make sure all SRS components are reconnected and all components are properly mounted. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–

DTC 65 – Left Side Belt Pretensioner Deployment Loop Open (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 2. Connect all SRS components, and ensure that all components are properly mounted. 3. Perform the SRS Diagnostic System Check. Is DTC 65 still current?	–	Go to *Step 8*	System OK
8	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the connector at the left side belt pretensioner. 3. Replace the left side belt pretensioner module. 4. Make sure all SRS components are reconnected and all components are properly mounted. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–

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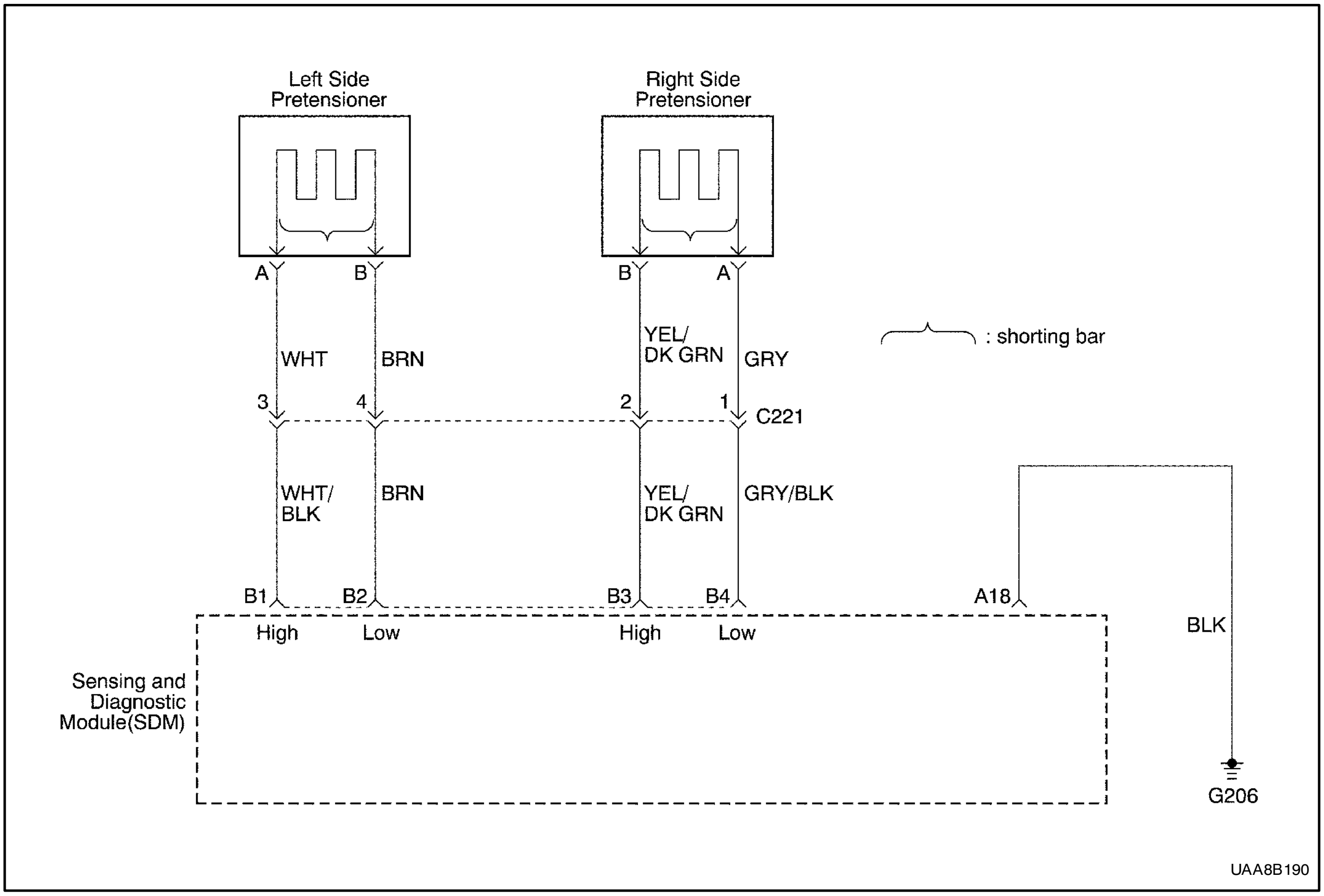

DIAGNOSTIC TROUBLE CODE (DTC) 66
LEFT SIDE BELT PRETENSIONER DEPLOYMENT LOOP VOLTAGE OUT OF RANGE

Circuit Description

When the ignition switch is turned to ON, the sensing and diagnostic module (SDM) will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, Ignition 1 and deployment loop voltages are measured to ensure that they are within their respective normal voltage ranges. The SDM monitors the voltages at the right side belt pretensioner low terminal (terminal B3) and the left side belt pretensioner low terminal (terminal B2) to detect shorts to ground or voltage in the deployment loops.

DTC 66 Will Set When

- Voltage at the left side belt pretensioner high terminal is higher than 6 volts for 500 milliseconds.
- Voltage at the left side belt pretensioner high terminal is less than 2 volts and the resistance of the left side belt pretensioner deployment loop is less than 4.5 ohms for 500 milliseconds.
- Ignition voltage is within the normal operation range.

Action Taken

- The SDM will turn on the AIRBAG indicator and set a DTC 66.
- The SDM will disable the left side belt pretensioner resistance test.

DTC 66 Will Clear When

- Voltage at the left side belt pretensioner high terminal is less than equal to 6 volts for 500 milliseconds.
- Voltage at the left side belt pretensioner high terminal is higher than or equal to 2 volts and the resistance of the left side belt pretensioner deployment loop is less than 4.5 ohms for 500 milliseconds.
- The ignition switch is turned to OFF.
- The scan tool CLEAR CODES command is received.

Diagnostic Aids

Carefully inspect the wires in the left side belt pretensioner loop for cutting or chafing. If the wiring pigtail of the left side belt pretensioner is damaged, the left side belt pretensioner module must be replaced.

DTC 66 – Left Side Belt Pretensioner deployment Loop Voltage Out of Range

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedure, be very careful when handling the SDM. Never strike or jar the SDM. Never power the supplemental restraints system (SRS) when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened, and the arrow on the SDM must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Step	Action	Value(s)	Yes	No
1	Perform the SRS Diagnostic System Check. Is the SRS Diagnostic System Check complete?	–	Go to *Step 2*	–
2	Visually inspect the wires to the left side belt pretensioner including the pigtail to the left side belt pretensioner. Is there any evidence of rubbing, damage, or chafing?	–	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition to LOCK and remove the key. 2. Temporarily disconnect the passenger airbag, the yellow clock spring connector on the steering column and connector C221. 3. Replace any damaged wiring, terminals, or harnesses. The left side belt pretensioner will require replacement if the pigtail wire harness has been damaged. 4. Replace the SDM. The arrow must be pointing to the front of the vehicle. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–
4	1. Turn the ignition OFF. 2. Disconnect the passenger airbag, the yellow clock spring connector on the steering column and connector C221. 3. Disconnect the SDM. 4. Using a digital multimeter, measure resistance between terminal A and/or B of belt pretensioner and ground. ● Refer to “Diagnostic Illustration 19” in this section. Is the resistance equal to the specified value?	∞	Go to *Step 6*	Go to *Step 5*
5	1. Repair the short to ground between the belt pretensioner circuit and ground or replace the wiring harness. 2. Replace the SDM. The arrow must be pointing to the front of the vehicle. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–
6	1. Disconnect the SDM. 2. Turn the ignition to ON. 3. Measure the voltage between terminal A and/or B of belt pretensioner and ground. ● Refer to “Diagnostic Illustration 20” in this section. Is the voltage equal to the specified value?	–	Go to *Step 5*	Go to *Step 7*

DTC 66 – Left Side Belt Pretensioner deployment Loop Voltage Out of Range (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Replace the SDM. The arrow must be pointing to the front of the vehicle. 2. Install the scan tool to the data link connector (DLC). 3. Clear the trouble code. 4. Perform the SRS Diagnostic System Check. Is DTC 66 still current?	–	Go to step 8	System OK
8	1. Replace the left side belt pretensioner. 2. Replace the SDM. The arrow must be pointing to the front of the vehicle. Is the repair complete?	–	Go to "SRS Diagnostic System Check"	–

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DIAGNOSTIC TROUBLE CODE (DTC) 71
INTERNAL SENSING AND DIAGNOSTIC MODULE (SDM) FAILURE

Circuit Description

DTC 71 is an indication of a potential internal SDM malfunction and will set if any of the following conditions is detected:

- Reserve voltage discharge time has failed for three consecutive ignition cycles.
- The calculated checksum for internal memory does not match the stored value.
- The temporary memory storage area is malfunctioning.
- The permanent memory storage area is malfunctioning.
- The voltage measured at driver low and passenger low are too high.
- The voltage measured at driver low and passenger low are too low.
- The accelerometer inside the SDM is malfunctioning.
- The driver current source and/or passenger current source is malfunctioning.
- The SDM is unable to read from or write to electronically erasable programmable read only memory (EEPROM).
- The arming sensor inside the SDM is not closed during a deployment event.

DTC 71 Will Set When

Any of the indicated malfunctions is detected by the SDM. The malfunctions are detected at various times:

- Turn-on.
- Continuous monitoring.
- Resistance measurement test.

Action Taken

The SDM turns on the AIRBAG indicator and sets a DTC 71.

DTC 71 Will Clear When

A scan tool CLEAR CODES command is received by the SDM. Some of the malfunctions will allow the AIRBAG indicator to turn off only briefly and then turn on again.

DTC 71 – Internal Sensing and Diagnostic Module (SDM) Failure

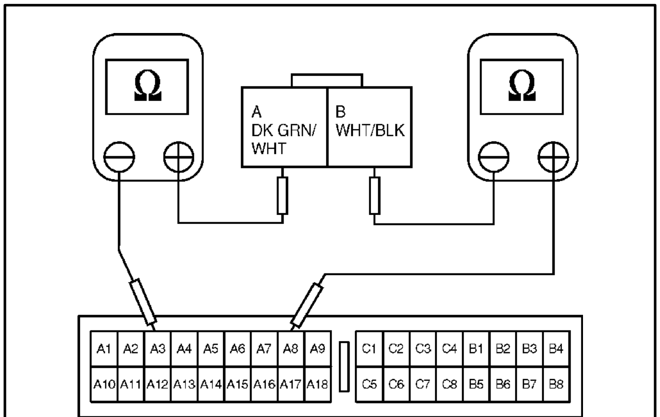
Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioners for 0.15 seconds after the ignition is OFF and the fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. Otherwise, injury could result.

Caution: During service procedure, be very careful when handling the SDM. Never strike or jar the SDM. Never power the supplemental restraints system (SRS) when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must be carefully tightened, and the arrow on the SDM must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered when it is not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Important: Codes 18, 24, and 71 cannot be reset if there has been a short to ground in the deployment loops. When DTC 18 or 24 has been set, it is necessary to replace the SDM. To avoid damaging the replacement SDM, ensure that the short to ground is repaired prior to installing a replacement SDM.

Step	Action	Value(s)	Yes	No
1	Perform the SRS Diagnostic System Check. Is the SRS Diagnostic System Check complete?	–	Go to *Step 2*	–
2	Check for current or history DTCs. Is either DTC 18 or DTC 24 also set as a current or a history DTC?	–	Go the diagnostic table for DTC 18 or DTC 24	Go to *Step 3*
3	1. Turn the ignition to LOCK and remove the key. 2. Disconnect the passenger airbag and the yellow clock spring connector on the steering column. 3. Replace the SDM. The arrow must be pointing toward the front of the vehicle. 4. Connect all SRS components, and ensure that all components are properly mounted. Is the repair complete?	–	Go to “SRS Diagnostic System Check”	–

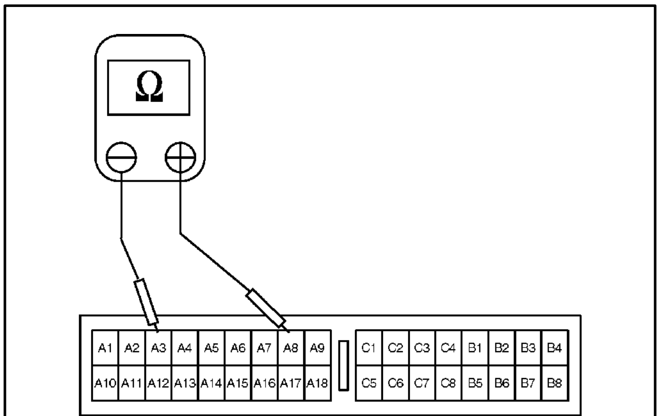
Caution: Do not use these illustrations to troubleshooting without consulting the diagnostic trouble code (DTC) charts. The DTC chart give additional safety precautions and detailed instructions for each test. Failure to follow the proper precautions can result in injury from unintended airbag deployment.



E28B008

DIAGNOSTIC ILLUSTRATION 1

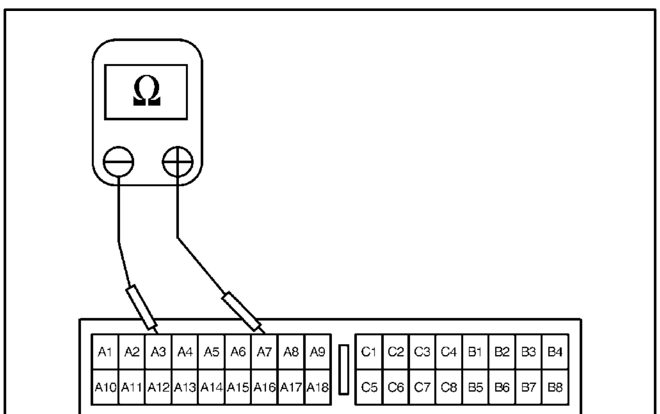
Checking the continuity between the passenger airbag and the sensing and diagnostic module (SDM).



E28B009

DIAGNOSTIC ILLUSTRATION 2

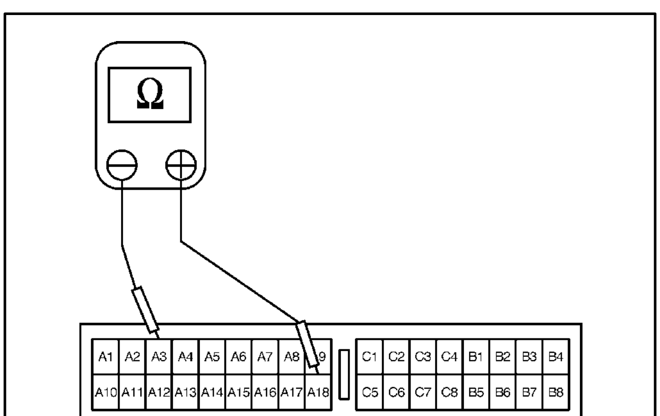
Checking for a short circuit between the passenger high and low circuits.



E28B010

DIAGNOSTIC ILLUSTRATION 3

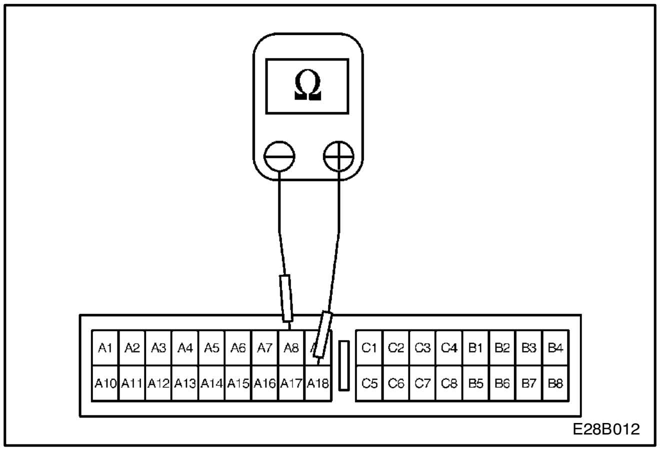
Checking for a short circuit between the passenger high and driver low circuits.



E28B011

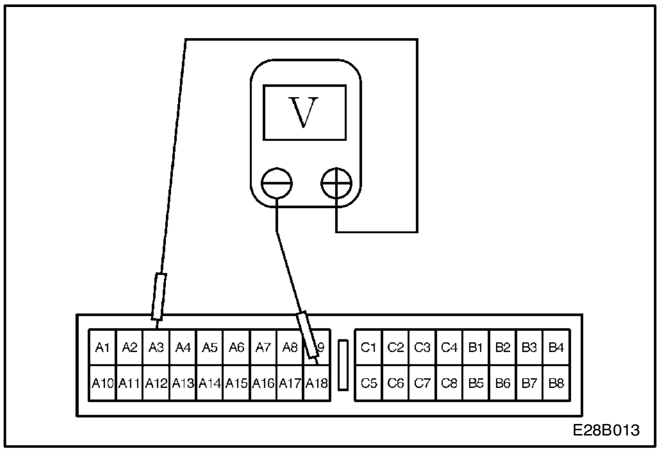
DIAGNOSTIC ILLUSTRATION 4

Checking for a short circuit between the passenger high circuit and ground.



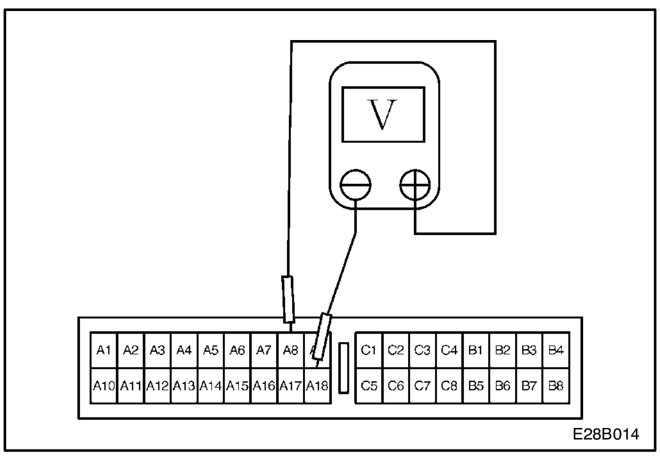
DIAGNOSTIC ILLUSTRATION 5

Checking for a short circuit between the passenger low circuit and ground.



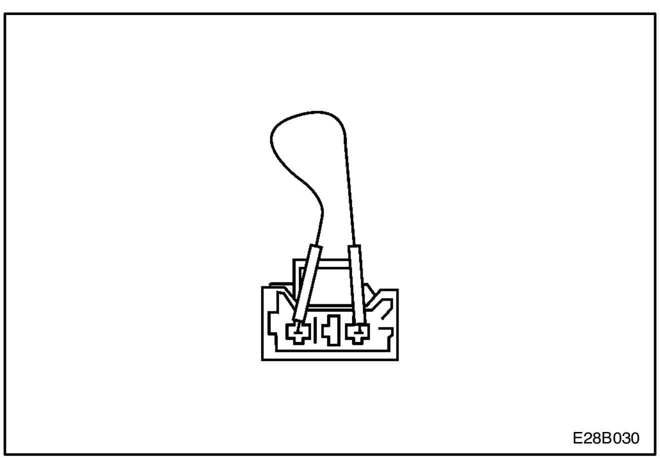
DIAGNOSTIC ILLUSTRATION 6

Checking for a short circuit between the passenger high circuit and voltage.



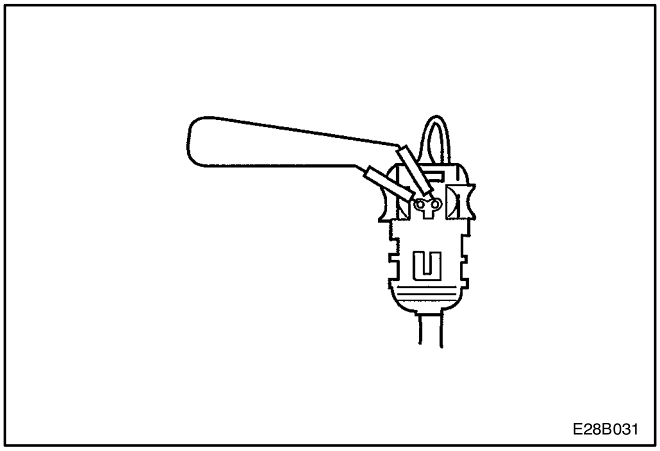
DIAGNOSTIC ILLUSTRATION 7

Checking for a short circuit between the passenger low circuit and voltage.



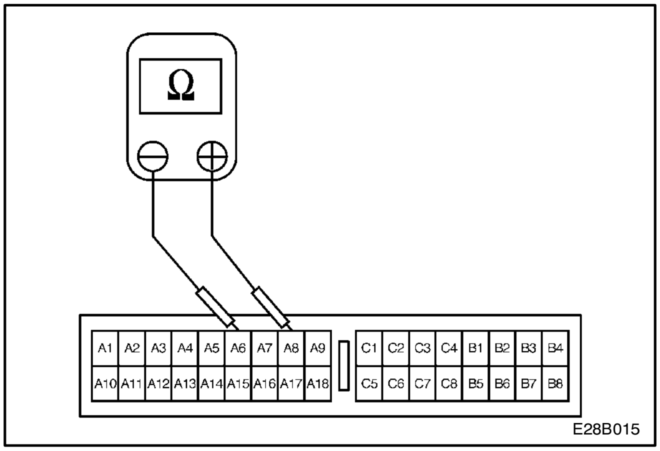
DIAGNOSTIC ILLUSTRATION 8

Placing a jumper on SDM side of the yellow clock spring connector.



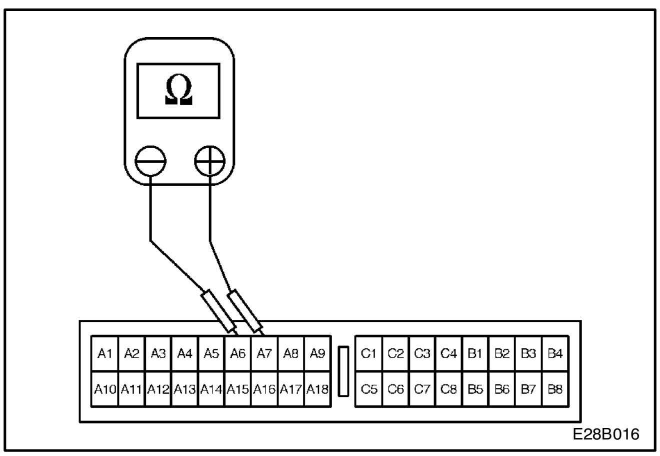
DIAGNOSTIC ILLUSTRATION 9

Placing a jumper on the clock spring-to-airbag connector.



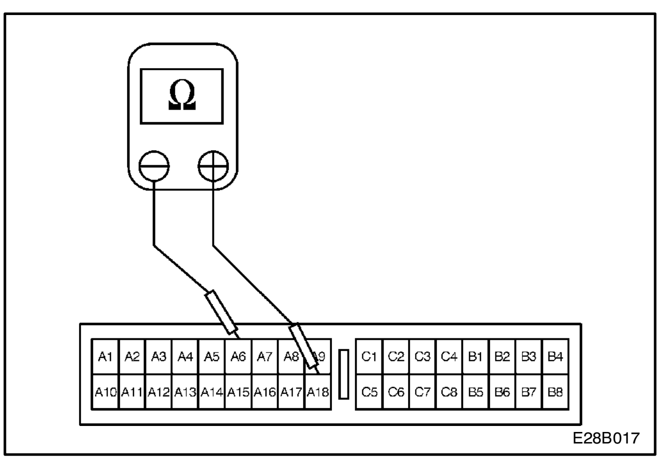
DIAGNOSTIC ILLUSTRATION 10

Checking for a short circuit between the driver high and passenger low circuits.



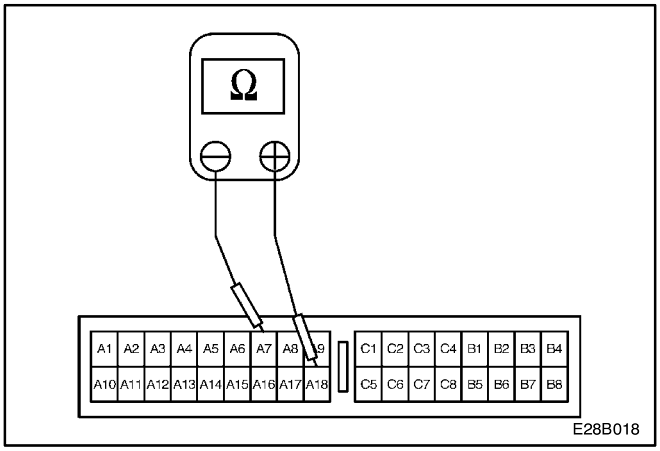
DIAGNOSTIC ILLUSTRATION 11

Checking for a short circuit between the driver high and driver low circuits.



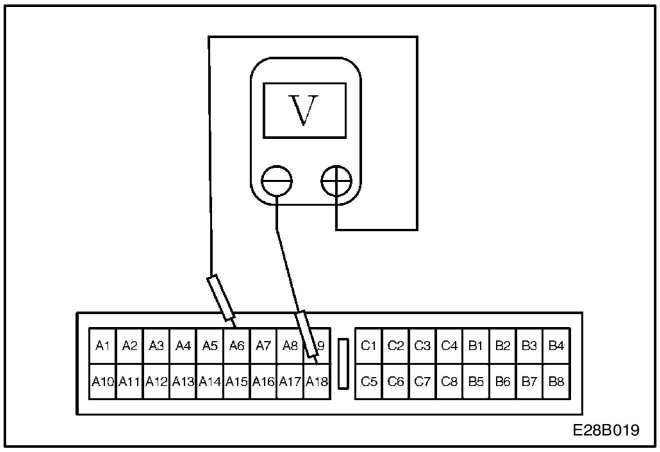
DIAGNOSTIC ILLUSTRATION 12

Checking for a short circuit between the driver high circuit and ground.



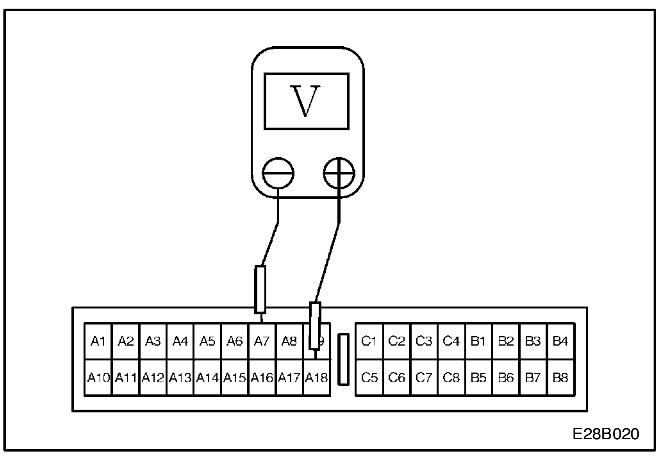
DIAGNOSTIC ILLUSTRATION 13

Checking for a short circuit between the driver low circuit and ground.



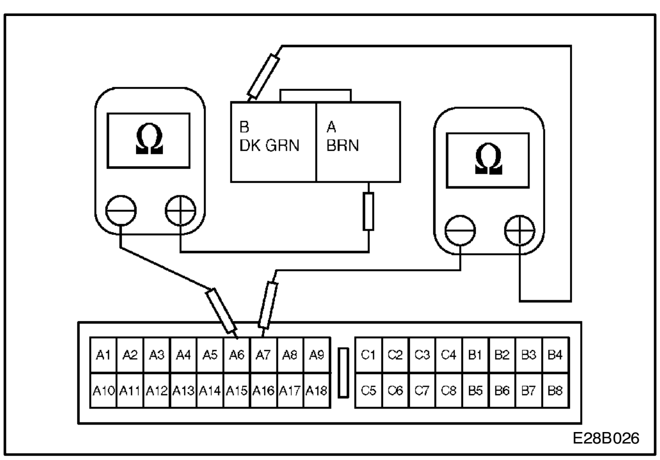
DIAGNOSTIC ILLUSTRATION 14

Checking for a short circuit between the driver high circuit and voltage.



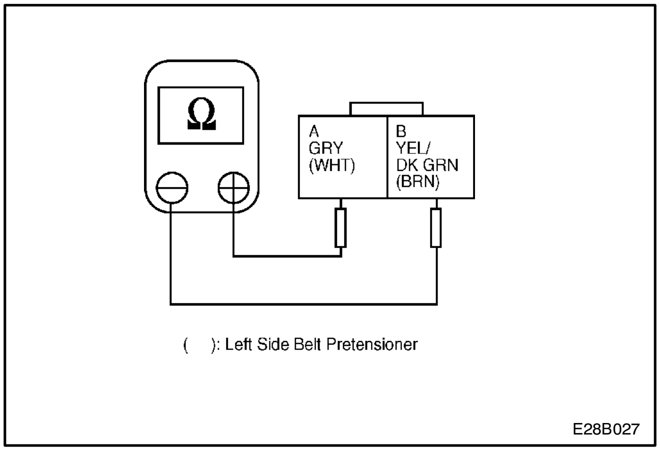
DIAGNOSTIC ILLUSTRATION 15

Checking for a short circuit between the driver low circuit and voltage.



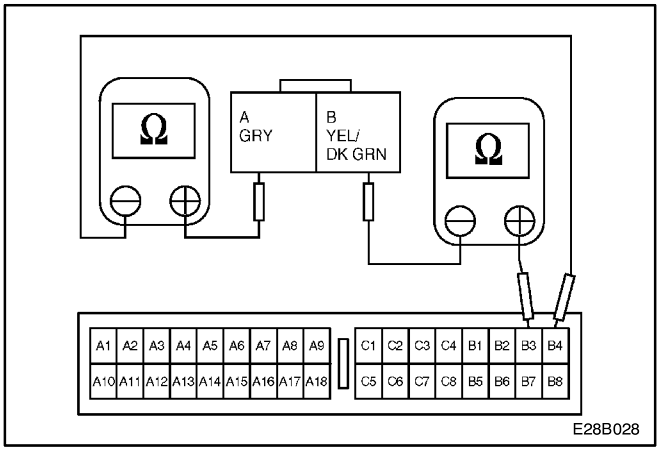
DIAGNOSTIC ILLUSTRATION 16

Checking for a open circuit between the sensing and diagnostic module (SDM) and the clock spring.



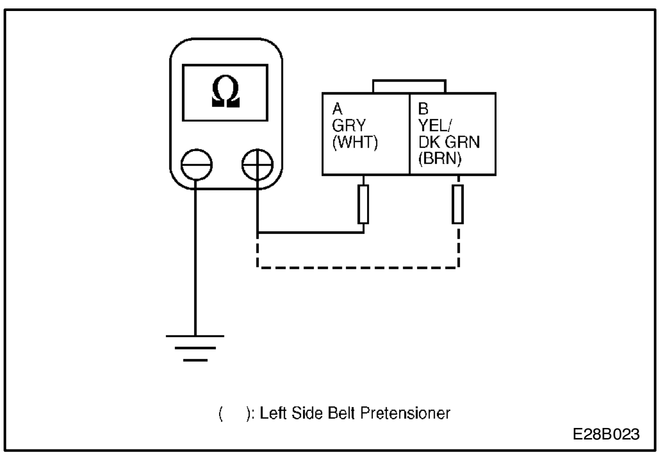
DIAGNOSTIC ILLUSTRATION 17

Checking for a short circuit between the right(left) pretensioner high and low circuits.



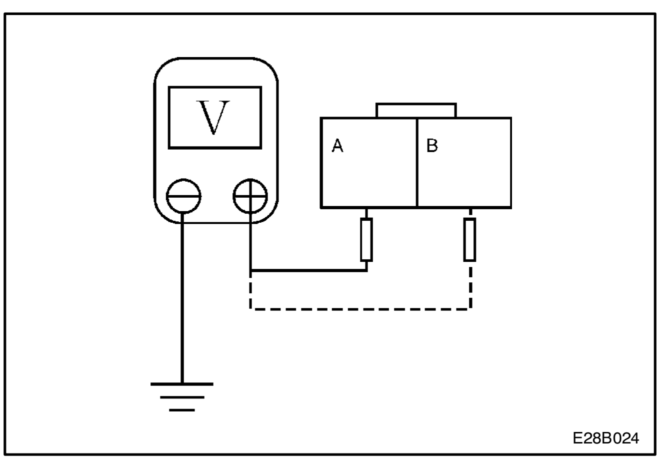
DIAGNOSTIC ILLUSTRATION 18

Checking for a continuity between the right side belt pretensioner and the sensing and diagnostic module (SDM).



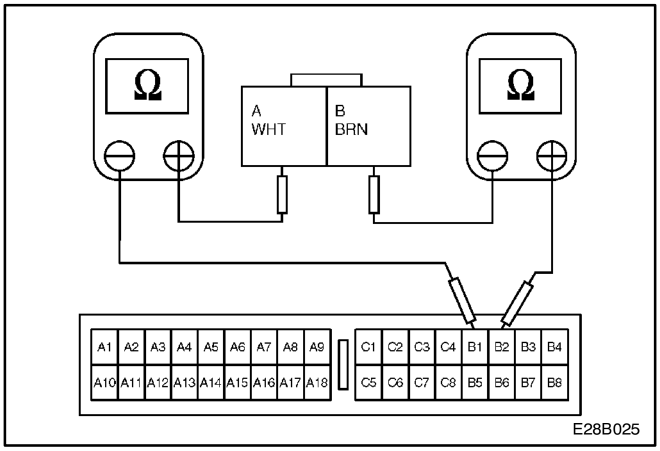
DIAGNOSTIC ILLUSTRATION 19

Checking for a short circuit between the wiring harness of right(left) side belt pretensioner and ground.



DIAGNOSTIC ILLUSTRATION 20

Checking for a short circuit between the belt pretensioner wiring harness and the voltage.



DIAGNOSTIC ILLUSTRATION 21

Checking for the continuity between left side belt pretensioner and sensing and diagnostic module (SDM).

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

SERVICE PRECAUTION

Caution: The sensing and diagnosis module (SDM) can maintain sufficient voltage to deploy the airbags and pretensioner for 0.15 seconds after the ignition is OFF and the airbag fuse has been removed. If the airbags or pretensioners are not disconnected, do not begin service until one minute has passed after disconnecting power to the SDM. If the airbag are disconnected, service can begin immediately without waiting for one-minute time period to expire. Failure to temporarily disable the SRS during service can result in unexpected deployment, personal injury, and otherwise unneeded SRS repairs.

DISABLING THE SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

1. Turn the steering wheel to the straight-ahead position.
2. Turn the ignition switch to LOCK and remove the key.
3. Remove the airbag fuse F19 in the I/P fuse block and wait more than one minute for SRS capacitor to discharge.

ENABLING THE SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

1. Insert airbag fuse F19 in the I/P fuse block.
2. Turn the ignition switch to ON and verify that the AIRBAG indicator flashes seven times and turns OFF. If it does not operate as described, perform the “SRS Diagnostic System Check” referring in this section.

Caution: While turning the ignition switch, staying well away from the inflator modules, or personal injury can be occurred.

HANDLING, INSTALLATION, AND DIAGNOSIS

- Airbag modules should not be subjected to temperature above 65°C(149°F).
- An airbag module or sensing and diagnostic module (SDM) should not be used if it has been dropped from height of 0.9 meters (3 feet) or greater.
- When an SDM is replaced, it must be oriented with the arrow on the SDM pointing toward the front of the vehicle.

- It is very important for the SDM to be installed flat on the mounting surface, parallel to the vehicle's longitudinal axis.
- To avoid setting diagnostic trouble codes (DTCs), do not apply power to the SRS unless all components are connected or a diagnostic chart request it.
- The SRS Diagnostic System Check must be the starting point of any SRS diagnostics. The SRS Diagnostic System Check will verify proper AIRBAG indicator operation and will lead you to correct chart to diagnose any SRS malfunctions. Bypassing these procedures may result in extended diagnostic time and incorrect parts replacements.

REPAIRS AND INSPECTIONS REQUIRED AFTER AN ACCIDENT

Caution: any repairs to the vehicle's structure must return it to the original production configuration. Deployment requires replacement of SDM, the inflator modules, and a dimensional inspection of the steering column.

- If any SRS components are damaged, they must be replaced. If SRS components mounting points are damaged, they must be repaired or replaced.
- Never use SRS parts from another vehicle. This does not include remanufactured parts purchased from an authorized source.
- Do not attempt to service the SDM, the clock spring, or other airbag modules, these items must be replaced if they are defective.
- Verify the part number of replacement airbag modules. Some inflator modules look identical but contain different internal components.

ACCIDENT WITH DEPLOYMENT – COMPONENTS REPLACEMENT

All SRS components must be replaced after frontal crash involving airbag deployment. After deployment, a powdery residue may be on the surface of the airbag. The powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by-products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by-product of the deployment reaction. The sodium hydroxide then quickly reacts with atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (also known as baking soda). Therefore, it is unlikely that sodium hydroxide will be present after deployment. Replace the following SRS components.

Caution: Wear gloves and safety glasses during the disposal procedure. Refer to "Deployed Airbag Module Disposal Procedure" in this section.

- The SDM.
- Airbag modules and pretensioners

- SRS wiring
- Clock spring

ACCIDENT WITHOUT DEPLOYMENT – COMPONENT INSPECTION

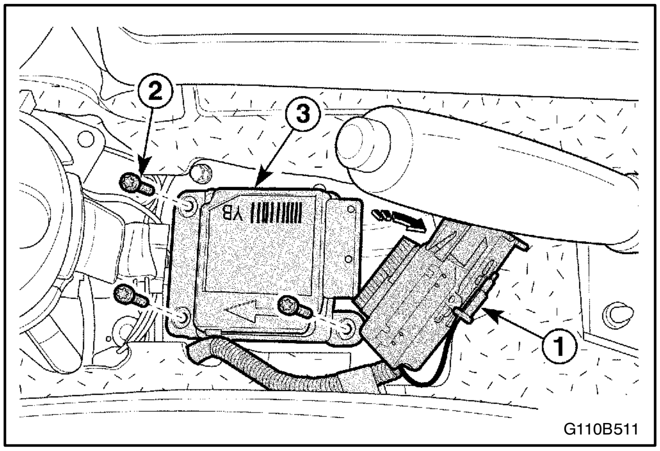
Certain inspection must be performed after any crash, whether the airbag has deployed or not:

- The steering column must be dimensionally inspected.
- Inspect the knee bolsters and mounting points for distortion, bending, cracking, or other damage.
- Inspect the instrument panel (I/P) and steering column reinforcement plate for distortion, bending, cracking, or other damage.
- Inspect the I/P braces for distortion, bending, cracking, or other damage.
- Inspect seat belt and mounting points. Refer to *Section 8A, Seat Belts.*

SENSING AND DIAGNOSTIC MODULE (SDM)

Caution: During service procedures, be very careful when handling the SDM. Never strike or jar the SDM. Never power up the SRS when the SDM is not rigidly attached to the vehicle. All SDM mounting bolts must carefully tighten, and the SDM arrow must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered while not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.

Important: If the vehicle interior has been exposed to extensive water intrusion such as water leaks, driving through high water, flooding, or other causes, the sensing and diagnostic module (SDM) and SDM connector may need to be replaced. With the ignition OFF, inspect the area around the SDM, including the carpet. If any significant soaking or evidence of previous soaking is detected, the water must be removed, the water damage repaired, and the SDM and SDM connector must be replaced. Before attempting any of these repairs, the supplemental restraint system (SRS) must be disabled. Refer to “Disabling the Supplemental Restraint System (SRS)” in this section.



Removal and Installation Procedure

1. Disable the supplemental restraint system (SRS). Refer to "Disabling the SRS" in this section.
2. Remove the floor console. Refer to Section 9G, Interior Trim.
3. Remove the connector position assurance lock, which is tethered to SDM connector.
4. Disconnect the SDM electrical connector.
5. Remove the SDM mounting bolts and discard them.

Installation Notice

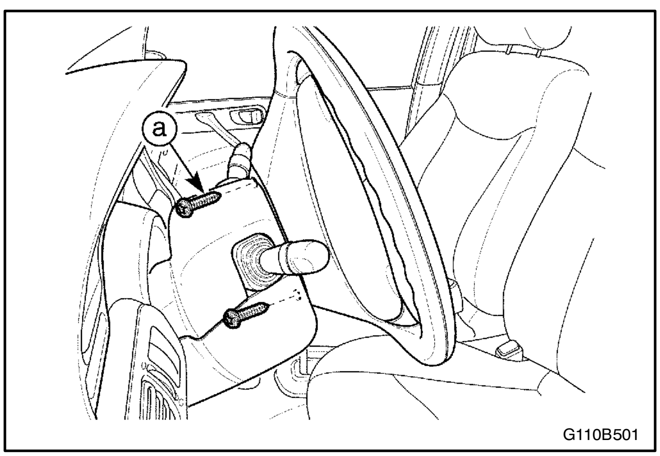
Tightening Torque	10 N·m (89 lb–in)

6. Remove the SDM.
7. Installation should follow the removal procedure in the reverse order.

Installation notice

Enable the SRS. Refer to "Enabling the SRS" in this section.

Caution: All SDM mounting bolts must carefully tighten, and the SDM arrow must be pointing toward the front of the vehicle to ensure proper operation of the SRS. The SDM could be activated if it is powered while not rigidly attached to the vehicle, resulting in unexpected deployment and possible injury.



DRIVER AIRBAG MODULE

Removal and Installation Procedure

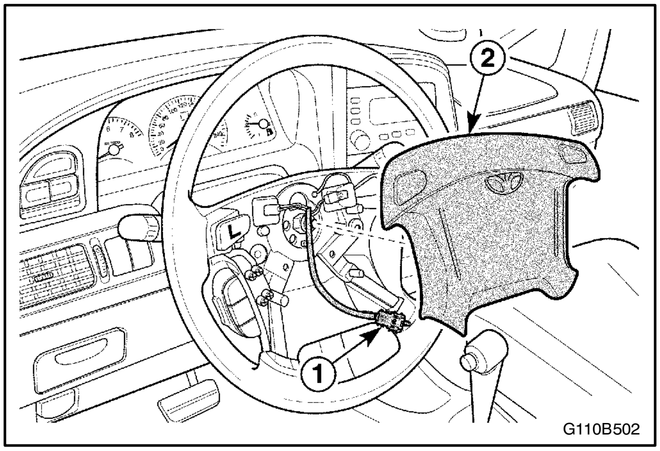
1. Disconnect the negative battery cable.

Caution: The SDM can maintain sufficient voltage to deploy the airbags for 0.15 seconds after the ignition is OFF and the airbag fuse has been removed. If the airbags are not disconnected, service cannot begin until one minute has passed after disconnecting power to the SDM. If the airbags are disconnected, service can begin immediately without waiting for one-minute time period to expire. Failure to temporarily disable the SRS during service result in unexpected deployment, personal injury, and otherwise unneeded SRS repair.

2. Remove two driver airbag module mounting bolts and discard them.

Installation Notice

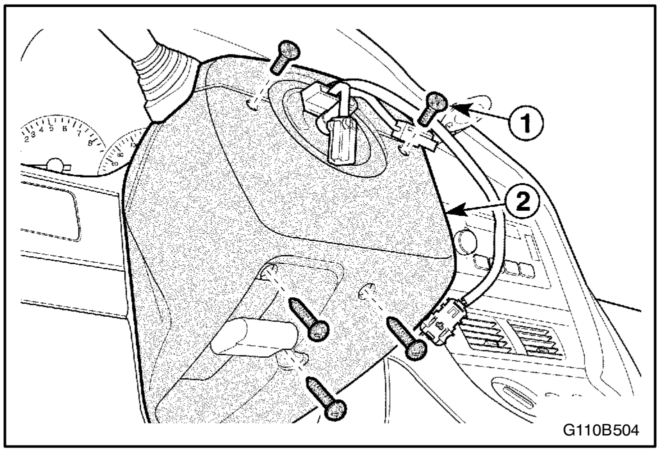
Tightening Torque	8 N·m (71 lb–in)



3. Remove the connector from the driver airbag module.
4. Remove the driver airbag module.

Caution: When handling an airbag module, always keeps the top of the unit facing upward. This leaves room for the airbag to expand if the module unexpectedly deploys. Without room for expansion, a module suddenly propelled toward a person or object can cause injury or vehicle damage.

5. Installation should follow the removal procedure in the reverse order.

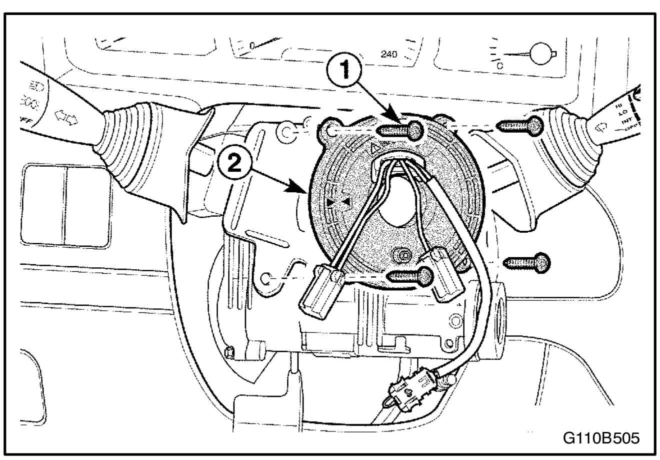


CLOCK SPRING

Removal and Installation Procedure

Caution: The SDM can maintain sufficient voltage to deploy the airbags for 0.15 seconds after the Ignition is OFF and the airbag fuse has been removed. If the airbags are not disconnected, service cannot begin until one minute has passed after disconnecting power to the SDM. If the airbags are disconnected, service can begin immediately without waiting for one-minute time period to expire. Failure to temporarily disable the SRS during service result in unexpected deployment, personal injury, and otherwise unneeded SRS repair.

1. Disconnect the negative battery cable.
2. Remove the driver airbag module. Refer to “Driver Airbag Module” in this section.
3. Remove the steering wheel. Refer to *Section 6E, Steering Wheel and Column.*
4. Remove the screws, and upper and lower steering column covers.



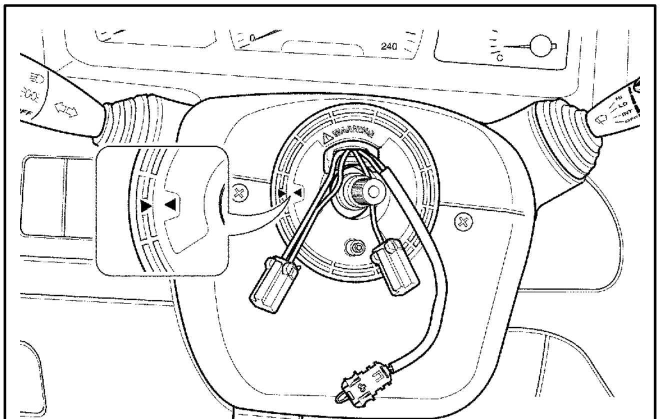
5. Carefully full the driver side knee bolster or instrument panel lower cover.
6. Disconnect the driver airbag, horn and remote audio control switch connectors at the lower steering column.
7. Remove the screws and the clock spring from the steering shaft.

Installation Notice

Tightening Torque	3 N·m (27 lb–in)

8. Installation should follow the removal procedure in the reverse order. Refer to “Clock Spring Alignment” in this section for alignment.

Caution: If the clock spring is not properly aligned, the steering wheel may not be able to rotate completely during a turn. Restricted turning ability can cause the vehicle to crash. Improper alignment of the clock spring also may make the supplemental restraint system (SRS) inoperative, preventing the airbag from deploying during crash. Both of the out comes can result in injury.



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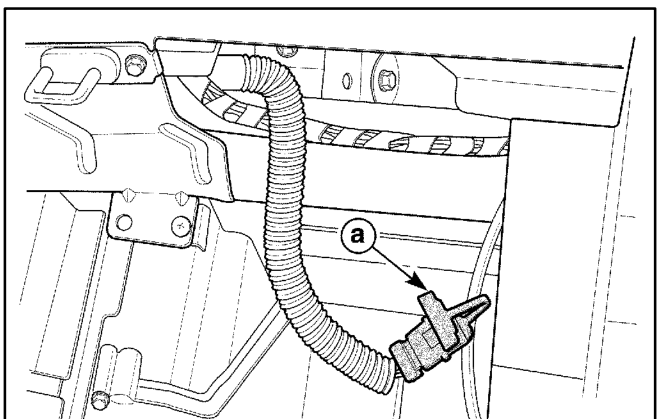
CLOCK SPRING ALIGNMENT

Notice: Turning the clock spring more than three turns clockwise or counterclockwise can damage the spring.

1. Turn the front wheels straight ahead.
2. Turn the lobe of clock spring clockwise to lock. (Do Not Force)
3. Then turn the lobe of clock spring count clockwise approximately three turns to the neutral position, with the front of the wheels straight ahead.
4. Properly align the pointed marks on the components of the clock spring.



G110B508

PASSENGER AIRBAG MODULE

Removal and Installation Procedure

Caution: The SDM can maintain sufficient voltage to deploy the airbags for 0.15 seconds after the Ignition is OFF and the airbag fuse has been removed. If the airbags are not disconnected, service cannot begin until one minute has passed after disconnecting power to the SDM. If the airbags are disconnected, service can begin immediately without waiting for one-minute time period to expire. Failure to temporarily disable the SRS during service result in unexpected deployment, personal injury, and otherwise unneeded SRS repair.

1. Disconnect the negative battery cable.
2. Remove the glove box. Refer to *Section 9E, Instrumentation/Driver Information.*
3. Disconnect the passenger airbag yellow electrical connector.
4. Remove the six mounting bolts form the airbag bracket.

Installation Notice

Tightening Torque	11 N·m (97 lb–ft)

5. Remove the passenger airbag module from the instrument panel by pushing upward.
6. Installation should follow the removal procedure in the reverse order.

FRONT SEAT BELT PRETENSIONER

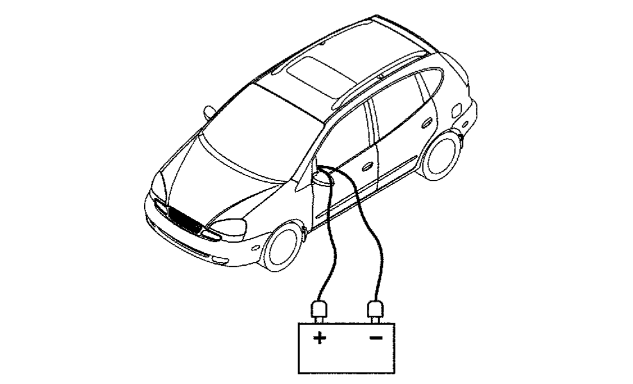
For removal and installation refer to *Section 8A, Seat Belts.*

AIRBAG MODULE DEPLOYMENT (IN VEHICLE)

Deploy airbags before disposing of them. If a vehicle to be scraped, the airbag may be deployed inside the vehicle.

Caution: To avoid injury while deploying an airbag or a pretensioner in the vehicle, observe the following precaution:

- Before deploying the airbags, remove all loose objects from the airbag's expansion area.
- Deploy the airbags with the vehicle doors closed and the side windows open.
- Deploy the airbags only in an evacuated area. Service personnel who must be present during the deployment should be at least 10 meters (33 feet) in front of the vehicle.
- Do not connect the voltage source until after having completed all other preparations for the deployment of the airbags.
- Allow a deployed airbag module or pretensioner to cool for at least 30 minutes before handling.
- Wear gloves and eye protection during the disposal procedure.
- If the deployment fails, disconnect the voltage source and wait 5 minutes before approaching the vehicle.



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Deployment Procedure

Caution: The SDM can maintain sufficient voltage to deploy the airbags for 0.15 seconds after the Ignition is OFF and the airbag fuse has been removed. If the airbags are not disconnected, service cannot begin until one minute has passed after disconnecting power to the SDM. If the airbags are disconnected, service can begin immediately without waiting for one-minute time period to expire. Failure to temporarily disable the SRS during service result in unexpected deployment, personal injury, and otherwise unneeded SRS repair.

1. Disconnect both battery cables and place the battery at least 10 meters (33 feet) from the vehicle.
2. Remove the driver side knee bolster or instrument panel lower cover from the steering column. Refer to *Section 9G, Interior **Trim**.*
3. At the lower steering column, cut the two wires leading from the supplemental restraint system (SRS) harness to the clock spring.
4. Strip 13 mm (0.5 inch) of the insulation from the end of the wires leading to the clock spring.
5. Use two additional wires, each at least 10 meters (33 feet) long, to reach from the deployment battery to the inflator module.
6. Strip 13 mm (0.5 inch) of the insulation from the ends of these two additional wires.
7. Twist the two wires together at one end.
8. Place the twisted ends of the two wires near the deployment battery. Do not connect the wires to the battery at this time.
9. Using the free ends of the 10 meters (33 feet) wires leading to the clock spring, make two splices, one at each wires from the airbag modules.
10. Wrap the wires with insulation tape.
11. Now that the free ends of the 10 meters (33 feet) wires are spliced to the airbag module wires, and the ends that are twisted together are near the deployment battery, clear the area.
12. Untwist the wires that near the deployment battery.
13. Touch one wire to the positive battery terminal and touch the other wire to the negative battery terminal. The airbag will deploy.
14. Repeat the procedure for the passenger airbag and pretensioners.
15. Using proper precautions, dispose of the deployed airbag/pretensioner. Refer to “Deployed Airbag Module Disposal Procedure” in this section.

AIRBAG MODULE DEPLOYMENT (OUTSIDE OF VEHICLE)

If the vehicle is within the warranty period, contact the Daewoo regional service manager for approval or special instructions before deploying the airbag modules.

Deploy airbag modules in following situations:

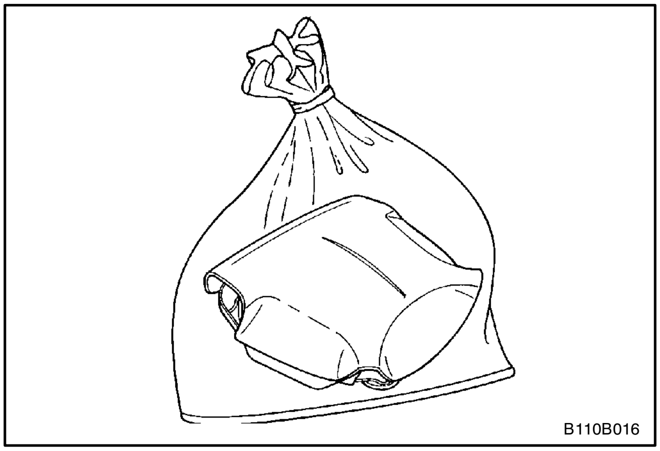
- If the vehicle is to be scrapped. Refer to “Airbag Module Deployment (Inside of Vehicle)” in this section.
- If an airbag module is damaged during transit, storage, or service.

Caution: to avoid injury while deploying an airbag module or pretensioner outside the vehicle, observe following precaution:

- **Deploy the airbags only in an evacuated area. Service personnel who must be present during the deployment should be at least 10 meters (33 feet) in front of the airbag module.**

- **Do not connect the voltage source until after having completed all other preparations for the deployment of the airbags.**
- **Allow a deployed airbag module or pretensioner to cool for at least 30 minutes before handling.**
- **Wear gloves and eye protection during the disposal procedure.**
- **If the deployment fails, disconnect the voltage source and wait 5 minutes before approaching the vehicle.**

1. Position the airbag module face up, on flat ground outdoors, at least 10 meters (33 feet) from the any obstacles or people.
2. Place a vehicle battery at least 10 meters (33feet) away from the airbag module.
3. Deploy the airbag module using the deployment tool.
4. If you do not have deployment tool follow below procedure.
5. Cut the yellow wires to the airbag module/pretensioner.
6. Strip 13 mm (0.5 inch) of the insulation from the end of the wires leading to the airbag module/pretensioner.
7. Use two additional wires, each at least 10 meters (33 feet) long, to reach from the deployment battery to the airbag module/pretensioner.
8. Strip 13 mm (0.5 inch) of the insulation from the ends of these two additional wires.
9. Twist the two wires together at one end.
10. Place the twisted ends of the two wires near the deployment battery. Do not connect the wires to the battery at this time.
11. Using the free ends of the 10 meters (33 feet) wires leading to the airbag module/pretensioner, make two splices, one at each wires from the airbag module/pretensioner.
12. Wrap the splices with insulating tape.
13. Now that the free ends of the 10 meters (33 feet) wires are spliced to the airbag module/pretensioner wires, and the ends that are twisted together are near the deployment battery, clear the area.
14. Untwist the wires that near the deployment battery.
15. Touch one wire to the positive battery terminal and touch the other wire to the negative battery terminal. The airbag module/pretensioner will deploy.
16. Using proper precautions, dispose of the deployed airbag module/pretensioner. Refer to “Deployed Airbag Module Disposal Procedure” in this section.



DEPLOYED AIRBAG MODULE DISPOSAL PROCEDURE

Caution: After deployment, a powdery residue may be on the surface of the airbag. The powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by-products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by-product of the deployment reaction. The sodium hydroxide then quickly reacts with atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate 9also known as baking soda). Therefore, it is unlikely that sodium hydroxide will be present after deployment.

Caution: Wear gloves and eye protection during the disposal procedure.

Caution: After deployment, the metal surfaces of the airbag module will be hot. In order to avoid the risk of an injury or a fire, do not place the deployed airbag module near any flammable objects, and allow the airbag module to cool for 30 minutes before handling.

Deploy an airbag or pretensioner before disposing of it. This includes those in a whole vehicle being scrapped. If the vehicle is still within the warranty period contact the Daewoo regional service manager for approval or special instructions before deploying an airbag module or a pretensioner. Deployed airbag module or pretensioner should be disposed of in the same manner as other scrap parts, with the addition of the following steps:

1. Place the deployed airbag or pretensioner in a sturdy plastic bag.
2. Seal the plastic bag securely.
3. Wash your hands and rinse them with water after handling a deployed airbag.

SRS WIRING REPAIR

Connector Repair

Caution: Before attempting any repairs, the SRS must be disabled. Refer to "Disabling the SRS" in this section for instructions on how to disable the SRS.

The terminals in the SRS are made of special metal to provide necessary contact integrity for the sensitive, low-energy circuits. These terminals are available only in connector repair assembly packs. Do not substitute any other terminals for those in the assembly packs.

Wire Repair

Caution: Before attempting any repairs, the SRS must be disabled. Refer to "Disabling the SRS" in this section for instructions on how to disable the SRS.

Do not repair any wires of supplemental restraint system (SRS). Replace any damaged wires with new one.

SPECIFICATIONS

GENERAL SPECIFICATION

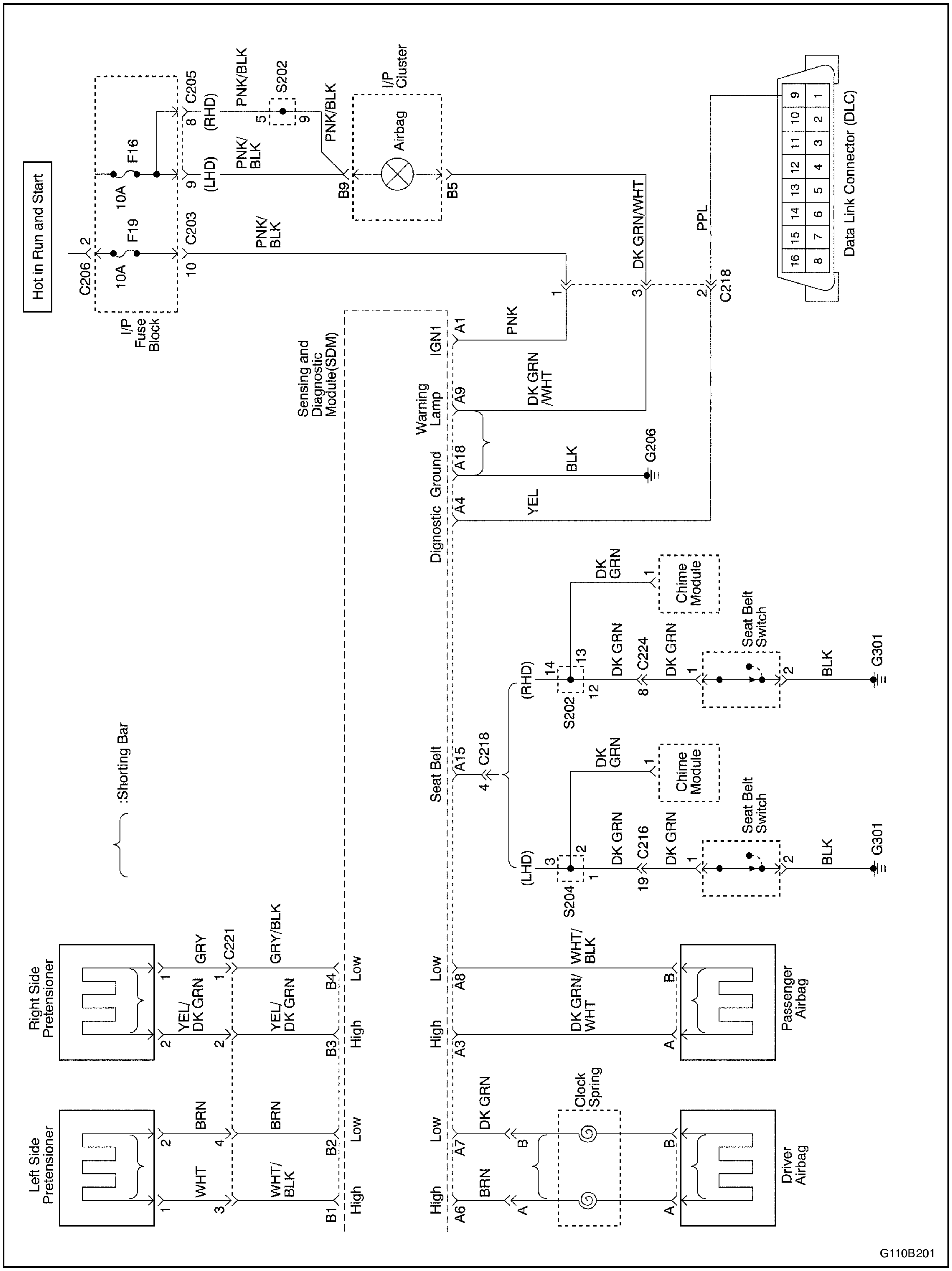
Application	Description
Airbag System Deployment Time	< 20ms
Detection Time	< 5ms
Operating Temperature	– 40°C – + 85°C
Storage Temperature	– 40°C – + 90°C
Airbag Replacement interval	Every 10–year after installation
Voltage Range	9 – 16 V
Current Consumption	5 ms after ignition switch ON < 1A 5ms – 5sec< 300mA, after 5sec. < 100mA
Acceleration Range	+/– 50g
Maximum Acceleration	+/– 600g pulse
Voltage Ramp	0.2 – 2.0 V/s
Energy Reservation	150ms after battery disconnection
Inflator Ignition Energy	4.3mJ
Squib Resistance	2.15 +/– 0.35**W**
Airbag Warning Lamp ON Time(When Ignition ON)	6sec

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Clock Spring Retaining Screws	3	–	27
Driver Airbag Module Mounting Bolts	8	–	71
Passenger Airbag Module Mounting Bolts	11	–	97
Sensing and Diagnostic Module(SDM) Mounting Bolts	10	–	89

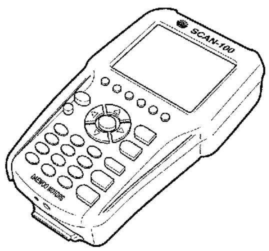
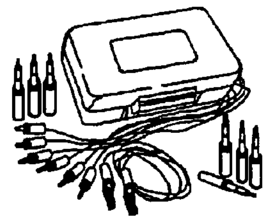
SCHEMATIC AND WIRING DIAGRAMS

SUPPLEMENTAL RESTRAINT SYSTEM



SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 E103A101	SCAN 100 Scan Tool	 A410B027	J–35616–A Connector Test Adapter Kit

SECTION 9A

BODY WIRING SYSTEM

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

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SPECIFICATIONS

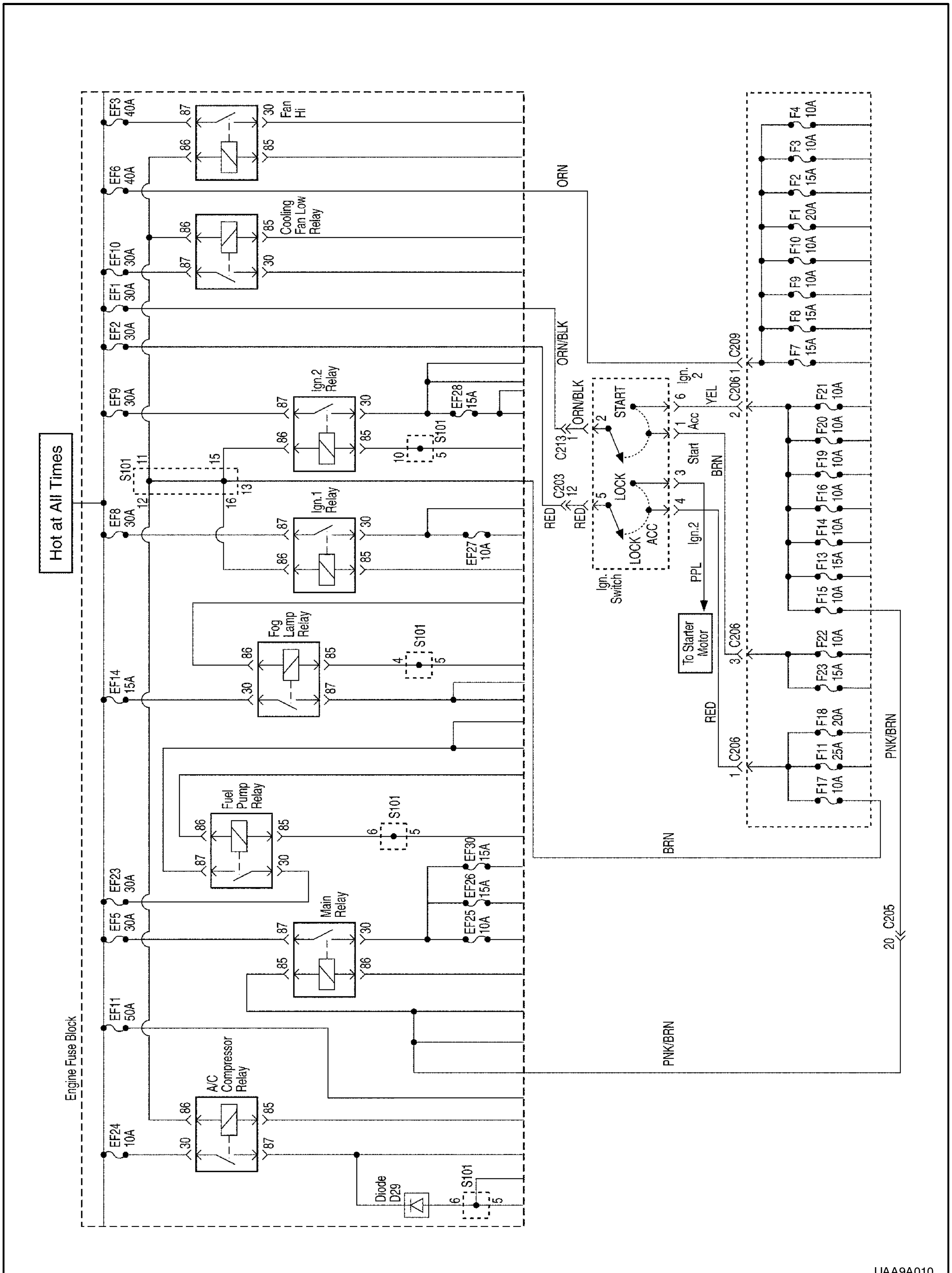
WIRE COLOR CHART

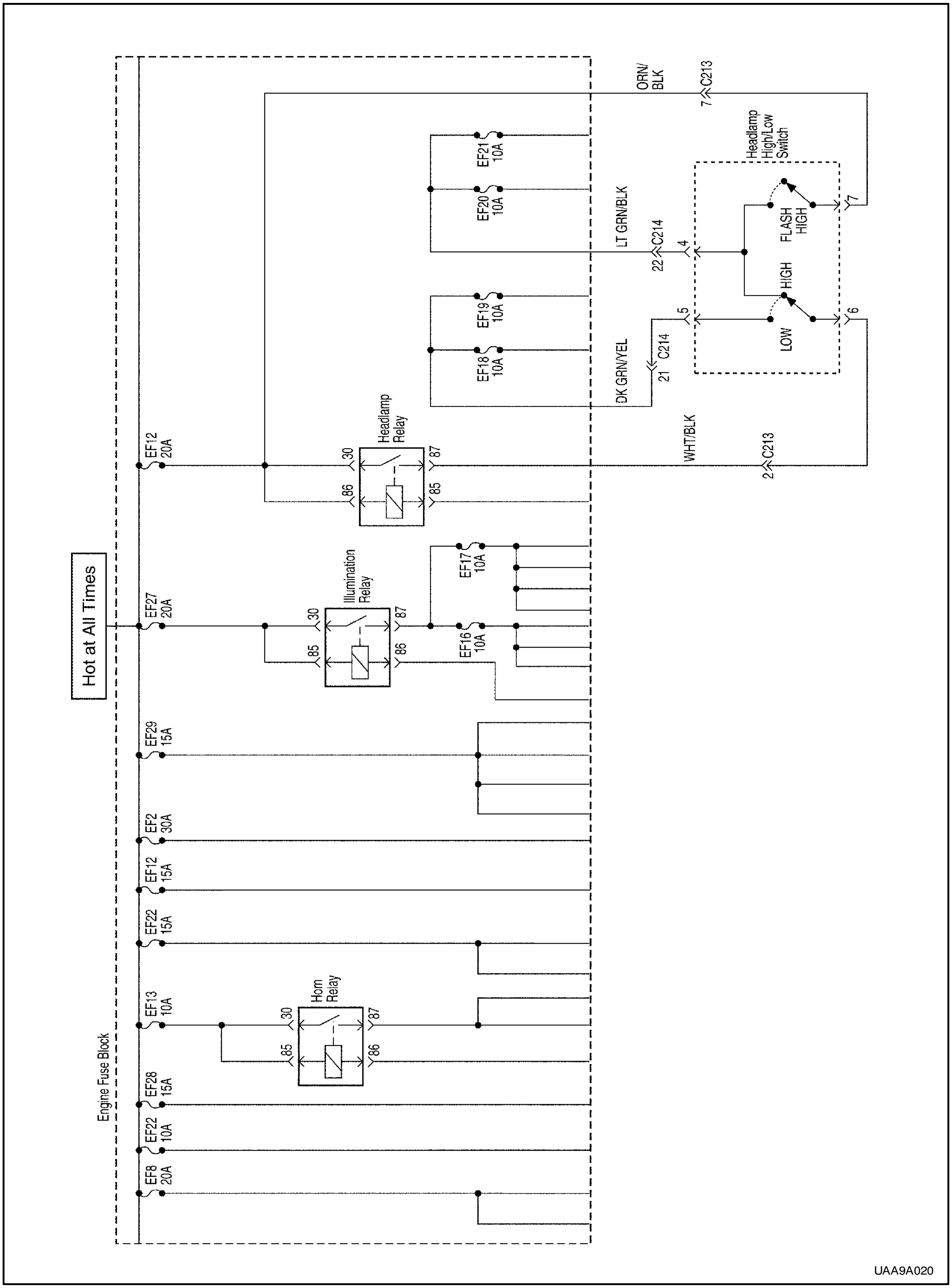
Wire Color	Abbreviation On Schematic
Green	DK GRN
Light Green	LT GRN
Blue	DK BLU
Brown	BRN
Orange	ORN
Yellow	YEL
Grey	GRY
Sky Blue	LT BLU
Red	RED
Black	BLK
Pink	PNK
White	WHT
Purple	PPL

Wires With Tracers

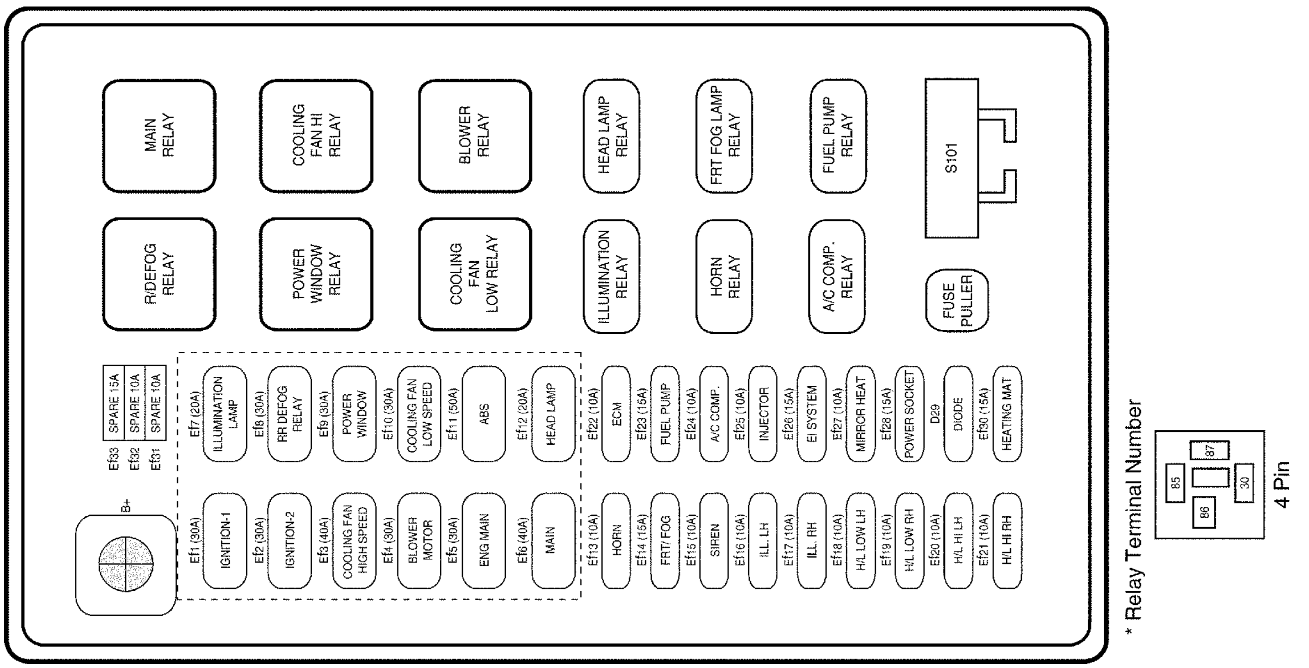
Wire Color	Abbreviation On Schematic
Red with White Tracer	RED/WHT

SCHEMATIC AND ROUTING DIAGRAMS




POWER DISTRIBUTION SCHEMATIC (Cont'd)
Hot at All Times
Engine Fuse Block
EF8 20A
EF22 10A
EF28 15A
EF13 10A
Horn Relay
30
85
87
86
EF22 15A
EF12 15A
EF2 30A
EF29 15A
EF27 20A
Illumination Relay
EF16 10A
EF17 10A
EF12 20A
Headlamp Relay
EF18 10A
EF19 10A
EF20 10A
EF21 10A
ORN/BLK
C213
LT GRN/BLK
C214
DK GRN/YEL
WHT/BLK
Headlamp High/Low Switch
FLASH HIGH
HIGH
LOW
UAA9A020

FUSE BLOCK LOCATOR (ENGINE)



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FUSE BLOCK LOCATOR (I/P)

F1 (20A) SUN ROOF	F7 (15A) DOOR LOCK UNIT	F13 ALTERNATOR	F19 (10A) SDM
F2 (15A) STOP LAMP	F8 (15A) HAZARD	F14 (10A) BACK UP LAMP	F20 (10A) TURN SIGNAL LAMP
F3 (10A) ROOM LAMP	F9 (10A) TCM	F15 (10A) TCM	F21 (10A) IMMOBILIZER
F4 (10A) DLC	F10 (10A) AUDIO	F16 (10A) CLUSTER	F22 (15A) AUDIO
F5	F11 (25A) WIPER	F17 (10A) RELAY IGN	F23 (15A) CIGAR LIGHTER
F6	F12	F18 (20A) A/C	F24

UAA9A040

FUSE CHART

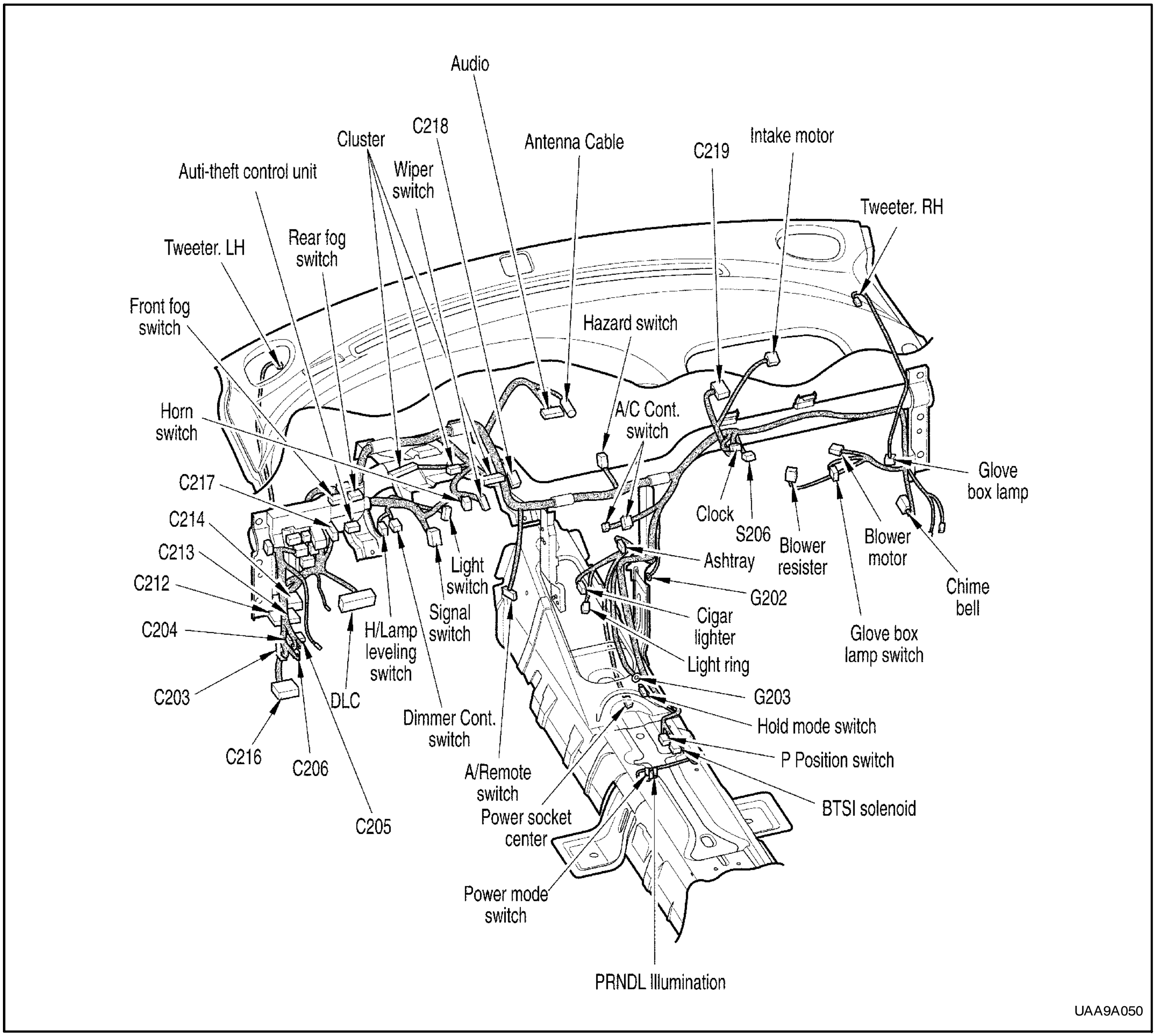
Fuses in Engine Room Fuse Block

Power Supply	*Classification*	Fuse No	Capacity	Usage
30 BAT (+)	SB (Slow–Blown Fuse)	Ef 1	30A	Ignition–1 (Key)
		Ef 2	30A	Ignition–2 (Key)
		Ef 3	20A	Cooling Fan High Speed
		Ef 4	30A	Blower Relay
		Ef 5	20A	Main Relay
		Ef 6	40A	I/P Fuse Block (F1~F10)
		Ef 7	20A	Illumination Relay
		Ef 8	30A	Rear Defog Relay
		Ef 9	30A	Power Window
		Ef 10	30A	Cooling Fan Low Speed
		Ef 11	50A	ABS
		Ef 12	20A	Head Lamp Low
	Blade Type Fuse	Ef 13	10A	Horn Relay
		Ef 14	15A	Front Fog Relay
		Ef 15	10A	Siren
Illumination (58)		Ef 16	10A	Illumination LH
		Ef 17	10A	Illumination RH
30 BAT (+)		Ef 18	10A	Head Lamp Low LH
		Ef 19	15A	Head Lamp Low RH
		Ef 20	10A	Head Lamp High LH
		Ef 21	10A	Head Lamp High RH
		Ef 22	–	Not used
30		Ef 23	15A	Fuel Pump Relay
		Ef 24	10A	A/C Comp. Relay
IGN 1 (15)		Ef 25	10A	Injector (2.0 DOHC)
		Ef 25	10A	ECM (1.8 SOHC)
		Ef 26	15A	DIS (2.0 DOHC)
		Ef 26	10A	Injector (1.8 SOHC)
IGN 2 (15A)		Ef 27	10A	Mirror Heating
		Ef 28	15A	Power Socket
Diode		D 29		A/C Compressor
IGN 1 (15)	Blade Type Fuse	Ef 30	15A	Heating Mat
SPARE		Ef 31	10A	Not Used
		Ef 32	10A	Not Used
		Ef 33	15A	Not Used

