SUPPLEMENT to SERVICE MANUAL

MUSSO (MY2001 EOBD)

SECTION INDEX

SSANGYONG MOTOR CO., LTD.

PYUNGTAEK, KOREA

PERSONAL INJURY CAUTION

Appropriate service methods and proper repair procedure 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.***

MUSSO (MY2001 EOBD)
SUPPLEMENT to SERVICE MANUAL

FOREWORD

This suppplement contains the additions to SERVICE MANUAL for MUSSO 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.

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SECTION 0B

GENERAL INFORMATION

TABLE OF CONTENTS

SPECIFICATIONS

TECHNICAL DATA

Performance - Manual Transaxle

Application	2.3L DOHC	3.2L DOHC
Maximum Speed (Km/h)	176	190
Minimum Turning Radius (m)	5.7	5.7

Performance - Autumatic Transaxle

Application	2.3L DOHC	3.2L DOHC
Maximum Speed (Km/h)	171	188
Minimum Turning Radius (m)	5.8	5.7

Engine

Application	2.3L DOHC	3.2L DOHC
Engine Type	4 Cylinder Gasoline	6 Cylinder Gasoline
Bore (mm)	90.9	89.9
Stroke (mm)	88.4	84
Total Displacement (cc)	2295	3199
Compression Ratio	10.4:1	10:1
Maximum Power (kW/rpm)	110/6200	162/6500
Maximum Torque (N.m/rpm)	210/2800	307/4700

Ignition System

Application	2.3L DOHC		3.2L DOHC
Ignition Type	Distributorless ignition		
Ignition Timing (BTDC)	M/T	8°	8°
	A/T	7°	
Ignition Sequence	1-3-4-2		1-5-3-6-2-4
Spark Plug Gap (mm)	0.8 ± 0.1		0.8 ± 0.1
Spark Plug Maker	Bosch, Chapion, Beru		
Spark Plug Type	F8DC4 (BOSCH) C11YCC (CHAMPION) 14F8DU4 (BERU)		

Clutch - Manual Transaxle

Application	2.3L DOHC	3.2L DOHC
Type	Single Dry Diaphram	
Outside Diameter (mm)	225	240
Inside Diameter (mm)	150	155
Thickness	9.2	9.3
Fluid	Common use :Brake Fluid	

Manual Transmission

Application	2.3L DOHC	3.2L DOHC
Maker	TREMEC	TREMEC
Type or Model	T5	T5
Gear Ratio : 1st	3.969	3.969
2nd	2.341	2.341
3rd	1.457	1.457
4th	1.000	1.000
5th	0.851	0.851
Reverse	3.705	3.705
Final Drive Ratio	4.55	3.73
Oil Capacity (L)	3.4	3.4

Auto Transmission

Application	2.3L DOHC	3.2L DOHC
Maker	BTRA	BTRA
Type or Model	M74 4WD	M74 4WD
Gear Ratio : 1st	2.740	2.740
2nd	1.510	1.510
3rd	1.000	1.000
4th	0.710	0.710
Reverse	2.428	3.705
Final Drive Ratio	5.86	4.550
Oil Capacity (L)	9	9

Transfer Case

Application	2.3L DOHC	3.2L DOHC
Maker	Borg Warner	Borg Warner
Model	Part Time 4408	Full Time 4423
Gear Ratio : High	1 : 1	1 : 1
Low	2.48 : 1	2.48 : 1
Oil Capacity (L)	1.2	1.4

Brake

Application		Specifications
Booster Size	non-ABS	8 inch + 9 inch
	ABS 5.0	7 inch + 8 inch
	ABS 5.3	8 inch + 9 inch
Master Cylinder Diameter (mm)		ϕ25.4
Booster Ratio		5.6 : 1
Front Brake : Disc Type Rear Brake : Disc Type		Ventilated Solid

Tire and Wheel

Application	Specifications
Standard Tire Size	P235/75 R15, P255/70 R15
Standard Wheel Size	7JJ x 15
Inflation Pressure At Full Lode	
P235 / 75 R15 : Front	30 Psi
Rear	30 Psi
P255 / 70 R15 : Front	30 Psi
Rear	30 Psi

Steering System

Application	Specifications
Gear Type	RACK & PINION
Wheel Alignment:	
Front : Toe-in	0 - 4 mm
Front : Caster	2°30'±30'
Front : Camber	0° ± 30'
Oil Capacity	1 L

Suspension

Application	Specifications
Front Type	Double Wishbone
Rear Type	5 - Link

Fuel System

Application	Specifications
Fuel Pump Type	Electric Motor Pump
Fuel Capacity	70 L

Lubricating System

Lubricating Type	2.3L DOHC	3.2L DOHC
Oil Pump Type	External Gear pump	
Oil Filter Type	Full Flow	
Oil Capacity (L) (Including Oil Filter)	7.5	8.2

Cooling System

Cooling Type	2.3L DOHC	3.2L DOHC
Coolant Capacity (L)	10.5	11.3
Radiator Type	Forced Circulation	
Water Pump Type	Centrifugal	

Electric System

Application	2.3L DOHC	3.2L DOHC
Battery (MF)	12V - 75 AH	
Generator	115 A	115 A
Starter	1.2 kw	1.7 kw

VEHICLE DIMENSIONS AND WEIGHTS

Vehicle Dimensions

Application	Application
Overall Length (mm)	4656
Overall Width (mm)	1864
Overall Height (mm)	1735
Wheel Base (mm)	2630
Tread : Front (mm) Rear (mm)	1510 1520

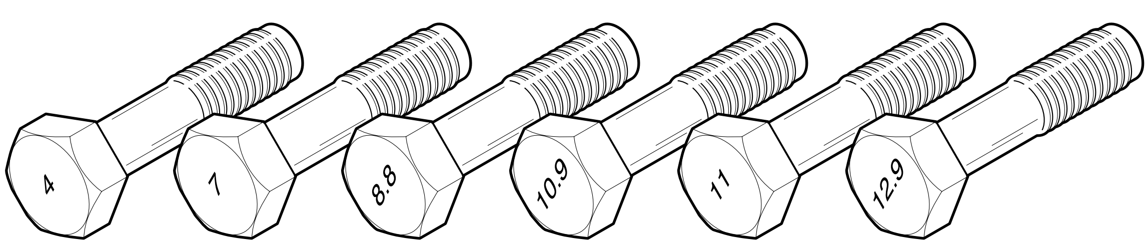
Vehicle Weights

Application	2.3L DOHC	3.2L DOHC
Manual : Curb Weight (kg) Gross Vehicle Weight (kg)	1835 2520	1910 2520
Automatic : Curb Weight (kg) Gross Vehicle Weight (kg)	1850 2520	1930 2520
Passenger Capacity	5	5

STANDARD BOLTS SPECIFICATIONS

Bolt*	Torque (N•m / lb-in)					
	Standard			Limit		
	4T	7T	9T	4T	7T	9T
M3 × 0.5	0.5 N•m (4.5 lb-in)	0.9 N•m (8 lb-in)	1.3 N•m (12 lb-in)	0.7 N•m (6.3 lb-in)	1.2 N•m (11 lb-in)	17 N•m (15 lb-in)
M4 × 0.7	1.2 N•m (11 lb-in)	2.0 N•m (18 lb-in)	3.0 N•m (27 lb-in)	1.6 N•m (14 lb-in)	2.6 N•m (23 lb-in)	4.0 N•m (36 lb-in)
M5 × 0.8	2.4 N•m (22 lb-in)	4.0 N•m (36 lb-in)	5.6 N•m (50 lb-in)	3.1 N•m (28 lb-in)	5.2 N•m (47 lb-in)	7.6 N•m (68 lb-in)
M6 × 1.0	4.0 N•m (36 lb-in)	6.7 N•m (60 lb-in)	9.7 N•m (87 lb-in)	5.4 N•m (49 lb-in)	9.0 N•m (81 lb-in)	12.7 N•m (114 lb-in)
M8 × 1.25	8.6 N•m (77 lb-in)	15.7 N•m (12 lb-in)	22.5 N•m (17 lb-in)	12.7 N•m (9 lb-in)	20.6 N•m (15.2 lb-in)	30.4 N•m (22 lb-in)
M10 × 1.25	18.6 N•m (14 lb-in)	32.3 N•m (24 lb-in)	46.0 N•m (34 lb-in)	25.5 N•m (19 lb-in)	42.1 N•m (31 lb-in)	60.8 N•m (31 lb-in)
M10 × 1.5	18.6 N•m (14 lb-in)	30.4 N•m (22 lb-in)	44.1 N•m (33 lb-in)	24.5 N•m (18 lb-in)	41.2 N•m (30 lb-in)	58.8 N•m (44 lb-in)
M12 × 1.25	34.3 N•m (25lb-in)	56.8 N•m (42 lb-in)	82.3 N•m (61 lb-in)	45.0 N•m (33 lb-in)	75.5 N•m (56 lb-in)	107.8 N•m (80 lb-in)
M12 × 1.75	32.3 N•m (24 lb-in)	53.9 N•m (40 lb-in)	77.4 N•m (57 lb-in)	43.1 N•m (32 lb-in)	71.5 N•m (53 lb-in)	98.0 N•m (73 lb-in)
M14 × 1.5	54.0 N•m (40 lb-in)	89.2 N•m (66 lb-in)	127.4 N•m (94 lb-in)	71.6 N•m (53 lb-in)	117.6 N•m (87 lb-in)	166.6 N•m (123 lb-in)
M16 × 1.5	81.3 N•m (60 lb-in)	107.8 N•m (80 lb-in)	196.0 N•m (145 lb-in)	107.8 N•m (80 lb-in)	186.2 N•m (138 lb-in)	264.6 N•m (196 lb-in)
M18 × 1.5	117.6 N•m (87 lb-in)	196.0 N•m (145 lb-in)	284.2 N•m (210 lb-in)	156.8 N•m (116 lb-in)	264.6 N•m (196 lb-in)	372.4 N•m (276 lb-in)
M20 × 1.5	166.6 N•m (123 lb-in)	274.4 N•m (203 lb-in)	392.0N•m (290 lb-in)	215.6 N•m (160 lb-in)	362.6 N•m (268 lb-in)	519.4 N•m (384 lb-in)
M22 × 0.5	225.4 N•m (167 lb-in)	372.4 N•m (276 lb-in)	529.2 N•m (392 lb-in)	294.0 N•m (218 lb-in)	490.0 N•m (362 lb-in)	705.6 N•m (522 lb-in)
M24 × 1.5	284.2 N•m (210 lb-in)	480.2 N•m (355 lb-in)	686.0 N•m (508 lb-in)	382.2 N•m (283 lb-in)	637.0 N•m (471 lb-in)	921.2 N•m (682 lb-in)
M24 × 2.0	274.4 N•m (203 lb-in)	460.6 N•m (341 lb-in)	666.4 N•m (493 lb-in)	372.4 N•m (276 lb-in)	617.4 N•m (457 lb-in)	891.8 N•m (660 lb-in)

*Diameter × pitch in millimeters



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MAINTENANCE AND REPAIR

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 of the tire inflation prassure. Refer to “Tire and Wheel” in section 2E.
- 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.

Engine Oil and Oil Filter Change

Always use above the API SH grade or recommended engine oil.

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.

Air Cleaner Element Replacement

Clean the air cleaner element every.

- Gasoline Engine : 15,000 km (10,000 miles)

Replace the air cleaner element every .

- Gasoline Engine : 60,000 km (36,000 miles)

Replace the air cleaner more often under dusty conditions

Fuel Filter Replacement

Replace the engine fuel filter every.

- Gasoline Engine : 60,000 km (36,000 miles)

Spark Plug Replacement

Replace spark plugs with same type.

- Type : BOSCH : F8DC4
  BERU : 14F-8DU4
  Champion : C11YCC
- Gap : 0.8 ± 0.1 mm

Spark Plug Wire Replacement

Clean wires and inspect them for burns, cracks or other damage. Check the wire boot fit at the Distributor and at the spark plugs. Replace the wires as needed.

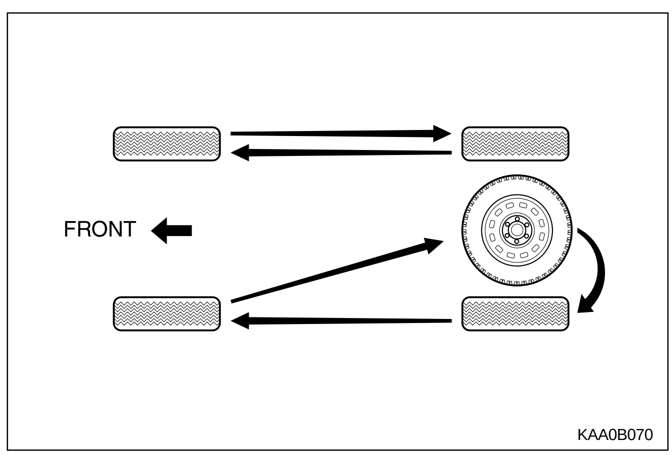
Brake System Service

Check the disc brake pads or the drum brake linings. Check the pad and the lining thickness carefully.

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.

Tire Rotation (Left-hand Drive Type)



SCHEDULED MAINTENANCE CHARTS (GASOLINE ENGINE)

Engine

MAINTENANCE ITEM \ MAINTENANCE INTERVAL		Kilometers or time in months, whichever comes first									
		x1,000 km	1	15	30	45	60	75	90	105	120
		Months	-	12	24	36	48	60	72	84	96
Drive belt			I	I	I	I	I	I	I	I	I
Engine oil & filter	(1) (3)		I	R	R	R	R	R	R	R	R
Cooling system hose & connections			I	I	I	I	I	I	I	I	I
Engine coolant	(3)		I	I	I	R	I	I	R	I	R
Fuel filter	(2)		-	-	-	-	R	-	-	-	R
Fuel line & connections			I	I	I	I	I	I	I	I	I
Air cleaner	(2)		-	I	I	I	R*	-	I	I	R*
Ignition timing			-	I	I	I	I	I	I	I	I
Spark plugs			-	-	R	-	R	-	R	-	R
Charcoal canister & vapor lines			-	-	-	I	-	-	I	-	-

Chart Symbols:

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

R - Replace or change.

* - Mileage (km) intervals only

(1) If vehicle is operated under severe condition : short distance driving, extensive idling or driving in dusty condition. Change engine oil and the filter every 7,500 km or 6 months, whichever comes first.

(2) More frequent maintenance is required if under dusty driving condition.

(3) Refer to “Recommended fluids and lubricants”.

Chassis and Body

MAINTENANCE ITEM \ MAINTENANCE INTERVAL		Kilometers or time in months, whichever comes first								
	x1,000 km	1	15	30	45	60	75	90	105	120
	Months	-	12	24	36	48	60	72	84	96
Exhaust pipes & mountings		-	I	I	I	I	I	I	I	I
Brake/Clutch fluid	(3)	-	I	R*	I	R*	I	R*	I	R*
Parking brake/Brake pads F & R	(4)	-	I	I	I	I	I	I	I	I
Brake line & connections (including booster)		I	I	I	I	I	I	I	I	I
Manual transmission oil	(3)	-	R	I	I	I	I	R	I	I
Clutch & brake pedal free play		-	I	I	I	I	I	I	I	I
Front & Rear Differential Fluid	(3)	-	I	R*	I	R*	I	R*	I	R*
Transfer case fluid	(3)	-	I	I	R	I	I	R	I	I
Automatic transmission fluid (BTRA M74)	(5)	-	I	I	I	I	I	I	I	I
Chassis & underbody bolts & nuts tight/secure	(6)	I	I	I	I	I	I	I	I	I
Tyre condition & inflation pressure		I	I	I	I	I	I	I	I	I
Wheel alignment	(7)	Inspect & ADJUST when abnormal condition is noted								
Steering wheel & linkage		-	I	I	I	I	I	I	I	I
Power steering fluid & lines	(3)	-	I	I	I	I	I	I	I	I
Drive shaft boots	(8)	I	I	I	I	I	I	I	I	I
Seat belts, buckles & anchors		I	I	I	I	I	I	I	I	I
Lubricate locks, hinges & bonnet latch		I	I	I	I	I	I	I	I	I
Wheel bearing grease		-	I	-	I	-	I	-	I	-
Propeller shaft grease - Front/Rear		-	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.

* - Mileage (km) intervals only

(3) Refer to “Recommended fluids and lubricants”.

(4) More frequent maintenance is required if under severe condition : short distance driving, extensive idling, frequent low - speed operation in stop-and-go traffic or driving in dusty condition.

(5) Change automatic transaxle fluid and filter every 75,000 km 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 mountainous terrain, or
- When doing frequent trailer towing, or
- Uses such as found in taxi, police or delivery service.

(6) After completion of off-road operation, the underbody of the vehicle should be thoroughly inspected. Examine threaded for looseness.

(7) If necessary, rotate and balance wheels.

(8) After completion of off-road operation, the drive shaft boots should be inspected.

(9) Inspect propeller shaft grease every 5,000 km or 3 month if the vehicle is mainly driven under severe conditions.
- In off-road or dusty road, or
- In hilly or mountainous terrain.

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 puling 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 is unusual sounds are noticed when turning or parking.

Headlight Aim

Take note of the light pattern occasionally. Adjust the headlights 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 (dip stick).
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 lower mark. 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 TWICE A MONTH

Tire And Wheel Inspection and Pressure Check

Check the tire 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. Refer to “Tire and Wheel” is in section 0B.

AT LEAST MONTHLY

Light Operation

Check the operation of the license plate light, the headlights (including the high beams), the parking lights, the fog lights, the taillight, the brake lights, the turn signals, the backup lights 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. A low fluid level can indicate worn disc brake pads which may need to be serviced. Check the breather hole in the reservoir cover to be free from dirt and check for an open passage.

Weather-Strip Lubrication

Apply a thin film silicone grease using a clean cloth.

EACH TIME THE OIL IS CHANGED

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, the parking brake, etc., at the same time. 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 line and the hoses for proper hookup, binding, leaks, cracks, 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 movements.

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 Belts 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.

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 (Change with filter)	3.2L DOHC	8.2 L	Quality class - API ; SH grade or above ACEA ; A2 or A3 MB sheet ; 229.1 Viscosity - MB sheet ; 224.1
	2.3L DOHC	7.5 L	
Engine Coolant	3.2L DOHC	11.3 L	ALUTEC P-78
	2.3L DOHC	10.5 L	
Automatic Transaxle Fluid		9 L	CASTROL TQ95
Mannal Transaxle Fluid		3.4 L	ATF DEXTRON II, III ATF S-2, S-3, S-4, TOTAL FIUID ATX
Transfer Case	Part Time	1.2 L	ATF DEXTRON II, III ATF S-2, S-3, S-4, TOTAL FIUID ATX
	Full Time	1.4 L	
Brake / Clutch Fluid		Approx. 0.5L level must be maintained between MAX & MIN level	DOT-3 & SAE J 1703
Power Steering System		1.0 L	ATF DEXRON-II
Parking Brake Cable		As required	Grease
Hood Latch Assembly		As required	Grease
Hood and Door Hinges Fuel Door Hinge Rear Compartment Lid Hinges		As required	Spray type grease
Weatherstrips		As required	Silicone grease

GENERAL DESCRIPTION AND SYSTEM 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 damaged and burning due to short-cir cuiting.
- 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 recommended essential and available tools where specified, are important for efficient and reliable performance of the service repairs.
- Use genuine SSANGYONG parts.
- Discard used cotter pins, gaskets, O-rings, oil seals, lock washers and self-locking nuts. Prepare new ones for installation. Normal function of these parts cannot be maintained if these parts are reused.
- Keep the disassembled parts neatly in groups to facilitate proper and smooth 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 completed, make a final check to be sure service was done properly and the problem was corrected.

VEHICLE IDENTIFICATION NUMBER SYSTEM

*** K P T L 4 B 1 9 S 1 P 000000 ***

12~17. Production Serial Number
: 000001- 999999

11. Plant Code
P : PyongTaek Plant

10. Model Year
1 : 2001
2 : 2002
3 : 2003
4 : 2004
5 : 2005

9. Check Digit
S : All area except North America

8. Engine Type
6 : 2295cc, In-line 4Cylinder, Gasoline (E23)
9 : 3199cc, In-line 6Cylinder, Gasoline (E32)
D : 2874cc, In-line 5Cylinder, Diesel (662LA)

7. Restraint System
1 : 3-Point Safety Belt, 2 : 2-Point Safety Belt

6. Trim Level
A : Standard, B : Deluxe, C : Super Deluxe

5. Body Type
0 : 5-Door
1 : 4-Door
2 : 3-Door
4 : 3-Door Soft Top

4. Line Models
E : Musso, LHD
F : Musso, RHD
L : Korando, LHD
R : Korando, RHD

3. Vehicle Type
T : Passenger Car, A : Truck

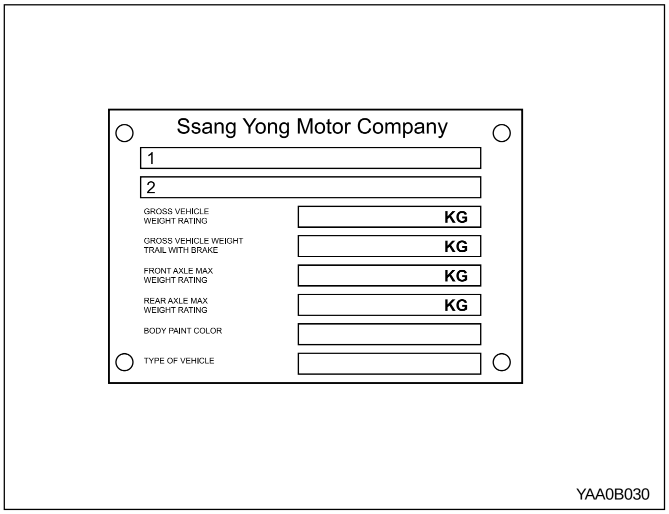
2. Maker Identification : P

1. Nation : K

*. Symbol according to No.

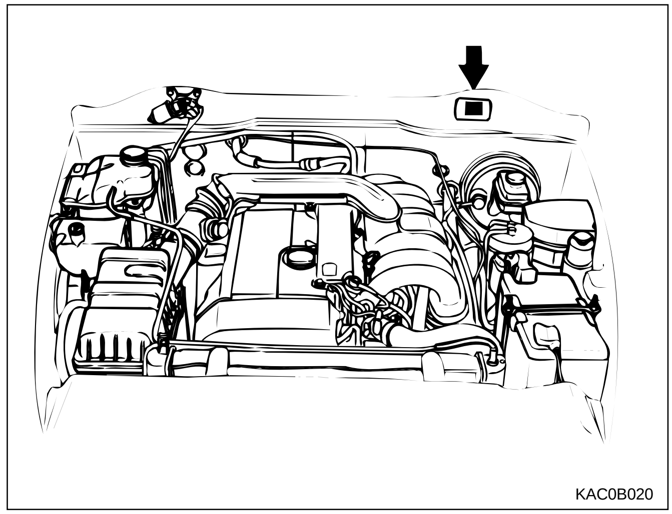
KAC0B010

Manufacturer' s Plate



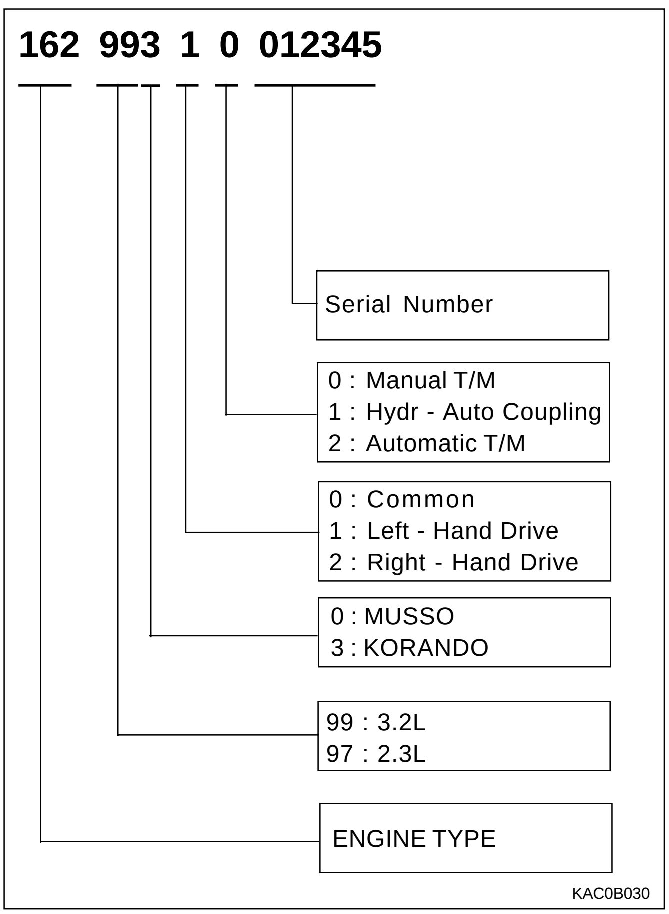
1 Type Approval No.
2 Vehicle Identification No.

Manufacturer' s Plate Location

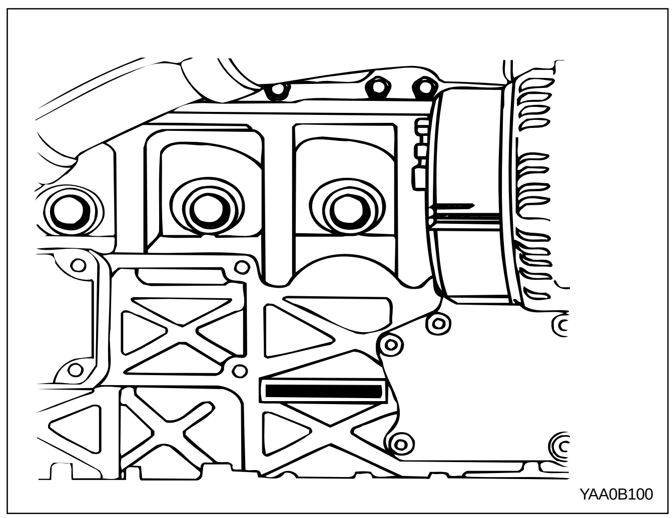


Gasoline Engine

Gasoline Engine Number

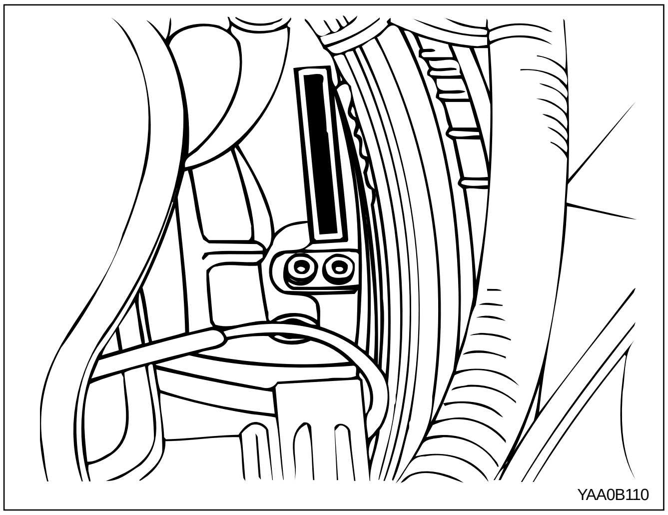


Engine Number Location



3.2L DOHC Gasoline Engine

The engine number is stamped on the lower rear side of the alternator.