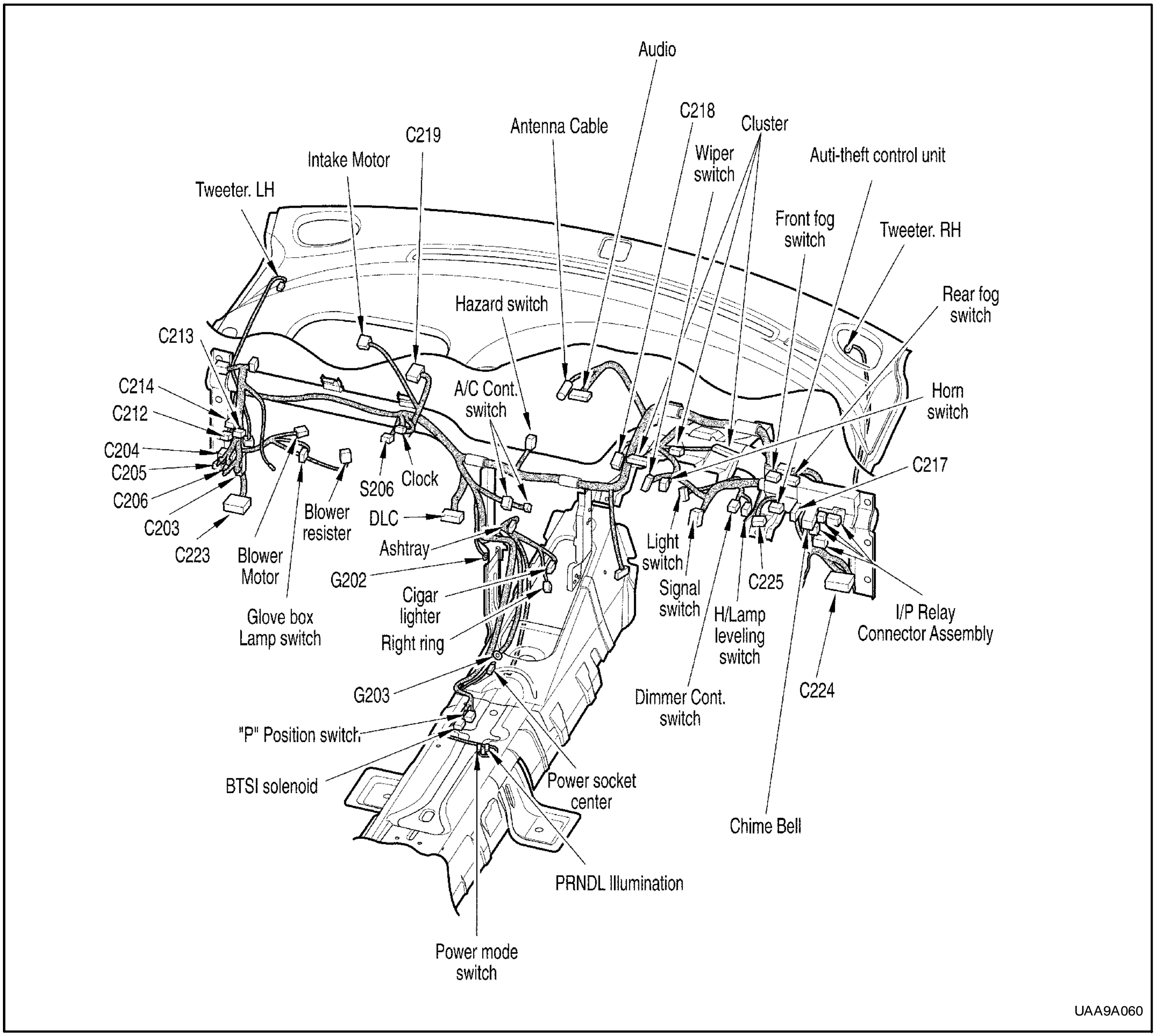
Fuses in Instrument Panel Fuse Block

Power Supply	*Classification*	Fuse No	Capacity	Usage
30 BAT (+)	Blade Type	F1	20A	Sun Roof
		F2	15A	Stop Lamp
		F3	10A	Room Lamp, Clock, Cluster, Map Lamp, Trunk Room Lamp
		F4	10A	DLC '6' Terminal
		F5	–	Not Used
		F6	–	Not Used
		F7	15A	Door Lock Unit
		F8	15A	Hazard Switch, Ultra Sonic Sensor
		F9	10A	TCM, Immobilizer, ECM
		F10	10A	Audio, ATC Control Module
IGN 2 (15A)		F11	25A	Wiper
		F12	–	Not Used
IGN 1 (15)		F13	15A	Alternator, Cam Sensor, CCCP, VSS, ECM (1.8 SOHC)
		F14	10A	Back Up Lamp, PNP Switch
		F15	10A	TCM, Cluster, PNP Switch, ECM (2.0 DOHC)
		F16	10A	Cluster, BTSI Solenoid, Chime Bell, Clock
IGN 2 (15A)		F17	10A	Ignition 2 Relay, ABS Module
		F18	20A	A/C
IGN 1 (15)		F19	10A	SDM
		F20	10A	Turn Signal Lamp
		F21	10A	Immobilizer
ACC (15C)		F22	15A	Audio
		F23	15A	Cigar Lighter, Power Socket Center
		F24	–	Not Used

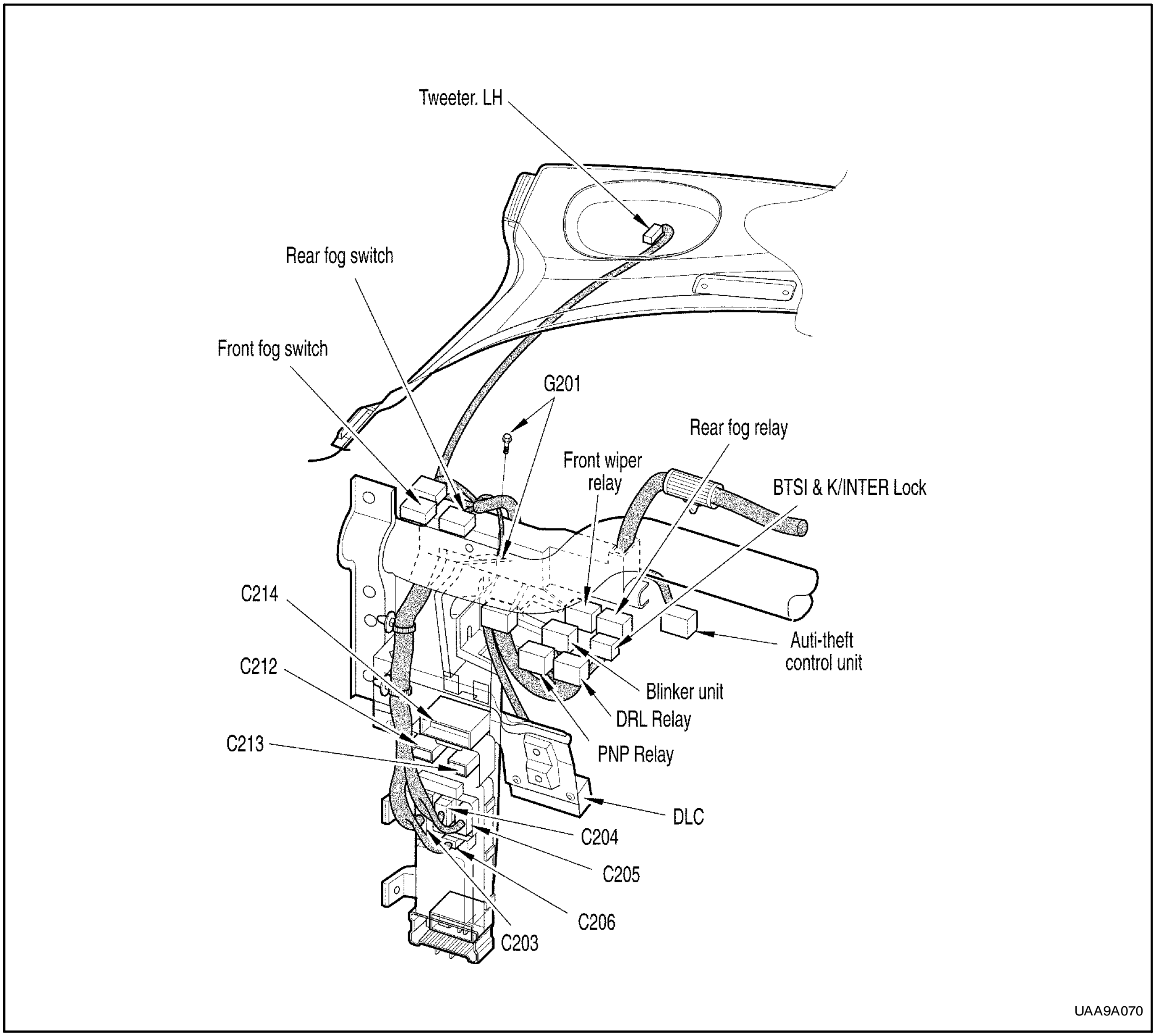
LEFT-HAND DRIVE INSTRUMENT HARNESS ROUTING



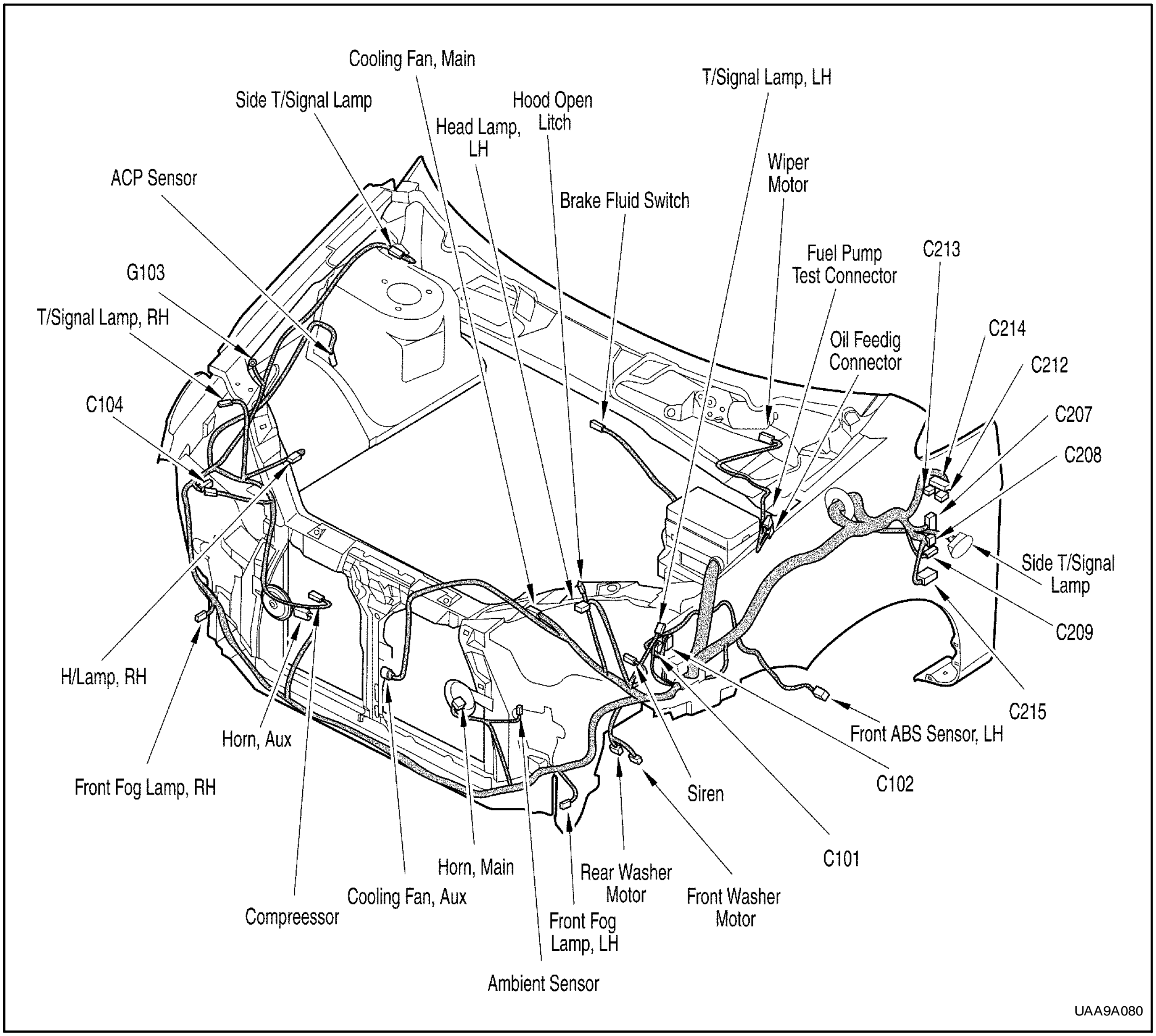
RIGHT-HAND DRIVE INSTRUMENT HARNESS ROUTING



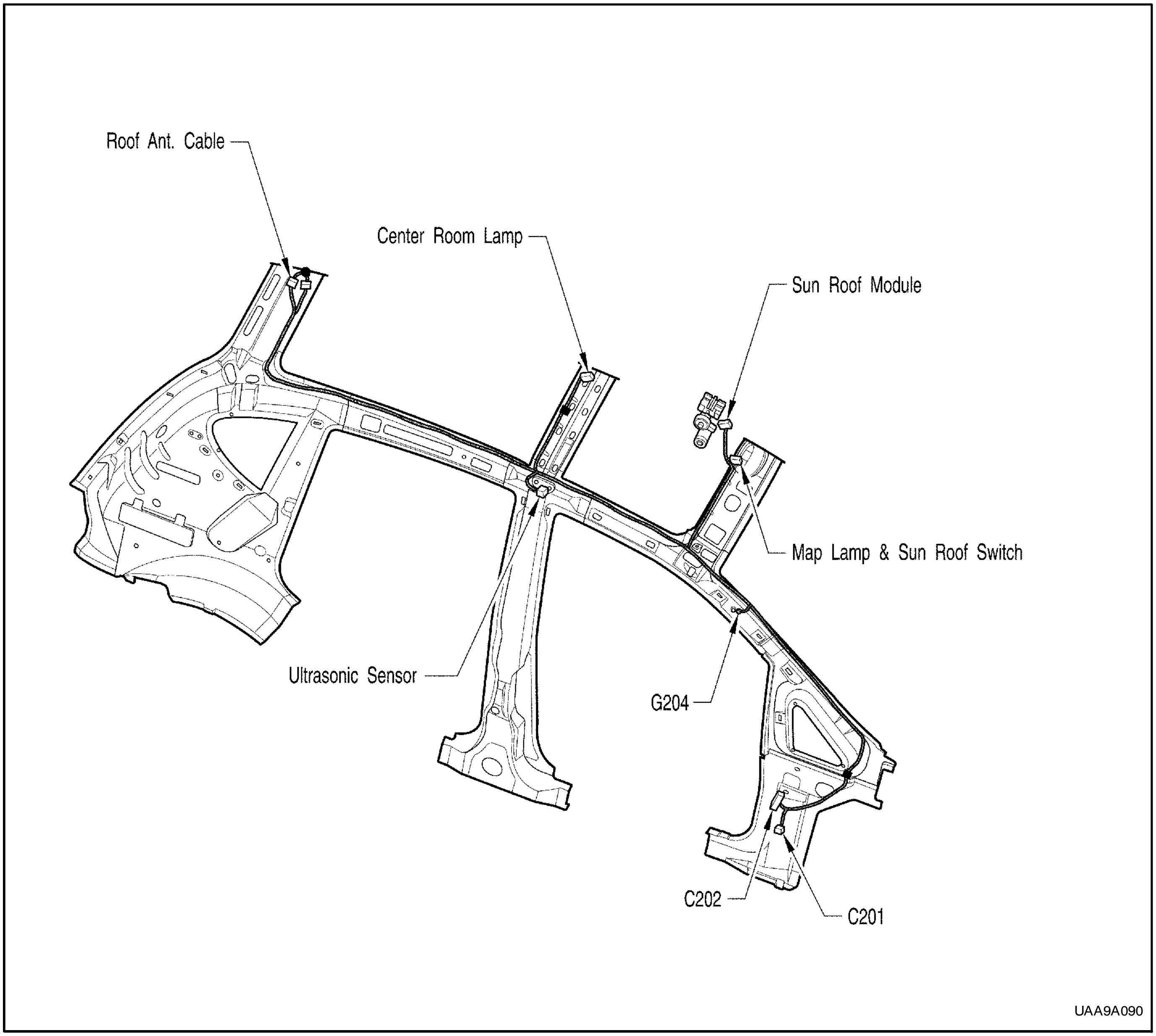
INSTRUMENT PANEL FUSE BLOCK HARNESS ROUTING



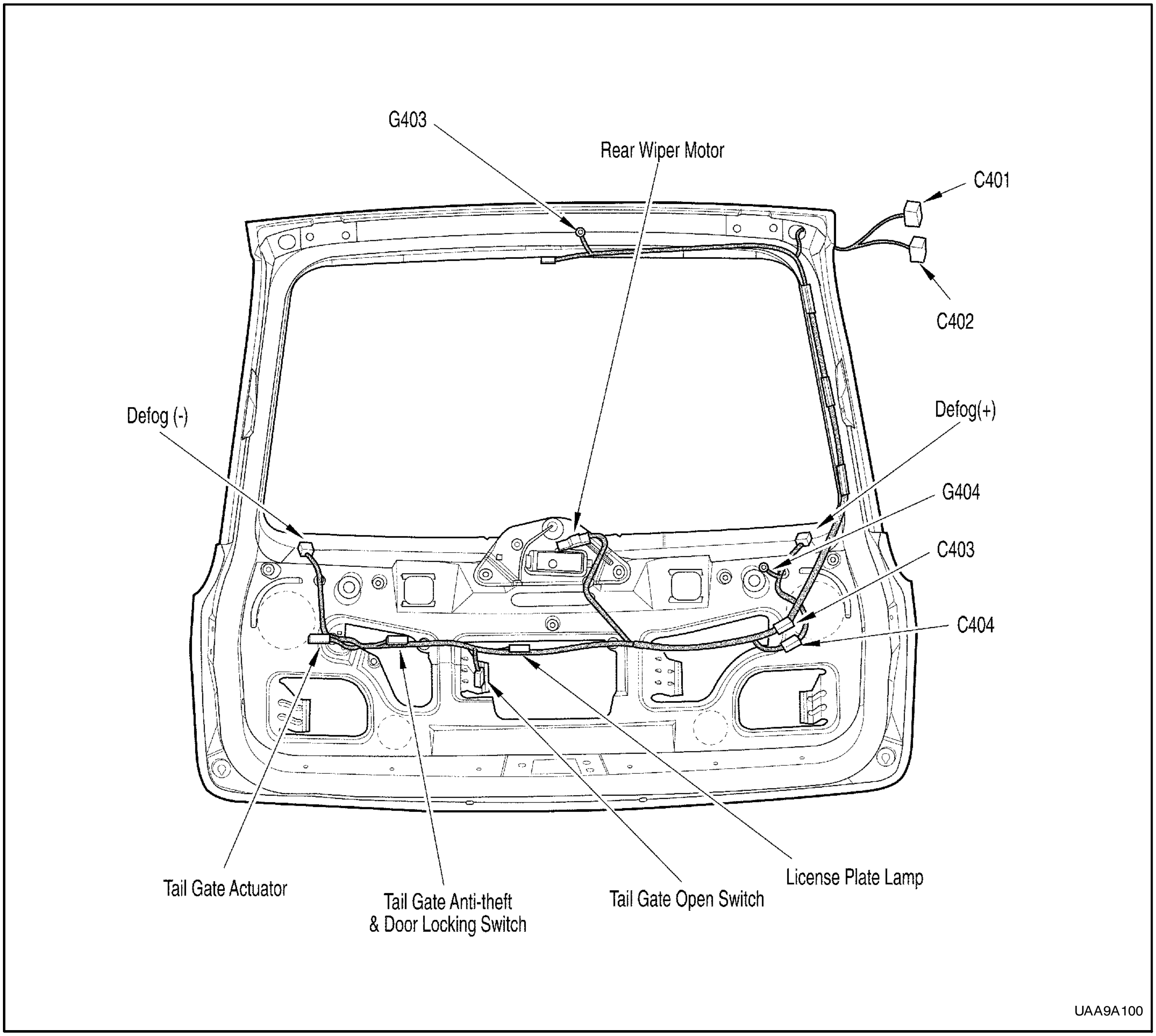
FRONT HARNESS ROUTING



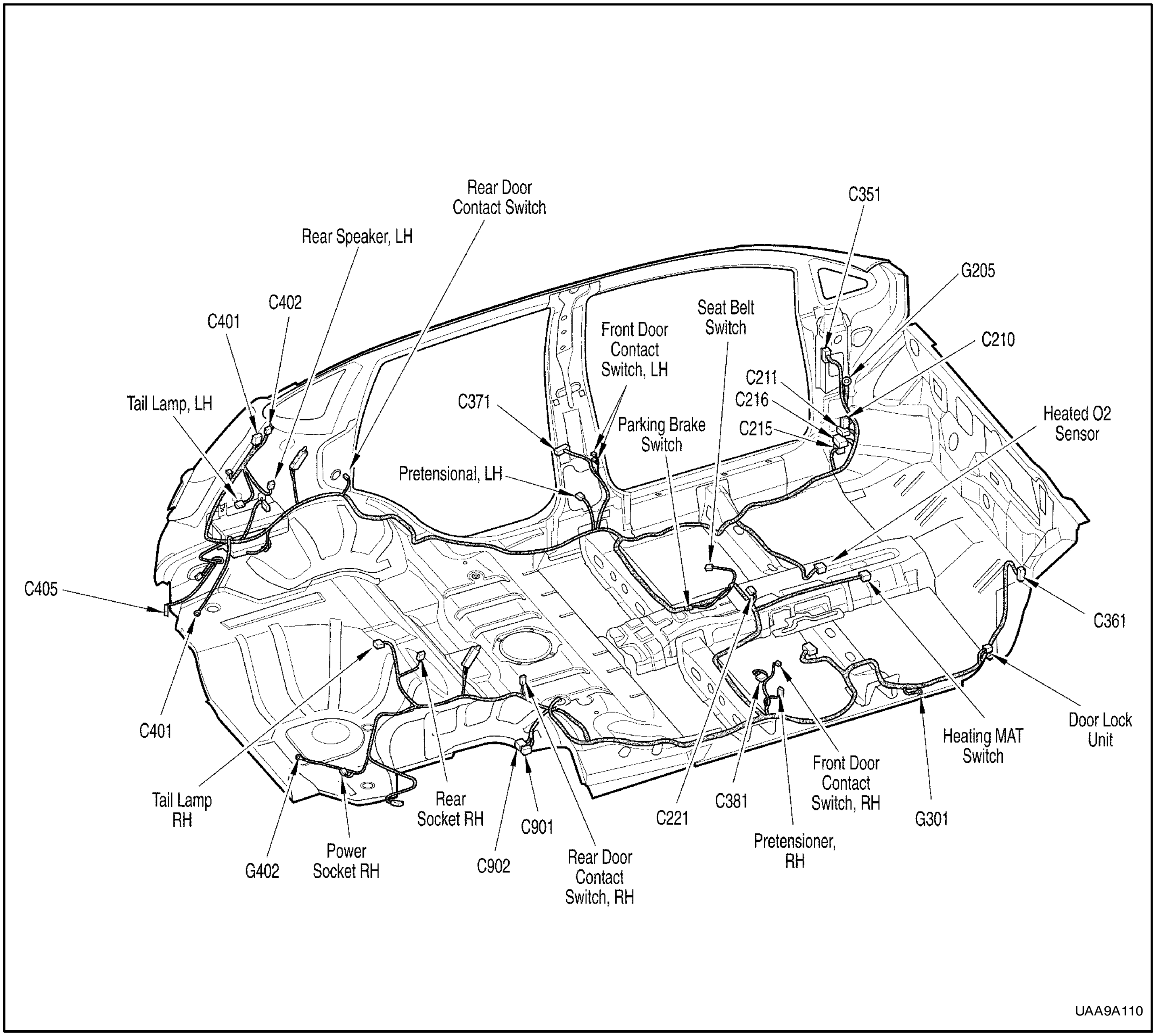
ROOF HARNESS ROUTING



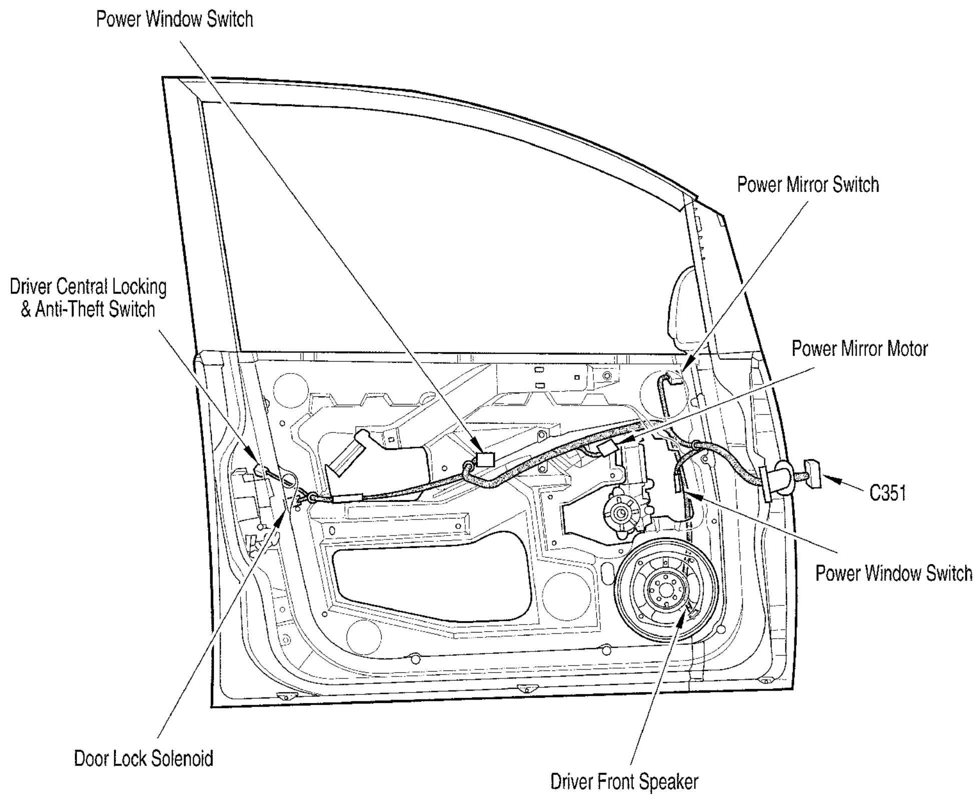
TAILGATE HARNESS ROUTING

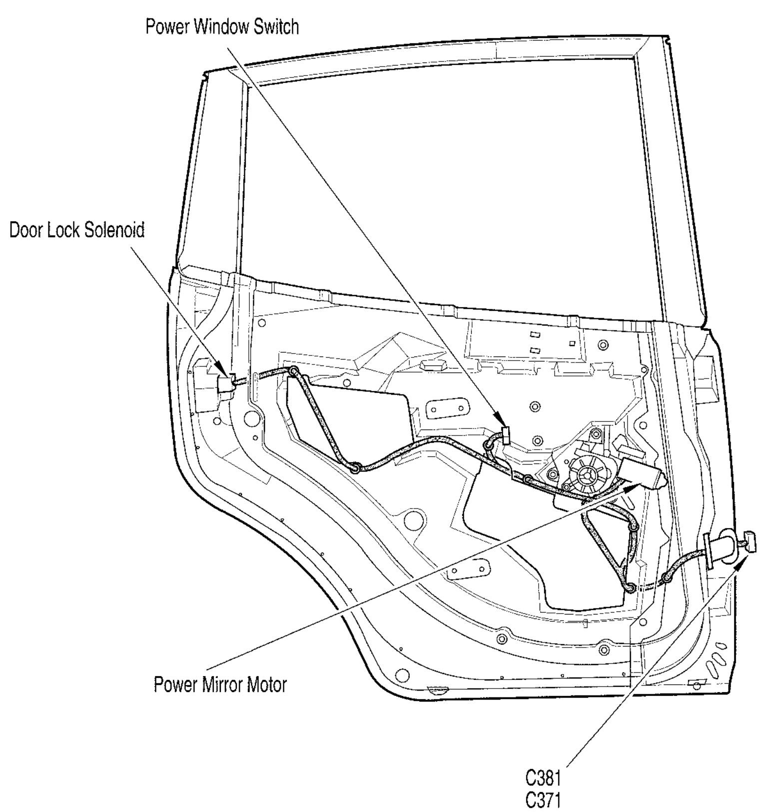


FLOOR HARNESS ROUTING



DOOR HARNESS ROUTING





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SECTION 9B

LIGHTING SYSTEMS

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

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DESCRIPTION AND OPERATION

HEADLAMPS

The headlamps are controlled by the multifunction lever located on the left side of the steering column. They will come ON with the ignition switch in any position. Turning the headlamp switch to the first position turns ON the parking lamps, the sidemarker lamps, the license plate lamps, and the instrument panel illumination. Turning the switch to the second position turns ON all of the previous lamps and the headlamps. Turning the switch to the OFF position turns OFF all the lamps.

Headlamp high beam and low beam are also controlled by this lever. When the headlamps are ON, pushing the lever away from the driver until the switch clicks changes the lamp from low beam to high beam, and returns to low beam when the lever is pulled back. Pulling the lever toward the driver also turns ON the high beam. The headlamps return to low beam when the lever is released. An indicator lamp on the instrument cluster assembly will come on when the high-beam headlamps are ON.

The headlamps must be aimed for proper illumination of the road. Headlamp aim should be checked whenever a new headlamp assembly is installed or service repairs to the front end area may have disturbed the headlamp assembly or its mountings.

PARKING AND TURN SIGNAL LAMPS

The parking lamps can be turned on by turning the lighting switch to the first position. The parking lamps can be turned OFF by turning the switch to the OFF position. If the parking lamps are ON and the ignition switch is OFF with the driver's door open, a warning tone will sound as a reminder to turn the lamps OFF.

The front, side, and rear turn signals are controlled by the lighting switch on the left side of the steering column. Moving the lever all the way up or down (past the detent) will turn ON the turn signals. When the turn is completed, the lever will return to horizontal and the turn signals will stop flashing.

For changing lanes or shallow turns, where the steering wheel does not turn far enough to cancel the signal, move the signal only to the first detent and hold it there. When the lever is released, it will return to horizontal and the turn signal will cancel.

The turn signals work only when the ignition switch is ON.

FOG LAMPS

The front fog lamp switch is located on the left side cluster housing. To use the front fog lamps, turn ON the headlamps or the parking lamps; then push the appropriate fog lamp switch.

The front fog lamps should not be used as a substitute for the headlamps.

The indicator light in the instrument cluster will illuminate to indicate that the fog lamps are ON. Push the switch again to turn OFF the fog lamps. The indicator light will then go off.

The front fog lamps must be aimed for proper illumination of the road. Fog lamp aim should be checked when a new bulb is installed or if service or repairs in the front end area may have disturbed the fog lamp mountings.

REAR COMBINATION LAMPS

The taillamps, stoplamps, backup lamps and turn signal lamps, are one assembly and the rear fog lamps are rear bumper.

Turning ON either the headlamps or the parking lamps will also turn ON the taillamps. When the brake pedal is pushed, the taillamps will glow more brightly to serve as stoplamps.

The center high-mounted stoplamp is located in the rear window and will also come on when the brake pedal is pressed.

The turn signals are controlled by the multifunction lever on the left side of the steering column. If the brake pedal is held down when a turn is signaled, one side will flash and the other will stay bright.

When the transaxle is shifted into reverse, the backup lamps will come on. On vehicles with an automatic transaxle, the backup lamps are activated by the park/neutral position switch. On vehicles with a manual transaxle, they are activated by a backup lamp switch connected to the transaxle.

LICENSE PLATE LAMP

The license plate lamps will come on when the headlamps or the parking lamps are ON. The license plate lamps are mounted above the license plate.

INTERIOR COURTESY LAMP

The courtesy lamp is located on the headliner just behind the front seats. The lamp switch has three positions. If the switch is left in the center position, the lamp will go on whenever a door is opened and go off when it is closed. In the ON position, the lamp will stay on until it is turned off. In the OFF position, the lamp will not come on, even when a door is opened.

GLOVE BOX LAMP

The glove box lamp is located above the glove box. It will come on whenever the glove box is opened.

LUGGAGE COMPARTMENT LAMP

The luggage compartment lamp will come on whenever the tailgate is opened.

DIAGNOSTIC INFORMATION AND PROCEDURES

HEADLAMPS

Low-Beam Headlamps Are Inoperative, High-Beam Headlamps Are OK

Step	Action	Value(s)	Yes	No
1	Check fuses EF18 (left side headlamps) and EF19 (right side headlamps). Is fuse EF18 or EF19 blown?	–	Go to *Step 2*	Go to *Step 3*
2	1. Check for a short circuit and repair if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
3	Check the voltage at fuses EF18 and EF19. Does the voltage available at fuses EF18 and EF19 equal the value specified?	11-14 v	Go to *Step 4*	Go to *Step 9*
4	1. Disconnect both headlamp connectors. 2. Turn the headlamps ON. 3. Select the low beams. Does the voltage at each headlamp connector terminal 5 equal the value specified?	11-14 v	Go to *Step 6*	Go to *Step 5*
5	Repair the open circuit between fuses EF18 or EF19 and the low beam headlamps. Is the repair complete?	–	System OK	–
6	1. Disconnect the headlamp connectors. 2. Connect an ohmmeter between ground and either headlamp connector terminal 6. Is the resistance equal to the value specified?	0 Ω	Go to *Step 8*	Go to *Step 7*
7	Repair the ground circuit. Is the repair complete?	–	System OK	–
8	Replace the faulty headlamps. Is the repair complete?	–	System OK	–
9	1. Disconnect the headlamp combination switch connector C1. 2. Select the low beams. 3. Use an ohmmeter to check the continuity between terminals 6 and 5 of the headlamp combination switch. Does the ohmmeter indicate the value specified?	0 Ω	Go to *Step 10*	Go to *Step 11*
10	Replace the headlamp combination switch. Is the repair complete?	–	System OK	–
11	Repair the open circuit between fuses EF18 and EF26 and the headlamp combination switch connector C1 terminal 5. Is the repair complete?	–	System OK	–

High-Beam Headlamps Are Inoperative, Low-Beam Headlamps Are OK

Step	Action	Value(s)	Yes	No
1	Check the high-beam headlamps in the “flash-to-pass” mode. Do the high-beam headlamps work in the “flash-to-pass” mode?	–	Go to *Step 8*	Go to *Step 2*
2	Check fuses EF20 and EF21. Is either fuse blown?	–	Go to *Step 3*	Go to *Step 4*
3	1. Check for a short circuit. Repair it if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
4	1. Turn the high-beam headlamps ON. 2. Check the voltage at fuses EF20 and EF21. Does the voltage available at fuses EF20 and EF21 equal the value specified?	11-14 v	Go to *Step 5*	Go to *Step 10*
5	1. Turn the high-beam headlamps ON. 2. Check the voltage at headlamp terminal 4 with high beams selected. Does the voltage available at the headlamp connector terminal 4 equal the value specified?	11-14 v	Go to *Step 7*	Go to *Step 6*
6	Repair the open circuit between fuse EF20 or EF21 and the high-beam headlamps. Is the repair complete?	–	System OK	–
7	Replace the faulty headlamps. Is the repair complete?	–	System OK	–
8	1. Disconnect the headlamp combination switch connector. 2. Put the switch in the high-beam position. 3. Use an ohmmeter to check the continuity of the headlamp switch between terminals 7 and 4. Does the ohmmeter indicate the specified value?	0 Ω	Go to *Step 10*	Go to *Step 9*
9	Replace the headlamp combination switch. Is the repair complete?	–	System OK	–
10	Repair the open circuit between headlamp combination switch connector C1 (terminal 4) and fuse EF20 or EF21. Is the repair complete?	–	System OK	–

High-Beam and Low-Beam Headlamps Are Inoperative On Both Left and Right Sides

Step	Action	Value(s)	Yes	No
1	Check fuses EF12, EF20, EF21, EF18, EF19. Is any fuse blown?	–	Go to *Step 2*	Go to *Step 3*
2	1. Check for a short circuit and repair if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
3	1. Turn the low-beam headlamps ON. 2. Check the voltage at fuses EF18 and EF19. 3. Check the voltage at fuses EF20 and EF21 with high beams selected. Does the voltage at the headlamps equal the value specified?	11-14 v	Go to *Step 4*	Go to *Step 9*
4	1. Turn the low-beam headlamps ON. 2. Check the voltage at the headlamp connector terminal 5. 3. Turn the high-beam headlamps ON. 4. Check the voltage at headlamp connector terminal 4. Does the battery voltage available at the headlamps equal the value specified?	11-14 v	Go to *Step 6*	Go to *Step 5*
5	Repair the open circuit between fuses EF20, EF21, EF18, and EF19 and the headlamps. Is the repair complete?	–	System OK	–
6	Use an ohmmeter to check between ground and the headlamp connector terminal 6. Is the resistance equal to the specified value?	0 Ω	*Go to Step 8*	*Go to Step 7*
7	Repair the ground circuit. Is the repair complete?	–	System OK	–
8	1. Replace the faulty headlamps. 2. Check the charging system to make sure that charging voltage is not excessively high. Repair if necessary. Is the repair complete?	–	System OK	–
9	Use a voltmeter to check for power to the fuses EF12. Does the voltage at fuses EF12 equal the value specified?	11-14 v	Go to *Step 11*	Go to *Step 10*
10	Repair the power supply circuit to the fuses EF12. Is the repair complete?	–	System OK	–
11	Temporarily substitute the illumination relay in place of the headlamp relay. Do the headlamps operate with the substituted relay?	–	Go to *Step 12*	Go to *Step 13*
12	Install the illumination relay in its original position, and install a new headlamp relay. Is the repair complete?	–	System OK	–
13	1. Return the illumination relay to its original position, but do not install the headlamp relay. 2. Use a voltmeter to check the headlamp relay connector for terminal 30. Does the voltmeter indicate the value specified?	11-14 v	Go to *Step 15*	Go to *Step 14*

High-Beam and Low-Beam Headlamps Are Inoperative On Both Left and Right Sides (Cont'd)

Step	Action	Value(s)	Yes	No
14	Replace the engine fuse block. Is the repair complete?	–	System OK	–
15	With the headlamp relay removed, use a voltmeter to check the headlamp relay connector for terminal 86. Does the voltmeter indicate the value specified?	11-14 v	Go to *Step 16*	Go to *Step 14*
16	1. With the headlamp relay removed, turn the headlamp switch to the low-beam position. 2. Use an ohmmeter to check the continuity between the connector for relay terminal 85 and ground. Does the ohmmeter indicate the specified value?	≈0 **W**	Go to *Step 22*	Go to *Step 17*
17	1. Reinstall the headlamp relay. 2. Check the voltage at the headlamp switch connector C2 terminal 1. Does the voltage equal the specified value?	11-14 v	Go to *Step 19*	Go to *Step 18*
18	Repair the open circuit between headlamp relay terminal 85 and the headlamp switch connector C2 terminal 1. Is the repair complete?	–	System OK	–
19	1. Disconnect the headlamp switch connector C2. 2. Turn the headlamps to the low-beam position. 3. Use an ohmmeter to check the continuity between terminals 1 and 2 of headlamp combination switch C2. Does the ohmmeter indicate the specified value?	≈0 **W**	Go to *Step 21*	Go to *Step 20*
20	Replace the headlamp switch. Is the repair complete?	–	System OK	–
21	Repair the open circuit between terminal 2 of headlamp switch connector C2 and ground. Is the repair complete?	–	System OK	–
22	Check the voltage at headlamp switch connector C1, terminal 6. Does the voltage equal the specified value?	11-14 v	Go to *Step 24*	Go to *Step 23*
23	Repair the open circuit between headlamp switch connector C1 and terminal 87 of the headlamp relay. Is the repair complete?	–	System OK	–
24	1. Disconnect headlamp switch connector C1. 2. Turn the headlamps to the low-beam position. 3. Connect an ohmmeter between terminals 5 and 6 of headlamp switch connector C1. Observe the reading on the ohmmeter. 4. Turn the headlamps to the high-beam position. 5. Connect an ohmmeter between terminals 4 and 6 of the headlamp switch. Observe the reading on the ohmmeter. Does the ohmmeter show the specified value for both of the tests?	≈0 **W**	Go to *Step 25*	Go to *Step 20*
25	Repair the open circuit between the headlamp switch and fuses EF30, EF21, EF18, and EF19. Is the repair complete?	–	System OK	–

HEADLAMP LEVELING

Headlamps Leveling System Does Not Work

Step	Action	Value	Yes	No
1	Check the headlamps. Do the headlamps work?	–	Go to *Step 3*	Go to *Step 2*
2	Repair the headlamp system before completing this diagnostic table. Has the headlamp system been repaired?	–	Go to *Step 3*	–
3	Check fuses EF18 and EF19. Is either of the fuses blown?	–	Go to *Step 5*	Go to *Step 4*
4	1. Check for a short circuit and repair if necessary. 2. Replace the blown fuse. Is the repair complete?	–	System OK	–
5	1. Turn the headlamps ON. 2. Check the voltage at fuses EF18 and EF19. Is the specified voltage available at the fuses?	11-14 v	Go to *Step 7*	Go to *Step 6*
6	Repair the open circuit between the headlamp switch and fuses EF18 and EF19. Is the repair complete?	–	System OK	–
7	1. Disconnect the electrical connectors at the headlamp leveling motors. 2. Turn the headlamps ON. 3. Check the voltage at terminal C of the headlamp leveling motors. Is the specified voltage available at both headlamp leveling motors?	11-14 v	Go to *Step 9*	Go to *Step 8*
8	Repair the open circuit between fuses EF18 and EF19 and the headlamp leveling motors. Is the repair complete?	–	System OK	–
9	With the headlamp leveling motors disconnected, check the resistance between ground and terminal A of the headlamp leveling motor connector. Is the resistance equal to the specified value?	≈0 **W**	Go to *Step 11*	Go to *Step 10*
10	Repair the ground circuit for the headlamp leveling motors. Is the repair complete?	–	System OK	–
11	1. Turn the headlamps ON. 2. With the headlamp leveling motors disconnected, check the voltage at terminal B of the headlamp leveling motor connector. Is the voltage approximately equal the specified value?	6.2-10.6 v	Go to *Step 17*	Go to *Step 12*
12	1. Disconnect the headlamp leveling and dimmer control switch. 2. Turn the headlamps ON. 3. Check the voltage at the WHT/BLK wire at the headlamp leveling switch connector. Is the voltage equal to the specified value?	11-14 v	Go to *Step 14*	Go to *Step 13*
13	Repair the open circuit between the headlamp relay and the headlamp leveling and dimmer switch. Is the repair complete?	–	System OK	–

Headlamps Leveling System Does Not Work (Cont'd)

Step	Action	Value	Yes	No
14	1. Remove the headlamp leveling and dimmer switch. 2. Use an ohmmeter to check the resistance between the two terminals on the lower row of terminals. (There are three terminals on the lower row, but only two of them connect to wires at the connector. Connect the ohmmeter to the switch terminals corresponding to the WHT/BLK and BRN/WHT connector wires.) As the headlamp leveling thumbwheel is changed from position "0" to position "3," does the resistance change smoothly within the specified value?	≈440-850 **W**	Go to *Step 16*	Go to *Step 15*
15	Replace the headlamp leveling and dimmer switch. Is the repair complete?	–	System OK	–
16	Repair the open circuit between the headlamp leveling and dimmer switch and the headlamp leveling motors. Is the repair complete?	–	System OK	–
17	1. Turn the headlamps ON. 2. With the headlamp leveling motor disconnected, check voltage at terminal B of the headlamp leveling motor connector while turning the thumbwheel of the headlamp leveling switch. Does the voltage smoothly change and match the values specified?	10.5 v at position "0" to 6.5 v at position "3"	Go to *Step 19*	Go to *Step 18*
18	Replace the headlamp leveling switch. Is the repair complete?	–	System OK	–
19	Replace the headlamp leveling motor. Is the repair complete?	–	System OK	–

FOG LAMPS

Diagnostic Aids

The front fog lamp switch is powered by the headlamp switch, so the fog lamps may not operate if the headlamps or taillamps will not turn ON.

Front Fog Lamps Do Not Work on Either Side

Step	Action	Value	Yes	No
1	Check the headlamps and the exterior lamps. Are the headlamps and the exterior lamps working?	–	Go to *Step 3*	Go to *Step 2*
2	Repair the headlamps and exterior lamp systems before continuing with this diagnostic table. Is the repair complete?	–	Go to *Step 3*	–
3	Check fuse EF14 and EF17. Is fuse EF14 and EF17 blown?	–	Go to *Step 5*	Go to *Step 4*
4	1. Check for a short circuit and repair if necessary. 2. Replace fuse EF14 and EF17. Is the repair complete?	–	System OK	–
5	Use a voltmeter to check if battery voltage is available at fuse EF14 and EF17. Does the voltmeter indicate the specified value?	11-14 v	Go to *Step 7*	Go to *Step 6*
6	Repair the power supply to fuse EF14 and EF17. Is the repair complete?	–	System OK	–
7	1. Disconnect the connectors at the front fog lamps. 2. Use an ohmmeter to check the resistance between ground and the BLK wire at the fog lamps. Does the ohmmeter indicate the specified value?	≈0 **W**	Go to *Step 9*	Go to *Step 8*
8	Repair the open ground circuit for the front fog lamps. Is the repair complete?	–	System OK	–
9	1. With the fog lamps disconnected, turn the front fog lamps to the ON position. 2. Turn the headlamps ON. 3. Check the voltage at the GRY wire at the front fog lamp connectors. Is the voltage equal to the specified value?	11-14 v	Go to *Step 10*	Go to *Step 11*
10	Replace the fog lamp bulbs. Is the repair complete?	–	System OK	–
11	1. Temporarily substitute the exterior illumination relay (taillamp relay) in place of the front fog lamp relay. 2. Turn the headlamps ON. 3. Turn the front fog lamp switch to the ON position. Do the front fog lamps work with the substituted relay?	–	Go to *Step 12*	Go to *Step 13*
12	1. Return the substituted relay to its original position. 2. Replace the front fog lamp relay. Is the repair complete?	–	System OK	–

Front Fog Lamps Do Not Work on Either Side (Cont'd)

Step	Action	Value	Yes	No
13	1. Return the substituted relay to its original position, but do not reinstall the front fog lamp relay at this time. 2. Use a voltmeter to probe each of the four terminals in the front fog lamp relay socket. Does one of the four terminals in the relay socket indicate the specified value?	11-14 v	Go to *Step 15*	Go to *Step 14*
14	Replace the engine fuse block. Is the repair complete?	–	System OK	–
15	1. Turn the headlamps ON. 2. Turn the front fog lamp switch to the ON position. 3. Probe the front fog lamp relay socket with the voltmeter. Besides the terminal which indicated battery voltage in Step 13, does another terminal in the relay socket (relay coil positive terminal) now indicate the specified value?	11-14 v	Go to *Step 21*	Go to *Step 16*
16	1. Turn the headlamps ON. 2. Check the voltage at the ORN wire at the front fog lamp switch. Does the voltmeter indicate the specified value?	11-14 v	Go to *Step 18*	Go to *Step 17*
17	Repair the open circuit between the headlamp switch and the front fog lamp switch. Is the repair complete?	–	System OK	–
18	1. With the front fog lamp switch disconnected, connect an ohmmeter between the two terminals of the front fog lamp switch. 2. Turn the front fog lamp switch to the ON position. Does the ohmmeter indicate the specified value?	0 **W**	Go to *Step 20*	Go to *Step 19*
19	Replace the front fog lamp switch. Is the repair complete?	–	System OK	–
20	Repair the open circuit between the front fog lamp switch and the front fog lamp relay. Is the repair complete?	–	System OK	–
21	Check the resistance between ground and the ground terminal at the front fog lamp relay socket. (The ground terminal at the relay socket is diagonally opposite from the relay coil positive terminal which was identified in Step 15.) Does the ohmmeter indicate the specified value?	≈0 **W**	Go to *Step 23*	Go to *Step 22*
22	Repair the ground circuit for the front fog lamp relay. Is the repair complete?	–	System OK	–
23	Repair the open circuit between the front fog lamp relay and the front fog lamps. Is the repair complete?	–	System OK	–

Rear Fog Lamps Do Not Work on Either Side

Diagnostic Aids

The rear fog lamp relay coil is powered by the headlamp relay, so the rear fog lamps may not work if the headlamps do not work.

Step	Action	Value	Yes	No
1	Check the headlamps and the exterior lamps. Are the headlamps and the exterior lamps working?	–	Go to *Step 3*	Go to *Step 2*
2	Repair the headlamps and exterior lamp systems before continuing with this diagnostic table. Is the repair complete?	–	Go to *Step 3*	–
3	1. Disconnect the connectors at the rear fog lamps. 2. Use an ohmmeter to check the resistance between ground and the BLK wire at the rear fog lamps. Does the ohmmeter indicate the specified value?	≈0 **W**	Go to *Step 5*	Go to *Step 4*
4	Repair the open ground circuit for the rear fog lamps. Is the repair complete?	–	System OK	–
5	1. With the rear fog lamps disconnected, turn the rear fog lamps to the ON position. 2. Turn the headlamps ON. 3. Check the voltage at the LT BLU/RED wire at the rear fog lamp connectors. Is the voltage equal to the specified value?	11-14 v	Go to *Step 6*	Go to *Step 7*
6	Replace the rear fog lamp bulbs. Is the repair complete?	–	System OK	–
7	1. Temporarily substitute the exterior illumination relay (taillamp relay) in place of the rear fog lamp relay. 2. Turn the headlamps ON. 3. Turn the rear fog lamp switch to the ON position. Do the rear fog lamps work with the substituted relay?	–	Go to *Step 8*	Go to *Step 9*
8	1. Return the substituted relay to its original position. 2. Replace the rear fog lamp relay. Is the repair complete?	–	System OK	–

Rear Fog Lamps Do Not Work on Either Side (Cont'd)

Step	Action	Value	Yes	No
9	1. Return the substituted relay to its original position, but do not reinstall the rear fog lamp relay at this time. 2. Use a voltmeter to probe each of the four terminals in the rear fog lamp relay socket. Does one of the four terminals in the relay socket indicate the specified value?	11-14 v	Go to *Step 11*	Go to *Step 10*
10	Repair the open circuit between fuse F17 and terminal 30 of the rear fog lamp relay. Is the repair complete?	–	System OK	–
11	1. Turn the headlamps ON. 2. Turn the rear fog lamp switch to the ON position. 3. Probe the rear fog lamp relay socket with the voltmeter. Besides the terminal which indicated battery voltage in Step 13, does another terminal in the relay socket (relay coil positive terminal) now indicate the specified value?	11-14 v	Go to *Step 17*	Go to *Step 12*
12	1. Turn the headlamps ON. 2. Check the voltage at terminal 5 of the rear fog lamp switch. Does the voltmeter indicate the specified value?	11-14 v	Go to *Step 14*	Go to *Step 13*
13	Repair the open circuit between the headlamp relay and the rear fog lamp switch. Is the repair complete?	–	System OK	–
14	1. With the rear fog lamp switch disconnected, connect an ohmmeter between terminals 1 and 5 of the rear fog lamp switch. 2. Turn the front fog lamp switch to the ON position. Does the ohmmeter indicate the specified value?	0 **W**	Go to *Step 14*	Go to *Step 13*
15	Replace the rear fog lamp switch. Is the repair complete?	–	System OK	–
16	Repair the open circuit between terminal 4 of the rear fog lamp switch and terminal 85 of the rear fog lamp relay. Is the repair complete?	–	System OK	–
17	Check the resistance between ground and the ground terminal at the rear fog lamp relay socket. (The ground terminal at the relay socket is diagonally opposite from the relay coil positive terminal which was identified in Step 17.) Does the ohmmeter indicate the specified value?	≈0 **W**	Go to *Step 19*	Go to *Step 18*
18	Repair the ground circuit for the rear fog lamp relay. Is the repair complete?	–	System OK	–
19	Repair the open circuit between the rear fog lamp relay and the rear fog lamps. Is the repair complete?	–	System OK	–

REAR COMBINATION LAMPS

Exterior Illumination Lamps Do Not Work

Step	Action	Value(s)	Yes	No
1	Check the headlamps. Do the headlamps work?	–	Go to *Step 3*	Go to *Step 2*
2	Repair the headlamps before continuing with this chart. After the headlamps have been repaired, are the rear combination lamps still inoperative?	–	Go to *Step 3*	System OK
3	1. Turn the illumination lamps ON. 2. Use a voltmeter to check voltage at the bulb socket positive terminal. Does voltage at the bulb socket equal the specified value?	11-14 v	Go to *Step 4*	Go to *Step 7*
4	Connect an ohmmeter between ground and the lamp socket negative terminal. Is the resistance equal to the specified value?	0 Ω	Go to *Step 6*	Go to *Step 5*
5	Repair the ground circuit for the lamps. Is the repair complete?	–	System OK	–
6	Replace the faulty bulbs. Is the repair complete?	–	System OK	–
7	Check fuses EF16 and EF17. Is either of the fuses blown?	–	Go to *Step 8*	Go to *Step 9*
8	1. Check for a short circuit and repair if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
9	1. Temporarily substitute the headlamp relay in place of the illumination relay. 2. Turn the illumination lamps switch ON. Do the taillamps illuminate?	–	Go to *Step 10*	Go to *Step 11*
10	1. Return the headlamp relay to its original position. 2. Replace the illumination relay. Is the repair complete?	–	System OK	–
11	1. Remove the illumination relay. 2. Use a voltmeter to check the illumination relay socket at the connector for terminal 30. Is the voltage equal to the specified value?	11-14 v	Go to *Step 13*	Go to *Step 12*
12	Replace the engine fuse block. Is the repair complete?	–	System OK	–
13	With the illumination relay removed, use a voltmeter to check the illumination relay socket at the connector for terminal 86. Is the voltage equal to the specified value?	11-14 v	Go to *Step 14*	Go to *Step 12*
14	With the illumination relay removed, connect an ohmmeter between ground and the connector for the illumination lamp relay terminal 85. Does the ohmmeter indicate the specified value?	≈0 **W**	Go to *Step 15*	Go to *Step 17*
15	1. Reinstall the illumination relay. 2. Turn the illumination switch to the ON position. 3. Check the voltage at EF16 and EF17. Is the voltage equal to the specified value?	11-14 v	Go to *Step 16*	Go to *Step 12*

Exterior Illumination Lamps Do Not Work (Cont'd)

Step	Action	Value(s)	Yes	No
16	Repair the open circuit between the fuses EF 17 and EF16 and the illumination lamps. Is the repair complete?	–	System OK	–
17	1. Disconnect the headlamp switch connector C2. 2. Connect a fused jumper wire between ground and terminal 4 of connector C2 (instrument harness side). Do the illumination lamps turn ON with the jumper in place?	–	Go to *Step 19*	Go to *Step 18*
18	Repair the open circuit between terminal 85 of the illumination relay and terminal 4 of the headlamp switch connector C2. Is the repair complete?	–	System OK	–
19	1. Disconnect the headlamp combination switch connector C2. 2. On the disconnected switch, select the illumination lamp ON position. 3. At the switch side of the connector C2, use an ohmmeter to check resistance between terminal 2 and terminal 4. Does the ohmmeter indicate the specified value?	≈ 0 **W**	Go to *Step 20*	Go to *Step 21*
20	Repair the open circuit between headlamp switch connector C2 terminal 2 and ground. Is the repair complete?	–	System OK	–
21	Replace the headlamp switch. Is the repair complete?	–	System OK	–

Stoplamps Do Not Work

Step	Action	Value(s)	Yes	No
1	Check fuse EF6. Is fuse EF6 blown?	–	Go to *Step 2*	Go to *Step 3*
2	1. Check for a short circuit and repair if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
3	1. Depress the brake pedal. 2. With the brake pedal depressed, check the positive terminals of the bulb sockets with a test lamp. Does the test lamp illuminate?	–	Go to *Step 4*	Go to *Step 6*
4	Connect an ohmmeter between ground and the stoplamp ground terminal. Is the resistance equal to the specified value?	0 Ω	Go to *Step 6*	Go to *Step 5*
5	Repair the ground circuit. Is the repair complete?	–	System OK	–
6	1. Disconnect the wiring connector from the brakelamp switch. 2. Depress the brake pedal. 3. Use an ohmmeter to check continuity between terminals 12 and 11 of the brakelamp switch. Is the resistance equal to the specified value?	0 Ω	Go to *Step 8*	Go to *Step 7*
7	Replace the brakelamp switch. Is the repair complete?	–	System OK	–
8	1. Disconnect the brakelamp switch electrical connector. 2. Check the voltage at terminal 2. Does the voltmeter show the specified value?	11-14 v	Go to *Step 10*	Go to *Step 9*
9	Repair the open circuit between the fuse EF6 and the stoplamp switch. Is the repair complete?	–	System OK	–
10	Repair the open circuit between the stoplamp switch and the stoplamps. Is the repair complete?	–	System OK	–

Center High-Mounted Stoplamp (CHMSL) Does Not Work

Step	Action	Value(s)	Yes	No
1	Check the stoplamps. Do the stoplamps work?	–	Go to *Step 3*	Go to *Step 2*
2	Repair the stoplamps before completing this diagnostic table. Does the CHMSL work after the stoplamps have been repaired?	–	System OK	Go to *Step 3*
3	1. Remove the CHMSL lamp bulb. 2. Visually and physically check the CHMSL lamp bulb. Is the lamp bulb defective?	–	Go to *Step 4*	Go to *Step 5*
4	Replace the CHMSL lamp bulb. Is the repair complete?	–	System OK	–
5	1. Disconnect the CHMSL connector. 2. Use an ohmmeter to measure the resistance between ground and the BLK wire in the CHMSL connector. Is the resistance equal to the specified value?	0 Ω	Go to *Step 7*	Go to *Step 6*
6	Repair the open circuit between ground and the BLK wire in the CHMSL connector. Is the repair complete?	–	System OK	–
7	Repair the open circuit between the stoplamp switch and the CHMSL. Is the repair complete?	–	System OK	–

Backup Lamps Inoperative

Step	Action	Value(s)	Yes	No
1	1. Block the wheels. 2. Apply the parking brake to prevent the vehicle from moving. 3. Turn the ignition ON. 4. Put the transaxle in REVERSE. 5. Remove one of the backup lamps from its socket. 6. Test the lamp socket positive terminal with a voltmeter. Does the battery voltage available at the backup lamp socket positive terminal equal the specified value?	11-14 v	Go to *Step 3*	Go to *Step 2*
2	Repair the open circuit between fuse F15 and the backup lamps. Is the repair complete?	–	System OK	–
3	Connect an ohmmeter between ground and the negative terminal at the bulb socket. Is the resistance equal to the specified value?	0 Ω	Go to *Step 4*	Go to *Step 5*
4	Replace the faulty backup lamps. Is the repair complete?	–	System OK	–
5	1. Install the backup lamps. 2. Disconnect the electrical connector at the reverse switch. 3. Turn the ignition ON. 4. Put the transaxle in REVERSE. 5. Use a voltmeter to check for the reverse switch terminal 1. Does voltage available at terminal 1 to the specified value?	11-14 v	Go to *Step 7*	Go to *Step 6*
6	Repair the open circuit between the backup lamps and the reverse switch. Is the repair complete?	–	System OK	–
7	1. Put the transaxle in REVERSE. 2. Use an ohmmeter to check the continuity between reverse switch terminal 1 and 2. Does the continuity between terminals 1 and 2 (terminals 7 and 8 with A/T) equal the specified value?	0 Ω	Go to *Step 9*	Go to *Step 8*
8	Replace the REVERSE switch to the repair complete?	–	System OK	–
9	Repair the ground circuit between the REVERSE switch and the backup lamps. Is the repair complete?	–	System OK	–

Turn Signal Lamps and Hazard Lamps Do Not Work

Step	Action	Value(s)	Yes	No
1	Check fuses F20, F8 and EF6. Is any fuse blown?	–	Go to *Step 2*	Go to *Step 3*
2	1. Check for a short circuit and repair if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
3	1. Turn the ignition ON. 2. Check the voltage at fuse F20, F8 and EF6. Does the battery voltage available at both fuses F20, F8 and EF6 equal the specified value?	11-14 v	Go to *Step 4*	Go to *Step 7*
4	1. Turn the hazard switch ON. 2. Remove each of the inoperative lamps from its socket. 3. Test each lamp socket positive terminal with a voltmeter. Does the battery voltage pulsing at the turn signal, hazard lamp socket positive terminal equal the specified value?	11-14 v	Go to *Step 5*	Go to *Step 9*
5	At each bulb socket, use an ohmmeter to check the ground circuit. Is the resistance equal to the specified value?	≈0 Ω	Go to *Step 6*	Go to *Step 8*
6	Replace any faulty turn signal/hazard bulbs. Is the repair complete?	–	System OK	–
7	Repair the power supply circuit to fuses. Is the repair complete?	–	System OK	–
8	Repair the open ground wires. Is the repair complete?	–	System OK	–
9	1. Turn the hazard switch ON. 2. Test the blinker unit connector terminal 49a with a voltmeter. Does the battery voltage pulsing at the blinker unit terminal 49a equal the specified value?	11-14 v	Go to *Step 15*	Go to *Step 10*
10	1. Turn the hazard switch ON. 2. Test blinker unit connector terminal 49 with a voltmeter. Does the battery voltage available at the blinker unit terminal 49 equal the specified value?	11-14 v	Go to *Step 11*	Go to *Step 14*
11	1. Disconnect the blinker unit from the connector. 2. Use an ohmmeter to check between ground and the connector for terminal 31 of the blinker connector. Is the resistance equal to the specified value?	≈0 Ω	Go to *Step 13*	Go to *Step 12*
12	Repair the blinker unit ground circuit. Is the repair complete?	–	System OK	–
13	Replace faulty blinker unit. Is the repair complete?	–	System OK	–

Turn Signal Lamps and Hazard Lamps Do Not Work (Cont'd)

Step	Action	Value(s)	Yes	No
14	1. Disconnect the hazard switch connector. 2. Check for voltage at terminal 8. 3. Turn the ignition ON. 4. Check for voltage at terminal 10. Does the voltage available at both terminals equal the specified value?	11-14 v	Go to *Step 16*	Go to *Step 15*
15	Repair the open circuit between the hazard switch and fuses F20, F8 or EF6. Is the repair complete?	–	System OK	–
16	With the hazard switch disconnected, use an ohmmeter to check for an open circuit between blinker unit terminal 49 and hazard switch connector terminal 7. Is there an open circuit?	–	Go to *Step 17*	Go to *Step 18*
17	Repair the open circuit between the hazard switch and the blinker unit. Is the repair complete?	–	System OK	–
18	1. Remove the hazard switch. 2. Turn the hazard switch OFF. 3. Use an ohmmeter to check for continuity between terminals 7 and 10. 4. Turn the hazard switch ON. 5. Use an ohmmeter to check for continuity between terminals 7 and 8. Does the ohmmeter show the specified value for both tests?	0 **W**	Go to *Step 20*	Go to *Step 19*
19	Replace the hazard switch. Is the repair complete?	–	System OK	–
20	1. With the hazard switch still removed for testing, turn the hazard switch to the ON position. 2. Use an ohmmeter to check the continuity between terminals 5, 6, and 9. Is there continuity between terminals 5, 6, and 9?	–	Go to *Step 19*	Go to *Step 21*
21	Repair the open circuit between hazard switch and the turn signal bulbs. Is the repair complete?	–	System OK	–

Hazard Lamps Do Not Operate, Turn Signals Are OK

Step	Action	Value(s)	Yes	No
1	Check fuse EF6. Is fuse EF6 blown?	–	Go to *Step 2*	Go to *Step 3*
2	1. Check for a short circuit and repair if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
3	Use a voltmeter to check for power to fuse EF6. Does the battery voltage available at fuse EF6 equal the value specified?	11-14 v	Go to *Step 5*	Go to *Step 4*
4	Repair the power supply circuit to fuse EF6. Is the repair complete?	–	System OK	–
5	1. Disconnect the hazard lamp switch connector. 2. Use a voltmeter to check power to the hazard switch terminal 8. Does the battery voltage available at connector terminal 8 equal the value specified?	11-14 v	Go to *Step 6*	Go to *Step 9*
6	1. Remove the hazard lamp switch and disconnect it for testing. 2. Turn the hazard lamp switch to the ON position. 3. Test with an ohmmeter between terminals 7 and 8. Is the resistance equal to the specified value?	0 Ω	Go to *Step 7*	Go to *Step 10*
7	1. With the hazard lamp switch still removed and disconnected for testing, turn the hazard lamp switch to the ON position. 2. Use an ohmmeter to check between terminals 5, 6, and 9. Is the resistance equal to the specified value?	0 Ω	Go to *Step 8*	Go to *Step 10*
8	Repair the open circuit between the hazard lamp switch connector and G201. Is the repair complete?	–	System OK	–
9	Repair the open circuit between the hazard lamp switch connector terminal H and fuse EF6. Is the repair complete?	–	System OK	–
10	Replace the faulty hazard lamp switch. Is the repair complete?	–	System OK	–

INTERIOR COURTESY AND LUGGAGE COMPARTMENT LAMPS

Interior Courtesy Lamp Inoperative

Caution: Always make sure there is an electrical load (lamp bulb, etc.) in any circuit between battery terminals. Do not make a short circuit between battery terminals with a jumper wire. Hazardous sparking would result.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

1. Bulb test. Clip one end of a jumper wire to the negative battery terminal. Clip the other end of the jumper wire onto one end of the bulb. Take the free end of the bulb (the end without the jumper attached) and touch it to the positive battery terminal.

Step	Action	Value(s)	Yes	No
1	1. Remove the interior courtesy lamp bulb and inspect the filament. 2. If the filament is not broken, test the bulb using the vehicle's battery and a jumper wire. Does the bulb pass the visual and physical checks?	–	Go to *Step 3*	Go to *Step 2*
2	Replace the bulb. Is the repair complete?	–	System OK	–
3	1. Reinstall the interior courtesy lamp bulb. 2. Check fuse EF6 and F3. Is any fuse blown?	–	Go to *Step 4*	Go to *Step 5*
4	1. Check for a short circuit and repair if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
5	Check fuse EF6 and F3. Does the voltage at fuse EF6 and F3 equal the specified value?	11-14 v	Go to *Step 7*	Go to *Step 6*
6	Repair the open circuit between the battery and fuse EF6 or F3. Is the repair complete?	–	System OK	–
7	1. Disconnect the interior courtesy lamp electrical connector. 2. Check the voltage at the ORN/BLK wire. Does the voltage at the ORN/BLK wire equal the value specified?	11-14 v	Go to *Step 8*	Go to *Step 9*
8	Repair the open circuit between fuse EF6 and the ORN/BLK wire of the interior courtesy lamp. Is the repair complete?	–	System OK	–
9	Use an ohmmeter to check the resistance between ground and the BLK wire of the interior courtesy lamp connector (harness side). Is the resistance equal to the specified value?	0 Ω	Go to *Step 10*	Go to *Step 11*
10	Replace the interior courtesy lamp switch assembly. Is the repair complete?	–	System OK	–
11	Repair the ground circuit for the interior courtesy lamp. Is the repair complete?	–	System OK	–

Luggage Compartment Lamp Inoperative

Caution: Always make sure there is an electrical load (lamp bulb, etc.) in any circuit between battery terminals. Do not make a short circuit between battery terminals with a jumper wire. Hazardous sparking will result.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

1. Bulb test. Clip one end of a jumper wire to the negative battery terminal. Clip the other end of the jumper wire onto one end of the bulb. Take the free end of the bulb (the end without the jumper attached) and touch it to the positive battery terminal.

Step	Action	Value(s)	Yes	No
1	1. Remove the luggage compartment lamp bulb and inspect the filament. 2. If the filament is not broken, test the bulb using the vehicle's battery and a jumper wire. Does the bulb pass the visual and physical check?	–	Go to *Step 3*	Go to *Step 2*
2	Replace the bulb. Is the repair complete?	–	System OK	–
3	1. Reinstall the luggage compartment lamp bulb. 2. Check fuse EF6 and F3. Is any fuse blown?	–	Go to *Step 4*	Go to *Step 5*
4	1. Check for a short circuit and repair if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
5	Check fuse EF6 and F3. Does the voltage at fuse EF6 and F3 equal the specified value?	11-14 v	Go to *Step* 7	Go to *Step* 6
6	Repair the open circuit between the battery and fuse EF6 or F3. Is the repair complete?	–	System OK	–
7	1. Disconnect the luggage compartment lamp electrical connector. 2. Check the voltage at the ORN/BLK wire. Does the voltage at the ORN/BLK wire equal the specified value?	11-14 v	Go to *Step* 8	Go to *Step* 9
8	Repair the open circuit between fuse EF6 and the luggage compartment lamp. Is the repair complete?	–	System OK	–
9	1. Reconnect the luggage compartment lamp. 2. Remove the luggage compartment lamp (tailgate) switch. 3. With a voltmeter (or test lamp), test the GRY/BLK wire at the luggage compartment lamp (tailgate) switch. Does the voltage at the luggage compartment lamp switch equal the specified value?	11-14 v	Go to *Step 11*	Go to *Step 10*
10	Repair the open circuit between the luggage compartment lamp and the luggage compartment lamp (tailgate) switch. Is the repair complete?	–	System OK	–

Luggage Compartment Lamp Inoperative (Cont'd)

Step	Action	Value(s)	Yes	No
11	Use an ohmmeter to check the resistance between ground and the BLK wire at the luggage compartment (tailgate) lamp switch connector (harness side). Is the resistance equal to the specified value?	0 Ω	Go to *Step 12*	Go to *Step 13*
12	Replace the luggage compartment lamp (tailgate) switch. Is the repair complete?	–	System OK	–
13	Repair the ground circuit for the interior courtesy lamp. Is the repair complete?	–	System OK	–

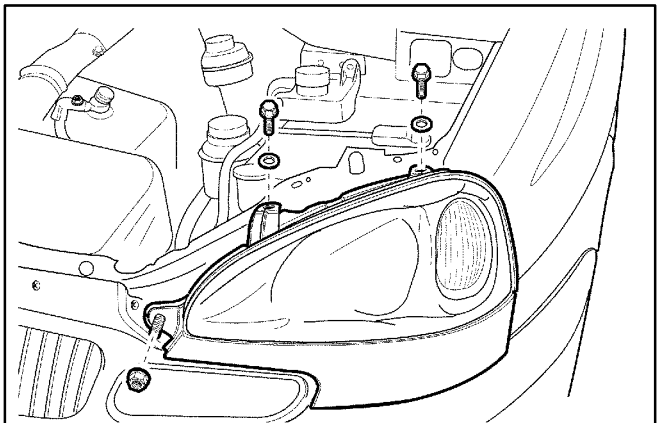
GLOVE BOX LAMP

Glove Box Lamp Inoperative

Step	Action	Value(s)	Yes	No
1	Check fuse F16. Is fuse F16 blown?	–	Go to *Step 2*	Go to *Step 3*
2	1. Check for a short circuit and repair if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
3	Use a voltmeter to check the voltage at fuse F16. Does the voltage match the value specified?	11-14 v	Go to *Step 5*	Go to *Step 4*
4	Repair the open circuit between the battery and fuse F16. Is the repair complete?	–	System OK	–
5	1. Disconnect the glove box lamp electrical connector. 2. Use a voltmeter to check the voltage at connector terminal 2. Does the voltage match the value specified?	11-14 v	Go to *Step 7*	Go to *Step 6*
6	Repair the open circuit between fuse F16 and the glove box lamp terminal 2. Is the repair complete?	–	System OK	–
7	Use an ohmmeter to check continuity between terminal 1 of the glove box lamp connector and ground. Does the ohmmeter show the specified value?	≈0 **W**	Go to *Step 8*	Go to *Step 9*
8	Replace the glove box lamp bulb. Is the repair complete?	–	System OK	–
9	Repair the ground circuit for the glove box lamp. Is the repair complete?	–	System OK	–

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE


UAA9B010

HEADLAMPS/FRONT TURN SIGNAL LAMPS

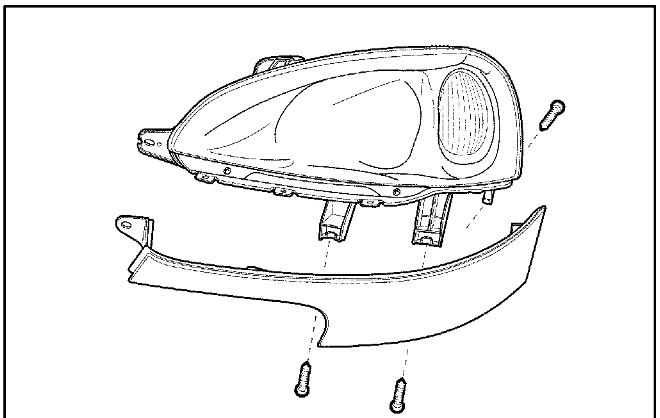
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the headlamp mounting bolts and nuts.

Installation Notice

Tightening Torque	4 N·m (35 lb–in)

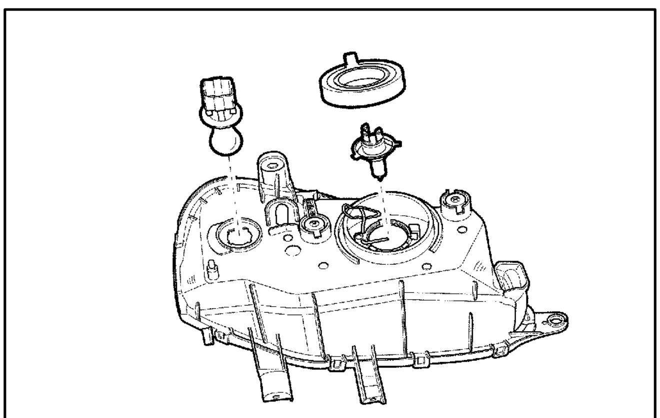
3. Disconnect the electrical connectors.


UAA9B020

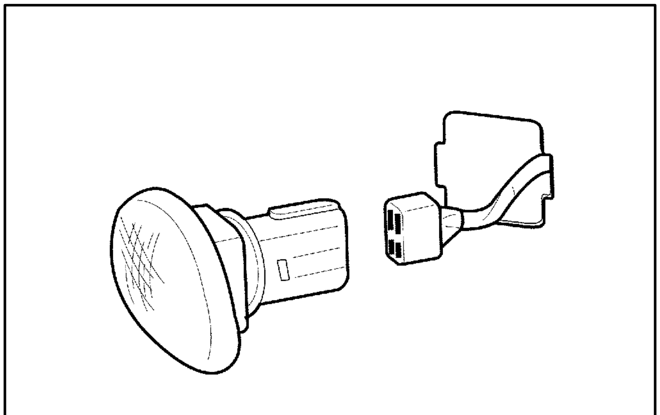
4. Remove the screw.

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

5. Disconnect the headlamp and the space.


UAA9B030

6. Remove the cap concealing the headlamp bulb.
7. Remove the headlamp assembly.
8. Remove the turn signal bulb.
9. Installation should follow the removal procedure in the reverse order.

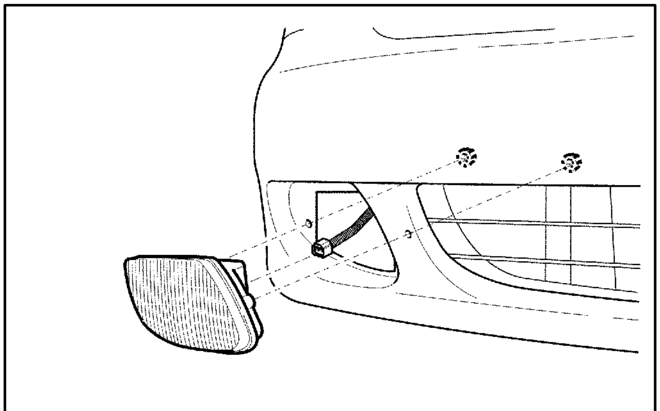


UAA9B040

SIDE TURN SIGNAL LAMPS

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. The side turn signal lamp rearward (left).
3. The side turn signal lamp foreward (right).
4. Remove the lamp.
5. Disconnect the electrical connector.
6. Installation should follow the removal procedure in the reverse order.



UAA9B050

FRONT FOG LAMP

Removal and Installation Procedure

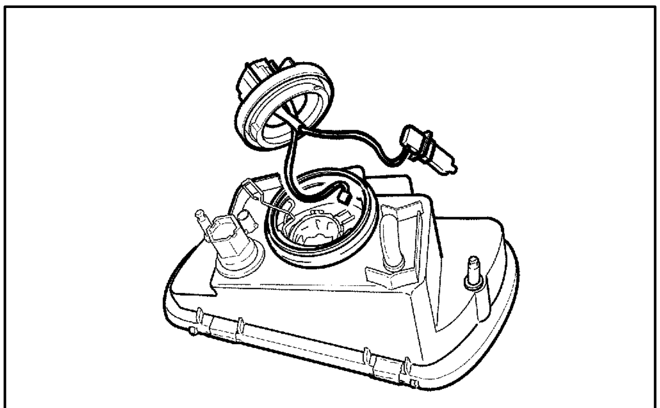
1. Disconnect the negative battery cable.
2. Remove the nuts and the front fog lamp.

Installation Notice

Tightening Torque	4 N·m (35 lb–in)

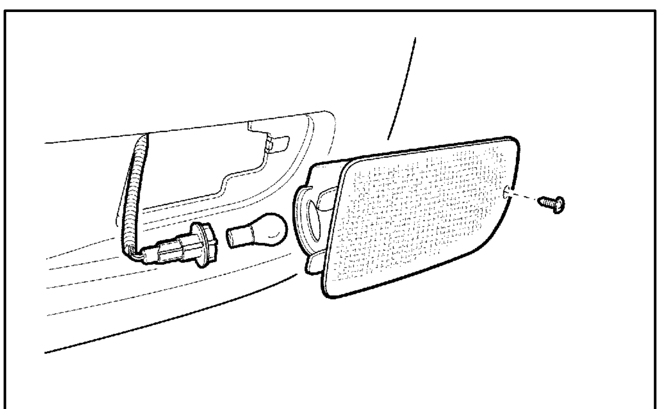
Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

3. Disconnect the electrical connect.



UAA9B060

4. Remove the fog lamp access cover.
5. Remove the retaining wire.
6. Remove the bulb.
7. Installation should follow the removal procedure in the reverse order.

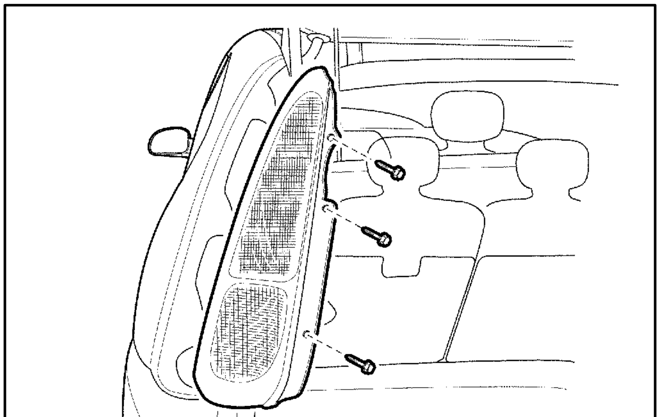


UAA9B070

REAR FOG LAMP

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the screws.
3. Remove the electrical connector.
4. Remove the fog lamp access cover.
5. Remove the bulb.
6. Installation should follow the removal procedure in the reverse order.



UAA9B080

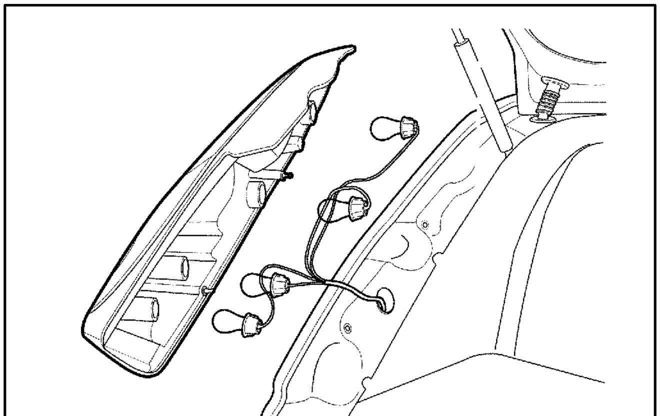
REAR COMBINATION LAMPS

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the screw.

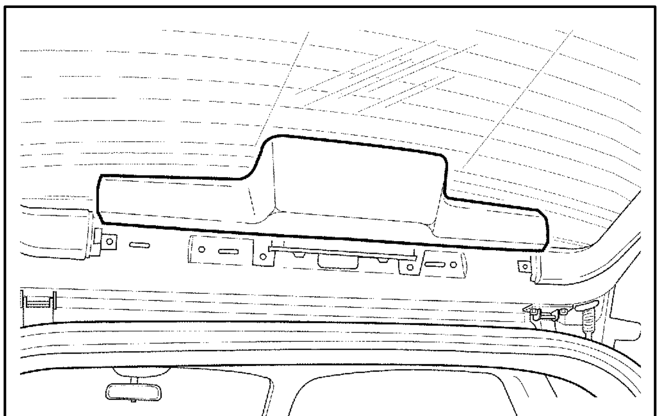
Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

3. Remove the rear combination lamps.



UAA9B090

4. Remove the bulb.
5. Installation should follow the removal procedure in the reverse order.

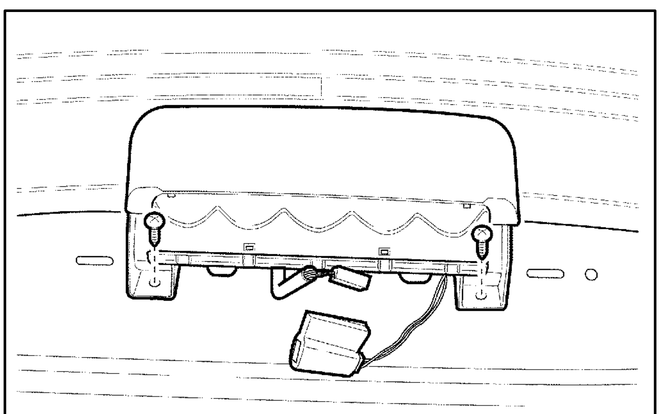


UAA9B100

CENTER HIGH–MOUNTED STOPLAMP

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the tailgate upper trim.

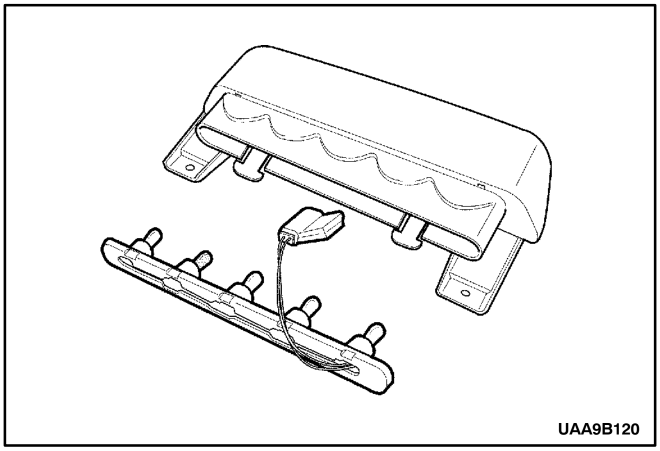


UAA9B110

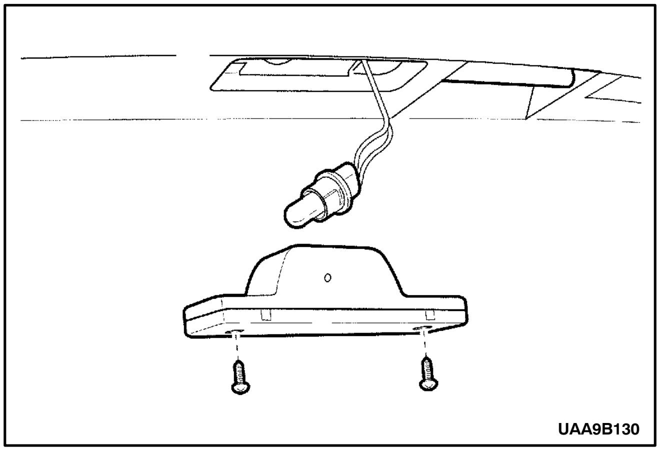
3. Remove the screws.

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

4. Disconnect the electrical connector.
5. Remove the center high-mounting stoplamp.



6. Remove the bulb.
7. Installation should follow the removal procedure in the reverse order.



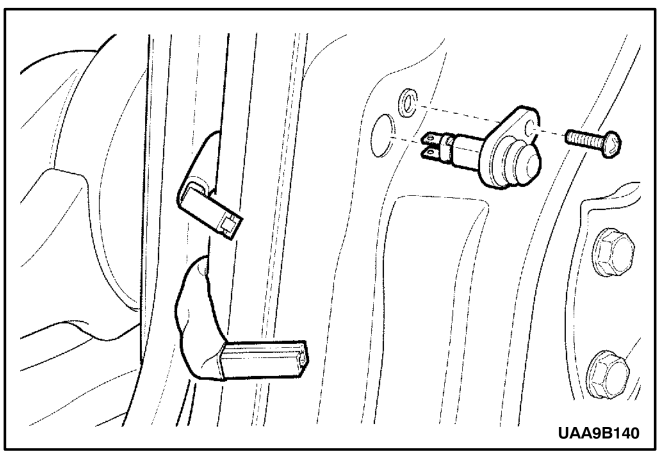
LICENSE PLATE LAMPS

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the screws.

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

3. Remove the lamp assembly.
4. Remove the lamp socket from the lamp housing.
5. Remove the bulb.
6. Installation should follow the removal procedure in the reverse order.



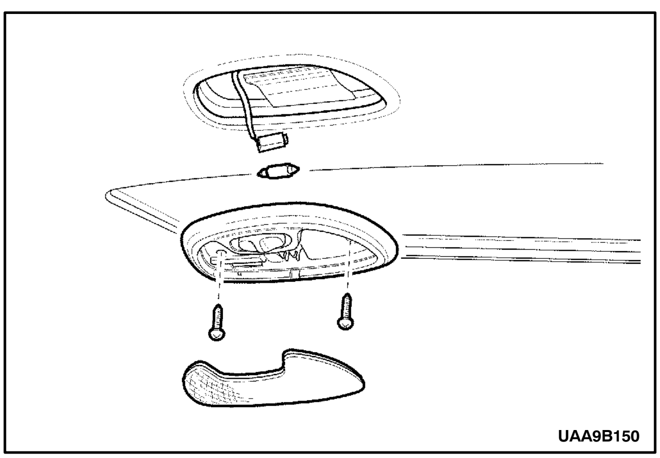
DOOR JAMB SWITCH

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the B pillar lower trim.
3. Remove the screw and the door jamb switch.

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

4. Disconnect the electrical connector.
5. Installation should follow the removal procedure in the reverse order.



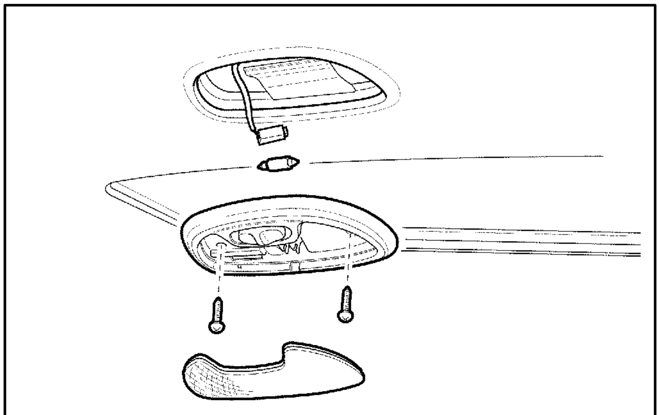
INTERIOR COURTESY LAMP

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Pry off the courtesy lamp lens by inserting screw-driver.
3. Remove the screws and the courtesy lamp housing from the headliner.

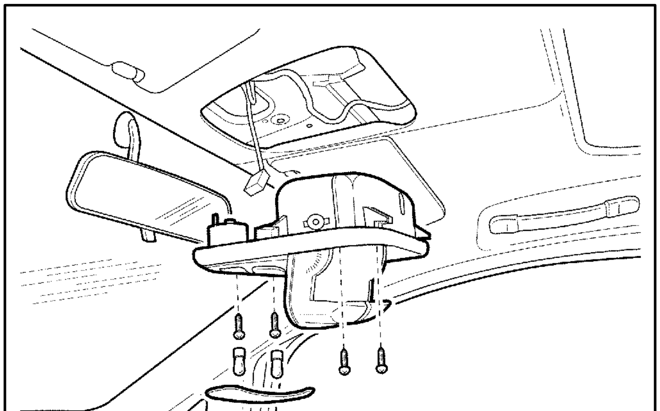
Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

4. Disconnect the electrical connector.



UAA9B150

5. Remove the bulb.
6. Installation should follow the removal procedure in the reverse order.



UAA9B160

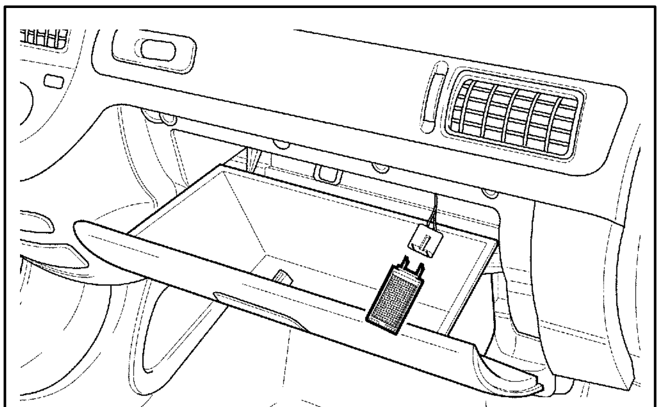
MAP LAMP

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Pry off the map lamp lens.
3. Remove the screws and the map lens.

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

4. Disconnect the electrical connector.
5. Installation should follow the removal procedure in the reverse order.

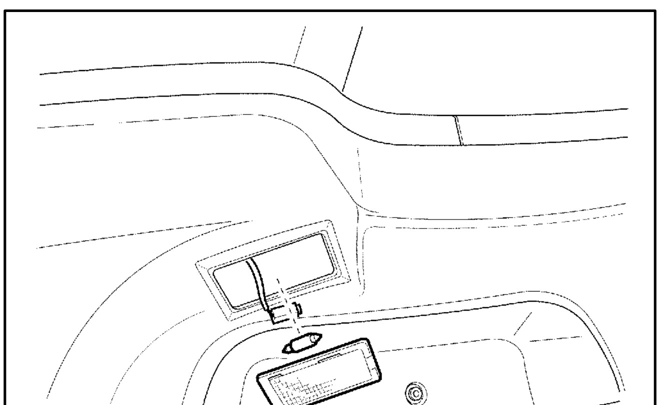


UAA9B170

GLOVE BOX LAMP

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Open the glove box.
3. Remove the glove box lamp.
4. Disconnect the electrical connector.
5. Remove the bulb.



UAA9B180

LUGGAGE COMPARTMENT LAMP

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the luggage compartment lamp.
3. Disconnect the electrical connector.
4. Remove the bulb.
5. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

BULB USAGE CHART

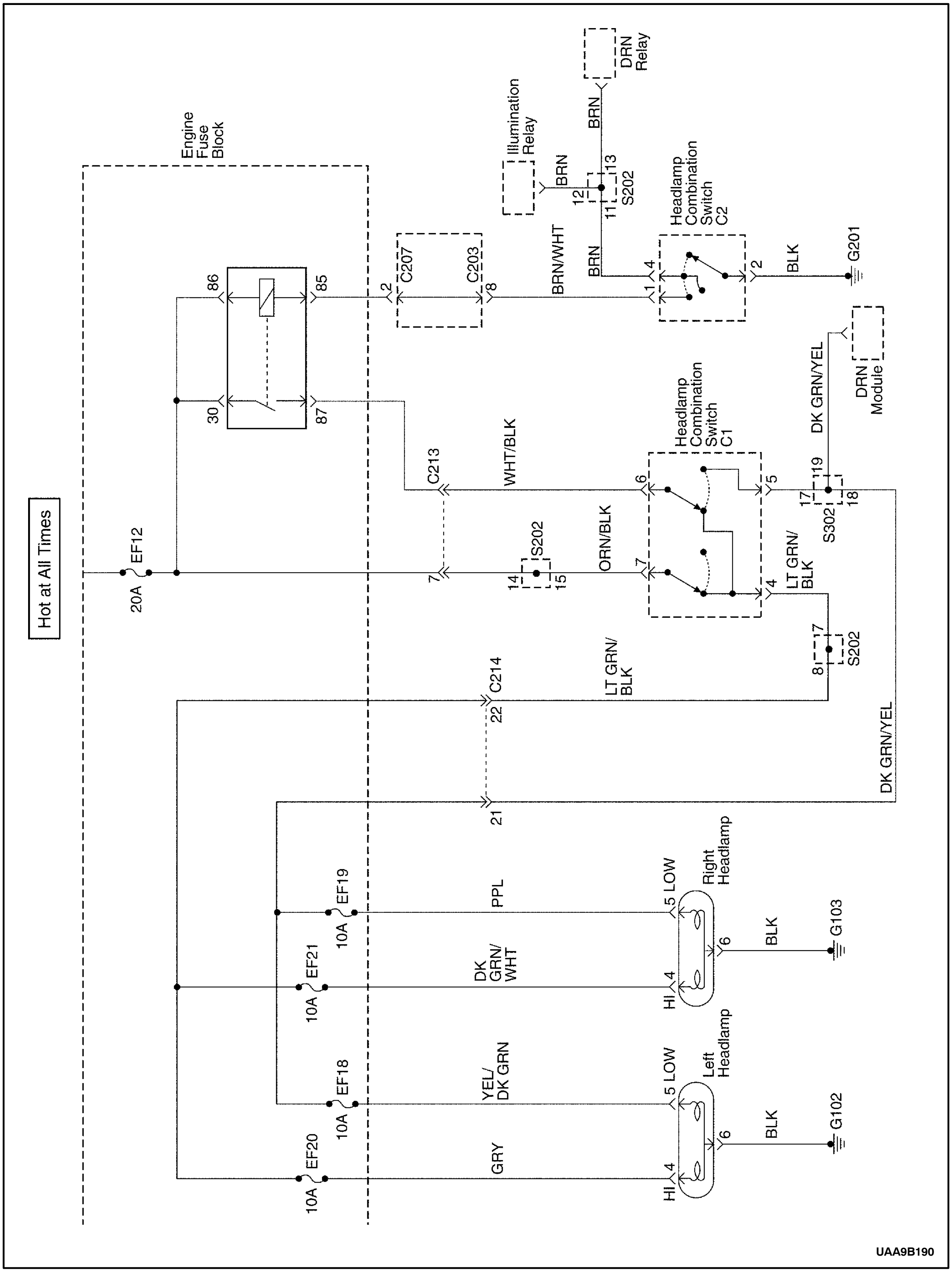
Bulb	Replacement Bulb Number
Backup Lamp	21W
Center High-Mounted Stoplamp	21W
Front Fog Lamp	55W
Glove Box Lamp	5W
Headlamp	Double 60/55W
Interior Courtesy Lamp	10W
License Plate Lamp	5W
Luggage Compartment Lamp	10W
Map Lamp	7.5W
Park and Front Turn Signal Lamp	Double 21/5W
Rear Fog Lamp	21W
Rear Turn Signal Lamp	Single 21W
Side Turn Signal Lamp	5W
Taillamp and Stoplamp	Double 21/5W

FASTENER TIGHTENING SPECIFICATIONS

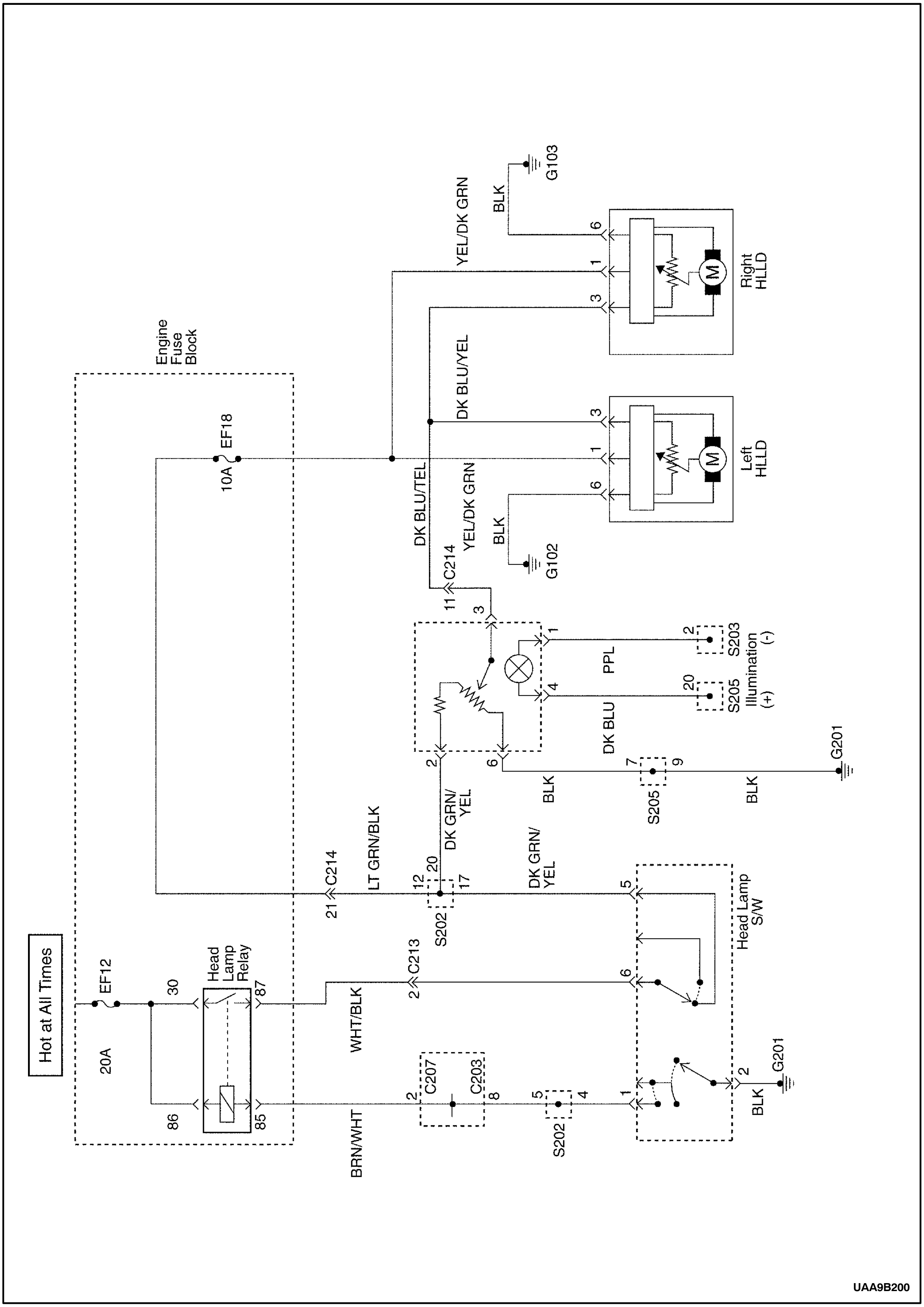
Application	N•m	Lb-Ft	Lb-In
Front Fog Lamp Nuts	4	–	35
Headlamp Assembly Bolts	4	–	35

SCHEMATIC AND ROUTING DIAGRAMS

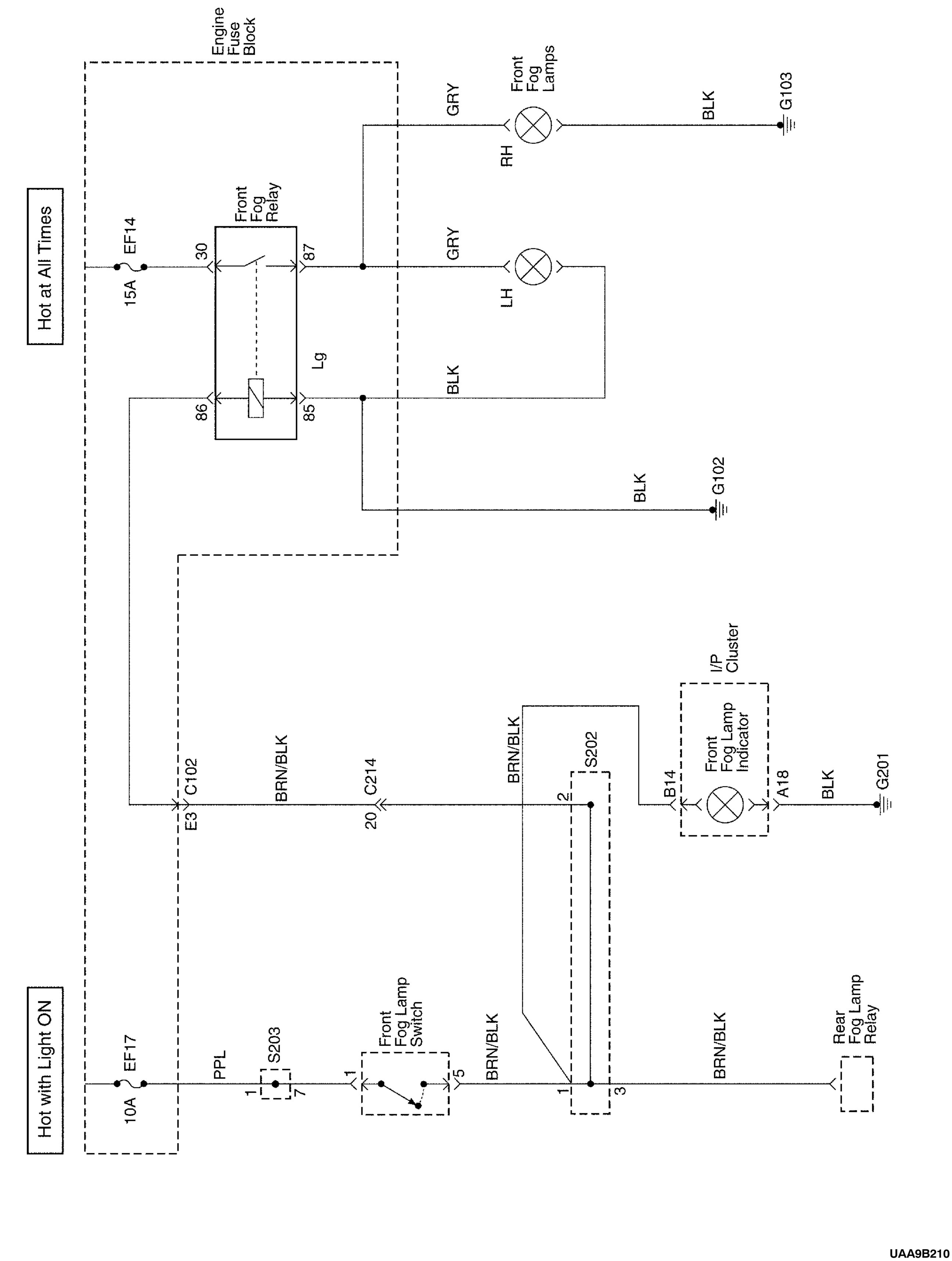
HEADLAMPS CIRCUIT



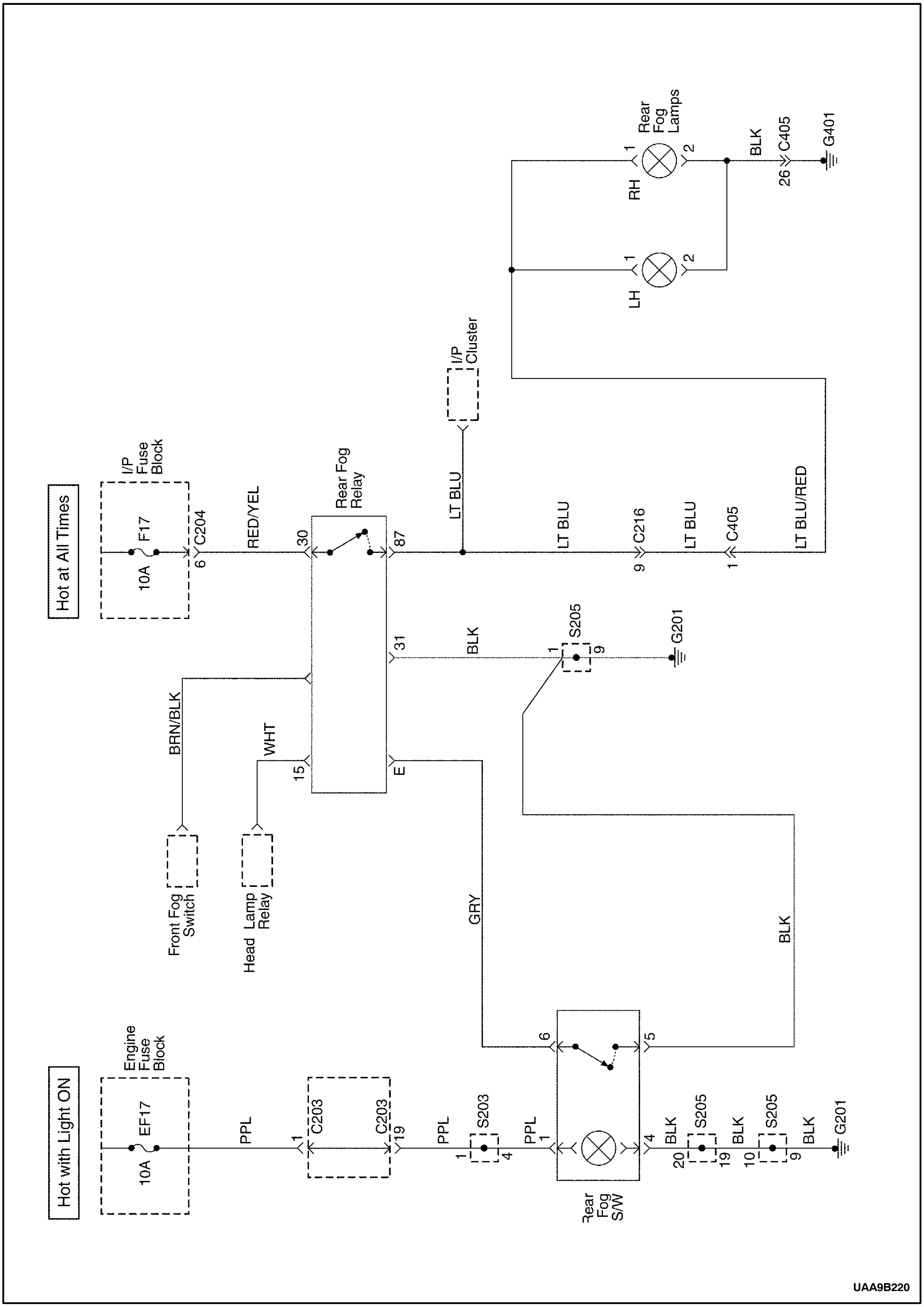
HEADLAMP LEVELING CIRCUIT



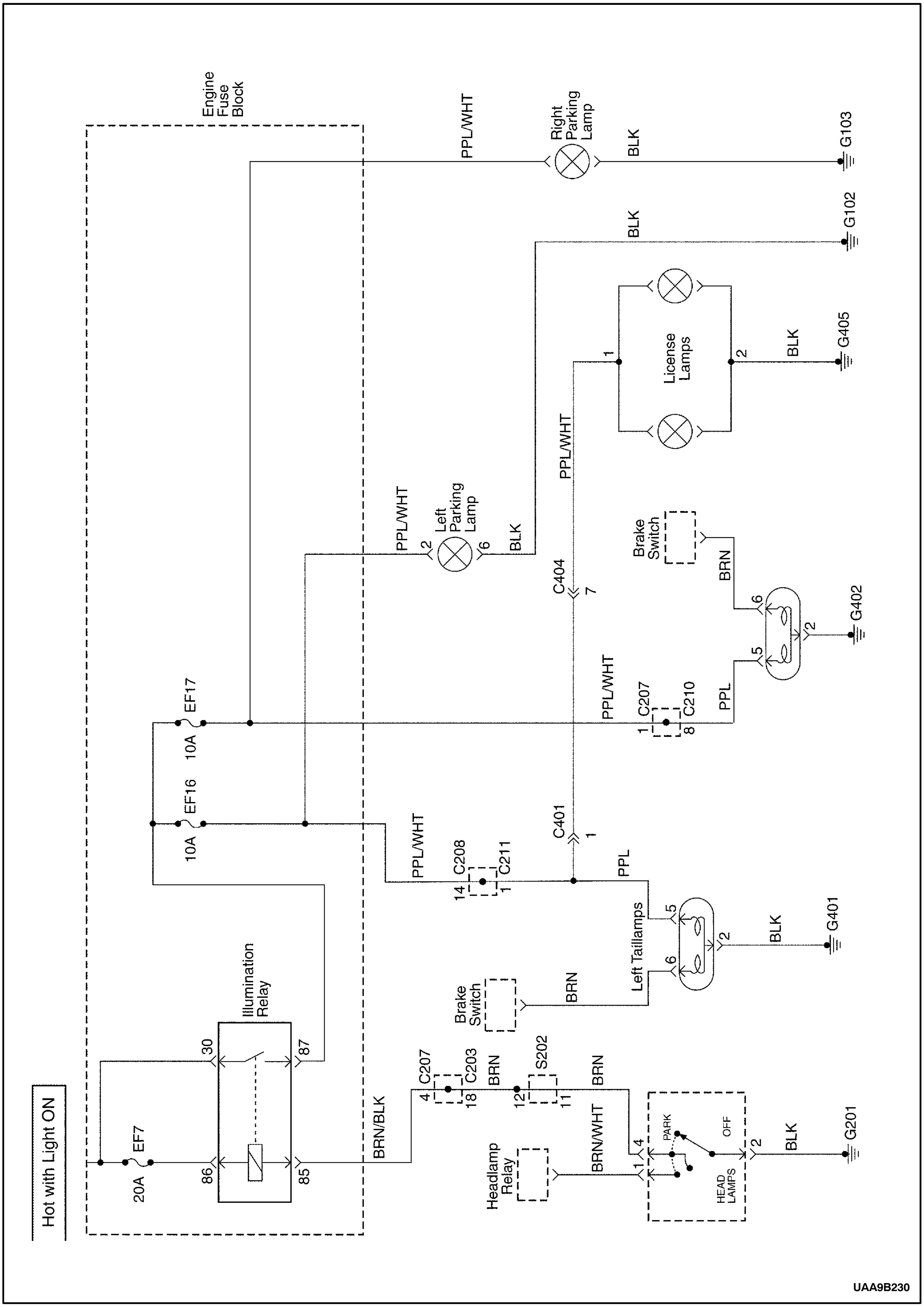
FRONT FOG LAMPS CIRCUIT



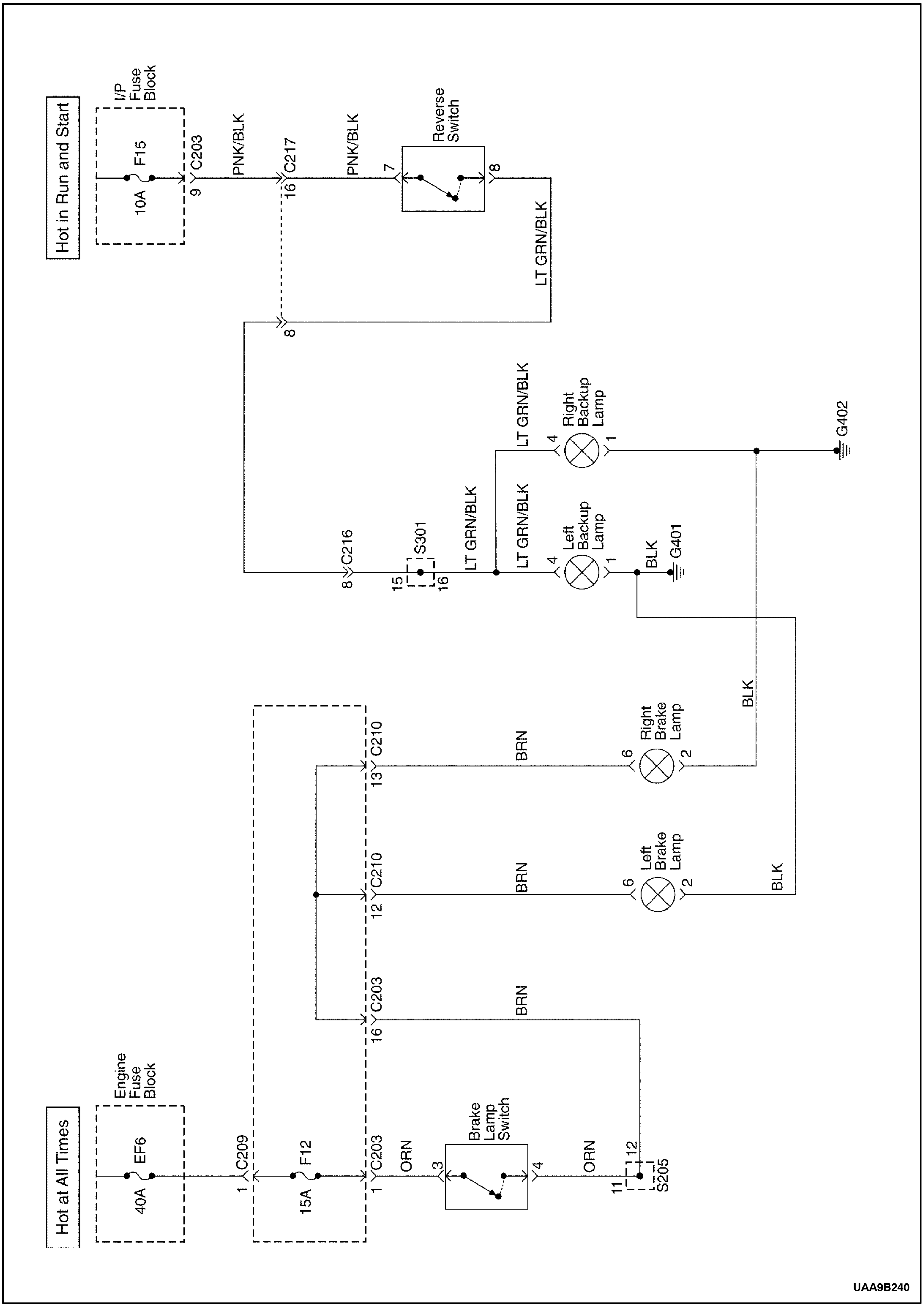
REAR FOG LAMPS CIRCUIT



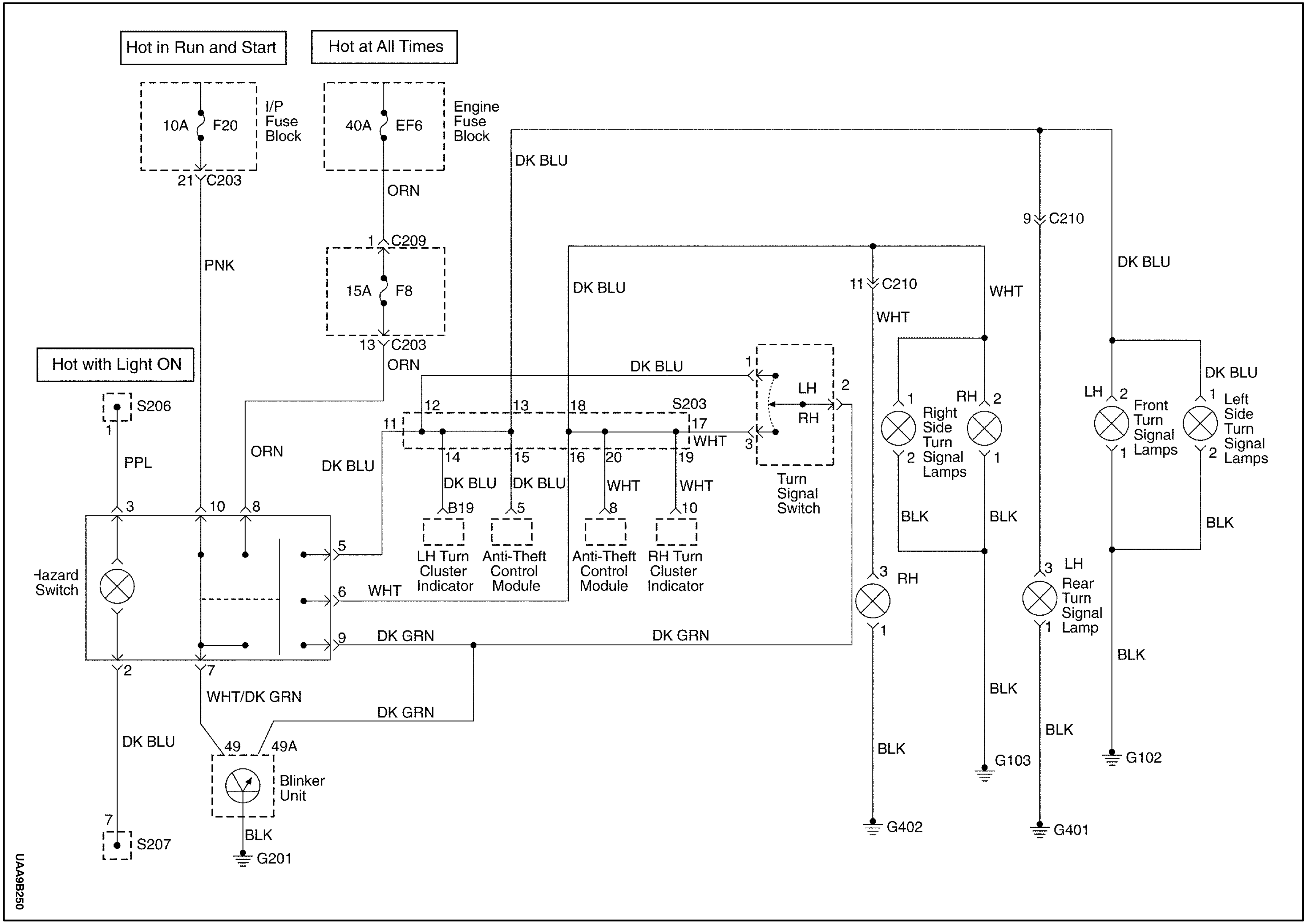
TAIL AND LICENSE LAMPS CIRCUIT



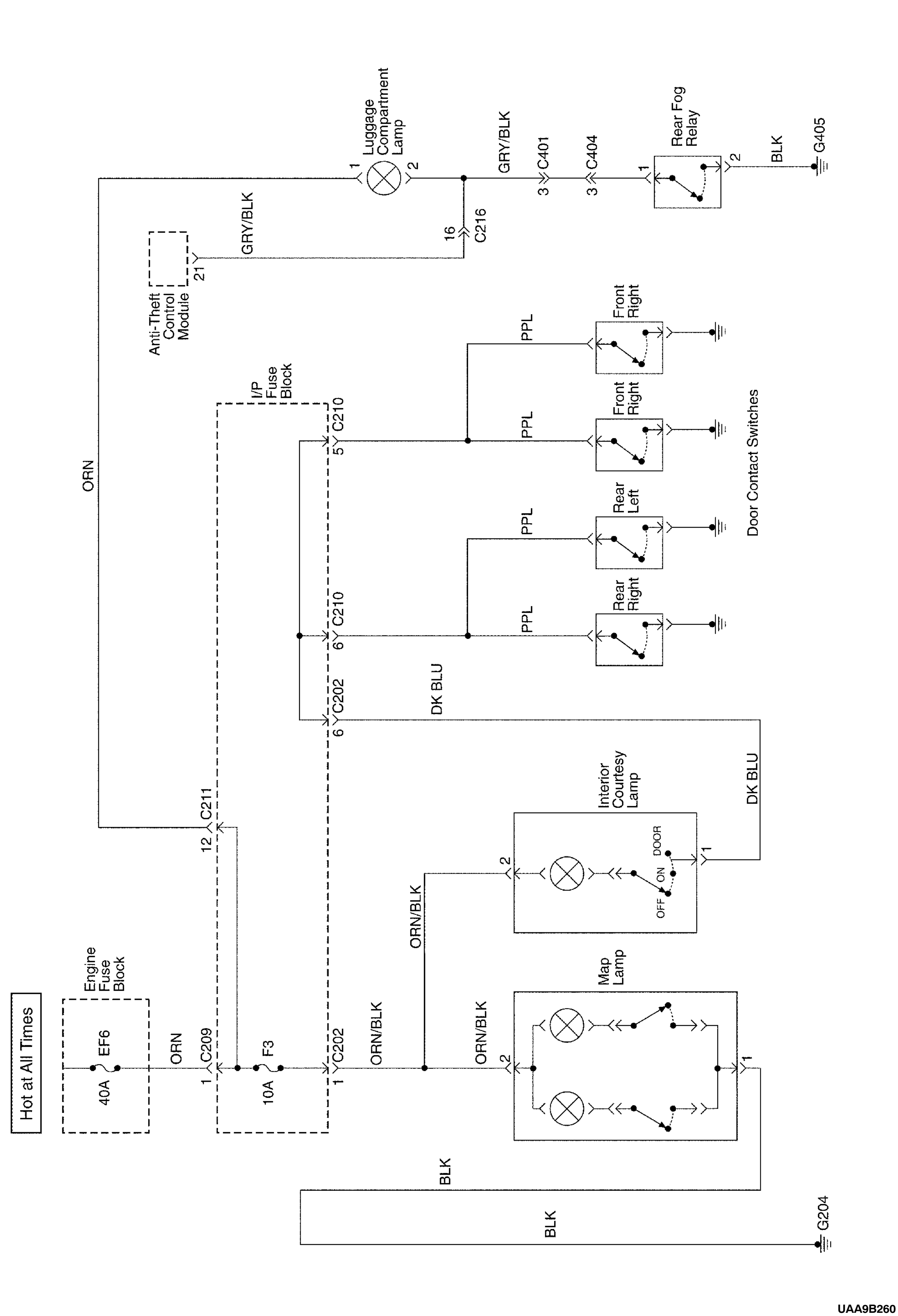
BACKUP AND BRAKE LAMPS CIRCUIT



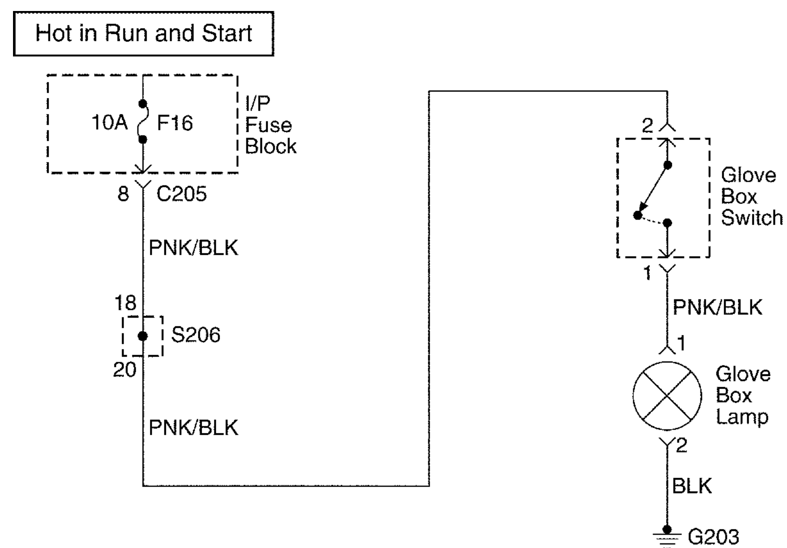
TURN AND HAZARD LAMPS CIRCUIT



INTERIOR COURTESY LAMP AND LUGGAGE COMPARTMENT LAMP CIRCUIT



GLOVE BOX LAMP CIRCUIT



UAA9B270

SECTION 9C

HORNS

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

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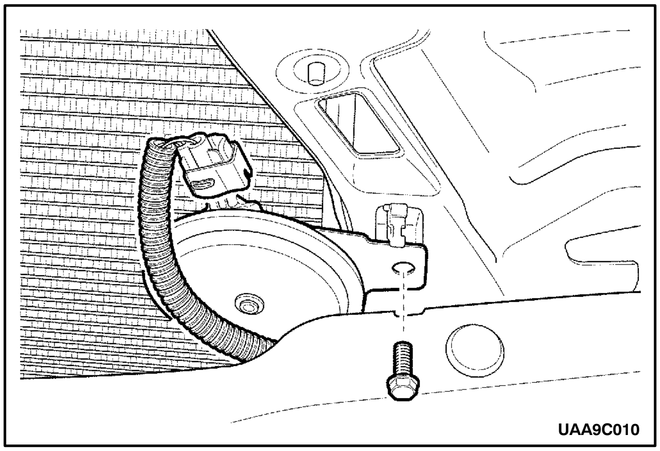
DESCRIPTION AND OPERATION

HORNS

The horns are located under the hood. They are attached near the radiator at the front of the vehicle. The horns are actuated by pressing the steering wheel pad, which grounds the horns' electrical circuit.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



HORNS

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connectors.
3. Remove the bolt and the horn.

Installation Notice

Tightening Torque	22 N·m (16 lb–ft)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

4. Installation should follow the removal procedure in the reverse order.

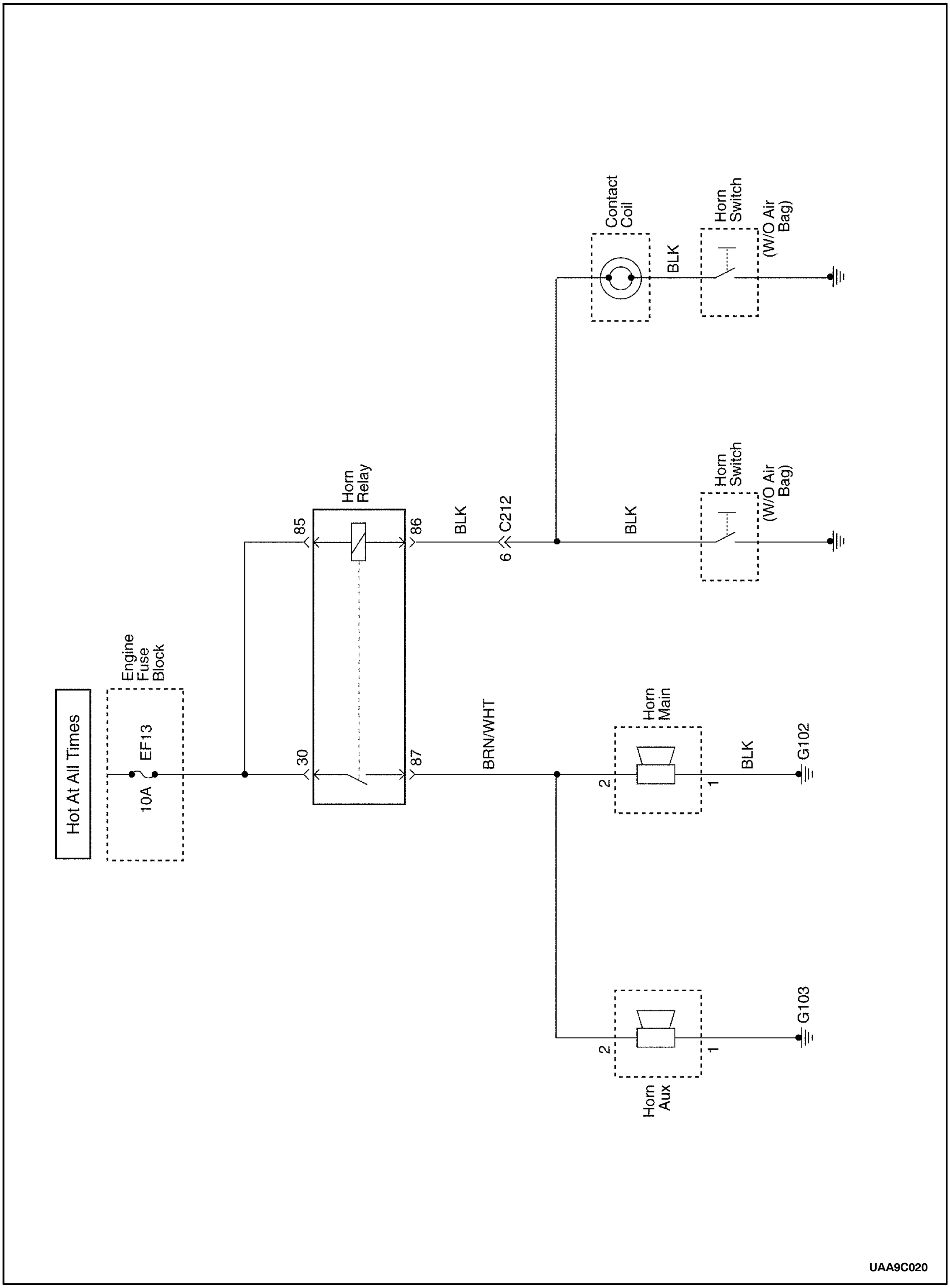
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Horn Bolt	22	16	–

SCHEMATIC AND ROUTING DIAGRAMS

HORN WIRING SYSTEM



SECTION 9D

WIPERS/WASHER SYSTEMS

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

WINDSHIELD WIPER SYSTEM

The windshield wiper system consists of a wiper motor, a linkage, a wiper arm and a blade, and a wiper/washer switch. The windshield wiper circuit incorporates a self-parking device which consists of a worm gear and a cam plate in order to keep the circuit engaged temporarily when the switch is turned off. The wiper system is driven by a permanent magnet-type motor. The windshield wiper motor is mounted on the dash panel and is directly connected to the windshield wiper linkage.

The windshield wiper motor has two speeds, LO and HI, and also has intermittent wiper capability. The wiper switch is an integral part of the wiper/washer switch. Windshield wiper operation is actuated through the lever on the right side of the steering column.

WINDSHIELD WASHER SYSTEM

The windshield washer system is equipped with a washer fluid reservoir, a washer fluid pump, hoses, nozzles, and a wiper/washer switch. The windshield washer reservoir is mounted behind the front left wheel well splash shield. Attached to the reservoir is a washer pump, which pumps fluid through the hoses to the two nozzles mounted on the hood. The washer switch is an integral part of the wiper/washer switch. Windshield washer operation is actuated through the lever on the right side of the steering column.

REAR WINDOW WIPER/WASHER SYSTEM

The rear window wiper system consists of a wiper motor, a wiper arm, and a blade. The rear window wiper motor is located inside the hatchback/tailgate door and is directly connected to the rear window wiper. The rear window washer system is equipped with a separate washer fluid pump and hose. The hatchback has a hatch-mounted rear window washer nozzle and on the wagon, the washer nozzle is incorporated into the rear wiper motor. The rear window washer reservoir is mounted behind the front left wheel well splash shield. Attached to the reservoir is a washer pump, which pumps fluid through a hose to the rear washer nozzle.

DIAGNOSIS

WINDSHIELD WIPERS

Windshield Wipers Do Not Work At Any Speed

Step	Action	Value	Yes	No
1	Check fuse F11. Is fuse F11 blown?	–	Go to *Step 2*	Go to *Step 3*
2	1. Check for a short circuit and repair it, if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
3	Check the voltage at fuse F11. Is the voltage equal to the specified value?	11-14 v	Go to *Step 5*	Go to *Step 4*
4	Repair the open power supply circuit to fuse F11. Is the repair complete?	–	System OK	–
5	1. Disconnect the wiper motor connector. 2. Turn the ignition ON. 3. Turn the wiper switch to HI. 4. Check the voltage at the wiper motor connector terminal 1. Is the voltage equal to the specified value?	11-14 v	Go to *Step 6*	Go to *Step 7*
6	Replace the wiper motor. Is the repair complete?	–	System OK	–
7	1. The wiper switch is still disconnected. 2. Turn the ignition ON. 3. Check for battery voltage at the wiper switch connector terminal A8. Is the voltage equal to the specified value?	11-14 v	Go to *Step 9*	Go to *Step 8*
8	Repair the open circuit between the wiper switch connector terminal A8 and fuse F11. Is the repair complete?	–	System OK	–
9	1. The wiper switch is still disconnected. 2. Turn the wiper switch to HI. 3. Use an ohmmeter to check for continuity between wiper switch terminal A8 and A9. Does the ohmmeter indicate the specified value?	$\approx 0\ \Omega$	Go to *Step 11*	Go to *Step 10*
10	Replace the wiper switch. Is the repair complete?	–	System OK	–
11	Repair the open circuit between the wiper switch and the wiper motor. Is the repair complete?	–	System OK	–

Wipers Do Not Work On HI Speed, LO Speed OK

Step	Action	Value	Yes	No
1	1. Turn the ignition ON. 2. Turn the wiper switch to HI. 3. Check voltage at the wiper motor connector terminal 1. Is voltage equal to the specified value?	11-14 v	Go to *Step 2*	Go to *Step 3*
2	Replace the wiper motor. Is the repair complete?	–	System OK	–
3	1. Disconnect the wiper switch. 2. Turn the wiper switch to HI. 3. Use an ohmmeter to check for continuity between wiper switch terminal A8 and A9. Does the ohmmeter indicate the specified value?	$\approx 0\ \Omega$	Go to *Step 5*	Go to *Step 4*
4	Replace the wiper switch. Is the repair complete?	–	System OK	–
5	Repair the open circuit between wiper switch connector terminal A9 and wiper motor connector terminal 1. Is the repair complete?	–	System OK	–

Wipers Do Not Work On LO Speed, HI Speed OK

Step	Action	Value	Yes	No
1	1. Turn the ignition ON. 2. Turn the wiper switch to LO. 3. Check the voltage at the wiper motor connector, terminal 2. Is the voltage equal to the specified value?	11-14 v	Go to *Step 2*	Go to *Step 3*
2	Replace the wiper motor. Is the repair complete?	–	System OK	–
3	1. Disconnect the wiper switch. 2. Turn wiper switch to LO. 3. Use an ohmmeter to check for continuity between wiper switch terminal A8 and A5. Does the ohmmeter indicate the specified value?	$\approx 0\ \Omega$	Go to *Step 5*	Go to *Step 4*
4	Replace the wiper switch. Is the repair complete?	–	System OK	–
5	Repair the open circuit between wiper switch connector terminal A5 and wiper motor connector terminal 2. Is the repair complete?	–	System OK	–

Wipers Do Not Work On Intermittent (INT), Other Speeds OK

Step	Action	Value	Yes	No
1	1. Turn the ignition ON. 2. Use a voltmeter to test voltage at wiper relay connector terminal 15. Is voltage equal to the specified value?	11-14 v	Go to *Step 3*	Go to *Step 2*
2	Repair the open circuit between the wiper relay connector terminal 15 and fuse F11. Is the repair complete?	–	System OK	–
3	1. Turn the ignition on. 2. Turn the wiper switch to INT. 3. Check the voltage at wiper relay connector terminal I. Does the voltmeter indicate a voltage equal to the specified value?	11-14 v	Go to *Step 7*	Go to *Step 4*
4	Check for an open circuit between wiper switch connector terminal 1 and wiper relay connector terminal I. Is there an open circuit?	–	Go to *Step 6*	Go to *Step 5*
5	Replace the wiper switch. Is the repair complete?	–	System OK	–
6	Repair the open circuit between wiper switch connector terminal 1 and wiper relay connector terminal I. Is the repair complete?	–	System OK	–
7	1. Turn the ignition ON. 2. Turn the wiper switch to INT. 3. Check for pulsing voltage at wiper relay connector terminal 2. Does the voltmeter indicate a pulsating voltage equal to the specified value?	11-14 v	Go to *Step 11*	Go to *Step 8*
8	Using an ohmmeter, check the resistance between ground and the wiper relay connector terminal 31. Is resistance equal to the specified value?	$\approx 0\ \Omega$	Go to *Step 10*	Go to *Step 9*
9	Repair the open ground circuit. Is the repair complete?	–	System OK	–
10	Replace the wiper relay. Is the repair complete?	–	System OK	–
11	1. Ignition ON. 2. Check the voltage at the wiper switch connector terminal 1. Is voltage pulsating at the specified value?	11-14 v	Go to *Step 12*	Go to *Step 13*
12	Replace the wiper switch. Is the repair complete?	–	System OK	–
13	Repair the open circuit between the wiper switch and the wiper relay. Is the repair complete?	–	System OK	–

Windshield Wipers Do Not Return To Park Position

Step	Action	Value	Yes	No
1	1. Turn the ignition ON. 2. Check the voltage at the wiper motor connector terminal 5. Is the voltage equal to the specified value?	11-14 v	Go to *Step 3*	Go to *Step 2*
2	Repair the open circuit between the wiper motor connector terminal 5 and fuse F11. Is the repair complete?	–	System OK	–
3	1. Turn the wiper switch to HI. 2. While turning the wiper switch OFF, check the voltage at the wiper motor connector terminal 1. Is the specified voltage indicated when the wiper switch is turned OFF?	11-14 v	Go to *Step 5*	Go to *Step 4*
4	Replace the wiper motor. Is the repair complete?	–	System OK	–
5	1. Disconnect the wiper relay. 2. Check continuity between wiper relay terminal 31b and 53e. Does the ohmmeter indicate the specified value?	≈ 0 Ω	Go to *Step 6*	Go to *Step 7*
6	Repair the open circuit between the wiper motor and the wiper relay. Is the repair complete?	–	System OK	–
7	Replace the wiper relay. Is the repair complete?	–	System OK	–

WINDSHIELD WASHER SYSTEM

Windshield Washer Inoperative, Wipers Work OK

Step	Action	Value	Yes	No
1	Activate the windshield washer switch. Do the windshield wipers operate when the washer switch is activated?	–	Go to *Step 4*	Go to *Step 2*
2	1. Turn the ignition ON. 2. While activating the washer switch, test the voltage at windshield wiper switch connector terminal A4. Is voltage equal to the specified value?	11-14 v	Go to *Step 8*	Go to *Step 3*
3	Replace windshield wiper switch. Is the repair complete?	–	System OK	–
4	Check the windshield washer fluid reservoir. Is there washer fluid in the fluid reservoir?	–	Go to *Step 6*	Go to *Step 5*
5	Fill the windshield washer fluid reservoir. Is the repair complete?	–	System OK	–
6	Check the windshield washer hoses and nozzles. Are the windshield washer hoses and nozzles clogged or damaged?	–	Go to *Step 7*	Go to *Step 8*
7	Repair the washer hoses and nozzles. Is the repair complete?	–	System OK	–
8	1. Turn the ignition ON. 2. With the windshield washer activated, test voltage at the windshield washer pump. Is the voltage equal to the specified value?	11-14 v	Go to *Step 10*	Go to *Step 9*
9	Repair open circuit between the windshield washer pump and the windshield wiper switch. Is the repair complete?	–	System OK	–
10	Use an ohmmeter to measure resistance between ground and the windshield washer pump connector terminal 1. Is the resistance equal to the specified value?	$\approx 0\ \Omega$	Go to *Step 12*	Go to *Step 11*
11	Repair the windshield washer pump ground circuit. Is the repair complete?	–	System OK	–
12	Replace the windshield washer pump. Is the repair complete?	–	System OK	–

REAR WINDOW WIPER

Diagnostic Aid

If the front wiper is operating correctly, it is not necessary to check the fuse or the power supply circuit. Begin the diagnostic check at *Step 5* of the table below.

Step	Action	Value	Yes	No
1	Check fuse F11. Is fuse F11 blown?	–	Go to *Step 2*	Go to *Step 3*
2	1. Check for a short circuit and repair it, if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
3	1. Turn the ignition ON. 2. Check the voltage at fuse F11. Is the specified voltage available at fuse F11?	11 - 14 v	Go to *Step 5*	Go to *Step 4*
4	Repair the open power supply circuit for fuse F4. Is the repair complete?	–	System OK	–
5	1. Disconnect the rear window wiper electrical connector. 2. Turn the ignition ON. 3. Check the voltage at the RED/WHT wire. Does the voltage equal the specified value?	11 - 14 v	Go to *Step 7*	Go to *Step 6*
6	Repair the open circuit for the RED/WHT wire between fuse F11 and the rear window wiper motor. Is the repair complete?	–	System OK	–
7	With the rear window wiper still disconnected, use an ohmmeter to check continuity between the BLK wire and ground. Does the ohmmeter indicate the specified value?	$\approx 0\ \Omega$	Go to *Step 9*	Go to *Step 8*
8	Repair the open ground circuit for the rear window wiper motor. Is the repair complete?	–	System OK	–
9	1. Turn the ignition ON. 2. Turn the rear window wiper ON. 3. Check the voltage at the GRY wire at the rear window wiper connector. Does the voltmeter indicate the specified value?	11 - 14 v	Go to *Step 10*	Go to *Step 11*
10	Replace the rear window wiper motor. Is the repair complete?	–	System OK	–
11	1. Disconnect the rear window wiper switch electrical connector. 2. Turn the ignition ON. 3. Check the voltage at connector terminal A3. Is the voltage equal to the specified value?	11 - 14 v	Go to *Step 13*	Go to *Step 12*
12	Repair the open circuit between fuse F11 and the rear window wiper switch connector terminal A3. Is the repair complete?	–	System OK	–
13	1. Connect an ohmmeter between terminals A1 and A3 of the rear window wiper switch. 2. Move the rear window wiper switch to the WIPE position. Does the ohmmeter indicate the specified value?	$\approx 0\ \Omega$	Go to *Step 14*	Go to *Step 15*

Rear Window Wiper (Cont'd)

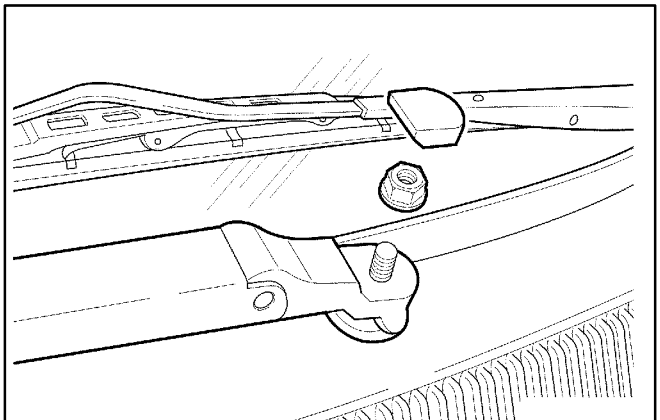
Step	Action	Value	Yes	No
14	Repair the open circuit between terminal A1 of the rear window wiper connector and the rear window wiper motor. Is the repair complete?	–	System OK	–
15	Replace the rear window wiper switch. Is the repair complete?	–	System OK	–

REAR WINDOW WASHER SYSTEM

Step	Action	Value	Yes	No
1	Check the washer fluid level. Is there fluid in the washer reservoir?	–	Go to *Step 3*	Go to *Step 2*
2	Fill the washer reservoir. Is the repair complete?	–	System OK	–
3	Verify that the hoses are not obstructed or leaking. • Disconnect the washer hose. • Blow through the washer hose toward the reservoir and also toward the nozzle. Are the hoses obstructed or leaking?	–	Go to *Step 4*	Go to *Step 5*
4	Repair or replace the hoses. Is the repair complete?	–	System OK	–
5	Check the function of the rear window wiper. Does the rear window wiper function correctly?	–	Go to *Step 7*	Go to *Step 6*
6	Repair the rear window wiper. Is the rear window wiper functioning correctly?	–	Go to *Step 7*	–
7	1. Disconnect the electrical connector at the rear window washer pump. 2. Use an ohmmeter to check continuity between terminal 1 and ground. Does the ohmmeter indicate the specified value?	≈ 0 Ω	Go to *Step 9*	Go to *Step 8*
8	Repair the open or high-resistance ground connection. Is the repair complete?	–	System OK	–
9	1. Turn on the rear window washer. 2. Check the voltage at terminal 2 of the rear window washer pump connector (LT GRN/BLK). Is the voltage equal to the specified value?	11 - 14 v	Go to *Step 10*	Go to *Step 11*
10	Replace the rear window washer pump. Is the repair complete?	–	System OK	–
11	1. Disconnect the rear window wiper switch. 2. Connect an ohmmeter between terminal A3 and terminal A2 of the rear window wiper switch. 3. Observe the ohmmeter when the switch is moved to the rear WASH position. Does the ohmmeter indicate the specified value?	≈ 0 Ω	Go to *Step 12*	Go to *Step 13*
12	Repair the open circuit between terminal A2 (LT GRN/BLK) of the rear window wiper switch connector and terminal 2 (LT GRN/BLK) of the rear window washer pump. Is the repair complete?	–	System OK	–
13	Replace the rear window wiper switch. Is the repair complete?	–	System OK	–

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE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FRONT WINDSHIELD WIPER ARM

Removal and Installation Procedure

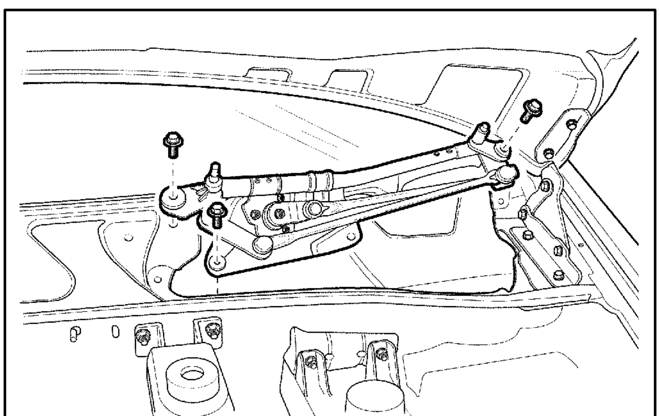
1. Open the hood.
2. Remove the cap to reveal the wiper arm nut,if necessary
3. Remove the nut from the wiper arm.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

4. Pull the wiper arm off.
5. Installation should follow the removal procedure in the reverse order.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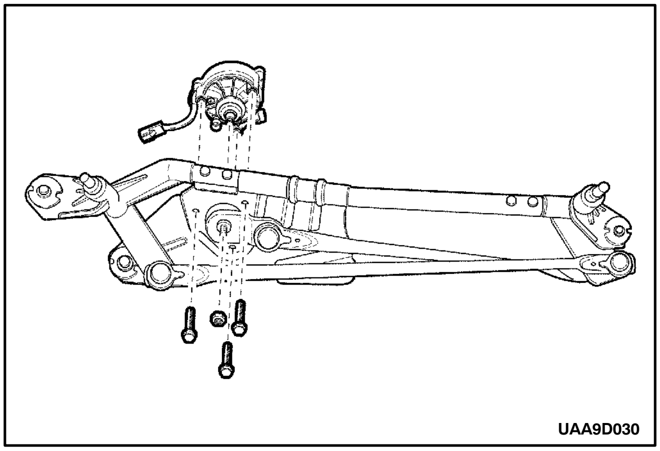
WINSHIELD WIPER MOTOR

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the wiper arm assembly.
3. Remove the cowl vent grill. Refer to *Section 9R, Body Front End.*
4. Remove the bolts and washer that secure the wiper arm linkage to the motor drive shaft.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)



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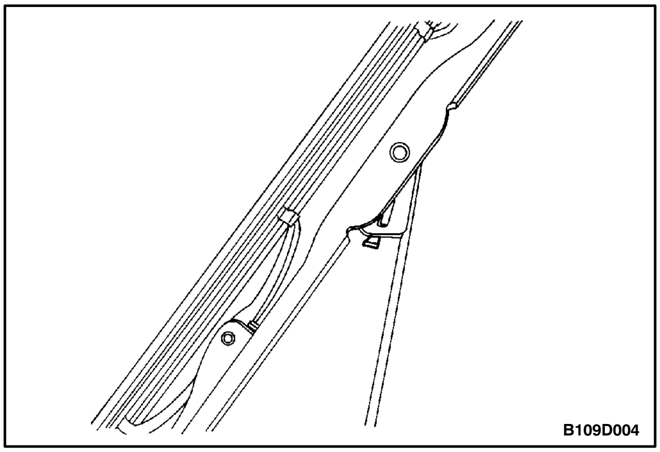
6. Pry the wiper arm linkage off the motor drive shaft.
7. Disconnect the electrical connector.
8. Remove the bolts and nut.

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

9. Installation should follow the removal procedure in the reverse order.



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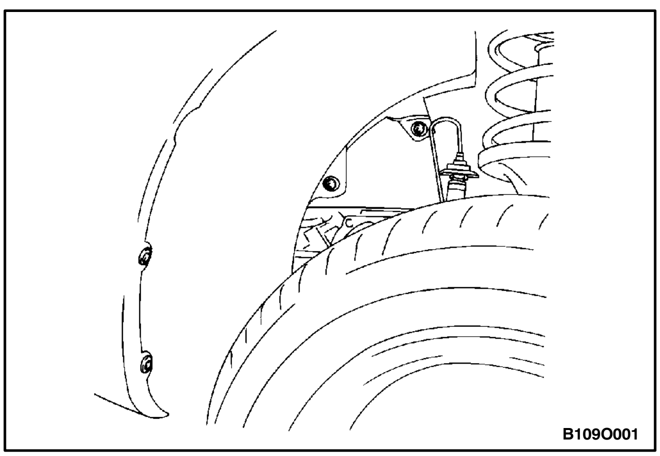
WINDSHIELD WIPER BLADE

Removal and Installation Procedure

1. Rotate the wiper blade on the arm.
2. While pressing the retainer clip,slide the wiper blade down the wiper arm and remove the blade.
3. Installation should follow the removal procedure in the reverse order.



B109O001

WINDSHIELD WASHER RESERVOIR

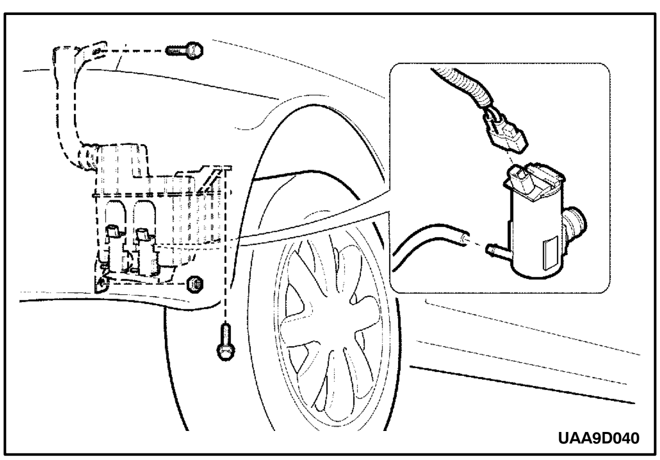
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the front left wheel. Refer to *Section 2E, Tires and • heel.*
3. Remove the bolts and the screws and the front wheel well splash shield.

Installation Notice

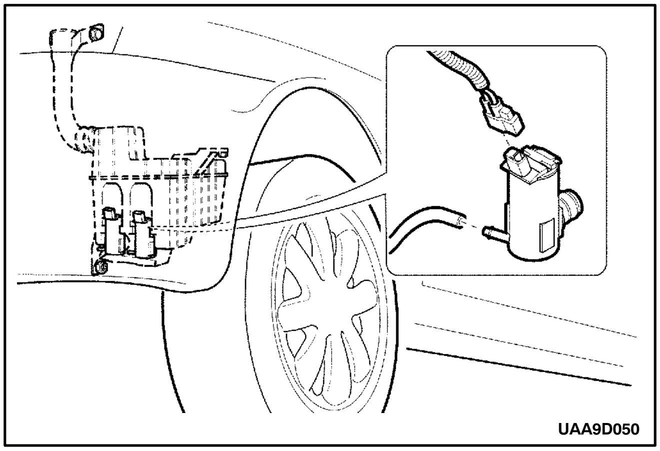
Tightening Torque	2 N·m (18 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.



UAA9D040

4. Disconnect the washer hose from the washer pump.
5. Disconnect the reservoir pump electrical connector.
6. Installation should follow the removal procedure in the reverse order.



WINDSHIELD WASHER PUMP

Removal and Installation Procedure

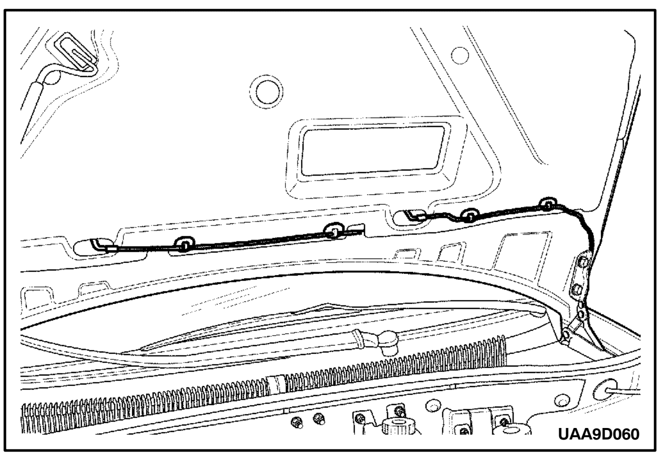
1. Disconnect the negative battery cable.
2. Remove the front left wheel. Refer to *Section 2E, Tires and • heel.*
3. Remove the bolts and the screws and the front wheel well splash shield

Installation Notice

Tightening Torque	2 N·m (18 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

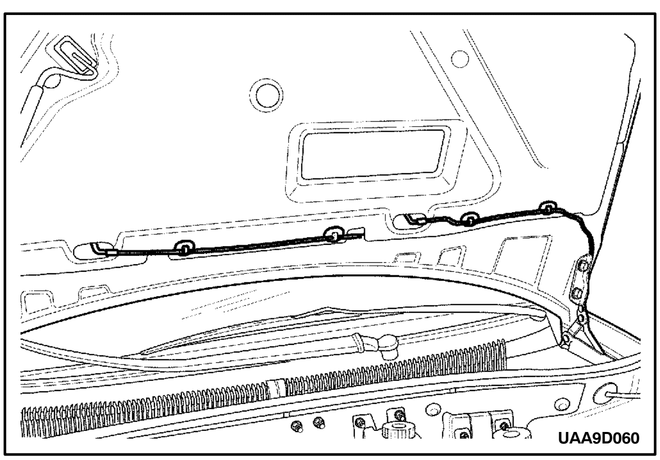
4. Disconnect the electrical connector.
5. Disconnect the washer hose from the washer pump.
6. Remove the washer pump.
7. Installation should follow the removal procedure in the reverse order.



WINDSHIELD WASHER NOZZLES

Removal and Installation Procedure

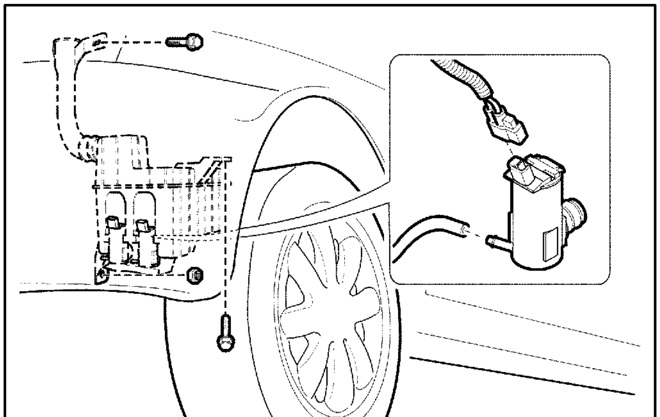
1. Disconnect the washer hose from the nozzle.
2. Remove the nozzle from the hood.
3. Installation should follow the removal procedure in the reverse order.



WINSHIELD WASHER HOSES

Removal and Installation Procedure

1. Disconnect the washer hose from the nozzle.



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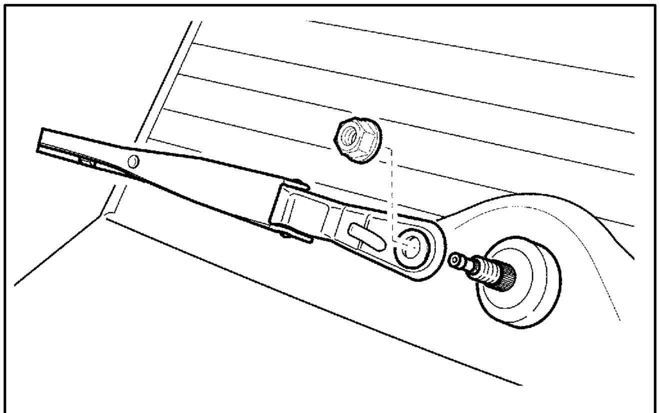
2. Remove the front left wheel. Refer to *Section 2E, Tires and • heels.*
3. Remove the bolts and screws and the front wheel well splash shield.

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

4. Disconnect the washer hose from the washer reservoir.
5. Remove the washer hose.
6. Installation should follow the removal procedure in the reverse order.



UAA9D080

REAR WINDOW WIPER ARM

Removal and Installation Procedure

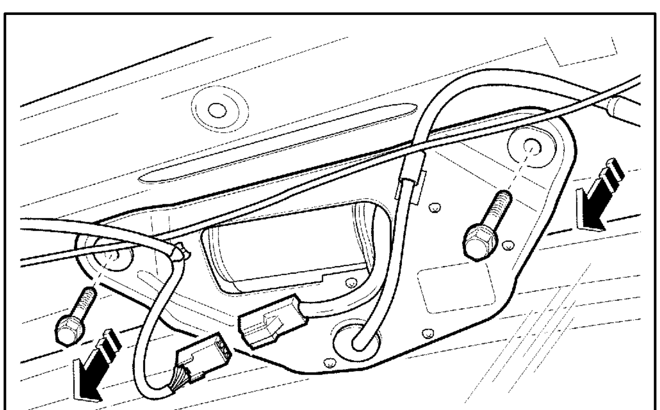
1. Open the wiper arm access cap.
2. Remove the washer hose.
3. Remove the nut.

Installation Notice

Tightening Torque	11 N·m (97 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

4. Pull the wiper arm off.
5. Installation should follow the removal procedure in the reverse order.

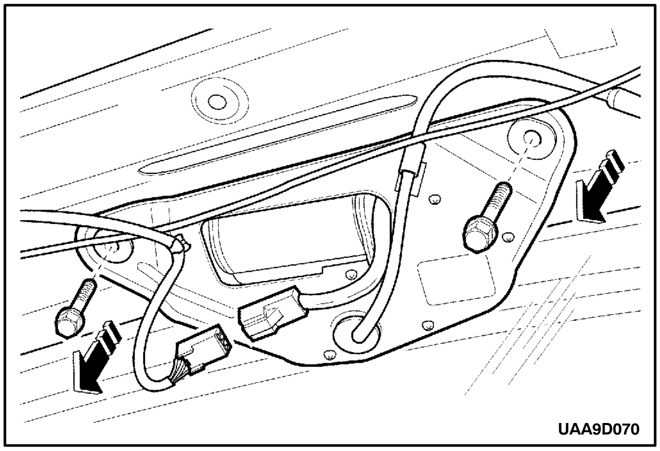


UAA9D070

REAR WINDOW WIPER MOTOR

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the rear window wiper arm. Refer to *“Rear • indow • iper Arm”* in this section.
3. Remove the back door trim. Refer to *Section 9G, Interior Trim.*
4. Disconnect the electrical connector.
5. Remove the washer hose.
6. Remove the bolts and the rear wiper motor.



Installation Notice

Tightening Torque	9 N·m (80 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

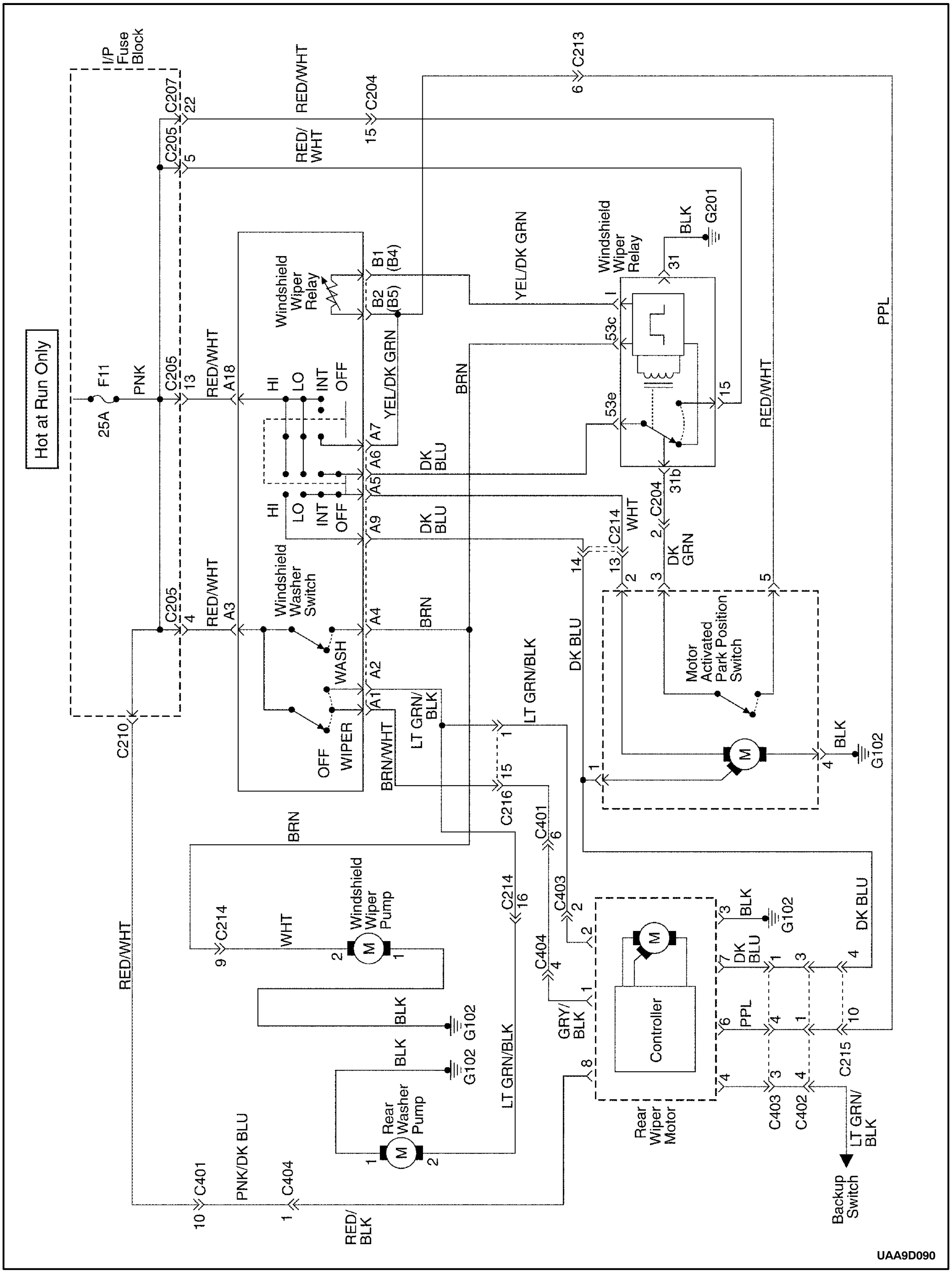
7. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Front Wheel Well Splash Shield Bolts	1.5	–	13
Washer Fluid Reservoir Bolts	15	11	–
Wiper Arm Linkage Nut	8.5	–	75
Wiper Arm Nut	11	–	97
Wiper Motor Bolts	9	–	80

SCHEMATIC AND ROUTING DIAGRAMS



SECTION 9E

INSTRUMENTATION/DRIVER INFORMATION

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

CIGAR LIGHTER

The cigar lighter is located the floor console. To use the lighter, push it in completely. When the lighter is hot, it will release itself from contact with the heating element. The lighter and the heating element can be damaged if the lighter is not allowed to fully release itself from the heating element.

ASHTRAY

The ashtray is located below the floor consol. To access the ashtray, pull it out of the ashtray housing. The ashtray lamp will go on when the parking lamps or headlamps are turned on.

INSTRUMENT PANEL VENTS

The center and the side vents in the instrument panel can be adjusted up and down and from side to side. The side vents can also be aimed toward the side windows in order to defog them.

GLOVE BOX

The glove box can be opened by pulling up on the latch handle. The glove box must be removed in order to gain access to the passenger-side airbag module (if equipped).

DIGITAL CLOCK

The digital clock is located cluster housing. The clock is capable of a 12-hour or a 24-hour display.

INSTRUMENT CLUSTER

The instrument cluster is located above the steering column and in the instrument cluster trim panel. The instrument cluster contains the instruments that provide the driver with vehicle performance information. The instrument cluster contains a speedometer, a tachometer, an odometer, a trip odometer, a temperature gauge, a fuel gauge and several indicator lamps. For replacement of the indicator lamp bulbs contained in the instrument cluster, refer to “Instrument Cluster Indicator Lamps Specifications” in this section.

SPEEDOMETER (CABLELESS)

The speedometer measures the speed of the vehicle. It consists of an instrument cluster gauge connected to the vehicle speed sensor on the transaxle output shaft (M/T) and to a sending unit in the electronic control module (A/T).

TRIP ODOMETER

The trip odometer measures the distance the vehicle has traveled since it was last reset. It consists of an instrument cluster gauge connected to the sending unit on the transaxle output shaft. The trip odometer can be reset to zero at any time so that the driver can record the distance traveled from any starting point.

FUEL GAUGE

The fuel gauge consists of an instrument cluster gauge connected to a sending unit in the fuel tank.

The fuel gauge indicates the quantity of fuel in the tank only when the ignition switch is turned to ON or ACC. When the ignition is turned to LOCK or START, the pointer may come to rest at any position.

TEMPERATURE GAUGE

The temperature gauge consists of an instrument cluster gauge connected to a temperature sensor that is in contact with the circulating engine coolant.

The temperature gauge indicates the temperature of the coolant. Prolonged driving or idling in very hot weather may cause the pointer to move beyond the center of the gauge. The engine is overheating if the pointer moves into the red zone at the upper limit of the gauge.

INSTRUMENT CLUSTER INDICATOR LAMPS

The instrument cluster contains indicator lamps that indicate the functioning of certain systems or the existence of potential problems with the operation of the vehicle. The indicator lamps are replaceable. For replacement of the indicator lamps contained in the instrument cluster, refer to “Instrument Cluster Indicator Lamps Specifications” in this section.

TACHOMETER

The tachometer measures the engine’s speed in terms of thousands of revolutions per minute. It consists of an instrument cluster gauge connected to a sending unit in the electronic control module.