2.3L DOHC Gasoline Engine

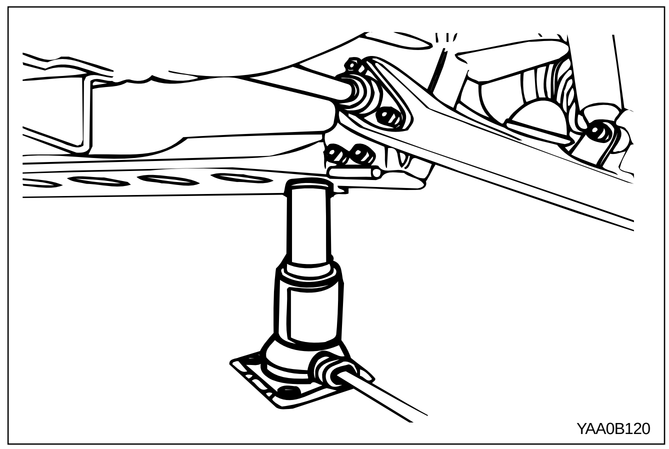
The engine number is stamped on the upper rear left-hand side of the cylinder block.

VEHICLE LIFTING PROCEDURES

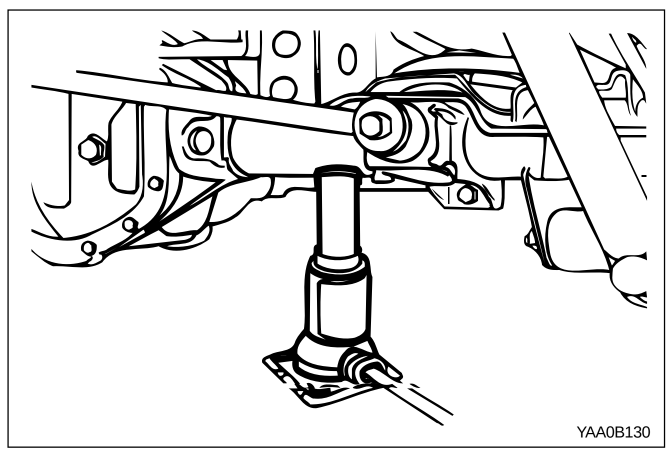
To raise the vehicle, place the lifting equipment only at the points indicated. Failure to use these precise positions may result in permanent vehicle body deformation.

Many dealer service facilities and service stations are equipped with automative 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 filter neck, the exhaust system, or the underbody.

Vehicle Lifting Points



Using Jack (Rearward of Front Tire)



Using Jack (Forward of Rear Tire)

ENGINE

CONTENTS

SECTION 1F

ENGINE CONTROLS

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

ENGINE AND ECM PROBLEM CHECK REPORT

VEHICLE AND CUSTOMER INFORMATION

Date Problem Occurred			
Customer Name		Vehicle Model	
Driver Name		VIN	
Purchase date		Engine Model	
License No.		Mileage	Km miles

MIL INFORMATION

Condition of MIL	☐ Remains on ☐ Sometimes illuminates ☐ Does not illuminate
DTC inspection (if available)	☐ Normal ☐ Malfunction code(s) (code) ☐ Freeze Frame data ( )

PROBLEM DESCRIPTION

☐ Engine Does Not Start	☐ No cranking ☐ No initial combustion ☐ No complete combustion
☐ Hard to Start	☐ Slow cranking ☐ Others
☐ Poor Idling	☐ Incorrect first Idle ☐ Abnormal idle rpm ☐ High (rpm) ☐ Low (rpm) ☐ Idling Unstable ☐ Others
☐ Poor Driveability	☐ Hesitation ☐ Back fire ☐ Muffler explosion (after-burning) ☐ Surging ☐ Knocking ☐ Poor performance ☐ Other
☐ Engine Stall	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C operation ☐ Shifting from N to D or D to N ☐ At full steering ☐ Others
☐ Others	

CONDITION WHEN PROBLEM OCCURS

Problem Frequency	☐ Constant ☐ Intermittent (times per day/month) ☐ Once only ☐ Others
Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Others
Ambient Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold (approx.____°F/____°C)
Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill ☐ Rough Road ☐ Others
Engine Temperature	☐ Cold ☐ Warming Up ☐ Before warming up ☐ After warm-up ☐ Any temp. ☐ Others
Engine Operation	☐ Starting ☐ Just after starting (min.) ☐ Idling ☐ Racing ☐ Driving ☐ Constant speed ☐ Acceleration ☐ Deceleration ☐ A/C switch ON/OFF ☐ Other

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 (2.3L DOHC: 2 - 3 or 1 - 4, 3.2L DOHC: 1 - 6 or 2 - 5 or 3 - 4). 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 (mass air flow sensor, manifold air pressure sensor).

Engine coolant temperature.

Intake air temperature.

Crankshaft position.

Engine speed (rpm).

ELECTRONIC IGNITION SYSTEM IGNITION COIL

The Electronic Ignition (EI) system ignition coil is located on the cylinder head cover. The double ended coils re ceive the signal for the ECM which controls the spark advance.

Each EI system ignition coil provides the high voltage to two spark plugs simultaneously;

2.3L DOHC

T1/1: cylinder 1 and 4

T1/2: cylinder 2 and 3

3.2L DOHC

T1/1: cylinder 2 and 5

T1/2: cylinder 3 and 4

T1/3: cylinder 1 and 6

The EI system ignition coil is not serviceable and must be replaced as an assembly.

CRANKSHAFT POSITION SENSOR

This Electronic Ignition (EI) system uses inductive or pick up type magnetic Crankshaft Position (CKP) sensor.

The CKP sensor is located in the opposite side of the crankshaft pulley and triggers the pick-up wheel teeth which is equipped 60 - 2 teeth with a gab of 2 teeth at 360-degree spacing. This sensor protrudes through its mount to within 1.1 ± 0.14 mm.

The output of the sensor is a sinusoidal signal. Each tooth of the pick-up 60 - 2 wheel generates a positive half wave. The ECM uses this sensor signal to generate timed ignition and injection pulses that it sends to the ignition coils and to the fuel injectors.

CAMSHAFT ACTUATOR

When the engine is running, the camshaft actuator rotates the intake camshaft hydraulically and mechanically relative to the camshaft sprocket by 32 ° crank angle to the “advanced” position and back to the “retard” position.

The camshaft actuator is actuated electro-mechanically by the ECM. The positioning time of apporx. 1 second is dependent on the engine oil pressure at the camshaft actuator and on the oil viscosity and oil temperature, respectively.

The camshaft indicator on the camshaft sprocket provides the camshaft rotational speed to the position sensor as an input parameter for the engine ignition control unit.

Operation Condition of Camshaft Actuator

Engine RPM	Camshaft position	Effect
Engine stop	Retard	-
0 - 1,500 rpm	Retard	Idle speed is improved Blow-by gas is decreased Valve overlap is decreased
1,500 - 4,300 rpm	Advanced	Torque is increased Fuel loss is decreased NOx is decreased
Above 4,300 rpm	Retard	Engine overrun is prohibited

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 "synchronized pulse" to trigger the injecors 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.

FUEL CONTROL SYSTEM OPERATION (2.3L DOHC)

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 and the two heated oxygen (O2S) sensors.

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 1 sensor is located in the exhaust manifold. The other O2S 2 sensor is located in the exhaust pipe after warm-up converter. 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 1 second. 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 -36 °C (-33 °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.

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 690 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 (22 °C).
- 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.

FUEL CONTROL SYSTEM OPERATION (3.2L DOHC)

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 Mass Air Flow (MAF) sensor and the four heated oxygen (O2S) sensors.

The MAF sensor monitors the mass flow of the air being drawn into the engine. An electrically heated element is mounted in the intake air stream, where it is cooled by the flow of incoming air. Engine Control Module (ECM) modulates the flow of heating current to maintain the temperature differential between the heated film and the intake air at a constant level. The amount of heating current required to maintain the temperature thus provides an index for the mass air flow. This concept automatically compensates for variations in air density, as this is one of the factors that determines the amount of warmth that the surrounding air absorbs from the heated element.

MAF sensor is located between the air filter and the throttle valve. Under high fuel demands, the MAF sensor reads a high mass flow condition, such as wide open throttle. The Engine Control Module (ECM) uses this information to enrich the mixture, thus increasing the fuel injector ontime, to provide the correct amount of fuel. When decelerating, the mass flow decreases. This mass flow change is sensed by the MAF sensor and read by the ECM, which then decreases the fuel injector on-time due to the low fuel demand conditions.

The two O2S sensor are located in the exhaust manifold. The other two O2S sensor are located in the exhaust pipe after warm-up converter. 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 1 second. 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 -36 °C (-33 °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.

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 690 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 MAF 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 (22 °C).
- 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 EVAP emission canister purge solenoid valve. This valve is Pulse Width Modulated (PWM) or turned ON and OFF several times a second. The EVAP emission canister purge PWM duty cycle varies according to operating conditions determined by mass airflow, engine coolant temperature, engine speed, vehicle speed, fuel trim, etc.

Poor idle, stalling, and poor driveability can be caused by the following conditions:

- An inoperative EVAP canister purge valve.
- A damaged canister.
- Hoses that are split, cracked, or not connected to the proper tubes.

EVAPORATIVE EMISSION CANISTER

The Evaporative Emission (EVAP) canister is an emission control device containing activated charcoal granules. The evaporative emission canister is used to store fuel vapors from the fuel tank. Once certain conditions are met, the Engine Control Module (ECM) activates the EVAP canister purge solenoid, allowing the fuel vapors to be drawn into the engine cylinders and burned.

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 blow-by 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 (2449.9 ± 159.1 at 20 °C [68 °F]) while high temperature causes low resistance (112.9 ± 7.2 at 120 °C [248 °F]).

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) P0116, P0117 or P0118. Remember, these DTCs 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 VALVE ACTUATOR

The throttle actuator is actuated by the ECM according to the position of the accelerator pedal position.

It has two potentiometers which signal the position of the throttle valve to the ECM to enable it to recognize the various engine load states.

Ignition “Off”

In the de-energized states the throttle valve position is determined to be spring capsule.

Ignition "On"

When the ignition S/W on the servo motor in the throttle actuator is operated by the ECM. The throttle valve adopts a position in line with the coolant temperature.

Closed position

In the closed throttle position, the servo motor controls engine speed by operating the throttle valve further (greater mixture) or closing it further (reduced mixture), depending on coolant temperature and engine load.

When this is done, the throttle valve can be closed further by the servo motor overcoming the force of the spring capsule (mechanical end stop). If the actuator is de-energized, the throttle valve is resting against the spring capsule.

Consequently, the throttle valve opening is a constant 10 - 12 ° approximately.

At no load, this produces an engine speed of about 1800rpm

Driving

When driving (part/full throttle), the servo motor controls the throttle valve in line with the various load states and according to the input signals from the pedal value sensor according to the input signals from the pedal value sensor according to the position of the accelerator pedal.

The function of the EA (electronic accelerator) in the ECM determines the opening angle of the throttle valve through the throttle actuator. Further functions are;

- Idle speed control
- Cruise control
- Reducing engine torque for ASR/ABS operation
- Electronic accelerator emergency running
- Storing faults
- Data transfer through CAN

RESONANCE FLAP (3.2L DOHC)

A pneumatically actuated resonance flap is located on the intake manifold. This effect is a kind of variable intake system for turbo-charging in accordance with resonance oscillation. The will be controlled by ECM according to the throttle angle (position) and engine speed (rpm).

Resonance flap closed

(at idle/partial load : less than about 3,800 rpm) The switch valve will be adjusted by ECM and resonance flap will be closed. By increasing air flow passage through dividing intake air flow toward both air collection housing. This leads to a significant increase in the torque in the lower speed range.

Resonance flap open

(at full load : over about 3,800 rpm)

This switch valve will be adjusted by ECM and resonance flap will be opened. When this flap is open, the collected air volume in resonance tube is not divided.

The cylinder on the intake stroke uses the air in both intake lines of the resonance intake manifold.

ACCELERATOR PEDAL POSITION SENSOR

The Accelerator Pedal Position (APP) sensor consists of two potentiometers and is connected to the accelerator pedal. The APP sensor electrical circuit consists of two 5-volt supply lines and two ground lines, both provided by the Engine Control Module (ECM). The ECM calculates the accelerator pedal position by monitoring the voltages on these signal lines. The APP sensor output changes as the accelerator pedal is moved.

The outputs of the APP sensor 1 and sensor 2 are low, about 0.5 volt and 0.3 volt respectively at the closed throttle position. As pushing the accelerator pedal, the output increases so that the output voltages will be about 4.5 volts and 2.3 volts individually when accelerating fully with the kickdown, at Wide Open Throttle (WOT).

The ECM can determine fuel delivery based on APP signal (driver demand). A broken or loose APP 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 APP sensor circuits should set a Diagnostic Trouble Codes (DTCs) P0220. Once the DTC is set, the ECM will substitute a default value for the APP sensor and some vehicle performance will return.

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 two heated O2 sensors (2.3L DOHC); O2 Bank 1 Sensor 1 and O2 Bank 1 Sensor 2 or four heated O2 sensors (3.2L DOHC); O2 Bank 1 Sensor 1, O2 Bank 1 Sensor 2, O2 Bank 2 Sensor 3 and O2 Bank 2 Sensor 4. 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. In example if the catalyst is operating efficiently, the O2 Bank 1 Sensor 1 sensor signals will be more active than the signals produced by the O2 Bank 1 Sensor 2 sensor. The O2 sensors' main function is cata-lyst 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 O2 Sensor circuit will set several DTCs as DTC P0131, P0132, P0133, P0134 or P0135 depending on the special condition.

A fault in the heating circuit of oxygen sensor will result in lower oxygen sensor response. This may cause incorrect catalyst monitor diagnostic results.

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 (39.260 ohms at -40 °C [-40 °F]), while high temperature causes a low resistance (130 ohms at 130 °C [266 °F]).

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 P0111, P0112 or P0113.

HOT FILM MASS AIR FLOW METER (3.2L DOHC)

The Hot Film Mass air flow meter (HFM) with recognition of flow direction related to pulsating flow is designed for recording load on ECM by measuring the output voltage proportional to the reference voltage of the ECM.

HFM is a thermal flow meter whose sensor element with its temperature sensors and heating area is ex-posed to the mass air flow to be measured. A heating area located in the center of a thin membrane is con-trolled to an over-temperature by a heating resistor and a temperature sensor of this membrane. And the value of over-temperature depends on the temperature of the in-flowing air.

Two temperature sensors on upstream and downstream of the heating area show the same temperature without incoming flow. With incoming flow, upstream part is cooled down but downstream temperature retains its temperature more or less due to the air heated up in the heating area. This temperature difference in quantity and direction depends on the direction of the incoming flow.

Engine Control Module (ECM) modulates the flow of heating current to maintain the temperature differential between the heated film and the intake air at a constant level. The amount of heating current required to maintain the temperature thus provides an index for the mass air flow. This concept automatically compensates for variations in air density, as this is one of the factors that determines the amount of warmth that the surrounding air absorbs from the heated element. MAF sensor is located between the air filter and the throttle valve.

Under high fuel demands, the MAF sensor reads a high mass flow 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 mass flow decreases. This mass flow change is sensed by the MAF sensor and read by the ECM, which then decreases the fuel injector on-time due to the low fuel demand conditions.

A failure in the MAF sensor circuit sets a diagnostic trouble codes P0101, P0102 or P0103.

To facilitate the installation of the HFM in the intake passage, lubricating agents may be used. However, when lubricants are used care must be taken to ensure that they do not enter the flow passage and cannot be sucked in with the air flow.

The following tables show the relationship between MAF and output voltage.

Air mass flow (kg/h)	Voltage (V)
0	0.95 – 1.05
10	1.28
15	1.41
30	1.71
60	2.16
120	2.76
250	3.51
370	3.93
480	4.23
640	4.56
800	4.82

MANIFOLD ABSOLUTE PRESSURE SENSOR (2.3L DOHC)

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 P0105, P0107, P0108.

ENGINE CONTROL MODULE

The Engine Control Module (ECM), located inside the right side kick panel, 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.

Engine RPM and air mass are used to measure the air intake quantity resulting in fuel injection metering.

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 resistances 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 M ohm input impedance to get accurate voltage readings. The ECM controls output circuits such as the ignition coils, the fuel injectors, the fuel pump relay, the intake manifold resonance flap (3.2L DOHC), the camshaft actuator, fuel tank shut off solenoid, Malfunction Indicator lamp (MIL), or the A/C clutch relay, etc., by controlling the ground circuit through transistors or a device called a "quad-driver".

FUEL INJECTOR

The Multipoint Fuel Injection (MFI) assembly is a solenoid-operated device controlled by the Engine Control Module (ECM) that meters pressurized fuel to an each individual cylinder. The injector sprays the fuel, in precise quantities at a point in time determined by the ECM, directly toward the cylinder intake valve. ECM energizes the fuel injector solenoid to lift the needle valve and to flow the fuel through the orifice. This injector's discharge orifice is calibrated to meet the effective fuel atomization necessary for both ensuring the maximum homogeneity in the air-fuel mixture and holding the condensation along the walls of the intake tract to a minimum.

Fuel enters the top feed injector from above and flows through its vertical axis. The lower end extends into the intake valve. 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 two knock sensors are mounted in the engine block near the cylinders. The sensors produce an output voltage which increases with the severity of the knock.

This signal is sent to the Engine Control Module (ECM) via a shielded cable. The ECM then adjusts the ignition timing to reduce the spark knock.

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 op-eration 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 complaint.

When the complaint 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 been resolved under the following conditions:

- Conditions noted by the customer.
- If a DTC was diagnosed, verify a repair by duplicating conditions present when the DTC was set as noted in the 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 or B 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 Euro On-Board Diagnostic (EOBD) experience in the 2001 model years, this list of non-vehicle faults that could affect the performance of the 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 and light-duty truck market in 2000, 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 Reid 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 Reid Vapor Pressure could show up as a Fuel Trim DTC due to excessive canister loading. High vapor pressures generated in the fuel tank can also affect the Evaporative Emission diagnostic.

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. Aftermarket electronics, such as cellular phones, stereos, and antitheft 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 custom-er 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 “KWP2000” 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 KWP2000 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)

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 Mass Air Flow (MAF) 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.
- Mass Air Flow (MAF) sensor or Manifold Absolute Pressure (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:

- Control module controlled Evaporative Emission (EVAP) Canister Purge Valve.
- A/C relays.
- Cooling fan relay.
- 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.

Intrusive Diagnostic Tests

This is any 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 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 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)
- Fuel Trim
- Evaporative Emission
- 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)
- Mass Air Flow (MAF) or Manifold Absolute Pressure (MAP)
- Intake Air Temperature (IAT)
- Throttle Position (TP)
- Canister Purge Valve Status
- 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 two 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).

Important: Only four 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.

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.

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 on-board memory data, such as preset radio tuning.)

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:

- Slow response.
- Response time (time to switch Rich/Lean or Lean/Rich).
- Inactive signal (output steady at bias voltage approximately 450 mv).
- Signal fixed high.
- Signal fixed low.
- Heater performance (time to activity on cold start).
- 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 de-celeration mode (deceleration when a lean mixture should be indicated).

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 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.

ECM compensates about rough road without any additional sensor. It means that ECM could distinguish the actual misfire or rough road variation.

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 Cur #1-6) 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 Hist #1-6) 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 cylinder number 1 misfired, look for a circuit or component related to cylinders number 1.

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 longterm 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 Evaporative Emission (EVAP) 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 O2S 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 O2S DTC may set). Use a scan tool to observe fuel trim counts while the problem is occurring.

DIAGNOSTIC INFORMATION AND PROCEDURE

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 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, refer to the applicable DTC tables.

Intermittent Malfunction Indicator Lamp (MIL)

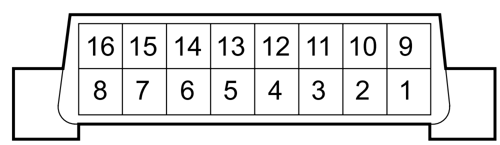
An intermittent Malfunction Indicator Lamp (MIL) with no DTC present may be caused by the following:

- 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:

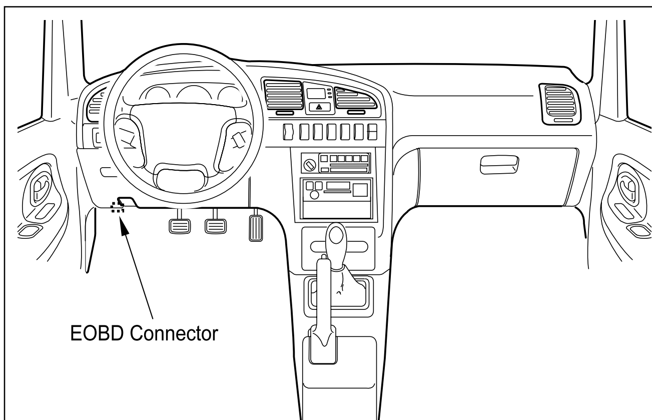
- Do they always buy from the same source? If so, fuel quality problems can usually be discounted.
- Do they buy their fuel from whichever fuel station that is advertising the lowest price? If so, check the fuel tank for signs of debris, water, or other contamination.



Date Link Connector (DLC)

1. ECS
2. IGNITION FEED
3. REKES
4. CHASSIS GROUND
5. ELECTRONICS GROUND
6. STICS
7. K-LINE-ECM
8. ABS 5.3 & ABD 5.3
9. AIR BAG
10.
11.
12. 4WD CHECK (CLUSTER)
13. K-LINE-TOD-TENTATIVELY
14. K-LINE-TCM-TENTATIVELY
15.
16. BATTERY POSITIVE

KAA1F0UA



YAB1F050

Process of Flywheel Backlash Compensation for Misfire Detection

When an ECM is reflashed, initialized or replaced, and driveplate of flywheel has been replaced, follow these procedures to relearn the Crankshaft Position (CKP) system variation:

Caution: To avoid personal injury when performing the flywheel adaptation procedure, always set the vehicle parking brake and block the drive wheels. Release the throttle immediately when the engine starts to decelerate. Once the learning procedure is completed, engine control will be learned to the operator, and the engine will respond to the throttle position.

STEP 1 : Initialization ECM to delete all adaptation values.

STEP 2 : Build-up following adaptation values.

- Oxygen sensor adaptation values.
- Idle controller adaptation values.

STEP 3 : Acceleation the vehicle in gear position 3 up to 5500 rpm.

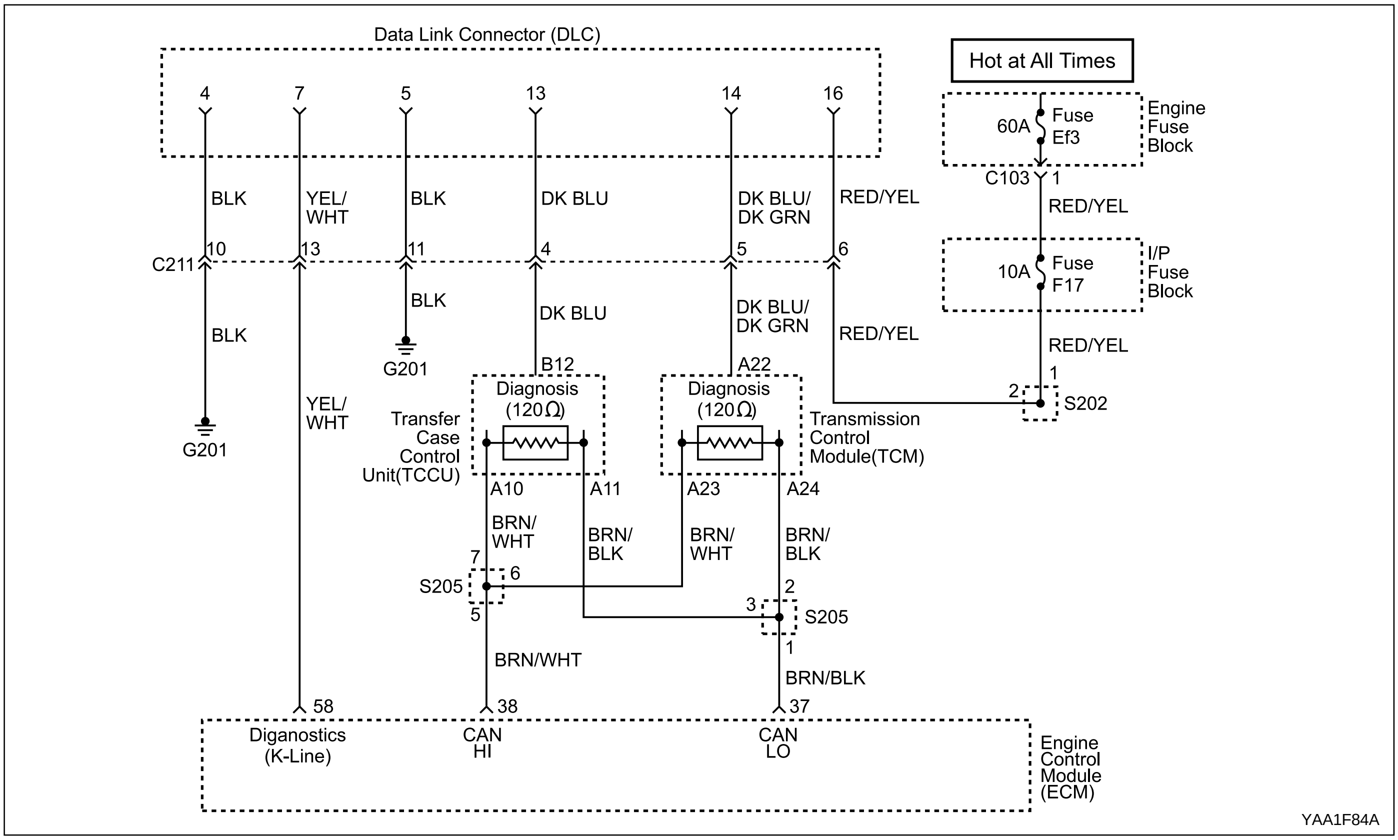
Caution : During this time, do not acceleration or Brake.