Notice: Do not operate the engine in the red zone; otherwise, engine damage may occur.

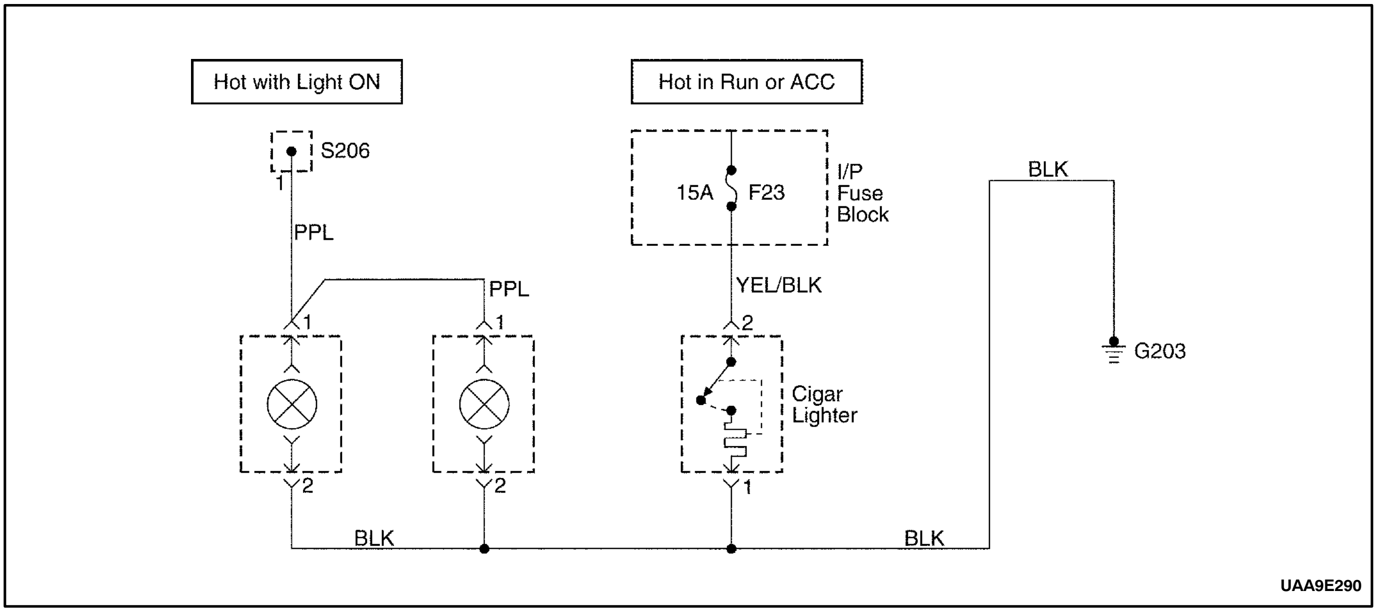
CHIME MODULE

The chime module will sound in order to bring attention to one or more of the following conditions:

- The lights are on and the ignition switch is not in ACC, ON, or START.
- The ignition key is in the ignition switch when the driver’s door is open.
- The seat belt is unbuckled when the ignition switch is in ON or START.

Voltage is supplied at all times through the fuse block to power the chime module.

DIAGNOSTIC INFORMATION AND PROCEDURES



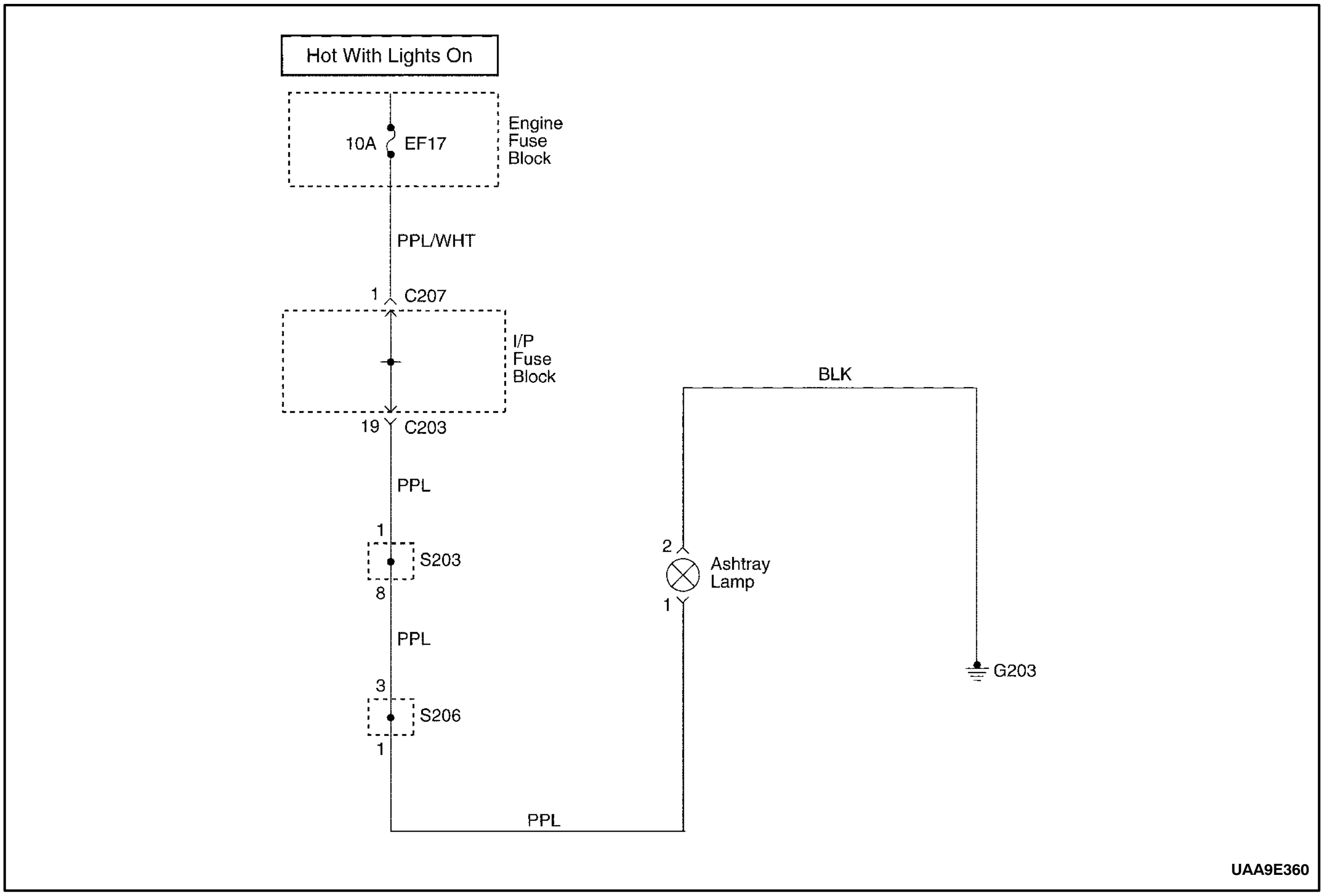
CIGAR LIGHTER

Cigar Lighter Inoperative

Step	Action	Value(s)	Yes	No
1	Check fuse F23. Is the fuse blown?	–	Go to Step 2	Go to Step 3
2	1. Check for a short circuit and repair if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
3	Use a voltmeter to check for voltage at fuse F23. Does the battery voltage available at the fuse F23 match the value specified?	11-14 v	Go to Step 5	Go to Step 4
4	Repair the open power supply circuit for fuse F23. Is the repair complete?	–	System OK	–
5	1. Remove the electrical connector from the back of the cigar lighter. 2. Use a voltmeter to check the voltage at the YEL/BLK wire. Does the battery voltage available at the YEL/BLK wire match the value specified?	11-14 v	Go to Step 7	Go to Step 6
6	Repair the open circuit between the fuse F23 and the cigar lighter. Is the repair complete?	–	System OK	–
7	Connect the voltmeter between the YEL/BLK and the BLK wires at the cigar lighter connector. Does the battery voltage match the value specified?	11-14 v	Go to Step 9	Go to Step 8

Cigar Lighter Inoperative

Step	Action	Value(s)	Yes	No
8	Repair the open ground circuit. Is the repair complete?	–	System OK	–
9	Replace the cigar lighter. Is the repair complete?	–	System OK	–



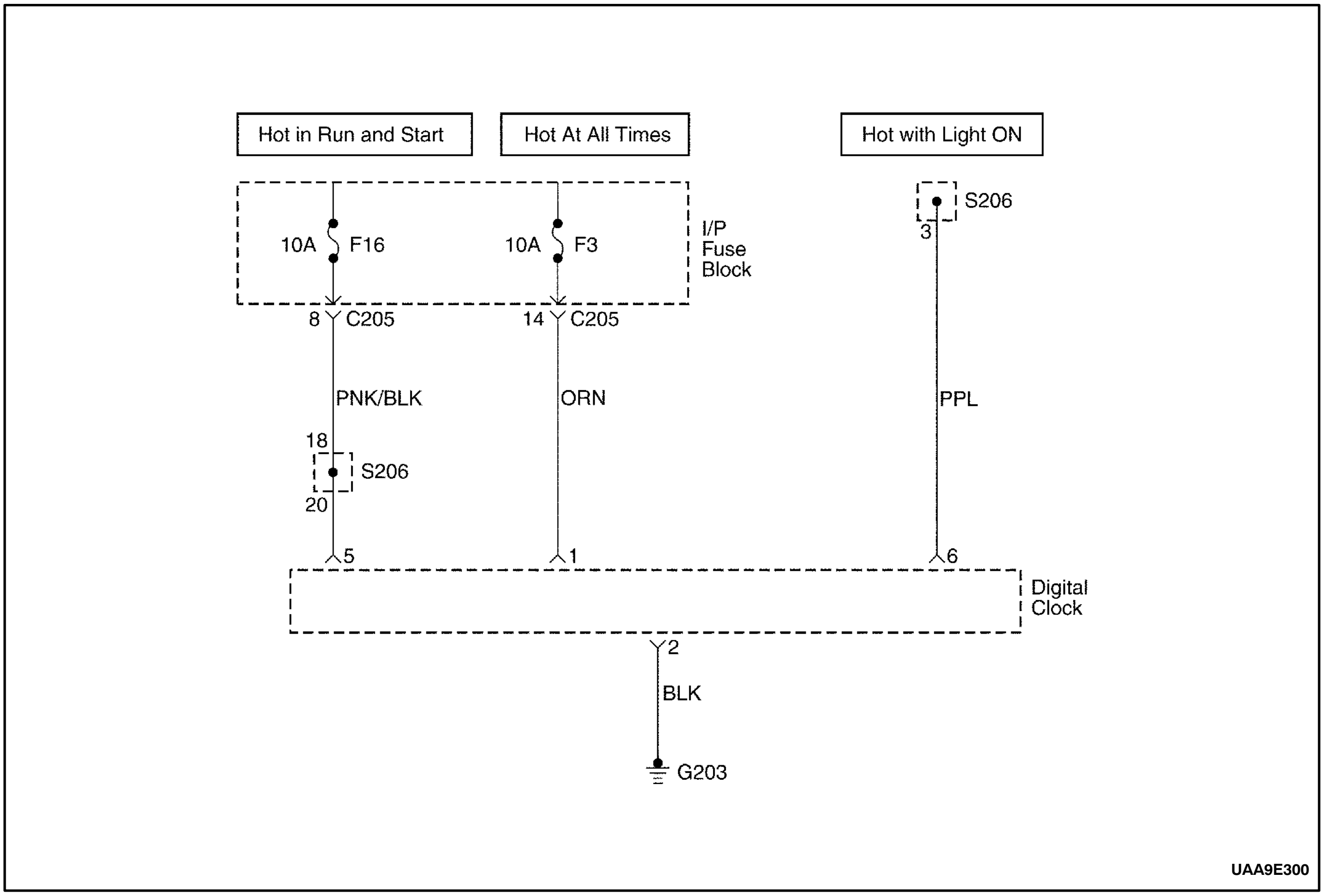
ASHTRAY LAMP

Ashtray Lamp Is Inoperative

Step	Action	Value	Yes	No
1	Turn the ignition ON.	–	Go to Step 3	Go to Step 2
2	Check the fuse EF17.	–	Go to Step 3	System OK
3	1. Remove the ashtray lamp from its socket. 2. Turn the ignition ON. 3. Check the voltage at the ashtray lamp positive terminal (PPL wire). Is the voltage equal to the specified value?	11 - 14 v	Go to Step 5	Go to Step 4
4	Repair the open circuit between fuse EF17 and the ashtray lamp. Is the repair complete?	–	System OK	–

Ashtray Lamp Is Inoperative

Step	Action	Value	Yes	No
5	Connect an ohmmeter between ground and the negative terminal at the ashtray lamp. Is the resistance equal to the specified value?	≈ 0 Ω	Go to Step 7	Go to Step 6
6	Repair the open ground circuit for the ashtray lamp. Is the repair complete?	–	System OK	–
7	Replace the ashtray lamp bulb. Is the repair complete?	–	System OK	–



DIGITAL CLOCK

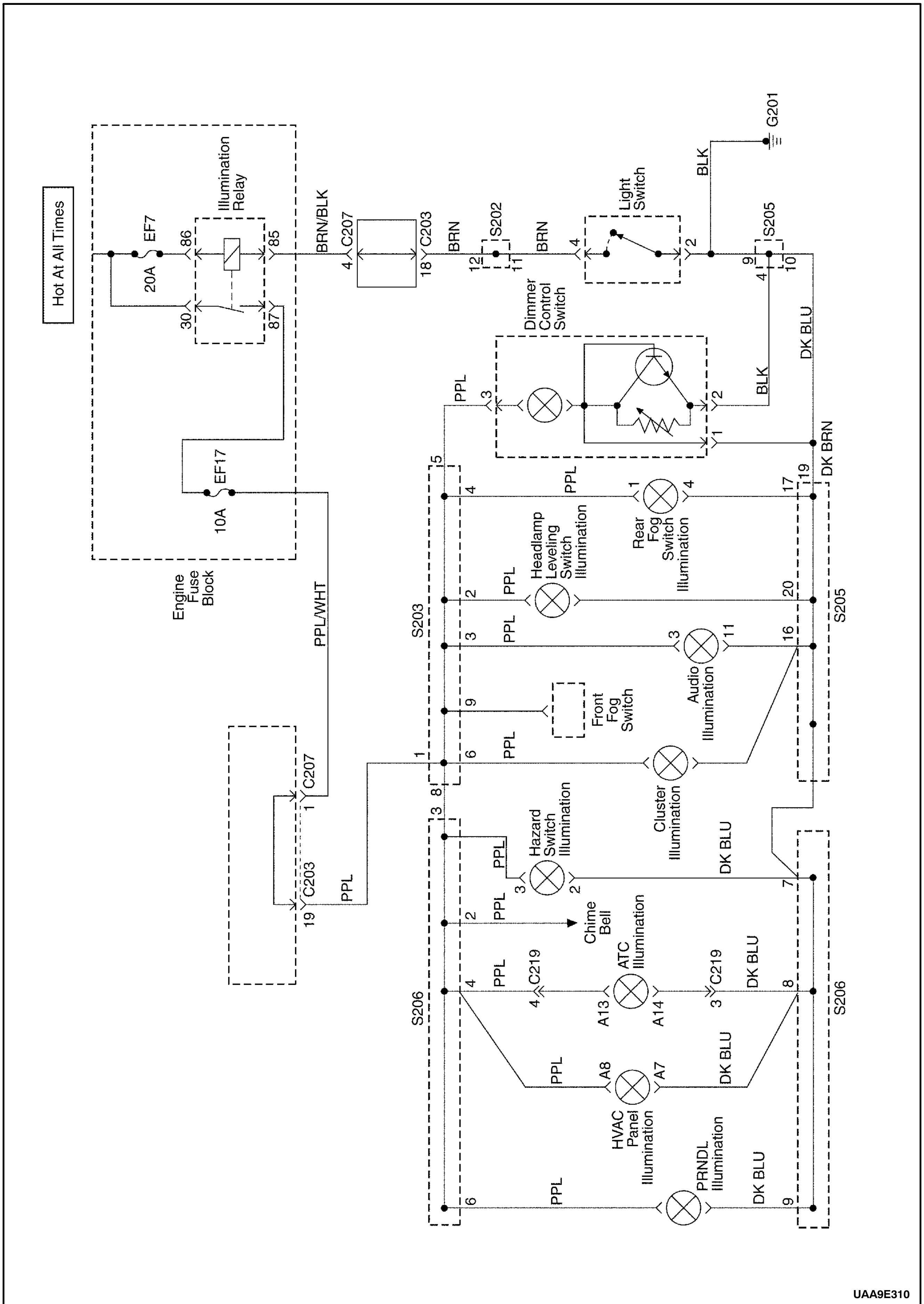
Digital Clock Inoperative

Step	Action	Value(s)	Yes	No
1	Is either of the fuses F3 or F16 blown?	–	Go to Step 2	Go to Step 3
2	1. Check for a short circuit and repair if necessary. 2. Replace the blown fuses. Is the repair complete?	–	System OK	–
3	1. Turn the ignition ON. 2. Use a voltmeter to check battery voltage available at fuses F3 and F16. Does the voltmeter indicate the value specified?	11-14 v	Go to Step 5	Go to Step 4
4	Repair the open power supply circuit for the fuse. Is the repair complete?	–	System OK	–
5	Use a voltmeter to check the battery voltage available at the clock connector terminal 1. Does the voltmeter indicate the value specified?	11-14 v	Go to Step 7	Go to Step 6
6	Repair the open circuit between the clock connector terminal 1 and the fuse F3. Is the repair complete?	–	System OK	–
7	Turn the ignition ON. Is battery voltage available at the clock connector terminal 5?	–	Go to Step 9	Go to Step 8

Digital Clock Inoperative

Step	Action	Value(s)	Yes	No
8	Repair the open circuit between the clock connector terminal 5 and the fuse F16. Is the repair complete?	–	System OK	–
9	Check continuity between the clock connector terminal 2 and ground. Does the multimeter indicate the value specified?	2 0 Ω	Go to Step 10	Go to Step 11
10	Replace the clock. Is the repair complete?	–	System OK	–
11	Repair the open ground circuit between the clock connector terminal 2 and the ground G203. Is the repair complete?	–	System OK	–

INSTRUMENT PANEL ILLUSTRATION



INSTRUMENT PANEL ILLUMINATION

Instrument Panel Illumination Does Not Work

Step	Action	Value	Yes	No
1	Test the parking lamps. Do the parking lamps work?	–	Go to Step 3	Go to Step 2
2	Repair the parking lamps before continuing with this diagnostic table. Is the instrument panel illumination still inoperative after the the parking lamps have been repaired?	–	Go to Step 3	System OK
3	Check fuse EF7. Is fuse EF7 blown?	–	Go to Step 4	Go to Step 5
4	1. Check for a short circuit and repair it if necessary. 2. Replace fuse EF7. Is the repair complete?	–	System OK	–
5	1. Turn the parking lamps ON. 2. Check the voltage at fuse EF7. Does the voltmeter indicate the specified value?	11 - 14 v	Go to Step 7	Go to Step 6
6	Repair the power supply for fuse EF7. Is the repair complete?	–	System OK	–
7	1. Turn the parking lamps ON. 2. Temporarily disconnect any of the instrument panel illumination lamps. 3. Check the voltage at the positive terminal (PPL wire) of any of the illumination lamps. Does the voltmeter indicate the specified value?	11 - 14 v	Go to Step 9	Go to Step 8
8	Repair the open circuit between fuse EF7 and the instrument panel illumination lamps. Is the repair complete?	–	System OK	–
9	1. Disconnect the dimmer control switch. 2. Turn the parking lamps ON. 3. Check the voltage at the DK BLU wire on the top row of the dimmer connector terminals. Does the voltmeter indicate the specified value?	11 - 14 v	Go to Step 11	Go to Step 10
10	Repair the open circuit between the dimmer control switch and the instrument panel illumination lamps. Is the repair complete?	–	System OK	–
11	With the dimmer control switch disconnected, use an ohmmeter to check the resistance between ground and the BLK wire at the dimmer control switch connector. Does the ohmmeter indicate the specified value?	$\approx 0\ \Omega$	Go to Step 13	Go to Step 12
12	Repair the open circuit between ground and the BLK wire at the dimmer control switch connector. Is the repair complete?	–	System OK	–
13	Replace the dimmer control switch. Is the repair complete?	–	System OK	–

Automatic Transaxle Gear Position Illumination Lamp Inoperative, All Other Instrument Lamps OK

Step	Action	Value(s)	Yes	No
1	Is fuse EF17 blown?	–	Go to Step 2	Go to Step 3
2	1. Check for a short circuit and repair if necessary. 2. Replace the blown fuse. Is the repair complete?	–	System OK	–
3	1. Turn the light switch ON. 2. Use a voltmeter to check battery voltage available at fuse EF17. Does the battery voltage match the value specified?	11-14 v	Go to Step 5	Go to Step 4
4	Repair the open circuit power supply circuit to fuse EF17. Is the repair complete?	–	System OK	–
5	1. Turn the light switch ON. 2. Remove the automatic transaxle position lamp. 3. Use a voltmeter to check battery voltage available at the lamp socket. Does the battery voltage match the value specified?	11-14 v	Go to Step 7	Go to Step 6
6	Repair the open circuit between the automatic transaxle position lamp socket and fuse EF17. Is the repair complete?	–	System OK	–
7	1. Turn the light switch ON. 2. Remove the automatic transaxle position lamp. 3. Use an ohmmeter to check the resistance between the ground circuit and the lamp socket. Is the resistance equal to the value specified?	0 Ω	Go to Step 9	Go to Step 8
8	Repair the open ground circuit between the automatic transaxle position lamp socket and the ground. Is the repair complete?	–	System OK	–
9	Replace the automatic transaxle position lamp. Is the repair complete?	–	System OK	–

SPEEDOMETER (CABLELESS)

Speedometer Inoperative, Other Gauges and Warning Lamps Are OK

Step	Action	Value	Yes	No
1	1. Connect a scan tool. 2. Check for engine control Diagnostic Trouble Codes (DTCs). Is a vehicle speed sensor (VSS) DTC set?	–	Go to Section 1F, Engine Controls	Go to Step 2
2	1. Turn the ignition OFF. 2. Remove the instrument cluster. 3. Use an ohmmeter to check the continuity of the wire between the instrument cluster connector terminal C3 and VSS. Is an open circuit detected?	–	Go to Step 3	Go to Step 4
3	Repair the open circuit between the instrument cluster connector terminal C3 and VSS. Is the repair complete?	–	System OK	–
4	Replace the speedometer. Is the repair complete?	–	System OK	–

TACHOMETER

Tachometer Does Not Work

Test Description

The number below refers to a step number in the diagnostic table.

3. If the coolant temperature gauge works, skip Steps 3 to 10 and go directly to Step 11. The coolant temperature gauge uses the same fuse and ground as the tachometer.

Step	Action	Value	Yes	No
1	Check the engine Diagnostic Trouble Codes (DTCs). Are there any current vehicle speed sensor (VSS) DTCs?	–	Go to Step 2	Go to Step 3
2	Diagnose and repair any VSS DTCs before continuing with this table. Are the VSS DTCs cleared?	–	Go to Step 3	–
3	Check fuse F16. Is fuse F16 blown?	–	Go to Step 5	Go to Step 4
4	1. Check for a short circuit and repair it, if necessary. 2. Replace fuse F16. Is the repair complete?	–	System OK	–
5	1. Turn the ignition ON. 2. Check the voltage at fuse F16. Is the voltage equal to the specified value?	11 - 14 v	Go to Step 7	Go to Step 6

Tachometer Does Not Work (Cont'd)

Step	Action	Value	Yes	No
6	Repair the power supply for fuse F16. Is the repair complete?	–	System OK	–
7	1. Disconnect the instrument cluster connector. 2. Turn the ignition ON. 3. Check the voltage at the instrument cluster connector terminal C1. Is the voltage at terminal C1 equal to the specified value?	11 - 14 v	Go to Step 9	Go to Step 8
8	Repair the open circuit between fuse F16 and instrument cluster connector terminal C1. Is the repair complete?	–	System OK	–
9	With the instrument cluster disconnected, use an ohmmeter to check resistance between instrument cluster connector terminal C12 and ground. Does the ohmmeter indicate the specified value?	≈ 0 Ω	Go to Step 11	Go to Step 10
10	Repair the open circuit between ground and instrument cluster connector terminal C12. Is the repair complete?	–	System OK	–
11	Check for a defect on the instrument cluster printed circuit. Is the printed circuit defective?	–	Go to Step 12	Go to Step 13
12	Replace the instrument cluster. Is the repair complete?	–	System OK	–
13	With the instrument cluster disconnected, use an ohmmeter to check for an open circuit between the electronic control module (ECM) and the instrument cluster connector terminal C2. Does the ohmmeter indicate the specified value?	≈ 0 Ω	Go to Step 15	Go to Step 14
14	Repair the open circuit between the instrument cluster connector terminal C2 and the ECM. Is the repair complete?	–	System OK	–
15	Replace the tachometer. Does the new tachometer work?	–	System OK	Go to Step 16
16	Replace the ECM. Is the repair complete?	–	System OK	–

FUEL GAUGE

Fuel Gauge Always Shows Full or Always Shows Empty

Step	Action	Value	Yes	No
1	1. Turn the ignition ON. 2. Observe the fuel gauge. Does the fuel gauge always indicate a full fuel tank even though it has been established that the tank is not full?	–	Go to Step 2	Go to Step 7
2	1. Turn the ignition OFF. 2. Disconnect the fuel tank sending unit. 3. Turn the ignition ON. Does the fuel gauge change to empty?	–	Go to Step 3	Go to Step 4
3	Replace the fuel tank sending unit. Is the repair complete?	–	System OK	–
4	1. Turn the ignition OFF. 2. Disconnect the instrument cluster connector terminal C14. 3. Turn the ignition ON. Does the fuel gauge now indicate an empty fuel tank?	–	Go to Step 5	Go to Step 6
5	Repair the short to ground in the WHT or GRY wire between the instrument cluster connector and the fuel tank sending unit. Is the repair complete?	–	System OK	–
6	Replace the fuel gauge. Is the repair complete?	–	System OK	–
7	1. If the fuel tank shows empty even though it has been established that the tank is not empty, disconnect the fuel tank sending unit electrical connector. 2. Turn the ignition ON. 3. Check the voltage at the fuel tank sending unit connector terminal 1. Does the voltmeter indicate the specified value?	11 - 14 v	Go to Step 9	Go to Step 8
8	Repair the open circuit between the fuel gauge and the fuel tank sending unit. Is the repair complete?	–	System OK	–
9	Check the continuity of the wire between the fuel tank sending unit connector terminal 6 and ground. Does the ohmmeter indicate the specified value?	≈ 0 Ω	Go to Step 11	Go to Step 10
10	Repair the open circuit or the poor connection between ground and the fuel tank sending unit connector. Is the repair complete?	–	System OK	–
11	1. With the fuel tank sending unit connector disconnected, attach a jumper between ground and terminal 1. 2. Turn the ignition ON. Does the fuel gauge move to full?	–	Go to Step 3	Go to Step 6

TEMPERATURE GAUGE

Diagnostic Aids

For full scale readings, the gauge may be indicating the correct coolant temperature. Problems not covered by this diagnostic table include the following:

- Low coolant level.
- Improper coolant mixture.
- Coolant leaks.
- Faulty coolant pump.
- Faulty thermostat.
- Gasket failure.
- Lack of lubrication.
- Lack of cooling fan operation.

This table covers problems with the gauge circuit, the gauge, and the sending unit, but not problems which cause actual overheating or underheating.

Test Description

The numbers below refer to steps on the diagnostic table.

2. The coolant temperature sensor (CTS) for the electronic control module (ECM) and the temperature gauge sending unit are close together on the engine block. Refer to the schematic to determine the correct wire color to verify that you are testing at the correct component.
3. The CTS for the ECM and the temperature gauge sending unit are close together on the engine block. Refer to the schematic to determine the correct wire color to verify that you are testing at the correct component.

Temperature Gauge Always Indicates Full Scale Hot Or Full Scale Cold, Other Gauges Are OK

Step	Action	Value	Yes	No
1	1. Allow the engine to cool to room temperature. 2. Turn the ignition ON. Does the temperature gauge always read at the high end of the scale?	–	Go to Step 2	Go to Step 7
2	Disconnect the coolant temperature sending unit electrical connector. Does the temperature gauge indicator point to the low end of the scale?	–	Go to Step 3	Go to Step 4
3	Replace the coolant temperature sending unit. Is the repair complete?	–	System OK	–
4	1. Turn the ignition OFF. 2. Disconnect the instrument cluster connector C1. 3. Turn the ignition ON. Does the temperature indicator now point to the low end of the scale?	–	Go to Step 5	Go to Step 6
5	Repair the short to ground in the WHT/BLK or WHT wire between the instrument cluster connector and the coolant temperature sending unit. Is the repair complete?	–	System OK	–
6	Replace the temperature gauge. Is the repair complete?	–	System OK	–
7	1. If the temperature gauge always reads at the low end of the scale, disconnect the coolant temperature sending unit. 2. Turn the ignition ON. 3. Check the voltage at the coolant temperature sending unit connector. Does the voltage equal the value specified?	11 - 14 v	Go to Step 10	Go to Step 8

Temperature Gauge Always Indicates Full Scale Hot Or Full Scale Cold, Other Gauges Are OK (Cont'd)

Step	Action	Value	Yes	No
8	Use an ohmmeter to check for an open circuit between the coolant temperature sending unit and the temperature gauge. Is there an open circuit?	–	Go to Step 9	Go to Step 10
9	Repair the open circuit between the temperature sending unit and temperature gauge. Is the repair complete?	–	System OK	–
10	1. Disconnect the coolant temperature sending unit. 2. Connect a jumper wire between the coolant temperature sending unit connector and ground. 3. Turn the ignition ON. Does the temperature gauge move to the high end of the scale?	–	Go to Step 3	Go to Step 6

INSTRUMENT CLUSTER INDICATOR LAMPS

Diagnostic Aid

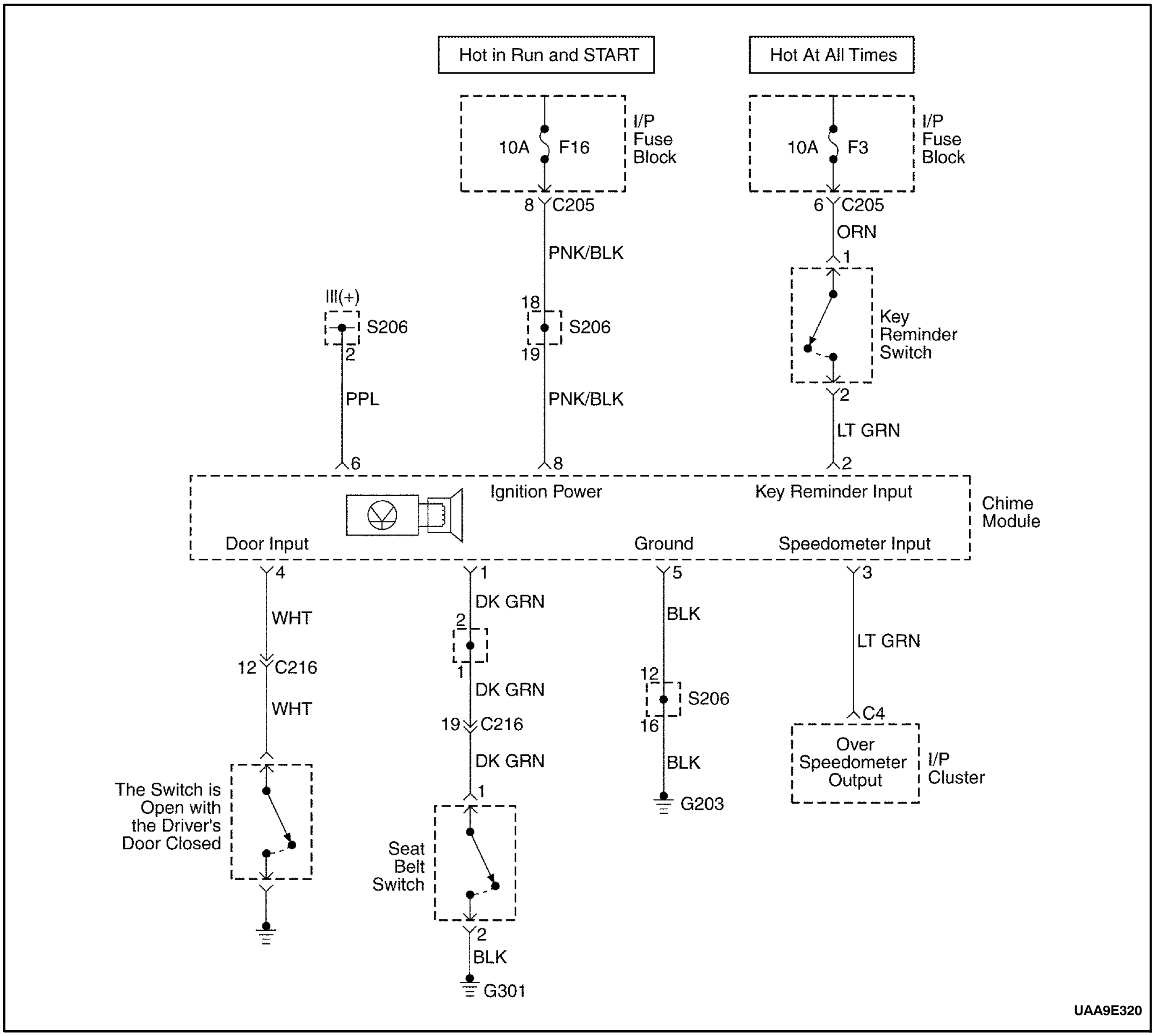
This table covers lamps powered by fuses F5 and F10: door ajar, rear deck lid ajar, service engine soon, oil pressure, battery, power, ABS, AIR BAG, low fuel warning. The ground for each circuit is provided by the component being monitored by the indicator lamp.

Instrument Cluster Indicator Lamps Do Not Operate

Step	Action	Value	Yes	No
1	Check fuses F5 and EF6. Is either fuse blown?	–	Go to Step 2	Go to Step 3
2	1. Check for a short circuit and repair it if necessary. 2. Replace the blown fuse. Is the repair complete?	–	System OK	–
3	1. Turn the ignition ON. 2. Check the voltage at fuses F3 and EF6. Does the voltmeter indicate the specified value?	11 - 14 v	Go to Step 5	Go to Step 4
4	Repair the open power supply circuit for F3 and/or EF6. Is the repair complete?	–	System OK	–
5	Check the cluster indicators. Is the problem associated with all of the cluster indicators?	–	Go to Step 8	Go to Step 6
6	1. If the problem is associated with only a single cluster indicator rather than all of the cluster indicators, locate the component (switch, sending unit, etc.) which provides the ground for the cluster indicator. 2. At the component, disconnect the wire from the instrument cluster indicator. 3. Connect a jumper wire between ground and the disconnected wire at the component. 4. Turn the ignition ON. Does the cluster indicator turn ON?	–	Go to Step 7	Go to Step 10

Instrument Cluster Indicator Lamps Do Not Operate (Cont'd)

Step	Action	Value(s)	Yes	No
7	Replace the faulty component (switch, sending unit, etc.). Is the repair complete?	–	System OK	–
8	Check the connectors at the rear of the instrument cluster. Are the connectors correctly attached?	–	Go to Step 10	Go to Step 9
9	Attach the connectors correctly. Is the repair complete?	–	System OK	–
10	1. Disconnect the instrument cluster connectors. 2. Turn the ignition ON. 3. Check the voltage at instrument cluster connector terminals C1, A20, and B9. (Consult the schematic. It may not be necessary to check all three terminals, depending on which circuits are being checked.) Does the voltmeter indicate the specified value?	11 - 14 v	Go to Step 12	Go to Step 11
11	Repair the open circuit between the fuses and the instrument cluster. Is the repair complete?	–	System OK	–
12	Check the warning lamp bulbs. Are the bulbs OK?	–	Go to Step 14	Go to Step 13
13	1. Replace any defective warning lamp bulbs. 2. If all bulbs are defective, check the charging system to make sure that the generator is not overcharging. Refer to Section 2E, Electrical System. 3. If a problem is found, repair the charging system. Is the repair complete?	–	System OK	–
14	Use an ohmmeter to check for an open wire between the instrument cluster connector and the connector at the component which is monitored by the indicator lamp. Is an open circuit detected?	–	Go to Step 15	Go to Step 16
15	Repair the open circuit between the instrument cluster and the component monitored by the indicator lamp. Is the repair complete?	–	System OK	–
16	Replace the instrument cluster. Is the repair complete.	–	System OK	–



CHIME MODULE

Door-Open Chime Does Not Operate

Step	Action	Value(s)	Yes	No
1	Check the chime fuse F16. Is the chime fuse F16 blown?	–	Go to Step 2	Go to Step 3
2	1. Check for a short circuit and repair it if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
3	1. Turn the ignition ON. 2. Open the driver's door. 3. Use a voltmeter to check for power at fuse F16. Does the voltmeter indicate the value specified?	11-14 v	Go to Step 5	Go to Step 4
4	Repair the open power supply circuit to fuse F16. Is the repair complete?	–	System OK	–

Door-Open Chime Does Not Operate

Step	Action	Value(s)	Yes	No
5	Check for an open circuit between fuse F16 and terminal 8 of the chime module connector. Is there an open circuit?	–	Go to Step 6	Go to Step 7
6	Repair the open circuit. Is the repair complete?	–	System OK	–
7	1. Disconnect the chime module electrical connector. 2. Connect an ohmmeter between terminal 5 of the chime module connector and ground. Does the ohmmeter indicate the specified value?	≈ 0 Ω	Go to Step 9	Go to Step 8
8	Repair the open ground circuit between ground and terminal 5 of the chime module connector. Is the repair complete?	–	System OK	–
9	1. Disconnect the chime module electrical connector. 2. Connect an ohmmeter between terminal 16 of the chime module connector and ground. 3. Leave the driver's door open. Does the ohmmeter indicate the specified value?	≈ 0 Ω	Go to Step 10	Go to Step 11
10	Replace the chime module. Is the repair complete?	–	System OK	–
11	Replace the driver's door open switch. Is the repair complete?	–	System OK	–

Key Reminder Chime Does Not Operate

Step	Action	Value(s)	Yes	No
1	Check fuse F3. Is fuse EF29 blown?	–	Go to Step 2	Go to Step 3
2	1. Check for a short circuit and repair it if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
3	Use a voltmeter to check for power at fuse F3. Does the voltmeter indicate the value specified?	11-14 v	Go to Step 5	Go to Step 4
4	Repair the open power supply circuit to fuse F3. Is the repair complete?	–	System OK	–
5	1. Put the key in the ignition. 2. Check for an open circuit between fuse F3 and terminal 2 of the chime module connector. Is there an open circuit?	–	Go to Step 6	Go to Step 9
6	1. Leave the key in the ignition. 2. Remove the plastic steering column covers. 3. Disconnect the key reminder switch. 4. Connect an ohmmeter between terminals 1 and 2 of the key reminder switch. Does the ohmmeter indicate the specified value?	≈ 0 Ω	Go to Step 7	Go to Step 8
7	Repair the open circuit between fuse F3 and terminal 2 of the chime module connector. Is the repair complete?	–	System OK	–

Key Reminder Chime Does Not Operate

Step	Action	Value(s)	Yes	No
8	Replace the key reminder switch. Is the repair complete?	–	System OK	–
9	1. Disconnect the chime module electrical connector. 2. Connect an ohmmeter between terminal 5 of the chime module connector and ground. Does the ohmmeter indicate the specified value?	≈ 0 Ω	Go to Step 11	Go to Step 10
10	Repair the open ground circuit between ground and terminal 5 of the chime module connector. Is the repair complete?	–	System OK	–
11	1. Leave the driver's door open. 2. Disconnect the chime module electrical connector. 3. Connect an ohmmeter between terminal 16 of the chime module connector and ground. Does the ohmmeter indicate the specified value?	≈ 0 Ω	Go to Step 12	Go to Step 13
12	Replace the chime module. Is the repair complete?	–	System OK	–
13	1. Remove the driver door-open switch. 2. Connect an ohmmeter between the chime module connector 4 and the driver door open switch connector 1. Does the ohmmeter indicate the specified value?	≈ 0 Ω	Go to Step 15	Go to Step 14
14	Repair the open circuit between the chime module connector 4 and the driver door open switch connector 1. Is the repair complete?	–	System OK	–
15	Replace the driver door-open switch. Is the repair complete?	–	System OK	–

Vehicle Speed Warning Chime Does Not Operate

Step	Action	Value(s)	Yes	No
1	Check the speedometer to make sure it is operating properly. Is the speedometer operating properly?	–	Go to Step 3	Go to Step 2
2	Repair the speedometer before continuing with this diagnostic table. Is the repair complete?	–	System OK	–
3	Check the chime module connector to make sure it is connected properly. Is the connector disconnected or partially disconnected?	–	Go to Step 4	Go to Step 5
4	Connect the electrical connector for the chime module. Is the repair complete?	–	System OK	–
5	Check fuse F16. Is fuse F16 blown?	–	Go to Step 6	Go to Step 7

Vehicle Speed Warning Chime Does Not Operate (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Check for a short circuit and repair it, if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
7	1. Turn the ignition ON. 2. Check the voltage at fuse F16. Is the specified voltage available at fuse F16?	11-14 v	Go to Step 9	Go to Step 8
8	Repair the power supply circuit for fuse F16. Is the repair complete?	–	System OK	–
9	1. Disconnect the chime module. 2. Turn the ignition ON. 3. Check the voltage at terminal 8 of the chime module connector. Does the voltage equal the specified value?	11-14 v	Go to Step 11	Go to Step 10
10	Repair the open circuit between fuse F16 and the chime module connector terminal 8. Is the repair complete?	–	System OK	–
11	With the chime module disconnected, use an ohmmeter to check the continuity between terminal 5 of the chime module connector and ground. Does the ohmmeter indicate the specified value?	≈ 0 Ω	Go to Step 13	Go to Step 12
12	Repair the open circuit between terminal 5 of the chime module connector and ground. Is the repair complete?	–	System OK	–
13	1. Disconnect the chime module connector. 2. Remove the instrument cluster. 3. Use an ohmmeter to check the continuity between the chime module connector terminal 3 and the speedometer connector C4. Does the ohmmeter indicate the specified value?	≈ 0 Ω	Go to Step 15	Go to Step 14
14	Repair the open circuit between the chime module connector terminal 3 and the speedometer connector C4. Is the repair complete?	–	System OK	–
15	Replace the chime module. Does the vehicle speed warning chime work after the chime module has been replaced?	–	System OK	Go to Step 16
16	Replace the speedometer. Is the repair complete?	–	System OK	–

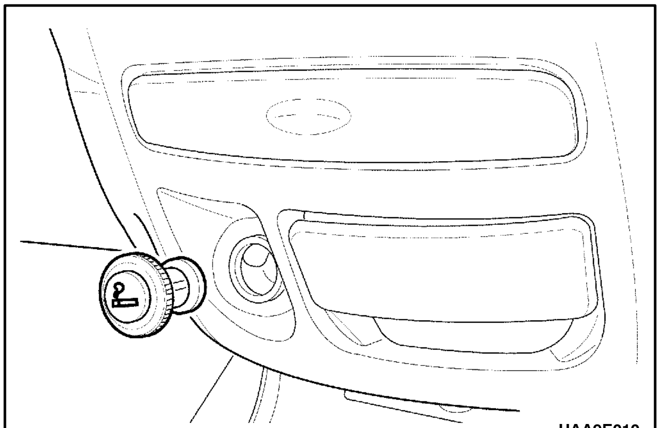
REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

CIGAR LIGHTER

(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal and Installation Procedure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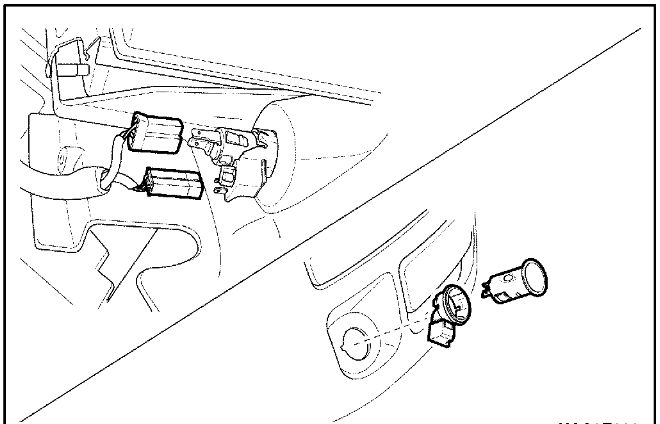
1. Disconnect the negative battery cable.
2. Remove the cigar lighter.
3. Remove the instrument panel center cover. Refer to “Instrument panel center cover” in this section.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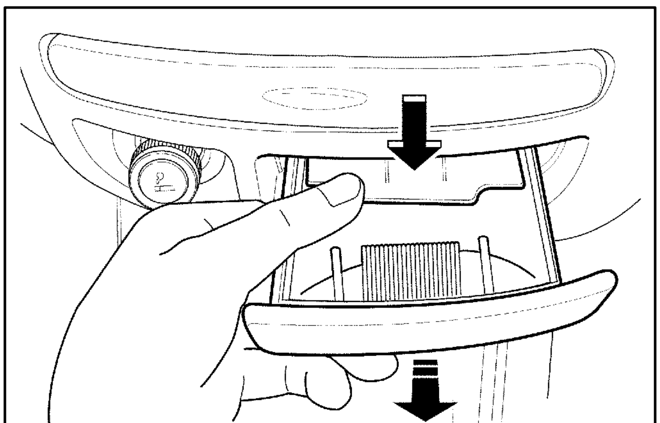
4. Disconnect the cigar lighter electrical connectors.
5. Remove the socket.
6. Remove the socket bracket.
7. Installation should follow the removal procedure in the reverse order.

ASHTRAY LAMP

(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal and Installation Procedure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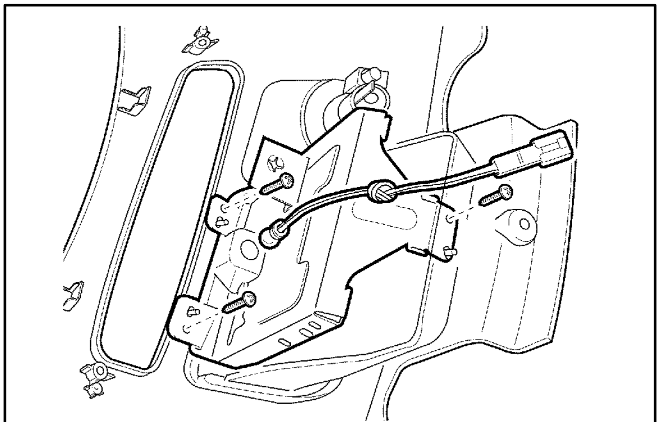
1. Disconnect the negative battery cable.
2. Remove the ashtray.
3. Remove the instrument panel center cover. Refer to “Instrument panel center cover” in this section.
4. Remove the cup holder. Refer to “Cup Holder” in this section.



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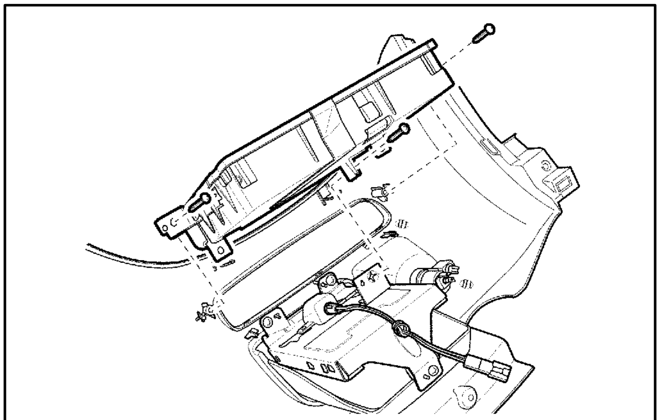
5. Remove the screws.
6. Disconnect the ashtray lamp.
7. Remove the ashtray bracket.
8. Installation should follow the removal procedure in the reverse order.



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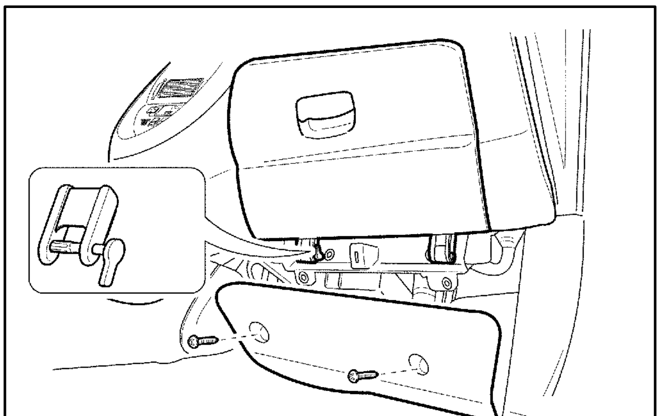
CUP HOLDER

(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal and Installation Procedure

1. Remove the instrument panel center cover. Refer to “Instrument panel center cover” in this section.
2. Remove the screws.
3. Remove the cup holder.
4. Installation should follow the removal procedure in the reverse order.



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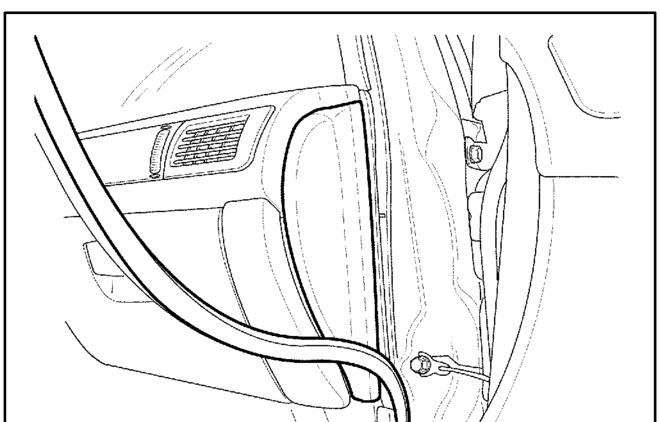
GLOVE BOX

(Left-Hand Drive Shown, Right-Hand Drive Similar)

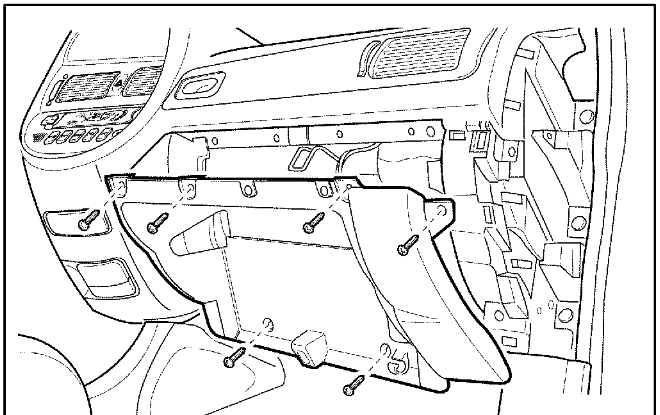
Removal and Installation Procedure

1. Remove the screws of shroud side trim.
2. Remove the keys and the air-conditioner cover.
3. Remove the glove box.

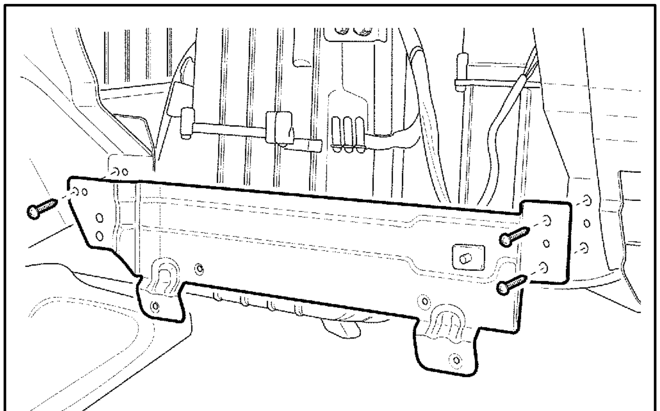


UAA9E070

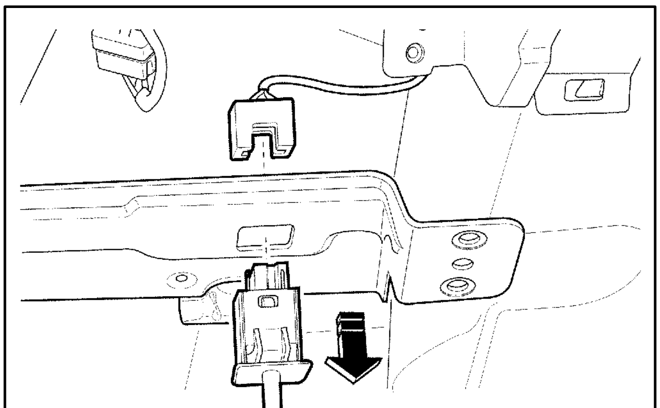
4. Remove the weatherstrip.
5. Remove the side cover.


UAA9E080

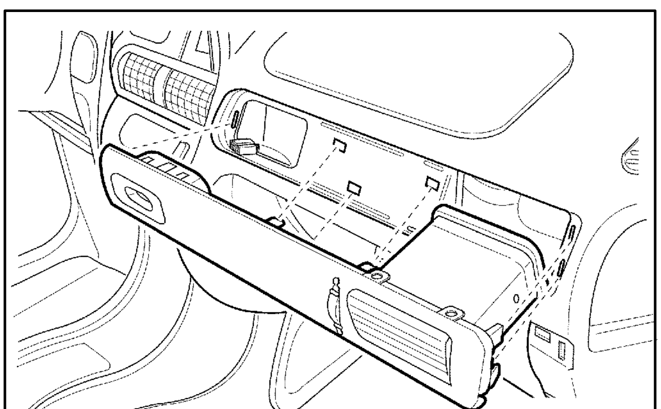
6. Remove the screws.
7. Remove the glove box housing.
8. Remove the glove box lamp. Refer to Section 9B, Glove Box Lamp.


UAA9E090

9. Remove the instrument panel center cover. Refer to “Instrument panel center cover” in this section.
10. Remove the screws.
11. Remove the glove box housing bracket.


UAA9E100

12. Disconnect the electrical connector.
13. Remove the switch of the glove box.
14. Installation should follow the removal procedure in the reverse order.

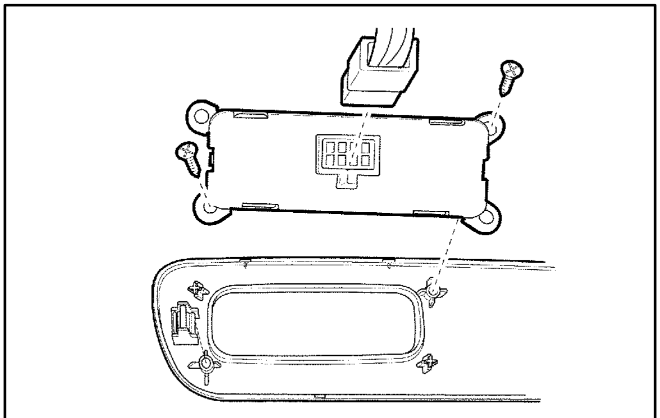

UAA9E110

INSTRUMENT PANEL RIGHT MOLDING

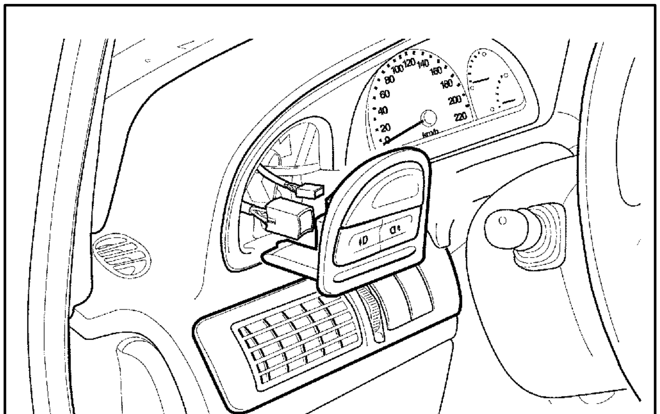
(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the keys.


UAA9E120

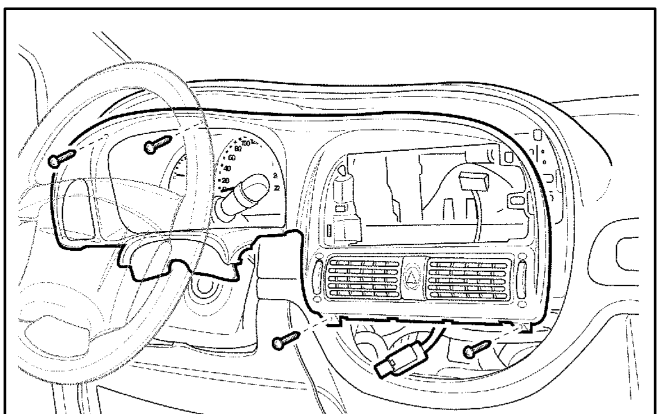
3. Disconnect the electrical connector of digital clock.
4. Remove the screws.
5. Remove the digital clock.


UAA9E130

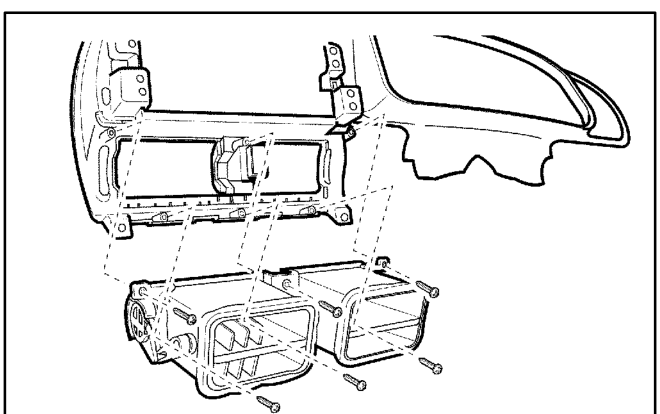
INSTRUMENT CLUSTER TRIM PANEL

Removal and Installation Procedure

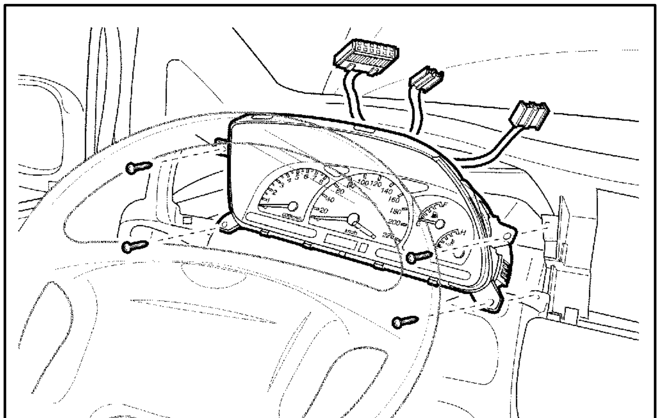
1. Disconnect the negative battery cable.
2. Remove the audio. Refer to Section 9F, Audio.
3. Remove the temperature control assembly. Refer to Section 7D, Temperature Control Assembly.
4. Remove the card holder,
5. Disconnect the electrical connector.


UAA9E140

6. Remove the screws.
7. Disconnect the hazard light electrical connector.


UAA9E150

8. Remove the screws.
9. Remove the center ventilation grill.
10. Installation should follow the removal procedure in the reverse order.

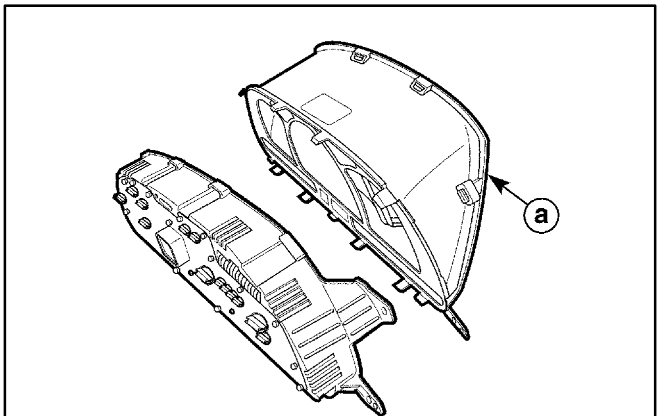


UAA9E160

INSTRUMENT CLUSTER

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the instrument cluster trim panel. Refer to “Instrument cluster trim panel” in this section.
3. Remove the screws.
4. Remove the instrument cluster.
5. Disconnect the electrical connector.
6. Installation should follow the removal procedure in the reverse order.

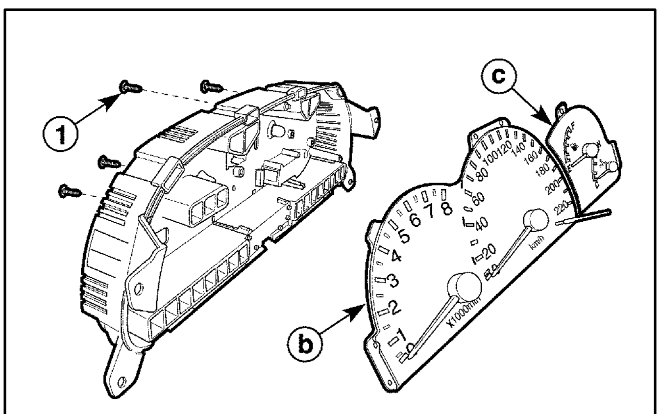


UAA9E170

SPEEDOMETER/TACHOMETER/FUEL GAUGE

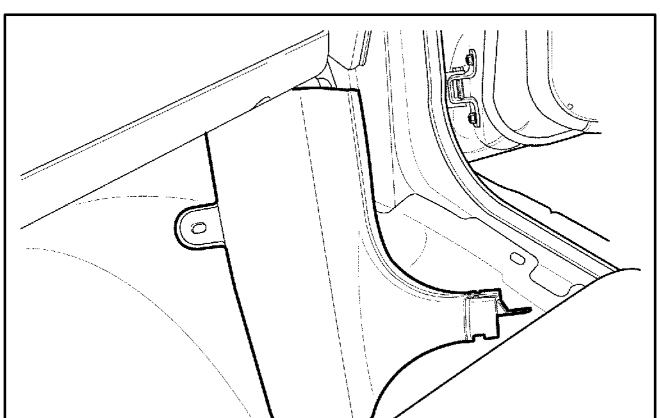
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the instrument cluster. Refer to “Instrument Cluster” in this section.
3. Remove the instrument cluster lens.



UAA9E180

4. Remove the screws.
5. Installation should follow the removal procedure in the reverse order.

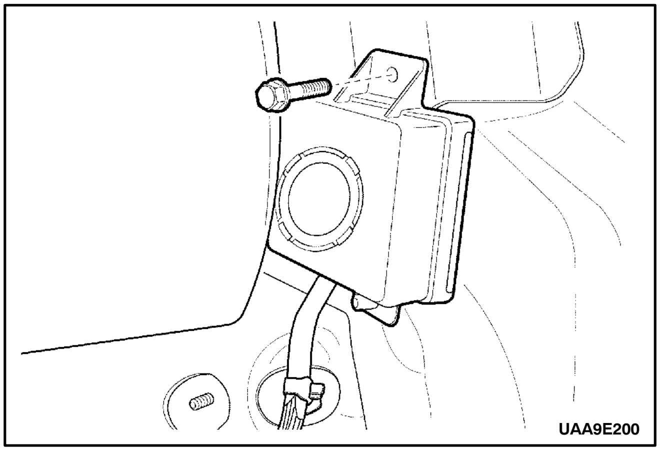


UAA9E190

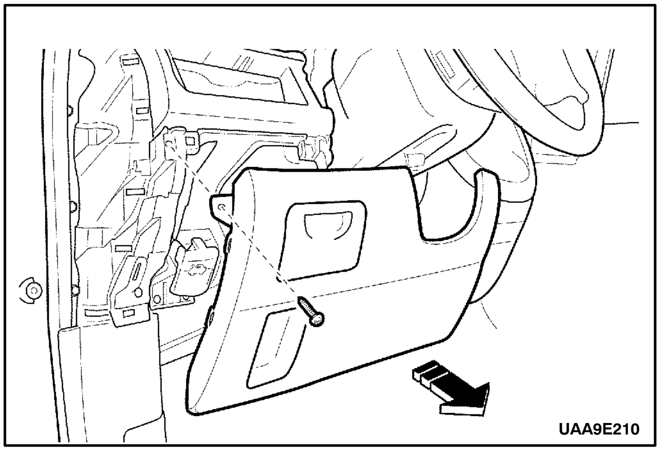
CHIME MODULE

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the front rocker trim panel. Refer to Section 9G, Interior System.
3. Remove the clip and the screw.
4. Remove the side shroud trim.



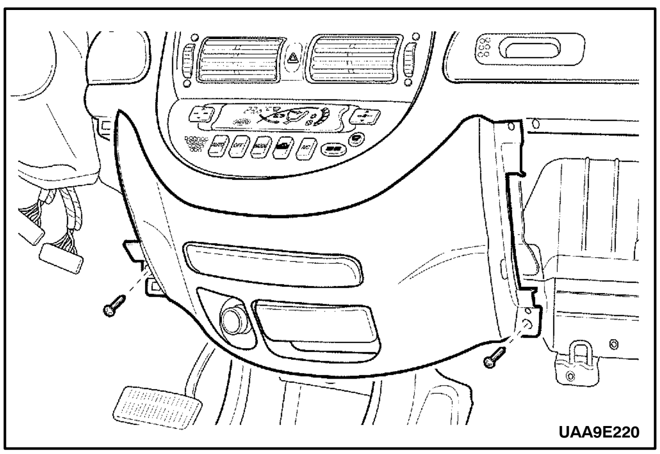
5. Remove the bolt and the nut.
6. Disconnect the electrical connector.
7. Remove the chime module.
8. Installation should follow the removal procedure in the reverse order.



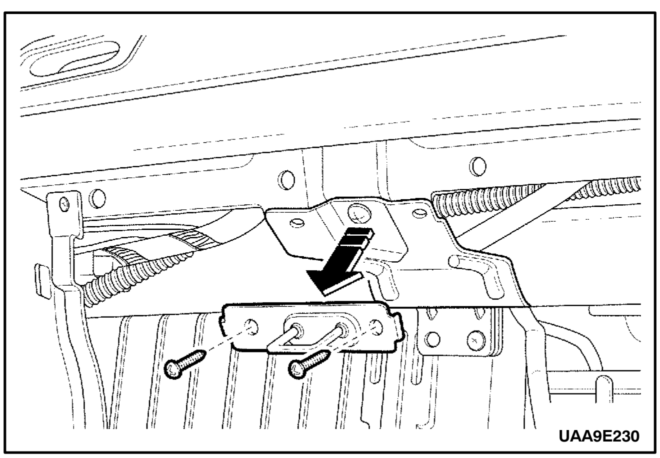
INSTRUMENT PANEL

Removal and Installation Procedure

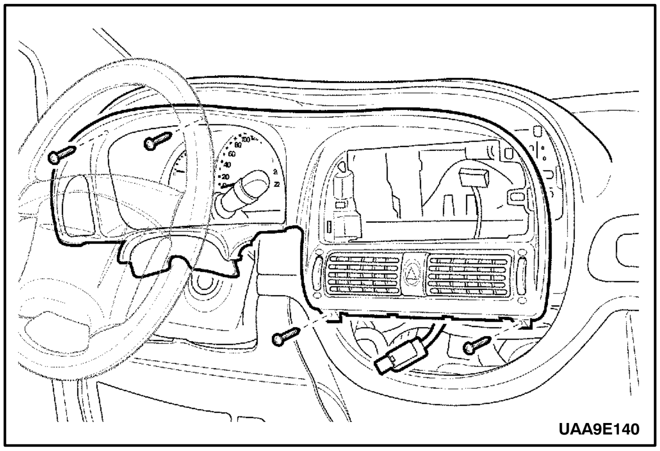
1. Disconnect the negative battery cable.
2. Remove the instrument panel side moldings.
3. Remove the screw.
4. Remove the instrument panel lower cover.
5. Remove the glove box/housing. Refer to “Glove Box” in this section.



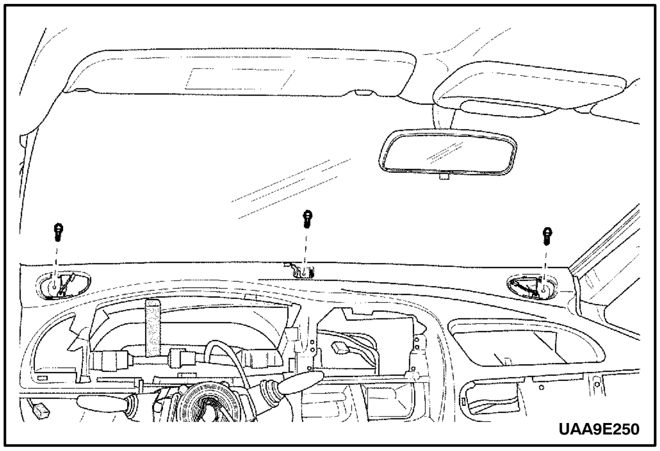
6. Remove the screws.
7. Remove the instrument panel center lower cover.
8. Remove the glove box housing bracket. Refer to “Glove Box” in this section.



9. Remove the screws.
10. Remove the glove box striker.
11. Remove the passenger airbag module. Refer to Section 8B, Passenger Airbag Module.



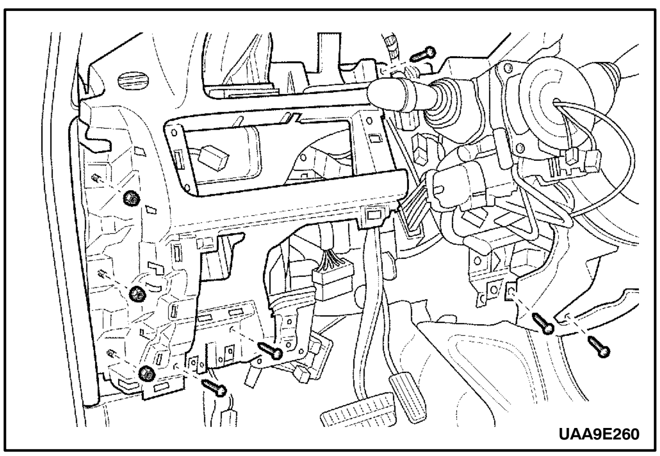
12. Remove the instrument cluster trim panel. Refer to "Instrument Cluster Trim Panel" in this section.
13. Remove the instrument cluster. Refer to "Instrument Cluster" in this section.



14. Remove the steering wheel and the steering wheel column cover. Refer to Section 6E, Steering Column.
15. Pry off the A-Pillar trim panel. Refer to Section 9G, A-Pillar Trim.
16. Remove the screws.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

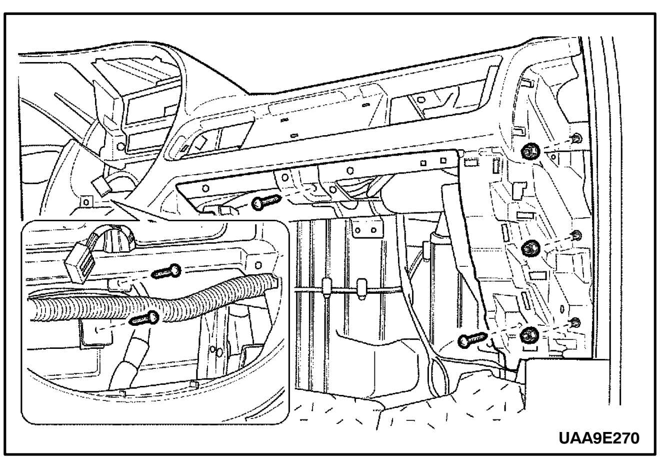


17. Remove the nuts.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

18. Remove the screws.

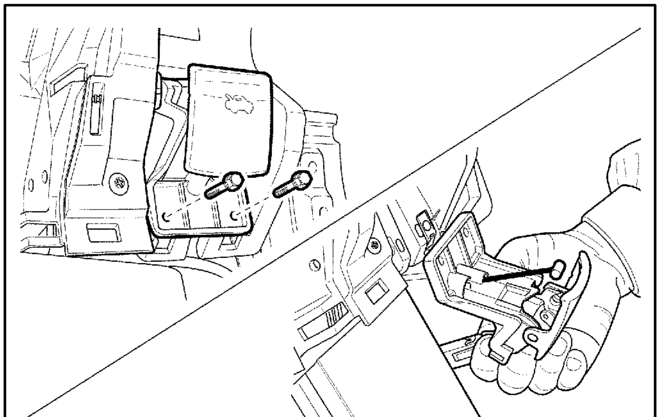


19. Remove the nuts.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

20. Remove the screws.
21. Remove the instrument panel.
22. Installation should follow the removal procedure in the reverse order.


UAA9E240

HOOD RELEASE LEVER

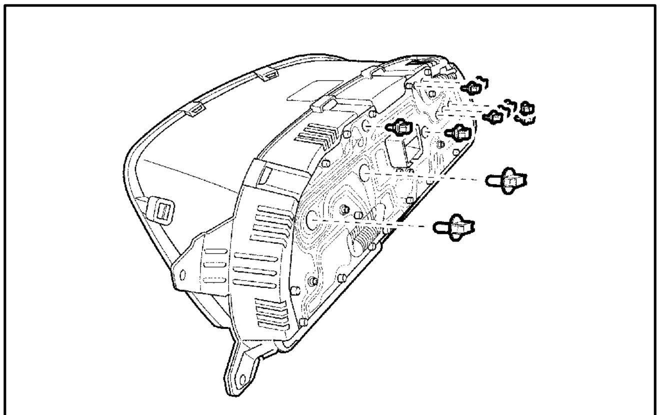
Removal and Installation Procedure

1. Remove the instrument panel lower cover. Refer to "Instrument Panel" in this section.
2. Remove the bolts.

Installation Notice

Tightening Torque	2 N·m (18 lb–in)

3. Remove the hood release lever.
4. Remove the hood release cable.
5. Installation should follow the removal procedure in the reverse order.


UAA9E280

INSTRUMENT CLUSTER INDICATOR LAMPS

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the instrument cluster. Refer to "Instrument Cluster" in this section.
3. Remove the detective bulb from the rear of the cluster.
4. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

INSTRUMENT CLUSTER INDICATOR LAMPS SPECIFICATIONS

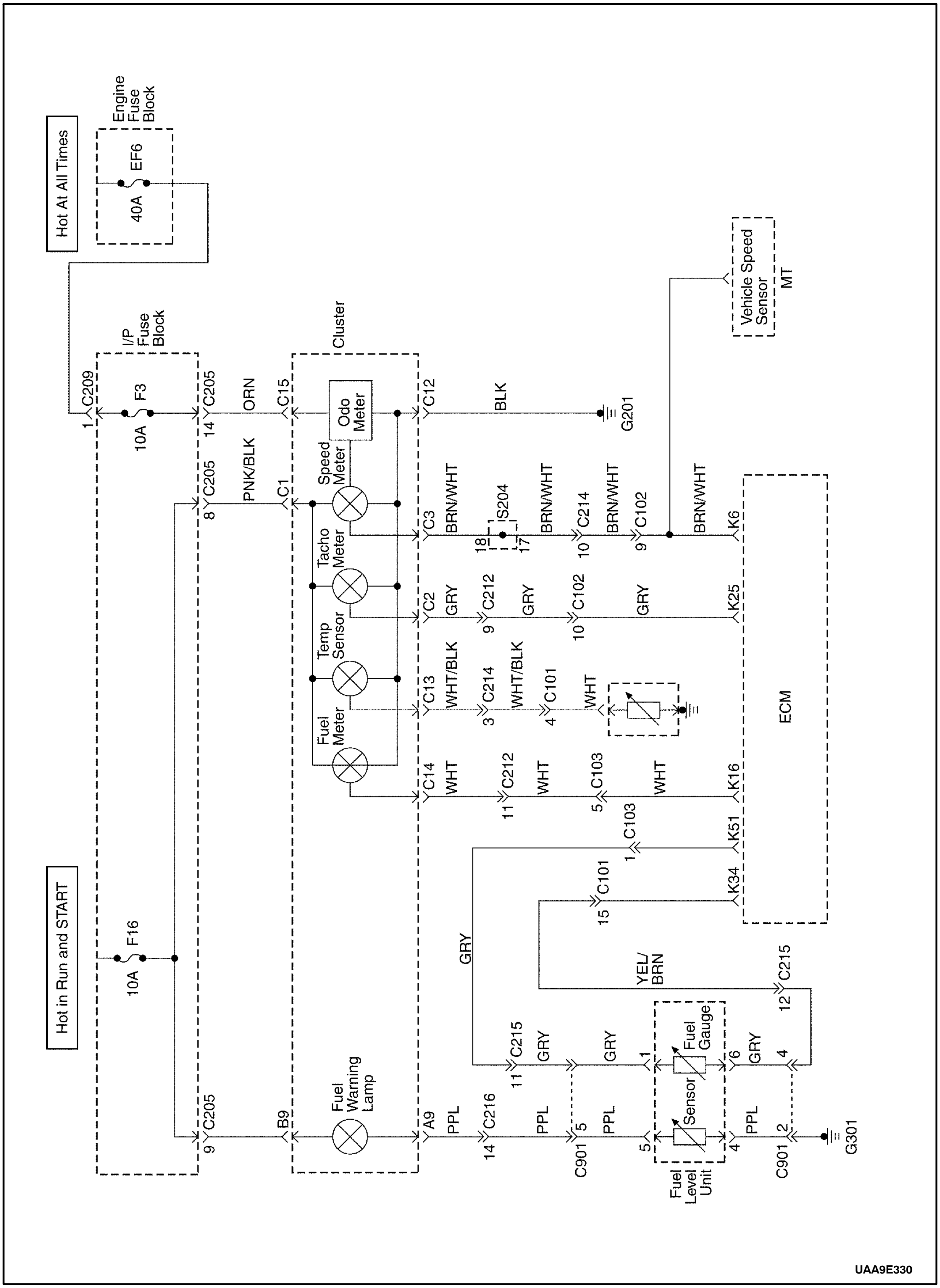
Indicator Lamp	Color	Bulb
ABS Warning	Amber	14V1.4W
Airbag Warning	Red	14V1.4W
Battery Charge Indicator	Red	14V 1.4W
Checking Engine Warning	Amber	14V 1.4W
Door Opening Warning	Red	14V 1.4W
Engine Hot Warning	Red	14V 1.4W
Fasten Seat Belt Warning	Red	14V 1.4W
Front Fog Lamp Indicator	Green	14V 1.4W
Hazard Warning Indicator	Red	14V 1.4W
High Beam Indicator	Blue	14V 1.4W
Low Fuel Level Warning	Amber	14V 3W
Oil Pressure Warning	Red	14V 1.4W
Parking Brake Indicator and Brake Fluid Warning	Red	14V 1.4W
Rear Fog Lamp Indicator	Amber	14V 1.4W
Trailer Indicator	Green	14V 1.4W
Transaxle Hold Mode Indicator	Amber	14V 1.4W
Transaxle Power Mode Indicator	Amber	14V 1.4W
Turn Signal Indicators	Green	14V 1.4W

FASTENER TIGHTENING SPECIFICATIONS

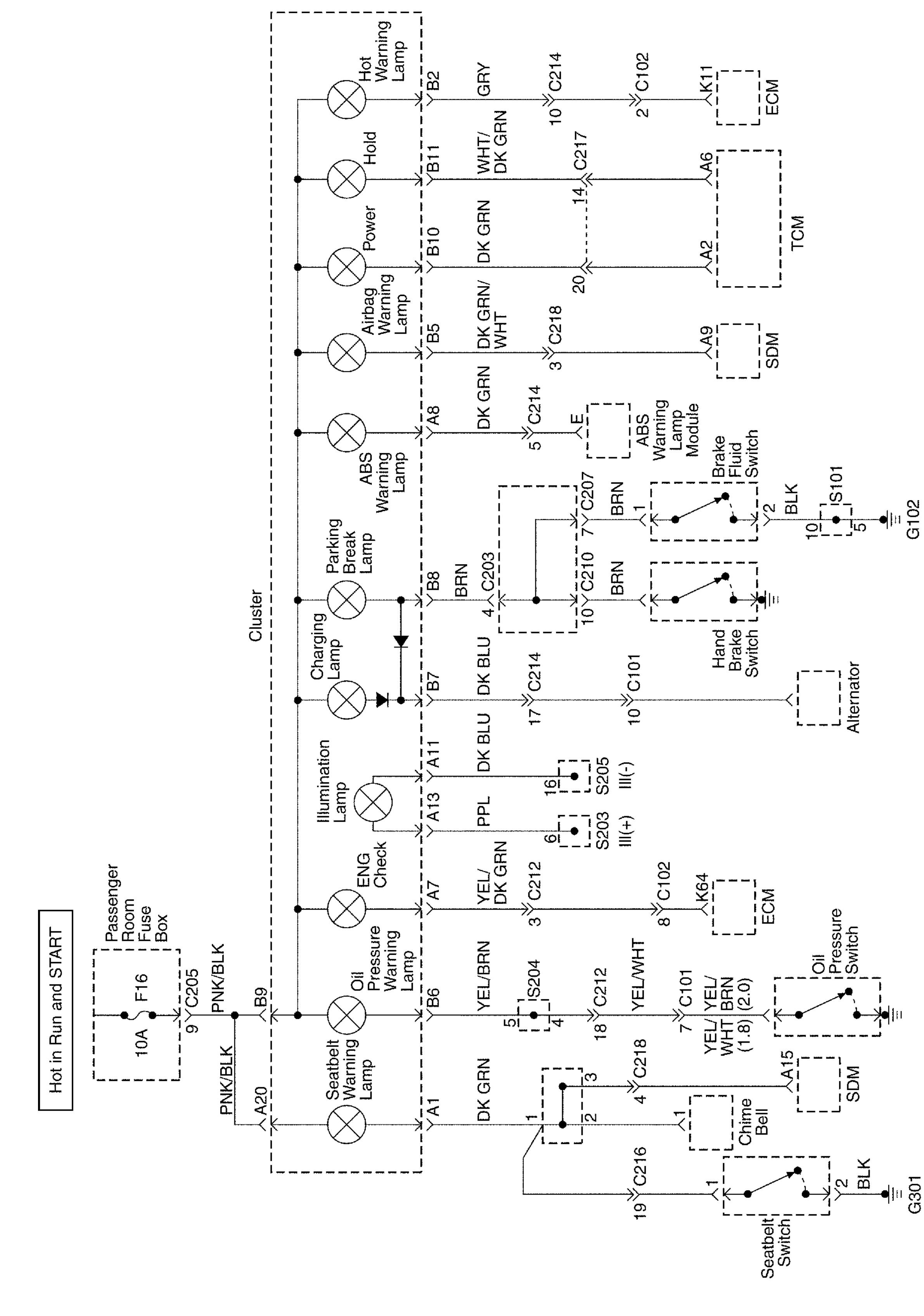
Application	N•m	Lb-Ft	Lb-In
Instrument Panel-to-Body Bolts	22	16	–
Instrument Panel-to-Fire Wall Nuts	10	–	89
Instrument Panel-to-Floor Bolts	22	16	–
Instrument Panel-to-Pedal Assembly Bolts	22	16	–
Steering Column Bolts	22	16	–
Steering Column Nuts	22	16	–

SCHEMATIC AND ROUTING DIAGRAMS

INSTRUMENT PANEL WIRING HARNESS(1 OF 3)

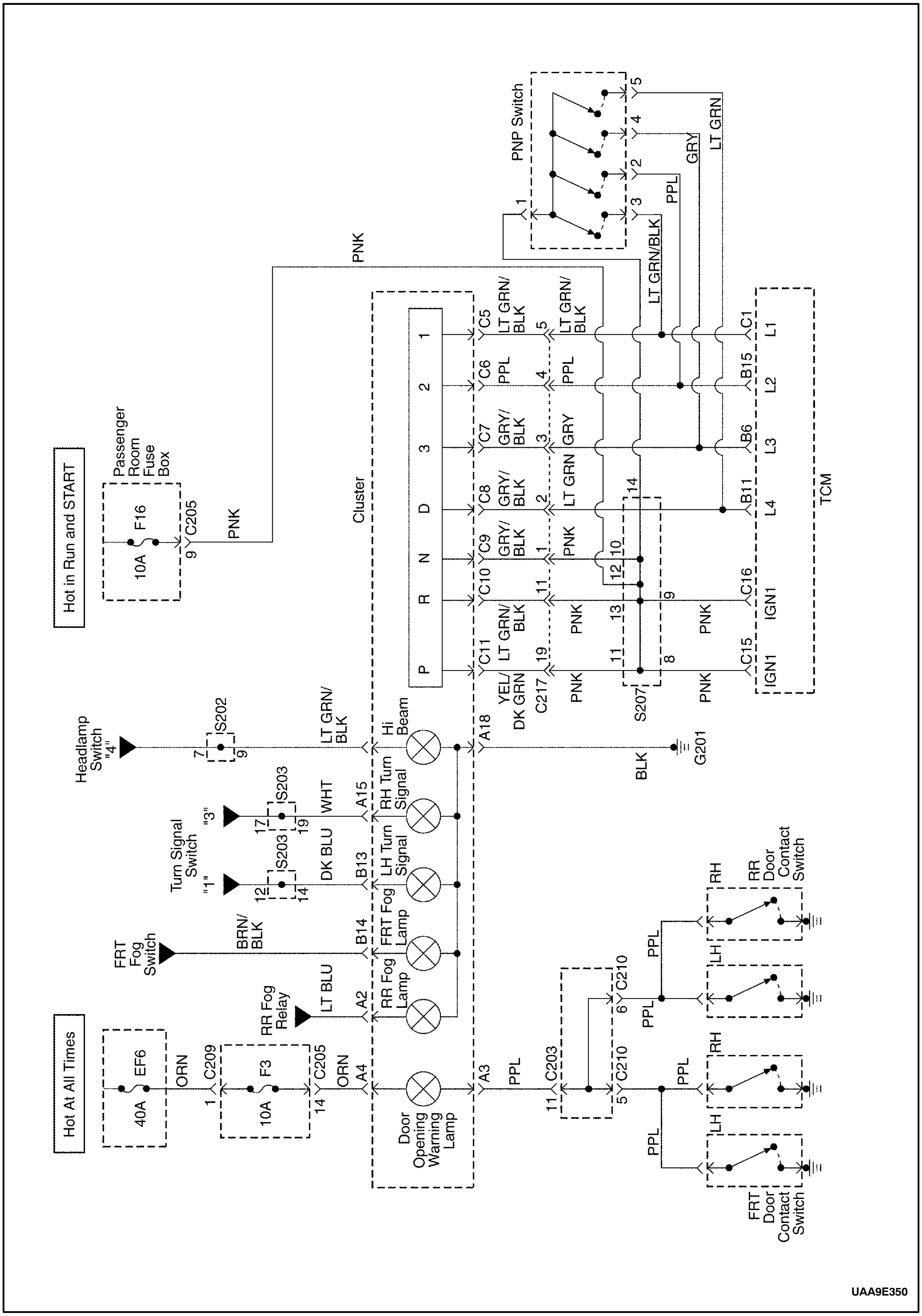


INSTRUMENT PANEL WIRING HARNESS(2 OF 3)



UAA9E340

INSTRUMENT PANEL WIRING HARNESS(3 OF 3)



SECTION 9F

AUDIO SYSTEMS

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

STEREO CASSETTE AM/FM RADIO WITH CD CHANGER

The stereo digital logic cassette AM/FM radio with electronic tape ejection and the stereo digital logic cassette AM/FM radio with a CD changer located in the trunk are optional equipment.

AUDIO SECURITY SYSTEM

The audio security system is activated whenever the audio system circuit is disconnected from the battery. A four-digit security code must be entered in order for the audio system to be functional once again. The security code is stamped on a card located in the vehicle (usually in the glove box).

Procedure

1. With the ignition switch in the ACC or ON position, turn the radio ON. At this time, "CODE" will be shown on the radio display along with chime sounds.
2. Enter the four-digit security number using the radio pre-set buttons 1 through 6.
3. After all four digits are entered, the digits will blink three times, and the radio will be functional.

Wrong Code

If the wrong code is entered, "ERR" will briefly appear on the display. After this, "CODE" will appear and the code entering procedure can be performed once again. If the correct code is not entered within 10 minutes, the radio should be disconnected from the battery to reset the audio system. After connecting the battery, repeat the code entering procedure.

FRONT AND REAR SPEAKERS

All audio systems use four speakers: two speakers mounted in the front doors and two speakers mounted in the rear.

TWEETER SPEAKERS

The tweeter speakers are mounted on the top side of the instrument panel.

ROOF ANTENNA

The two-piece roof antenna is standard equipment. The top half of the antenna can be unscrewed and removed if height clearance problems occur.

TAPE PLAYER AND CASSETTE CARE

The head and the capstan are the two parts of the tape player that should be cleaned. This service should be performed every 100 hours of cassette operation.

In order to clean the head and the capstan, use a cotton swab dipped in rubbing alcohol.

A cassette cleaning kit may also be used to clean the head and the capstan. Follow the cleaning kit instructions to clean the tape player.

Do not touch the tape head with magnetized tools. If the head becomes magnetized, it will degrade cassettes played in the player. No service is performed on the cassettes. The cassette manufacturer handles warranties of the cassettes. Store cassettes away from extreme heat and direct sunlight.

COMPACT DISC CARE

Handle discs carefully. Store the discs in protective cases away from the sun, heat, and dust. If the surface is soiled, dampen a clean, soft cloth in a solution of mild neutral detergent and wipe the disc clean. Mini discs (about 3 inches in diameter), will not eject and should not be used.

DIAGNOSTIC INFORMATION AND PROCEDURES

STEREO CASSETTE AM/FM RADIO

Cassette AM/FM Radio Inoperative

Step	Action	Value(s)	Yes	No
1	Check fuses EF6, F22, and F10. Are fuses EF6, F22, and F10 blown?	–	Go to *Step 2*	Go to *Step 3*
2	1. Check for a short circuit and repair if necessary. 2. Replace the blown fuses. Is the repair complete?	–	System OK	–
3	1. Use a voltmeter to test for battery voltage at fuses EF6 and F10. 2. Turn the ignition ON and test for battery voltage at fuse F22. Does the battery voltage match the specified value at fuses EF6, F22, and F10?	11-14 v	Go to *Step 5*	Go to *Step 4*
4	Repair the power supply circuit to the fuses. Is the repair complete?	–	System OK	–
5	1. Disconnect the radio electrical connector. 2. Turn the ignition ON. 3. Use a voltmeter to test for battery voltage at the radio connector terminals 4 and 5. Does the battery voltage match the specified value at both terminals?	11-14 v	Go to *Step 7*	Go to *Step 6*
6	Repair the open circuit between the radio connector and the fuse. Is the repair complete?	–	System OK	–
7	Use an ohmmeter to test the ground circuit at the radio connector terminal 14. Does the resistance match the specified value?	0-0.5 Ω	Go to *Step 9*	Go to *Step 8*
8	Repair the open ground circuit between the radio connector and ground G202. Is the repair complete?	–	System OK	–
9	Replace the radio. Is the repair complete?	–	System OK	–

Cassette Player Inoperative, AM/FM Functions OK

Step	Action	Value(s)	Yes	No
1	Verify the customer complaint. Does the cassette player destroy tapes?	–	Go to *Step 5*	Go to *Step 2*
2	Using a good-quality tape, determine whether the cassette player performs poorly or is inoperative. Does the cassette player perform poorly?	–	Go to *Step 5*	Go to *Step 3*
3	Check the cassette player for obstructions behind the tape door. Is an obstruction found?	–	Go to *Step 4*	Go to *Step 8*
4	Check to see if the obstruction can be removed using gentle force. Is the obstruction removed?	–	Go to *Step 5*	Go to *Step 6*

Cassette Player Inoperative, AM/FM Functions OK (Cont'd)

Step	Action	Value(s)	Yes	No
5	Clean the cassette player head, the capstan, and the drive system. Does the tape play properly?	–	Go to *Step 7*	Go to *Step 6*
6	Replace the radio. Is the repair complete?	–	System OK	–
7	Check the cassette player for normal operation. Is the repair complete?	–	System OK	–
8	Advise the owner of a defective or worn tape. Is the repair complete?	–	System OK	–

FM Does Not Work, AM and Cassette OK

Step	Action	Value(s)	Yes	No
1	Check the radio for normal operation. Is FM inoperative and the rest of the system operating properly?	–	Go to *Step 2*	System OK
2	Replace the radio. Is the repair complete?	–	System OK	–

AM Radio Does Not Work, FM and Cassette OK

Step	Action	Value(s)	Yes	No
1	1. Unplug the antenna cable from the antenna. 2. Connect the test antenna to the antenna cable. 3. Check the AM radio reception. Is the AM radio operating properly?	–	Go to *Step 2*	Go to *Step 3*
2	Replace the antenna. Is the repair complete?	–	System OK	–
3	1. Remove the radio from the instrument panel. 2. Unplug the antenna cable from the radio. 3. Plug the test antenna into the radio. 4. Check the AM radio reception. Is the AM radio operating properly?	–	Go to *Step 4*	Go to *Step 5*
4	Replace the antenna cable between the radio and the antenna. Is the repair complete?	–	System OK	–
5	Replace the radio. Is the repair complete?	–	System OK	–

SPEAKERS

Front Speakers Distorted or Inoperative, Rest of Audio System OK

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition and the radio ON. 2. Check for distorted or inoperative front speakers using the fader and the balance controls with all of the sources (AM, FM, tape, CD). Are the front speakers distorted?	–	Go to *Step 2*	Go to *Step 4*
2	Check the speaker and the door area for damage, rattles, or vibration. Is there anything loose or in the way of the speaker causing the distortion?	–	Go to *Step 3*	Go to *Step 4*
3	Make the necessary repairs to secure the component causing the distortion. Is the repair complete?	–	System OK	–
4	1. Remove the front speakers and disconnect the speaker connector. 2. Using an ohmmeter, test the speaker wires for a short to ground. Does the ohmmeter show the specified value?	∞	Go to *Step 6*	Go to *Step 5*
5	Repair the short circuit between the front speaker connector and the radio connector. Is the repair complete?	–	System OK	–
6	Substitute a known good speaker for the speaker causing the distortion. Is the distortion eliminated?	–	Go to *Step 7*	Go to *Step 8*
7	Replace the speaker. Is the repair complete?	–	System OK	–
8	Replace the radio. Is the repair complete?	–	System OK	–

Rear Speakers Distorted or Inoperative, Rest of Audio System OK

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition and the radio ON. 2. Check for distorted or inoperative rear speakers using the fader and the balance controls with all the of the sources (AM, FM, tape, CD). Are the rear speakers distorted?	–	Go to *Step 2*	Go to *Step 4*
2	Check the speakers, the rear deck, and the trunk area for damage, rattles, or vibration. Is there anything loose or in the way of the speaker causing the distortion?	–	Go to *Step 3*	Go to *Step 4*
3	Make the necessary repairs to secure the component causing the distortion. Is the repair complete?	–	System OK	–
4	1. Disconnect the rear speakers. 2. Using an ohmmeter, test the speaker wires for a short to ground. Does the ohmmeter show the specified value?	∞	Go to *Step 6*	Go to *Step 5*
5	Repair the short circuit between the rear speaker connector and the radio connector. Is the repair complete?	–	System OK	–

Rear Speakers Distorted or Inoperative, Rest of Audio System OK (Cont'd)

Step	Action	Value(s)	Yes	No
6	Substitute a known good speaker for the speaker causing the distortion. Is the distortion eliminated?	–	Go to *Step 7*	Go to *Step 8*
7	Replace the speaker. Is the repair complete?	–	System OK	–
8	Replace the radio. Is the repair complete?	–	System OK	–

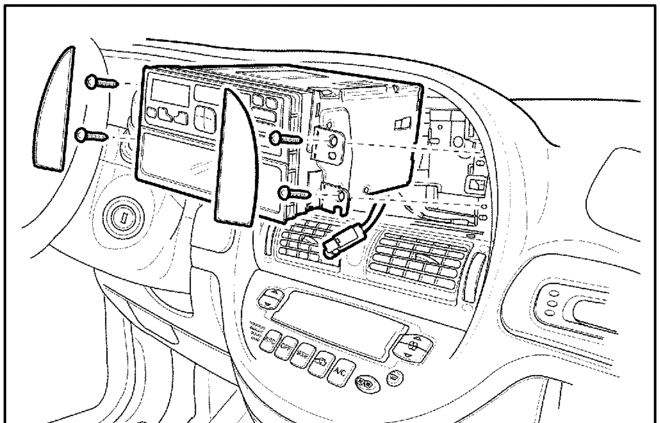
ANTENNA

Power Antenna Does Not Work

Step	Action	Value(s)	Yes	No
1	Check fuse EF1, F9 and F10. Is fuse EF29 blown?	–	Go to *Step 2*	Go to *Step 3*
2	1. Check for a short circuit and repair if necessary. 2. Replace the blown fuse. Is the repair complete?	–	System OK	–
3	1. Turn the ignition ON. 2. Turn the radio ON. 3. Use a voltmeter to test for battery voltage at radio terminal 12. Does the battery voltage match the specified value?	11-14 v	Go to *Step 4*	Go to *Step 13*
4	Repair the open circuit between the radio terminal 12 and the glass antenna connector terminal A. Is the repair complete?	–	System OK	–
5	Replace the audio system. Is the repair complete?	–	System OK	–

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



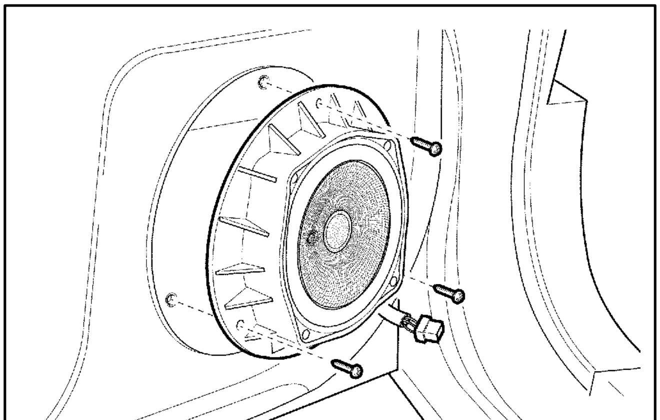
UAA9F010

STEREO CASSETTE AM/FM RADIO

(Left-hand Drive Shown, Right-Hand Drive Similar)

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the bezel-audio.
3. Remove the screws.
4. Remove the electrical connector and the jack.
5. Remove the cassette and the deposit box.
6. Installation should follow the removal procedure in the reverse order.

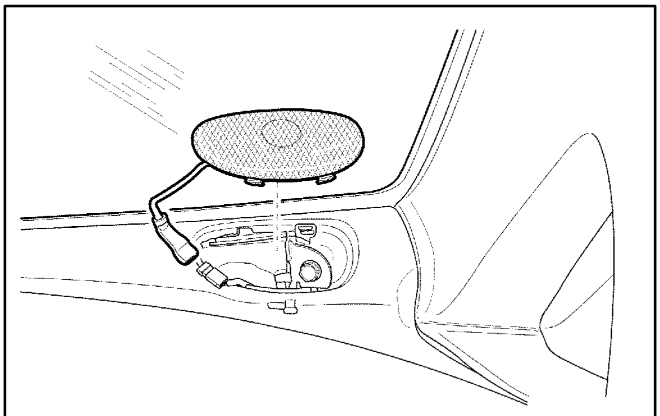


UAA9F020

FRONT DOOR SPEAKERS

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the front door trim panel. Refer to *Section 9G, Interior Trim.*
3. Remove the screws.
4. Disconnect the electrical connector.
5. Remove the front door speaker.
6. Installation should follow the removal procedure in the reverse order.



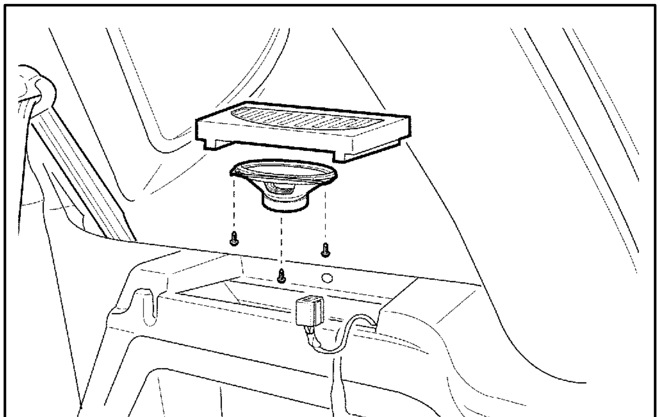
UAA9F030

TWEETER SPEAKERS

(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal and Installation Procedure

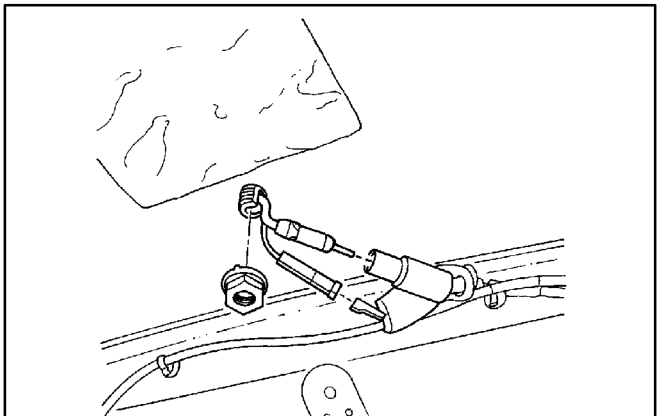
1. Disconnect the negative battery cable.
2. Remove the tweeter speaker by prying the tweeter speaker off the instrument panel.
3. Disconnect the electrical connector.
4. Installation should follow the removal procedure in the reverse order.


UAA9F040

REAR SPEAKERS

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the rear speaker grill.
3. Remove the screws.
4. Disconnect the electrical connector.
5. Remove the rear speaker.
6. Installation should follow the removal procedure in the reverse order.


B309F003

ROOF ANTENNA

Removal and Installation Procedure

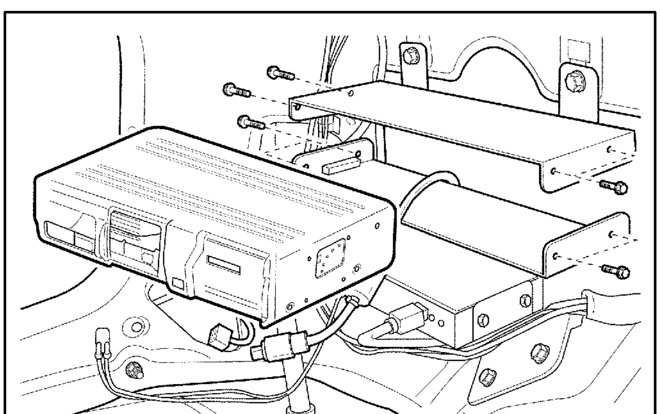
1. Disconnect the negative battery cable.
2. Remove the formed headliner. Refer to *Section 9Q, Roof.*
3. Disconnect the antenna cable and the electrical connector.
4. Remove the nut and the antenna.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

5. Installation should follow the removal procedure in the reverse order.


UAA9F050

COMPACT DISC CHANGER

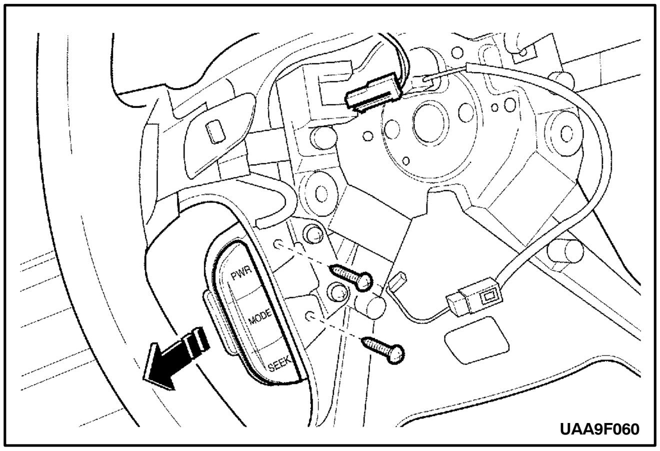
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the rear side trim panel. Refer to *Section 9G, Interior Trim.*
3. Remove the bolts.

Installation Notice

Tightening Torque	7 N·m (62 lb–in)

4. Disconnect the CD changer electrical connector and antenna jack.
5. Installation should follow the removal procedure in the reverse order.



AUDIO REMOTE CONTROLLER

Removal and Installation Procedure

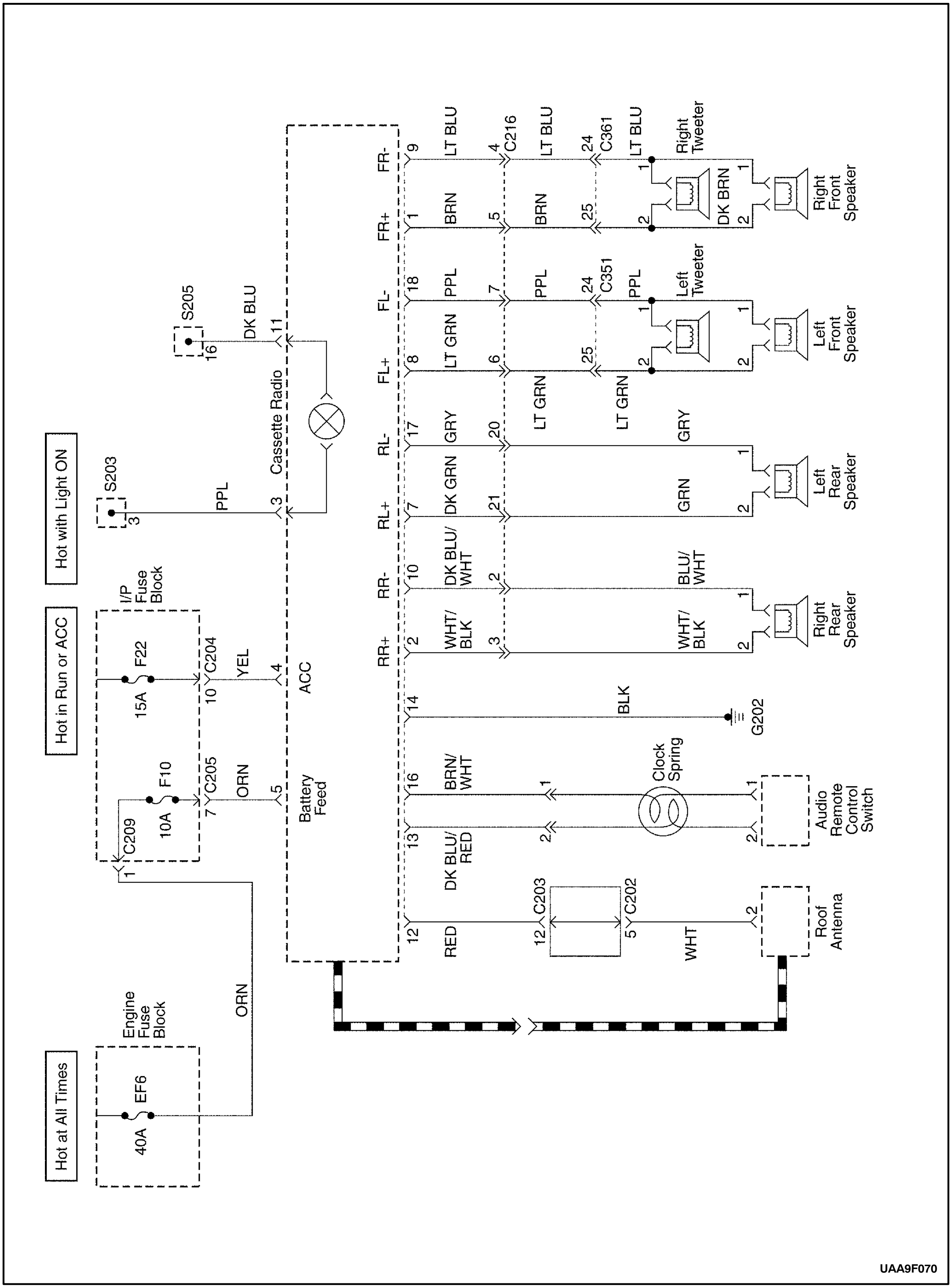
1. Disconnect the negative battery cable.
2. Remove the drive airbag module.
3. Disconnect the electrical connector.
4. Remove the screws.
5. Remove the audio remote controller.
6. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
CD Changer Nuts	7	–	62
Roof Antenna Nut	10	–	89

SCHEMATIC AND ROUTING DIAGRAMS



SECTION 9G

INTERIOR TRIM

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

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DESCRIPTION AND OPERATION

INTERIOR TRIM PANELS

The interior trim panels are molded plastic and fasten with screws, bolts or plastic clips.

PRESSURE RELIEF VENT

When all the windows are closed and the ventilation system is on, the addition of outside air to the interior of the vehicle causes a positive pressure within the vehicle. In order to relieve the pressure, air is released through two pressure relief vents. The pressure relief vents are located at the rear quarter of the vehicle, behind the bumper fascia.

REAR COMPARTMENT SECURITY COVER

A rear compartment security cover is provided. The rear compartment security cover can be easily removed if more cargo space is needed.

FLOOR CONSOLE

The floor console fits over the tunnel in the floor of the vehicle and extends from under the center of the instrument panel to the rear seat area. The floor console contains the transaxle shift lever, the parking brake lever, and an ashtray for the rear seat occupants.

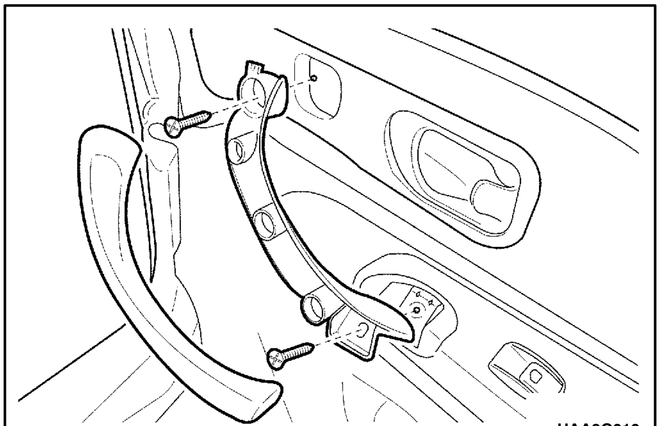
The sensing and diagnostic module (SDM) for the air-bag system is located under the floor console.

FLOOR CARPET

The molded one-piece floor carpet goes over both the front and the rear floor pans.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE


UAA9G010

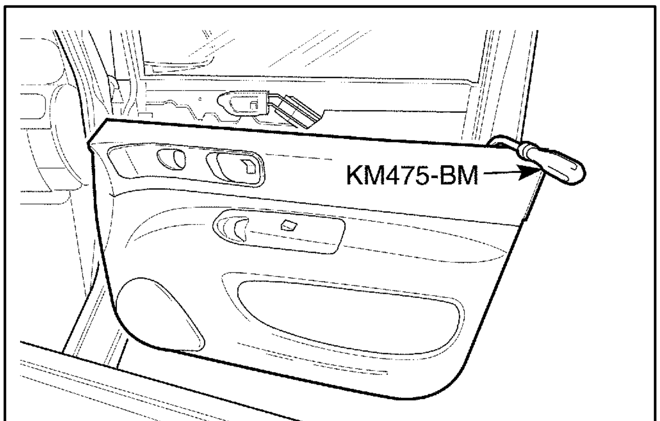
FRONT DOOR TRIM PANEL

Tools Required

KM–475–B Trim Remover

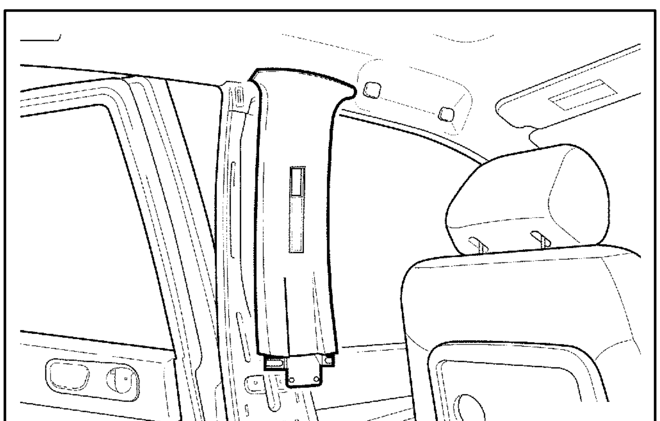
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the outer handle grip.
3. Remove the screws.
4. Remove the inner handle grip.



UAA9G020

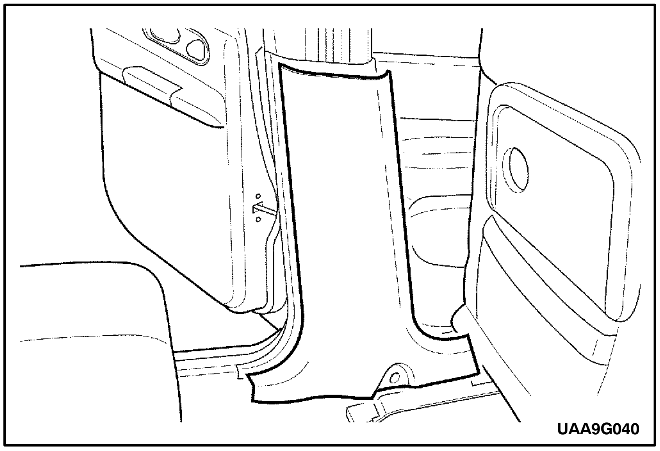
5. Remove the screws and the keys securing the trim panel.
6. Disconnect the power window control electrical connector.
7. Using the trim remover KM–475–B, pry off the trim panel.
8. Installation should follow the removal procedure in the reverse order.


UAA9G030

UPPER B-PILLAR TRIM PANEL

Removal and Installation Procedure

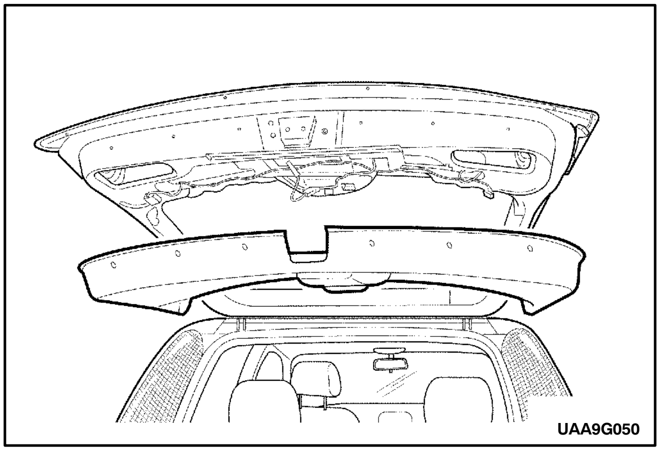
1. Remove the front seat belt. Refer to *Section 8A, Seat Belt.*
2. Remove the lower B-pillar trim panel. Refer to *“Lower B-pillar Trim Panel”* in this section.
3. Pry off the upper B-pillar trim panel.
4. Installation should follow the removal procedure in the reverse order.



LOWER B-PILLAR TRIM PANEL

Removal and Installation Procedure

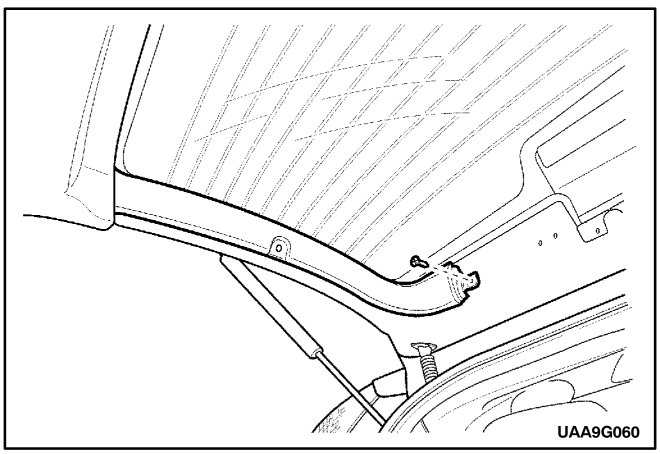
1. Remove the front seat belt. Refer to *Section 8A, Seat Belt.*
2. Remove the front rocker trim panel. Refer to *“Front Rocker Trim Panel”* in this section.
3. Remove the rear rocker trim panel. Refer to *“Rear Rocker Trim Panel”* in this section.
4. Pry off the lower B-pillar trim panel.
5. Installation should follow the removal procedure in the reverse order.



TAILGATE LOWER TRIM PANEL

Removal and Installation Procedure

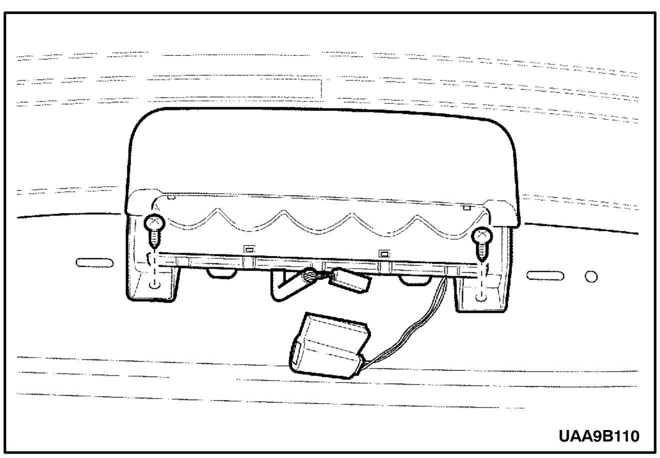
1. Remove the screws and the clips.
2. Pry off the tailgate lower trim panel.
3. Installation should follow the removal procedure in the reverse order.



TAILGATE SIDE TRIM PANEL

Removal and Installation Procedure

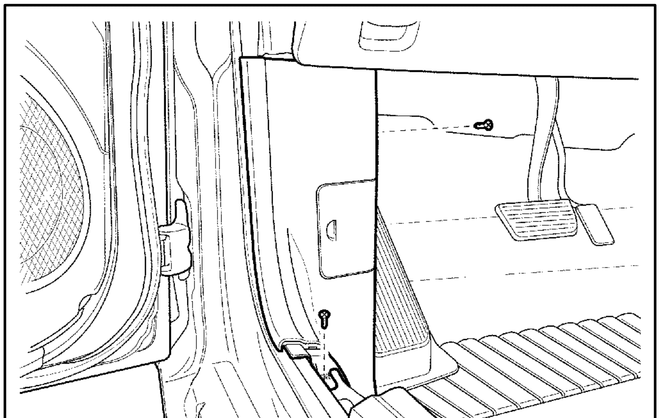
1. Remove the tailgate upper trim panel. Refer to “*Tailgate upper trim panel*” in this section.
2. Remove the screws and the clips.
3. Pry off the tailgate side trim panel.
4. Installation should follow the removal procedure in the reverse order.



TAILGATE UPPER TRIM PANEL

Removal and Installation Procedure

1. Pry off the tailgate upper trim panel.
2. Installation should follow the removal procedure in the reverse order.



UAA9G080

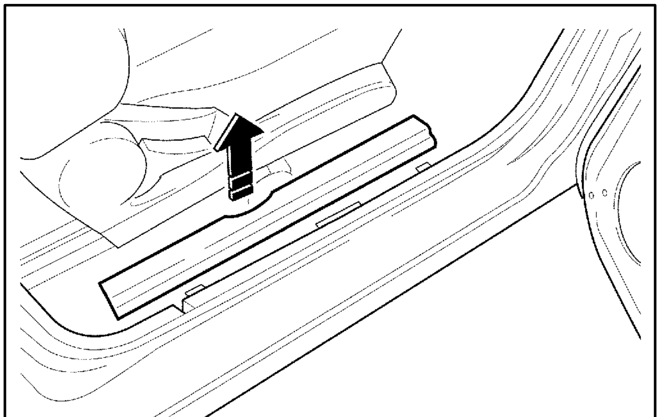
KICK PANEL

Removal and Installation Procedure

1. Remove the front rocker trim panel. Refer to *Section 9G, Interior System.*
2. Remove the kick panel screw and clip.

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

3. Pry off the kick panel.
4. Installation should follow the removal procedure in the reverse order.

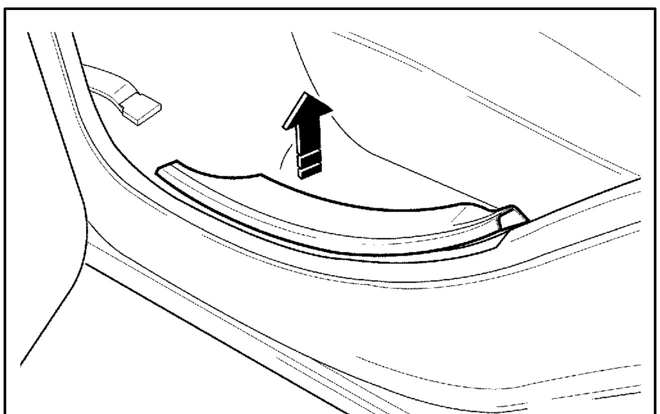


UAA9G090

FRONT ROCKER TRIM PANEL

Removal and Installation Procedure

1. Pry off the front rocker trim panel.
2. Installation should follow the removal procedure in the reverse order.

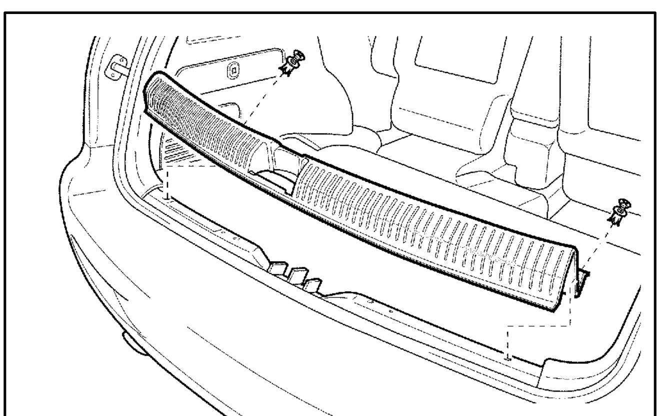


UAA9G100

REAR ROCKER TRIM PANEL

Removal and Installation Procedure

1. Pry off the rear rocker trim panel.
2. Installation should follow the removal procedure in the reverse order.

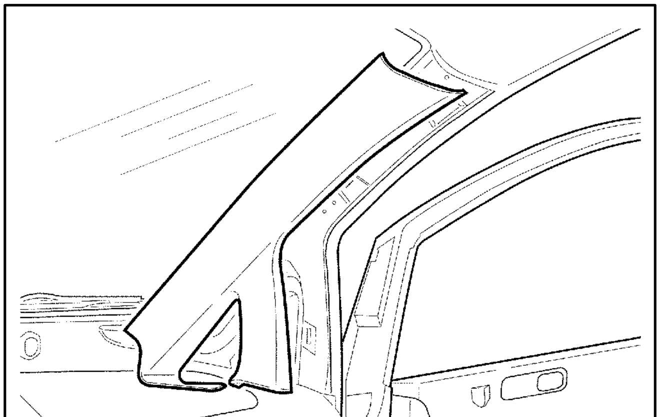


UAA9G110

LUGGAGE COMPARTMENT REAR TRIM PANEL

Removal and Installation Procedure

1. Remove the clips.
2. Remove the luggage compartment rear trim panel.
3. Installation should follow the removal procedure in the reverse order.

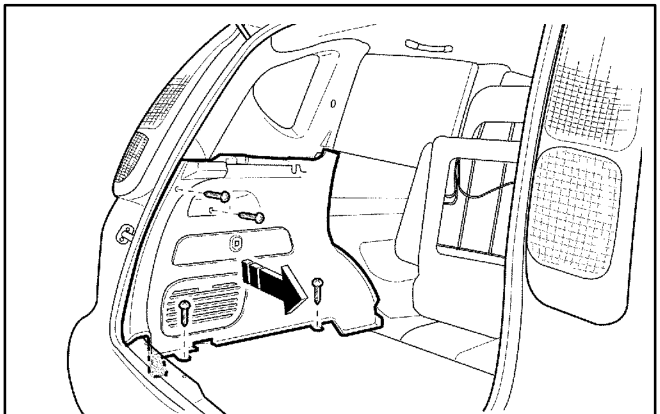


UAA9G120

A-PILLAR TRIM PANEL

Removal and Installation Procedure

1. Pry off the A-pillar trim panel.
2. Installation should follow the removal procedure in the reverse order.

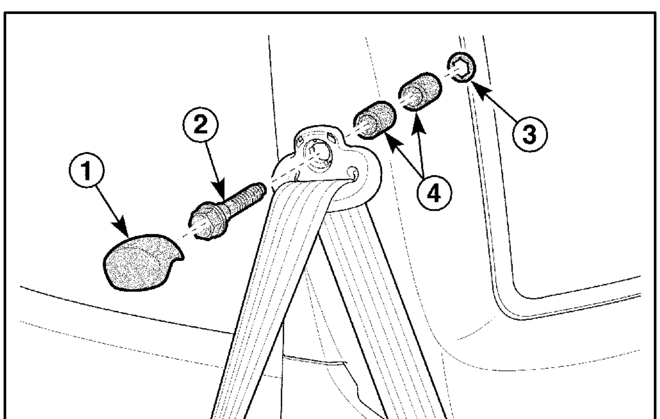


UAA9G130

LUGGAGE COMPARTMENT WHEELHOUSE TRIM PANEL

Removal and Installation Procedure

1. Remove the luggage compartment rear trim panel. Refer to *"Luggage Compartment Rear Trim Panel"* in this section.
2. Remove the rear rocker trim panel. Refer to *"Rear Rocker Trim Panel"* in this section.
3. Remove the rear seat belt. Refer to *Section 8A, Seat Belts.*
4. Remove the screws.
5. Pry off the luggage compartment wheelhouse trim panel.
6. Disconnect the speaker electrical connector.
7. Installation should follow the removal procedure in the reverse order.



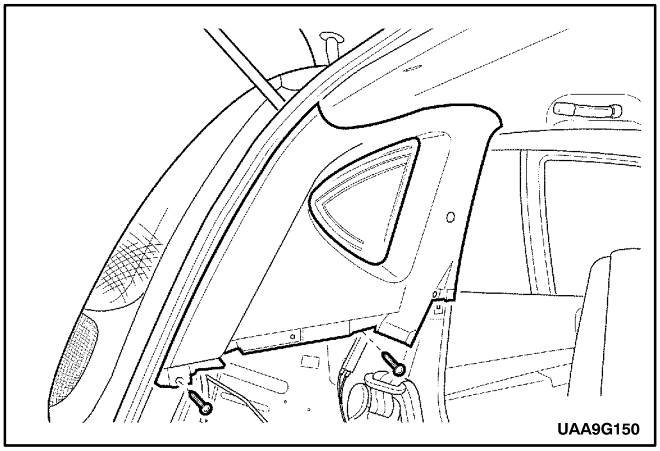
UAA9G140

C-PILLAR TRIM PANEL

Removal and Installation Procedure

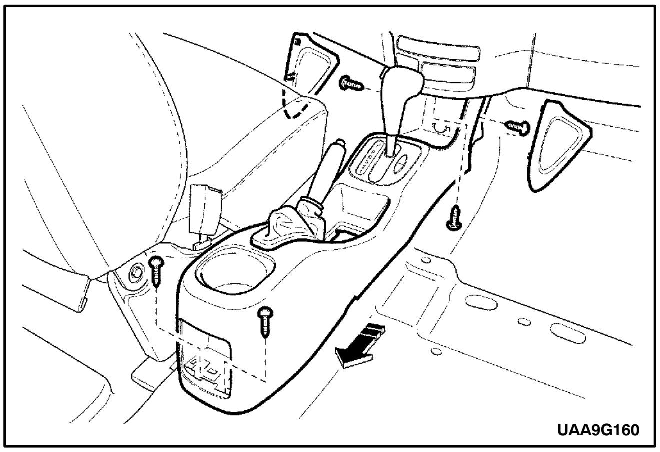
1. Remove the luggage compartment wheelhouse trim panel. Refer to *"Luggage Compartment Wheelhouse Trim Panel"* in this section.
2. Remove the bolt and the C-pillar seat belt.

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.



UAA9G150

3. Remove the screws.
4. Pry off the C-pillar trim panel.
5. Installation should follow the removal procedure in the reverse order.



UAA9G160

FLOOR CONSOLE

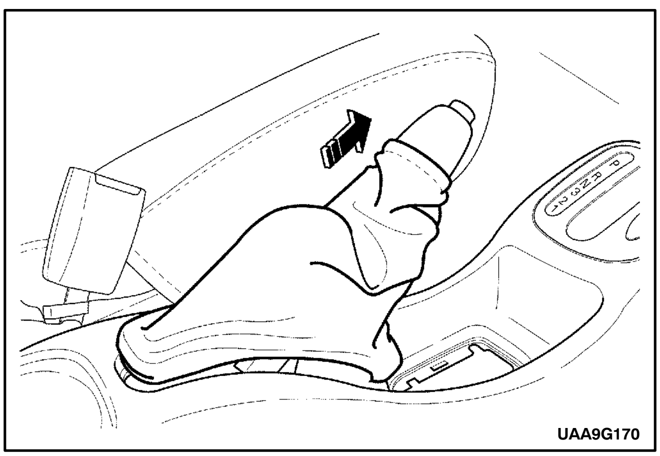
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Pry off the front extension consoles.
3. Remove the ashtray console rear.
4. Remove the screws

Installation Notice

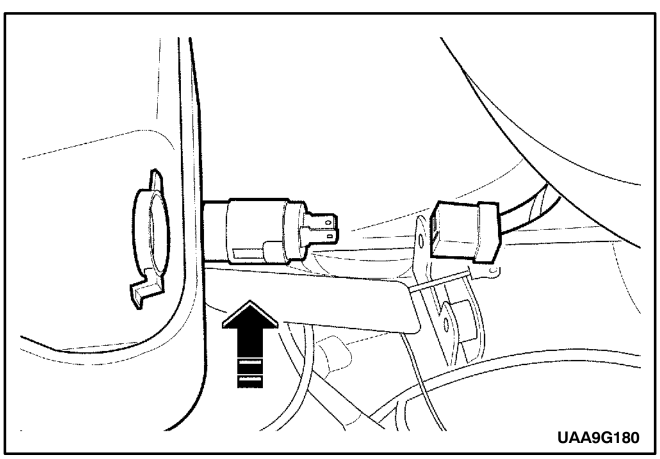
Tightening Torque	4 N·m (35 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.



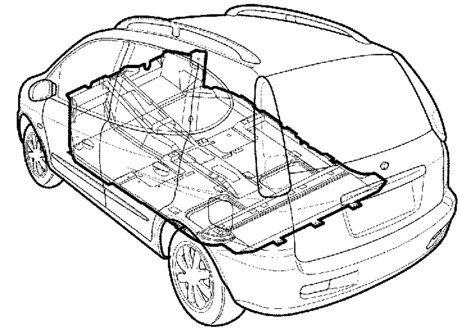
UAA9G170

5. Remove the shift lever boot.



UAA9G180

6. Disconnect the electrical connector.
7. Remove the floor console.
8. Installation should follow the removal procedure in the reverse order.



UAA9G070

FLOOR CARPET

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the front seats. Refer to *Section 9H, Seats.*
3. Remove the rear seats. Refer to *Section 9H, Seats.*
4. Remove the floor console. Refer to *“Floor Console”* in this section.
5. Remove the left and right rocker trim panels. Refer to *“Rocker Trim Panel”* in this section.
6. Remove the kick panel. Refer to *“Kick Panel”* in this section.
7. Remove the cover of rear seat.
8. Remove the floor console. Refer to *“Floor Console”* in this section.
9. Remove the floor carpet.
10. Installation should follow the removal procedure in the reverse order.

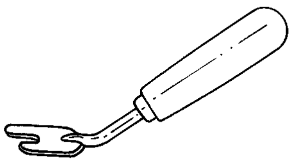
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Floor Console Bolts	4	–	35

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 A109G029	**KM-475-B** **Trim Remover**

SECTION 9H

SEATS

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

SEATS

Important: Do not attempt to change the designed seat position by altering the designed seat adjuster-to-floor pan anchor provisions or the seat adjuster-to-seat frame anchor provisions. Changing seat position could affect the performance of the seat system.

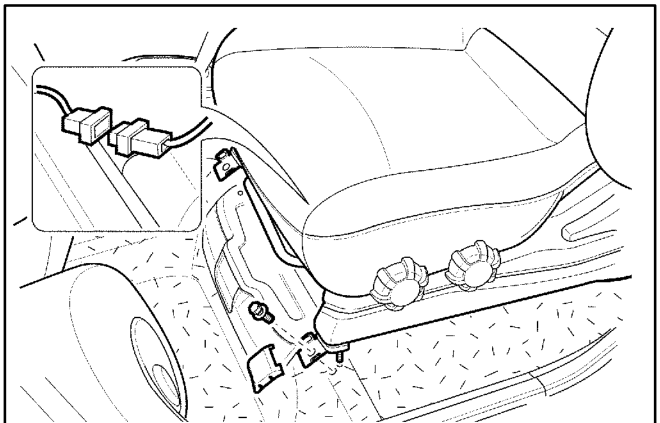
This vehicle is equipped with bucket front seats with separate, adjustable head restraints and a three-passenger rear bench seat. Seat cushions and seatbacks have formed foam pads, which fit the contours of the full panel seatback frame assembly and also the designed contour of the seat cushion frame. The front bucket seats have a recline adjustment. The driver seat has a height adjustment and an optional lumbar support.

LUMBAR SUPPORT

The adjustable lumbar support is optional. The lumbar support adjustment knob located on the side of the front seat can be adjusted in order to give more support to the lower back area if needed.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



UAA9H010

FRONT BUCKET SEAT

Removal and Installation Procedure

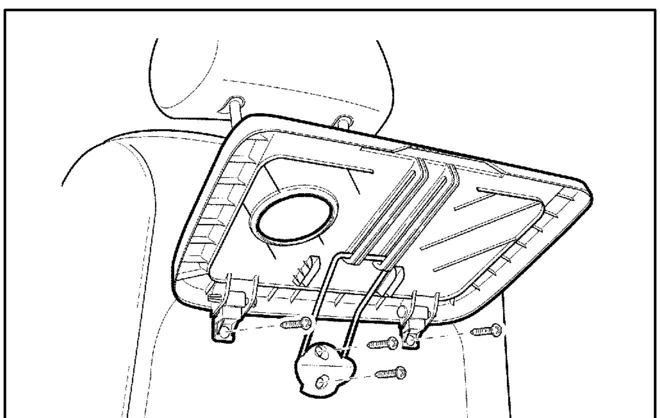
1. Disconnect the negative battery cable.
2. Remove the plastic caps to reveal the bolts securing the rear portion of the front seat to the floor.
3. Remove the bolts.

Installation Notice

Tightening Torque	25 N·m (18 lb–ft)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

4. Disconnect the electrical connector from the driver's seat.
5. Remove the seat.
6. Installation should follow the removal procedure in the reverse order.

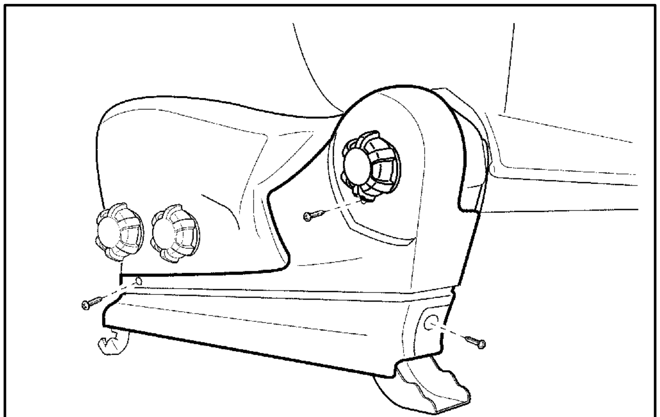


UAA9H020

FRONT SEATBACK

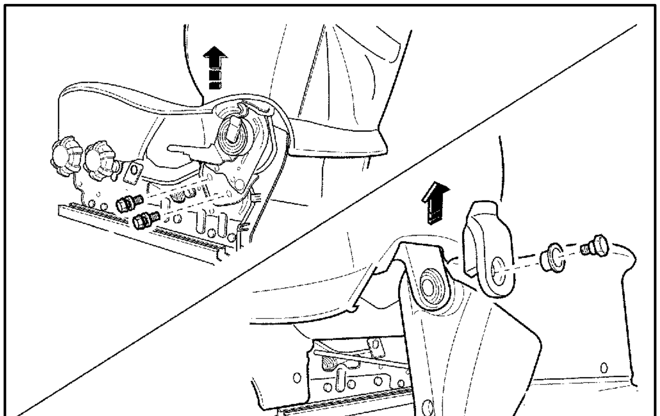
Removal and Installation Procedure

1. Remove the front bucket seat from the vehicle. Refer to *"Front Bucket Seats"* in this section.
2. Remove the screws.
3. Remove the front seat back table.



UAA9H030

4. Remove the dial recliner.
5. Remove the screws.
6. Remove the front seat outer cover.



UAA9H040

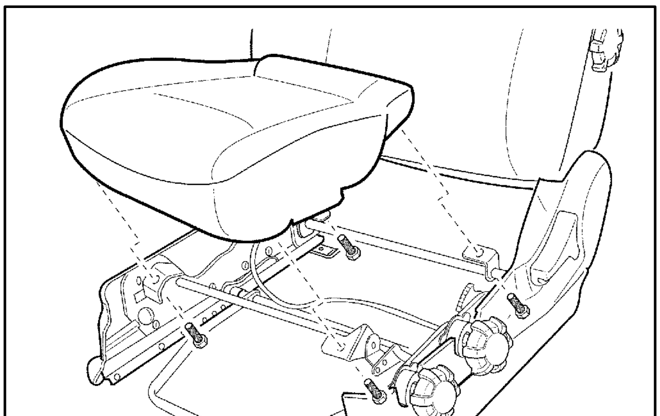
7. Remove the bolts.

Installation Notice

Tightening Torque	49 N·m (36 lb–ft)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

8. Remove the bushing.
9. Remove the regulator cap.
10. Remove the front seatback.
11. Installation should follow the removal procedure in the reverse order.



UAA9H050

FRONT SEAT CUSHION

Removal and Installation Procedure

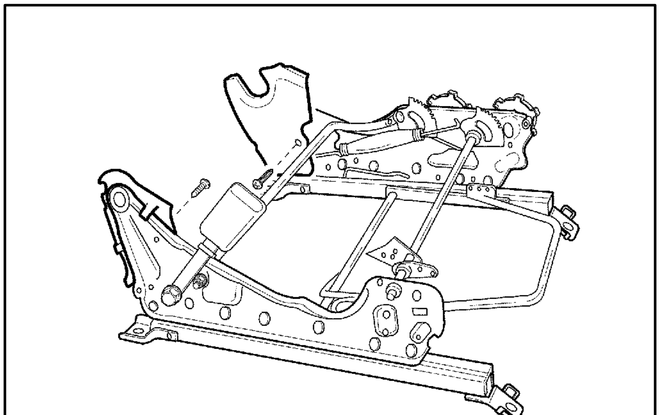
1. Remove the front bucket seat from the vehicle. Refer to *“Front Bucket Seats”* in this section.
2. Remove the bolts.

Installation Notice

Tightening Torque	24 N·m (18 lb–ft)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

3. Remove the front seat cushion from the seat track.
4. Installation should follow the removal procedure in the reverse order.

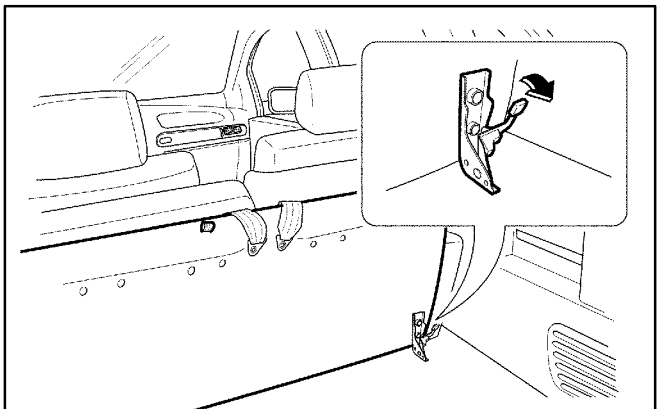


UAA9H060

FRONT SEAT GUIDE RAIL

Removal and Installation Procedure

1. Remove the front bucket seat from the vehicle. Refer to *"Front Bucket Seats"* in this section.
2. Remove the front seatback. Refer to *"Front Seat-back"* in this section.
3. Remove the front seat cushion. Refer to *"Front Seat Cushion"* in this section.
4. Remove the screws.
5. Remove the cover from the guide rail.
6. Remove the front seat guide rail.
7. Installation should follow the removal procedure in the reverse order.

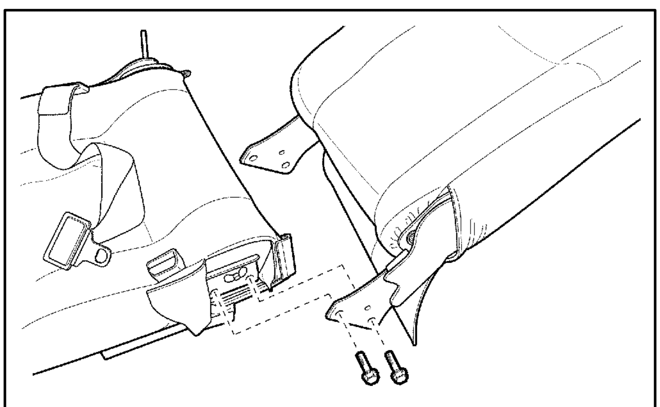


UAA9H070

REAR SEAT CUSHION

Removal and Installation Procedure

1. Remove the rear seat.



UAA9H080

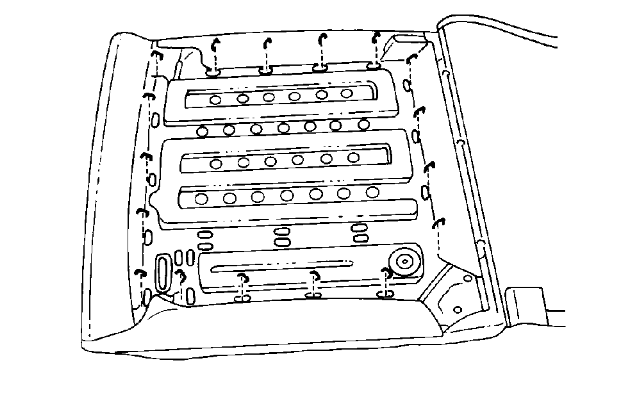
2. Remove the bolts.

Installation Notice

Tightening Torque	45 N·m (33 lb–ft)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

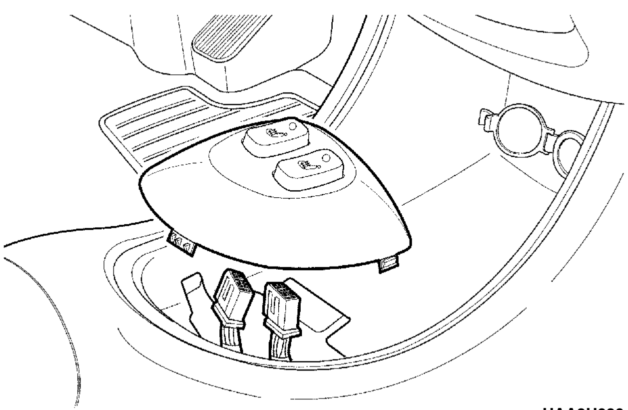
3. Remove the rear seat cushion.
4. Installation should follow the removal procedure in the reverse order.


C309H007

SEAT COVERS

Removal and Installation Procedure

1. Remove the seatback and/or cushion. Refer to “Front Seatback”, “ Front Seat Cushion” in this section.
2. Remove the hog rings from the seatback and/or cushion.
3. Remove the seat cover from the seatback and/or cushion.
4. Installation should follow the removal procedure in the reverse order.


UAA9H090

HEATING MAT SWITCH

Removal and Installation Procedure

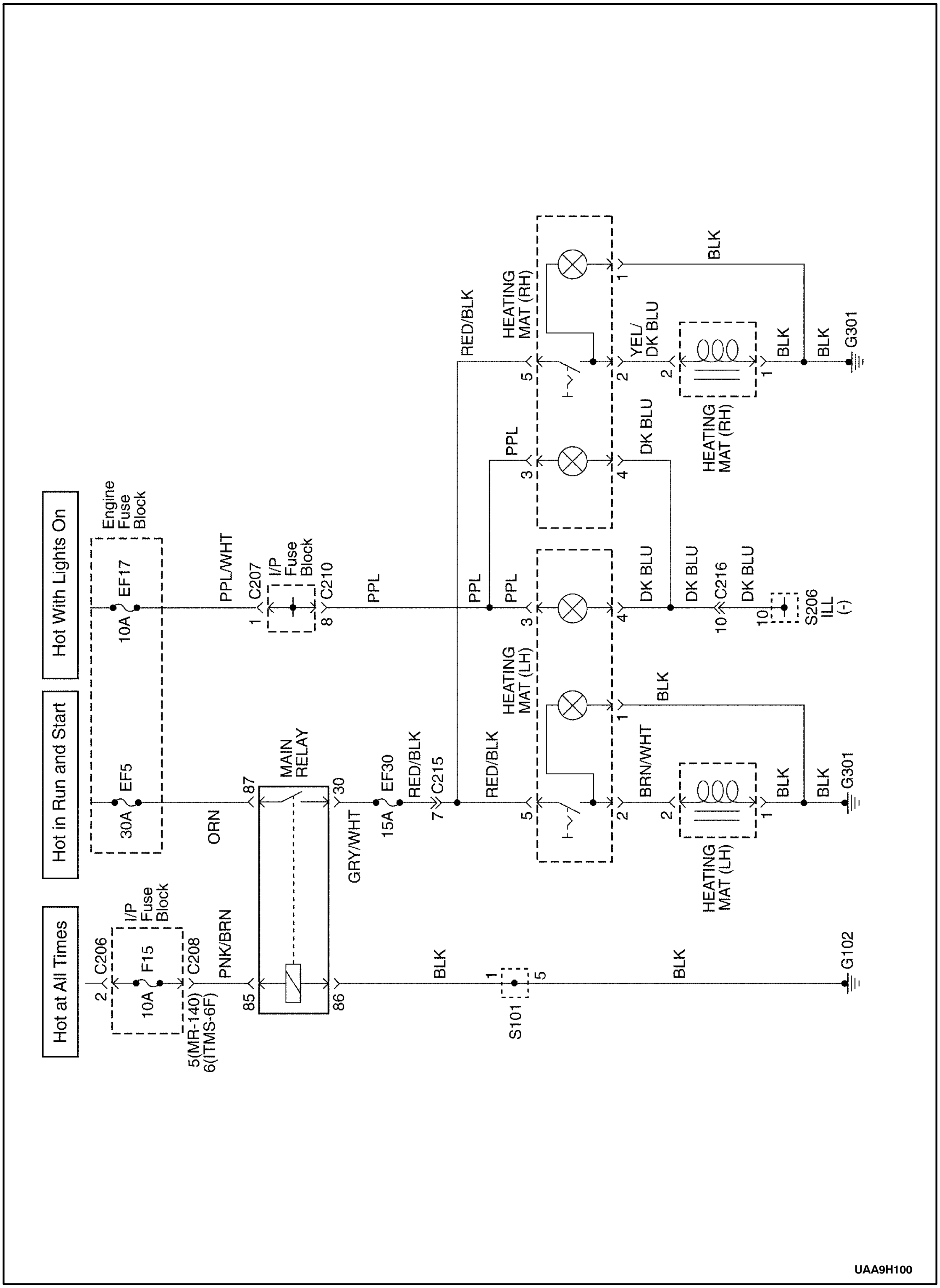
1. Disconnect the negative battery cable.
2. Remove the heating mat switch cover.
3. Disconnect the heating mat switch electrical connector.
4. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

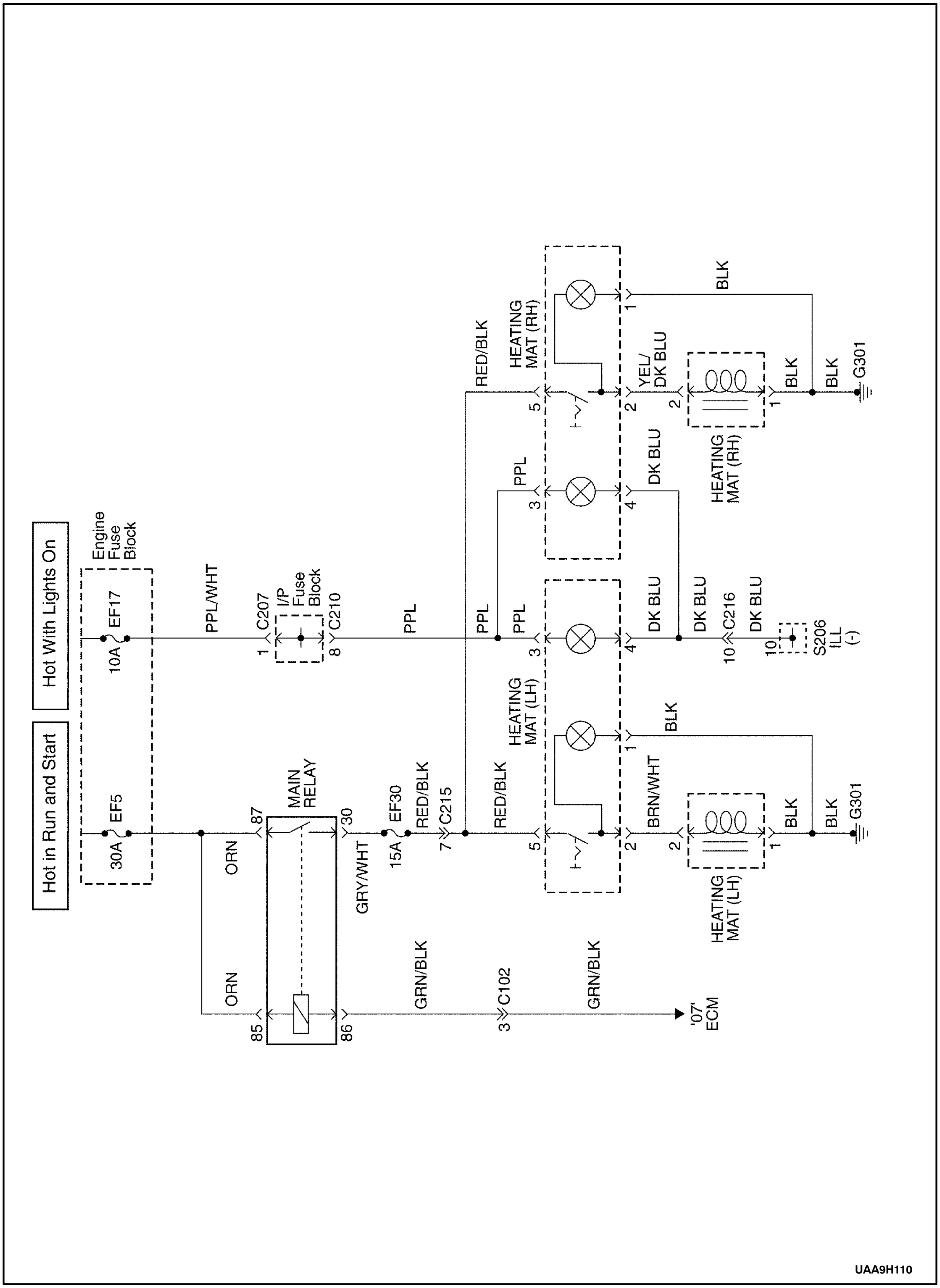
FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Front Seatback Bolts	49	36	–
Front Seat Cushion Bolts	24	18	–
Rear Seat Cushion Bolts	45	33	–
Seat-to-Floor Bolts	25	18	35

SCHEMATIC AND ROUTING DIAGRAMS

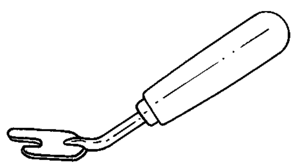


HEATING MAT WIRING SYSTEM



SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 A109G029	**KM-475-B** **Trim Remover**

SECTION 9I

WATERLEAKS

TABLE OF CONTENTS

DIAGNOSTIC INFORMATION AND PROCEDURES

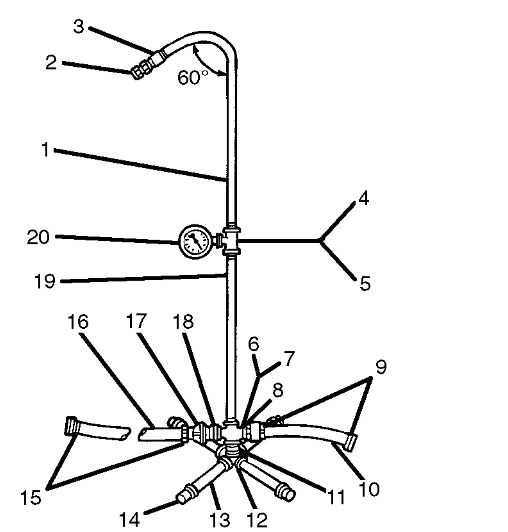
WATERLEAK DIAGNOSIS

The repair of waterleaks in the body requires proper testing and diagnosis. Repair waterleaks by adjusting the misaligned parts and using the proper repair materials. First, determine what conditions cause the leak. For example, the leak may occur only when the vehicle is parked on an incline, or water may appear only in the spare tire compartment. Second, test the area for the source of the leak using the following testing methods. If the general leak area is found, determine the exact entry point of the leak by using a water hose or an air hose. If the general leak area is not obvious, use the watertest stands to determine the area of the leak. It may be necessary to remove some interior trim panels or some parts in order to locate the leaks.

Important: It is necessary to find the origin of all the leaks before making any repairs. Random repairs may stop the leak only temporarily and may make future repairs more difficult. Continue localized testing in the general area in order to ensure that all leaks are found.

Generalized Testing

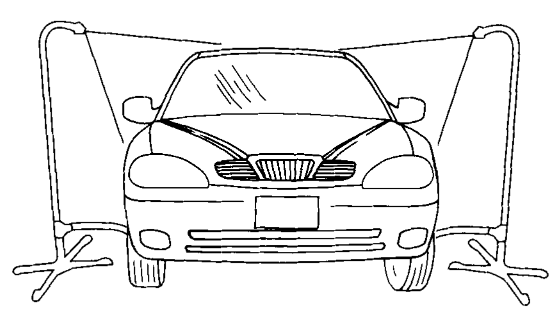
1. Set up the watertest stands.



A109I003

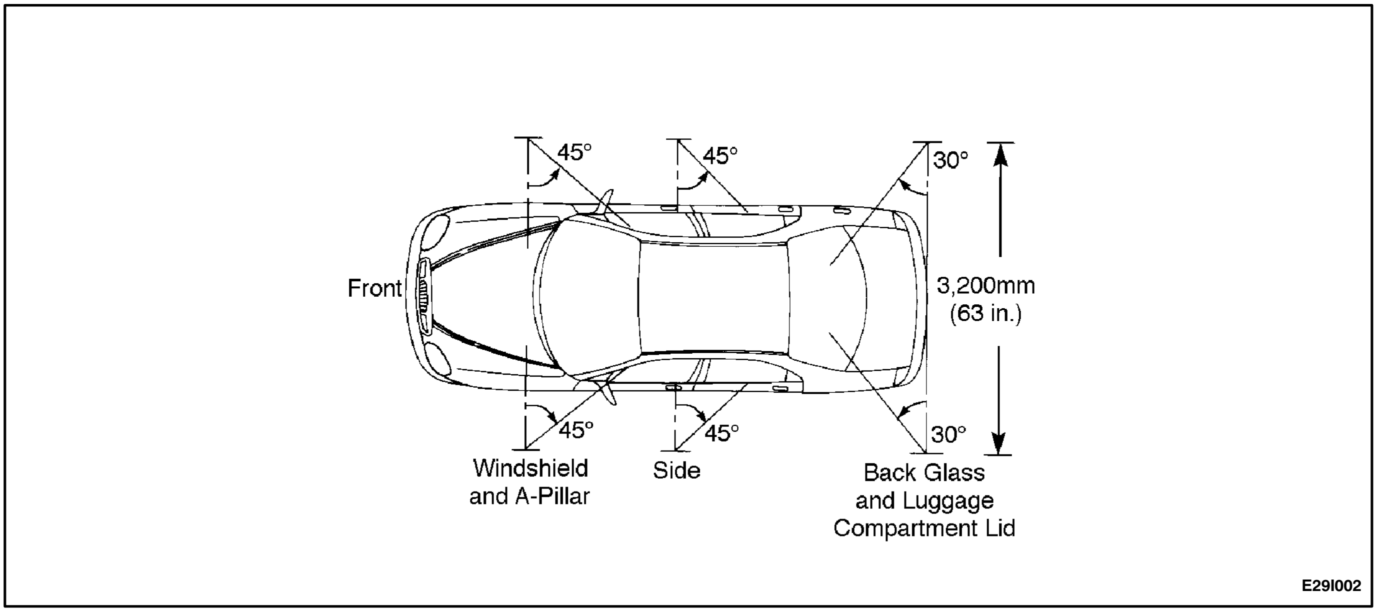
1 1/2-inch by 36-inch Pipe
2 Full-jet Spray Nozzle #1/2 GG-25 or Equivalent Nozzle Height at 1,600 mm to the Floor
3 1/2-inch Coupling
4 1/2-inch by 1/2-inch by 1/4-inch Reducing T (Right Only)
5 1/2-inch Coupling (Left Only)
6 1/2-inch Cross (Right Only)
7 1/2-inch Tee (Left Only)
8 1/2-inch Pipe-to-Hose Nipple (Right Only)
9 5/8-inch Female Hose Coupling
10 5/8-inch Input Hose (2 Feet Long, Right Only)
11 1/2-inch Close Nipple
12 1/2-inch Cross with Weld-on 1/2-inch Cap
13 1/2-inch by 12-inch Nipple
14 1/2-inch Cap
15 5/8-inch Female Hose Coupling
16 5/8-inch Cross Hose (12 Feet Long)
17 5/8-inch Hose Quick Connect
18 1/2-inch Pipe-to-Hose Nipple
19 1/2-inch by 30-inch Pipe (Straight)
20 1/4-inch Water Pressure Gauge (Right Only)

2. Set up the watertest stand leak test.



E29I001

3. Perform the watertest stand leak test. Refer to “Watertest Stand Specifications” in this section.
4. If the local water pressure does not allow the required water pressure of 155 kPa (22.5 psi), move both stands closer to the vehicle so that the water spray overlaps.

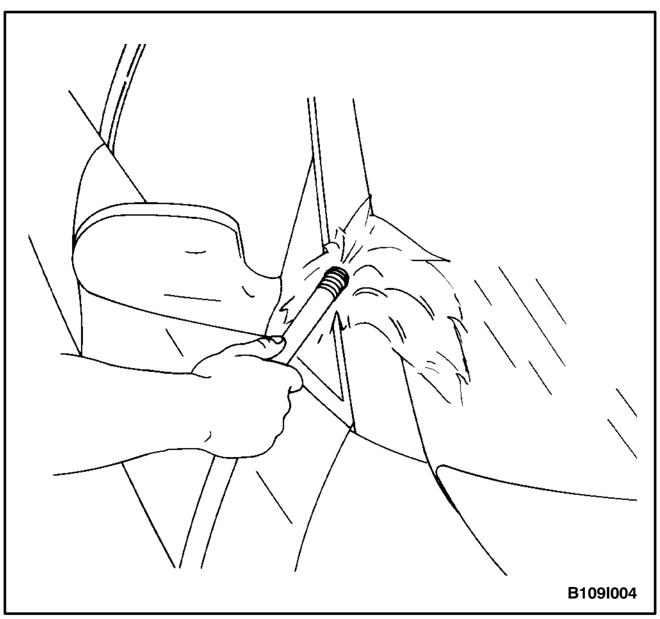


Localized Testing (Spot Test)

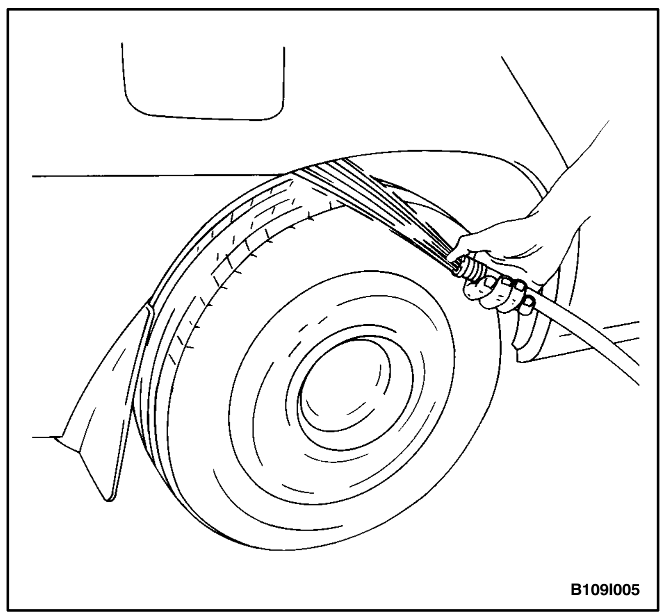
1. Do localized testing with a water hose or an air hose.
2. Begin testing by spraying the air or the water at the base of the suspected leak area. Continue spraying the air or the water upward until the leak is found.

Water Hose Test

1. Place another person inside the vehicle in order to detect the location of the leak.
2. Use a water hose without a nozzle.

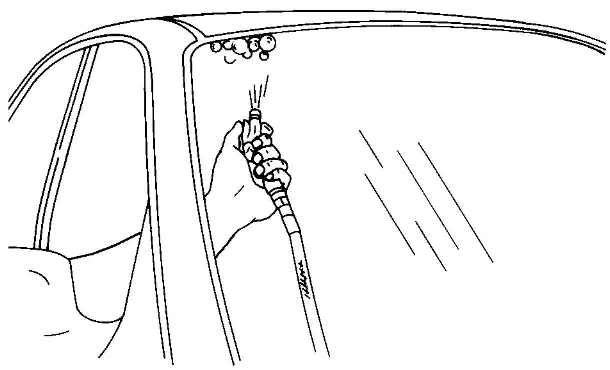


3. Begin spraying the water at the base of the suspected leak area. Continue spraying the water upward until the leak is found.



Air Hose Test

1. Apply soapy water to the outside of the vehicle in the suspected leak area.
2. Blow air from inside the vehicle. The air pressure should not exceed 205 kPa (29.7 psi).
3. Determine the location of the leaks from the bubbles formed in the soapy water.



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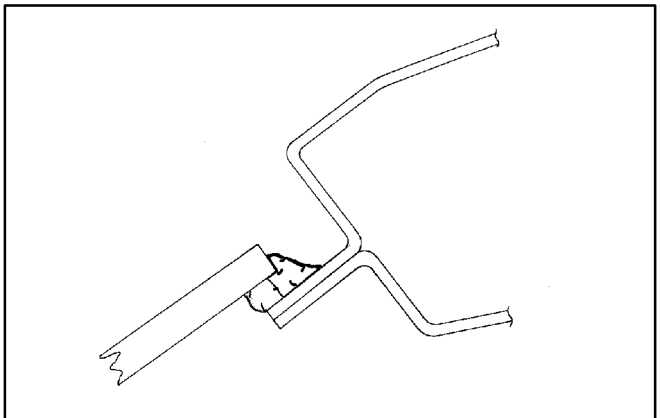
REPAIR INSTRUCTIONS

ON-VEHICLE SERVICE



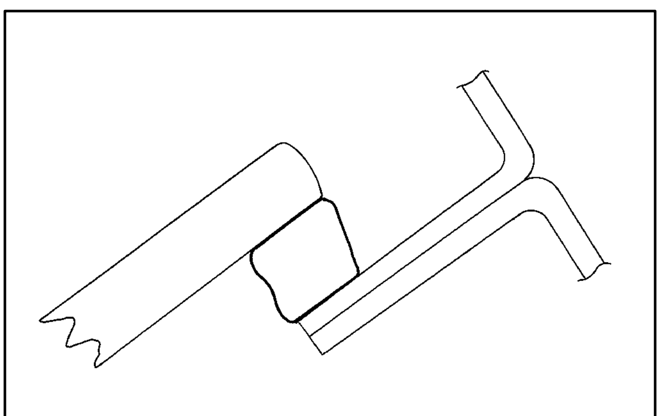
A109I007

WATERLEAK REPAIR

Some waterleaks around the glass can be repaired without removing the glass.

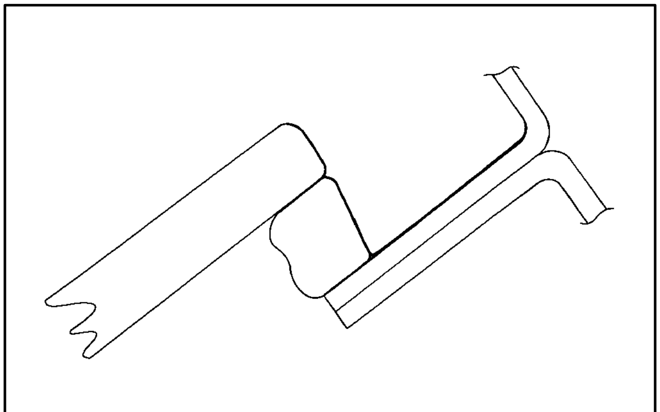
Important: This type of repair may be used only for urethane-installed glass.