STEP 5 : Check the compensation status through scan tool.

STEP 6 : Fulfill this procedure again if not this value is "0".

Parameter	Unit	Value	
Disable Condition for Flywheel Adaptation	1=YES / 0=NO	0	Learning
		1	Symptom 17, 18, 20 (engine speed fault)
		2	Compensation process is in preparation
		3	Engine speed of gradient is too high, or Brake is in use
		4	Engine speed is too high or to low
		5	No Decel. Fuel Shut Off, No Fuel Cut

BLANK



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.

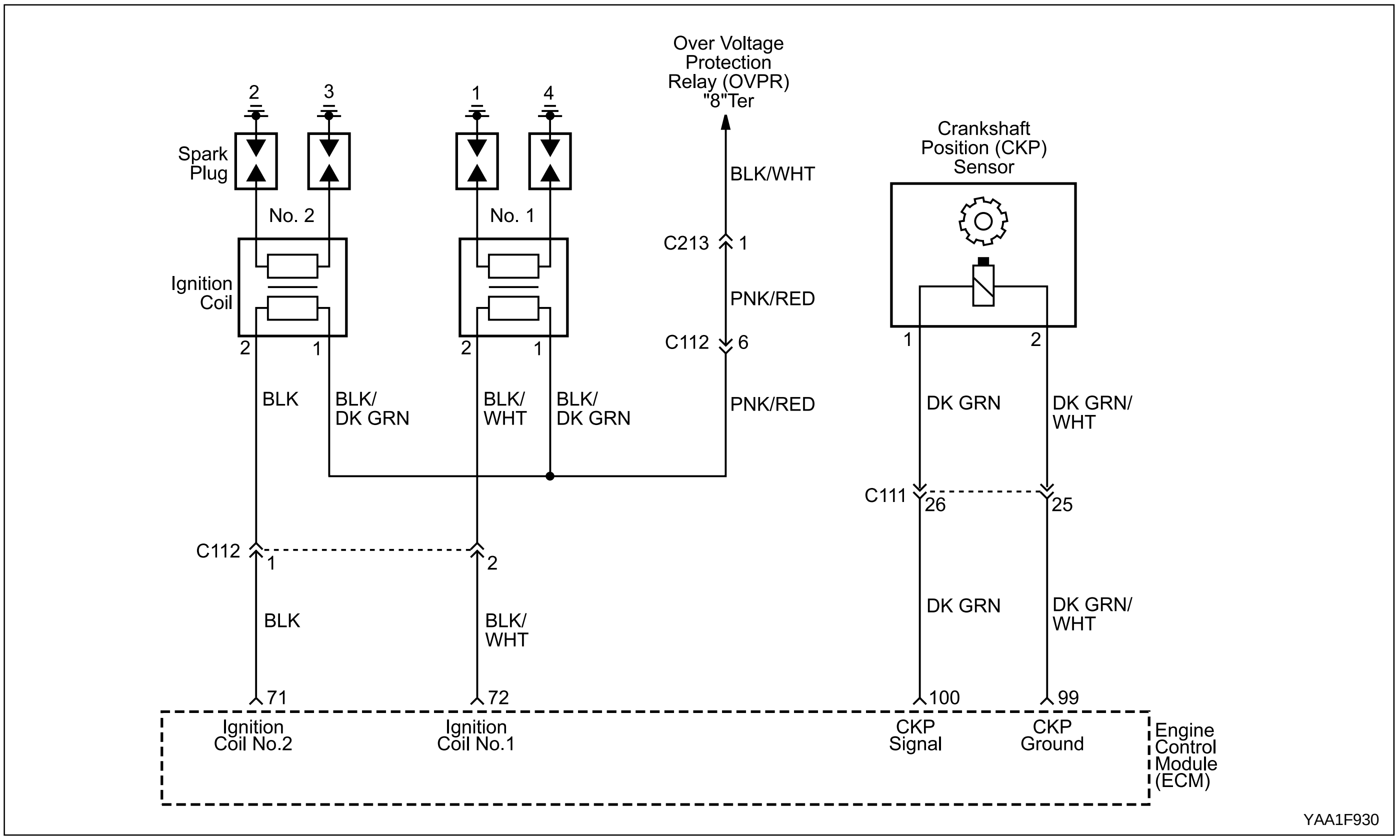
Test Description

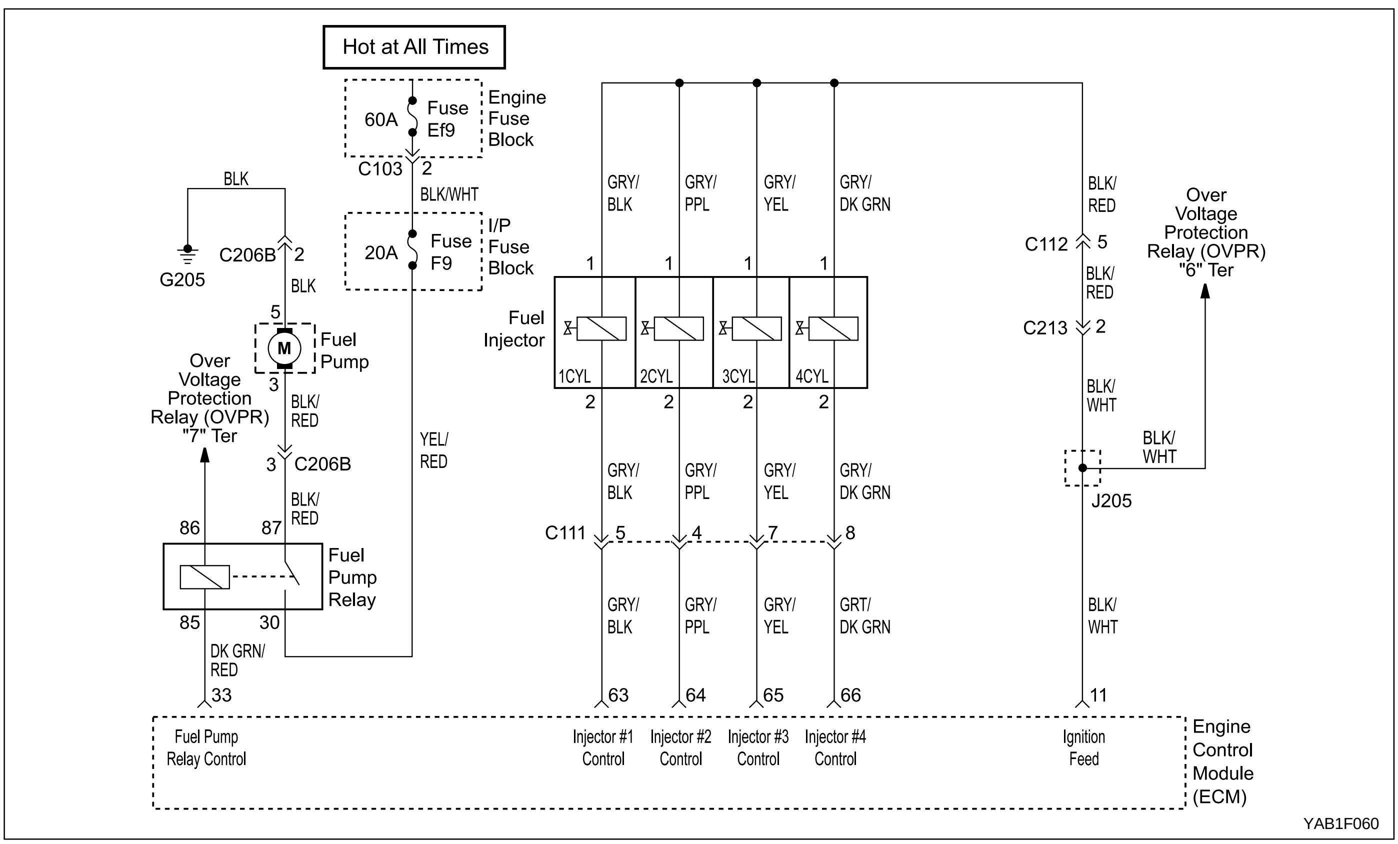
Number(s) below refer to the step(s) number on the diagnostic table.

1. The Malfunction Indicator Lamp (MIL) should be on steady with the ignition ON and the engine OFF. If not, go to “DTC P0650-225”.
2. Checks the serial data circuit and ensures that the ECM is able to transmit serial data.
3. This test ensures that the ECM is capable of controlling the MIL, and the MIL driver circuit is not shorted to ground.
4. If the engine will not start, refer to “Engine Cranks But Will Not Run” in this section.
8. This vehicle is equipped with an ECM, which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). The replacement ECM must be reprogrammed. Refer to the latest Techline proce-dure for ECM reprogramming.

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 “DTC P0650-225”
2	1. Turn the ignition OFF. 2. Install the scan tool. 3. Turn the ignition ON, with the engine OFF. 4. Attempt to display the Engine Control Module (ECM) data with the scan tool. Does the scan tool display ECM data?	-	Go to Step 3	Go to Step 6
3	1. Using the scan tool output test function, select MIL lamp control and command the MIL OFF. 2. Observe the MIL. Does the MIL turn OFF?	-	Go to Step 4	Go to “DTC P0650-224”
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 “TROUBLE CODE” with the scan tool. Are any Diagnostic Trouble Codes (DTCs) stored?	-	Go to applicable DTC table	Go to Step 6
6	1. Turn the ignition OFF. 2. Disconnect the ECM. 3. Turn the ignition ON, with the engine OFF. 4. 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 the DLC ground circuits for an open. Is a problem found?	-	Go to Step 7	Go to Step 8
7	Repair the open, short to ground, or short to voltage in the serial data circuit or the DLC ignition feed circuit or DLC ground circuits. Is the repair complete?	-	System OK	-
8	1. Attempt to reprogram the ECM. 2. Attempt to display the ECM data with the scan tool. Does the scan tool display ECM data?	-	Go to Step 3	Go to Step 9
9	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	-	System OK	-


Over Voltage Protection Relay (OVPR) "8"Ter
2
3
1
4
Spark Plug
No. 2
No. 1
Ignition Coil
BLK/WHT
C213 1
PNK/RED
C112 6
PNK/RED
Crankshaft Position (CKP) Sensor
BLK
BLK/ DK GRN
BLK/ WHT
BLK/ DK GRN
DK GRN
DK GRN/ WHT
C111 26
25
C112 1
2
BLK
BLK/ WHT
DK GRN
DK GRN/ WHT
71
72
100
99
Ignition Coil No.2
Ignition Coil No.1
CKP Signal
CKP Ground
Engine Control Module (ECM)
YAA1F930


Hot at All Times
60A
Fuse Ef9
Engine Fuse Block
C103 2
BLK/WHT
20A
Fuse F9
I/P Fuse Block
BLK
G205
C206B 2
BLK
5
Fuel Pump
3
Over Voltage Protection Relay (OVPR) "7" Ter
BLK/ RED
3 C206B
BLK/ RED
YEL/ RED
86
87
Fuel Pump Relay
85
30
DK GRN/ RED
33
GRY/ BLK
GRY/ PPL
GRY/ YEL
GRY/ DK GRN
Fuel Injector
1CYL
2CYL
3CYL
4CYL
C111 5
4
7
8
GRT/ DK GRN
63
64
65
66
BLK/ RED
C112 5
C213 2
BLK/ WHT
J205
Over Voltage Protection Relay (OVPR) "6" Ter
11
Fuel Pump Relay Control
Injector #1 Control
Injector #2 Control
Injector #3 Control
Injector #4 Control
Ignition Feed
Engine Control Module (ECM)
YAB1F060

ENGINE CRANK BUT WILL NOT RUN (2.3L DOHC)

Test Description

The number(s) below refer to specific step(s) on diagnostictable.

3. By performing a compression test, it can be determined if the engine has the mechanical ability to run.
9. It is important to check for the presence of spark from all of the ignition wires. If spark is presence from one to three of the ignition coil terminals, the Crankshaft Position (CKP) sensor is OK.
31. The replacement ECM must be reprogrammed. Refer to the latest Techline information for reprogramming procedure.
33. This step checks for proper operation of the Engine Control Model's (ECM's) control of the fuel pump circuit.
52. This step checks for a ground signal being suppliedby the ECM to operate the fuel injectors. If there isno ground present during the cranking of the engine, and the fuel injector wiring is OK, the ECM is at fault.

Engine Crank But Will Not Run (2.3L DOHC)

Caution: 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 possible fire or personal injury.

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 "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?	600 kPa (87 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 the 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 32	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 wires. Is spark present from all of the ignition wires?	1.8 - 2.2 KΩ	Go to Step 2	Go to Step 11

Engine Crank But Will Not Run (2.3L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition OFF. 2. Disconnect the Crankshaft Position (CKP) sensor connector. 3. Turn the ignition ON. 4. Measure the resistance between the CKP sensor terminal 1 and 2. Does the voltage measure near the value specified?	1,090 ± 164 kΩ	Go to Step 12	Go to Step 17
12	Measure the voltage between the CKP sensor connector terminal 1 and ground. Does the voltage measure near the value specified?	0 v	Go to Step 13	Go to Step 14
13	Measure the voltage between the CKP sensor connector terminal 2 and ground. Does the voltage measure near the value specified?	0 v	Go to Step 18	Go to Step 15
14	Check for an open or short in the wire between the CKP sensor connector terminal 1 and the Engine Control Module (ECM) connector terminal 100.	-	Go to Step 16	Go to Step 31
15	Check for an open or short in the wire between the CKP sensor connector terminal 2 and the ECM connector terminal 99.	-	Go to Step 16	Go to Step 31
16	Repair the wiring as needed. Is the repair complete?	-	Go to Step 2	-
17	1. Turn the ignition OFF. 2. Replace the CKP sensor. Is the repair complete?	-	Go to Step 2	-
18	1. Turn the ignition OFF. 2. Disconnect the ignition coil No. 1. 3. Connect a test light between terminal 1 of the ignition coil No. 1 connector and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to Step 19	Go to Step 24
19	Check for open or short in the wire between ignition coil No. 1 connector terminal 2 and ECM connector terminal 72 and repair as necessary. Is the repair complete?	-	Go to Step 2	Go to Step 20
20	1. Turn the ignition OFF. 2. Disconnect the fuel injector harness connectors 3. Install a spark tester on cylinder #1 spark plug. 4. Crank the engine and check for spark. 5. Repeat the above procedure on cylinder #4. Is a spark observed on two spark plug cables?	-	Go to Step 25	Go to Step 21
21	Measure the resistance of the spark plug cable that the spark plug tester did not spark. Is the resistance of the spark plug cable between the special value?	1.8 - 2.2 kΩ	Go to Step 22	Go to Step 23
22	1. Turn the ignition OFF. 2. Replace ignition coil No. 1. Is the repair complete?	-	Go to Step 2	-
23	Replace the spark plug cable Is the repair complete?	-	Go to Step 2	-

Engine Crank But Will Not Run (2.3L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
24	Check for a short circuit or open in the wire between ignition coil No. 1 terminal 1 and Over Voltage Protection Relay (OVPR) connector terminal 8 and repair as necessary. Is the repair complete?	-	Go to Step 2	Go to "OVPR Circuit Check"
25	1. Turn the ignition OFF. 2. Disconnect the ignition coil No. 2. 3. Connect a test light between terminal 1 of the ignition coil No. 2 connector and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to Step 26	Go to Step 30
26	Check for open or short in the wire between ignition coil No. 2 connector terminal 2 and ECM connector terminal 71 and repair as necessary. Is the repair complete?	-	Go to Step 2	Go to Step 27
27	1. Turn the ignition OFF. 2. Disconnect the fuel injector harness connectors. 3. Install a spark tester on cylinder #2 spark plug. 4. Crank the engine and check for spark. 5. Repeat the above procedure on cylinder #3. Is a spark observed on two spark plug cables?	-	Go to Step 2	Go to Step 28
28	Measure the resistance of the spark plug cable that the spark plug tester did not spark. Is the resistance of the spark plug cable between the special value?	1.8 - 2.2 KΩ	Go to Step 29	Go to Step 23
29	1. Turn the ignition OFF. 2. Replace ignition coil No. 2. Is the repair complete?	-	Go to Step 2	-
30	Check for a short circuit or open in the wire between ignition coil No. 2 terminal 1 and Over Voltage Protection Relay (OVPR) connector terminal 8 and repair as necessary. Is the repair complete?	-	Go to Step 2	Go to "OVPR Circuit Check"
31	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 2	-
32	1. Turn the ignition OFF. 2. Connect a fuel pressure gauge. 3. Crank the engine. Is any fuel pressure present?	-	Go to Step 41	Go to Step 33
33	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the fuel pump. 3. Connect a test light between the fuel pump connector terminals 5 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?	1 sec	Go to Step 34	Go to Step 44

Engine Crank But Will Not Run (2.3L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
34	Replace the fuel pump. Is the repair complete?	-	Go to Step 2	-
35	Is the fuel pressure within the value specified?	230 - 380 kPa (46 - 55 psi)	Go to Step 39	Go to Step 36
36	1. Check the fuel filter for a restriction. 2. Inspect the fuel lines for kinks and restrictions. Is the problem found?	-	Go to Step 37	Go to Step 38
37	1. Replace the fuel filter and/or the fuel lines as needed. 2. Connect a fuel pressure gauge. 3. Crank the engine. Is the fuel pressure within the value specified?	230 - 380 kPa (46 - 55 psi)	Go to Step 2	Go to Step 38
38	1. Disconnect the 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 pressure of fuel. Is any fuel present?	-	Go to Step 41	Go to Step 42
39	Check the fuel for contamination. Is the fuel contamination?	-	Go to Step 40	Go to Step 55
40	1. Remove the contaminated fuel from the fuel tank. 2. Clean the fuel tank as needed. Is the repair complete?	-	Go to Step 2	-
41	Replace the fuel pressure regulator. Is the repair complete?	-	Go to Step 2	-
42	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 a restriction. Is the problem found?	-	Go to Step 43	Go to Step 34
43	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	-
44	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the fuel pump. 3. Connect a test light between the fuel pump connector terminal 3 and a known good ground. 4. Turn the ignition ON. 5. With the ignition ON, the test light should light for the time specified. Is the test light on?	1 sec	Go to Step 45	Go to Step 46
45	Repair the open wire between the fuel pump connector terminal 5 and ground. Is the repair complete?	-	Go to Step 2	-
46	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 86 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to Step 47	Go to Step 51

Engine Crank But Will Not Run (2.3L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
47	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 85 and battery positive. 3. Turn the ignition ON. 4. With the ignition ON, the test light should light for the time specified. Is the test light on?	1 sec	Go to Step 48	Go to Step 52
48	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 49	Go to Step 54
49	Check for open between the fuel pump relay connector terminal 87 and fuel pump connector terminal 3 and repair as necessary. Is the repair complete?	-	Go to Step 2	Go to Step 50
50	Replace the fuel pump relay. Is the repair complete?	-	Go to Step 2	-
51	Check for an open or short to voltage in the circuit between the fuel pump relay terminal 86 and OVPR circuit terminal 7. Is a problem found and corrected?	-	Go to Step 2	Go to "OVPR Circuit Check"
52	Check the wire between the fuel pump relay connector terminal 85 and the ECM connector terminal 33 for an open. Is the problem found?	-	Go to Step 53	Go to Step 31
53	Repair the wire between the fuel pump relay connector terminal 85 to the ECM connector terminal 33. Is the repair complete?	-	Go to Step 2	-
54	Repair the wire between the fuel pump relay connector terminal 30 and the battery. Is the repair complete?	-	Go to Step 2	-
55	1. Turn the ignition OFF. 2. Disconnect the fuel injector harness connectors from all of the fuel injectors. 3. Turn the ignition ON. 4. Connect a test light between the fuel injector harness connector 1 and ground. 5. Repeat step 4 for each of the remaining fuel injectors. Is the test light on at all of the fuel injectors?	-	Go to Step 56	Go to Step 59
56	1. Turn the ignition OFF. 2. Connect a test light between the fuel injector harness connector terminal 2 and battery positive. 3. Crank the engine. 4. Repeat steps 2 and 3 for each of the remaining fuel injectors. Does the test light flash for all of the fuel injectors?	-	Go to Step 57	Go to Step 60

Engine Crank But Will Not Run (2.3L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
57	Measure the resistance of each fuel injector. Is the resistance within the value specified (the resistance will increase slightly at higher temperatures)?	14 - 17 KΩ	System OK	Go to Step 58
58	Replace any of the fuel injectors with a resistance out of specification. Is the repair complete?	-	Go to Step 2	-
59	Check for open or short in the wire between fuel injector harness connector terminal 1 from all of the fuel injectors and OVPR connector terminal 6 and repair as necessary. Is the repair complete?	-	Go to Step 2	Go to "OVPR Circuit Check"
60	1. Check for an open between the fuel injector 1 harness connector terminal 2 and the ECM connector terminal 63. 2. Check for an open between the fuel injector 2 harness connector terminal 2 and the ECM connector terminal 64. 3. Check for an open between the fuel injector 3 harness connector terminal 2 and the ECM connector terminal 65. 4. Check for an open between the fuel injector 4 harness connector terminal 2 and the ECM connector terminal 66. Is the problem found?	-	Go to Step 61	Go to Step 31
61	Repair the open fuel injector harness wire(s) Is the repair complete?	-	Go to Step 2	-

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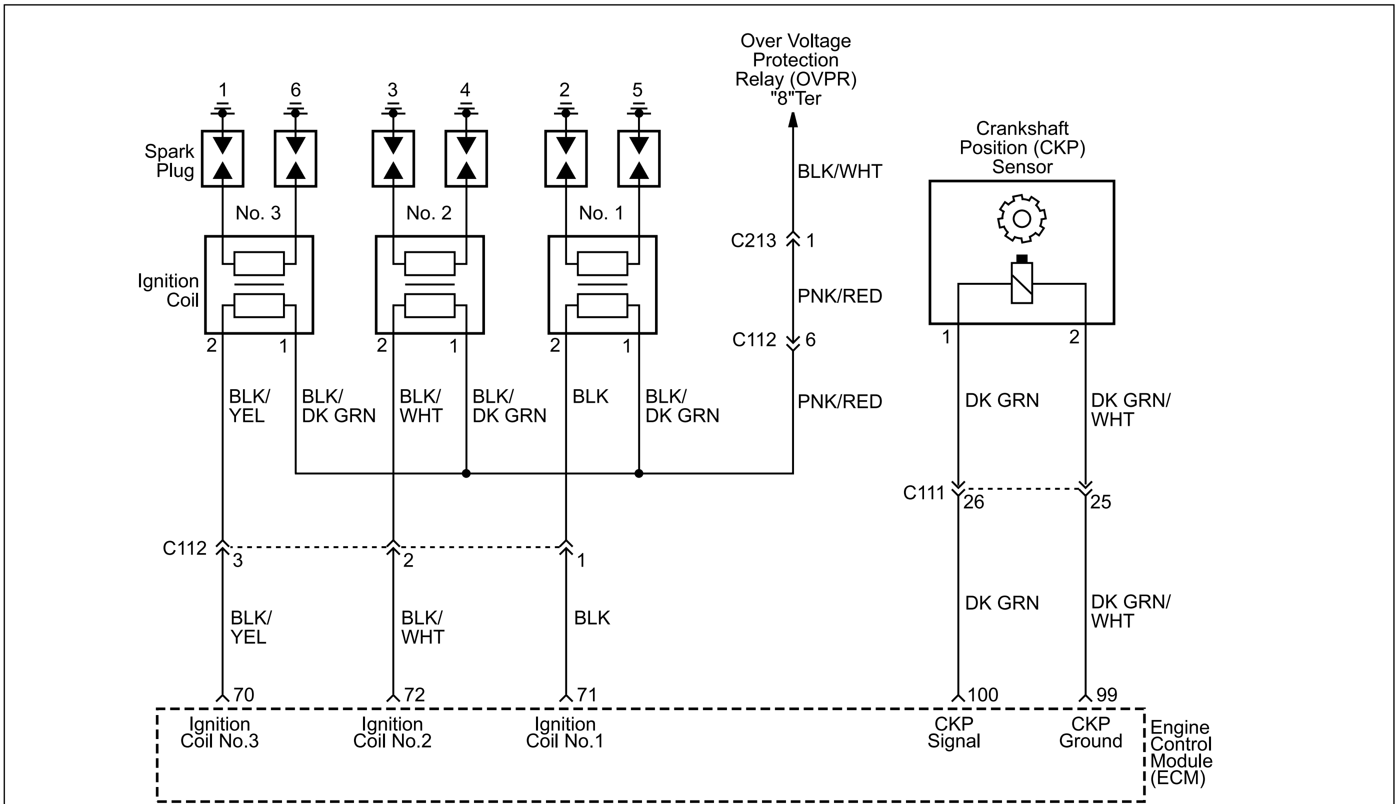

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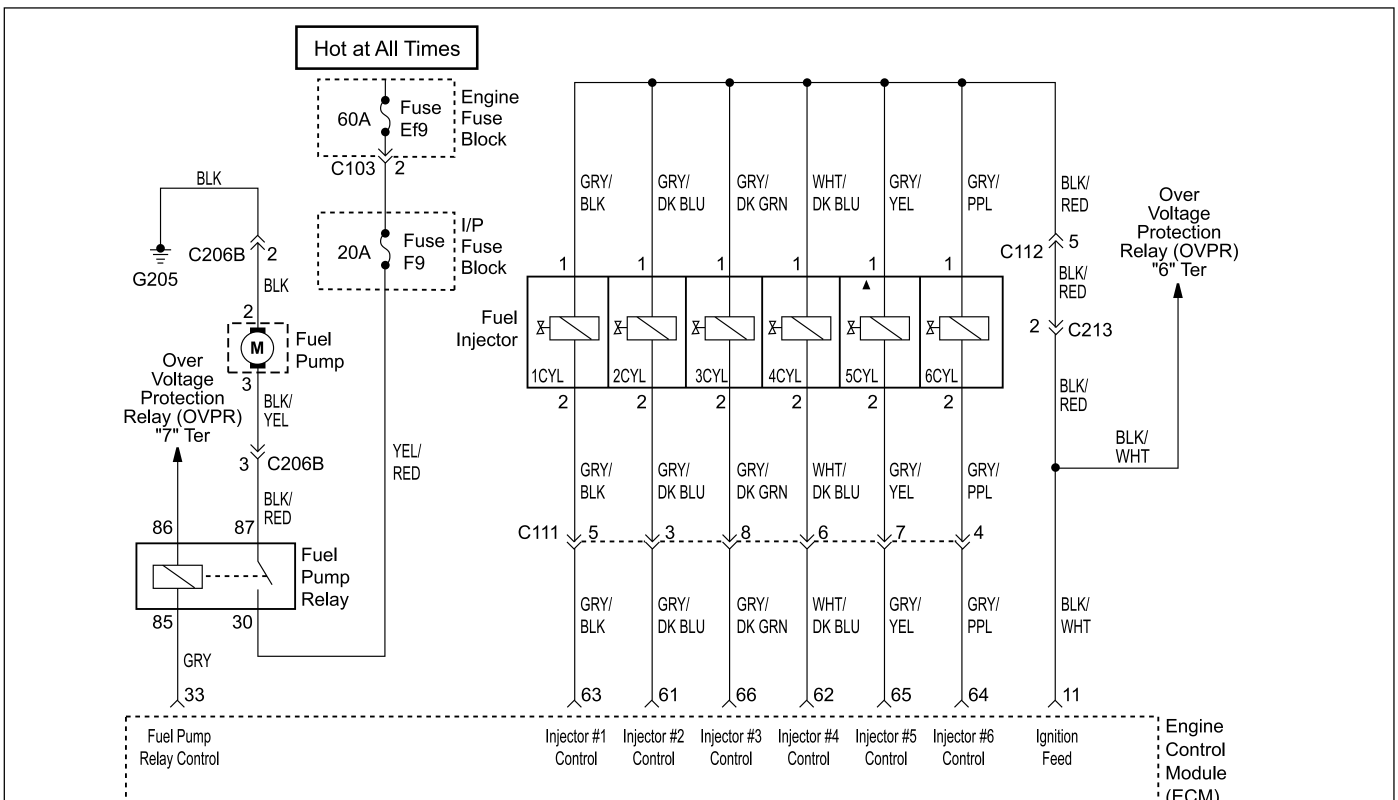

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ENGINE CRANK BUT WILL NOT RUN (3.2L DOHC)

Test Description

The number(s) below refer to specific step(s) on diagnostictable.