1. Remove the reveal molding in the area of the leak. It may be necessary to remove the garnish molding or the trim strip lace in order to locate the leak.
2. While spraying water over the leak area, carefully push the glass outward in order to determine the size of the leak.
3. Mark the location of the leak.
4. Use water to clean any dirt from the area. Dry the area with an air hose.
5. Using a sharp knife, trim off the uneven edges of the adhesive caulking material around the leak for a distance of 75 to 100 mm (3 to 4 inches) on both sides of the leak.



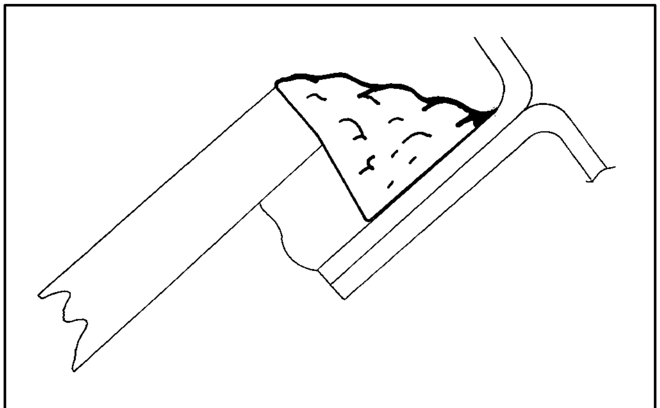
A109I008

6. Using a sharp knife, trim off the uneven edges of the adhesive material around the leak 75 to 100 mm (3 to 4 inches) on both sides of the leak.



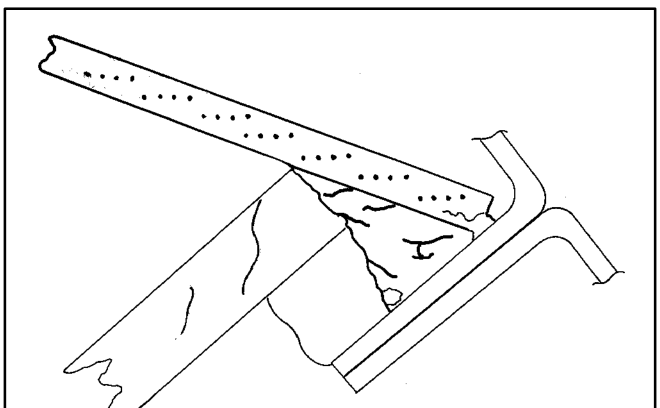
A109I009

7. Prime the trimmed area with the primer.



A109I010

8. Allow the primer to dry for 5 minutes.
9. Apply the adhesive over the leak and for a distance of 75 to 100 mm (3 to 4 inches) on both sides of the leak.



A109I011

10. Immediately after applying the adhesive, use a flat stick or a similar tool to work the adhesive into the leak area and into the joint between the original material and the vehicle body in order to ensure a watertight seal.
11. Spray warm or hot water over the repaired area in order to determine if the leak was repaired. Do not run a heavy stream of water directly on the freshly-applied adhesive.
12. Install the trim strip lace if it was removed.
13. Install the garnish molding if it was removed.
14. Install the reveal molding.

Important: After the completion of any waterleak repair, re-test the area using the watertest stands. Do not use localized testing procedures on the newly-repaired areas, as the repair material may dislodge under abnormal pressure.

SPECIFICATIONS

RECOMMENDED MATERIALS FOR WATERLEAK REPAIRS

Leak Areas	Repair Materials
Windshield, back window	Urethane adhesive, caulking kit, or the equivalent
Metal joints	Brushable seam sealer which can be painted
Ventilation ducts	3M™ Auto Bedding and Glazing Compound or the equivalent
Small cracks and pin holes	3M™ Drip-Check Sealer or the equivalent
Large holes	3M™ Automotive Joint and Seam Sealer
Weatherstrips	3M™ 08011 Weatherstrip Adhesive or the equivalent
Bolts, studs, and screws	Strip caulk

WATERTEST STAND SPECIFICATIONS

Application	Description
Nozzle Type	Full jet spray nozzle #1/2 GG-25 or equivalent with a 60° included angle
Nozzle Height	Approximately 1,600 mm (63.0 in.) from the floor
Volume of Flow	14L (3.7 gal) per minute
Pressure	155 kPa (22.5 psi) measured at the nozzle
Windshield and A-Pillar Test Stand Position	Approximately 30° down, 45° toward the rear, and aimed at the corner of the windshield
B-Pillar Test Stand Position	Approximately 30° down, 45° toward the rear, and aimed at the center of the rear door
Back Window and Rear Deck Lid Test Stand Position	Approximately 30° down, 30° toward the front and aimed approximately 610 mm (24.0 in.) from the corner of the back window

SECTION 9J

WINDNOISE

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DIAGNOSTIC INFORMATION AND PROCEDURES

WINDNOISE DIAGNOSIS

Caution: An assistant should drive the vehicle while the technician checks for the location of the windnoise, in order to prevent personal injury or vehicle damage.

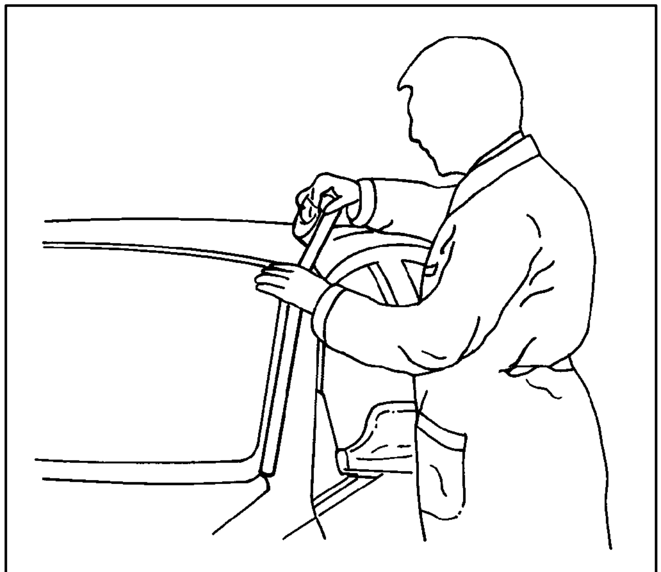
A test drive in the vehicle is necessary to accurately determine the location of the windnoise. Often there is a primary leak and secondary leaks. Failure to repair all leaks will only reduce the windnoise, not eliminate it.

During the test drive the technician should bring the following items to aid in determining the location of the windnoise.

- A mechanics stethoscope or vacuum hose
- Masking tape
- Strip caulk
- A china marking pencil
- A screwdriver

Perform the following steps in order to conduct the road test:

1. Choose a route that includes smooth straight streets that run in all four directions (north, south, east, and west).
2. Choose streets with little traffic or noise that would interfere with the test.
3. Drive the vehicle at the speeds at which the noise was noticed by the customer or until the noise is produced. Do not exceed legal speed limits.
4. The windnoise is external if any of the following conditions occur:
   - The windnoise is caused by the wind.
   - The windnoise can be heard with the door glass lowered and while the vehicle is being driven.
   - The windnoise is eliminated when tape is placed over various moldings and gaps.
5. Internal windnoise is air leaving the vehicle and should be repaired in the following manner.
   - In order to locate the leak, tape off the body lock pillar pressure relief valves. This will cause air pressure to build up inside the vehicle and enhance the windnoise.
   - Use a stethoscope or a vacuum hose to locate the leak.
   - Temporarily repair the leak with masking tape.



A109J001

   - Continue testing in order to determine if the noise has been eliminated or if other leaks exist.
   - When all leaks have been found, return to the shop and make permanent repairs with the proper alignment techniques and sealing materials.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

WINDNOISE REPAIR

Windnoise leak repairs are very similar to waterleak repairs. Refer to *Section 9I, Waterleaks*. The actual procedure depends on the type of seal being repaired.

Leaks around the door opening weatherstrips do not always indicate a faulty weatherstrip. A door or window adjustment may resolve the condition. Refer to *Section 9P, Doors* or *Section 9L, Glass and Mirrors*.

SECTION 9K

SQUEAKS AND RATTLES

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DIAGNOSTIC INFORMATION AND PROCEDURES

SQUEAK AND RATTLE DIAGNOSIS

Rattle Coming From the Side Rail

Checks	Action
Check the brake lines.	• Tap lightly on the brake lines and listen for a rattle. • Install plastic tie straps to secure the brake lines tightly together.

Rattle Under Vehicle at Higher RPM

Checks	Action
Check for heat shield contact with the underbody.	• Raise the vehicle and perform a visual inspection. • Bend the heat shield slightly to gain clearance from the underbody.

Squeak From the Front of the Vehicle in Cold Weather

Checks	Action
Check the front stabilizer shaft insulators.	• While the vehicle is cold, perform a test drive and achieve full front suspension travel by driving through a dip in the road. • Remove the insulators and wrap teflon tape around the stabilizer shaft. Reinstall the insulators over the tape.

Thump From Rear of Vehicle on Bumps

Checks	Action
Check for a properly secured spare tire in the rear compartment.	• Open the rear compartment and perform a visual inspection of the spare tire and the tools. • Tightly secure the spare tire and all tools. • Perform a road test to verify that the noise is eliminated.

Glass Knock Coming From the Rear of the Vehicle When Driving Over Bumps

Checks	Action
Check for an out-of-adjustment tailgate latch.	• Test drive the vehicle in order to verify this condition. • Loosen the latch nuts and adjust the latch downward.

Rattle Coming From Door

Checks	Action
Check the door lock striker.	• Tighten the door lock striker bolt.
Check for rattling electrical connectors inside the door trim panel.	• Tap on the trim panel and listen for a rattle. • Remove the trim panel and wrap foam padding around the connectors as required.

Squeak When Operating Door

Checks	Action
Check for a lack of lubrication of the door hinge pins.	• Operate the doors and listen for squeaks. • Lubricate the door hinge pins with light oil and coat with lithium grease.

Squeak Coming From Console When Shifting Manual Transaxle (Condition Occurs In Cold Weather with a Cold Engine)

Checks	Action
Check the manual transaxle control lever lower boot.	• Move the control lever between gears and listen for squeaks. • Remove the floor console and replace the lower shift boot or apply talcum powder to the lower shift boot.

Buzz From the Left Side of Instrument Panel

Checks	Action
Check for vibration of the fuse box cover against the instrument panel side trim.	• Tap on the cover with a finger and listen for a buzz. • Apply 6.35 mm (0.250 inch) by 25.4 mm (1.00 inch) felt pads to the side trim where the cover makes contact.

Squeak Coming From Instrument Cluster Trim Plate

Checks	Action
Check for rubbing of the cluster trim plate on the instrument panel.	• Test drive the vehicle in order to verify this condition. • Remove the instrument cluster trim plate and install felt tape to the edges.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

SQUEAK AND RATTLE REPAIR

Squeaks and rattles are caused by the unwanted movement between parts of a vehicle. There are three means to prevent squeaks or rattles.

- Attach the parts securely so that there is no relative motion during the operation of the vehicle.
- Separate the parts so that there is no contact during operation.
- Insulate the parts so that no squeaks or rattles occur with the movement of the parts. Low uniform friction surfaces can be used to eliminate “stick-slip” motion.

SECTION 9L

GLASS AND MIRRORS

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

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DESCRIPTION AND OPERATION

STATIONARY GLASS

Stationary glass consists of all the glass on the vehicle which is immovable within its frame, such as the windshield glass, the back glass, and the inside rearview mirror.

OUTSIDE REARVIEW MIRRORS

One type of outside rearview mirrors are available: electric remote control.

INSIDE REARVIEW MIRROR

The rearview mirror pivots at the ball-and-socket mirror pivot and can be manually adjusted up/down and left/right.

DIAGNOSTIC INFORMATION AND PROCEDURES

TESTING REAR WINDOW DEFOGGER GRID LINE

If it has been observed during use that a grid line is inoperative, the following procedure can be used to find the break. If none of the grid lines is operating, a full system diagnosis should be completed before attempting to repair the grid lines.

1. Start the engine.
2. While the engine is running, turn on the rear window defogger.
3. From the inside of the vehicle, connect a voltmeter to each end of a grid line. The voltmeter will indicate battery voltage if the grid line is open.

Notice: Use care when touching the voltmeter terminals to a grid line. If the terminals are roughly applied, the grid line may be scratched, resulting in an open circuit.

4. If a grid line is found to be open, move a voltmeter terminal from one side of the grid line and re-test at a point nearer to the other side of the window. Continue to re-test, each time bringing one of the voltmeter terminals closer to the opposite side of the window from where it was originally connected. The break in the grid line is at the point where the voltmeter begins reading 0 volts instead of battery voltage.
5. Use a marking crayon to mark lightly the break point on the rear window. Mark the glass instead of marking directly on the grid line, and make the mark far enough from the grid line so that it can easily be removed without disturbing the repair.
6. Use a grid line repair kit to fix the break in the grid line. Refer to “Rear Window Defogger Grid Line Repair” in this section.

OUTSIDE REARVIEW MIRROR DEFOGGERS

Step	Action	Value(s)	Yes	No
1	Check the rear window defogger. Does the rear window defogger work?	–	Go to *Step 4*	Go to *Step 2*
2	Repair the rear window defogger before proceeding with the outside mirror diagnosis. Is the repair complete?	–	Go to *Step 3*	–
3	Test the outside mirror defoggers. Does the repair of the rear window defogger system also fix the problem with the outside mirror defoggers?	–	System OK	Go to *Step 4*
4	Check fuse EF27. Is fuse EF27 blown?	–	Go to *Step 5*	Go to *Step 6*
5	1. Check for a short circuit and repair it, if necessary. 2. Replace the fuse. Is the repair complete?	–	System OK	–
6	1. On the side of the vehicle which has the malfunctioning mirror defogger, remove the black plastic escutcheon from the trim panel side of the door. 2. Disconnect the outside mirror electrical connector. 3. Turn the ignition ON. 4. Turn on the defogger. 5. Use a voltmeter to backprobe terminal 3 (GRY) at the mirror electrical connector. Does the voltmeter indicate the specified value?	11-14 v	Go to *Step 8*	Go to *Step 7*
7	Repair the open circuit between fuse EF27 and the mirror connector. Is the repair complete?	–	System OK	–

Outside Rearview Mirror Defoggers (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition OFF. 2. Disconnect the outside mirror electrical connector. 3. Use an ohmmeter to measure the resistance between terminal 2 (BLK) of the mirror connector and ground. Does the ohmmeter indicate the specified value?	*2* 0 Ω	Go to *Step 10*	Go to *Step 9*
9	Repair the open ground circuit for the outside rearview mirror. Is the repair complete?	–	System OK	–
10	Replace the defective outside rearview mirror. Is the repair complete?	–	System OK	–

ELECTRIC CONTROL OUTSIDE REARVIEW MIRRORS

Outside Rearview Mirrors Do Not Adjust

Step	Action	Value(s)	Yes	No
1	Check fuse F17. Is fuse F17 blown?	–	Go to *Step 2*	Go to *Step 3*
2	1. Check for a short circuit and repair it, if necessary. 2. Replace fuse F17. Is the repair complete?	–	System OK	–
3	Turn the ignition ON. Check the voltage at fuse F17. Is the voltage at F17 equal to the specified value?	11-14 v	Go to *Step 5*	Go to *Step 4*
4	Repair the open power supply circuit for fuse F17. Is the repair complete?	–	System OK	–
5	Check the power mirrors. Are both power mirrors inoperative?	–	Go to *Step 6*	Go to *Step 13*
6	1. Remove the retaining screw for the door power mirror and power window switch assembly. 2. Lift the switch assembly so the connectors on the underside are visible. Is the connector secured to the power mirror switch?	–	Go to *Step 8*	Go to *Step 7*
7	Connect the connector to the power mirror switch. Is the repair complete?	–	System OK	–
8	Use an ohmmeter to check the continuity between terminal 2 (BLK) of the mirror switch connector and ground. Does the ohmmeter indicate the specified value?	*2* 0 Ω	Go to *Step 10*	Go to *Step 9*
9	Repair the open ground circuit for the mirror switch. Is the repair complete?	–	System OK	–
10	1. Turn the ignition ON. 2. Check the voltage at terminal 1 (RED/YEL) of the mirror switch connector. Is the voltage equal to the specified value?	11-14 v	Go to *Step 12*	Go to *Step 11*

Outside Rearview Mirrors Do Not Adjust (Cont'd)

Step	Action	Value(s)	Yes	No
11	Repair the open power supply circuit for the mirror switch. Is the repair complete?	–	System OK	–
12	Replace the outside rearview mirror switch. Is the repair complete?	–	System OK	–
13	1. On the side which has the inoperative mirror, remove the black plastic escutcheon from the trim panel side of the door. 2. Disconnect the outside mirror electrical connector. 3. Turn the ignition ON. 4. At the outside mirror connector, connect a voltmeter between terminal 6 (DK GRN) and terminal 4 (DK GRN/YEL). 5. Operate the in/out adjustment on the switch, and record the voltage indicated in each switch position. 6. Connect a voltmeter between terminal 6 (DK GRN) and terminal 5 (WHT/DK GRN). 7. Operate the up/down adjustment on the switch, and record the voltage indicated in each switch position. Does the voltmeter indicate the specified voltage for each test, with the polarity reversing when the switch is changed from in to out, or up to down?	11-14 v	Go to *Step 14*	Go to *Step 15*
14	Replace the outside rearview mirror. Is the repair complete?	–	System OK	–
15	1. Remove the retaining screw for the power door mirror and power window switch assembly. 2. Lift the switch assembly so the connectors on the underside are visible. 3. Leave the outside mirror disconnected, but do not disconnect the mirror switch connector. 4. Turn the ignition ON. 5. At the mirror switch connector, backprobe to measure the voltage between terminal 6 (DK GRN) and terminal 4 (DK GRN/YEL). 6. Operate the in/out adjustment on the switch, and record the voltage indicated in each switch position. 7. Connect a voltmeter between terminal 6 (DK GRN) and terminal 4 (DK GRN/YEL). 8. Operate the up/down adjustment on the switch, and record the voltage indicated in each switch position. Does the voltmeter indicate the specified voltage for each test, with the polarity reversing when the switch is changed from in to out or up to down?	11-14 v	Go to *Step 16*	Go to *Step 12*
16	Repair the open circuit between the mirror switch and the outside rearview mirror connector. Is the repair complete?	–	System OK	–

REPAIR INSTRUCTIONS

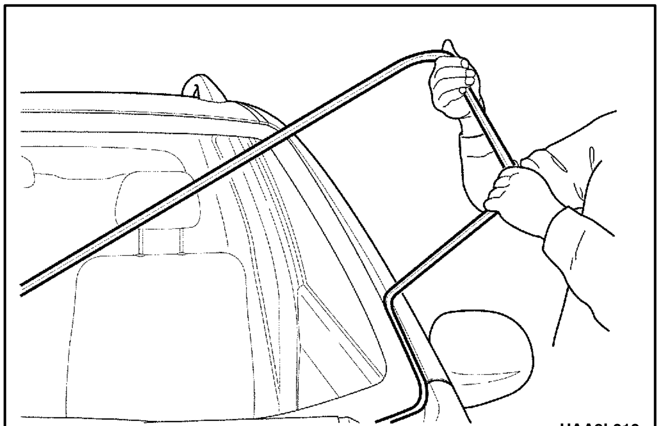
ON–VEHICLE SERVICE

WINDSHIELD

Tools Required

J–24402 Glass Sealant Remover

Removal Procedure



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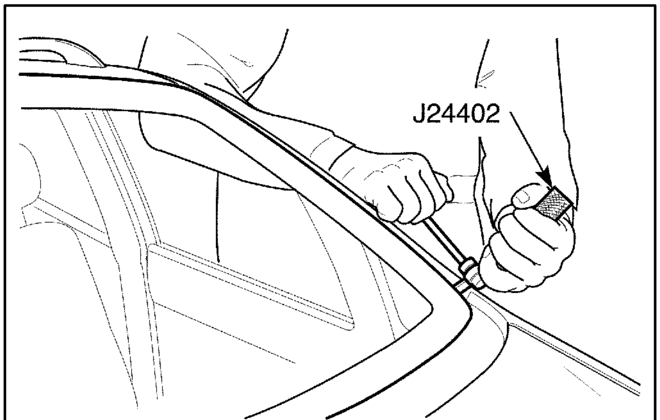
1. Remove the cowl vent grille. Refer to *Section 9R, Body Front End.*
2. Remove the inside rearview mirror. Refer to *"Inside Rearview Mirror"* in this section.
3. Remove the weatherstrip around the windshield.



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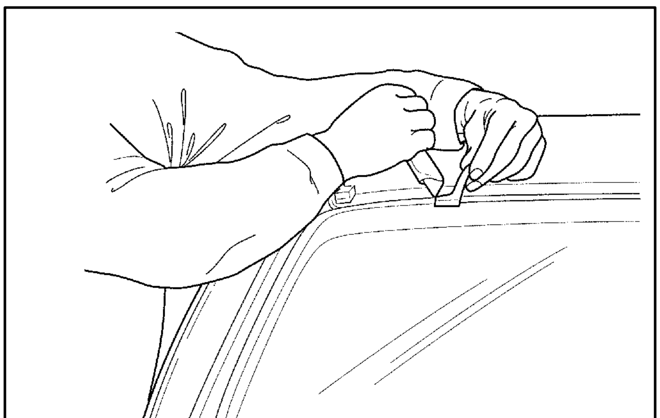
4. Using the glass sealant remover J–24402, cut the adhesive around the windshield.



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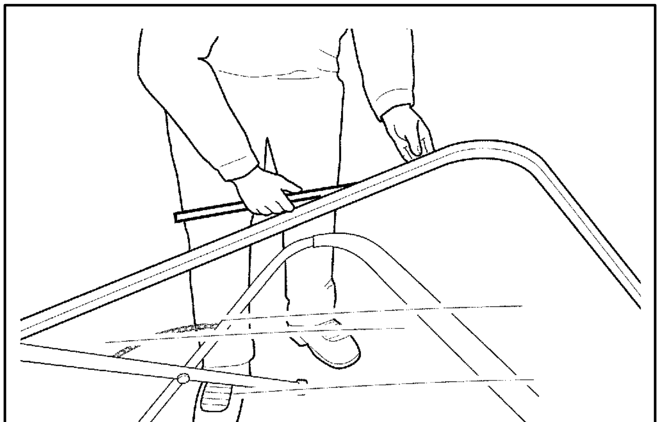
5. Remove the windshield from the vehicle.
6. Using a knife, remove the adhesive from the windshield.
7. Using a knife, remove the adhesive from the windshield frame.



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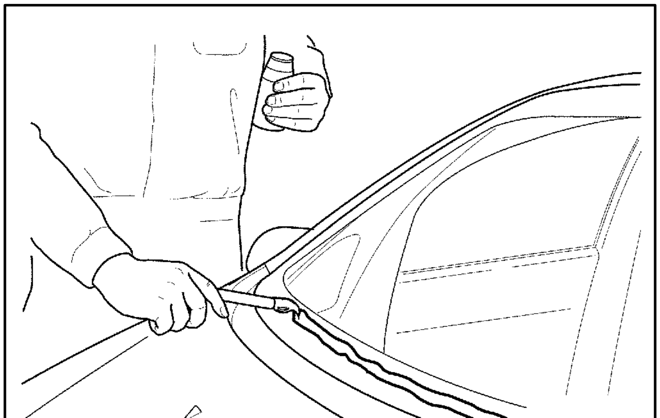
Installation Procedure

1. Installation the new weatherstrip to the windshield.



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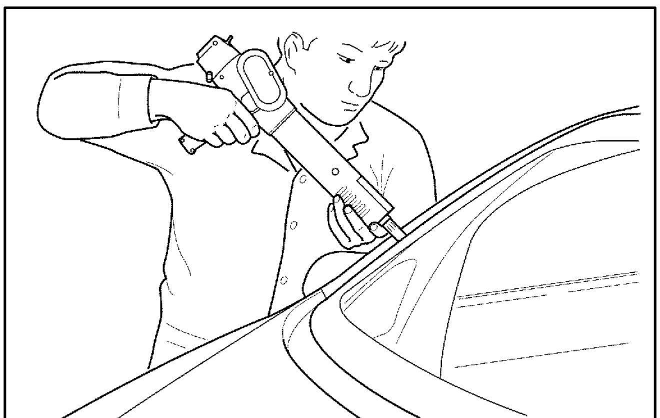
2. Apply tape to the new weatherstrip and the windshield to hold the weatherstrip in place.
3. Apply adhesive primer to the windshield frame and the perimeter of the windshield.



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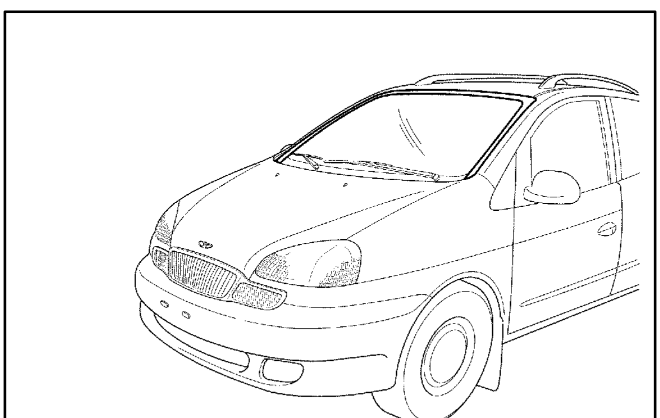
4. Apply glass adhesive to the windshield frame.



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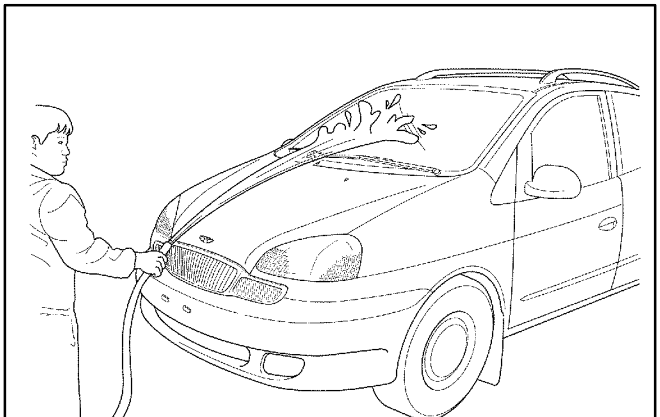
5. Install the windshield into the windshield frame.
6. Reposition the ape over the weatherstrip, the windshield, and the windshield frame to hold the windshield in place.
7. Let the adhesive dry for 24 hours.
8. Remove the tape.



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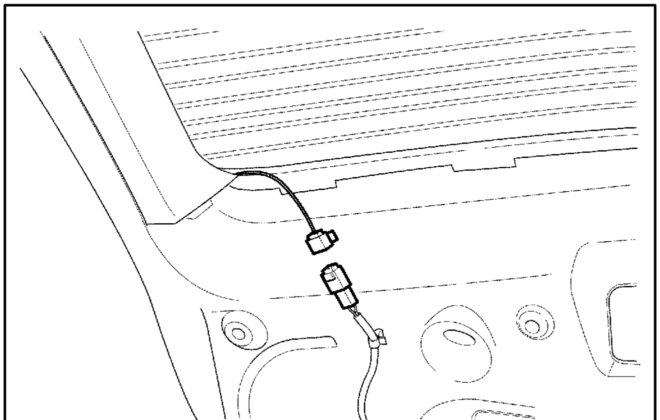
9. Check for waterleaks by pouring water on the windshield. If a leak is found, dry the windshield and fill the area that leaks with adhesive. If the leak persists, remove the windshield and repeat the entire procedure.
10. Install the inside rearview mirror. Refer to *“Inside Rearview Mirror”* in this section.
11. Install the cowl vent grille. Refer to *Section 9R, Body Front End.*



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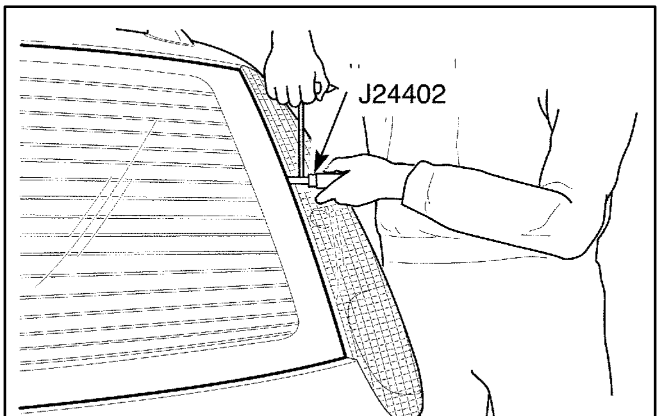
REAR WINDOW GLASS

Tools Required

J–24402 Glass Sealant Remover

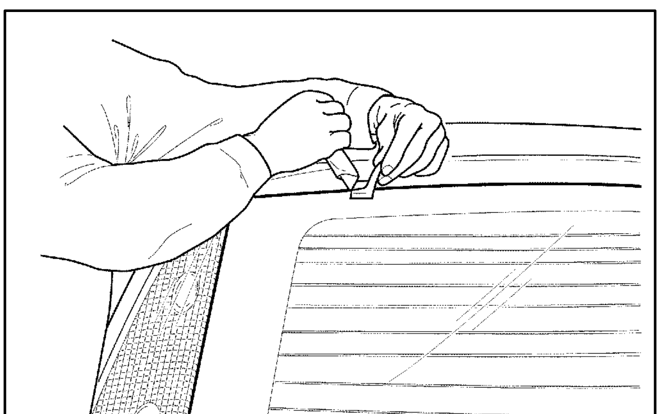
Removal procedure

1. Disconnect the negative battery cable.
2. Disconnect the rear window defogger electrical connector.
3. Remove the rear window wiper. Refer to *Section 9D, Wiper/Washer Systems.*



UAA9L100

4. Remove the glass dam both side of the rear window.
5. Using the glass sealant remover J–24402, cut the adhesive around the rear window.



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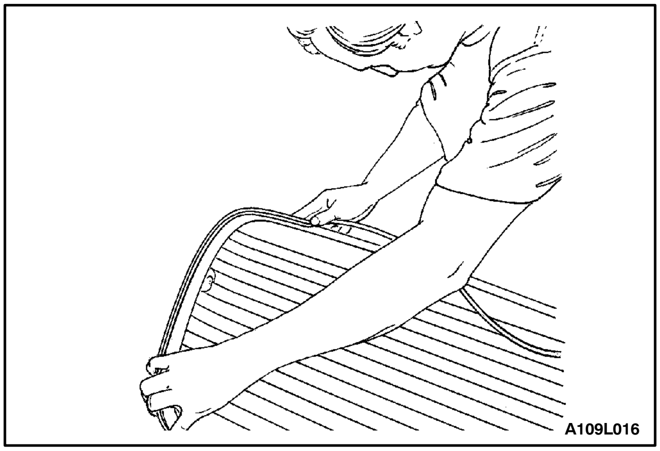
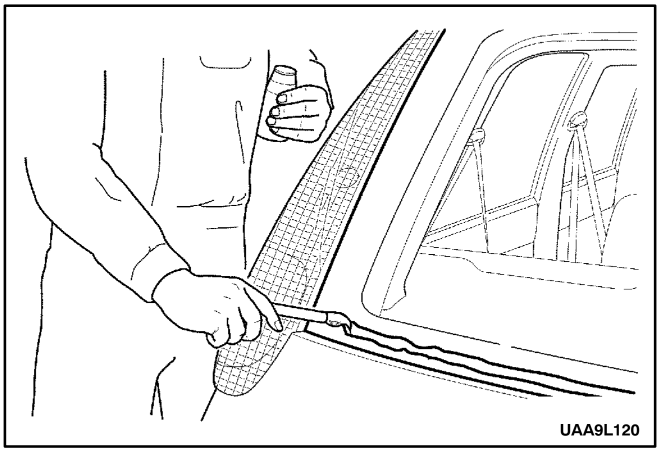
6. Remove the rear window from the vehicle.
7. Using a knife, remove the adhesive from the rear window.
8. Using a knife, remove the adhesive from the rear window frame.

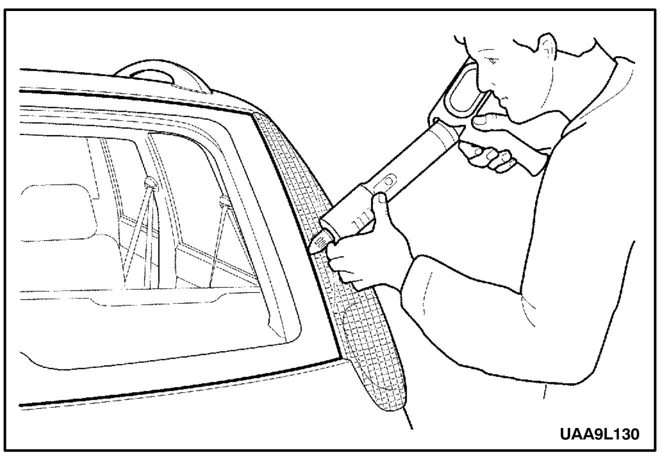


Installation Procedure

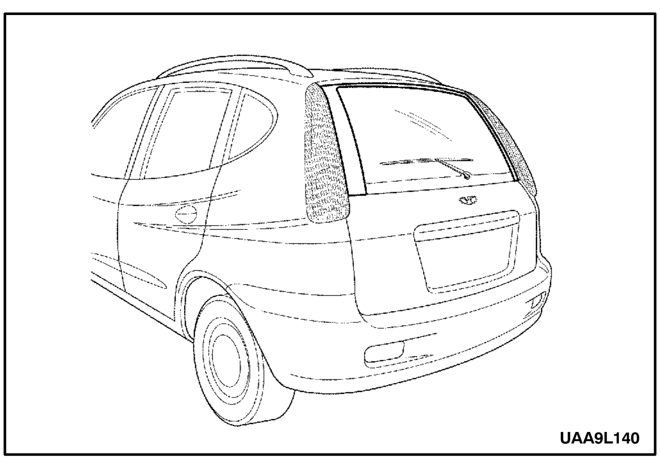
1. Install the new glass dam to the rear window.



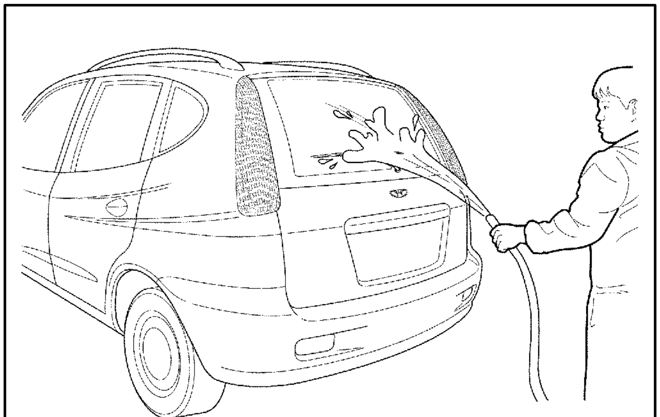
2. Apply tape to the new glass dam and the rear window to hold the glass dam in place.
3. Apply adhesive primer to the rear window frame and the perimeter of the rear window.



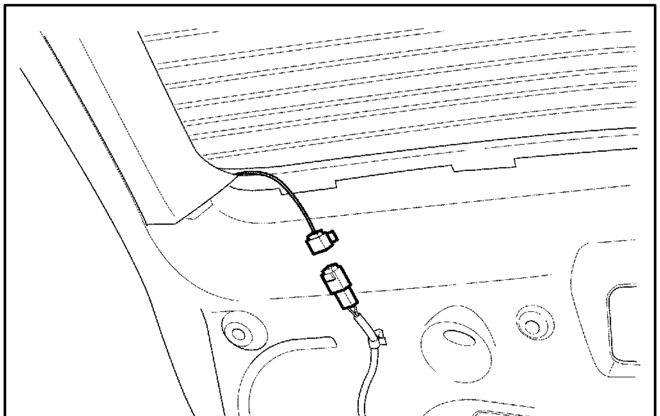
4. Apply glass adhesive to the rear window frame.



5. Install the rear window into the rear window frame
6. Reposition the tape over the glass dam, the rear window, and the rear window frame to hold the rear window in place.
7. Let the adhesive dry for 24 hours.
8. Remove the tape.

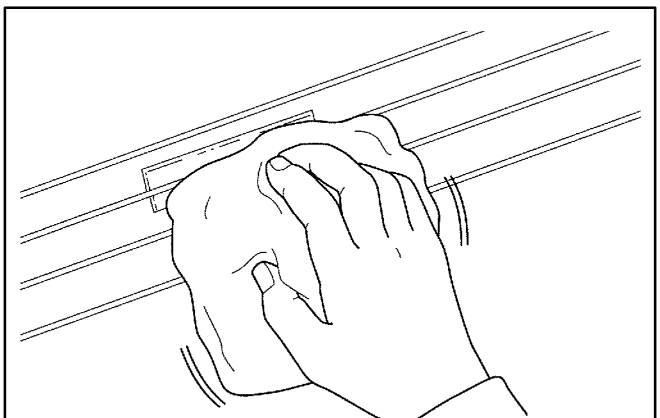

UAA9L150

9. Check for waterleaks by pouring water on the rear window. If a leak is found, dry the window and fill the area that leaks with adhesive. If the leak persists, remove the rear window and repeat the entire procedure.
10. Connect the rear window defogger electrical connector.
11. Install the rear window wiper. Refer to *Section 9D, Wiper/Washer Systems.*
12. Connect the negative battery cable.

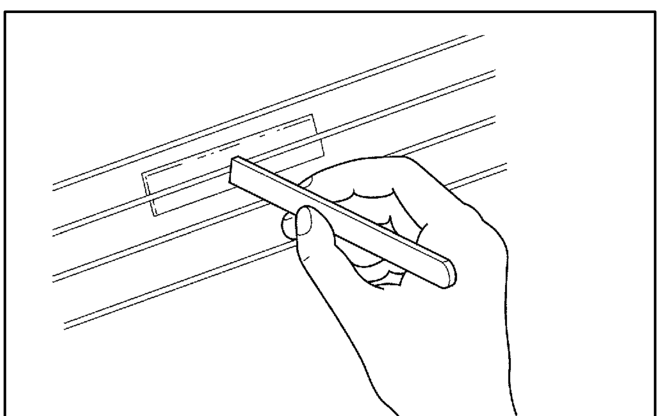

UAA9L090

REAR WINDOW DEFOGGER GRID LINE REPAIR

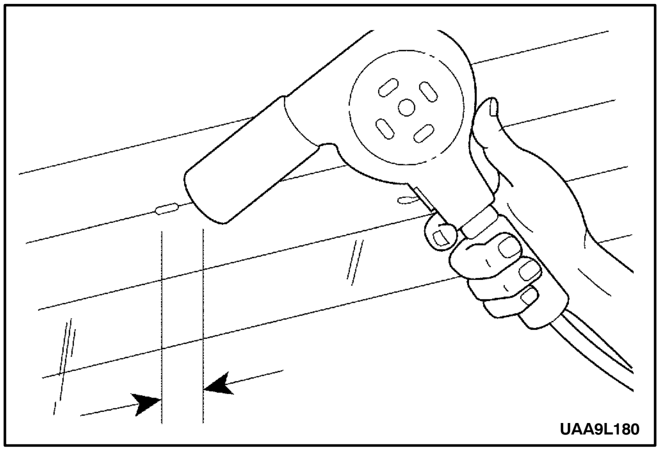
1. Disconnect the negative battery cable.
2. Disconnect the rear window defogger electrical connectors.


UAA9L160

3. Inspect the rear window defogger grid lines.
4. Mark the grid line break on the outside of the glass with a wax pencil or a crayon.
5. Buff the grid lines that are to be repaired with steel wool. Wipe the lines clean using a cloth dampened with alcohol. Buff and clean about 6 mm (0.25 inch) beyond each side of the break in the grid line.


UAA9L170

6. Attach a grid line repair decal or two strips of tape above and below the repair areas.
   - A repair decal or tape must be used in order to control the width of the repair areas.
   - If a decal is used, the die-cut metered slot must be the same width as the grid line.
7. Apply the grid repair material to the repair area using a small wooden stick or a spatula. The grid repair material should be at room temperature.
8. Carefully remove the decal or the tape.

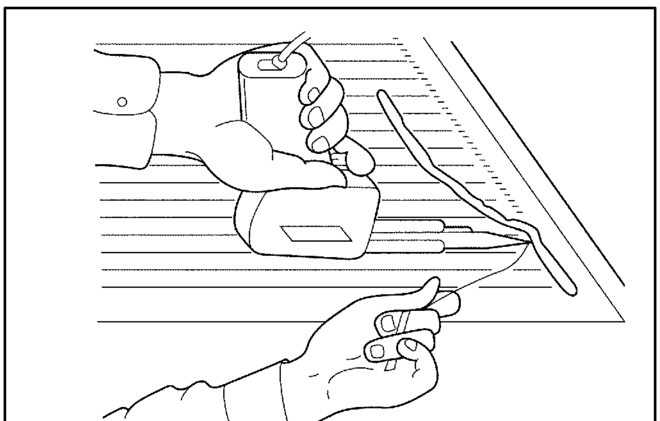


UAA9L180

Notice: The grid line repair material must be cured with heat. In order to avoid heat damage to the interior trim, protect the trim near the repair area where heat will be applied.

9. Heat the repair area for 1 to 2 minutes.
10. Hold the heat gun nozzle 25mm (1 inch) from the surface. A minimum temperature of 149°C (300°F) is required.
11. Inspect the grid line repair area. If the repair appears discolored, apply a coating of tincture of iodine to the area using a pipe cleaner or a line brush. Allow the iodine to dry for about 30 seconds. Carefully wipe off the excess iodine with a lint-free cloth.
12. Connect the rear window defogger electrical connectors.
13. Test the operation of the rear window defogger in order to verify that the repair was successful.

Important: At least 24 hours is required for complete curing of the repair materials. The repair area should not be physically disturbed until after that time.

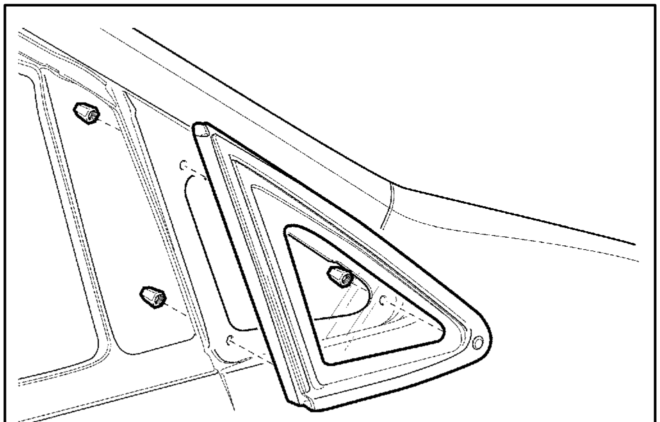


UAA9L190

REAR WINDOW DEFOGGER BRAIDED LEAD WIRE REPAIR

The rear window defogger bus lead wire or the terminal can be reattached by resoldering. Use a solder containing 3 percent silver and a rosin flux paste.

1. The repair area should be buffed with fine steel wool before soldering the bus lead wire.
2. Apply the paste-type rosin flux in small quantities to the wire lead and the bus lead wire repair area using a brush.
3. Coat the soldering iron tip with solder. Use only enough solder to ensure a complete repair.
4. Use only enough heat to melt the solder. Do not overheat the wire when resoldering to the bus lead wire.

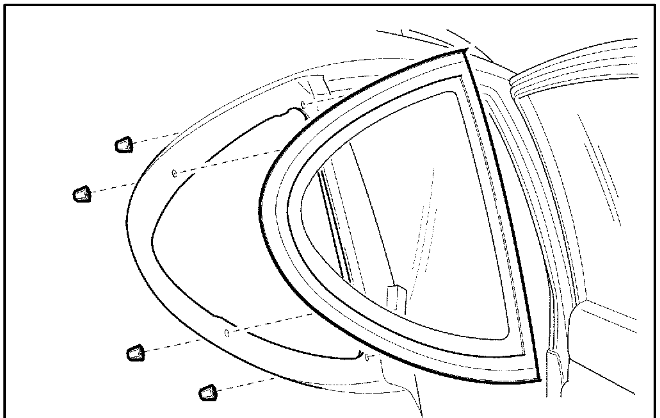


UAA9L200

FRONT QUARTER WINDOW

Removal and Installation Procedure

1. Remove the A-pillar trim panel. Refer to *Section 9G, Interior Trim.*
2. Remove the plastic nuts.
3. Remove the front quarter window.
4. Installation should follow the removal procedure in the reverse order.

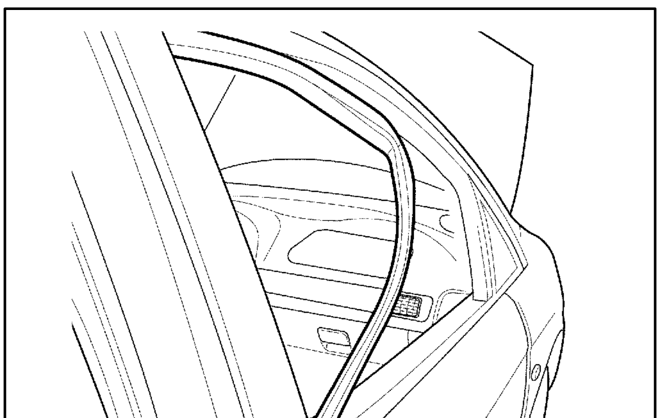


UAA9L210

REAR QUARTER WINDOW

Removal and Installation Procedure

1. Remove the C-pillar trim panel. Refer to *Section 9G, Interior Trim.*
2. Remove the plastic nuts.
3. Remove the rear quarter window.
4. Installation should follow the removal procedure in the reverse order.

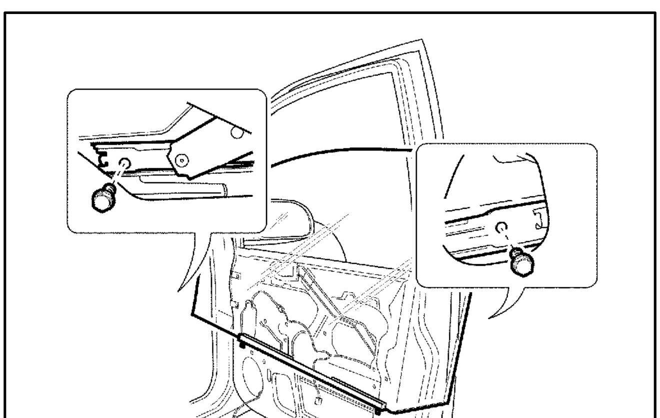


UAA9L220

FRONT DOOR GLASS

Removal and Installation Procedure

1. Remove the door trim panel. Refer to *Section 9G, Interior Trim.*
2. Remove the door seal trim. Refer to *Section 9P, Doors.*
3. Remove the remote control outside rearview mirrors. Refer to *"Remote Control Outside Rearview Mirrors"* in this section.
4. Remove the outer channel molding and the garnish molding.
5. Remove the glass run.



UAA9L230

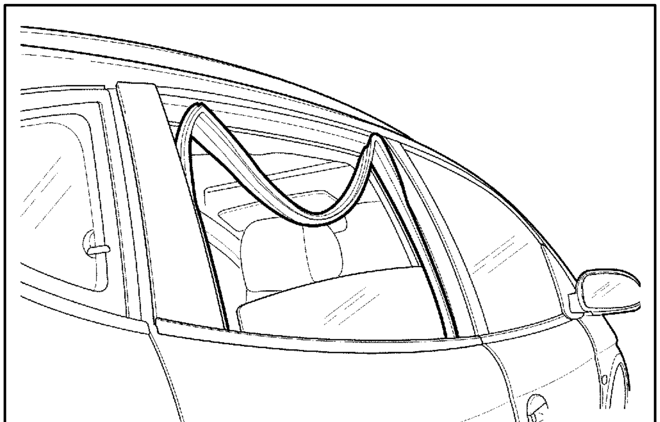
6. Remove the bolts that secure the glass to the window regulator.

Installation Notice

Tightening Torque	5 N·m (44 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

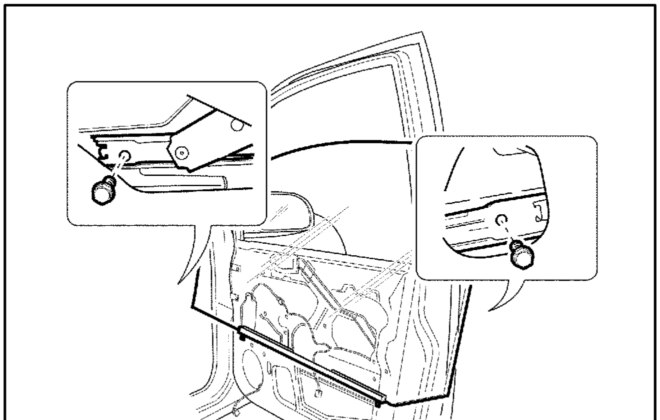
7. Remove the glass from the door.
8. Installation should follow the removal procedure in the reverse order.


UAA9L240

REAR DOOR GLASS

Removal and Installation Procedure

1. Remove the door trim panel. Refer to *Section 9G, Interior Trim.*
2. Remove the door seal trim. Refer to *Section 9P, Doors.*
3. Remove the outer channel molding and the garnish molding.
4. Remove the glass run.


UAA9L230

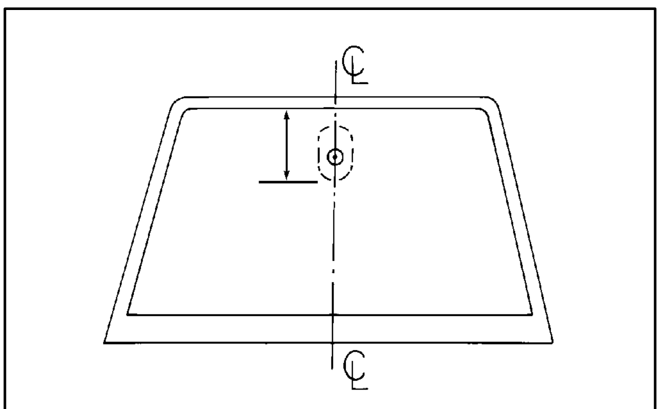
5. Remove the bolts that secure the glass to the window regulator.

Installation Notice

Tightening Torque	5 N·m (44 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

6. Remove the glass from the door.
7. Installation should follow the removal procedure in the reverse order.


A109L022

INSIDE REARVIEW MIRROR

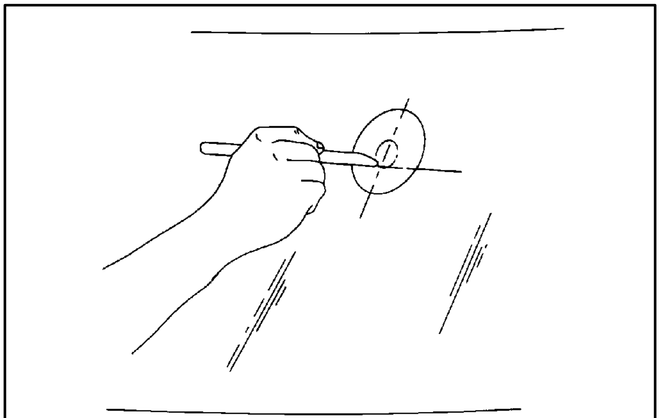
The inside rearview mirror is attached to a support which is secured to the windshield glass. The support is installed by the glass supplier using a plastic-polyvinyl butyl adhesive.

Service replacement windshield glass has the mirror support bonded to the glass assembly. In order to install a detached mirror support or to install a new part, the following items will be needed:

- Loctite® Minute-Bond Adhesive.
- Original or replacement mirror support.
- Wax marking pencil or crayon.
- Rubbing alcohol.
- Clean paper towel.
- Fine grit sandpaper (grit #320 or #360).
- 2 mm allen wrench.

Installation Procedure

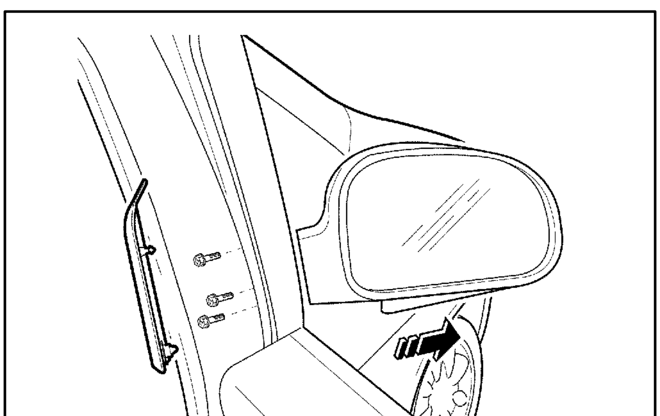
1. Measure the distance from the headliner to the bottom of the location where the mirror support will be mounted on the windshield.


A109L023

2. Mark this position on the outside of the glass with a wax pencil or crayon. Draw a large diameter circle around the mirror support location on the outside of the glass.
3. Clean the inside surface of the glass with a domestic scouring cleanser, a glass cleaning solution, or a polishing compound and paper towels. Rub the glass until the area is completely dry. When the area is dry, clean the area with an alcohol-saturated paper towel in order to remove any traces of the scouring powder or the glass cleaning solution.
4. If the mirror support is new, clean the bonding surface with fine grit sandpaper #320 or #360. If the original mirror support is being used, all traces of factory-installed adhesive must be removed prior to reinstallation.
5. Wipe the sanded mirror support with a clean paper towel saturated with rubbing alcohol. Allow the support to dry.
6. Follow the adhesive kit manufacturer's directions for adhesive application and mirror support preparation before installing the mirror support to the glass.
7. Position the mirror support to its premarked position. Use steady pressure and press the support against the glass for 30 to 60 seconds.
8. After 5 minutes, remove the excess adhesive with an alcohol-moistened towel or a glass-cleaning solution.
9. Install the inside rearview mirror to the mirror support with the mounting screw.

Tighten

Tighten the rearview mirror mounting screw to 1.5 N•m (13 lb-in).


UAA9L250

REMOTE CONTROL OUTSIDE REARVIEW MIRRORS

Removal and Installation Procedure

1. Remove the window frame inner cover.
2. Remove the bolts.

Installation Notice

Tightening Torque	8 N·m (71 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

3. Remove the door seal trim. *Refer to Section 9P, Doors.*
4. Disconnect the electrical connector.
5. Remove the outside rearview mirror assembly from the door.
6. Installation should follow the removal procedure in the reverse order.

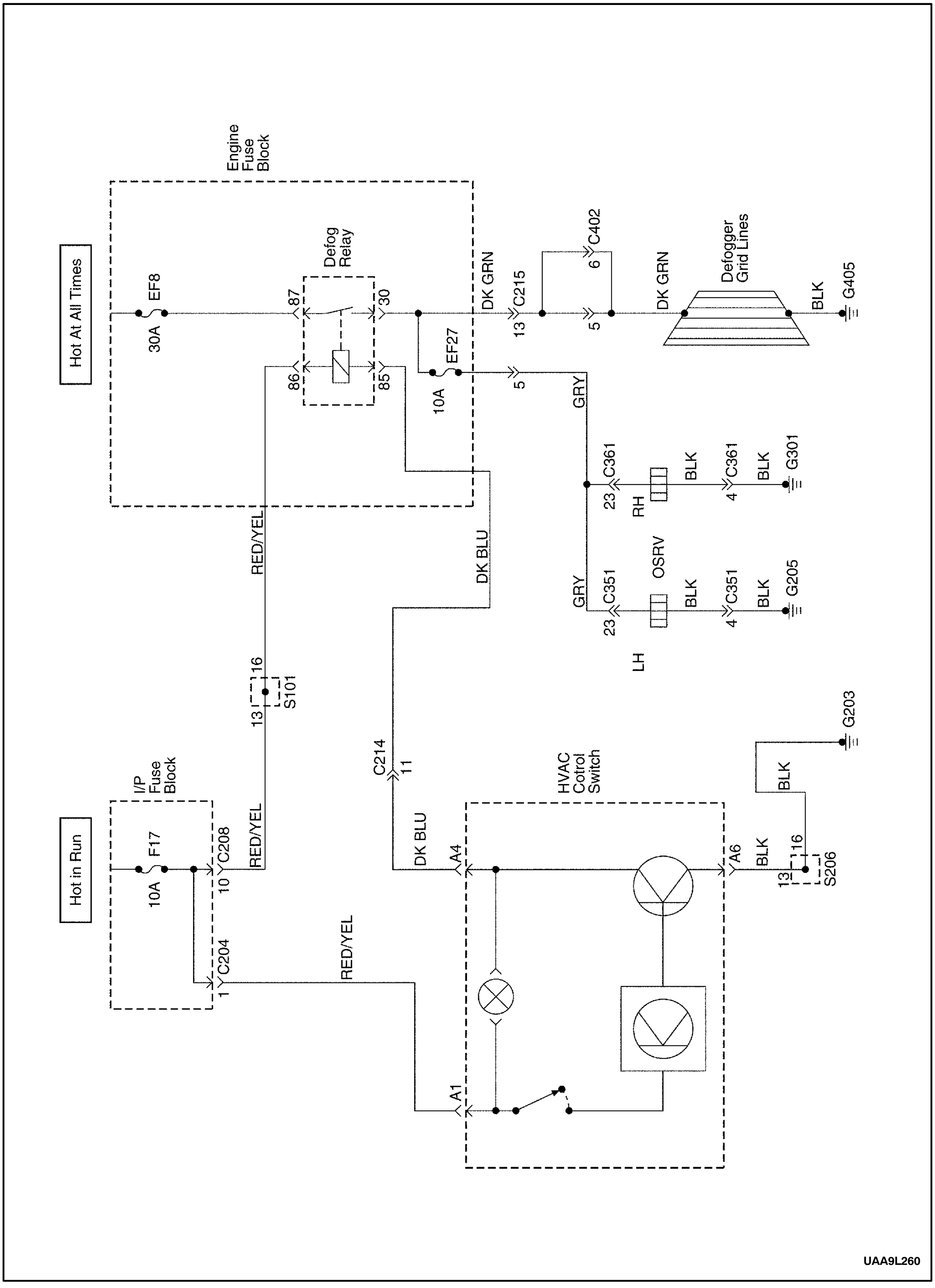
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

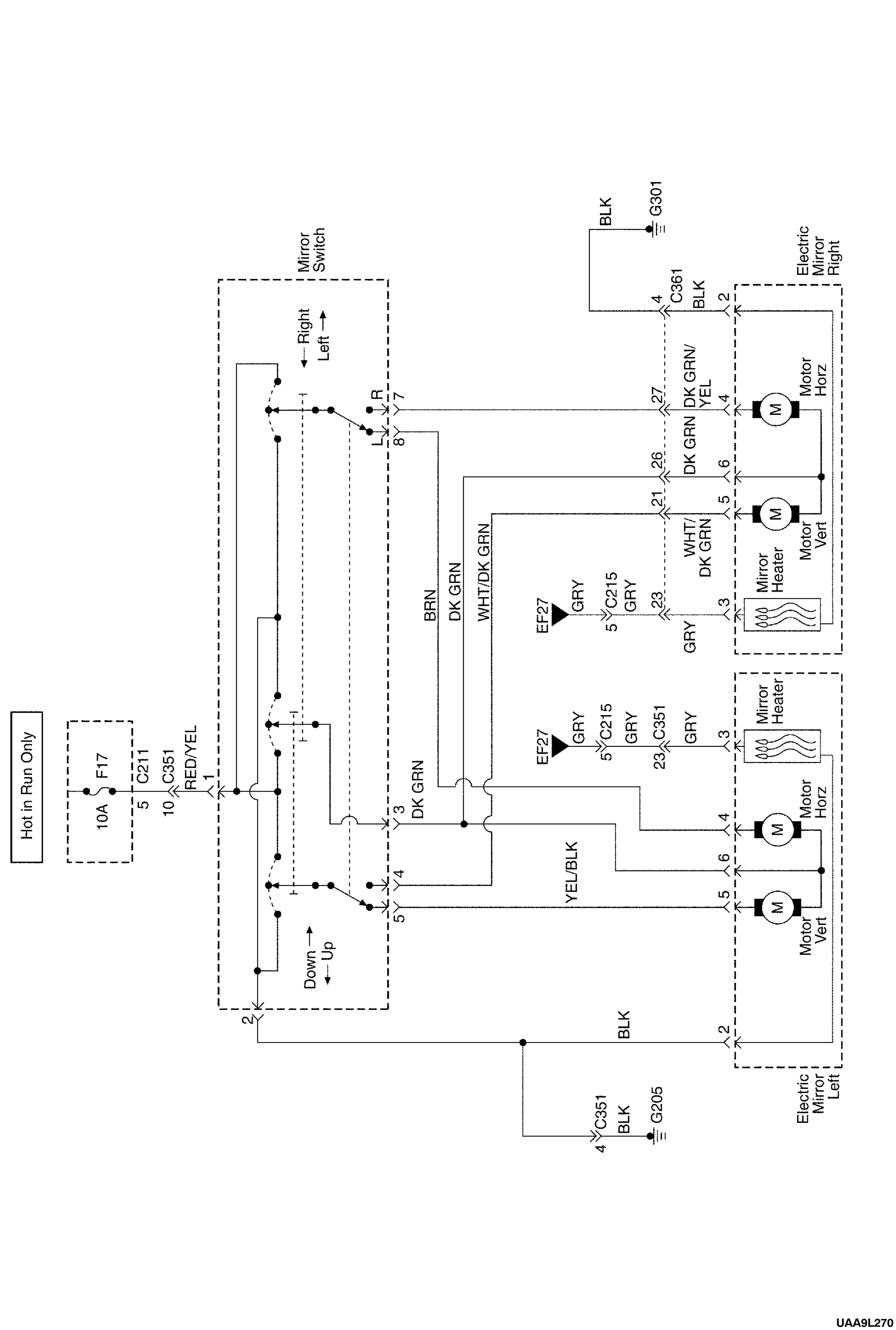
Application	N•m	Lb-Ft	Lb-In
Glass Bolts	5	–	44
Rearview Mirror Mounting Bolrs	8	–	71

SCHEMATIC AND ROUTING DIAGRAMS

REAR WNDOW AND OUTSIDE REARVIEW MIRROR DEFOGGER

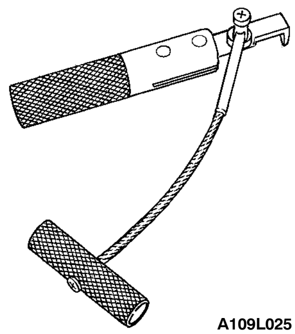


ELECTRIC CONTROL OUTSIDE REARVIEW MIRRORS



SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 A109L025	**J-24402 Glass Sealant Remover**

SECTION 9M

EXTERIOR TRIM

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

EMBLEMS AND LETTERING

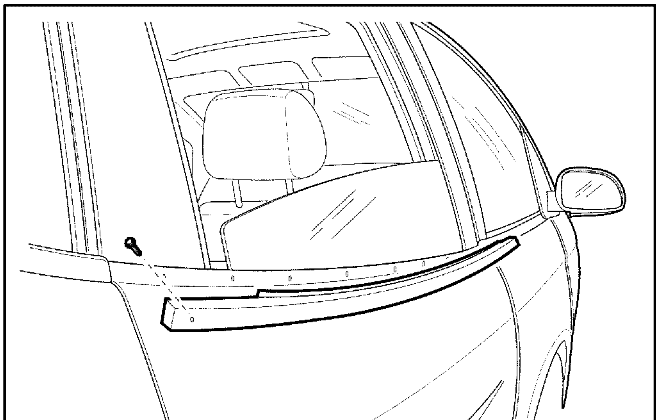
The emblems and lettering on the vehicle are attached by adhesive. The company emblem appears on the hood and the tailgate. The lettering, which appears in several places on the body of the vehicle, features the model, the grade, and the company name.

MUD GUARDS

Front and rear mud guards are standard equipment on all models. Mud guards will help prevent an excessive buildup of mud on the body.

REPAIR INSTRUCTIONS

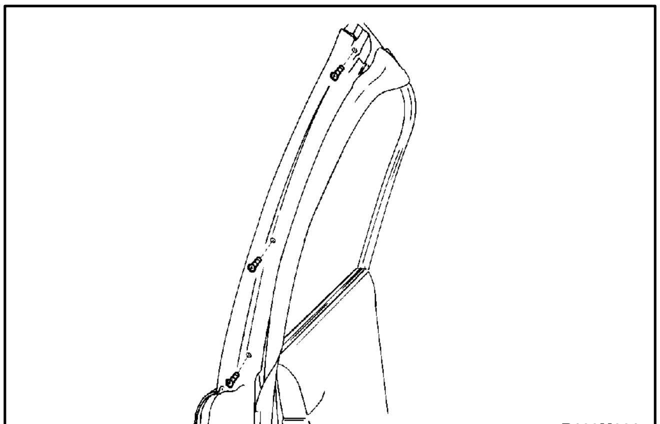
ON–VEHICLE SERVICE


UAA9M010

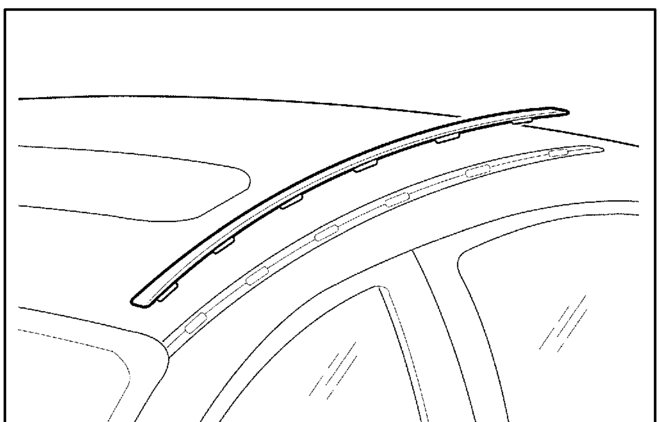
GARNISH MOLDING

Removal and Installation Procedure

1. Remove the screw.
2. Remove the outer channel molding.


B109M001

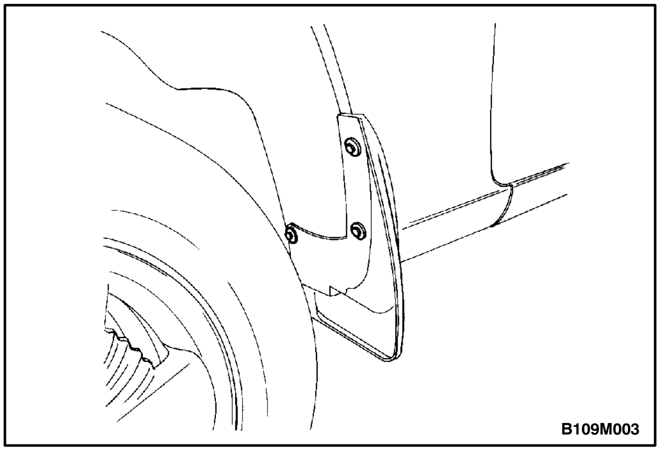
2. Reposition the weatherstrip in order to access the screws.
3. Remove the screws and the garnish molding.
4. Installation should follow the removal procedure in the reverse order.


UAA9M020

ROOF MOLDING

Removal and Installation Procedure

1. Remove the roof molding onto the sealant.
2. Installation should follow the removal procedure in the reverse order.


B109M003

MUD GUARDS

Removal and Installation Procedure

1. Remove the screws and the mud guard.
2. Installation should follow the removal procedure in the reverse order.

SECTION 9N

FRAME AND UNDERBODY

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

GENERAL BODY CONSTRUCTION

This vehicle is constructed with a unitized body which incorporates integral front and rear frame side rails.

The front suspension lower control arms are bolted to and retained by supports, one each on the right and left sides. The front suspension lower control arm supports are attached to the underbody with three bolts at two locations. The engine is bolted to the integral front side rails. The suspension strut towers must be dimensionally correct in relation to the remainder of the underbody in order to maintain specified suspension strut and caster/camber angles.

Since the individual underbody parts contribute directly to the overall strength of the body, it is essential to observe proper welding techniques during service repair operations. The underbody parts should be properly sealed and rustproofed whenever body repair operations destroy or damage the original sealing and rustproofing. When rustproofing critical underbody parts, use a good-quality type of air-dry primer, such as a corrosion-resistant chromate or an equivalent material. Combination-type primer/surfacers are not recommended.

ENGINE UNDER COVERS

The engine under covers are molded pieces of plastic that serve as shields for the underside of the engine. The covers help protect the engine from small rocks, gravel and other objects that would otherwise come into contact with the engine during normal driving conditions.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

ALIGNMENT CHECKING

An accurate method of determining the alignment of the underbody uses a measuring tram gauge. The tram gauge set used to perform the recommended measuring checks must include a vertical pointer.

Two types of measurements can be made with a tram gauge: direct point-to-point measurements and measurements calculated on a horizontal plane (datum line) parallel to the underbody. Point-to-point measurements are generally taken on steering and suspension engine compartment parts and simply require the vertical pointers to be set equally.

For horizontal plane measurements, the vertical pointers must be set as specified for each point to be measured.

Dimensions-to-gauge holes are measured to the center of the holes and flush to the adjacent surface metal unless otherwise specified. It is recommended that the diagonal dimensions to the cross-body be checked on both sides in order to verify the dimensional accuracy of the vehicle underbody.

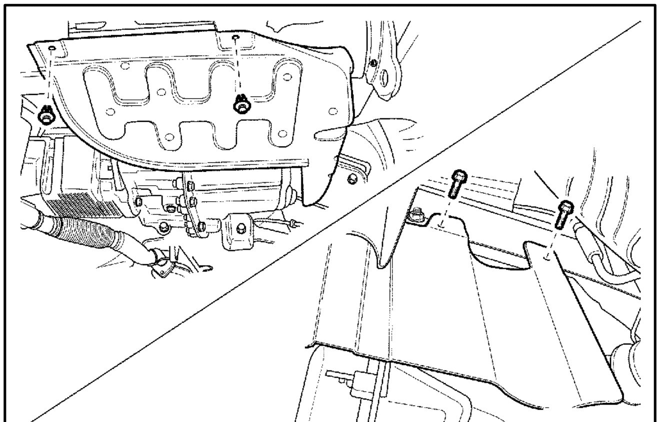
FLOOR PAN INSULATORS

The floor pan insulators have been designed for the higher floor pan temperatures that result from the use of the catalytic converter in the exhaust system. Therefore, when servicing a vehicle, it is essential that any insulators that may have been disturbed or removed be reinstalled in the original sequence and location. Also, if an insulator needs to be replaced, use only the insulation specified for that location on the floor pan.

When servicing or replacing interior insulators, observe the following instructions.

- Install the insulators in the original position and sequence. Butt the pieces together in order to avoid gapping or overlapping.
- If it is necessary to replace an insulator, use only the specified insulation.
- Use the original part to determine the amount of replacement material required and as a template for cutting and fitting the new piece to the floor pan.
- When installing the insulator, do not enlarge any cutouts or holes that are used for the attachment of interior parts such as the instrument panel or the floor console.
- Route the cross-body harness for interior parts over the floor pan insulators. Clip it in the original location.
- Do not apply spray-on deadeners or trim adhesives to the top of the floor pan at the area directly over the catalytic converter or the muffler.

Any insulator service repair or replacement should be the same thickness, size, and location as the original installation in the vehicle.


UAA9N010

ENGINE UNDER COVER

Removal and Installation Procedure

1. Raise and suitably support the vehicle.
2. Remove the clips.
3. Remove the bolts.

Installation Notice

Tightening Torque	2 N·m (18 lb–in)

4. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Engine Under Cover Screw	2	–	18

SECTION 9O

BUMPERS AND FASCIAS

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

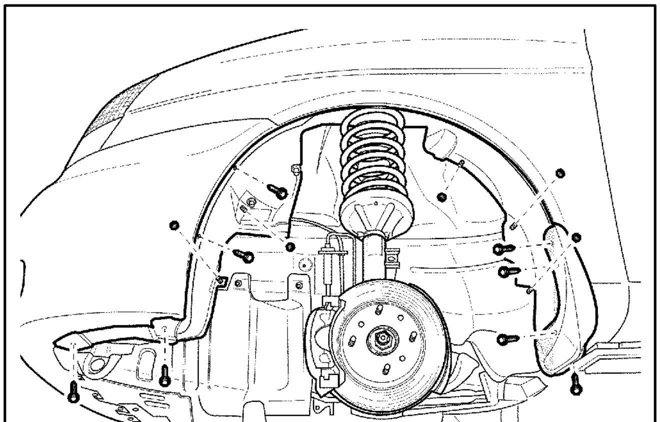
DESCRIPTION AND OPERATION

BUMPERS

The bumper systems are designed to sustain a collision into a fixed barrier at either 8 km/h (5 mph) or 4 km/h (2.5 mph) without damage. After absorbing the energy of a collision, these bumper systems restore themselves to their original position. Both the front and the rear bumpers feature an impact bar and a polymer fascia cover. Both the front and the rear bumper assembly can be removed as a whole unit or the fascia cover can be removed separately.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

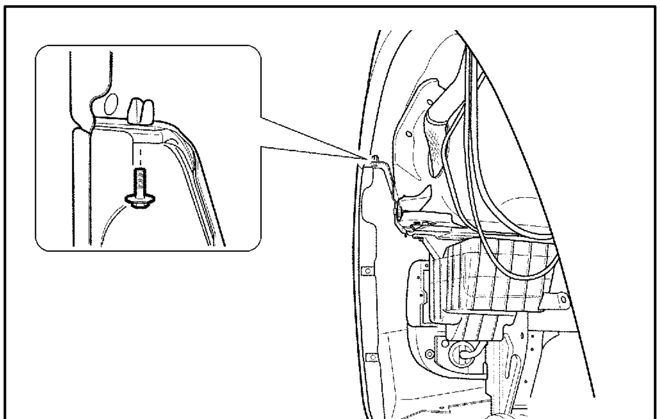


UAA9O010

FRONT BUMPER FASCIA

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the front wheels. Refer to *Section 2E, Tires and Wheels.*
3. Remove the screws and reposition the front portion of the liner fender.



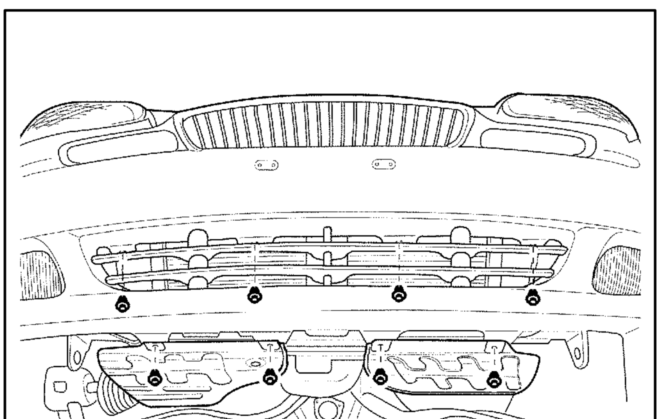
UAA9O020

4. Remove the fender-to-fascia bolt.

Installation Notice

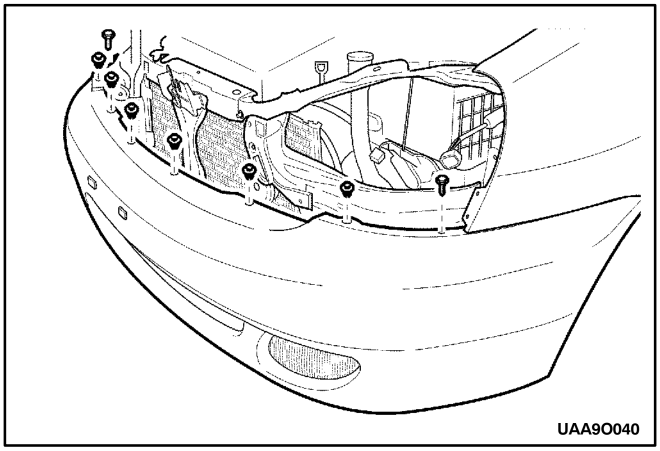
Tightening Torque	2 N·m (18 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

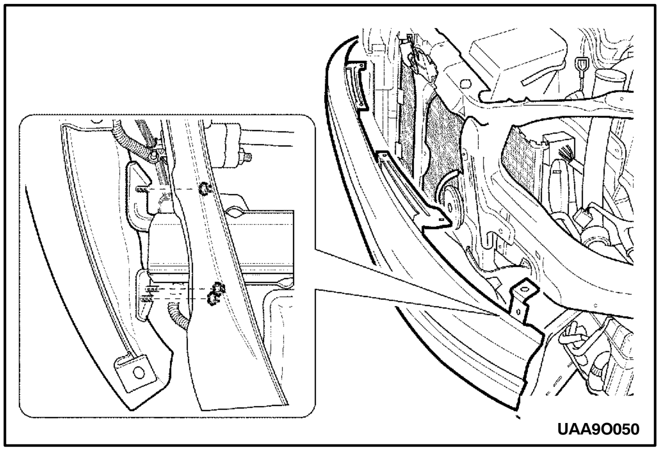


UAA9O030

5. Remove the clips of the fascia.



6. Remove the headlamps. Refer to *Section 9B, Lighting Systems.*
7. Remove the radiator grille. Refer to *Section 9R, Body Front End.*
8. Remove the upper fascia bolts and clips.
9. Disconnect the fog lamp electrical connector.
10. Remove the front bumper fascia.
11. Installation should follow the removal procedure in the reverse order.



FRONT BUMPER IMPACT BAR

Removal and Installation Procedure

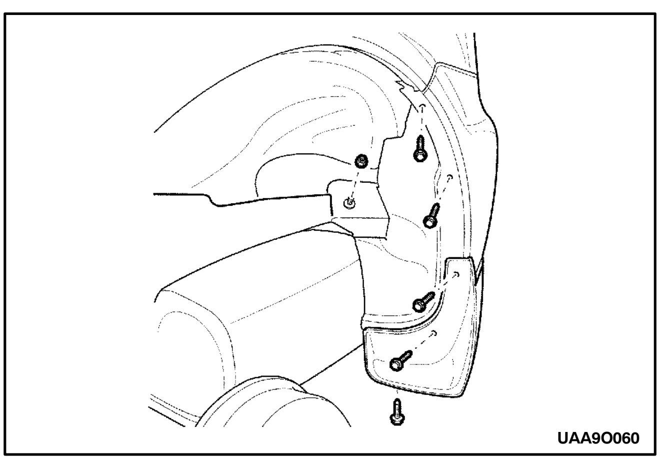
1. Remove the front bumper fascia. Refer to *"Front Bumper Fascia"* in this section.
2. Remove the front bumper impact bar nuts.

Installation Notice

Tightening Torque	35 N·m (26 lb–ft)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

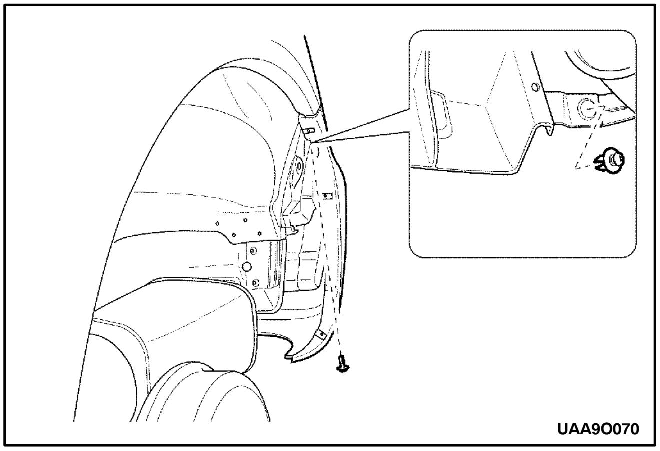
3. Remove the impact bar.
4. Installation should follow the removal procedure in the reverse order.



REAR BUMPER FASCIA

Removal and Installation Procedure

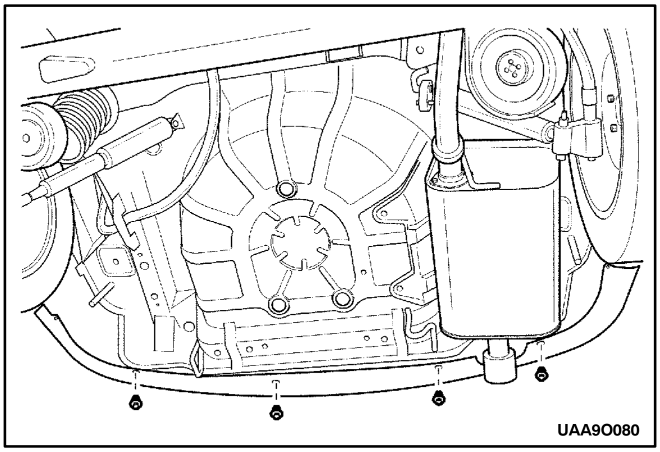
1. Remove the screws and rear wheel mud guard.
2. Remove the screws and the rear liner fender.



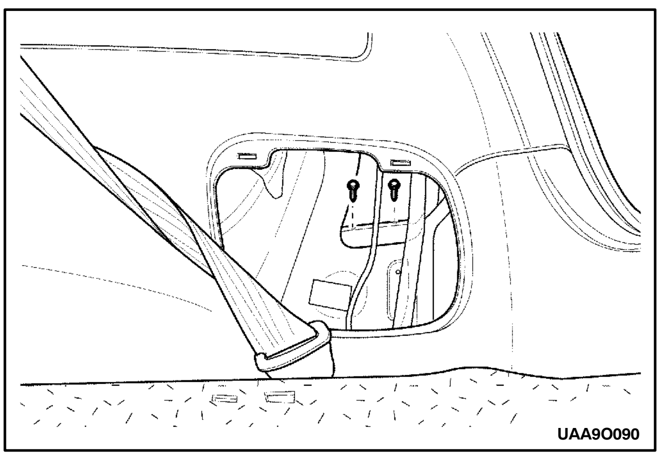
3. Remove the bolt and the clip.

Installation Notice

Tightening Torque	2 N·m (18 lb–in)



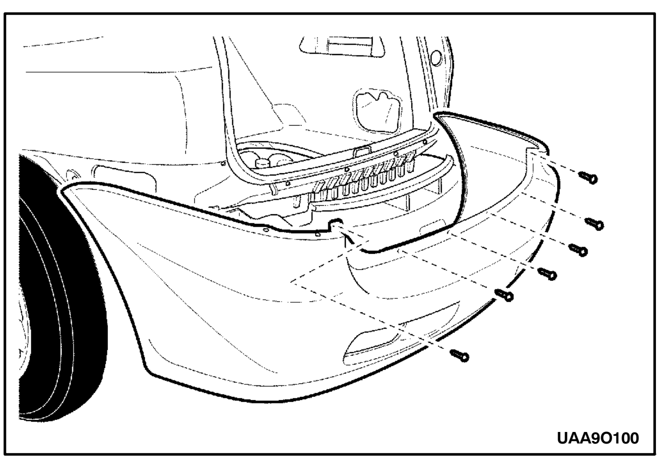
4. Remove the lower fascia clips.



5. Remove the upper fascia bolts.

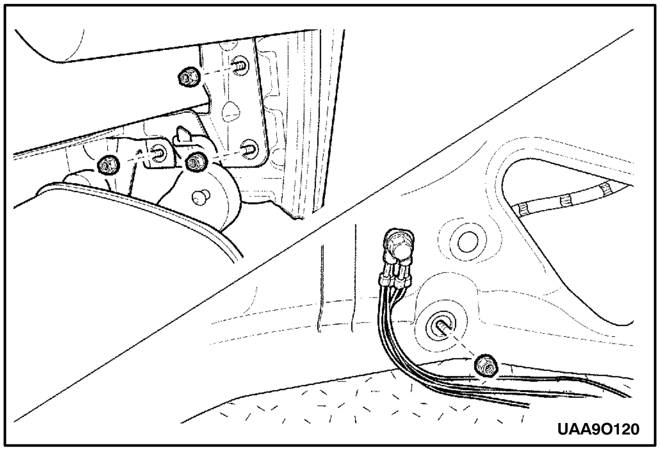
Installation Notice

Tightening Torque	2 N·m (18 lb–in)



Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

6. Remove the screws.
7. Remove the rear bumper fascia.
8. Installation should follow the removal procedure in the reverse order.



REAR BUMPER IMPACT BAR

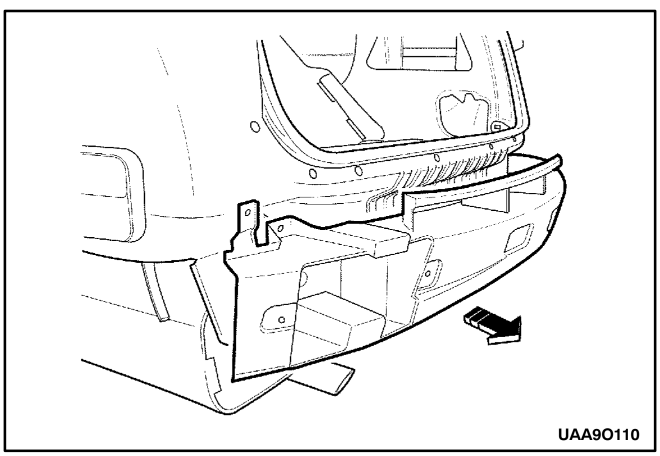
Removal and Installation Procedure

1. Remove the rear bumper fascia. Refer to *“Rear Bumper Fascia”* in this section.
2. Remove the luggage compartment wheelhouse trim panel. Refer to *Section 9G, Interior Trim.*
3. Remove the nuts securing the impact bar.

Installation Notice

Tightening Torque	30 N·m (22 lb–ft)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.



4. Remove the rear impact bar.
5. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Fender-to-Fascia Bolts	2	–	18
Front Impact Bar Bolts	35	26	–
Rear Impact Bar Bracket Nuts	30	22	–

SECTION 9P

DOORS

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

DOOR LOCK STRIKER

The front and the rear door lock strikers each consist of a striker with two screws threaded into a floating cage plate in the B-pillars and C-pillars. The door is secured in the closed position when the door lock fork snaps over and engages the striker.

CHILDPROOF REAR DOOR LOCK

The childproof rear door locks help prevent passengers, especially children, from opening the rear doors of the vehicle from the inside.

In order to activate these locks, move the levers of both rear doors to the lock position. Then, close both doors. Rear passengers will be unable to open the doors from inside of the vehicle.

In order to deactivate the childproof rear door lock, unlock the door from the inside of the vehicle and open the door from the outside. Move the lever to the unlock position. The rear door will now work normally.

POWER DOOR LOCKS

The power door locks use a solenoid that is contained in each door lock assembly. The door locks are activated by the actuator on the inside door handle or by the lock cylinder on the driver's door only. When the driver's door is locked or unlocked by the actuator or the lock cylinder, all the doors are locked or unlocked accordingly.

POWER WINDOWS

The power windows are controlled by electrical switches on the door panels and are operated by a motor at each window regulator. Each door has a switch to control its window, and the driver's door has four switches to control all door windows on the vehicle. The windows are lowered by pressing down on the switch and are raised by pulling up on the switch. The window will stop movement when the switch is released or when the window is completely open or closed.

The driver's window operates automatically. By pressing and releasing the switch, the driver's window will lower. It will stop only when the switch is activated again or when the window is completely open. By pulling and releasing the switch, the window will rise and will stop only when the switch is activated again or when the window is completely closed.

The driver's door control also contains a button that, when pressed, will prevent the operation of the windows in the front passenger door or the rear door.

DIAGNOSTIC INFORMATION AND PROCEDURES

POWER DOOR LOCKS

Power Door Locks Do Not Operate At Any Door

Step	Action	Value	Yes	No
1	Check fuse EF6. Is fuse EF6 blown?	–	Go to *Step 2*	Go to *Step 3*
2	1. Check for a short circuit and repair it, if necessary. 2. Replace fuse EF6. Is the repair complete?	–	System OK	–
3	Check the voltage at fuse EF6. Is the voltage equal to the specified value?	11-14 v	Go to *Step 5*	Go to *Step 4*
4	Repair the power supply circuit for fuse EF6. Is the repair complete?	–	System OK	–
5	Check the voltage at terminal 5 (ORN) of the door lock relay connector. Is the voltage equal to the specified value?	11-14 v	Go to *Step 7*	Go to *Step 6*
6	Repair the open circuit between fuse EF6 and terminal 5 (ORN) of the door lock relay connector. Is the repair complete?	–	System OK	–
7	Use an ohmmeter to check continuity between terminal 8 (BLK) of the door lock relay connector and ground. Does the ohmmeter indicate the specified value?	≈ 0 *W*	Go to *Step 9*	Go to *Step 8*
8	Repair the open circuit between terminal 8 (BLK) of the door lock relay connector and ground. Is the repair complete?	–	System OK	–
9	1. Disconnect the door lock relay connector. 2. Connect a fused jumper wire to the positive battery terminal. 3. Connect another jumper wire to ground. 4. Apply the positive jumper wire to terminal 2 (WHT) of the door lock relay connector. 5. Apply the grounded jumper wire to terminal 3 (DK BLU) of the door lock relay connector. 6. Switch the jumper wires so that the positive jumper is connected to terminal 3 (DK BLU) and the grounded jumper is connected to terminal 2 (WHT). Do the doors lock and unlock when power and ground are applied to terminals 2 and 3 of the door lock relay connector?	–	Go to *Step 11*	Go to *Step 10*
10	Repair the open circuit between the door lock relay connector and S301. Is the repair complete?	–	System OK	–

Power Door Locks Do Not Operate At Any Door (Cont'd)

Step	Action	Value	Yes	No
11	1. Raise the power window in the driver's door. 2. Disconnect the door lock connector at the top of the door lock. (There are three connectors on the door lock. Use the schematic to verify the correct connector.) 3. Use an ohmmeter to check continuity between terminal 2 (BLK) of the door lock switch connector and ground. Does the ohmmeter indicate the specified value?	≈ 0 *W*	Go to *Step 13*	Go to *Step 12*
12	Repair the open circuit between the door lock switch connector terminal 2 (BLK) and ground. Is the repair complete?	–	System OK	–
13	1. Make sure that the door lock relay connector is connected. 2. Touch a grounded jumper wire to terminal 1 (DK GRN) of the disconnected door lock switch connector. 3. Remove the grounded jumper wire and touch it to terminal 3 (LT GRN) of the disconnected door lock switch connector. Do the doors lock and unlock when terminals 3 and 1 are alternately grounded?	–	Go to *Step 14*	Go to *Step 15*
14	1. Make sure all the lock rods are connected to the driver's door lock. 2. If no disconnected lock rods are located, replace the driver's door lock with the integral door lock switch. (Do not confuse the door lock with the lock cylinder. The door lock has three connectors: the lock switch, the lock solenoid, and the door contact switch. Use the schematic to verify the correct connector.) Is the repair complete?	–	System OK	–
15	Use an ohmmeter to check the continuity between terminal 1 (DK GRN) of the disconnected door lock switch connector and terminal 6 (DK GRN) of the door lock relay connector. Does the ohmmeter indicate the specified value?	≈ 0 *W*	Go to *Step 17*	Go to *Step 16*
16	Repair the open DK GRN wire. Is the repair complete?	–	System OK	–
17	Use an ohmmeter to check the continuity between terminal 3 (LT GRN) of the disconnected door lock switch connector and terminal 4 (LT GRN) of the door lock relay connector. Does the ohmmeter indicate the specified value?	≈ 0 *W*	Go to *Step 19*	Go to *Step 18*
18	Repair the open LT GRN wire. Is the repair complete?	–	System OK	–
19	Replace the door lock relay. Is the repair complete?	–	System OK	–

POWER WINDOWS

Power Windows Do Not Operate

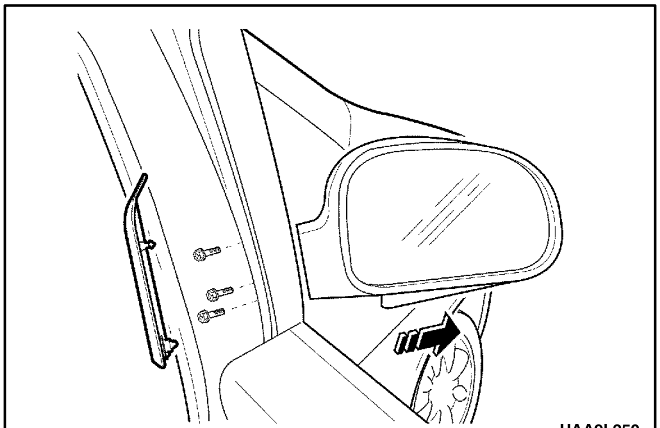
Step	Action	Value	Yes	No
1	1. Make sure the window lock switch on the driver's door is not engaged. 2. Test each of the power windows. Does any power window operate?	–	Go to *Step 7*	Go to *Step 2*
2	1. At the driver's door, remove the power window/power mirror switch retaining screw. 2. Lift up the power window switch so that the connector is exposed. 3. Turn the ignition ON. 4. Check the voltage at terminal 10 (LT GRN) of the power window switch. Is the voltage equal to the specified value?	11-14 v	Go to *Step 4*	Go to *Step 3*
3	Repair the open power supply circuit to the driver's door power window switch. Is the repair complete?	–	System OK	–
4	Use an ohmmeter to check continuity between ground and terminal 4 (BLK) of the driver's door power window switch connector. Does the ohmmeter indicate the specified value?	≈ 0 *W*	Go to *Step 6*	Go to *Step 5*
5	Repair the open circuit between ground and terminal 4 (BLK) of the driver's door power window switch. Is the repair complete?	–	System OK	–
6	Replace the driver's door power window switch. Is the repair complete?	–	System OK	–
7	1. At the door with the inoperative power window, remove the door trim panel 2. Connect a fused jumper wire to the positive battery terminal. 3. Connect another jumper wire to the negative battery terminal. 4. Disconnect the two-wire connector that connects the window motor to the door harness. 5. Connect the negative jumper wire to one of the terminals of the two-wire connector. 6. Touch the positive jumper wire to the other terminal of the two-wire connector. 7. Reverse the jumper wire connections. Does the window move up when the motor is powered directly by the battery, and down when the jumper connections are reversed?	–	Go to *Step 9*	Go to *Step 8*
8	Replace the window motor. Is the repair complete?	–	System OK	–
9	Check the operation of the windows. Is the driver's window the one that is inoperative?	–	Go to *Step 10*	Go to *Step 11*
10	Replace the driver's door power window switch. Is the repair complete?	–	System OK	–

Power Windows Do Not Operate (Cont'd)

Step	Action	Value	Yes	No
11	1. Make sure the window lock switch on the driver's door is not engaged. 2. Turn the ignition ON. 3. Backprobe to check the voltage at terminal 5 (PNK) of the driver's door power window switch. Is the voltage equal to the specified value?	11-14 v	Go to *Step 12*	Go to *Step 10*
12	1. Make sure the window lock switch on the driver's door is not engaged. 2. Turn the ignition ON. 3. Check the voltage at terminal 5 (PNK) of the window switch connector for the inoperative window. Is the voltage equal to the specified value?	11-14 v	Go to *Step 14*	Go to *Step 13*
13	Repair the open (PNK) wire between the window switch and the driver's door power window switch. Is the repair complete?	–	System OK	–
14	1. At the inoperative window switch, use an ohmmeter to check continuity between ground and terminal 1. 2. At the inoperative window switch, use an ohmmeter to check continuity between ground and terminal 4. When performing both ohmmeter tests, does the ohmmeter indicate the specified value?	≈ 0 *W*	Go to *Step 15*	Go to *Step 16*
15	Replace the power window switch. Is the repair complete?	–	System OK	–
16	If one of the window switch wires tested in Step 15 does not show continuity with ground, use an ohmmeter to test the continuity of that wire between the window switch and the driver's door power window switch. Does the ohmmeter indicate the specified value?	≈ 0 *W*	Go to *Step 17*	Go to *Step 18*
17	Replace the window switch for the inoperative window. Is the repair complete?	–	System OK	–
18	Repair the open circuit between the window switch and the driver's door power window switch. Is the repair complete?	–	System OK	–

REPAIR INSTRUCTIONS

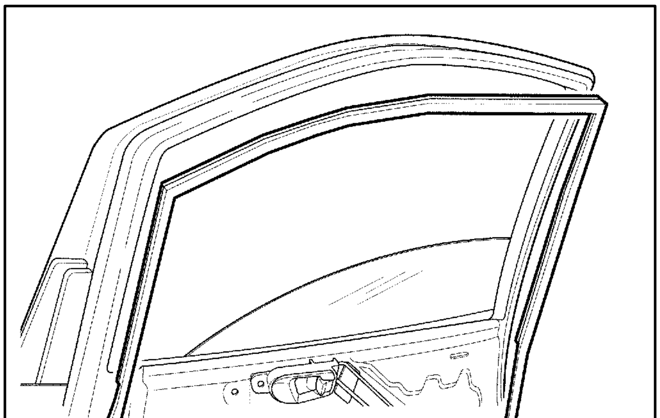
ON–VEHICLE SERVICE


UAA9L250

FRONT/REAR DOOR GLASS RUN

Removal and Installation Procedure

1. Remove the outside rearview mirror. Refer to *Section 9L, Glass and Mirrors.*
2. Remove the door trim panel. Refer to *Section 9G, Interior Trim.*
3. Remove the outer channel molding.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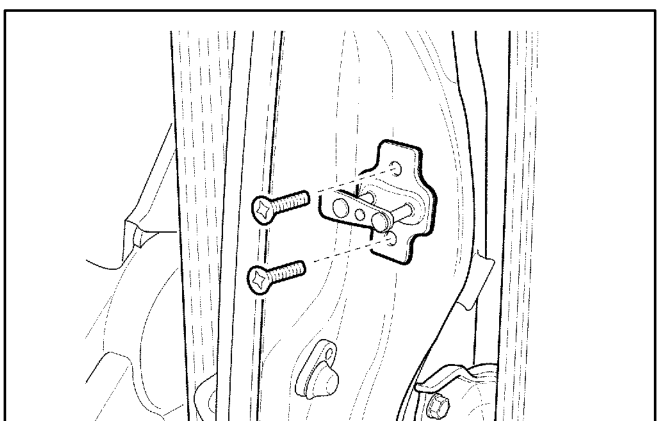
4. Remove the glass run.
5. Installation should follow the removal procedure in the reverse order.


UAA9P030

DOOR LOCK STRIKER

Removal and Installation Procedure

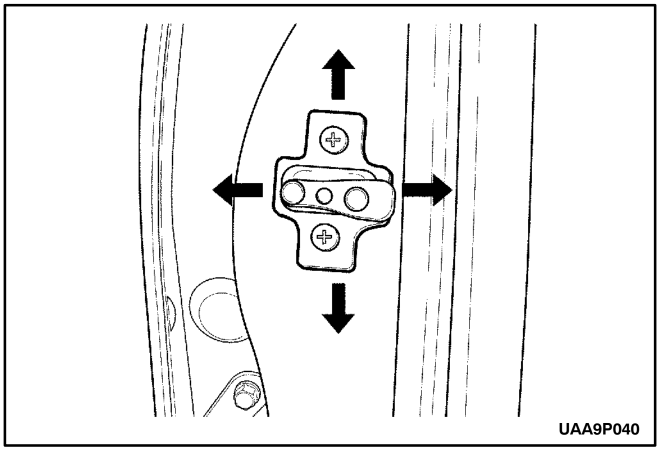
1. Remove the screws.

Installation Notice

Tightening Torque	24 N·m (18 lb–ft)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

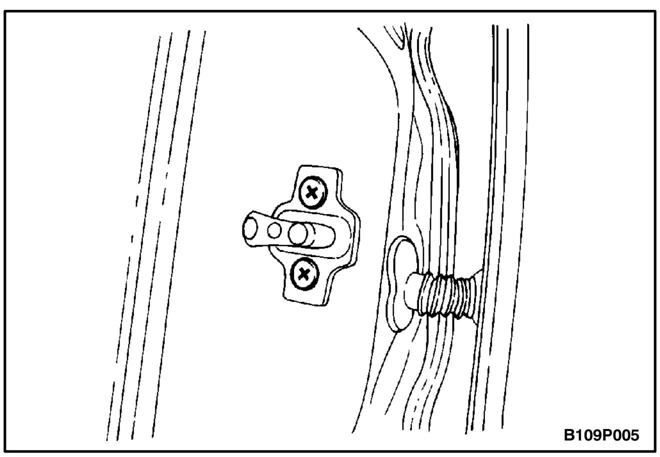
2. Remove the door lock striker.
3. Installation should follow the removal procedure in the reverse order.



DOOR LOCK STRIKER ADJUSTMENT

The door lock striker consists of a striker with two screws that are threaded into a tapped, floating cage plate located in the appropriate body pillar. This floating cage plate allows the striker to be easily adjusted in or out and up or down. The door is secured in the closed position when the door lock fork snaps over and engages the striker.

Notice: The door lock striker is an important attaching part that can affect the performance of vital components and systems and can cause major repair expenses. If replacement becomes necessary, the door lock striker must be replaced by one with the same part number or with an equivalent. Do not use a replacement part of lesser quality or of a substitute design. The specified torque values must be used during reassembly in order to ensure the proper retention of the part.



Up/Down or In/Out Adjustment

An adjustment of the striker in the up and down or in and out directions may be necessary for a number of reasons: vehicle frame damage as the result of a collision, installation of new door weatherstripping, customer complaints of excessive windnoise, or difficulty in opening or closing the door. In order to adjust the door striker in an up and down or in and out direction, perform the following procedure:

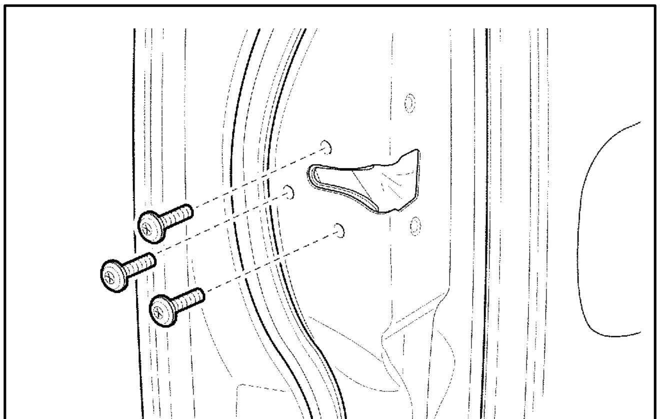
1. The door must be properly aligned.
2. Loosen the striker screws.
3. The floating cage plate can be moved slightly using the ends of the striker screws. Move the floating cage plate to the desired position.

Notice: It is important to use a flat-end rotary file in order not to damage the tapped floating cage plate. The striker screws and the tapped floating cage plate are important attaching parts that could affect the performance of vital components and systems.

4. If proper adjustment requires that the floating cage plate be moved more than is possible, use an electric hand drill and a 3/8-inch rotary file with a flat head in order to enlarge the body opening in the direction required.
5. Tighten the striker screws to the correct position.

Installation Notice

Tightening Torque	24 N·m (18 lb–ft)



UAA9P050

FRONT/REAR DOOR LOCK

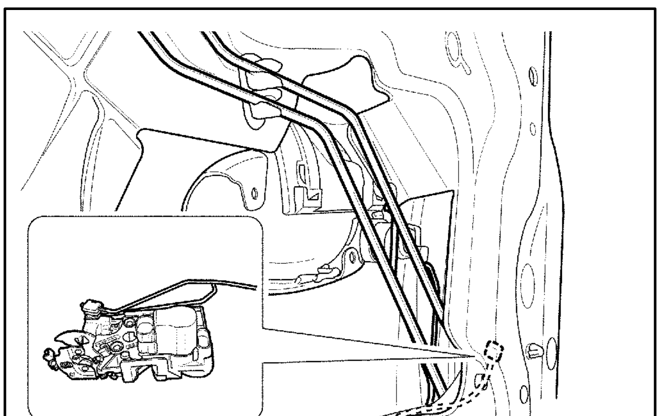
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the seal trim. Refer to *“Door Seal Trim”* in this section.
3. Remove the bolts.

Installation Notice

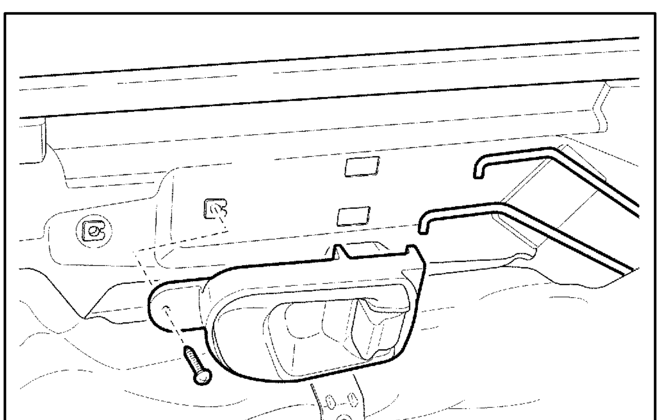
Tightening Torque	8 N·m (71 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.



UAA9P060

4. Disconnect the lock rods.
5. Disconnect the electrical connector.
6. Remove the door lock assembly.
7. Installation should follow the removal procedure in the reverse order.



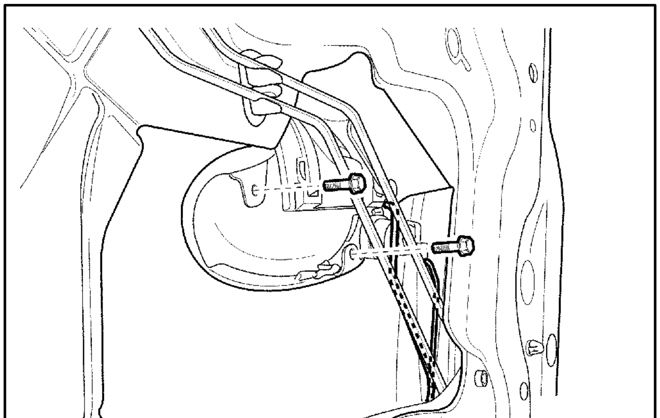
UAA9P070

INSIDE DOOR HANDLE

Removal and Installation Procedure

1. Remove the door seal trim. Refer to *“Door Seal Trim”* in this section.
2. Remove the screw securing the door handle to the door.
3. Slide the door handle forward and remove it from the door.
4. Disconnect the inside door handle and the lock rods.

5. Installation should follow the removal procedure in the reverse order.



UAA9P080

OUTSIDE DOOR HANDLE

Removal and Installation Procedure

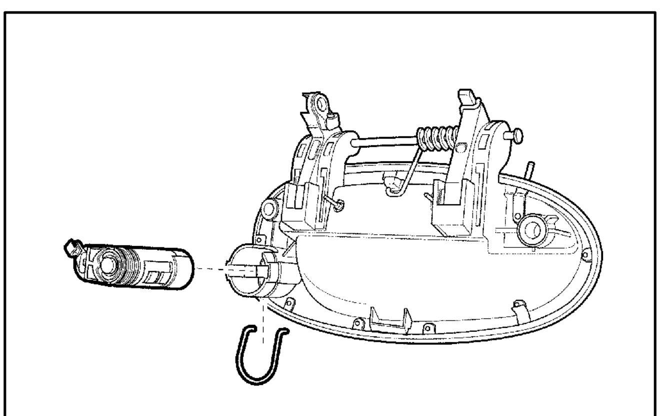
1. Upper the window completely.
2. Remove the door seal trim. Refer to *"Door Seal Trim"* in this section.
3. Remove the bolts.

Installation Notice

Tightening Torque	4 N·m (35 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

4. Disconnect the outside door handle and the lock rods.
5. Installation should follow the removal procedure in the reverse order.

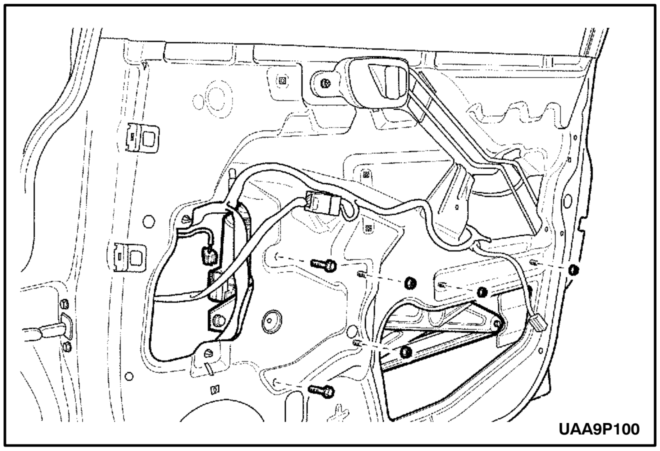


UAA9P090

DOOR LOCK CYLINDER

Removal and Installation Procedure

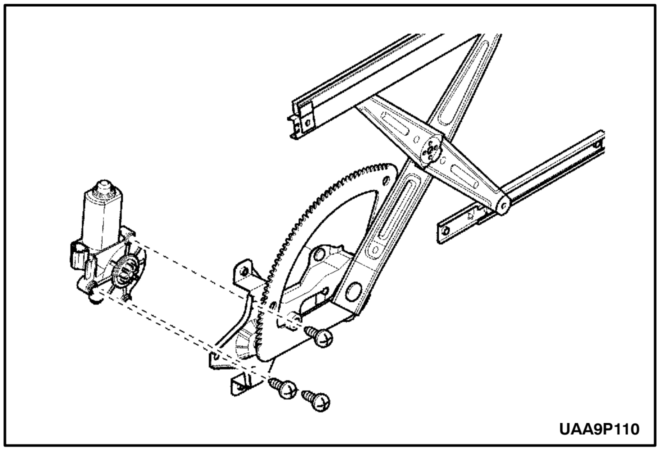
1. Remove the door seal trim. Refer to *"Door Seal Trim"* in this section.
2. Disconnect the outside door handle lock rod.
3. Remove the retaining clip and the lock cylinder.
4. Installation should follow the removal procedure in the reverse order.



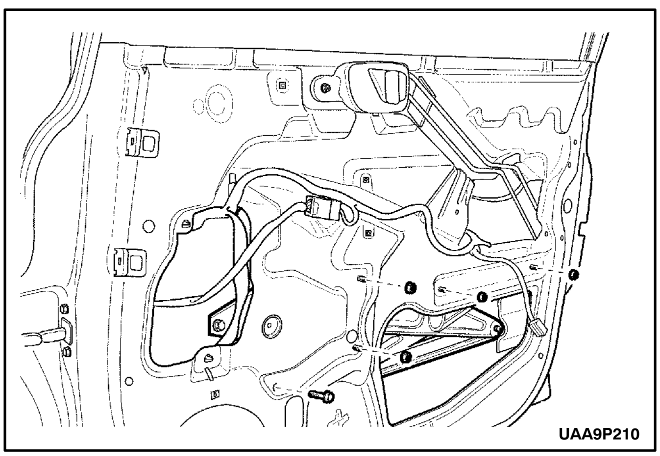
POWER FRONT/REAR WINDOW REGULATOR

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the door glass. Refer to *Section 9L, Glass and Mirror.*
3. Disconnect the electrical connector.
4. Remove the nuts and the bolts.
5. Remove the window regulator.



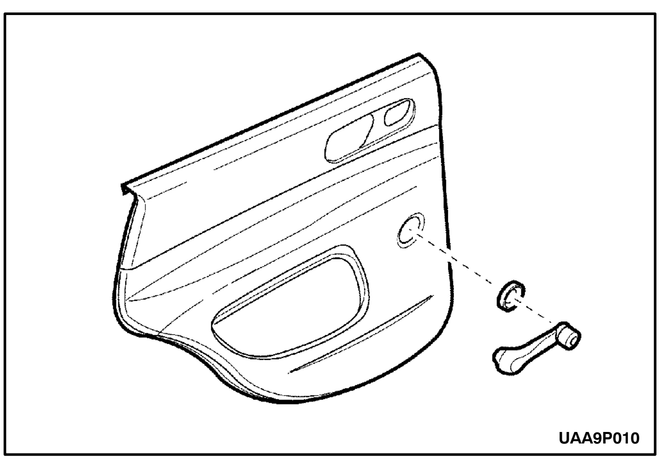
6. Remove the screws.
7. Remove the power window motor.
8. Installation should follow the removal procedure in the reverse order.



MANUAL REAR WINDOW REGULATOR

Removal and Installation Procedure

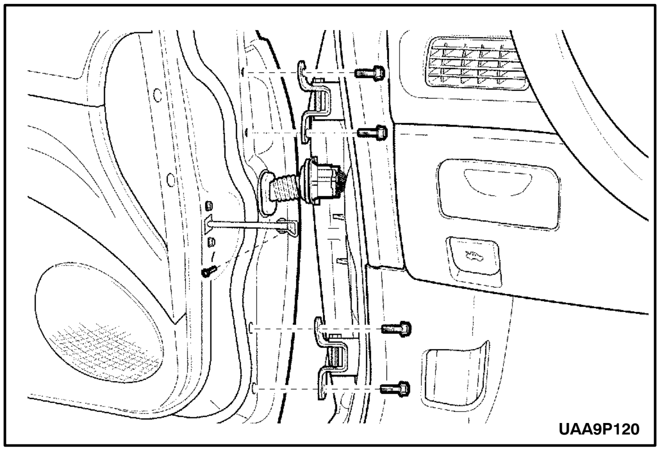
1. Remove the regulator handle. Refer to *“Manual Rear Window Regulator Handle”* in this section.
2. Remove the rear door glass. Refer to *Section 9L, Glass and Mirrors.*
3. Remove the nuts and the window regulator.
4. Installation should follow the removal procedure in the reverse order.



MANUAL REAR WINDOW REGULATOR HANDLE

Removal and Installation Procedure

1. Reposition the plastic ring behind the window regulator handle to reveal the “C” clip.
2. Remove the “C” clip.
3. Remove the window regulator handle and the plastic ring.
4. Installation should follow the removal procedure in the reverse order.



FRONT/REAR DOOR ASSEMBLY

Removal and Installation Procedure

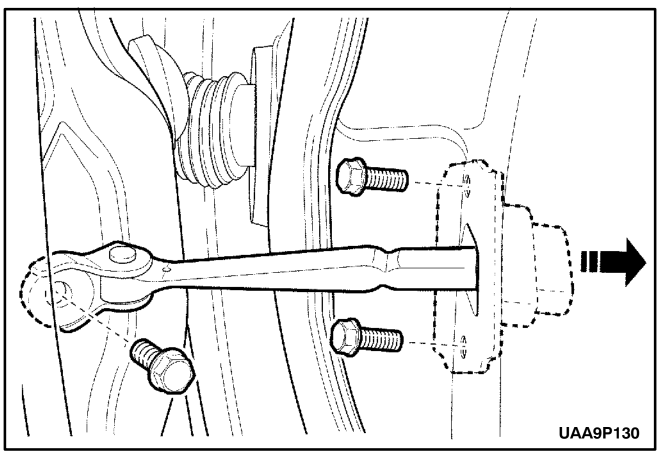
1. Disconnect the negative battery cable.
2. Remove the bolts and the door open link from the body.
3. With the aid of another technician, remove the door hinge bolts and the front door.

Installation Notice

Tightening Torque	25 N·m (225 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

4. Disconnect the body-to-door rubber grommet and electrical connector.
5. Installation should follow the removal procedure in the reverse order.



DOOR HOLD OPEN LINK

Removal and Installation Procedure

1. Remove the door seal trim. Refer to *"Door Seal Trim"* in this section.
2. Remove the bolt on the body.

Installation Notice

Tightening Torque	25 N·m (18 lb–ft)

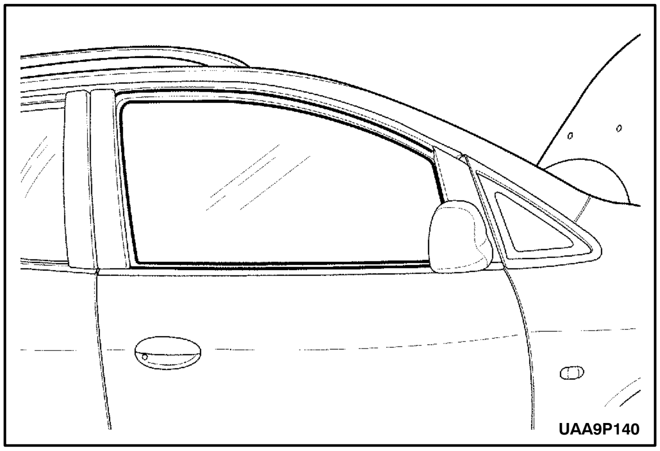
3. Remove the bolts on the door.

Installation Notice

Tightening Torque	6 N·m (53 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

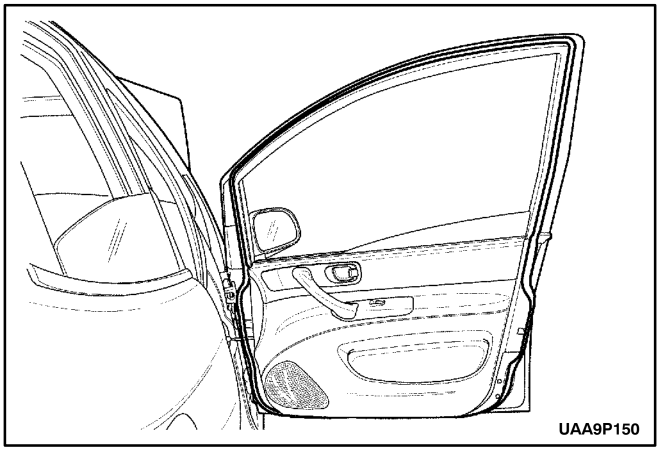
4. Remove the door hold open link.
5. Installation should follow the removal procedure in the reverse order.



OUTSIDE CHANNEL MOLDING

Removal and Installation Procedure

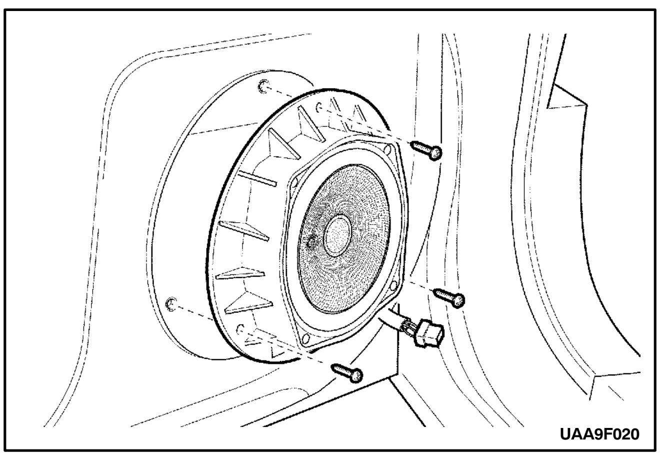
1. Lower the window completely.
2. Lift the outside channel molding off the door.
3. Installation should follow the removal procedure in the reverse order.



DOOR WEATHERSTRIP

Removal and Installation Procedure

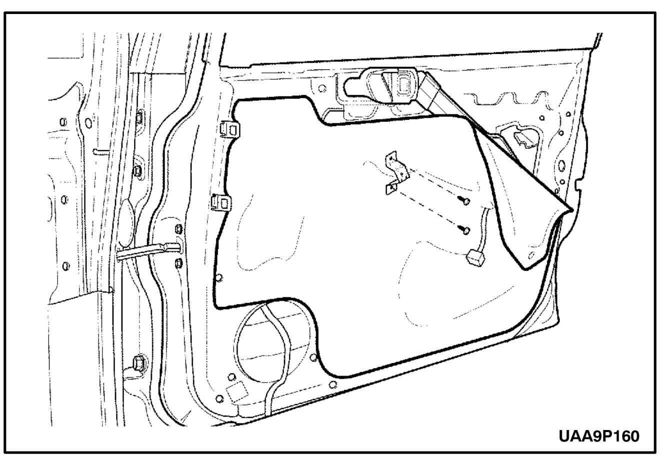
1. Remove the door hold open link-to-body bolt and the door hold open link.
2. Remove the door weatherstrip.
3. Installation should follow the removal procedure in the reverse order.



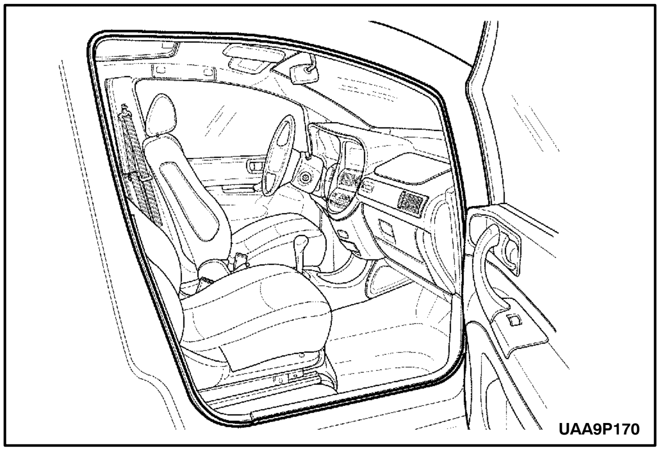
DOOR SEAL TRIM

Removal and Installation Procedure

1. Remove the door trim panel. Refer to *Section 9G, Interior Trim.*
2. Remove the screws.
3. Disconnect the electrical connector.
4. Remove the speaker.



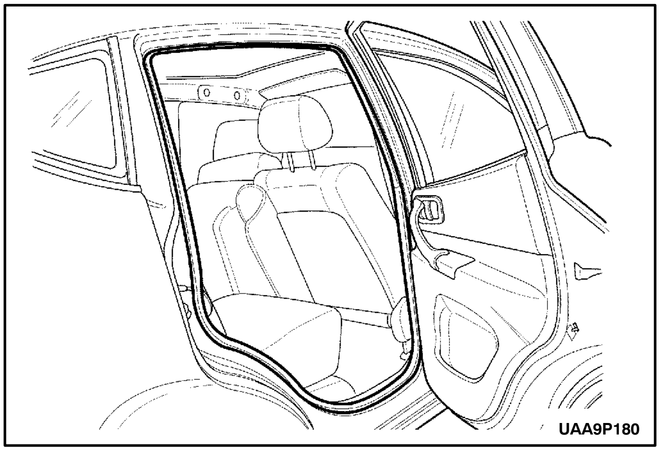
5. Remove the screws and the door pull bracket.
6. Remove the door seal trim.
7. Installation should follow the removal procedure in the reverse order.



FRONT DOOR OPENING WEATHERSTRIP

Removal and Installation Procedure

1. Remove the kick panel, the front rocker panel, and the lower B-pillar trim panel. Refer to *Section 9G, Interior Trim.*
2. Remove the door opening weatherstrip.
3. Installation should follow the removal procedure in the reverse order.



REAR DOOR OPENING WEATHERSTRIP

Removal and Installation Procedure

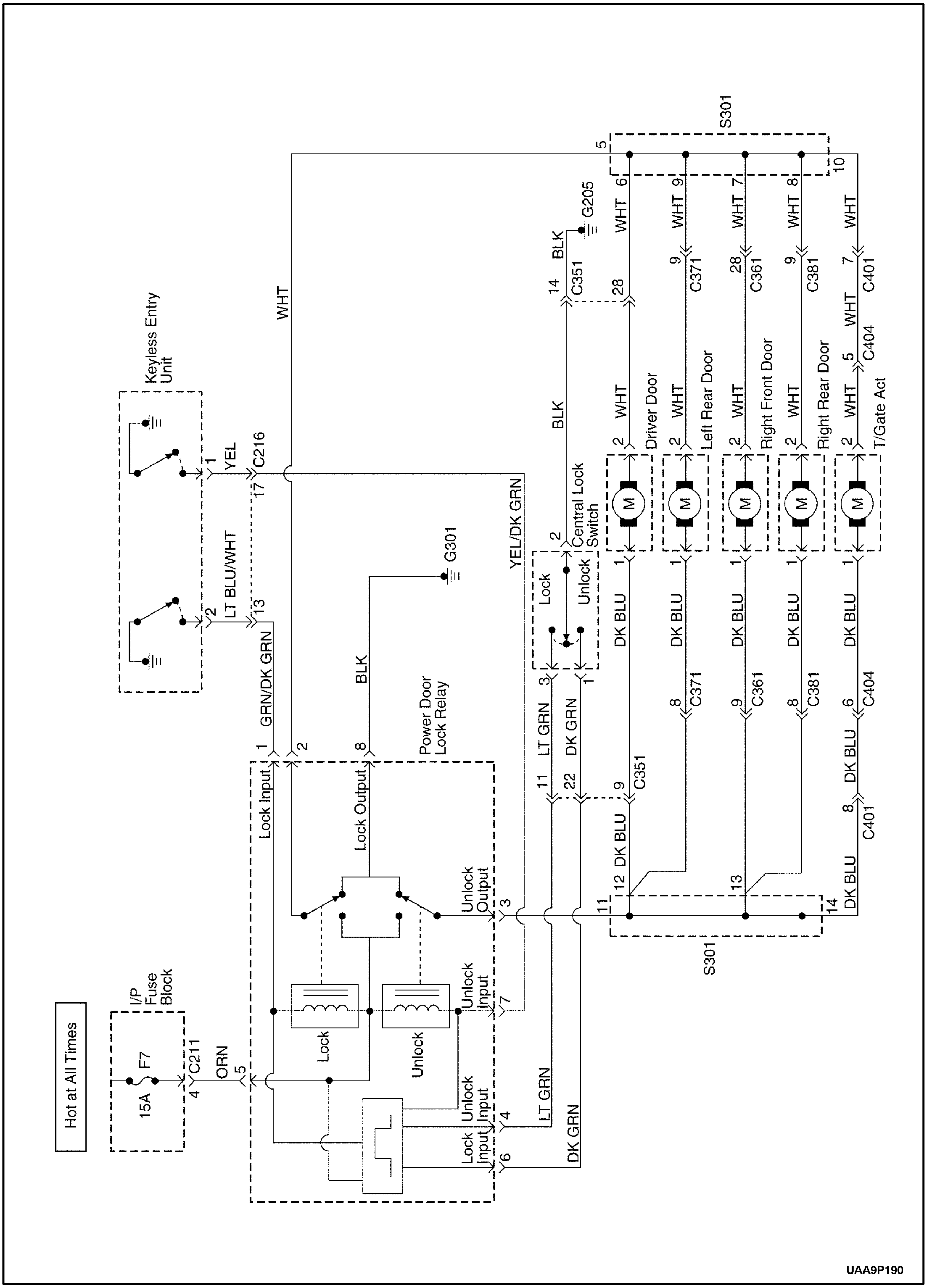
1. Remove the rear rocker panel and the lower B-pillar trim panel. Refer to *Section 9G, Interior Trim.*
2. Remove the door opening weatherstrip.
3. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

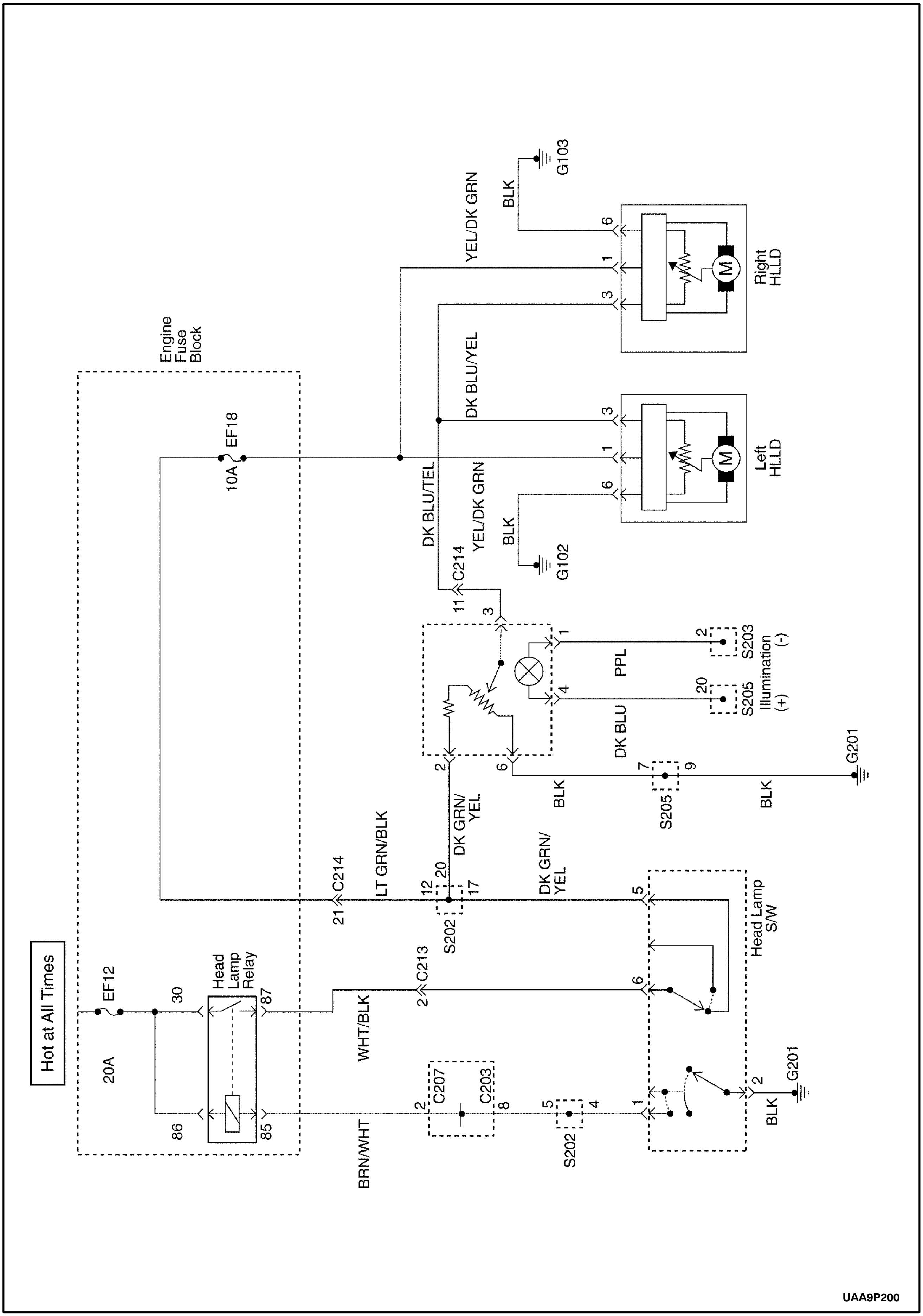
FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Door Hinge Bolts	25	18	–
Door Hold Open Link-to-Body Bolt	25	18	–
Door Lock Striker Bolts	24	18	–
Outside Door Handle Bolts	4	–	35

SCHEMATIC AND ROUTING DIAGRAMS



POWER WINDOWS



SECTION 9Q

ROOF

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

ROOF

The roof is a one-piece painted metal unit which incorporates a single solid headliner. There are two moldings, one per side on the vehicle's roof, which enclose and hide the roof rail seams. The roof moldings are serviceable as individual units.

The one-piece formed headliner consists of a molded substrate covered with a foam-backed cloth facing. The one-piece construction requires the headliner be serviced as a complete assembly.

POWER SUNROOF

The sunroof is

- Intended to provide light and air through the roof of the vehicle.
- Built into the roof.
- Made of glass.
- Equipped with a sunshade that opens and closes manually.
- Powered by an electric motor.
- Controlled by a toggle switch built into the interior courtesy lamp assembly.

The sunroof control switch is

- A toggle button located on the right side of the lamp/switch assembly.

To operate the sunroof,

- The ignition must be in the ON position.

Tilting the Sunroof, Open and Closed

To tilt open the rear end of the sunroof,

- Press and hold the forward portion of the toggle button until the sunroof tilts open.

To close the sunroof from a tilted-open position,

- Press and hold the rear portion of the toggle button until the sunroof tilts closed.

Sliding the Sunroof, Open and Closed

To slide open the sunroof,

- Press the rear portion of the toggle button until the sunroof slides. If the sun shade is closed, the sunroof will pull the sunshade open when the sunroof slides open.

To close the sunroof from a slid-open position,

- Press the forward portion of the toggle button until the sunroof slides closed.

SUN VISORS

The sun visors swing down in order to block out glare. They also swing to the side when they are released from the support.

PASSENGER ASSIST HANDLES

There is a passenger assist handle for each rear outboard seat and for the front passenger seat. Passengers can use these handles to assist in keeping their balance over rough roads or during sharp turns.

INTERIOR COURTESY LAMP/POWER SUNROOF CONTROL SWITCH

The courtesy lamp is located on the headliner above the rearview mirror. The lamp switch is located on the left side of the lamp/switch assembly and has three positions. If the switch is in the center position, the lamp will go on whenever a door is opened and go off when it is closed. In the forward position, the lamp will stay on until it is turned off. In the rear position, the lamp will not come on, even when a door is opened. The sunroof control switch is also located on the interior courtesy lamp assembly.

DIAGNOSTIC INFORMATION AND PROCEDURES

POWER SUNROOF

Power Sunroof Does Not Work

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition ON. 2. Operate the power mirror. Does the power mirror work?	–	Go to *Step 4*	Go to *Step 2*
2	Check the fuse EF6, F1 and F17. Are the fuses blown?	–	Go to *Step 3*	Go to *Step 4*
3	1. Check for a short circuit. 2. Repair the short circuit, if necessary. 3. Replace the fuse. Is the repair complete?	–	System OK	–
4	1. Disconnect the lamp/sunroof switch. 2. Turn the ignition ON. 3. At the lamp/sunroof switch, on the fuse-side of the connector, check the voltage at terminal 4. Does the voltmeter indicate the specified value?	11-14 v	Go to *Step 6*	Go to *Step 5*
5	Repair the open circuit between the fuse F17 and the sunroof switch. Is the repair complete?	–	System OK	–
6	1. Reconnect the sunroof switch. 2. Disconnect the sunroof module six-pin electrical connector. 3. Use an ohmmeter to measure the resistance between the terminal 4 and ground. Is the resistance within the specified value?	≈ 0 Ω	Go to *Step 8*	Go to *Step 7*
7	Repair the ground circuit. Is the repair complete?	–	System OK	–
8	1. Leave the sunroof module disconnected. 2. Turn the ignition ON. 3. Check the voltage at terminal 3 of the connector for the sunroof module. Does the voltmeter indicate the specified value?	11-14 v	Go to *Step 10*	Go to *Step 9*
9	Repair the open power supply to terminal 3 of the sunroof module connector. Is the repair complete?	–	System OK	–
10	1. Reconnect the sunroof module. 2. Remove the sunroof motor, but leave the connectors attached. 3. Use the sunroof switch to attempt to operate the motor in both directions. Does the motor operate?	–	Go to *Step 11*	Go to *Step 12*
11	Repair the jammed sunroof mechanism. Is the repair complete?	–	System OK	–

Power Sunroof Does Not Work (Cont'd)

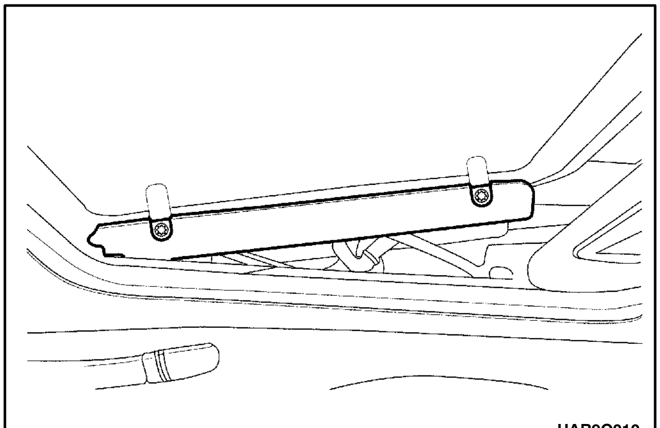
Step	Action	Value(s)	Yes	No
12	1. Disconnect both of the one-wire connectors at the sunroof motor. 2. Connect a voltmeter between the one-wire connectors. 3. Turn the ignition ON. 4. Turn the sunroof switch to the CLOSE position and observe the voltmeter reading. 5. Turn the sunroof switch to the OPEN position and observe the voltmeter reading. 6. The meter will show the same voltage at both switch positions, but one of the switch positions will show a reverse polarity. Does the voltmeter indicate the specified value when the switch is in either the OPEN or the CLOSE position?	11-14 v	Go to *Step 14*	Go to *Step 13*
13	Replace the sunroof module. Is the repair complete?	–	System OK	–
14	Replace the sunroof motor. Does the sunroof operate?	–	System OK	Go to *Step 13*

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

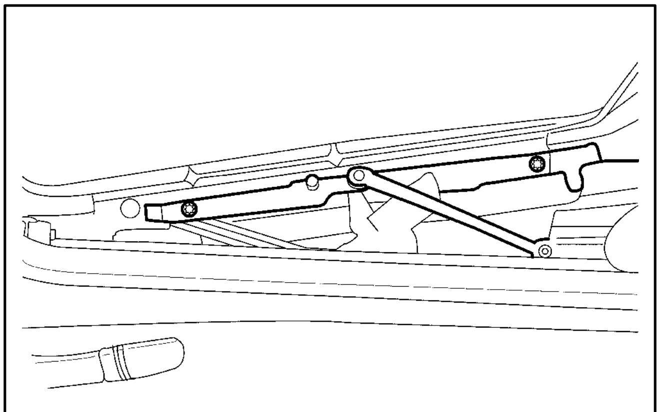
GLASS PANEL

Removal and Installation Procedure



UAB9Q010

1. Tilting the sunfoof.
2. Remove the side inner covers of both.

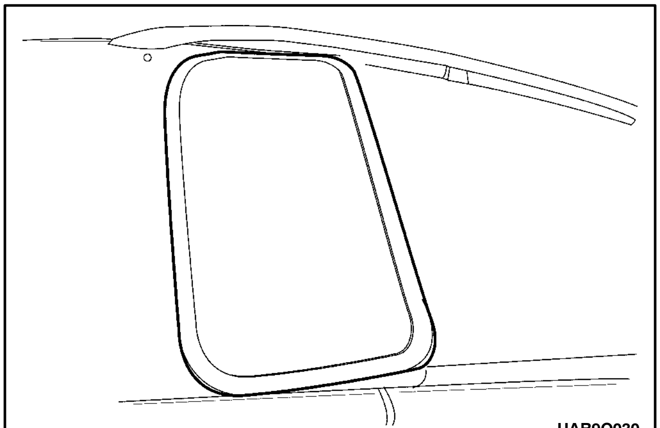


UAB9Q020

3. Remove the four torx screws.

Installation Notice

Tightening Torque	5 N·m (44 lb–in)

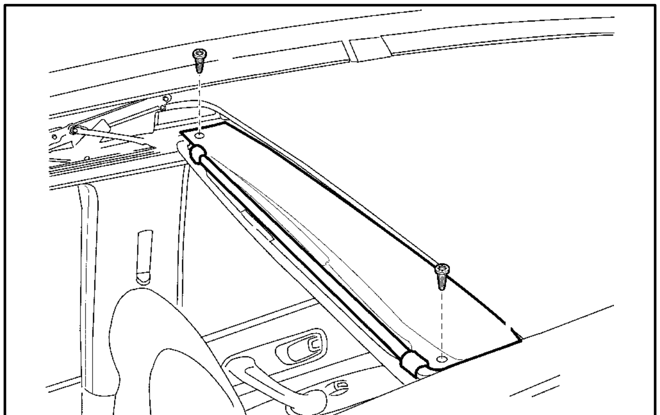


UAB9Q030

4. Remove the sunroof glass.
5. Installation should follow the removal procedure in the reverse order.

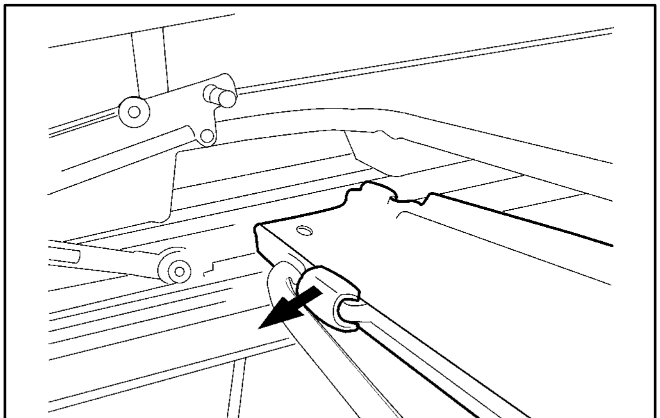
SUNSHADE PANEL

Removal and Installation Procedure



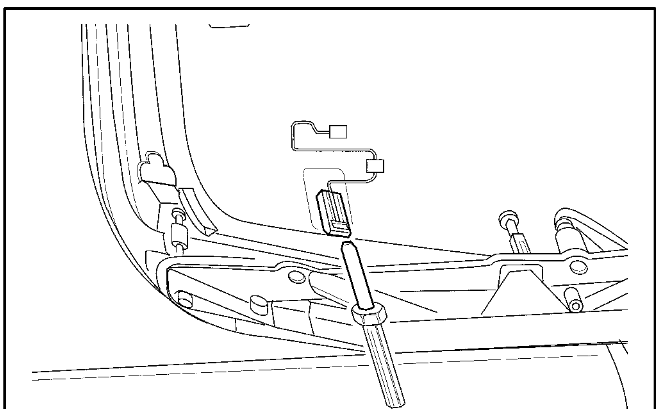
UAB9Q040

1. Remove the glass panel. Refer to “Glass Panel” in this section.
2. Remove the torx screws on the drain channel.



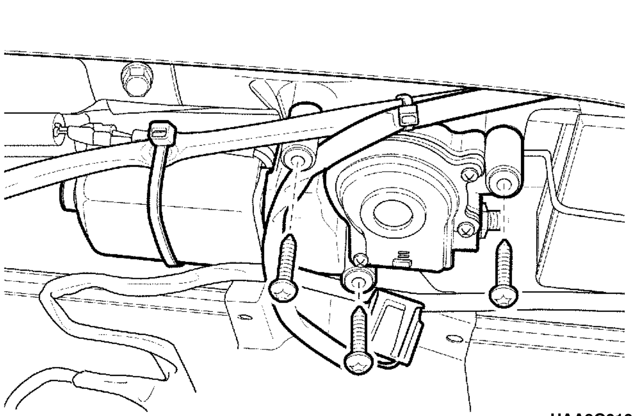
UAB9Q050

3. Pull the hook and the remove the drain channel.



UAB9Q060

4. Remove the sunshade by putting the slide block in the guide rail on the slide.
5. Installation should follow the removal procedure in the reverse order.


UAA9Q010

POWER SUNROOF

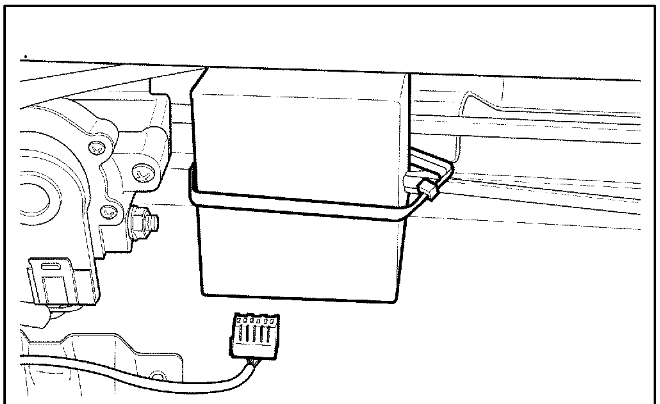
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the headliner. Refer to *“Formed Headliner”* in this section.
3. Remove the drain hoses.
4. Remove the strap.
5. Disconnect the electrical connector.
6. Remove the bolts.

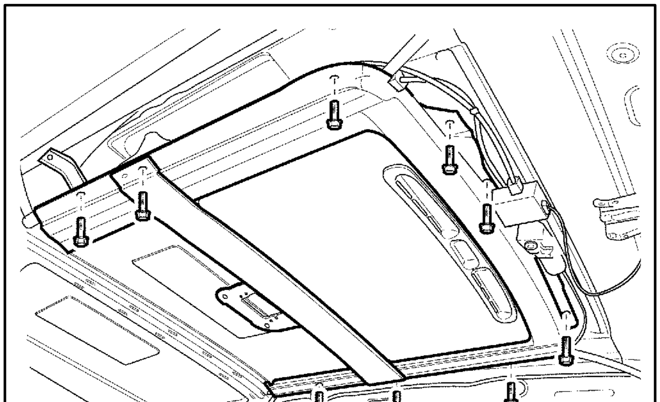
Installation Notice

Tightening Torque	3 N·m (27 lb–in)

7. Remove the motor.


UAA9Q020

8. Disconnect the electrical connector.
9. Remove the strap.
10. Remove the motor control module.

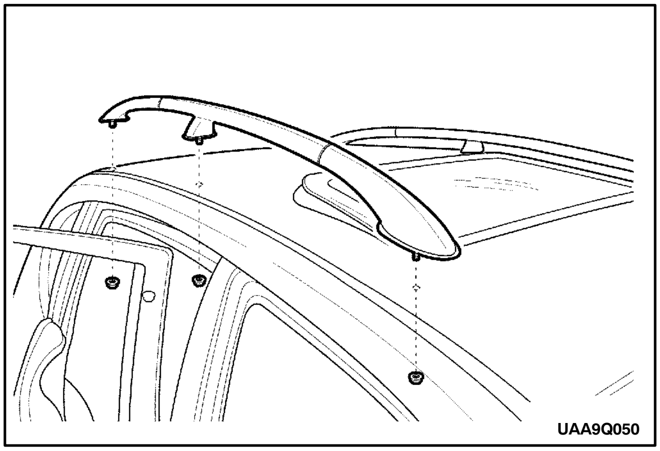

UAA9Q030

11. Remove the bolts.

Installation Notice

Tightening Torque	3 N·m (27 lb–in)

12. Remove the sunroof housing from the vehicle.
13. Remove the drain channel.
14. Remove the sunshade.
15. Installation should follow the removal procedure in the reverse order.



ROOF RACK

Removal and Installation Procedure

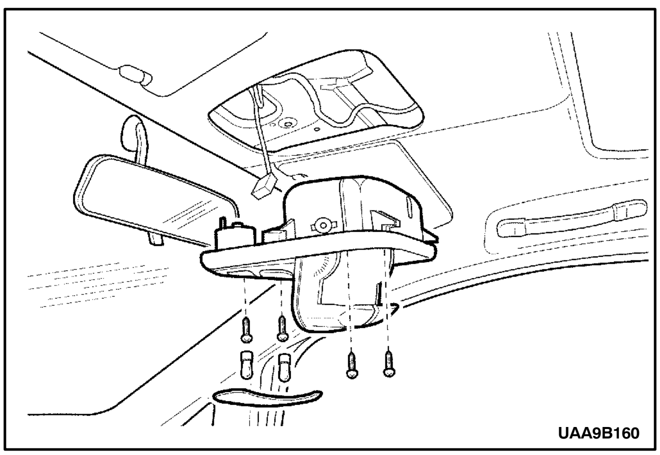
1. Remove the headliner. Refer to *“Formed Headliner”* in this section.
2. Remove the nuts.

Installation Notice

Tightening Torque	27 N·m (20 lb–ft)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

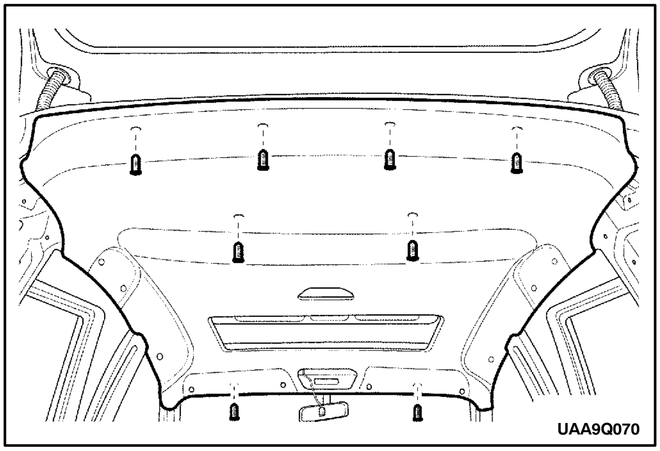
3. Remove the roof rack.
4. Installation should follow the removal procedure in the reverse order.



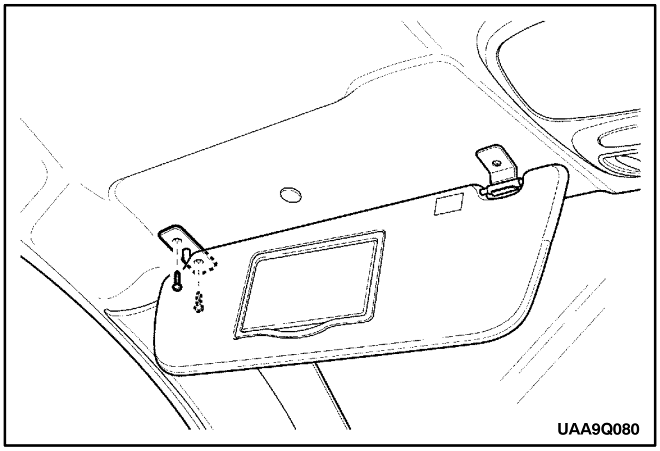
FORMED HEADLINER

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the sun visors and the sun visor supports from the headliner. Refer to *“Sun Visors”* in this section.
3. Remove the left and the right A-pillar trim panels.
4. Remove the bolts and the seat belt anchors from the left and the right upper B-pillar trim panels.
5. Disconnect the top of the left and the right upper B-pillar trim panels.
6. Remove the left and the right C-pillar trim panels.
7. Remove the interior courtesy lamp and the map lamp. Refer to *Section 9B, Lighting Systems.*



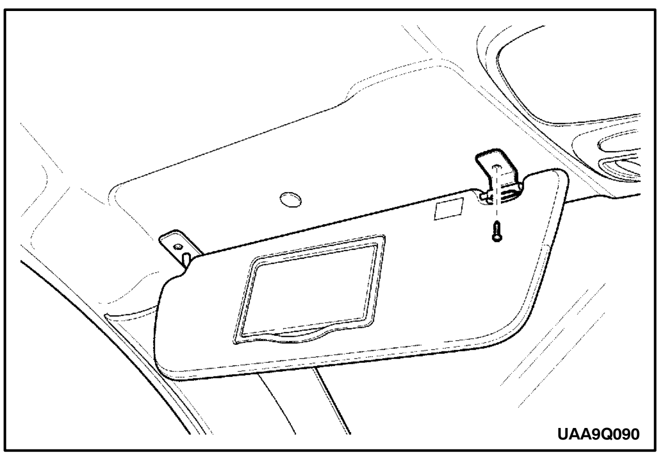
8. Remove the sunroof molding.
9. Disconnect the top of the left and the right door opening weatherstrip.
10. Remove the plastic retaining clips in the headliner on the driver's side.
11. Remove the passenger assist handles. Refer to *"Passenger Assist Handles"* in this section.
12. Remove the clips.
13. Remove the formed headliner through a tailgate.
14. Installation should follow the removal procedure in the reverse order.



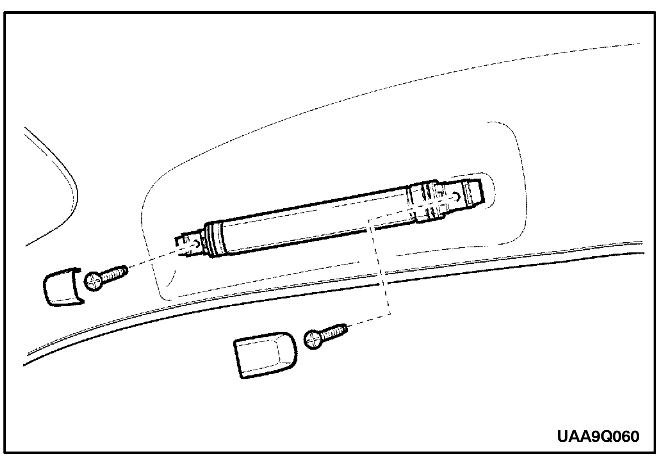
SUN VISORS

Removal and Installation Procedure

1. Remove the screws and the sun visor from the headliner.



2. Remove the screw and the sun visor support from the headliner.
3. Installation should follow the removal procedure in the reverse order.



PASSENGER ASSIST HANDLES

Removal and Installation Procedure

1. Remove the plastic caps to reveal the assist handle screws.
2. Remove the screws.
3. Remove the assist handle from the headliner.
4. Installation should follow the removal procedure in the reverse order.

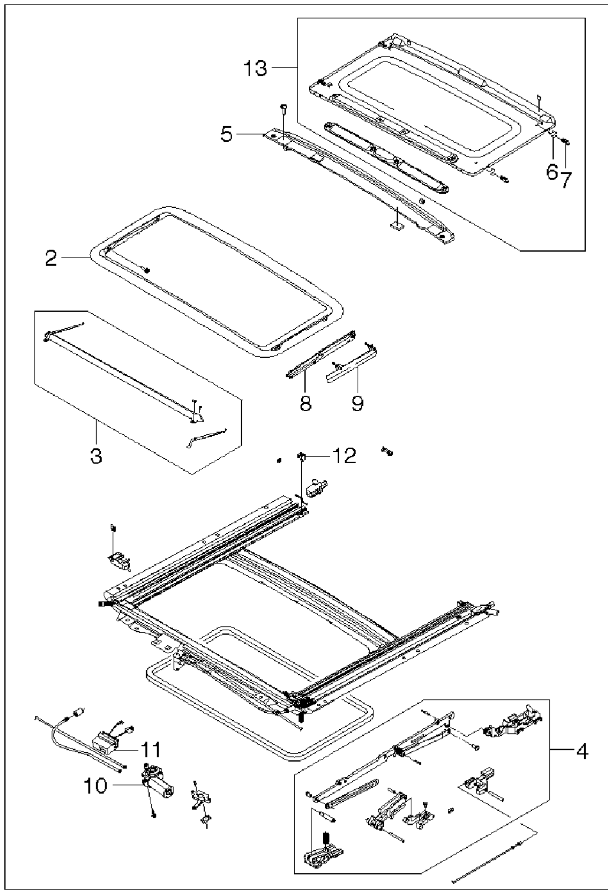
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Roof Rack Bolts	27	20	–
Sunroof Housing Bolts	3	–	27

COMPONENT LOCATOR

ROOF



1 Sunroof Assembly
2 Glass Panel
3 WDO Deflector
4 Mechanism
5 Drain Channel
6 Slide Block Spring
. 7 Slide Block
. 8 Side Inner Cover
9 Side Outer Cover
10 Drive Gear & Motor
11 Relay Box
12 Sunshade Rear Stopper
13 Sunshade

SECTION 9R

BODY FRONT END

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DESCRIPTION AND OPERATION

BODY FRONT END

This vehicle has a unitized body with a frame assembly supporting the engine and the transaxle. The fender panels and the radiator support are also integral parts of the body.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

LUBRICATION

The hood hinges and the locking mechanisms require periodic lubrication for proper operation. Refer to *Section 0B, General Information* for the specific types and intervals of lubrication.

FASTENERS

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

Many aluminum components are used on current models. Aluminum in contact with steel may corrode rapidly if it is not protected by special finishes or isolators.

The fasteners used have a special finish which provides adequate protection from corrosion. These special fasteners differ in color in order to easily identify them from the standard metric fasteners, which are medium blue.

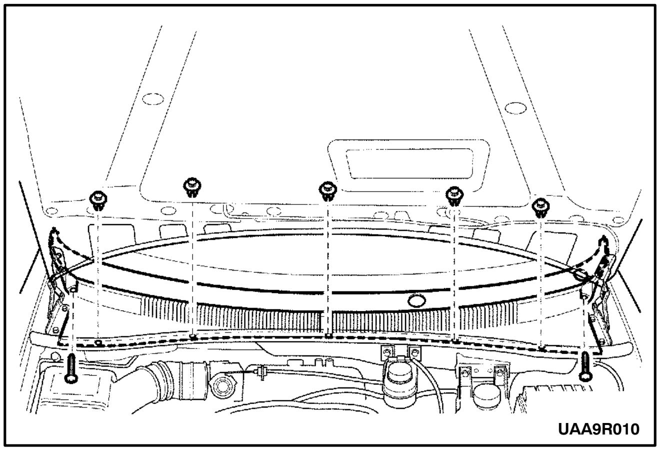
When replacing fasteners, avoid substituting otherwise similar fasteners in the same location.

ANTICORROSION MATERIALS

In order to provide rust resistance, anticorrosion materials have been applied to the interior surfaces of most of the metal panels. When you service these panels, properly recoat them with a service-type anticorrosion material if any of the original material has been disturbed.

FRONT END SEALING

All locations where waterleaks may occur are sealed during production with high quality, durable sealers. If it becomes necessary to reseal specific areas, use a high-quality sealer of medium-bodied consistency which will retain its flexible characteristics after curing and can be painted, if necessary.

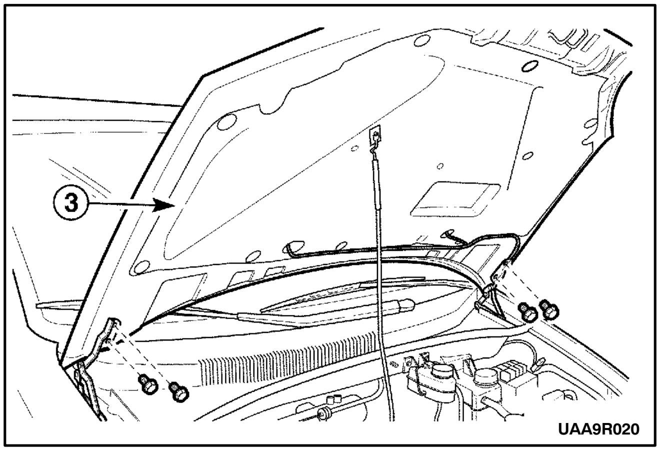


COWL VENT GRILLE

(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal and Installation Procedure

1. Raise the hood and support it with the hood prop.
2. Remove the wiper arms. Refer to *Section 9D, Wipers/Washer Systems.*
3. Remove the screws and the clips.
4. Remove the cowl vent grille.
5. Installation should follow the removal procedure in the reverse order.



HOOD

Removal and Installation Procedure

Notice: Install protective coverings over the fenders and the windshield in order to prevent damage to the paint, the glass and the moldings when you are removing and installing the hood.

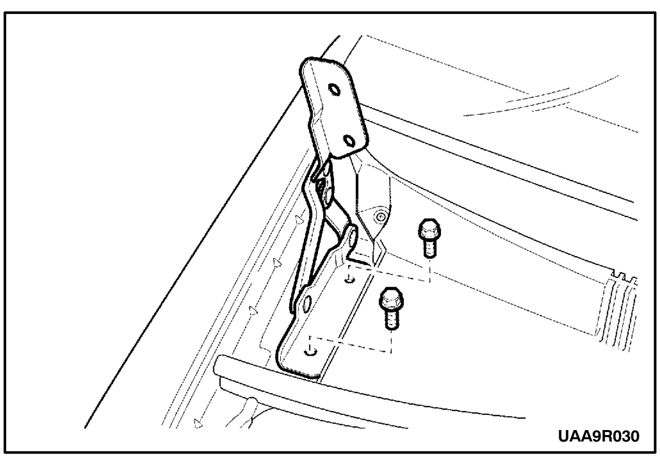
1. Raise and support the hood.
2. Mark the position of the hinge to the hood to facilitate alignment during installation.
3. Remove the bolts that retain the hood to both hinges.

Installation Notice

Tightening Torque	27 N·m (20 lb–ft)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

4. With the aid of another technician, remove the hood from the hinges.
5. Installation should follow the removal procedure in the reverse order.



HOOD HINGES

Removal and Installation Procedure

1. Remove the hood. Refer to *"Hood"* in this section.
2. Remove the bolts.

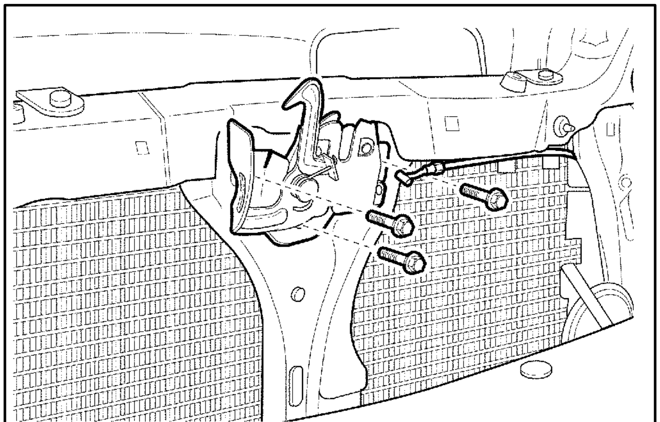
Installation Notice

Tightening Torque	27 N·m (20 lb–ft)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

3. Remove the hood hinges.

4. Installation should follow the removal procedure in the reverse order.



UAA9R040

HOOD SECONDARY LATCH

(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal and Installation Procedure

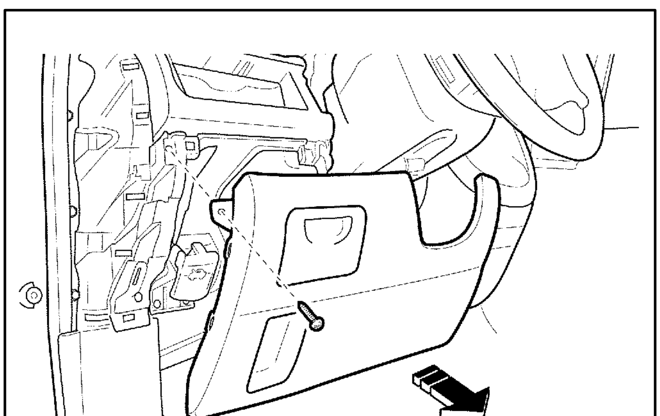
1. Open the hood.
2. Remove the radiator grille. Refer to *"Radiator Grille"* in this section.
3. Mark the position of the hood latch on the radiator support to facilitate alignment during installation.
4. Remove the bolts and the hood latch.

Installation Notice

Tightening Torque	8 N·m (71 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

5. Disconnect the hood release cable.
6. Installation should follow the removal procedure in the reverse order.



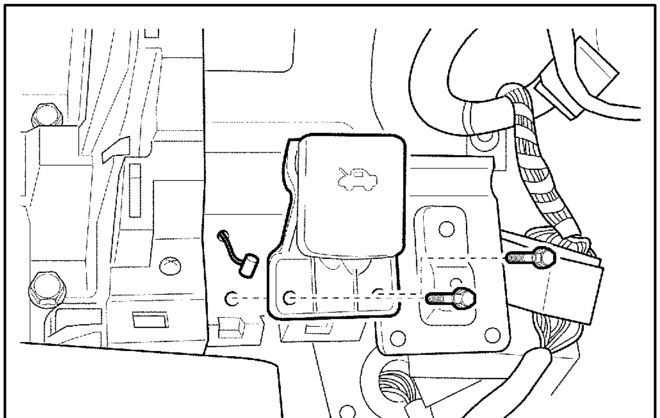
UAA9E210

HOOD LATCH RELEASE CABLE

(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal and Installation Procedure

1. Remove the instrument panel lower cover.


UAA9R060

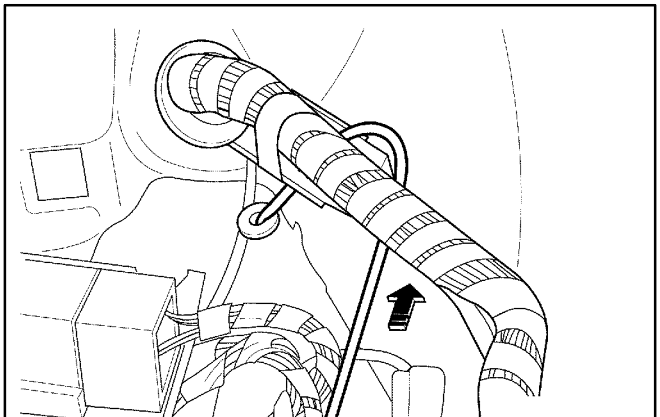
2. Remove the bolts.

Installation Notice

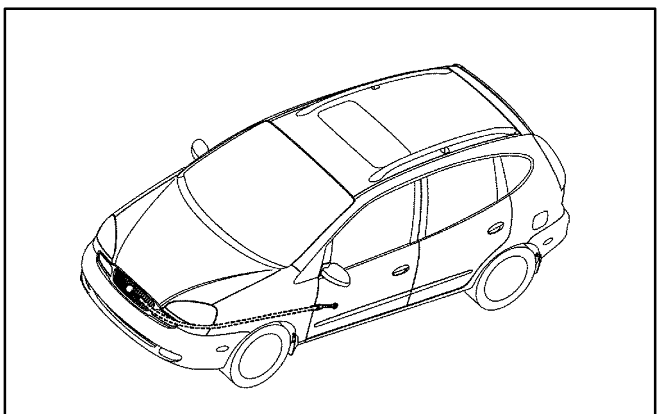
Tightening Torque	4 N·m (35 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

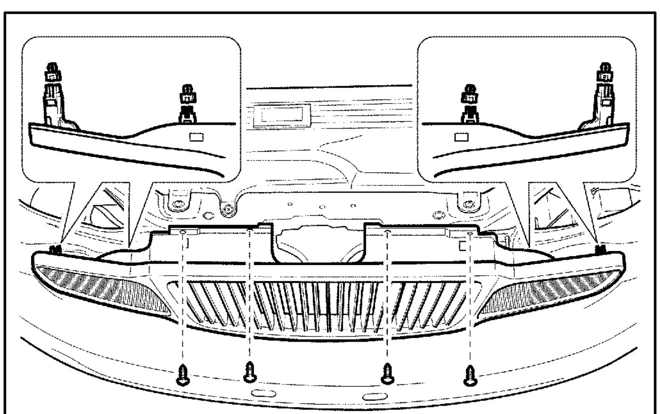
3. Disconnect the hood release cable.
4. Remove the hood latch lever.