3. By performing a compression test, it can be determined if the engine has the mechanical ability to run.
9. It is important to check for the presence of spark from all of the ignition wires. If spark is presence from one to three of the ignition coil terminals, the Crankshaft Position (CKP) sensor is OK.
37. The replacement ECM must be reprogrammed. Refer to the latest Techline information for reprogramming procedure.
39. This step checks for proper operation of the Engine Control Model's (ECM's) control of the fuel pump cir-cuit.
58. This step checks for a ground signal being suppliedby the ECM to operate the fuel injectors. If there isno ground present during the cranking of the engine, and the fuel injector wiring is OK, the ECM is at fault.

Engine Crank But Will Not Run (3.2L DOHC)

Caution: 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 possible fire or personal injury.

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 "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?	600 kPa (87 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 the 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 32	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 wires. Is spark present from all of the ignition wires?	1.8 - 2.2 KΩ	Go to Step 2	Go to Step 11

Engine Crank But Will Not Run (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition OFF. 2. Disconnect the Crankshaft Position (CKP) sensor connector. 3. Turn the ignition ON. 4. Measure the resistance between the CKP sensor terminal 1 and 2. Does the voltage measure near the value specified?	1,090 ± 164 KΩ	Go to Step 12	Go to Step 17
12	Measure the voltage between the CKP sensor connector terminal 1 and ground. Does the voltage measure near the value specified?	0 v	Go to Step 13	Go to Step 14
13	Measure the voltage between the CKP sensor connector terminal 2 and ground. Does the voltage measure near the value specified?	0 v	Go to Step 18	Go to Step 15
14	Check for an open or short in the wire between the CKP sensor connector terminal 1 and the Engine Control Module (ECM) connector terminal 100.	-	Go to Step 16	Go to Step 37
15	Check for an open or short in the wire between the CKP sensor connector terminal 2 and the ECM connector terminal 99.	-	Go to Step 16	Go to Step 37
16	Repair the wiring as needed. Is the repair complete?	-	Go to Step 2	-
17	1. Turn the ignition OFF. 2. Replace the CKP sensor. Is the repair complete?	-	Go to Step 2	-
18	1. Turn the ignition OFF. 2. Disconnect the ignition coil No. 1. 3. Connect a test light between terminal 1 of the ignition coil No. 1 connector and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to Step 19	Go to Step 24
19	Check for open or short in the wire between ignition coil No. 1 connector terminal 2 and ECM connector terminal 71 and repair as necessary. Is the repair complete?	-	Go to Step 2	Go to Step 20
20	1. Turn the ignition OFF. 2. Disconnect the fuel injector harness connectors 3. Install a spark tester on cylinder #2 spark plug. 4. Crank the engine and check for spark. 5. Repeat the above procedure on cylinder #5. Is a spark observed on two spark plug cables?	-	Go to Step 25	Go to Step 21
21	Measure the resistance of the spark plug cable that the spark plug tester did not spark. Is the resistance of the spark plug cable between the special value?	1.8 - 2.2 KΩ	Go to Step 22	Go to Step 23
22	1. Turn the ignition OFF. 2. Replace ignition coil No. 1. Is the repair complete?	-	Go to Step 2	-
23	Replace the spark plug cable Is the repair complete?	-	Go to Step 2	-

Engine Crank But Will Not Run (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
24	Check for a short circuit or open in the wire between ignition coil No. 1 terminal 1 and Over Voltage Protection Relay (OVPR) connector terminal 8 and repair as necessary. Is the repair complete?	-	Go to Step 2	Go to "OVPR Circuit Check"
25	1. Turn the ignition OFF. 2. Disconnect the ignition coil No. 2. 3. Connect a test light between terminal 1 of the ignition coil No. 2 connector and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to Step 26	Go to Step 30
26	Check for open or short in the wire between ignition coil No. 2 connector terminal 2 and ECM connector terminal 72 and repair as necessary. Is the repair complete?	-	Go to Step 2	Go to Step 27
27	1. Turn the ignition OFF. 2. Disconnect the fuel injector harness connectors. 3. Install a spark tester on cylinder #3 spark plug. 4. Crank the engine and check for spark. 5. Repeat the above procedure on cylinder #4. Is a spark observed on two spark plug cables?	-	Go to Step 31	Go to Step 28
28	Measure the resistance of the spark plug cable that the spark plug tester did not spark. Is the resistance of the spark plug cable between the special value?	1.8 - 2.2 KΩ	Go to Step 29	Go to Step 23
29	1. Turn the ignition OFF. 2. Replace ignition coil No. 2. Is the repair complete?	-	Go to Step 2	-
30	Check for a short circuit or open in the wire between ignition coil No. 2 terminal 1 and Over Voltage Protection Relay (OVPR) connector terminal 8 and repair as necessary. Is the repair complete?	-	Go to Step 2	Go to "OVPR Circuit Check"
31	1. Turn the ignition OFF. 2. Disconnect the ignition coil No. 3. 3. Connect a test light between terminal 1 of the ignition coil No. 3 connector and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to Step 32	Go to Step 36
32	Check for open or short in the wire between ignition coil No. 3 connector terminal 2 and ECM connector terminal 70 and repair as necessary. Is the repair complete?	-	Go to Step 2	Go to Step 33
33	1. Turn the ignition OFF. 2. Disconnect the fuel injector harness connectors. 3. Install a spark tester on cylinder #1 spark plug. 4. Crank the engine and check for spark. 5. Repeat the above procedure on cylinder #6. Is a spark observed on two spark plug cables?	-	Go to Step 2	Go to Step 34

Engine Crank But Will Not Run (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
34	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 special value?	1.8 - 2.2 KΩ	Go to Step 35	Go to Step 23
35	1. Turn the ignition OFF. 2. Replace ignition coil No. 3. Is the repair complete?	-	Go to Step 2	-
36	Check for a short circuit or open in the wire between ignition coil No. 3 terminal 1 and Over Voltage Protection Relay (OVPR) connector terminal 8 and repair as necessary. Is the repair complete?	-	Go to Step 2	Go to "OVPR Circuit Check"
37	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 2	-
38	1. Turn the ignition OFF. 2. Connect a fuel pressure gauge. 3. Crank the engine. Is any fuel pressure present?	-	Go to Step 41	Go to Step 39
39	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the fuel pump. 3. Connect a test light between the fuel pump connector 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?	1 sec	Go to Step 40	Go to Step 50
40	Replace the fuel pump. Is the repair complete?	-	Go to Step 2	-
41	Is the fuel pressure within the value specified?	230 - 380 kPa (46 - 55 psi)	Go to Step 45	Go to Step 42
42	1. Check the fuel filter for a restriction. 2. Inspect the fuel lines for kinks and restrictions. Is the problem found?	-	Go to Step 43	Go to Step 44
43	1. Replace the fuel filter and/or the fuel lines as needed. 2. Connect a fuel pressure gauge. 3. Crank the engine. Is the fuel pressure within the value specified?	230 - 380 kPa (46 - 55 psi)	Go to Step 2	Go to Step 44
44	1. Disconnect the 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 pressure of fuel. Is any fuel present?	-	Go to Step 47	Go to Step 48
45	Check the fuel for contamination. Is the fuel contamination?	-	Go to Step 46	Go to Step 61

Engine Crank But Will Not Run (3.2L DOHC) (Cont'd)

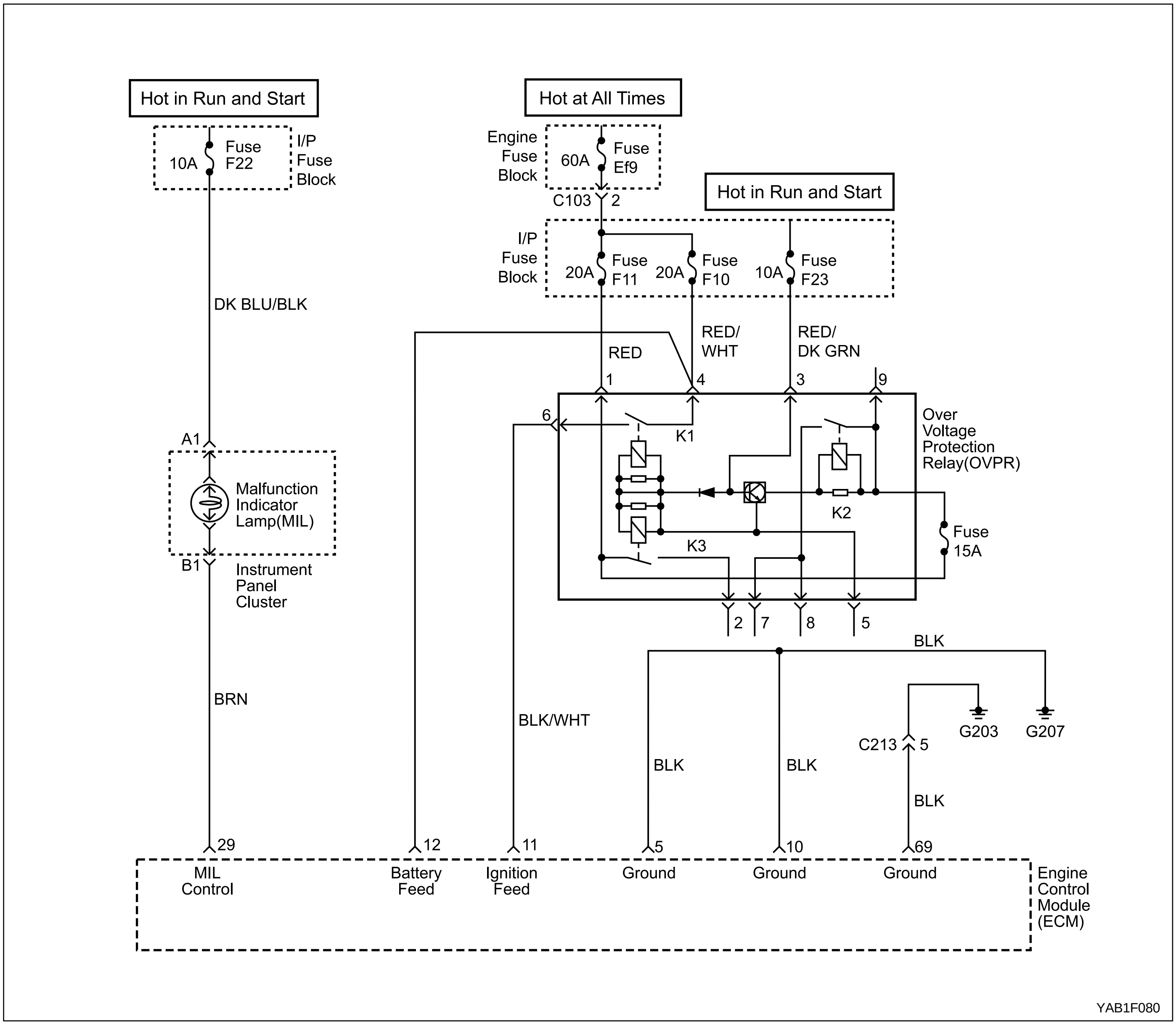
Step	Action	Value(s)	Yes	No
46	1. Remove the contaminated fuel from the fuel tank. 2. Clean the fuel tank as needed. Is the repair complete?	-	Go to Step 2	-
47	Replace the fuel pressure regulator. Is the repair complete?	-	Go to Step 2	-
48	1. Remove the fuel pump assembly from the fuel tank. 2. Inspect the fuel pump sender and the fuel coupling hoses for a restriction. 3. Inspect the in-tank fuel filter for a restriction. Is the problem found?	-	Go to Step 49	Go to Step 40
49	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	-
50	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the fuel pump. 3. Connect a test light between the fuel pump connector terminal 2 and a known good ground. 4. Turn the ignition ON. 5. With the ignition ON, the test light should light for the time specified. Is the test light on?	1 sec	Go to Step 51	Go to Step 52
51	Repair the open wire between the fuel pump connector terminal 3 and ground. Is the repair complete?	-	Go to Step 2	-
52	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 86 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to Step 53	Go to Step 57
53	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 85 and battery positive. 3. Turn the ignition ON. 4. With the ignition ON, the test light should light for the time specified. Is the test light on?	1 sec	Go to Step 54	Go to Step 58
54	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 55	Go to Step 60
55	Check for open between the fuel pump relay connector terminal 87 and fuel pump connector terminal 3 and repair as necessary. Is the repair complete?	-	Go to Step 2	Go to Step 56
56	Replace the fuel pump relay. Is the repair complete?	-	Go to Step 2	-

Engine Crank But Will Not Run (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
57	Check for an open or short to voltage in the circuit between the fuel pump relay terminal 86 and OVPR circuit terminal 7. Is a problem found and corrected?	-	Go to Step 2	Go to "OVPR Circuit Check"
58	Check the wire between the fuel pump relay connector terminal 85 and the ECM connector terminal 33 for an open. Is the problem found?	-	Go to Step 59	Go to Step 37
59	Repair the wire between the fuel pump relay connector terminal 85 to the ECM connector terminal 33. Is the repair complete?	-	Go to Step 2	-
60	Repair the wire between the fuel pump relay connector terminal 30 and the battery. Is the repair complete?	-	Go to Step 2	-
61	1. Turn the ignition OFF. 2. Disconnect the fuel injector harness connectors from all of the fuel injectors. 3. Turn the ignition ON. 4. Connect a test light between the fuel injector harness connector 1 and ground. 5. Repeat step 4 for each of the remaining fuel injectors. Is the test light on at all of the fuel injectors?	-	Go to Step 62	Go to Step 65
62	1. Turn the ignition OFF. 2. Connect a test light between the fuel injector harness connector terminal 2 and battery positive. 3. Crank the engine. 4. Repeat steps 2 and 3 for each of the remaining fuel injectors. Does the test light flash for all of the fuel injectors?	-	Go to Step 63	Go to Step 66
63	Measure the resistance of each fuel injector. Is the resistance within the value specified (the resistance will increase slightly at higher temperatures)?	14 - 17 KΩ	System OK	Go to Step 64
64	Replace any of the fuel injectors with a resistance out of specification. Is the repair complete?	-	Go to Step 2	-
65	Check for open or short in the wire between fuel injector harness connector terminal 1 from all of the fuel injectors and OVPR connector terminal 6 and repair as necessary. Is the repair complete?	-	Go to Step 2	Go to "OVPR Circuit Check"

Engine Crank But Will Not Run (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
66	1. Check for an open between the fuel injector 1 harness connector terminal 2 and the ECM connector terminal 63. 2. Check for an open between the fuel injector 2 harness connector terminal 2 and the ECM connector terminal 61. 3. Check for an open between the fuel injector 3 harness connector terminal 2 and the ECM connector terminal 66. 4. Check for an open between the fuel injector 4 harness connector terminal 2 and the ECM connector terminal 62. 5. Check for an open between the fuel injector 5 harness connector terminal 2 and the ECM connector terminal 65. 6. Check for an open between the fuel injector 6 harness connector terminal 2 and the ECM connector terminal 64. Is the problem found?	-	Go to Step 67	Go to Step 37
67	Repair the open fuel injector harness wire(s) 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 F30 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.

Test Description

Number(s) below refer to the step(s) number on the diagnostic table.

1. The Euro On-Board Diagnostic (EOBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure re-cords data on the scan tool, if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is stored in the scan tool for later reference.
3. Connections that are suspected of being faulty should be thoroughly checked as described in the diagnostic aids.
4. If the engine fails to start and the MIL is inoperative, then the fault can be isolated to either the ECM igni-tion feed, the battery feed, or a poor ground at the engine block or the ECM.
6. Probing the MIL circuit with a test light to ground stimulates the ECM's control of the MIL. If the MIL illuminates, then the malfunction can be isolated to the control of the MIL or a poor connection at the MIL terminal to the ECM. Connections that are suspected of being faulty should be thoroughly checked as described in the diagnostic aids.
8. It takes very little resistance for the battery and ignition feed circuits to cause an intermittent condition and should also be checked for a poor connection as described in diagnostic aids.
12. Before replacing the ECM, check for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring harness. Replacement ECM must be reprogrammed. Refer to the latest Techline information for reprogramming procedures.
21. ECM grounds will only cause a problem if all of the grounds are not making a good connection. If an ECM ground problem is suspected, the most probable place to check is where all the grounds meet, at the engine block.
23. If not faults have been found at this point and no DTCs were set, refer to the diagnostic aids for additional checks and information.

No Malfunction Indicator Lamp

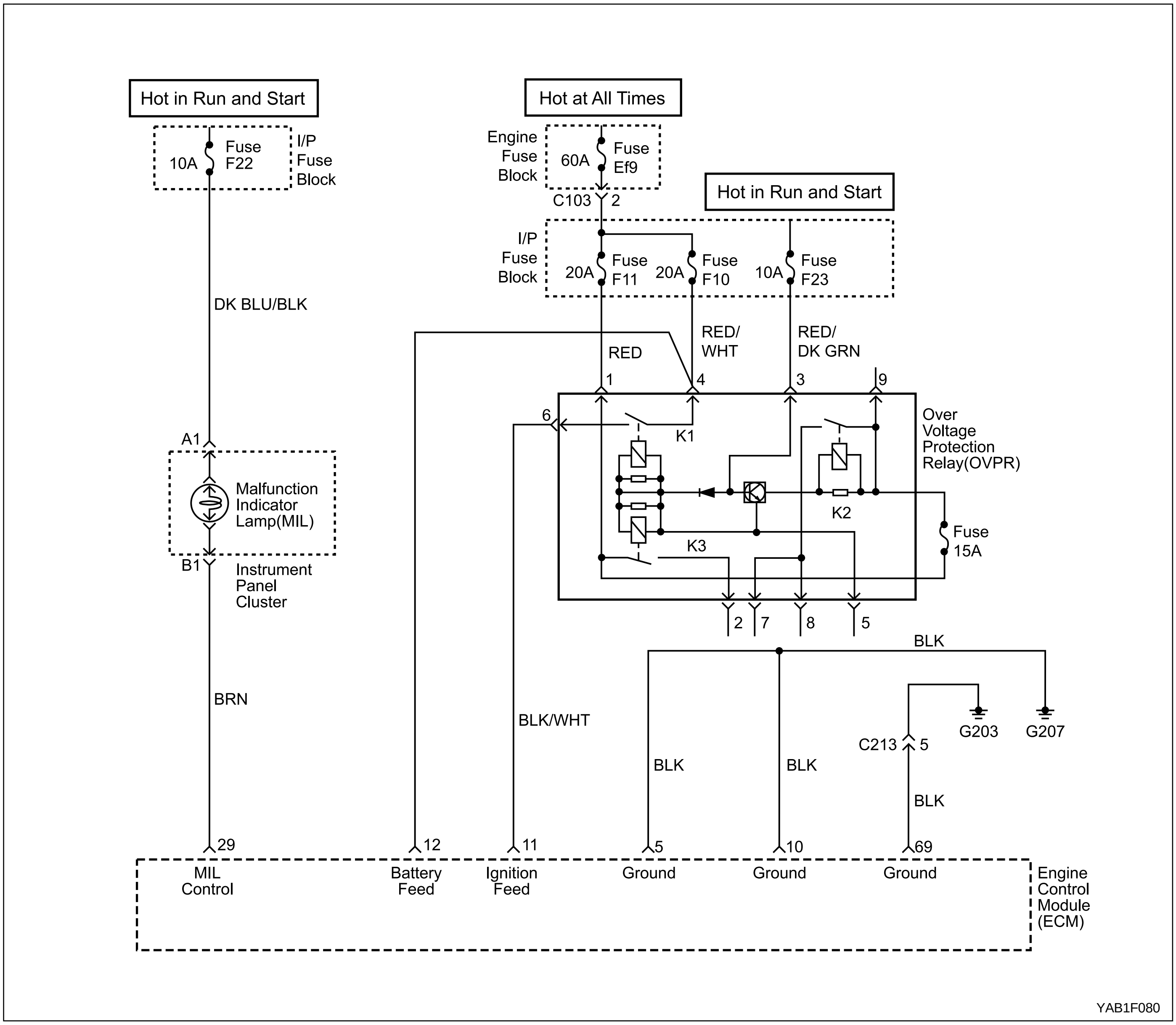
Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check performed?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	Turn the ignition ON, with the engine OFF. Is the Malfunction Indicator Lamp (MIL) ON?	-	Go to Step 3	Go to Step 4
3	Check for a poor connection at the battery feed terminal 12 or ignition feed terminal 11 at the Engine Control Module (ECM) connector and repair as necessary. Is a repair necessary?	-	Go to Step 22	Go to Step 5
4	Attempt to start the engine. Does the engine start?	-	Go to Step 6	Go to Step 7
5	Check for a faulty ECM ground connection at the engine block or ECM connector ground terminals and repair as necessary. Is the repair complete?	-	Go to Step 22	-
6	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector. 3. Turn the ignition ON. 4. With a test light connected to ground, probe the MIL control circuit terminal 29. Is the MIL ON?	-	Go to Step 8	Go to Step 9
7	Inspect the ignition and battery feed fuses. Are the fuses OK?	-	Go to Step 10	Go to Step 11

No Malfunction Indicator Lamp (Cont'd)

Step	Action	Value(s)	Yes	No
8	Check for a poor connection in the battery feed terminal 12, ignition feed terminal 11 or the MIL control circuits and repair as necessary. Is the repair necessary?	-	Go to Step 22	Go to Step 12
9	With a test light connected to ground, probe the MIL control circuit terminal 29. Does the test light illuminate?	-	Go to Step 13	Go to Step 14
10	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector. 3. Turn the ignition ON. 4. With a test light connected to ground, probe the ECM connector terminal 12. Does the test light illuminate?	-	Go to Step 15	Go to Step 16
11	1. Check for a short to ground in the circuit of the fuse that was open and repair as necessary. 2. Replace the open fuse. Is the repair complete?	-	Go to Step 22	-
12	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 22	-
13	Repair the short to voltage in the MIL control circuit. Is the repair complete?	-	Go to Step 22	-
14	Check for an open or a poor connection in the MIL control circuit between ECM connector terminal 29 and MIL connector terminal B1 and repair as necessary. Is the repair necessary?	-	Go to Step 22	Go to Step 17
15	With a test light connected to ground, probe the ECM connector terminal 11. Does the test light illuminate?	-	Go to Step 18	Go to Step 10
16	Repair the open battery feed circuit. Is the repair complete?	-	Go to Step 22	-
17	Check for an open ignition feed circuit or fuse to the MIL between I/P fuse block fuse F30 and MIL connector terminal A1 and repair as necessary. Is the repair necessary?	-	Go to Step 22	Go to Step 20
18	Check for a poor connection in the battery feed terminal 12 or the ignition feed terminal 11 and repair as necessary?	-	Go to Step 22	Go to Step 21
19	Repair the open in the ignition feed circuit from terminal 11. Is the repair complete?	-	Go to Step 22	-
20	Replace the instrument panel cluster. Refer to *Section 9E, Instrumentation/Driver Information.* Is the repair complete?	-	Go to Step 22	-
21	Check for a faulty ECM ground connection at the engine block or ECM connector and repair as necessary?	-	Go to Step 22	Go to Step 12

No Malfunction Indicator Lamp (Cont'd)

Step	Action	Value(s)	Yes	No
22	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 23	Go to Step 1
23	1. Allow the engine to idle until normal operation temperature is reached. 2. Check if any DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK



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.

Test Description

Number(s) below refer to the step(s) number on the diagnostic table.

1. The Euro On-Board Diagnostic (EOBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on then scan tool, if applicable. This creates an electronic copy of the data taken when the malfunc-tion occurred. The information is stored in the scan tool for later reference.
2. When the ignition is turned ON, the MIL should be turned ON and remain ON until the engine is running or if an emission related DTC is stored.
3. This step checks the short to the ground at the MIL control circuit.
7. The replacement ECM must be reprogrammed. Refer to the latest Techline information for reprogramming procedures.

Malfunction Indicator Lamp On Steady

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check performed?	-	Go to Step 2	Go to " Euro On-Board Diagnostic System Check"
2	Turn the ignition ON, with the engine OFF. Is the Malfunction Indicator Lamp ON?	-	Go to Step 3	Go to "P0650-225"
3	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector. 3. Turn the ignition ON. Is the MIL ON?	-	Go to Step 4	Go to Step 5
4	Check the MIL control circuit between MIL connector terminal B1 and ECM connector terminal 29 for a short to ground and repair as necessary. Is a repair necessary?	-	Go to Step 8	Go to Step 6
5	Check the malfunctioning ECM connector terminals and repair as necessary. Is the repair complete?	-	Go to Step 8	Go to Step 7
6	Replace the instrument panel cluster. Refer to *Section 9E, Instrumentation/Driver Information.* 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 9	-
8	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 9	Go to Step 1
9	1. Allow the engine to idle until normal operation temperature is 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 SYSTEM DIAGNOSIS

System Description

The fuel pump is an in-tank fuel pump 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 one 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 form 320 to 380 kPa (46 to 55 psi) by the fuel pressure regulator.

The excess fuel is returned to the fuel tank.

Test Description

Number(s) below refer to the step(s) number on the diagnostic table.

2. When the engine is idling, the intake manifold vacuum is high. This vacuum is applied to the fuel pressure regulator diaphragm, offsetting the spring pressure inside the fuel pressure regulator and lowing the fuel pressure.
10. If there is fuel bleeding back through the fuel return outlet, this is due to a faulty fuel pressure regulator.
12. Fuel leaking from the fuel pump inlet is due to a faulty one-way check valve in the fuel pump.
14. Another symptom often present when the fuel injectors are leaking is hard starting. Leaking fuel injectors can cause a flooding condition.

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 Ef11 form 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?	320 - 380 kPa (46 - 55 psi)	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 60 - 70 kPa (18 - 21 in. Hg) of vacuum to the fuel pressure regulator. Did the fuel pressure decrease?	-	Go to Step 4	Go to Step 16

Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
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?	320 - 380 kPa (46 - 55 psi)	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
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?	320 - 380 kPa (46 - 55 psi)	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?	320 - 380 kPa (46 - 55 psi)	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. Repair the fuel return outlet for leaking. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	320 - 380 kPa (46 - 55 psi)	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. Repair the fuel inlet for leaking. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	320 - 380 kPa (46 - 55 psi)	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	-

Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
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?	320 - 380 kPa (46 - 55 psi)	System OK	-
16	1. Replace the fuel pressure regulator. 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	-
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?	320 - 380 kPa (46 - 55 psi)	Go to Step 19	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?	320 - 380 kPa (46 - 55 psi)	Go to Step 6	-
19	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?	320 - 380 kPa (46 - 55 psi)	System OK	-

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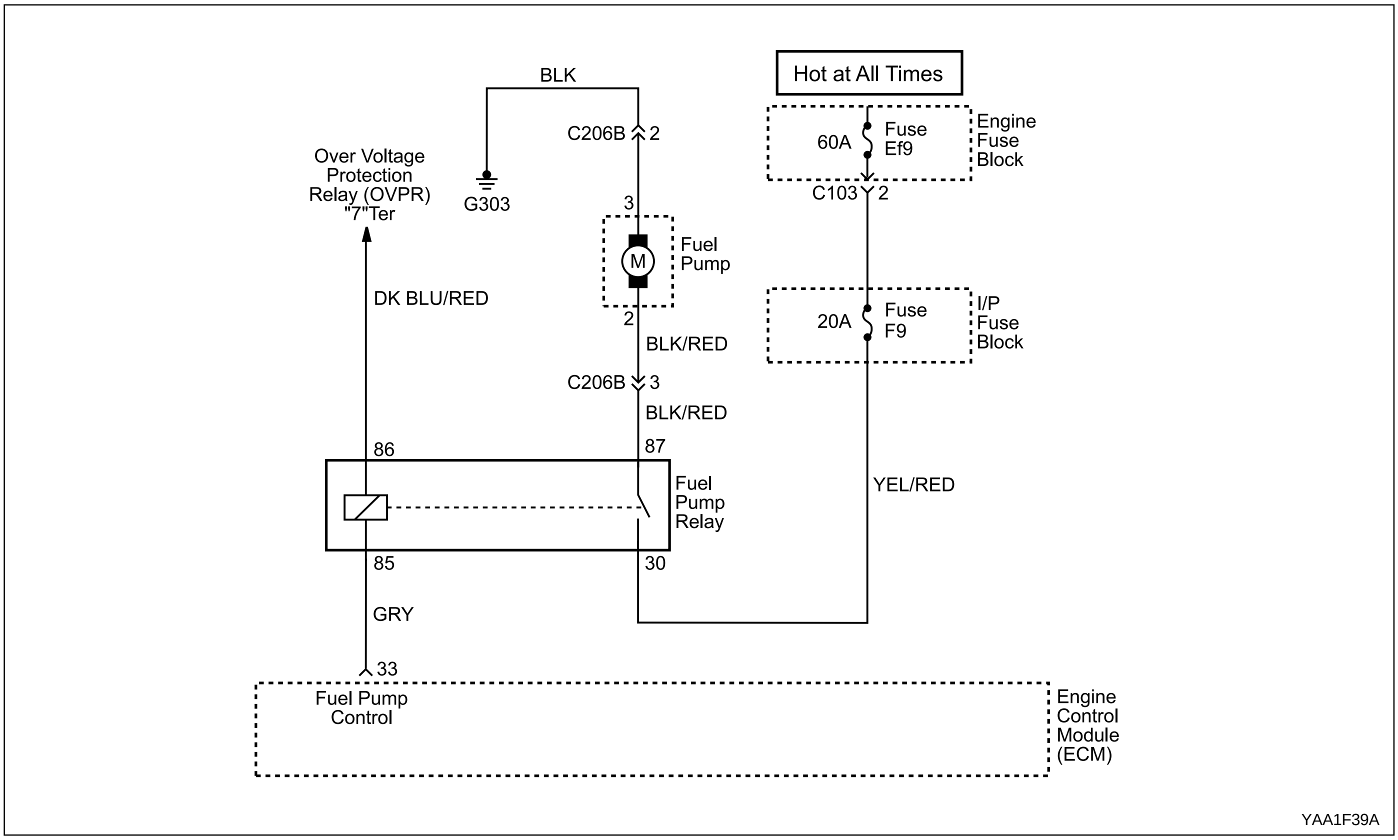

FUEL PUMP RELAY CIRCUIT CHECK

Circuit Description

When the ignition switch is turned ON, the Engine Control Module (ECM) will activate the 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 1 second after the ignition switch is turned ON, engine stopped or engine stalled.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed through wire insulation, or broken wire inside the insulation.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

3. This step checks for the Engine Control Module (ECM) providing ground for the operation of the fuel pump relay.
7. By Confirming that the wiring is OK using steps 2 through 6, it can be determined that the fuel pump relay is at fault.
9. After determining that there is no ground being provided by the ECM to the fuel pump relay, the fault is either the ECM or the wiring between the ECM and the fuel pump relay.

Fuel Pump Relay Circuit Check

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?	1 sec	System OK	Go to Step 2
2	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 86 and ground. 4. Turn the ignition ON. Is the test light ON?	-	Go to Step 3	Go to Step 8
3	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 85 and battery positive. 3. Turn the ignition ON. 4. With the ignition ON, the test light should light for the time specified. Is the test light ON?	1 sec	Go to Step 4	Go to Step 9
4	Turn the ignition OFF. Connect a test light between the fuel pump relay connector terminal 30 and ground. Is the test light ON?	-	Go to Step 5	Go to Step 11
5	Check for an open or short to ground in the wire between the fuel pump relay connector terminal 87 and the fuel pump terminal 2. Is the problem found?	-	Go to Step 6	Go to Step 7
6	1. Repair the wire between the fuel pump relay connector terminal 87 and the fuel pump terminal 2. 2. Install the fuel pump relay. 3. Turn the ignition ON. Does the fuel pump operates for the time specified?	1 sec	System OK	-
7	1. Replace the fuel pump relay. 2. Turn the ignition ON. Does the fuel pump operate for the time specified?	1 sec	System OK	-
8	Check for an open wire between the fuel pump relay connector terminal 86 and the Over Voltage Protection Relay (OVPR) connector terminal 7. Is the problem found?	-	Go to Step 13	Go to “OVPR Circuit Check”
9	Check for an open wire between the fuel pump relay connector terminal 85 and the Engine Control Module (ECM) connector terminal 33. Is the problem found?	-	Go to Step 10	Go to Step 12
10	1. Repair the wire between the fuel pump relay connector terminal 85 and the ECM connector terminal 33. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Turn the ignition ON. Does the fuel pump operate for the time specified?	1 sec	System OK	-

Fuel Pump Relay Circuit Check (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Repair the wire between the fuel pump relay connector terminal 30 and battery. 2. Install the fuel pump relay. 3. Turn the ignition ON. Does the fuel pump operate for the time specified?	1 sec	System OK	-
12	1. Turn the ignition OFF. 2. Replace the ECM. 3. Turn the ignition ON. Does the fuel pump operate for the time specified?	1 sec	System OK	-
13	Repair the wire between the fuel pump relay connector terminal 86 and the OVPR connector terminal 7. Is the repair complete?	-	System OK	-

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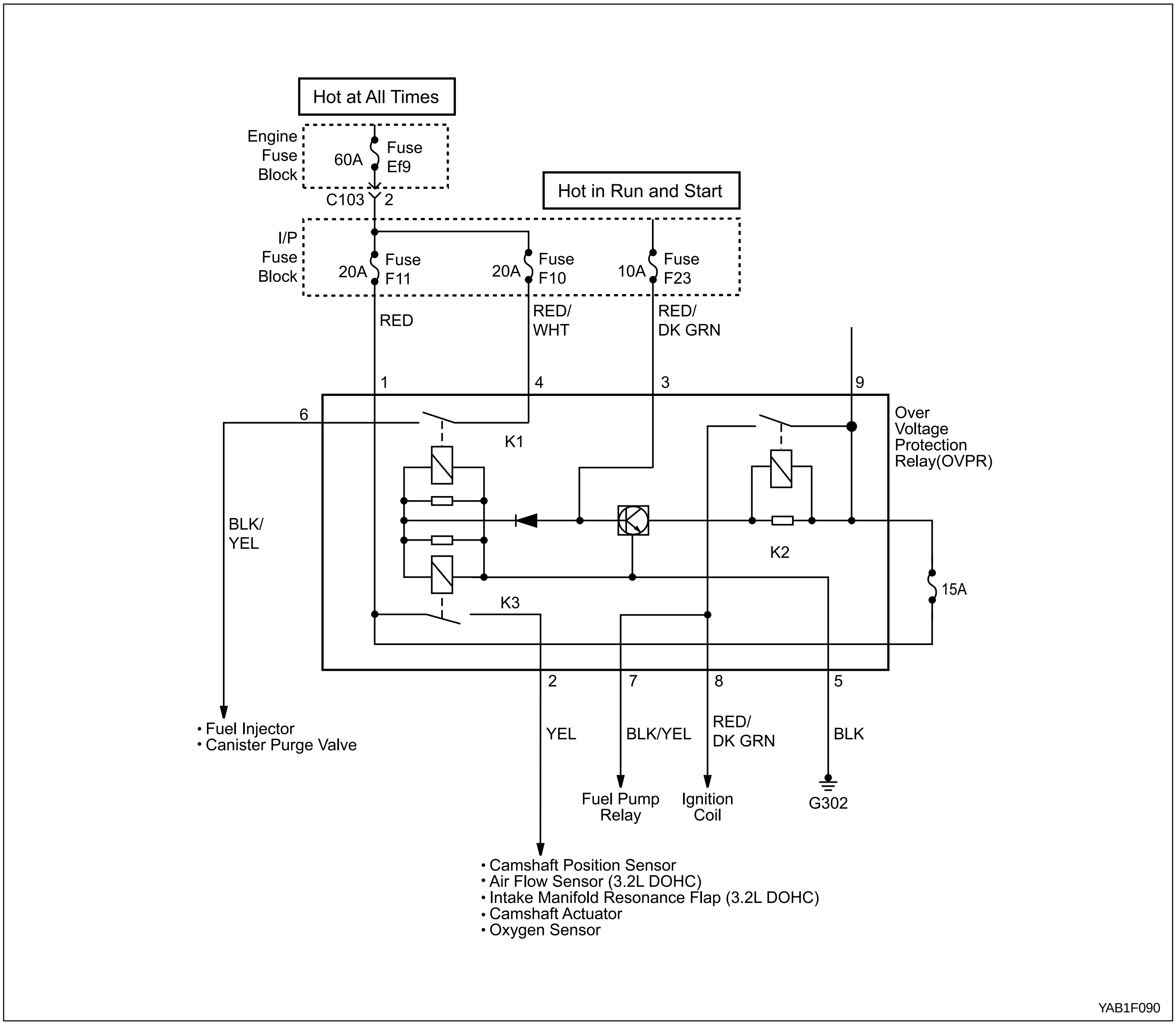

OVER VOLTAGE PROTECTION RELAY (OVPR) CIRCUIT CHECK

Circuit Description

When the ignition is turned ON or to the START position, the Over Voltage Protection Relay (OVPR) is energized.

The OVPR then supplies voltage to the fuel injector, camshaft position sensor, air flow sensor, intake manifold resonance flap, camshaft actuator, fuel pump relay and ignition coil.

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 OVPR 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.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

2. If the voltage at OVPR connector terminals 2, 6, 7, and 8 are B+, the OVPR is OK.
9. After confirming correct voltage and ground to the OVPR terminals, it can be determined that the OVPR is faulty

Over Voltage Protection Relay (OVPR) Circuit Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition ON. 2. With the test light connect to ground, probe the Over Voltage Protection Relay (OVPR) connector terminals 2, 6, 7, and 8. Is the test light on at OVPR connector terminals 2, 6, 7, and 8 terminals?	-	Go to Step 2	Go to Step 3
2	With a Digital Voltage Meter (DVM) connected to ground, probe the OVPR connector terminal 6. Does the DVM display a voltage near the battery voltage?	B+	System OK	Go to Step 5
3	Check the test light. Is the test light on at OVPR connector terminal 6 and off at OVPR connector terminal 2, 7, and 8?	-	Go to Step 4	Go to Step 13
4	1. Turn the ignition OFF. 2. Disconnect the OVPR. 3. With the test light connected to ground, prove the OVPR connector terminal 1. Is the test light on?	-	Go to Step 12	Go to Step 6
5	1. Turn the ignition OFF. 2. Inspect the Instrument Panel (I/P) fuse block fuse F10. Is the fuse OK?	-	Go to Step 10	Go to Step 11
6	Inspect the I/P fuse block fuse F11. Is the fuse OK?	-	Go to Step 7	Go to Step 8
7	Check the open in the wiring between the OVPR connector terminal 1 and I/P fuse block fuse F11 and repair as necessary. Is the repair complete?	-	System OK	-
8	Replace the engine fuse block fuse F11. Is the repair complete?	-	System OK	-
9	1. Turn the ignition OFF. 2. Replace the OVPR. Is the repair complete?	-	System OK	-
10	Check the open in the wiring between the OVPR connector terminal 4 and I/P fuse block fuse F10 and repair as necessary. Is the repair complete?	-	System OK	-
11	Replace the I/P fuse block fuse F10. Is the repair complete?	-	System OK	-
12	Check the OVPR ground circuit for an open and repair as necessary. Is a repair complete?	-	System OK	Go to Step 9
13	Check the test light. Is the test light off at OVPR connector terminal 2, 6, 7, and 8?	-	Go to Step 14	Go to Step 9

Over Voltage Protection Relay (OVPR) Circuit Check (Cont'd)

Step	Action	Value(s)	Yes	No
14	1. Ignition OFF. 2. Disconnect the OVPR. 3. Ignition ON. 4. With the test light connected to ground, prove the OVPR connector terminal 3. Is the test light on?	-	Go to Step 9	Go to Step 15
15	1. Turn the ignition OFF. 2. Inspect the I/P fuse block fuse F23. Is the fuse OK?	-	Go to Step 16	Go to Step 17
16	Check the open in the wiring between the OVPR connector terminal 3 and I/P fuse block fuse F23 and repair as necessary. Is the repair complete?	-	System OK	-
17	Replace the I/P fuse block fuse F23. Is the repair complete?	-	System OK	-

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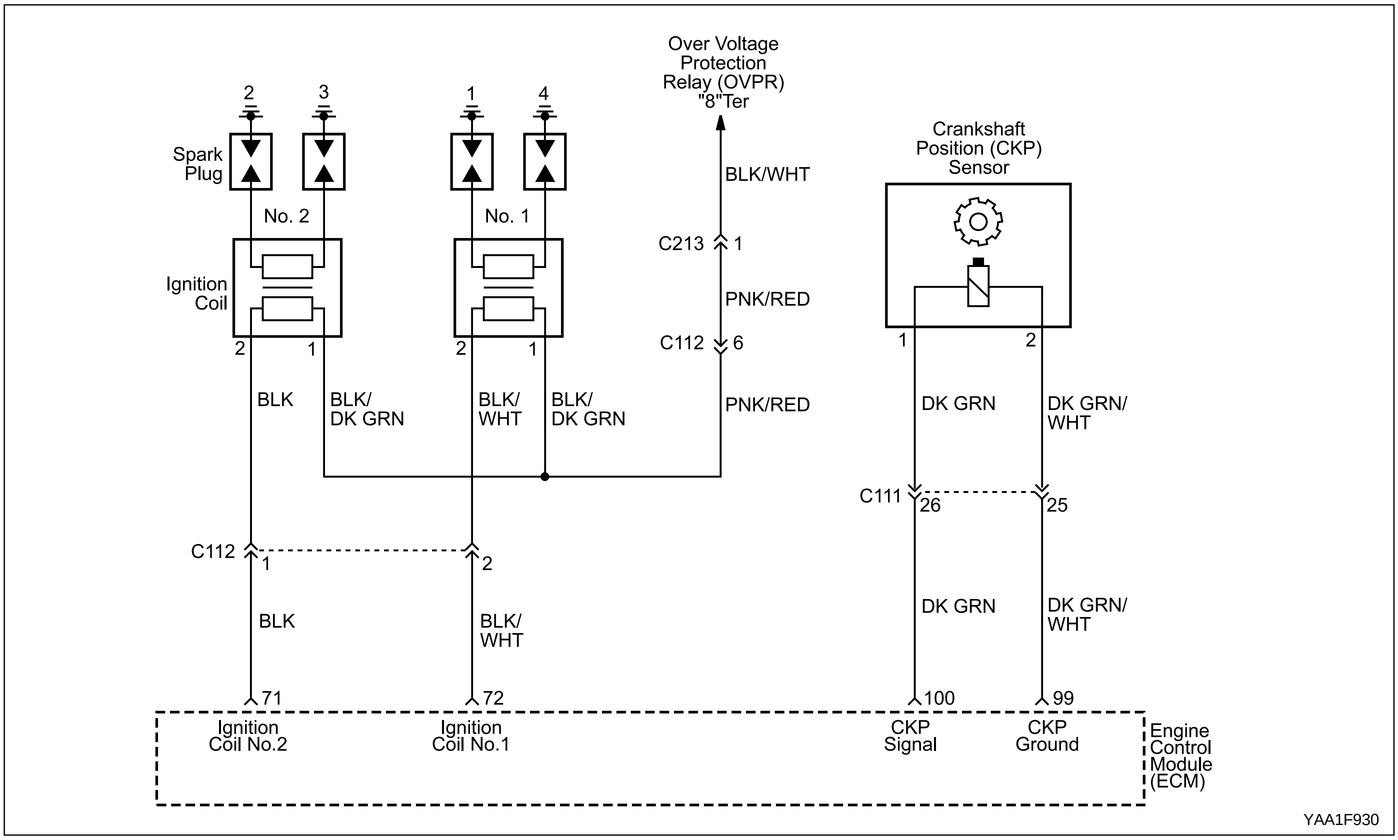

IGNITION SYSTEM CHECK (2.3L DOHC)

Circuit Description

The Electronic Ignition (EI) system uses a waste spark method of spark distribution. The Crankshaft Position (CKP) sensor sends reference pulses to the Engine Control Module (ECM). The ECM then triggers the EI system ignition coils Once the ECM triggers the EI system ignition coils 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.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

2. It is important to check for the presence of spark to all of the cylinders to isolate the problem to either EI system ignition coil inputs or output.
5. In checking the ECM outputs for the electronic park timing signal, it recommended to use an oscilloscope to view the varying voltage signals. In measuring these outputs with a voltmeter, intermittent errors may occur that cannot be seen by a voltmeter.
6. After confirming ECM inputs for the electronic spark timing to the EI system coil are OK, it can be determined that a faulty EI system ignition coil is at fault.
11. After confirming proper CKP sensor input to the ECM and no wiring problems present, it can be determined that the ECM is at fault.
20. If the wiring between the ignition coil and the Over Voltage Protection Relay (OVPR) connector terminal 8 is OK, the problem is in the OVPR circuit.

Ignition System Check (2.3L 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 the spark plug for wet, 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?	1.8 - 2.2 kΩ	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 connectors. 3. While cranking the engine, measure the voltage at the ignition coil No. 1 connector terminal 2. Does the voltage fluctuate within the values specified?	0.04 - 2.0 v	Go to Step 6	Go to Step 8
6	While cranking the engine, measure the voltage at the ignition coil No. 2 connector terminal 2. Does the voltage fluctuate within the values specified?	0.04 - 2.0 v	Go to Step 10	Go to Step 7
7	Check for an open in the wire from the ignition coil No. 2 connector terminal 2 to the ECM connector terminal 71. Is the problem found?	-	Go to Step 9	Go to Step 11
8	Check for an open in the wire from the ignition coil No. 1 connector terminal 2 to the ECM connector terminal 72. Is the problem found?	-	Go to Step 9	Go to Step 11
9	1. Repair the wiring as needed. 2. Connect the 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	-
10	1. Replace the ignition coil that the spark is not present. 2. Connect the 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 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 (2.3L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Turn the ignition OFF. 2. Disconnect the Crankshaft Position (CKP) sensor connector. 3. Measure the resistance between the CKP sensor terminal 1 and 2. Is the resistance within the value specified?	1,090 ± 164 Ω	Go to Step 13	Go to Step 22
13	1. Turn the ignition ON. 2. Measure the voltage between the CKP sensor connector terminal 2 and 1. Is the voltage near the value specified?	0 v	Go to Step 19	Go to Step 14
14	Measure the voltage between the CKP sensor connector terminal 2 and ground. Is the voltage near the value specified?	0 v	Go to Step 15	Go to Step 16
15	1. Turn the ignition OFF. 2. Check the wire between the CKP sensor connector terminal 1 and ECM connector terminal 100 for an open or short. Is the problem found?	-	Go to Step 18	Go to Step 11
16	1. Turn the ignition OFF. 2. Check the wire between the CKP sensor connector terminal 2 and ECM connector terminal 99 for an open or short. Is the problem found?	-	Go to Step 17	Go to Step 11
17	Repair the wire between the CKP sensor connector terminal 2 and ECM connector terminal 99. Is the repair complete?	-	System OK	-
18	Repair the wire between the CKP sensor connector terminal 1 and ECM connector terminal 100. Is the repair complete	-	System OK	-
19	1. Turn the ignition OFF. 2. Connect a test light between ignition coil No. 1 terminal 1 and ground. 3. Turn the ignition ON and check the test light. 4. Repeat the above procedure on ignition coil No. 2. Is the test light on all ignition coils?	-	Go to Step 5	Go to Step 20
20	Check for an open in the wiring between the ignition coils connector terminal 1 and the Over Voltage Protection Relay (OVPR) connector terminal 8. Is the problem found?	-	Go to Step 21	Go to "OVPR Circuit Check"
21	Repair the open wiring between the ignition coils connector terminal 1 and the OVPR connector terminal 8. Is the repair complete?	-	System OK	-
22	Replace the CKP sensor. Is the repair complete?	-	System OK	-

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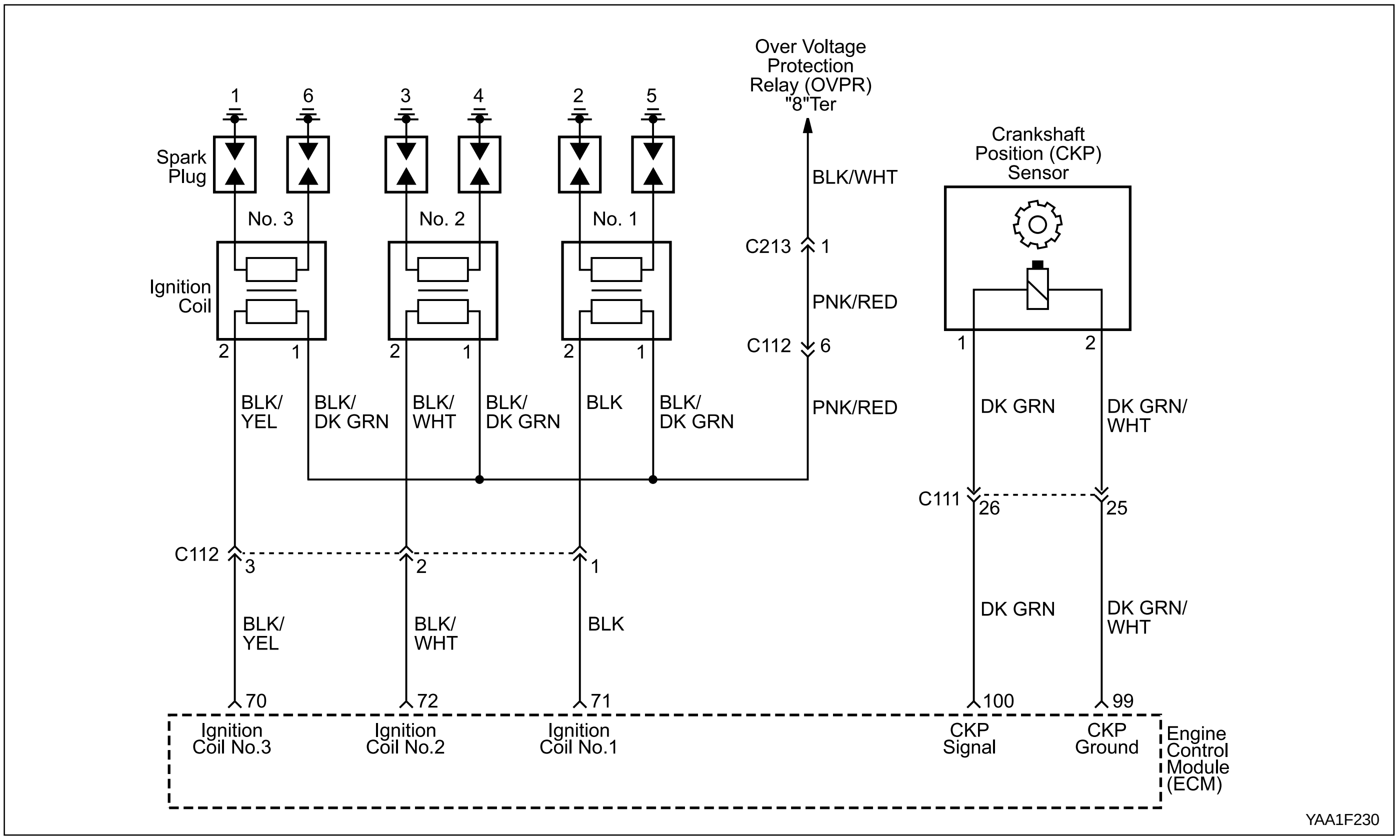


IGNITION SYSTEM CHECK (3.2L DOHC)

Circuit Description

The Electronic Ignition (EI) system uses a waste spark method of spark distribution. The Crankshaft Position (CKP) sensor sends reference pulses to the Engine Control Module (ECM). The ECM then triggers the EI system ignition coils Once the ECM triggers the EI system ignition coils 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.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

2. It is important to check for the presence of spark to all of the cylinders to isolate the problem to either EI system ignition coil inputs or output.
5. In checking the ECM outputs for the electronic park timing signal, it recommended to use an oscilloscope to view the varying voltage signals. In measuring these outputs with a voltmeter, intermittent errors may occur that cannot be seen by a voltmeter.
7. After confirming ECM inputs for the electronic spark timing to the EI system coil are OK, it can be determined that a faulty EI system ignition coil is at fault.
13. After confirming proper CKP sensor input to the ECM and no wiring problems present, it can be determined that the ECM is at fault.
22. If the wiring between the ignition coil and the Over Voltage Protection Relay (OVPR) connector terminal 8 is OK, the problem is in the OVPR circuit.