UAA9R070

5. Remove the cable and the grommet from inside the vehicle.
6. Remove the liner fender.


UAA9R080

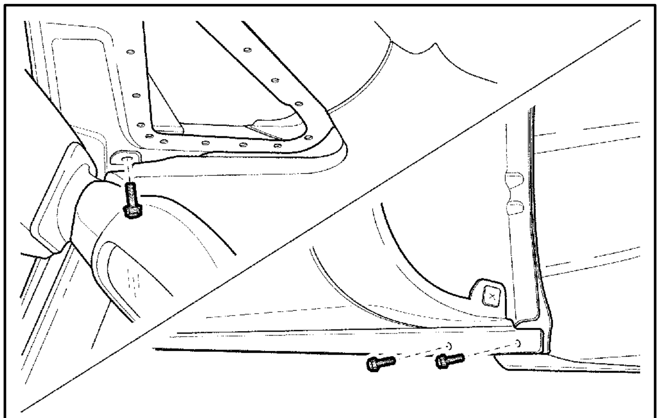
7. Remove the cable.
8. Installation should follow the removal procedure in the reverse order.


UAA9R090

RADIATOR GRILLE

Removal and Installation Procedure

1. Open the hood.
2. Remove the headlamp. Refer to *Section 9B, Lighting Systems.*
3. Remove the screws and the clips.
4. Remove the radiator grille.
5. Installation should follow the removal procedure in the reverse order.



UAA9R120

FENDER

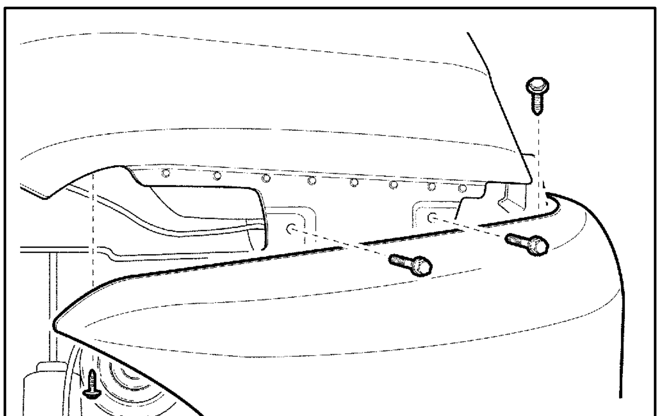
Removal and Installation Procedure

1. Raise the suitably support the vehicle.
2. Remove the front wheel. Refer to *Section 2E, Tires and Wheels.*
3. Remove the front liner fender. Refer to *Section 9O, Bumpers and Fascias.*
4. Remove the bolts.

Installation Notice

Tightening Torque	8 N·m (71 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.



UAA9R100

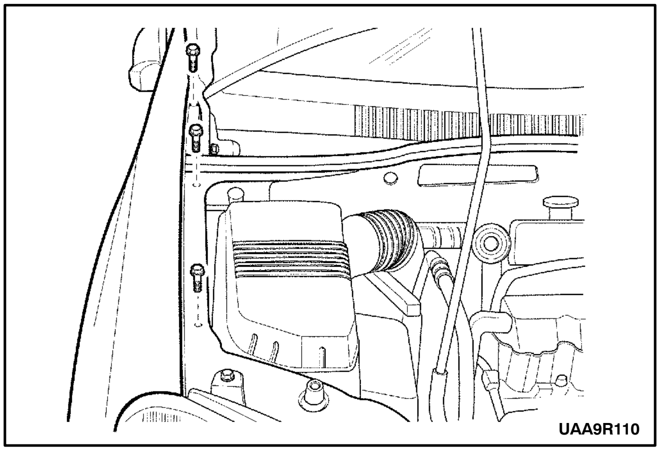
5. Remove the headlamp. Refer to *Section 9B, Lighting Systems.*
6. Remove the bolt between the bumper fascia and the fender.

Installation Notice

Tightening Torque	4 N·m (35 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

7. Remove the screw.



8. Remove the cowl vent grille. Refer to *"Cowl Vent Grille"* in this section.
9. Remove the bolts along the top of the fender.

Installation Notice

Tightening Torque	8 N·m (71 lb–in)

Installation notice

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

10. Remove the fender.
11. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Hinge Bolts	27	20	–
Hood-to-Hinge Bolts	27	20	–
Hood Latch Bolts	8	–	71
Hood Release Handle Nuts	4	–	35

SECTION 9S
BODY REAR END

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

FUEL FILLER DOOR

The fuel filler door attaches to the fuel tank pocket on the right side of the vehicle. The door is opened by pulling on the fuel filler door remote handle located on the floor in front of the driver's seat.

TAILGATE

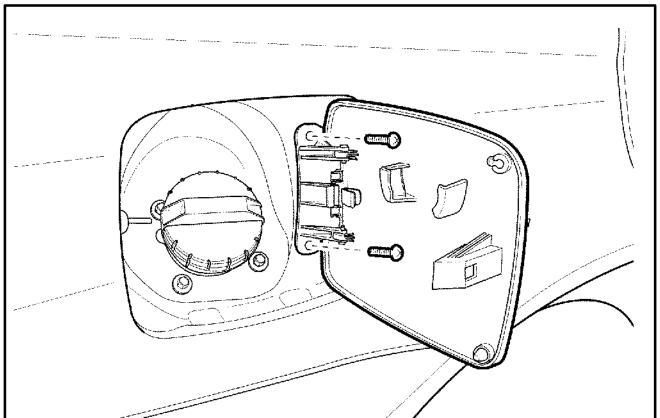
The tailgate is made of a steel frame which contains the rear glass. The steel frame is made of an inner and outer panel hemmed around the perimeter and bonded together with structural adhesive. The gas support assemblies assist in the opening of the tailgate and can hold it in the open position.

FIRE EXTINGUISHER

The fire extinguisher is located inside the right side floor deposit box. The fire extinguisher is standard in cars sold in Lebanon and Lybia and is a dealer installed option in Brazil.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



UAA9S010

FUEL FILLER DOOR

Removal and Installation Procedure

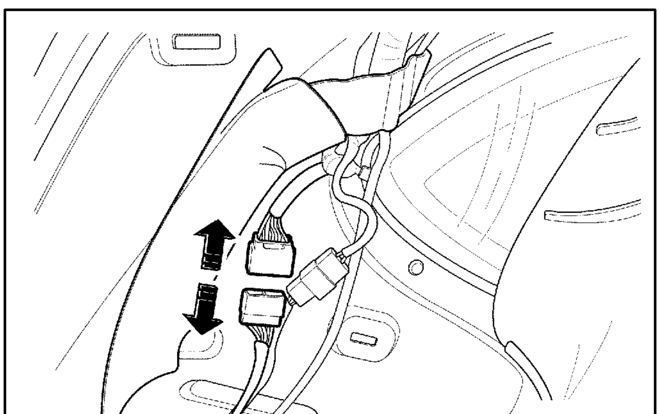
1. Open the fuel filler door.
2. Remove the screws.

Installation Notice

Tightening Torque	4 N·m (35 lb–ft)

3. Remove the fuel filler door.
4. Installation should follow the removal procedure in the reverse order.

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to sure to use the correct fasteners to premature corrosion.

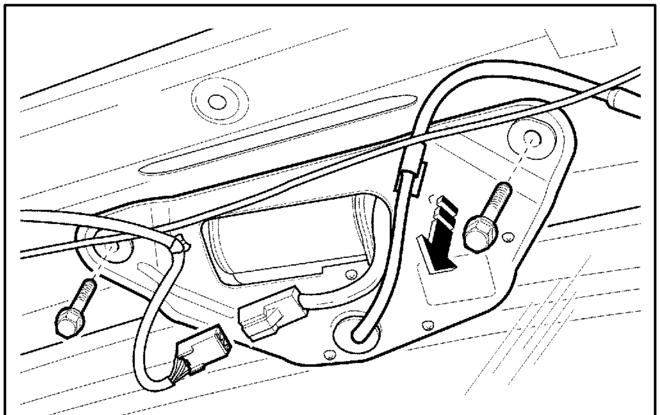


UAA9S020

TAILGATE

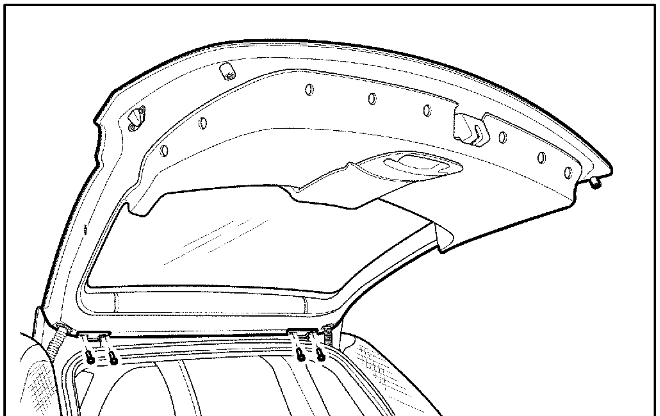
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Open and suitably support the tailgate.
3. Remove the luggage compartment rear trim panel. Refer to *Section 9G, Interior Trim.*
4. Remove the C-pillar trim panel. Refer to *Section 9G, Interior Trim.*
5. Disconnect the electrical connector.



UAA9S030

6. Remove the tailgate lower trim panel. Refer to *Section 9G, Interior Trim.*
7. Disconnect the hose nozzle from the tailgate washer.



UAA9S040

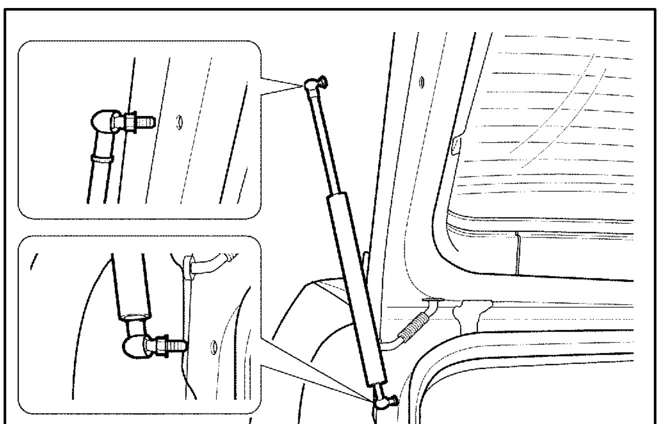
8. Remove the gas support assemblies from the tailgate. Refer to *“Gas Support Assemblies”* in this section.
9. With the aid of another technician, remove the bolts and the tailgate from the hinges.

Installation Notice

Tightening Torque	20 N·m (15 lb–ft)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

10. Installation should follow the removal procedure in the reverse order.



UAA9S050

GAS SUPPORT ASSEMBLIES

Removal and Installation Procedure

1. Open and suitably support the tailgate.
2. Remove the bolt and the gas support assembly from the body.

Installation Notice

Tightening Torque	20 N·m (71 lb–in)

3. Remove the bolt and the gas support assembly from the tailgate.

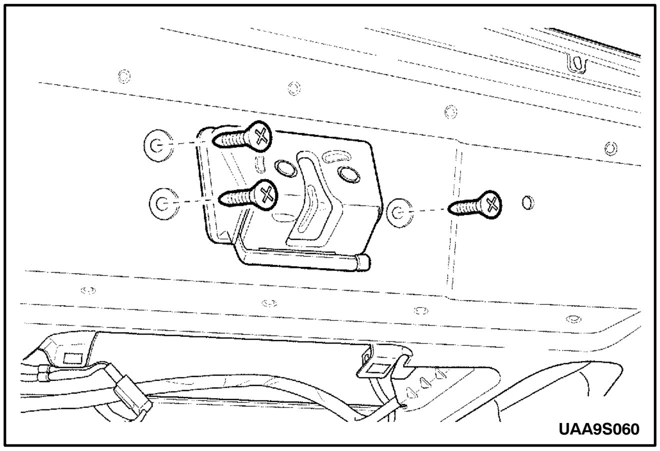
Installation Notice

Tightening Torque	20 N·m (71 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

4. Installation should follow the removal procedure in the reverse order (When the same gas support is used.).

Notice: If the new gas support is used. First ball joint must be mounted and gas support shall be connected to the ball joints.



LUGGAGE COMPARTMENT LOCK

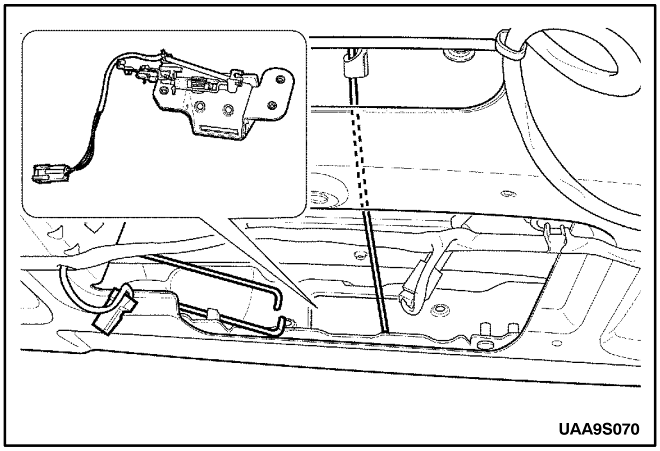
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the tailgate lower trim panel. Refer to *Section 9G, Interior Trim.*
3. Disconnect the lock rods.

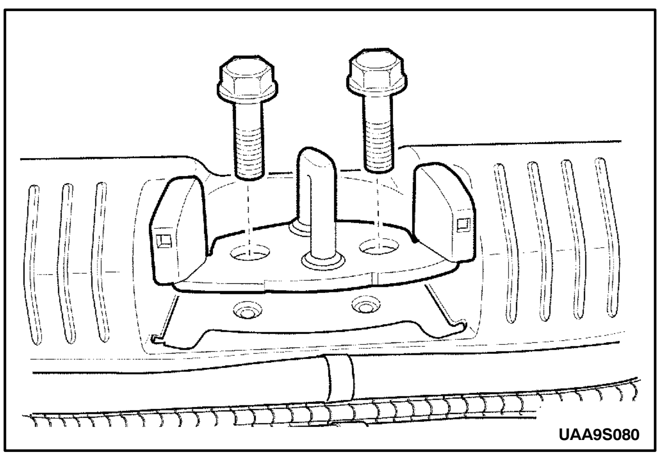
Installation Notice

Tightening Torque	6 N·m (53 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.



4. Remove the screws.
5. Disconnect the electrical connector.
6. Remove the luggage compartment lock.
7. Installation should follow the removal procedure in the reverse order.



LUGGAGE COMPARTMENT LOCK STRIKER

Removal and Installation Procedure

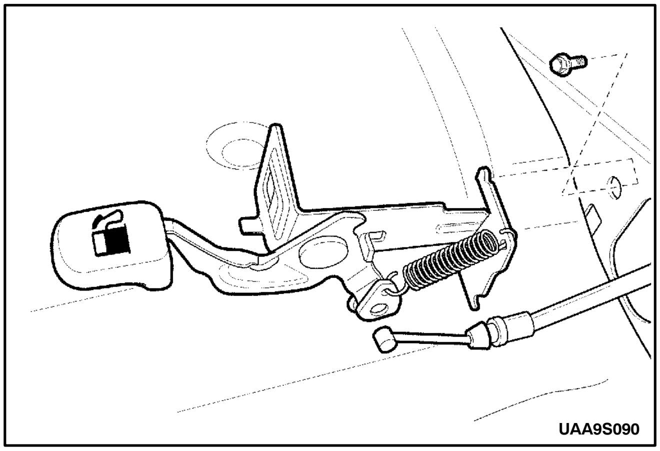
1. Open the tailgate.
2. Remove the bolts.

Installation Notice

Tightening Torque	10 N·m (89 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

3. Remove the lock striker
4. Installation should follow the removal procedure in the reverse order.



FUEL FILLER DOOR REMOTE CABLE AND HANDLE

(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal and Installation Procedure

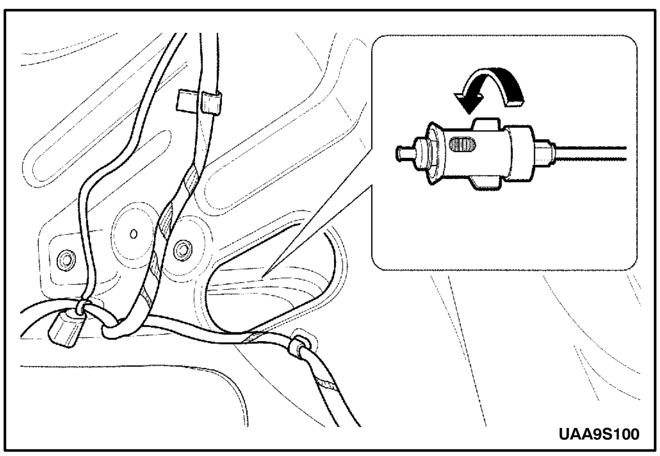
1. Remove the front locker trim panel. Refer to *Section 9G, Interior Trim.*
2. Remove the screw.

Installation Notice

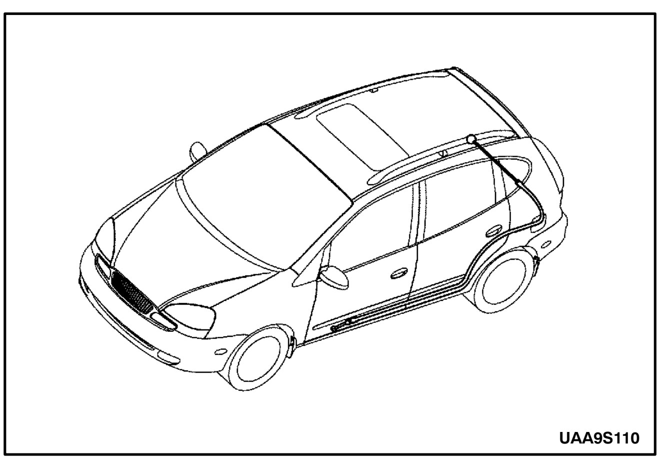
Tightening Torque	8 N·m (71 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

3. Disconnect the cable from the handle.
4. Remove the fuel filler door remote handle.



5. Remove the lower B-pillar trim panel. Refer to *Section 9G, Interior Trim.*
6. Remove the rear locker trim panel. Refer to *Section 9G, Interior Trim.*
7. Remove the luggage compartment wheelhouse trim panel. Refer to *Section 9G, Interior Trim.*
8. Disconnect the cable from the fuel filler door.



9. Remove the strap.
10. Remove the cable.
11. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Fuel Filler Door Screws	4	–	35
Fuel Filler Door/Remote Cable Handle Screws	8	–	71
Gas Support Assembly Bolts	20	15	71
Luggage Compartment Lock Screws	6	–	53
Luggage Compartment Lock Striker Bolts	10	–	89
Tailgate Hinge Bolts	20	15	–

SECTION 9T

REMOTE KEYLESS ENTRY AND ANTI-THEFT SYSTEM

REMOTE KEYLESS ENTRY AND PERIMETER/ULTRASONIC ANTI-THEFT SYSTEM

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IMMOBILIZER ANTI-THEFT SYSTEM

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SECTION 9T

REMOTE KEYLESS ENTRY AND PERIMETER/ULTRASONIC ANTI-THEFT SYSTEM

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

REMOTE KEYLESS ENTRY AND ANTI-THEFT SYSTEM

The remote keyless entry and anti-theft system can perform the following functions:

- Remotely lock and unlock the vehicle doors with a hand-held high-frequency transmitter.
- Sense intrusion into the vehicle through the doors, the trunk, or the hood.
- Activate a warning to signal an intrusion.
- Help the driver find the vehicle in a parking area.
- Automatically re-lock the doors if a door or the trunk is not opened within 30 seconds after the vehicle has been unlocked by the remote keyless entry.
- Communicate serial data to a scan tool to help diagnose system faults.
- Sense movement inside the vehicle, if it is equipped with the optional ultrasonic motion detector.

The remote keyless entry and anti-theft system consists of the following components:

- Keyless entry and anti-theft control module/receiver.
- Security indicator.
- Rear deck lid open switch.
- Rear deck lid tamper switch.
- Front door tamper switches.
- Door open switches.
- Central locking unit.
- Flashing turn signal lamps.
- Siren.
- Hood open switch.
- Ultrasonic sensor (optional).

REMOTE LOCKING AND UNLOCKING

The hand-held transmitter locks and unlocks the vehicle doors by sending radio waves to the control module/receiver in the vehicle. The effective range of the transmitter varies between 5 and 10 meters (approximately 16 to 32 feet), depending on whether or not objects such as other vehicles are blocking the path of the radio waves.

The transmitter has a LOCK button and an UNLOCK button which only function when the ignition is OFF. Pressing the UNLOCK button has the following effects:

- The doors are unlocked.
- The turn signal lamps flash twice.
- The control module is disarmed.

Pressing the LOCK button has the following effects:

- The doors are locked.
- The turn signal lamps flash once.
- The control module is armed.

The transmitter has a replaceable battery. The battery is designed to last at least three years before replacement is necessary.

SECURITY INDICATOR

There is a security indicator on the instrument panel. After the LOCK button of the transmitter is pressed, the module is placed in the armed mode, and the security indicator flashes. The security indicator turns ON for 0.1 second and OFF for 0.7 second. It then flashes at that frequency until the control module/receiver is disarmed.

INTRUSION SENSING

The anti-theft function is armed if the transmitter sends the LOCK message to the control module/receiver when the ignition is OFF.

When the hood, the door, or the rear deck lid is opened, the hood open switch, the door open switch, or the trunk open switch will change its input to ground. The alarm will be activated if the hood open sensor, the door open sensor, or the trunk open sensor changes its input to ground before either of the following conditions occurs:

- An UNLOCK message is received from the transmitter.
- The front door tamper switch or the tailgate tamper switch indicates key operation by changing its input to ground.

The alarm also will be activated if the ignition input is changed to battery voltage before either of the following conditions occurs:

- An UNLOCK message is received from the transmitter.
- The front door tamper switch or the rear deck lid tamper switch indicates key operation by changing its input to ground.

The alarm also will be activated if the anti-theft function has been armed and the ultrasonic sensor (optional) detects movement within the vehicle before either the front door tamper switch or the rear deck lid tamper switch indicates key operation.

SIREN

The remote keyless entry system is armed when the LOCK message is received from the transmitter when the ignition is OFF. When the system is armed, it will activate the siren and flash the turn signals for 28 seconds if any of the following conditions occurs:

- A door is opened without using the key (front door open switch input is changed to ground).
- The rear deck lid is opened without using the key (trunk open switch input is changed to ground).
- The hood is opened while the anti-theft system is armed (hood open switch input is changed to ground).
- The ignition switch input is changed to battery voltage.
- Movement within the vehicle is detected by the optional ultrasonic sensor.

The siren is disarmed when any of the following conditions occurs:

- The door is opened with the key.
- The rear deck lid is opened with the key.
- The UNLOCK button or the LOCK button on the remote transmitter is pressed within 2 seconds of the beginning of the alarm. If the UNLOCK button or the LOCK button is not pressed within 2 seconds of the beginning of the alarm, the transmitter will not stop the alarm.

VEHICLE LOCATOR

The remote keyless entry system assists the driver in locating the vehicle. When the vehicle is unlocked with the remote control, the turn signals flash twice to indicate the location of the vehicle. The duration of the flashes and the length of time between flashes is used to indicate certain vehicle conditions. Refer to "Fault or Alarm Indication" in this section.

AUTOLOCKING (SAFETY LOCK)

The remote keyless entry system features an autolocking control. If the doors are unlocked with the remote transmitter when the control module/receiver is in the armed mode, the doors are automatically re-locked after 30 seconds unless any of the following events occur:

- The door is opened.
- The ignition switch is turned ON.
- The rear deck lid is opened.
- The hood is opened.

ULTRA SONIC INTERIOR SPACE PROTECTION

Interior space protections is secondary option and only activated when the alarm is armed using the twin sensor, situated at the top of the left hand door "B" pillar, monitor the interior space and activate the alarm if an instrusion into the passenger compartment is detected (entry gained through a window or sunroof).

CONTROL MODULE/RECEIVER

The remote keyless entry control module/receiver is contained in the instrument lower cover. The module/receiver processes signals from the remote transmitter and the intrusion sensors, and it activates the alarm if an intrusion is detected. The control module/receiver also has a self-diagnostic function which will display trouble codes. In order to display trouble codes, a scan tool must be connected to the data link connector (DLC).

The control module/receiver will not communicate with transmitters from other vehicles because there are over four billion possible electronic password combinations, and passwords are not duplicated. The control module/receiver has an attached antenna to detect signals from the transmitter.

FAULT OR ALARM INDICATION

When the UNLOCK button on the remote transmitter is pressed, the control module/receiver will flash the parking lamps to indicate information about the remote keyless entry and anti-theft system.

Normal Condition: If there has not been an intrusion, and no fault has been detected, the control module/receiver will signal a normal condition when the UNLOCK button is pressed. The parking lamps will flash twice for 0.5 second, with a 0.5 second pause between flashes.

Fault Indication: If there is a fault in the remote keyless entry and anti-theft system, the control module/receiver will signal the fault when the UNLOCK button is pressed. The parking lamps will flash twice for 0.5 second, with a 0.5 second pause between flashes.

Alarm Indication: If there has been an intrusion since the last time the LOCK button was pressed, the control module/receiver will signal that there has been an intrusion when the UNLOCK button is pressed. The parking lamps will flash twice for 0.5 second, with a 1.5 second pause between flashes.

Alarm and fault information in the control module/receiver will be erased the next time the control module/receiver enters the armed condition after receiving a LOCK message from the transmitter.

PASSWORD PROGRAMMING

If a transmitter is lost or damaged, the control module/receiver must be re-programmed to communicate with a new transmitter. The passwords recorded in the control module/receiver should not be deleted when power is off in the control module/receiver.

Each control module/receiver should be able to record five passwords. The following method is used to record new passwords in the control module/receiver:

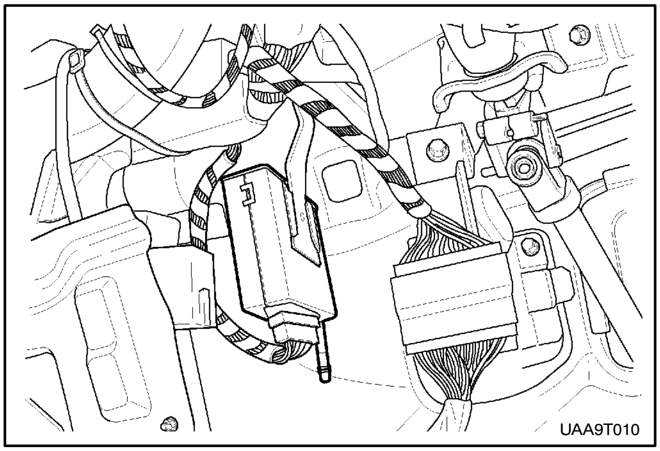
1. Connect the scan tool to the data link connector (DLC).
2. Turn the ignition ON.
3. Delete the current passwords.
4. Send the programming mode message to the control module/receiver.
5. Press any button of the transmitter to generate a data code including a password which will be recorded by the control module/receiver. The control module/receiver sends a response message to the scan tool to indicate that the first password has been recorded.
6. Press any button of the transmitter three more times until the control module/receiver has responded that the third, fourth, and fifth passwords have been recorded.
7. Turn the ignition OFF.
8. Disconnect the scan tool.

The control module/receiver leaves the programming mode automatically and switches to the normal operating mode when either of the following conditions occurs:

- The scan tool is disconnected from the DLC.
- Five passwords are recorded in the control module/receiver.

REPAIR INSTRUCTIONS

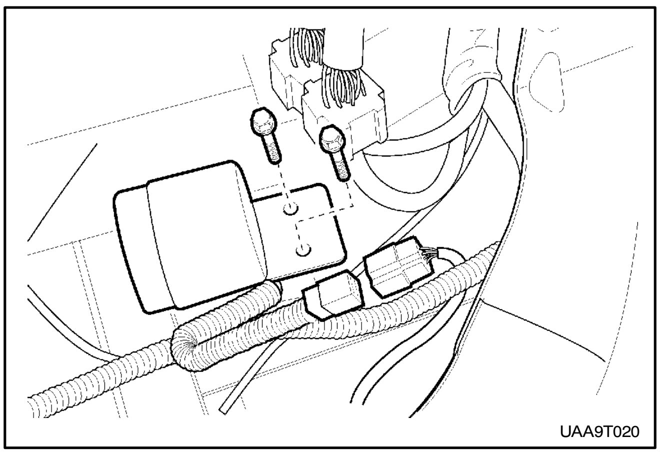
ON–VEHICLE SERVICE



CONTROL MODULE/RECEIVER

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the instrument lower cover. Refer to *Section 9E, Instrumentation/Driver Information.*
3. Disconnect the control module/receiver electrical connector.
4. Remove the screw.
5. Slide the control module/receiver toward the rear of the vehicle and remove it.
6. Installation should follow the removal procedure in the reverse order.



SIREN

Removal and Installation Procedure

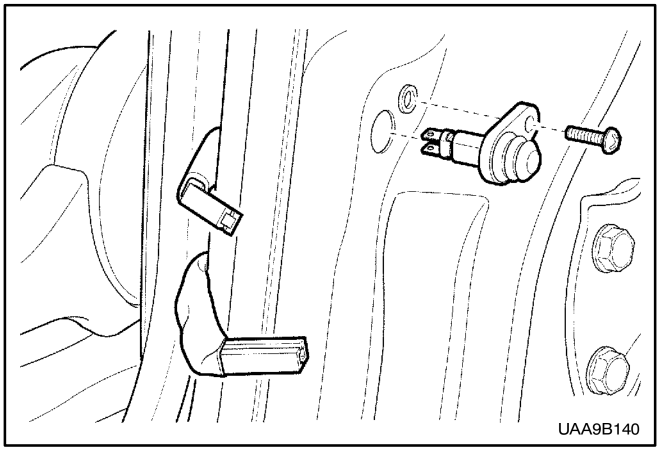
1. Disconnect the negative battery cable.
2. Disconnect the siren electrical connector.
3. Remove the bolts.

Installation Notice

Tightening Torque	3 N·m (27 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

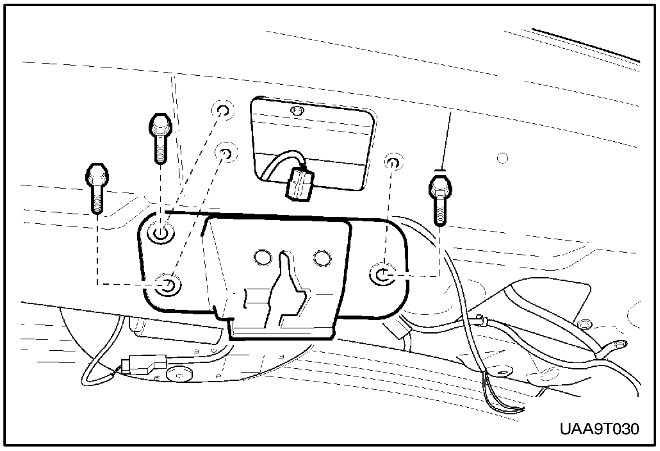
4. Remove the siren.
5. Installation should follow the removal procedure in the reverse order.



DOOR TAMPER SWITCH

Removal and Installation Procedure

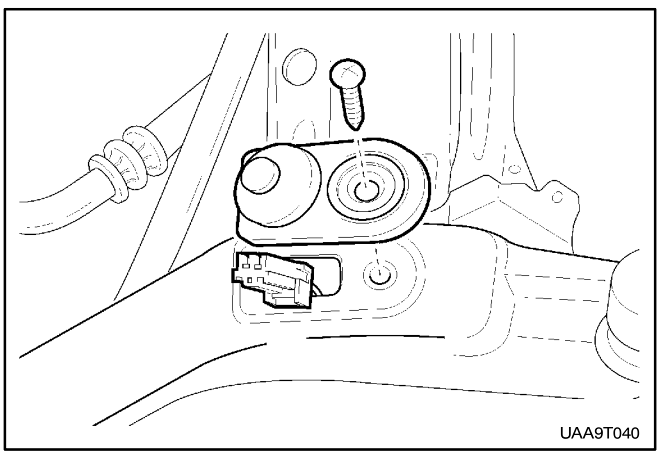
1. Disconnect the negative battery cable.
2. Remove the B-pillar lower trim panel. Refer to *Section 9G, Interior Trim.*
3. Remove the screw.
4. Disconnect the door tamper switch electrical connector.
5. Remove the door tamper switch.
6. Installation should follow the removal procedure in the reverse order.



TAILGATE TAMPER SWITCH

Removal and Installation Procedure

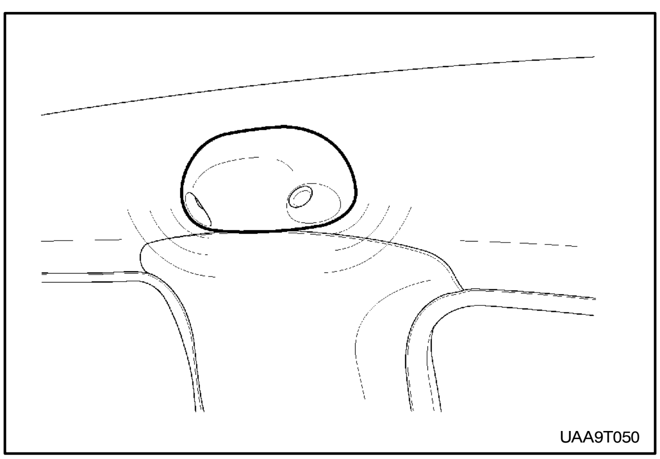
1. Disconnect the negative battery cable.
2. Remove the tailgate lower trim panel. Refer to *Section 9G, Interior Trim.*
3. Disconnect the tailgate tamper switch electrical connector from the tamper switch.
4. Remove the bolts.
5. Remove the tailgate lock and the tailgate tamper switch.
6. Installation should follow the removal procedure in the reverse order.



HOOD OPEN SWITCH

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the screw.
3. Disconnect the electrical connector from the hood open switch.
4. Remove the hood open switch.
5. Installation should follow the removal procedure in the reverse order.



ULTRASONIC SENSOR

Removal and Installation Procedure

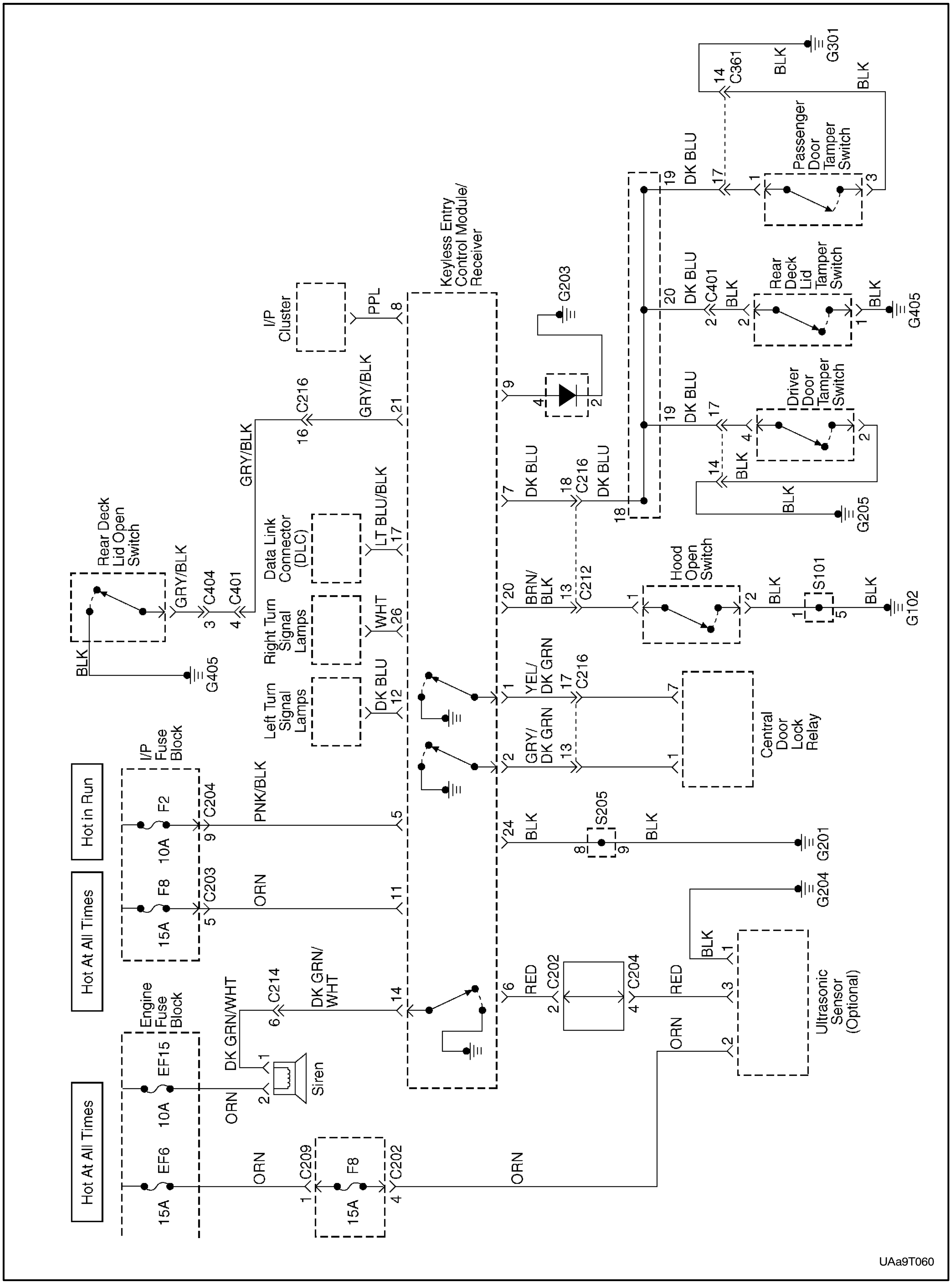
1. Slide the ultrasonic sensor in a downward direction to loosen the upper retaining clip, and simultaneously pull the sensor away from the B-pillar.
2. Disconnect the electrical connector.
3. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

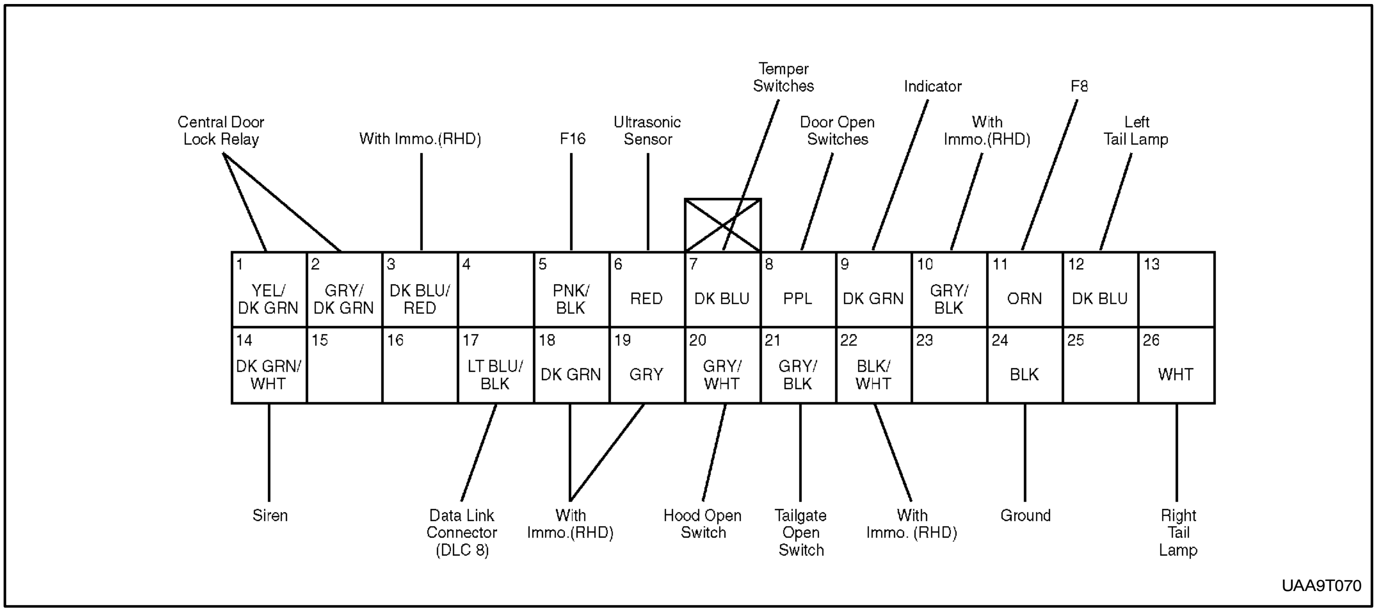
FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Hood Open Switch Mounting Screw	4	–	35
Siren Bracket Mounting Bolt	22	16	–
Siren Mounting Bolts	3	–	27

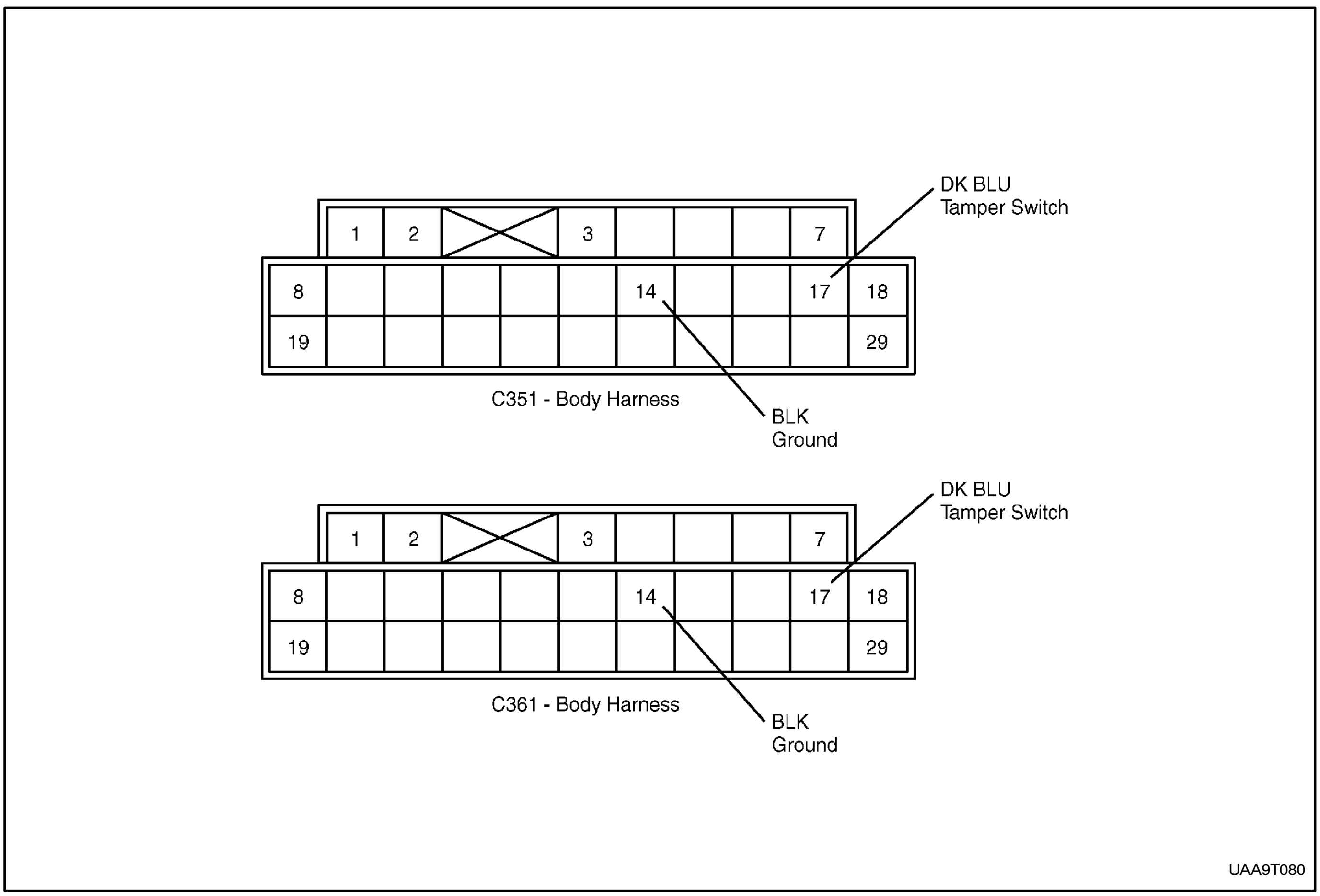
SCHEMATIC AND ROUTING DIAGRAMS



CONTROL MODULE/RECEIVER CONNECTOR

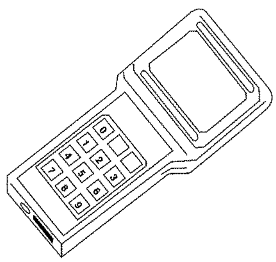


WIRING HARNESS CONNECTORS



SPECIAL TOOLS

SPECIAL TOOLS TABLE

 A110B003	Scan Tool

SECTION 9T

IMMOBILIZER ANTI-THEFT SYSTEM

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

IMMOBILIZER SYSTEM

The purpose of the Immobilizer system is to provide additional theft deterrence to the vehicle in which it is installed and to prevent it from being stolen or driven by unauthorized users.

The verification of the user authorization is done by an ignition key with integrated transponder.

The external LED displays the Immobilizer status and has an additional theft deterrence function.

To secure the communication, the status is exchanged between the Immobilizer and the ECM in a 5 byte of encoded data.

These 5 bytes are composed by a mixture of random data and two types of fixed code

- a vehicle model identification number : MIN
- a vehicle specific identification : VIN

The MIN is known from the first supply of the system.

The VIN is realized by ICU on the special order from the key coding (reading of transponder code and storing it as valid key code in Immobilizer EEPROM).

A different random data is computed at each key transition.

All the immobilization communication between the ECM and ICU is made on K-line (K line : Serial data line '7').

Due to the learning of the Vehicle specific identification Number, both ICU and ECM can stay in 3 stable modes

- Virgin mode (VIN not learnt)
- Learnt mode (VIN learnt)
- Neutral mode (for a new VIN learning)

In case of using valid key, the release message communication with the ECM take place and the LED displays the Immobilizer status valid key In case of using invalid key, the ECM disables the fuel injector circuit with coded intervention and sets DTC(Diagnostic Trouble Code)

The above conditions are maintained until the ignition is switched off.

An ECM without an immobilizer control unit cannot be interchanged for an ECM that is used with an immobilizer control unit system. The Immobilizer control unit and ECM must have a matching ID code. ID coding and key coding are accomplished by using Scanner–100

The Immobilizer system consists of

- a maximum or 5 ignition keys with integrated transponder
- the toroidal coil (Detection coil) for energizing and reading the transponder mounted at the ignition lock.
- the Immobilizer control unit(ICU) with :
  - power supply
  - ignition input circuit
  - transponder modulation and demodulation unit
  - EEPROM
  - driver electronic for the external status LED
  - serial data link hardware
- the external status LED for displaying the Immobilizer status
- the serial data link between Immobilizer and ECM

ELECTRONICALLY CODED KEYS

Each valid ignition key has an internal transponder which is a read /write transponder.

The transponder contains an implementation of a crypto-algorithm with 96 bits of user configurable s cret-key contained in EEPROM and transmits data to the ICU by modulating the amplitude of the ele tromagnetic field, and receives data and commands in a similar way.

DETECTION COIL

The toroidal coil is mounted at the ignition lock in front of the key barrel.

It is connected to the ICU with a four terminal connector fixed at the body of the coil.

The length of the connection between coil and Immobilizer is restricted to 50cm. The correct placement on the ignition lock and the exact electrical data is very important for the reading distance of transponder.

The toroidal coil and receiving coil inside the transponder built a transformer. During the readingprocess the coil induces energy into the transponder. The transponder charges the field and generates an amplitude modulated signal with the manchester coded data. This charge of the field is demodulated inside the Immobilizer.

The Immobilizer contains the coil driver hardware for direct connection of the toroidal coil.

IMMOBILIZER CONTROL UNIT

The function of the Immobilizer System is shared between the ICU and the ECM.

The task of the Immobilizer Electronic Control unit (ICU) are:

- Reading of the input information "ignition ON/OFF"
- Controlling the states LED
- Controlling the transponder read/write process (modulation, demodulation, decoding, comparison of the read code with the code of the valid keys).
- Communication with the ECM after ignition ON (receiving of the ECM-request and transmission of release message).
- Special functions for calculation and handling of the VIN-code.

The VIN code is calculated by the Immobilizer using a random generator.

The VIN code is transmitted from the Immobilizer in the release message communication only incase of using an authorized key. Without an authorized key it is not possible to getthe system VIN code.In case of ECM internal state is in Virgin mode or neutral mode the ECM learns the system VIN code automatically after receiving the first release response message.

To get a synchronized Immobilizer system (same VIN-code in Immobilizer and ECM,authorized key) the DLC test equipment has to be used for authorization of the keys(first key coding). The usage of this test equipment is restricted to authorized persons.

- Communication with the DLC-test equipment. Main functions are the key coding procedure, the VIN-code handling and the support for system test functions.
- Handling of the software watchdog

Operation

In the active mode of immobilizer (engine OFF, IG key OFF) the status LED isblinking as mode A. When ignition is turned ON, the system wakes up and tries to read out the transponder.

In case of the detection of a valid key , The release message communication with the ECM takes place. The status LED displays the Immobilizer state “valid key”.

After turning off the ignition(ignition OFF detection similar to the ECM ignition OFF detection), the Immobilizer changes to the active mode. The status LED is blinking as Mode A.

Data Link Connector (DLC) Mode

When the ignition is on, a scan tool can switch the immobilizer control unit to the DLC mode for diagnostics, key coding and ID coding.

- The status LED is turned off during DLC-mode
- The Immobilizer will answer all correct messages, which are defined as Immobilizer messages.

ID Code Handling

One of 65,535 VIN codes is stored in the immobilizer EEPROM.

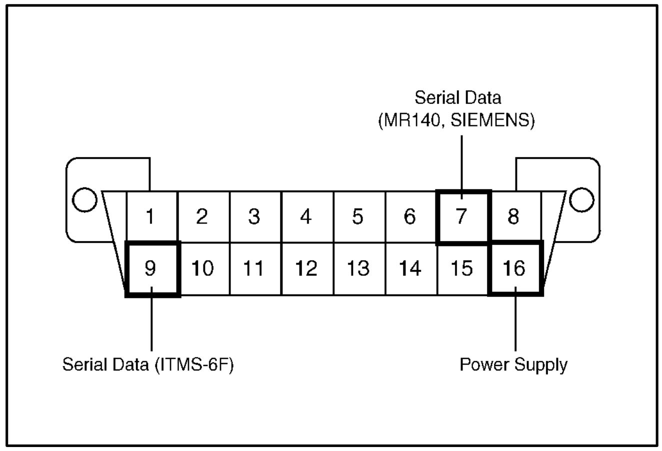
The VIN code can be erased by using “Reset VIN code” command of the scan tool.

When the immobilizer control unit calculates a new VIN code, ECM VIN code should be reset to get identical with the immobilizer control unit’s.

During diagnostic procedures, the VIN code can be read for comparison with the ECM VIN code by using the scan tool’s “Read immobilizer control unit VIN code” command.

SERIAL DATA LINK

Serial data can be exchanged between a scan tool and the ECM and the Immobilizer control unit.



PULL–UP RESISTOR (DUMMY PLUG)

Dummy plug is a hardware to communicate between ECM and IMMOBILIZER.

ELECTRONIC CONTROL MOUDLE (ECM)

- ECM in Virgin mode

  In this mode, the ECM knows only the model vehicle identifier code.

  The engine can be locked/unlocked.

  ECM requests to ICU the VIN number. As soon as the ECM receives two correct consecutive communication frames with the same VIN code the ECM learns it.

  The VIN code will be stored in non-volatile memory at the end of power latch phase. ECM enters in Learnt mode.

- ECM in Learnt mode

  In such a state, ECM checks on every communication, the correct encoding of the ICU.

  If the code received is not correct, then the vehicle is immobilized.

  The coded 5 bytes of data emitted by ECM are a mixture of MIN code and random.

  The coded 5 bytes of data emitted by ICU are a mixture of VIN code and random.

- ECM in Neutral mode

  This mode is a special intermediate mode, used for ICU replacement or immobilizer option installation.

  ECM request to ICU the VIN number. As soon as the ECM receives two correct consecutive communication frames with the same VIN code the ECM learns it. The VIN code will be stored in non-volatile memory at the end of power latch phase. ECM enters in Learnt mode.

- After turning on the ignition the ECM will control the engine in a normal way for starting and running while waiting for a valid release response message from the Immobilizer.

1. After receiving a response message including the information “ICU in learnt mode” and the correct system VIN-code

   → the ECM enters the release state, which allows to continue the running of the engine.
2. After receiving a response message including the information “ICU in learnt mode” and a wrong system VIN-code

   → the ECM does not send a new request and enters the blocked state, which causes the activation of the immobilization actions of the engine.
3. If the ECM doesn’t receive a response message within a defined time from beginning of the release time period or the ECM receives a no release answer

   → the ECM enters the blocked state, which causes the activation of the immobilization actions of the engine.

- The inactive state of the Immobilizer (valid key/invalid key) ends with turning off the ignition.

SECURITY INDICATOR

There is a security indicator on the instrument panel.

Status LED

An external LED displays the immobilizer system status. The immobilizer contains the LED driver hardware for direct connection of one LED.

Status LED Modes

Status LED	Immobilizer System Status	Note
Blinking	Active	– Ignition OFF
Blinking	Active	– Invalid key detected – Ignition ON
OFF	Inactive	– Valid key detected – Ignition ON
Blinking	Active	– VIN-code is different between ICU and ECM in learnt state – Ignition ON
ON	Active	– Transponder reading error – Ignition ON
Blinking	Active	– Reader exciter ASIC error – Ignition OFF

DIAGNOSTIC INFORMATION AND PROCEDURES

IMMOBILIZER SYSTEM (ITMS–6F)

The immobilizer anti-theft system requires diagnosis when it is not possible to start the engine. If the no-start condition occurs because of the immobilizer system, a diagnostic trouble code (DTC) 53 should be set.

The immobilizer control unit monitors the detection and the reading of the ignition key. The self-test capacity is limited to those functions. Faults are communicated to a scan tool during diagnosis, but they are not stored in the immobilizer control unit's memory.

Unauthorized use of a scan tool could be a method of defeating the immobilizer anti-theft system, so certain scan tool procedures require the use of a password. The following functions are password protected:

- Coding of an additional key.
- Deleting all key codes.
- Deletion of the immobilizer identification (ID) code.
- Deletion of the electronic control module (ECM) ID code.

The following functions do not require a password:

- Reading an ignition key to determine if the transponder is working or if a key is authorized.
- Reading the immobilizer ID code to verify that it matches the ECM ID code.

IMMOBILIZER SYSTEM (SIRIUS D4, MR–140)

The immobilizer anti-theft system requires diagnosis when it is not possible to start the engine. If the no-start condition occurs because of the immobilizer system, a diagnostic trouble code (P) 1626, 1628, 1629, 1631 should be set.

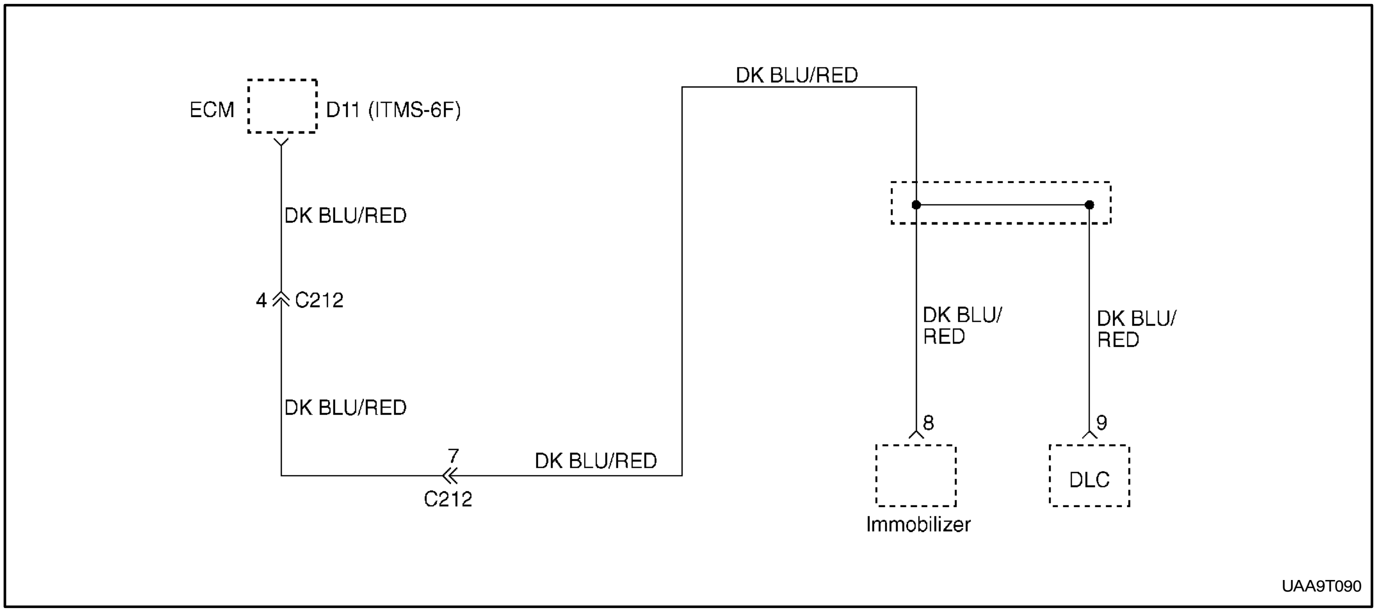
The immobilizer control unit monitors the detection and the reading of the ignition key. The self-test capacity is limited to those functions. Faults are communicated to a scan tool during diagnosis, but they are not stored in the immobilizer control unit's memory.

Unauthorized use of a scan tool could be a method of defeating the immobilizer anti-theft system, so certain scan tool procedures require the use of a password. The following functions are password protected:

- Coding of an additional key.
- Deleting all key codes.

The following functions do not require a password:

- Reading an ignition key to determine if the transponder is working or if a key is authorized.
- Reading the immobilizer ID code to verify that it matches the ECM ID code.



DIAGNOSTIC TROUBLE CODE (DTC) 53
ECM IMMOBILIZED ERROR

Circuit Description

When the ignition is turned ON, the key is tested by the immobilizer anti-theft system. While the key code is being read by the immobilizer control unit, the engine can start and run with any key that will turn the lock cylinder. The key code is read and compared with key codes that have been stored in the memory of the immobilizer control unit. If a valid key is detected, the immobilizer control unit sends a serial data release message to the electronic control module (ECM). Included in the release message is an identification (ID) code which assures that neither the immobilizer control unit nor the ECM have been substituted to defeat the system. If the ECM receives an invalid release message, the ECM performs the following actions:

- Disables the fuel injector circuit.

DTC 53 Will Set When

- The ECM does not receive the signal from the immobilizer control module within 1 second when the vehicle is stationary or within 1.5 seconds when the vehicle is moving.
- The ECM receives an incorrect release message from the immobilizer control unit more than five times.

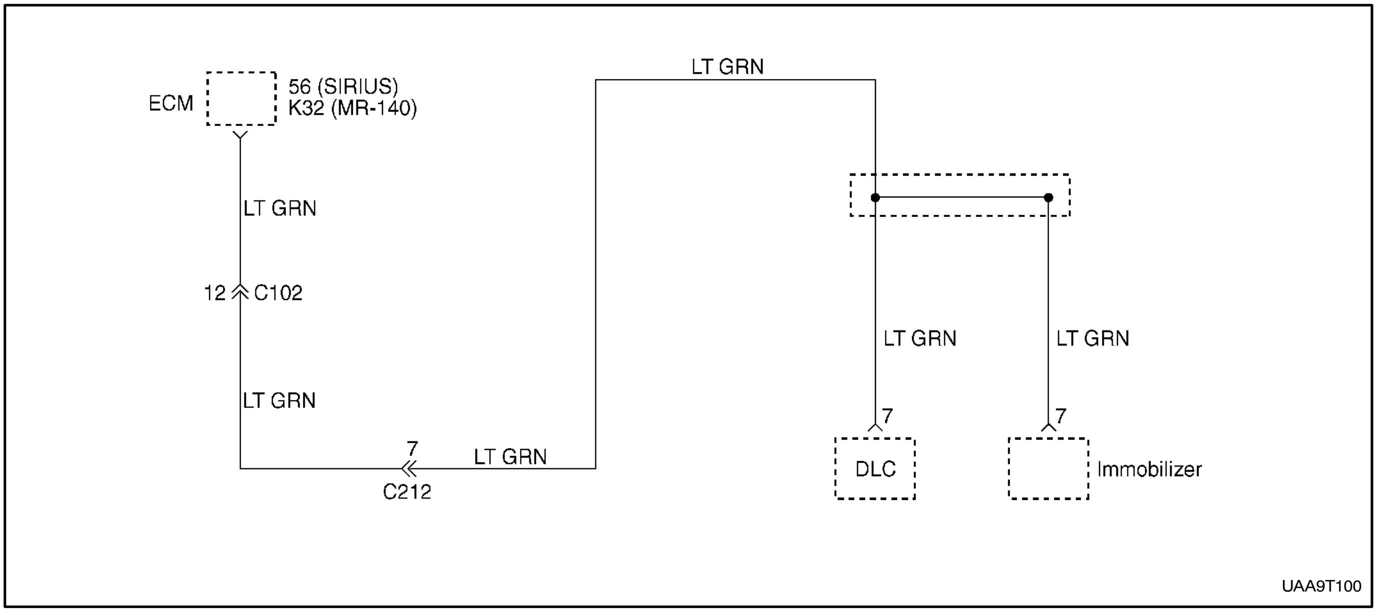
The above conditions are maintained until the ignition is switched OFF.

DTC 53 Will Clear When

- The ignition switch is turned OFF or the scan tool CLEAR CODES command is issued.

DTC 53 – ECM Immobilized Error

Step	Action	Value	Yes	No
1	Connect the scan tool using the following procedure: 1. Insert the immobilizer data cartridge into the scan tool. 2. Turn the ignition switch OFF. 3. Connect the scan tool to the data link connector (DLC). 4. Connect the scan tool's power cord to the cigar lighter socket. 5. Turn the ignition ON, but do not start the engine. Is communication established between the scan tool and the immobilizer control unit?	–	Go to *Step 2*	Go to "Communication Between Immobilizer and Test Equipment"
2	Select SYSTEM DIAGNOSIS from the scan tool menu. Does the KEY STATUS message indicate POS NR (position number) 00?	–	Go to "Key Status Errors"	Go to *Step 3*
3	Read the IMMO & ECM ID-CODE message that is displayed after requesting SYSTEM DIAGNOSIS. Does the message ID-CODE DIFFERENT appear?	–	Go to "ID Code Reprogramming"	Go to *Step 4*
4	Check for an open serial data wire between the immobilizer control unit and the ECM. Is the circuit open?	–	Go to *Step 5*	Go to *Step 6*
5	Repair the open serial data wire between the ECM and the immobilizer control unit. Is the repair complete?	–	System OK	–
6	1. Replace the ECM. 2. Reprogram the identification (ID) code. Refer to "ID Code Reprogramming" in this section. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (P) 1626 (MR-140), 1628 (SIRIUS) ECM IMMOBILIZER ERROR (NO SUCCESSFUL COMMUNICATION)

Circuit Description

When the ignition is turned ON, the key is tested by the immobilizer anti-theft system. While the key code is being read by the immobilizer control unit, the engine can start and run with any key that will turn the lock cylinder. The key code is read and compared with key codes that have been stored in the memory of the immobilizer control unit. If a valid key is detected, the immobilizer control unit sends a serial data release message to the electronic control module (ECM). Included in the release message is an identification (ID) code which assures that neither the immobilizer control unit nor the ECM has been substituted to defeat the system. If the ECM receives an invalid release message, the ECM performs the following actions:

- Disables the fuel injector circuit.

P 1626, 1628 Will Set When

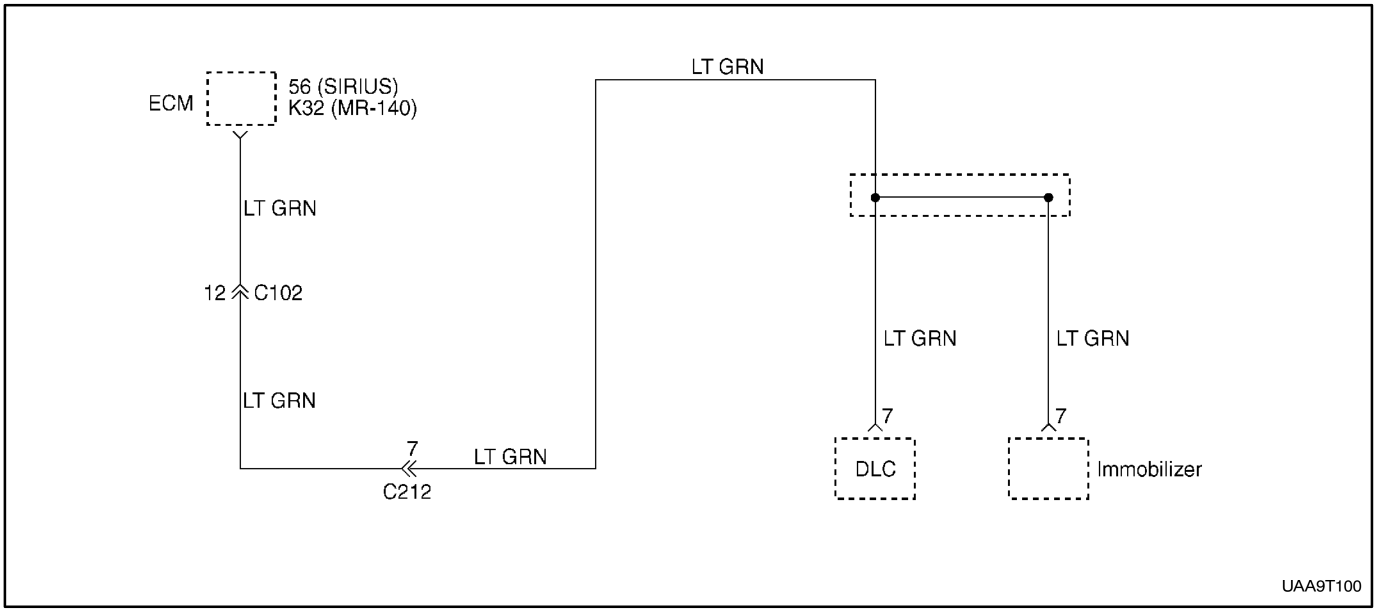
- The ECM does not receive the signal from the immobilizer control module within 1.260 seconds after the ignition is turned on.
- The above conditions are maintained until the ignition is switched OFF.

P 1626, 1628 Will Clear When

- The ignition switch is turned OFF or the scan tool TROUBLE CODE CLEAR command is issued.

P 1626, 1628 – ECM Immobilizer Error (No Successful Communication)

Step	Action	Value	Yes	No
1	Connect the scan tool using the following procedure: 1. Insert the cartridge into the scan tool. 2. Turn the ignition switch to the OFF position. 3. Connect the scan tool to the data link connector (DLC). 4. Connect the scan tool's power cord to the cigar lighter socket. 5. Select immobilizer mode on the scan tool. 6. Turn the ignition ON, but do not start the engine. Is communication established between the scan tool and the immobilizer control unit?	–	Go to *Step 2*	Go to "Communication Between Immobilizer and Test Equipment"
2	Read the IMMO & ECM ID CODE message that was displayed after requesting DIAGNOSIS. Did the message differ from normal message? Normal Message – ECM MODE: LEARNT IMMO. MODE: LEARNT VIN CODE: SAME	–	Go to "Identification (ID) Code Reprogramming"	Go to *Step 3*
3	Check for an open serial data wire between the immobilizer control unit and the ECM. Was the circuit open?	–	Go to *Step 4*	Go to *Step 5*
4	Repair the open serial data wire between the ECM and the immobilizer control unit. Is the repair complete?	–	System OK	–
5	1. Replace the immobilizer. 2. Reprogram the identification (ID) code. Refer to "Identification (ID) Code Reprogramming" in this section. Is the repair complete?	–	System OK	– Go to *Step 6*
6	1. Replace the ECM. 2. Turn the ignition ON, OFF for more than 4 seconds. 3. Turn the ignition ON. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (P) 1631 (MR-140), 1629 (SIRIUS) ECM IMMOBILIZER ERROR (INCORRECT ANSWER)

Circuit Description

When the ignition is turned ON, the key is tested by the immobilizer anti-theft system. While the key code is being read by the immobilizer control unit, the engine can start and run with any key that will turn the lock cylinder. The key code is read and compared with key codes that have been stored in the memory of the immobilizer control unit. If a valid key is detected, the immobilizer control unit sends a serial data release message to the electronic control module (ECM). Included in the release message is an identification (ID) code which assures that neither the immobilizer control unit nor the ECM has been substituted to defeat the system. If the ECM receives an invalid release message, the ECM performs the following actions:

- Disables the fuel injector circuit.

P 1631, 1629 Will Set When

- The ECM receives an incorrect release message from the immobilizer control unit more than five times.

P 1631, 1629 Will Clear When

- The ignition switch is turned OFF or the scan tool TROUBLE CODE CLEAR command is issued.

P 1631, 1629 – ECM Immobilizer Error (Incorrect Answer)

Step	Action	Value	Yes	No
1	Connect the scan tool using the following procedure: 1. Insert the cartridge into the scan tool. 2. Turn the ignition switch to the OFF. 3. Connect the scan tool to the data link connector (DLC). 4. Connect the scan tool's power cord to the cigar lighter socket. 5. Turn the ignition ON, but do not start the engine. Is communication established between the scan tool and the immobilizer control unit?	–	Go to *Step 2*	Go to "Communication Between Immobilizer and Test Equipment"
2	1. Select DIAGNOSIS from the scan tool menu. 2. Read the IMMO & ECM ID CODE (immobilization and electronic control module identification code) message. Did the message differ from normal message? Normal Message – ECM MODE: LEARNT IMMO. MODE: LEARNT VIN CODE: SAME	–	Go to "Identification (ID) Code Reprogramming"	Go to *Step 3*
3	1. Replace the ECM. 2. Reprogram the ID code. Is the repair complete?	–	System OK	– Go to *Step 4*
4	1. Replace the ECM. 2. Turn the ignition ON, OFF for more than 4 seconds. 3. Turn the ignition ON. Is the repair complete?	–	System OK	–

KEY STATUS ERRORS (ITMS–6F)

The following KEY STATUS messages may be shown on the scan tool after commanding SYSTEM DIAGNOSIS:

- IGNITION OFF STATUS. This message informs the technician that the ignition is OFF during the key coding process. Turn the ignition ON during key coding, but do not start the engine.
- KEY IS OCCUPIED. Only five keys may be coded. If a new key is desired, the previous key codes must be deleted. Up to five keys may then be authorized.
- ALREADY AUTHORIZED. Key coding is being attempted with a key that is already authorized.
- ERROR NO. 001, 002, 003. There is no communication between the transponder in the ignition key and the detection coil. Follow the steps below to diagnose the problem:
  1. Try a different key. If a different key works, the problem is in the original key.
  2. If trying a different key results in the same error message, replace the detection coil.
- INVALID KEY. The communication between the immobilizer control unit and the key transponder has not validated the key. Follow the steps below to diagnose the problem:
  3. Code the key. Refer to “Key Coding Procedure” in this section.
  4. If the same message is received after key coding, check the connection of the detection coil.
  5. If the detection coil is okay, replace the immobilizer. Refer to “Immobilizer Control Unit” in this section.
- NO TRANSPONDER DETECTED. The fault may be in ignition key transponder, the detection coil, or the immobilizer. Follow the steps below to diagnose the problem:
  6. Try a different key. If a different key works, the problem is in the original key.
  7. If trying a different key results in the same error message, check the connection of the detection coil.
  8. If the connection of the detection coil is okay, disconnect the detection coil and use an ohmmeter to check for an open detection coil.
  9. If the detection coil is not open, replace the immobilizer control unit. Refer to “Immobilizer Control Unit” in this section.

KEY STATUS ERRORS (SIRIUS D4, MR–140)

The following KEY STATUS messages may be shown on the scan tool after commanding FIRST KEY CODING and KEY ADD:

- IGNITION OFF STATUS. This message informs the technician that the ignition is off during the key coding process. Turn the ignition ON during key coding, but do not start the engine.
- KEY IS OCCUPIED. Only five keys may be coded. If a new key is desired, the previous key codes must be deleted. Up to five keys may then be authorized.
- ALREADY AUTHORIZED. Key coding is being attempted with a key that is already authorized.
- ERROR NO. A3, A4, A5. There is no communication between the transponder in the ignition key and the detection coil. Follow the steps below to diagnose the problem:
  1. Try a different key. If a different key works, the problem was in the original key.
  2. If trying a different key resulted in the same error message, replace the detection coil.
- INVALID KEY. The communication between the immobilizer control unit and the key transponder has not validated the key. Follow the steps below to diagnose the problem:
  1. Code the key. Refer to “Key Coding Procedure” in this section.
  2. If the same message is received after key coding, check the connection of the detection coil.
  3. If the detection coil is okay, replace the immobilizer. Refer to “Immobilizer Control Unit” in this section.
- NO TRANSPONDER DETECTED. The fault may be in ignition key transponder, the detection coil, or the Immobilizer. Follow the steps below to diagnose the problem
  1. Try a different key. If a different key works, the problem was in the original key.
  2. If trying a different key resulted in the same error message, check the connection of the detection coil.
  3. If the connection of the detection coil is okay, disconnect the detection coil and use an ohmmeter to check for an open detection coil.
  4. If the detection coil was not open, replace the immobilizer control unit. Refer to “Immobilizer Control Unit” in this section.

COMMUNICATION BETWEEN IMMOBILIZER CONTROL UNIT AND TEST EQUIPMENT (ITMS–6F)

1. Connect the test equipment as described in the *Scan Tool Equipment Manual*.
2. If communication between the scan tool and the test equipment was unsuccessful, wait 30 seconds and try again.
3. If communication was not successful on the second try, turn the ignition OFF and check the wire and connectors between the immobilizer control unit terminal 8 and the data link connector (DLC) terminal 9.
4. If the wire and connectors between the DLC and the immobilizer control unit are okay, replace the immobilizer control unit. Refer to “Immobilizer Control Unit” in this section.

COMMUNICATION BETWEEN IMMOBILIZER CONTROL UNIT AND TEST EQUIPMENT (SIRIUS D4, MR–140)

1. Connect the test equipment as described in the *Scan Tool Equipment Manual*.
2. If communication between the scan tool and the test equipment was unsuccessful, wait 30 seconds and try again.
3. If communication was not successful on the second try, turn the ignition OFF and check the wire and connectors between the immobilizer control unit terminal 7 and the data link connector (DLC) terminal 7.
4. If the wire and connectors between the DLC and the immobilizer control unit are okay, replace the immobilizer control unit. Refer to “Immobilizer Control Unit” in this section.

REPAIR INSTRUCTIONS

ON-VEHICLE SERVICE

KEY CODING PROCEDURE

1. Install the immobilizer control unit cartridge in the scan tool.
2. Turn the ignition off
3. Connect the scan tool
4. Turn the ignition on with the key to be coded
5. Enter the four-digit password that enables service personnel to use the scan tool for key coding.
6. Use the scan tool command.
7. Verify that the key coding was successful by starting the engine with each of the authorized keys.

ID CODE REPROGRAMMING

Reprogram the identification (ID) code in the following situations:

- An immobilizer control unit has been replaced.
- An electronic control module (ECM) has been replaced.

If a valid key has been lost, refer to “Key Coding Procedure” in this section.

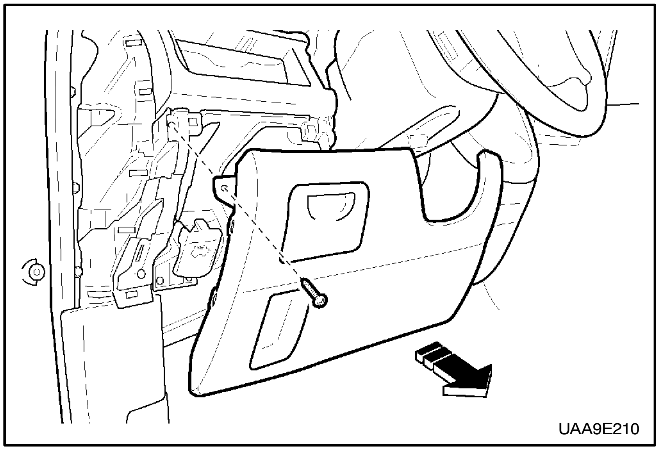
TRANSPONDER

Each valid ignition key has an internal transponder which is a read /write transponder.

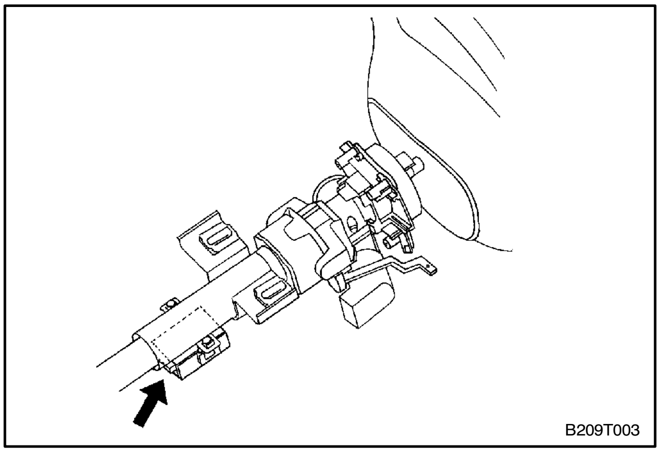
The transponder contains an implementation of a crypto-algorithm with 96 bits of user configurable secret-key contained in EEPROM and transmits data to the ICU by modulating the amplitude of the electromagnetic field, and receives data and commands in a similar way.

DETECTION COIL

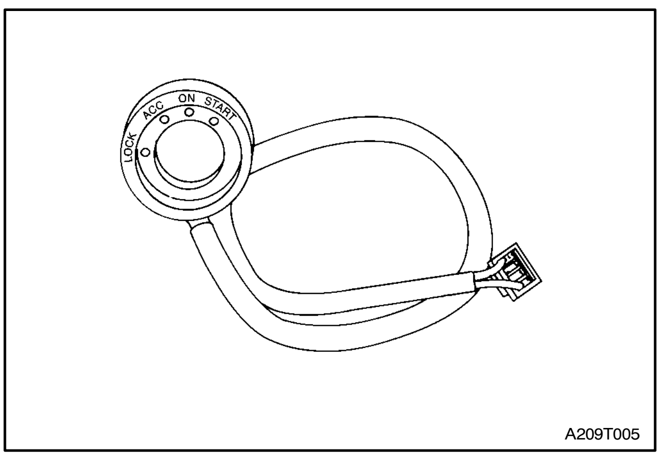
Removal and Installation Procedure



1. Remove the instrument panel lower cover.



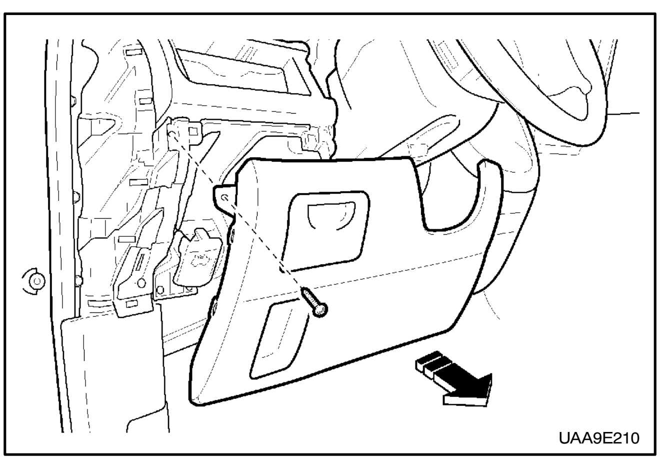
2. Disconnect the two-pin connector from the immobilizer.



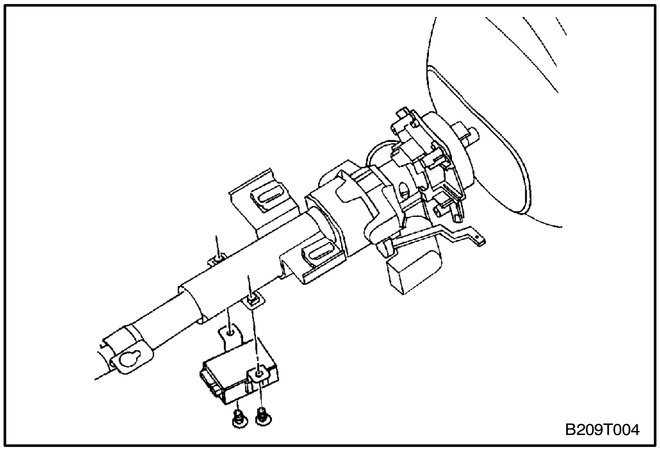
3. Pry the detection coil away from the lock cylinder. If the detection coil will be replaced with a new one, it does not matter if the key position trim ring is damaged during removal. A new trim ring is part of the new detection coil.
4. Installation should follow the removal procedure in the reverse order.

IMMOBILIZER CONTROL UNIT

Removal and Installation Procedure



1. Disconnect the negative battery cable.
2. Remove the instrument panel lower cover.



3. Remove the bolts and the immobilizer control unit.

Installation Notice

Tightening Torque	4 N·m (35 lb–in)

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

4. Disconnect the electrical connectos from the immobilizer control unit.
5. Installation should follow the removal procedure in the reverse order.

Important: After replacing the immobilizer, the keys must be re-authorized using the key coding procedure. Refer to “Key Coding Procedure” in this section.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Immobilizer Control Unit Mounting Bolts	4	–	35

SCHEMATIC AND ROUTING DIAGRAMS