Ignition System Check (3.2L DOHC)

Caution: Use only electrically insulated pliers when handling ignition wires with the engine running to prevent an electrical shock.

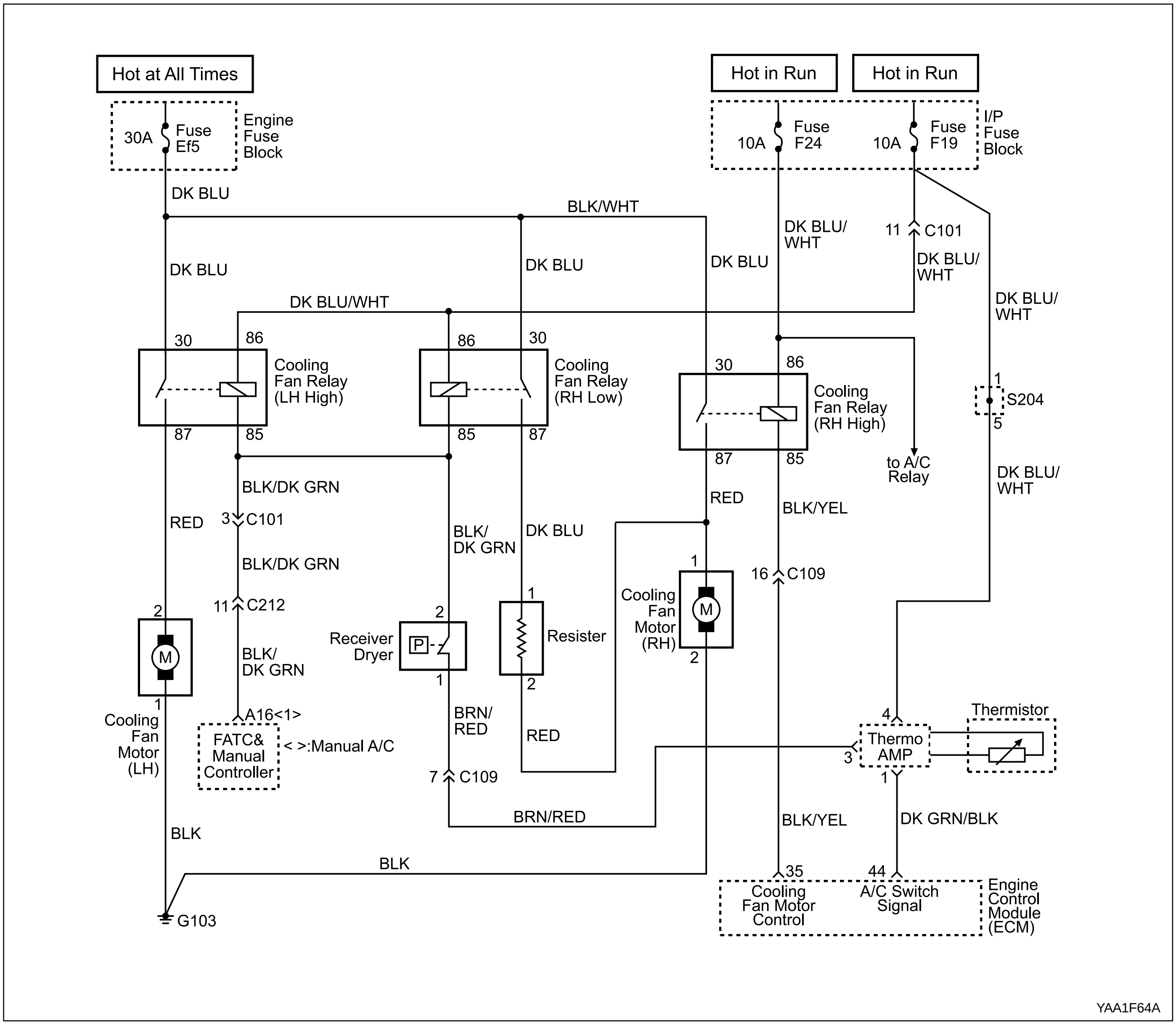
Step	Action	Value(s)	Yes	No
1	1. Remove the spark plugs. 2. Inspect the spark plug for wet, cracks, wear, improper gap, burned electrodes, or heavy deposits. 3. Replace the spark plugs as needed. Is the repair complete?	-	System OK	Go to Step 2
2	Check for the presence of spark from all of the ignition 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?	1.8 - 2.2 kΩ	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 14
5	1. Turn the ignition OFF. 2. Disconnect the Electronic Ignition (EI) system ignition coil connectors. 3. While cranking the engine, measure the voltage at the ignition coil No. 1 connector terminal 2. Does the voltage fluctuate within the values specified?	0.04 - 2.0 v	Go to Step 6	Go to Step 10
6	While cranking the engine, measure the voltage at the ignition coil No. 2 connector terminal 2. Does the voltage fluctuate within the values specified?	0.04 - 2.0 v	Go to Step 7	Go to Step 9
7	While cranking the engine, measure the voltage at the ignition coil No. 3 connector terminal 2. Does the voltage fluctuate within the values specified?	0.04 - 2.0 v	Go to Step 12	Go to Step 8
8	Check for an open in the wire from the ignition coil No. 3 connector terminal 2 to the Engine Control Module (ECM) connector terminal 70. Is the problem found?	-	Go to Step 11	Go to Step 13
9	Check for an open in the wire from the ignition coil No. 2 connector terminal 2 to the ECM connector terminal 72. Is the problem found?	-	Go to Step 11	Go to Step 13
10	Check for an open in the wire from the ignition coil No. 1 connector terminal 2 to the ECM connector terminal 71. Is the problem found?	-	Go to Step 11	Go to Step 13
11	1. Repair the wiring as needed. 2. Connect the 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 (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Replace the ignition coil that the spark is not present. 2. Connect the 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	-
13	1. Replace the ECM. 2. Connect the 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	-
14	1. Turn the ignition OFF. 2. Disconnect the Crankshaft Position (CKP) sensor connector. 3. Measure the resistance between the CKP sensor terminal 1 and 2. Is the resistance within the value specified?	1,090 ± 164 Ω	Go to Step 15	Go to Step 24
15	1. Turn the ignition ON. 2. Measure the voltage between the CKP sensor connector terminal 2 and 1. Is the voltage near the value specified?	0 v	Go to Step 21	Go to Step 16
16	Measure the voltage between the CKP sensor connector terminal 2 and ground. Is the voltage near the value specified?	0 v	Go to Step 17	Go to Step 18
17	1. Turn the ignition OFF. 2. Check the wire between the CKP sensor connector terminal 1 and ECM connector terminal 100 for an open or short. Is the problem found?	-	Go to Step 20	Go to Step 13
18	1. Turn the ignition OFF. 2. Check the wire between the CKP sensor connector terminal 2 and ECM connector terminal 99 for an open or short. Is the problem found?	-	Go to Step 19	Go to Step 13
19	Repair the wire between the CKP sensor connector terminal 2 and ECM connector terminal 99. Is the repair complete?	-	System OK	-
20	Repair the wire between the CKP sensor connector terminal 1 and ECM connector terminal 100. Is the repair complete	-	System OK	-
21	1. Turn the ignition OFF. 2. Connect a test light between ignition coil No. 1 terminal 1 and ground. 3. Turn the ignition ON and check the test light. 4. Repeat the above procedure on ignition coil No. 2 and No 3. Is the test light on all ignition coils?	-	Go to Step 5	Go to Step 22

Ignition System Check (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
22	Check for an open in the wiring between the ignition coils connector terminal 1 and the Over Voltage Protection Relay (OVPR) connector terminal 8. Is the problem found?	-	Go to Step 23	Go to "OVPR Circuit Check"
23	Repair the open wiring between the ignition coils connector terminal 1 and the OVPR connector terminal 8. Is the repair complete?	-	System OK	-
24	Replace the CKP sensor. Is the repair complete?	-	System OK	-



ENGINE COOLING FAN CIRCUIT CHECK - WITH A/C

Circuit Description

The cooling fan circuit operates the cooling fan motor (RH) and the cooling fan motor (LH).

The cooling fan motor (RH) is controlled by the Engine Control Module (ECM) based on inputs from the Engine Coolant Temperature (ECT) sensor and the Air Conditioning Pressure (ACP) sensor or A/C switch signal. The ECM controls the cooling fan motor (RH) operation by internally grounding the ECM connector terminal 35 when the engine coolant temperature is high. This energizes the cooling fan relay (RH high) and operates the cooling fan motor (RH) at high speed as the cooling fan motor (RH) is connected directly to the battery.

Whereas Full Automatic Temperature Control (FATC) or Manual A/C control panel controls the cooling fan motor (LH) and the cooling fan motor (RH). When the A/C switch is ON, FATC or Manual A/C control panel provides the ground to cooling fan relay (LH high) and the cooling fan relay (RH low). These make the cooling fan motor (LH) operate high speed and the cooling fan motor (RH) operate low.

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 fan motor (RH) is not operated, the cooling system should be checked.

- If the I/P fuse block fuse F25 becomes open (blown) immediately after installation, inspect for a short to ground in the wiring of the cooling fan relay (RH high) circuit. If the engine fuse block fuse Ef14 becomes open (blown) when the cooling fan relay (RH high) is to be turned ON by the Engine Control Module (ECM), suspect a faulty cooling fan motor circuit.
- The ECM will turn the cooling fan motor (RH) ON at high speed when the coolant temperature reaches 105 °C (221 °F).
- The cooling fan motor (RH) circuit can be checked quickly by disconnecting the ECM connector and grounding the connector terminal 35. This should create high speed cooling fan motor (RH) operation with the ignition ON.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

4. This step checks for the ability of the Engine Control Module (ECM) to operate the cooling fan motor (RH).
5. This step checks for the presence of battery voltage to the cooling fan motor (RH) when the ECM commands the operation of motor. If battery voltage is present and the motor is not operating, the problem is in the ground side of the cooling fan motor (RH) circuit or motor.
19. This step checks for the ability of the FATC controller (or Manual A/C controller) to operate the cooling fans in response to A/C switch ON.
21. This step checks for the presence of battery voltage to the cooling fan motor (LH) when the A/C is ON. If battery voltage is present and the motor is not operating, the problem is in the ground side of the cooling fan motor (LH) circuit or motor.

Engine Cooling Fan Circuit Check - with A/C

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check performed?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Check the I/P fuse block fuse F24 and F19. 2. Replace the fuses as needed. Are the fuses OK?	-	Go to Step 3	Go to “Diagnostic Aids”
3	1. Check the engine fuse block fuse Ef5. 2. Replace the fuse as needed. Is the fuse OK?	-	Go to Step 3	Go to “Diagnostic Aids”
4	1. Turn the ignition OFF. 2. Turn the A/C switch OFF. 3. Connect a scan tool to the Data Link Connector (DLC). 4. Start the engine. 5. The cooling fan motor (RH) should run at high speed when the coolant temperature reaches 105 °C (221 °F). Does the cooling fan motor (RH) run at high speed?	-	Go to Step 19	Go to Step 5
5	1. Turn the ignition OFF. 2. Disconnect the cooling fan motor (RH) connector. 3. Turn the ignition ON. 4. The Coolant Temperature value should be above 105 °C (221 °F). 5. With a test light connected to ground, probe the cooling fan motor (RH) connector terminal 1. Is the test light ON?	-	Go to Step 6	Go to Step 7

Engine Cooling Fan Circuit Check - with A/C (Cont'd)

Step	Action	Value(s)	Yes	No
6	With a test light connected to battery, probe the cooling fan motor (RH) connector terminal 2. Is the test light ON?	-	Go to Step 17	Go to Step 14
7	1. Turn the ignition OFF. 2. Disconnect the cooling fan relay (RH high) connector. 3. Turn the ignition ON. 4. The Coolant Temperature value should be above 105 °C (221 °F). 5. With a test light connected to battery, probe the cooling fan relay (RH high) connector terminal 85. Is the test light ON?	-	Go to Step 8	Go to Step 11
8	With a test light connected to ground, probe the cooling fan relay (RH high) connector terminal 86. Is the test light ON?	-	Go to Step 9	Go to Step 12
9	With a test light connected to ground, probe the cooling fan relay (RH high) connector terminal 30. Is the test light ON?	-	Go to Step 10	Go to Step 13
10	Check for an open wire between the cooling fan relay (RH high) connector terminal 87 and the cooling fan motor (RH) connector terminal 1. Is the problem found?	-	Go to Step 14	Go to Step 16
11	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector. 3. Check for an open wire between the cooling fan relay (RH high) connector terminal 85 and ECM connector terminal 35. Is the problem found?	-	Go to Step 14	Go to Step 15
12	Check for an open wire between the cooling fan relay (RH high) connector terminal 86 and I/P fuse block fuse F24 and repair as necessary. Is the repair complete?	-	System OK	-
13	Check for an open wire between the cooling fan relay (RH high) connector terminal 30 and engine fuse block fuse Ef5 and repair as necessary. Is the repair complete?	-	System OK	-
14	Repair the open wire as needed. Is the repair complete?	-	System OK	-
15	Check for a poor connection at the terminals and repair the malfunctioning terminals as necessary. Is a repair complete?	-	System OK	Go to Step 18
16	1. Turn the ignition OFF. 2. Replace the cooling fan relay (RH high). Is the action complete?	-	System OK	-
17	Replace the cooling fan motor (RH). Is the action complete?	-	System OK	-
18	Replace the ECM. Is the action complete?	-	System OK	-

Engine Cooling Fan Circuit Check - with A/C (Cont'd)

Step	Action	Value(s)	Yes	No
19	1. Turn the ignition OFF. 2. Turn the ignition ON. 3. Start the engine. 4. Turn the A/C switch ON. 5. Confirm that the Coolant Temperature value on the scan tool is less than 105 °C (221 °F). 6. The cooling fan motor (RH) should run at low speed and the cooling fan motor (LH) should run at high speed. Do the cooling fan motors run at the specified speed?	-	System OK	Go to Step 20
20	Does the cooling fan motor (RH) run at low speed?	-	Go to Step 21	Go to Step 32
21	1. Turn the ignition OFF. 2. Disconnect the cooling fan motor (LH) connector. 3. Start the engine. 4. Turn the A/C switch ON. 5. With a test light connected to ground, probe the cooling fan motor (LH) connector terminal 2. Is the test light ON?	-	Go to Step 22	Go to Step 23
22	With a test light connected to battery, probe the cooling fan motor (LH) connector terminal 1. Is the test light ON?	-	Go to Step 31	Go to Step 14
23	1. Turn the ignition OFF. 2. Disconnect the cooling fan relay (LH high) connector. 3. Start the engine. 4. Turn the A/C switch ON. 5. With a test light connected to battery, probe the cooling fan relay (LH high) connector terminal 85. Is the test light ON?	-	Go to Step 24	Go to Step 27
24	With a test light connected to ground, probe the cooling fan relay (LH high) connector terminal 86. Is the test light ON?	-	Go to Step 25	Go to Step 28
25	With a test light connected to ground, probe the cooling fan relay (LH high) connector terminal 30. Is the test light ON?	-	Go to Step 26	Go to Step 29
26	Check for an open wire between the cooling fan relay (LH high) connector terminal 87 and the cooling fan motor (LH) connector terminal 2. Is the problem found?	-	Go to Step 14	Go to Step 30
27	Check for an open wire between the cooling fan relay (LH high) connector terminal 85 and FATC controller terminal A16 (or Manual A/C controller terminal 1) and repair as necessary. Is the repair complete?	-	System OK	Go to "7B or 7D HVAC section"
28	Check for an open wire between the cooling fan relay (LH high) connector terminal 86 and I/P fuse block fuse F19 and repair as necessary. Is the repair complete?	-	System OK	-

Engine Cooling Fan Circuit Check - with A/C (Cont'd)

Step	Action	Value(s)	Yes	No
29	Check for an open wire between the cooling fan relay (LH high) connector terminal 30 and engine fuse block fuse Ef5 and repair as necessary. Is the repair complete?	-	System OK	-
30	1. Turn the ignition OFF. 2. Replace the cooling fan relay (LH high). Is the action complete?	-	System OK	-
31	Replace the cooling fan motor (LH). Is the action complete?	-	System OK	-
32	1. Turn the ignition OFF. 2. Disconnect the cooling fan relay (RH low) connector. 3. Start the engine. 4. Turn the A/C switch ON. 5. With a test light connected to battery, probe the cooling fan relay (RH low) connector terminal 85. Is the test light ON?	-	Go to Step 33	Go to Step 38
34	With a test light connected to battery, probe the cooling fan relay (RH low) connector terminal 87. Is the test light ON?	-	Go to Step 35	Go to Step 39
35	With a test light connected to ground, probe the cooling fan relay (RH low) connector terminal 86. Is the test light ON?	-	Go to Step 36	Go to Step 40
36	With a test light connected to ground, probe the cooling fan relay (RH low) connector terminal 30. Is the test light ON?	-	Go to Step 37	Go to Step 41
37	1. Turn the ignition OFF. 2. Replace the cooling fan relay (RH low) Is the action complete?	-	System OK	-
38	Check for an open wire between the cooling fan relay (RH low) connector terminal 85 and FATC controller terminal A16 (or Manual A/C controller terminal 1) and repair as necessary. Is the repair complete?	-	System OK	Go to "7B or 7D section"
39	Check for an open wire between the cooling fan relay (RH low) connector terminal 87 and the cooling fan relay (RH high) connector terminal 87 and repair as necessary. Is the repair complete?	-	System OK	-
40	Check for an open wire between the cooling fan relay (RH low) connector terminal 86 and I/P fuse block fuse F19 and repair as necessary. Is the repair complete?	-	System OK	-
41	Check for an open wire between the cooling fan relay (RH low) connector terminal 30 and engine fuse block fuse Ef5 and repair as necessary. Is the repair complete?	-	System OK	-

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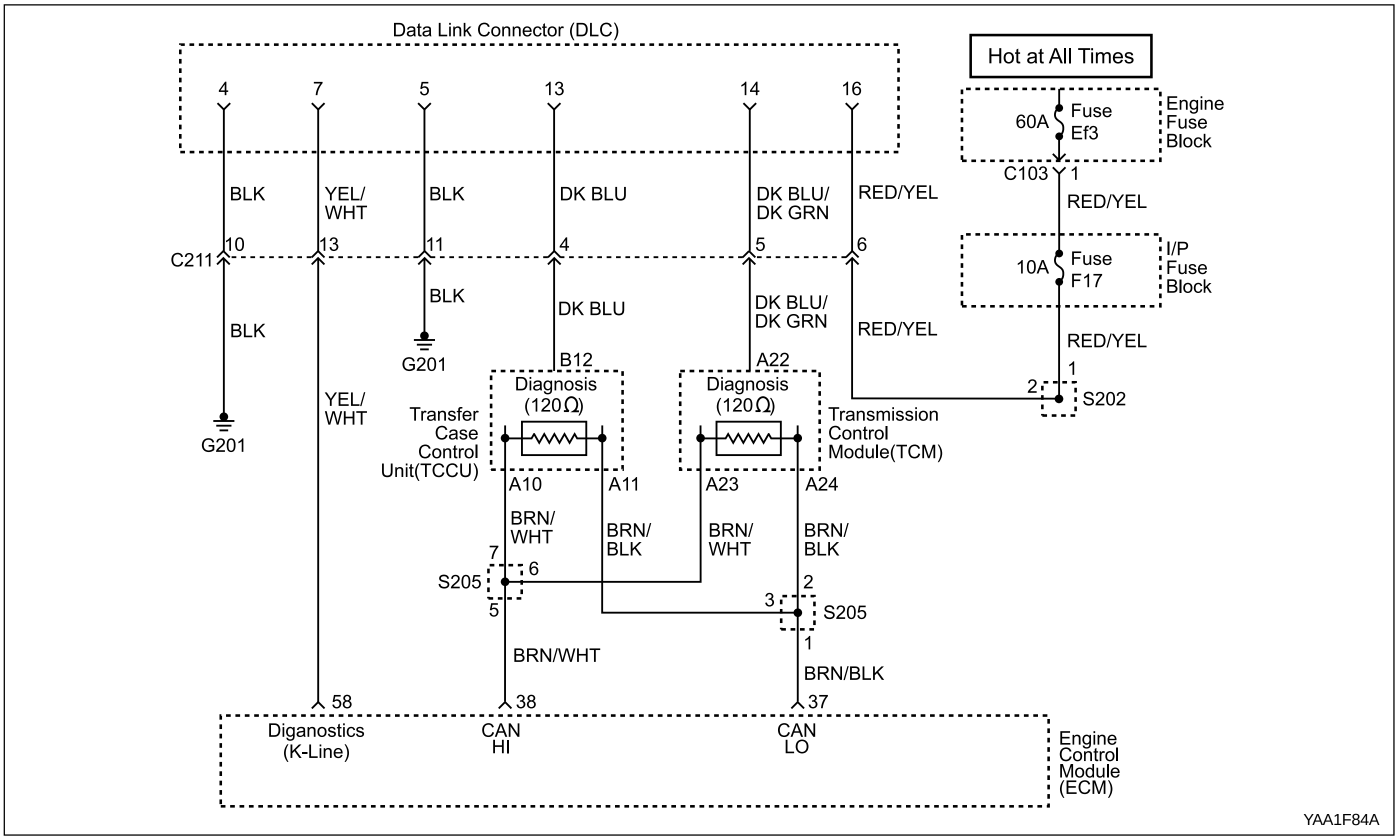

DATA LINK CONNECTOR DIAGNOSIS

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 serial data circuit to the DLC allows the ECM to communicate with the scan tool. Also DLC provides serial data line to communicate with the other modules such as the Electronic Brake Control Module (EBCM), the Transmission Control Module.

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.

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

8. Locate and repair any shorts that may have caused the fuse to open before replacement, if the no voltage condition was due to an open fuse.

11. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

16. The scan tool or associated cables could be malfunctioning. Refer to the scan tool's manual for repair information.

Data Link Connector Diagnosis

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check performed?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install the scan tool. Does the scan tool power up?	-	Go to Step 3	Go to Step 4
3	1. Disconnect the scan tool. 2. With a test light connected to ground, probe the serial data terminal 7 at the Data Link Connector (DLC). Does the test light remain OFF?	-	Go to Step 5	Go to Step 6
4	1. Disconnect the scan tool. 2. With the test light connected to ground, probe the DLC battery feed circuit terminal 16. Does the test light illuminate?	-	Go to Step 7	Go to Step 8
5	With the test light connected to B+, probe the serial data terminal 7 at the DLC. Does the test light remain OFF?	-	Go to Step 9	Go to Step 10
6	Check the serial data circuit for a short to voltage and repair as necessary. Is a repair necessary?	-	Go to Step 17	Go to Step 11
7	With the test light connected to B+, probe the DLC ground circuit terminal 4 and 5. Does the test light illuminate for both circuits?	-	Go to Step 15	Go to Step 12
8	Repair the open or short to ground in the DLC battery feed circuit. Is the repair complete?	-	Go to Step 17	-
9	Check the serial data circuit for an open or poor connection and repair as necessary. Is a repair necessary?	-	Go to Step 17	Go to Step 13
10	Check the serial data circuit for short to ground and repair as necessary. Is a repair necessary?	-	Go to Step 17	Go to Step 11
11	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 17	-
12	Repair the open or poor connection(s) in the DLC ground circuit(s). Is the repair complete?	-	Go to Step 17	-
13	Install the scan tool. Can the scan tool communicate with the ECM?	-	Go to Step 17	Go to Step 14
14	Install the scan tool on another vehicle with a serial data terminal and check for proper operation. Does the scan tool work properly on a different vehicle?	-	Go to Step 11	Go to Step 16
15	Check the DLC electrical terminals for proper tension or excessive resistance and repair as necessary. Is a repair necessary?	-	Go to Step 17	Go to Step 16

Data Link Connector Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
16	1. The scan tool is malfunctioning. 2. Refer to the scan tool's manual for repair. Is the repair complete?	-	Go to Step 17	-
17	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 18	Go to Step 2
18	1. Allow the engine to idle until normal operation temperature is reached. 2. Check if any DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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TROUBLE CODE DIAGNOSIS

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) will be turned ON and a DTC will be stored in the ECM's memory. If the problem is intermittent, the light will go out after 10 seconds if the fault is no longer present. The DTC will stay in the ECM's memory until the battery voltage for 10 seconds will clear all 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	Description	2.3L DOHC	3.2L DOHC	Type	Illuminate MIL
P0010	Camshaft actuator short circuit to ground/battery/open	O	O	B	Yes
P0101	Mass air flow plausibility		O	B	Yes
P0102	Mass air flow low voltage		O	B	Yes
P0103	Mass air flow high voltage		O	B	Yes
P0105	Manifold absolute pressure plausibility	O		B	Yes
P0107	Manifold absolute pressure low voltage	O		B	Yes
P0108	Manifold absolute pressure high voltage	O		B	Yes
P0111	Intake air temperature plausibility	O	O	B	Yes
P0112	Intake air temperature low voltage	O	O	B	Yes
P0113	Intake air temperature high voltage	O	O	B	Yes
P0116	Engine coolant temperature plausibility	O	O	B	Yes
P0117	Engine coolant temperature low voltage	O	O	B	Yes
P0118	Engine coolant temperature high voltage	O	O	B	Yes
P0120	Throttle position sensor error	O	O	B	Yes
P0121	Throttle adaptation or throttle spring check	O	O	B	Yes
P0125	Engine coolant temperature warm-up	O	O	B	Yes
P0131	O2 bank 1 sensor 1 low voltage	O	O	B	Yes
P0132	O2 bank 1 sensor 1 high voltage	O	O	B	Yes
P0133	O2 bank 1 sensor 1 slow response	O	O	B	Yes
P0134-82	O2 bank 1 sensor 1 no activity detected	O	O	B	Yes
P0134-83	O2 bank 1 sensor 1 not lean after coasting shut down	O	O	B	Yes
P0135-86	O2 bank 1 sensor 1 heater short circuit to battery	O	O	B	Yes
P0135-87	O2 bank 1 sensor 1 heater short circuit to ground or open	O	O	B	Yes
P0137	O2 bank 1 sensor 2 low voltage	O	O	B	Yes
P0138	O2 bank 1 sensor 2 high voltage	O	O	B	Yes
P0140	O2 bank 1 sensor 2 not lean after coasting shut down	O	O	B	Yes
P0141-94	O2 bank 1 sensor 2 heater short circuit to battery	O	O	B	Yes
P0141-95	O2 bank 1 sensor 2 heater short circuit to ground or open	O	O	B	Yes
P0151	O2 bank 2 sensor 3 low voltage		O	B	Yes
P0152	O2 bank 2 sensor 3 high voltage		O	B	Yes

Diagnostic Trouble Codes (Cont'd)

DTC	Description	2.3L DOHC	3.2L DOHC	Type	Illuminate MIL
P0153	O2 bank 2 sensor 3 slow response		O	B	Yes
P0154-202	O2 bank 2 sensor 3 no activity detected		O	B	Yes
P0154-203	O2 bank 2 sensor 3 not lean after coasting shut down		O	B	Yes
P0155-206	O2 bank 2 sensor 3 heater short circuit to battery		O	B	Yes
P0155-207	O2 bank 2 sensor 3 heater short circuit to ground or open		O	B	Yes
P0157	O2 bank 2 sensor 4 low voltage		O	B	Yes
P0158	O2 bank 2 sensor 4 high voltage		O	B	Yes
P0160	O2 bank 2 sensor 4 not lean after coasting shut down		O	B	Yes
P0161-214	O2 bank 2 sensor 4 heater short circuit to battery		O	B	Yes
P0161-215	O2 bank 2 sensor 4 heater short circuit to ground or open		O	B	Yes
P0171	Bank 1 system too lean	O	O	B	Yes
P0172	Bank 1 system too rich	O	O	B	Yes
P0174	Bank 2 system too lean		O	B	Yes
P0175	Bank 2 system too rich		O	B	Yes
P0220	Accelerator pedal position sensor malfunction	O	O	B	Yes
P0231	Fuel pump short circuit to ground or open	O	O	B	Yes
P0232	Fuel pump short circuit to battery	O	O	B	Yes
P0261	Injector 1: short circuit to ground or open	O	O	B	Yes
P0262	Injector 1: short circuit to battery	O	O	B	Yes
P0264	Injector 2: short circuit to ground or open	O	O	B	Yes
P0265	Injector 2: short circuit to battery	O	O	B	Yes
P0267	Injector 3: short circuit to ground or open	O	O	B	Yes
P0268	Injector 3: short circuit to battery	O	O	B	Yes
P0270	Injector 4: short circuit to ground or open	O	O	B	Yes
P0271	Injector 4: short circuit to battery	O	O	B	Yes
P0273	Injector 5: short circuit to ground or open		O	B	Yes
P0274	Injector 5: short circuit to battery		O	B	Yes
P0276	Injector 6: short circuit to ground or open		O	B	Yes
P0277	Injector 6: short circuit to battery		O	B	Yes
P0300	Multiple cylinder misfire	O	O	B	Yes
P0301	Cylinder 1 misfire	O	O	B	Yes
P0302	Cylinder 2 misfire	O	O	B	Yes
P0303	Cylinder 3 misfire	O	O	B	Yes
P0304	Cylinder 4 misfire	O	O	B	Yes
P0305	Cylinder 5 misfire		O	B	Yes
P0306	Cylinder 6 misfire		O	B	Yes
P0325	Knock sensor 1: noise level check	O	O	B	Yes
P0330	Knock sensor 2: noise level check		O	B	Yes
P0335	Crankshaft position sensor malfunction	O	O	B	Yes
P0336	Crankshaft position sensor signal range	O	O	B	Yes
P0341	Camshaft position sensor signal: cylinder 1 missing	O	O	B	Yes

Diagnostic Trouble Codes (Cont'd)

DTC	Description	2.3L DOHC	3.2L DOHC	Type	Illuminate MIL
P0351	Cylinder 2/5 (1/4: 2.3L DOHC) coil: ignition driver output current check	O	O	B	Yes
P0352	Cylinder 3/4 (2/3: 2.3L DOHC) coil: ignition driver output current check	O	O	B	Yes
P0353	Cylinder 1/6 coil: ignition driver output current check		O	B	Yes
P0420	Amplitude ratio of post and pre heated oxygen sensor bank 1	O	O	B	Yes
P0430	Amplitude ratio of post and pre heated oxygen sensor bank 2		O	B	Yes
P0444	Purge valve short circuit to ground or open	O	O	B	Yes
P0445	Purge valve short circuit to battery	O	O	B	Yes
P0460	Fuel level sensor plausibility	O	O	B	Yes
P0462	Fuel level sensor short circuit to ground or open	O	O	B	Yes
P0463	Fuel level sensor short circuit to battery	O	O	B	Yes
P0501	Vehicle speed no signal	O	O	B	Yes
P0562	Battery voltage low	O	O	B	Yes
P0600	Can communication malfunction	O	O	B	Yes
P0601	Cpu check	O	O	B	Yes
P0602	Coding plausibility	O	O	B	Yes
P0604	Ram test	O	O	B	Yes
P0605	Checksum test	O	O	B	Yes
P0650-224	Mil short circuit to battery	O	O	B	Yes
P0650-225	Mil short circuit to ground or open	O	O	B	Yes
P0661	Resonance flap short circuit to ground or open		O	B	Yes
P0662	Resonance flap short circuit to battery		O	B	Yes
P1813	Clutch switch plausibility	O	O	B	Yes

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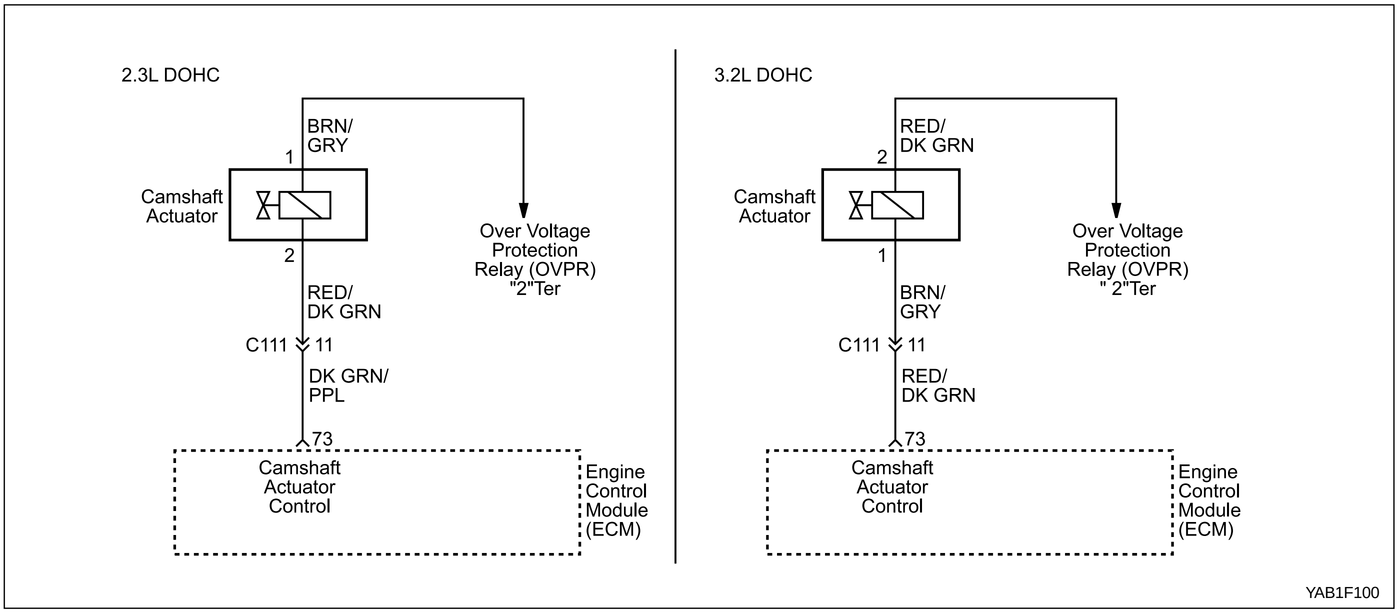

DIAGNOSTIC TROUBLE CODE (DTC) P0010 CAMSHAFT ACTUATOR SHORT CIRCUIT TO GROUND/BATTERY/OPEN

Circuit Description

When the engine is running, the camshaft adjuster rotates the intake camshaft hydraulically/machanically relative to the camshaft sprocket by 34 ° crankangle to the ”advanced” position and back to the “retarded” position. The camshaft adjuster is actuated electro-mechanically by the Engine Control Module (ECM). The positioning time of approx. 1 second is dependent on the engine oil pressure at the camshaft adjuster and on the oil viscosity and oil temperature, respectively. The position indicator on the camshaft sprocket provides the camshaft rotational speed to the position sensor as an input parameter for the engine ignition control unit.

Conditions for Setting the DTC

short circuit to ground or open

- voltage is less than 2 volts for ground, 5 consecutive tests
- voltage is less than 3 volts for open, 5 consecutive tests

short circuit to battery

- current is between 3 ampares and 6 ampares (depending on driver condition), 5 consecutive tests.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

The camshaft actuator output stage driver diagnosis detects short circuit to battery voltage and ground and a disconnected line. The fault short circuit to battery voltage will be detected if the driver is energized. The fault short circuit to ground and open line will be detected if the driver is not energized.

There is a fault, if the corresponding fault feedback signal is received from the output stage.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0010 is the result of a hard failure or an intermittent condition. It may be necessary to operate the vehicle within the Freeze Frame conditions and Conditions for Setting the DTC in order to duplicable the malfunction detected by the ECM.
10. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0010 Camshaft Actuator Short Circuit to Ground/Battery/Open

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate engine at normal temperature. 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 parameters under conditions and Conditions for Setting The DTC. Does the scan tool indicate DTC P0010 this driving cycle?	-	Go to Step 4	Go to “Diagnostic Aids”
4	1. Turn the ignition OFF. 2. Disconnect the camshaft actuator connector. 3. Turn the ignition ON. 4. Using a Digital Voltmeter (DVM), measure the voltage at camshaft actuator connector terminal 2 (1)*. Does the voltage displayed as specified?	B+	Go to Step 5	Go to Step 11
5	Using a DVM, measure the voltage at camshaft actuator connector terminal 1 (2)*. Does the voltage displayed as specified?	7 v	Go to Step 6	Go to Step 7
6	1. Turn the ignition OFF. 2. Replace the camshaft actuator. Is the repair complete?	-	Go to Step 12	-
7	With a test light connected to the battery, probe the CMP circuit terminal 1 (2)*. Does the test light illuminate?	-	Go to Step 8	Go to Step 9
8	Check the Camshaft Actuator circuit from terminal 1 (2)* to Engine Control Module (ECM) for short to ground and repair as necessary. Is the repair complete?	-	Go to Step 12	Go to Step 10
9	Check the camshaft actuator circuit from terminal 1 (2)* to ECM for open and repair as necessary. Is the repair complete?	-	Go to Step 12	Go to Step 10

* : 2.3L DOHC

DTC P0010 Camshaft Actuator Short Circuit to Ground/Battery/Open (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 12	-
11	Check for open or short in the wire between camshaft actuator terminal 2 (1)* and Over Voltage Protection Relay (OVPR) connector terminal 2 and repair as necessary. Is the repair complete?	-	Go to Step 12	Go to "OVPR Circuit Check"
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 the 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

* : 2.3L DOHC

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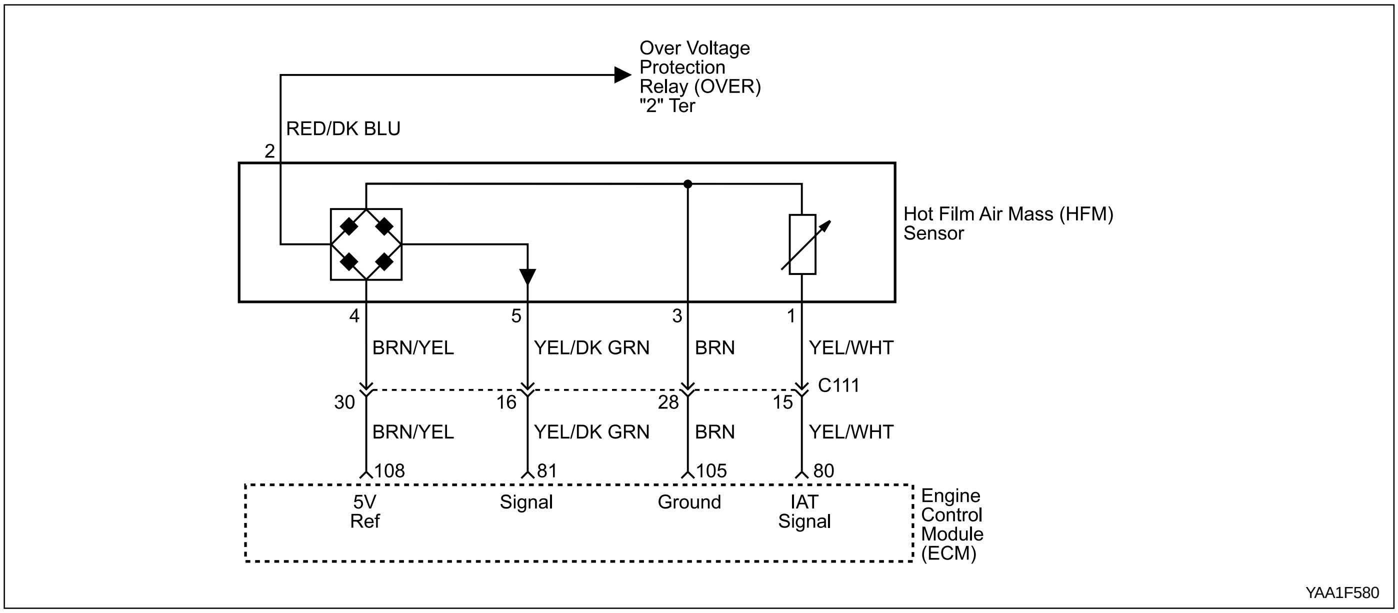


DIAGNOSTIC TROUBLE CODE (DTC) P0101 MASS AIR FLOW PLAUSIBILITY (3.2L DOHC)

Circuit Description

The heated element on the hot-film air mass meter is a platinum film resistor (heater). It is located on a ceramic plate together with the other elements in the bridge circuit. The temperature sensitive resistor (flow sensor) also included in the bridge. The separation of heater and flow sensor facilitates design of the control circuitry.

Saw cuts are employed to ensure thermal decoupling between the heating element and the intake air temperature sensor. The complete control circuitry is located on a single layer. The voltage at the heater provides the index for the mass air flow. The hot film air mass meter's electronic circuitry then converts the voltage to a level suitable for processing in the engine control module (ECM). This device does not need a burn off process to maintain its measuring precision over an extended period. In recognition of the fact that most deposits collect on the sensor element's leading edge, the essential thermal transfer elements are located downstream on the ceramic layer. The sensor element is also designed to ensure that deposits will not influence the flow pattern around the sensor.

Conditions for Setting the DTC

- Ratio between measured air mass and calculated air mass is between 0.5 and 1.5 for more than 2.5 seconds.
- DTCs P0101, P0102, P0103, P0111, P0112, P0113, P0171, P0172, P0174, P0175, P0335 and P0336 are not set.
- Start end reached.
- Engine speed gradient is less than 250 [rpm/s]
- Throttle valve gradient is less than 30 [°/s]
- Throttle valve angle is beween 64° and 70°

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The Malfunction Indicator Lamp (MIL) will turn off after three consecutive driving 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.

Diagnostic Aids

- Check air cleaner for being plugged.
- Check for air intake ducts for restrictions.
- Check air intake ducts for leaks after the MAF sensor.
- Check for partly restricted exhaust system.
- Check for any other source that would allow air into the engine after the MAF sensor.
- This would include:
  - Intake manifold gasket
  - Intake manifold
  - Throttle body and/or gasket

- PCV system, this includes the oil dipstick for proper seating
- Injector O-rings

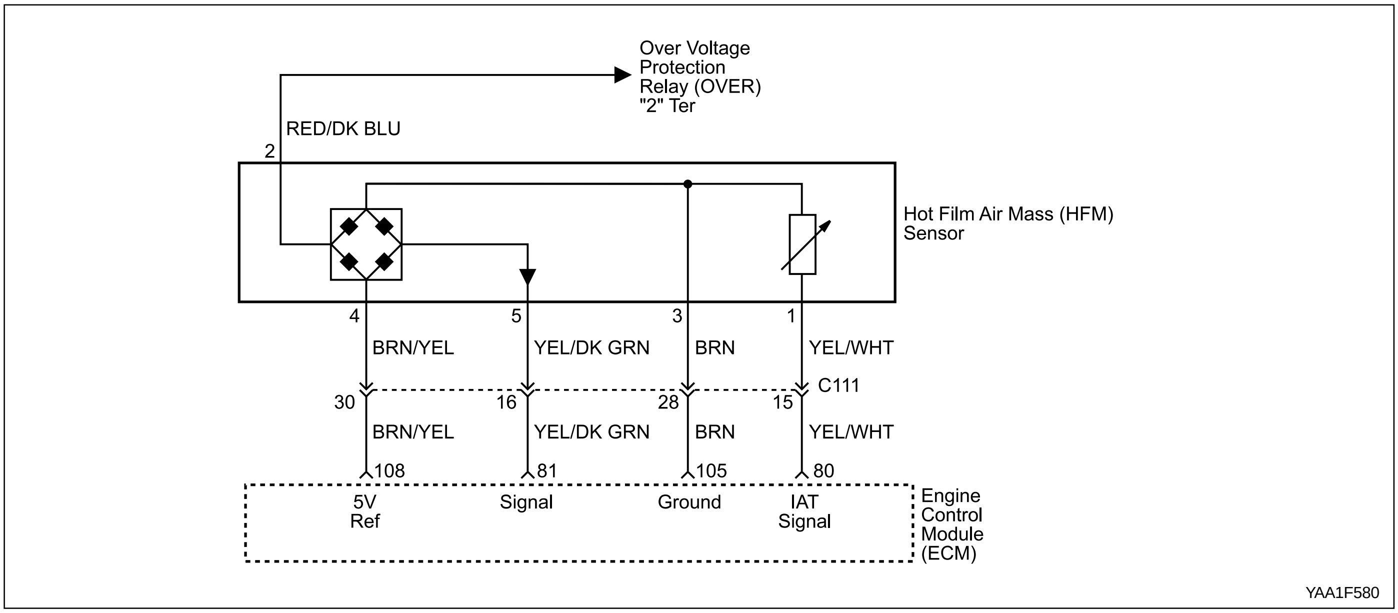
Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

DTC P0101 Mass Air Flow Plausibility (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is DTC P0102 or P0103 preset?	-	Go to applicable DTC table	Go to Step 3
3	1. Operate engine at normal temperature. 2. Using the scan tool, select Engine Data. 3. With engine at idle, the scan tool should indicate a “Mass Air Flow Meter” reading at the specified value. Is the reading at the specified value?	1.3 - 1.7 v at Idle	Go to Step 4	Go to Step 6
4	Increase engine rpm to 2500 and hold steady. Is the reading at the specified value?	1.8 - 2.2 v at 2500 rpm	Go to Step 5	Go to Step 6
5	Release the throttle, and watch the Mass Air Flow (MAF) sensor readings on the scan tool. The “Mass Air Flow Meter” should decrease at a steady rate down to the reading determined at idle, did it?	-	Go to Step 8	Go to Step 6
6	Check for restrictions in the Mass Air Flow induction system. Also check for air leaks after the MAF sensor or a possible restricted exhaust system and repair as necessary. Is the repair complete?	-	Go to Step 8	Go to Step 7
7	1. Turn the ignition OFF. 2. Replace the MAF sensor. Is the repair complete?	-	Go to Step 8	-
8	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine. 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 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) P0102 MASS AIR FLOW LOW VOLTAGE (3.2L DOHC)

Circuit Description

The heated element on the hot-film air mass meter is a platinum film resistor (heater). It is located on a ceramic plate together with the other elements in the bridge circuit. The temperature sensitive resistor (flow sensor) also included in the bridge. The separation of heater and flow sensor facilitates design of the control circuitry. Saw cuts are employed to ensure thermal decoupling between the heating element and the intake air temperature sensor. The complete control circuitry is located on a single layer. The voltage at the heater provides the index for the mass air flow. The hot film air mass meter's electronic circuitry then converts the voltage to a level suitable for processing in the engine control module (ECM). This device does not need a burn off process to maintain its measuring precision over an extended period. In recognition of the fact that most deposits collect on the sensor element's leading edge, the essential thermal transfer elements are located downstream on the ceramic layer. The sensor element is also designed to ensure that deposits will not influence the flow pattern around the sensor.

Conditions for Setting the DTC

- Load threshold is less than 0.02.
- No fault of engine speed.
- Start end reached.

Action Taken When the DTC Sets

- The Malfunition Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The Malfunction Indicator Lamp (MIL) will turn off after three consecutive driving 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.

Diagnostic Aids

An intermittent may be caused by a poor connection, misrouted harness, rubbed through wire insulation, or a wire broken inside insulation.

For the load limit monitoring a calculated, which is proportional to the sensor output voltage, is compared with on upper threshold value continuously. As soon as the diagnosis load exceeds the limit, a fault code P0102 is set.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

13. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM repro gramming.

DTC P0102 Mass Air Flow Low Voltage (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Using the scan tool, select Engine Data Display. Does the scan tool display “Mass Air Flow Meter” between the specified values?	0.9 - 1.1 v	Go to Step 3	Go to Step 5
3	1. Operate engine at normal temperature. 2. With engine at idle, the scan tool should indicate a “Mass Air Flow Meter” reading at the specified value Is the reading at the specified value?	1.3 - 1.7 v at Idle	Go to Step 4	Go to Step 5
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 and Conditions for Setting the DTC as noted. Does the scan tool display Mass Air Flow (MAF) voltage below the specified value?	0.2 v	Go to Step 5	Go to "Diagnostic Aids"
5	1. Turn the ignition OFF. 2. Disconnect MAF sensor. 3. Turn the ignition ON. 4. With a test light connected to the ground, probe the MAF sensor circuit terminal 2. Does the test light illuminate?	-	Go to Step 6	Go to "Over Voltage Protection Relay (OVPR) Circuit Check"
6	Measure voltage between MAF sensor harness connector terminal 2 and 3. Is voltage greater than specified value?	10 v	Go to Step 7	Go to Step 11
7	Measure voltage at MAF sensor harness connector terminal 4 with Digital Voltmeter to ground. Is voltage near the specified value?	5 v	Go to Step 8	Go to Step 10
8	With a test light connected to the battery, prove the MAF sensor signal circuit terminal 5. Does the test light illuminate?	-	Go to Step 9	Go to Step 12
9	Check the MAF sensor signal circuit for an open or short to ground and repair as necessary. Is a repair necessary?	-	Go to Step 14	Go to Step 13

DTC P0102 Mass Air Flow Low Voltage (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the 5 volts reference circuit for an open or short to ground and repair as necessary. Is a repair complete?	-	Go to Step 14	Go to Step 13
11	Check the MAF sensor ground circuit for an open and repair as necessary. Is a repair complete?	-	Go to Step 14	Go to Step 13
12	1. Turn the ignition OFF. 2. Replace the MAP sensor. Is the action complete?	-	Go to Step 14	-
13	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the action complete?	-	Go to Step 14	-
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine. 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 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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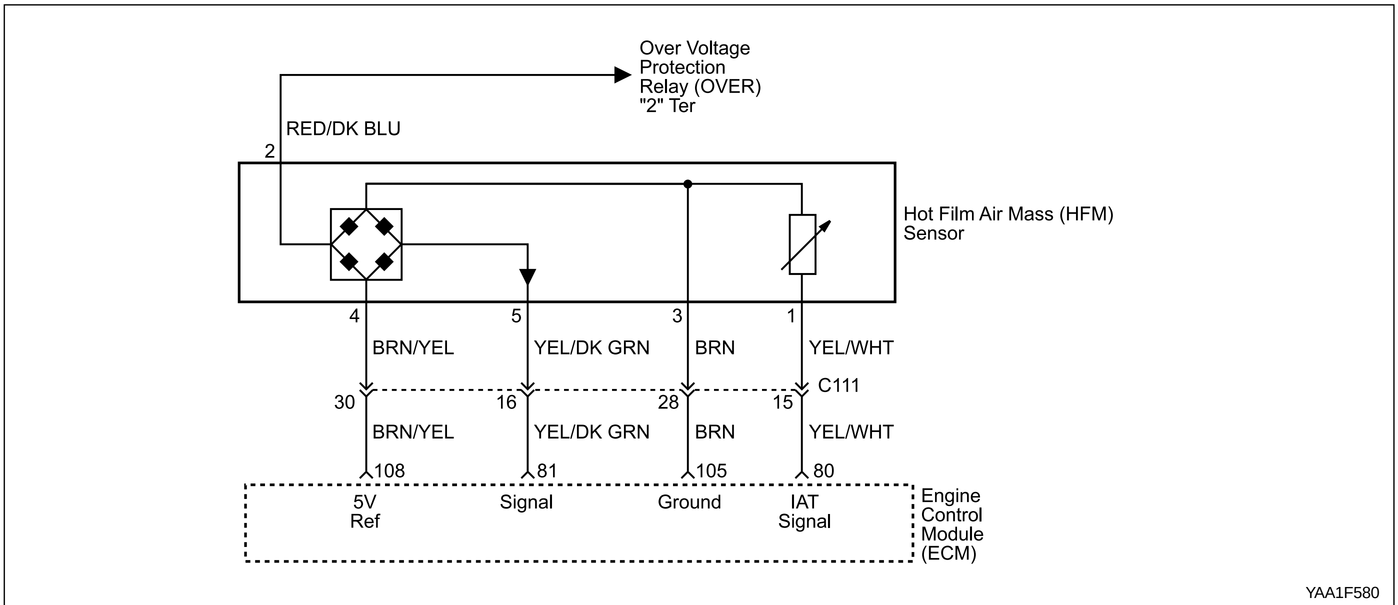

DIAGNOSTIC TROUBLE CODE (DTC) P0103 MASS AIR FLOW HIGH VOLTAGE (3.2L DOHC)

Circuit Description

The heated element on the hot-film air mass meter is a platinum film resistor (heater). It is located on a ceramic plate together with the other elements in the bridge circuit. The temperature sensitive resistor (flow sensor) also included in the bridge. The separation of heater and flow sensor facilitates design of the control circuitry. Saw cuts are employed to ensure thermal decoupling between the heating element and the intake air temperature sensor. The complete control circuitry is located on a single layer. The voltage at the heater provides the index for the mass air flow. The hot film air mass meter's electronic circuitry then converts the voltage to a level suitable for processing in the Engine Control Module (ECM). This device does not need a burn off process to maintain its measuring precision over an extended period. In recognition of the fact that most deposits collect on the sensor element's leading edge, the essential thermal transfer elements are located downstream on the ceramic layer. The sensor element is also designed to ensure that deposits will not influence the flow pattern around the sensor.

Conditions for Setting the DTC

- Load threshold is less than 1.6.
- No fault of engine speed.
- Start end reached.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The Malfunction Indicator Lamp (MIL) will turn off after three consecutive driving 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.

Diagnostic Aids

An intermittent may be caused by a poor connection, misrouted harness, rubbed through wire insulation, or a wire broken inside insulation.

For the load limit monitoring a calculated load, which is propotional to the sensor output voltage, is compared with an upper and lower threshold value continuously. As soon as the diagnosis load exceeds the limit, a fault load P0103 is set.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

13. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0103 Mass Air Flow High Voltage (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Using the scan tool, select Engine Data Display. Does the scan tool display “Mass Air Flow Meter” between the specified values?	0.9 - 1.1 v	Go to Step 3	Go to Step 5
3	1. Operate engine at normal temperature. 2. With engine at idle, the scan tool should indicate a “Mass Air Flow Meter” reading at the specified value Is the reading at the specified value?	1.3 - 1.7 v at Idle	Go to Step 4	Go to Step 5
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 and Conditions for Setting the DTC as noted. Does the scan tool display Mass Air Flow (MAF) voltage above the specified value?	4.8 v	Go to Step 5	Go to "Diagnostic Aids"
5	1. Turn the ignition OFF. 2. Disconnect MAF sensor. 3. Turn the ignition ON. 4. With a test light connected to the ground, probe the MAF sensor circuit terminal 2. Does the test light illuminate?	-	Go to Step 6	Go to "Over Voltage Protection Relay (OVPR) Circuit Check"
6	Measure voltage between MAF sensor harness connector terminal 2 and 3. Is voltage greater than specified value?	10 v	Go to Step 7	Go to Step 11
7	Measure voltage at MAF sensor harness connector terminal 4 with Digital Voltmeter to ground. Is voltage near the specified value?	5 v	Go to Step 8	Go to Step 10
8	With a test light connected to the battery, prove the MAF sensor signal circuit terminal 5. Does the test light illuminate?	-	Go to Step 9	Go to Step 12
9	Check the MAF sensor signal circuit for a short to voltage and repair as necessary. Is a repair necessary?	-	Go to Step 14	Go to Step 13

DTC P0103 Mass Air Flow High Voltage (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the 5 volts reference circuit for an open or short to ground and repair as necessary. Is a repair complete?	-	Go to Step 14	Go to Step 13
11	Check the MAF sensor ground circuit for an open and repair as necessary. Is a repair complete?	-	Go to Step 14	Go to Step 13
12	1. Turn the ignition OFF. 2. Replace the MAP sensor. Is the action complete?	-	Go to Step 14	-
13	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the action complete?	-	Go to Step 14	-
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine. 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 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) P0105
MANIFOLD ABSOLUTE PRESSURE PLAUSIBILITY (2.3L DOHC)

System 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 and engine speed. If the ECM does not see the expected MAP change or more, DTC P0105 will set.

Conditions for Setting the DTC

- The ratio between measured intake manifold pressure and emergency intake manifold pressure is between 0.5 and 1.5 for more than 2.5 seconds.
- DTCs P0107, P0108, P0120, P0335, P0336 and P0601 are not set.
- Misfire is not detected.
- Start end detected.
- Engine speed gradient is less than 200 [rpm/s].
- Throttle valve gradient is less than 20 [°/s].
- Throttle valve angle is greater than 15°.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The Malfunction Indicator Lamp (MIL) will turn off after three consecutive driving 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.

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.

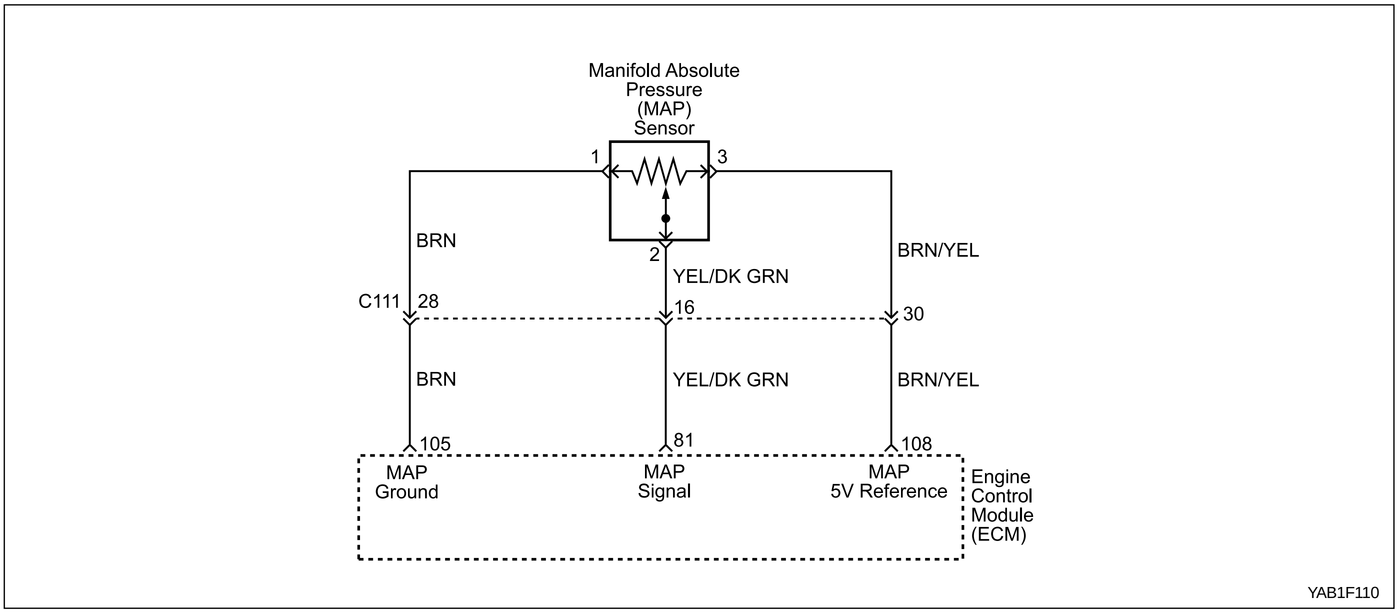
Test Description

Numbers below refer to the step numbers on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. A sensor that displays an ignition ON, engine OFF BARO value that does not appear the same as a known good vehicle should be considered to be malfunctioning.
3. While starting the engine, the MAP sensor should detect any changes in the manifold pressure. This test is to determine if the sensor is stuck at a value.
4. A normal MAP sensor will react as quickly to the throttle changes as they can be made. A sensor should not appear to be lazy or catch up with the throttle movements.
5. This step checks if the reason for no MAP change was due to a faulty sensor or vacuum source to the sensor.
7. The MAP sensor vacuum source should be thoroughly checked for restrictions. A drill bit can be used to clean out any casting flash that may exist in the vacuum port.
9. The MAP Sensor System Performance diagnostic may have to complete several tests before determining if the diagnostic has passed or failed the last test. Operate the vehicle in the Conditions for Setting the DTC several times to ensure that the diagnostic runs enough tests to pass or fail.
10. If no faults have been found at this point and no additional DTCs are set, refer to "Diagnostic Aids" in this section for additional checks and information.

DTC P0105 Manifold Absolute Pressure Rationality (2.3L DOHC)

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 "Euro On-Board Diagnostic System Check"
2	1. Install a scan tool. 2. Turn the ignition switch 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 in 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 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 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) P0107 MANIFOLD ABSOLUTE PRESSURE LOW VOLTAGE (2.3L 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 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 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 altitudes.

Conditions for Setting the DTC

- MAP sensor voltage is less than 0.1 volt
- No fault of engine speed.
- Engine start end reached.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The Malfunction Indicator Lamp (MIL) will turn off after three consecutive driving 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.

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.

Test Description

Numbers below refer to the step numbers on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step will determine if DTC P0107 is the result of a hard failure or an intermittent condition.
3. Jumpering harness terminal 2 to 3 (signal circuit to 5 volts) will determine if the sensor is malfunctioning or if there is a problem with the ECM or wiring.
6. The scan tool may not display 104kPa. The important thing is that the ECM recognizes the vacuum as more than 90kPa, indicating that the ECM and the signal circuit are OK. A test light that illuminates indicates a short to ground in the signal circuit.
7. A short to ground in the 5 volt reference circuit could also set additional DTCs.
11. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for the ECM reprogramming.

DTC P0107 Manifold Absolute Pressure Low Voltage (2.3L DOHC)

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 “Euro On-Board Diagnostic System Check”
2	1. Connect scan tool and start the engine. 2. With engine idling, 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 frieze 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: • 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 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

DTC P0107 Manifold Absolute Pressure Low Voltage (2.3L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
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	-
12	Check the MAP 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
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 Code (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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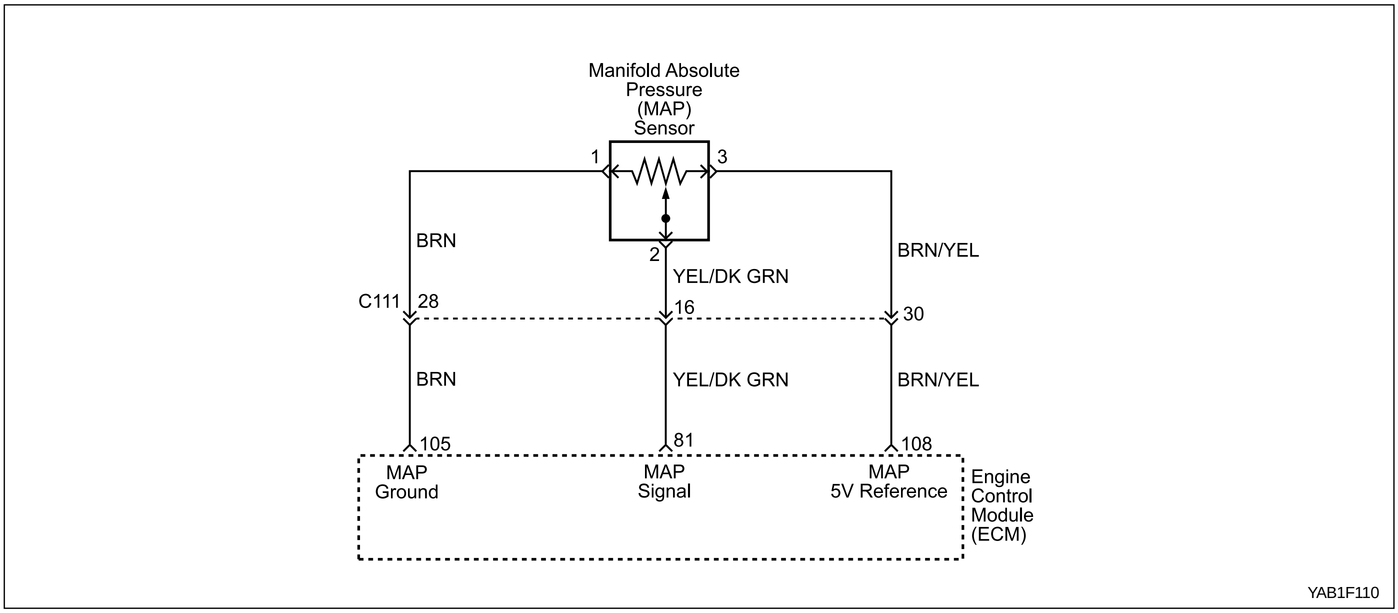

DIAGNOSTIC TROUBLE CODE (DTC) P0108 MANIFOLD ABSOLUTE PRESSURE HIGH VOLTAGE (2.3L DOHC)

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 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 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 altitudes.

Conditions for Setting the DTC

- MAP sensor voltage is greater than 4.9 volts.
- No fault of engine speed.
- Engine start end reached.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The Malfunction Indicator Lamp (MIL) will turn off after three consecutive driving 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.

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.

Test Description

Numbers below refer to the step numbers on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step will determine if DTC P0108 is the result of a hard failure or an intermittent condition.
3. This step simulates conditions for a DTC P0107. If the ECM recognizes the change, the ECM, the 5 volt reference and the sensor signal circuits are OK.

5. This step also looks for an open in the sensor ground circuit. If the circuit is open, additional DTCs will also be set. If no other DTCs are set and the circuit is found to be open, then the open must be between the MAP sensor and the electrical connector ground splice.
6. When the sensor signal circuit is shorted to battery voltage, the TP will be displayed above 0 % at all times and A/C High Side will be displayed high. The vehicle will also remain in Open Loop.
8. The MAP sensor vacuum source should only supply vacuum to the MAP sensor. Check the vacuum port for a restriction caused by casting flash.
9. Disconnect all sensors that use a 5 volt reference one at a time while monitoring the short on the 5 volt reference circuit. Replace any sensor that may have caused the short on the 5 volt reference circuit.
12. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for the ECM reprogramming.

DTC P0108 Manifold Absolute Pressure High Voltage (2.3L DOHC)

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 “Euro On-Board Diagnostic System Check”
2	1. Install a scan tool. 2. Idle the engine. Does the scan tool display a Manifold Absolute Pressure (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 scan tool display a MAP of the specified value or less?	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 frieze frame conditions and Conditions For Setting the DTC as noted. Does the scan tool display a MAP equal to or greater 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 B+. Does the test light illuminate?	-	Go to Step 7	Go to Step 11
6	Check the MAP sensor signal circuit at terminal 81 for a short to voltage and repair as necessary. Is a repair necessary?	-	Go to Step 14	Go to Step 12
7	With a Digital Voltmeter (DVM) connected to ground, probe the 5 volt reference circuit at terminal 108. Does the DVM display 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 108 for a short to voltage and repair as necrssary. Is a repair necessary?	-	Go to Step 14	Go to Step 12
10	Repair the vacuum source as necessary. Is a repair necessary?	-	Go to Step 14	-

DTC P0108 Manifold Absolute Pressure High Voltage (2.3L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open in the MAP sensor ground citcuit at terminal 1 and repair as necessary. Is a repair necessary?	-	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	-
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 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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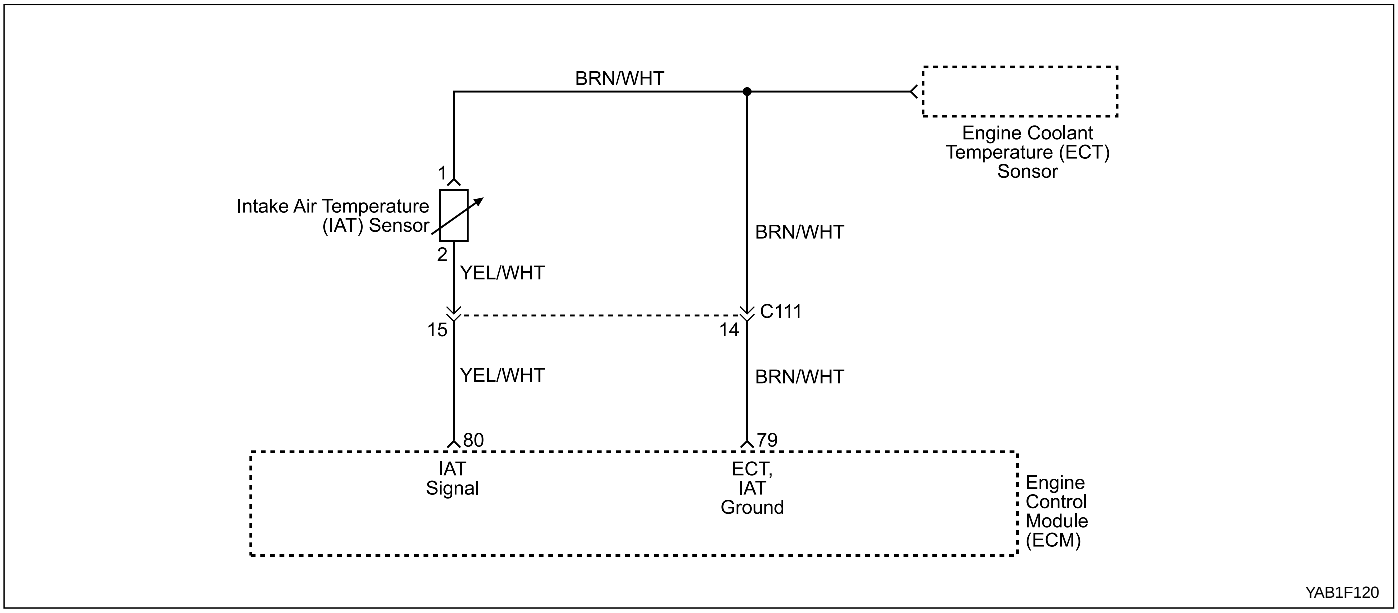

DIAGNOSTIC TROUBLE CODE (DTC) P0111 INTAKE AIR TEMPERATURE PLAUSIBILITY (2.3L DOHC)

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

- Temperature change rate is greater than 20 °C between 2 measurements (100 milliseconds) more than five times.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

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.

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
4. This step simulates a DTC P0113 condition. If the scan tool displays the specified value, the IAT signal circuit and the ECM are OK.
14. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0111 Intake Air Temperature Plausibility (2.3L DOHC)

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 “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is the Intake Air Temperature (IAT) value greater than the specified value?	0 v	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?	0 v	Go to Step 4	Go to Step 5
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?	4.9 v	Go to Step 11	Go to Step 12
5	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 at terminal 2 and the IAT sensor ground circuit at terminal 1 together at the IAT sensor electrical connector. Is the IAT sensor value greater than the specified value?	0 v	Go to Step 7	Go to Step 6
6	Jumper the IAT sensor signal circuit at terminal 2 to ground. Is the IAT sensor value greater than the value specified?	0 v	Go to Step 8	Go to Step 9
7	Check for a poor connection at the IAT sensor electrical connector and replace any malfunctioning terminals if necessary. Is a repair necessary?	-	Go to Step 15	Go to Step 11
8	Check the IAT sensor ground circuit for an open and repair as necessary. Is a repair necessary?	-	Go to Step 15	Go to Step 10
9	Check the IAT sensor signal circuit for an open and repair as necessary. Is a repair necessary?	-	Go to Step 15	Go to Step 10
10	Check for a poor IAT sensor ground circuit at terminal 79 or a poor IAT sensor signal circuit terminal 80 connection at the Engine Control Module (ECM) and repair if necessary. Is a repair necessary?	-	Go to Step 15	Go to Step 14
11	Replace the IAT sensor. Is the action complete?	-	Go to Step 15	-

DTC P0111 Intake Air Temperature Plausibility (2.3L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Turn the ignition switch OFF. 2. Disconnect the Engine Control Module (ECM) red 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 13	Go to Step 14
13	Repair the short to ground in the IAT sensor signal circuit as necessary. Is the repair complete?	-	Go to Step 15	-
14	1. Turn the ignition switch OFF. 2. Replace the ECM. Is the action 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 ran and passed?	-	Go to Step 16	Go to Step 2
16	Check if any DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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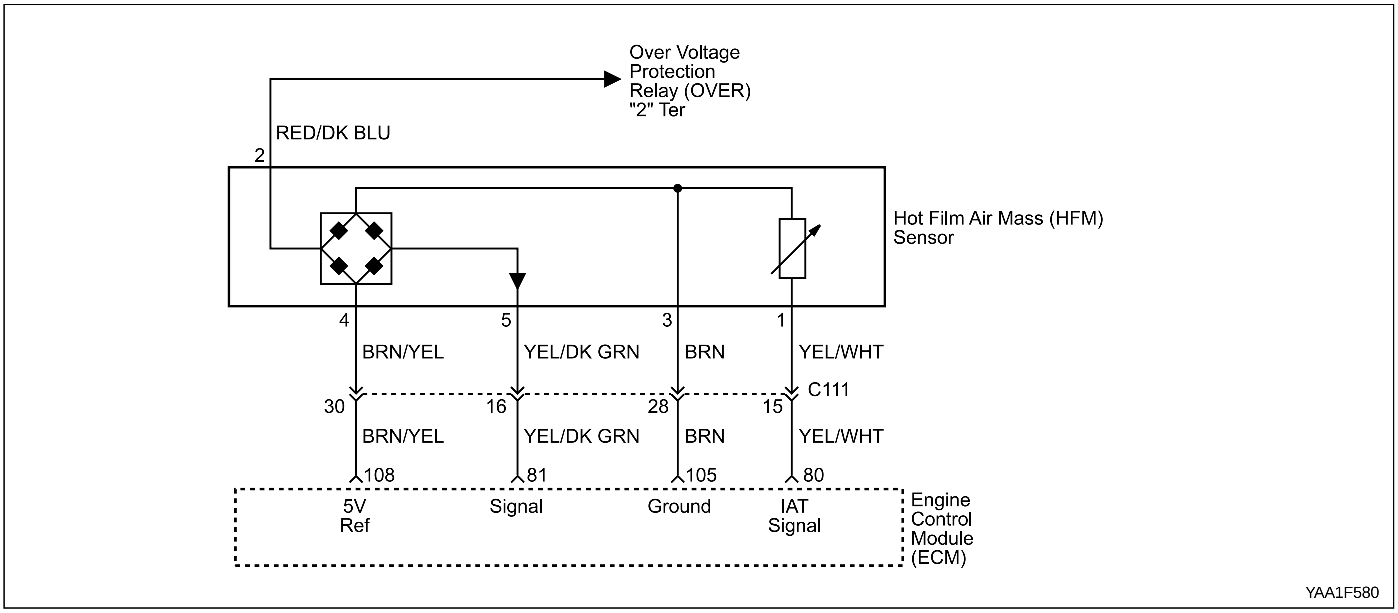

DIAGNOSTIC TROUBLE CODE (DTC) P0111 INTAKE AIR TEMPERATURE PLAUSIBILITY (3.2L DOHC)

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

- Temperature change rate is greater than 20°C between 2 measurements (100 milliseconds) more than five times.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

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.

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
4. This step simulates a DTC P0113 condition. If the scan tool displays the specified value, the IAT signal circuit and the ECM are OK.
14. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0111 Intake Air Temperature Plausibility (3.2L DOHC)

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 "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is the Intake Air Temperature (IAT) value greater than the specified value?	0 v	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?	0 v	Go to Step 4	Go to Step 5
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?	4.9 v	Go to Step 11	Go to Step 12
5	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 at terminal 1 and the IAT sensor ground circuit at terminal 3 together at the IAT sensor electrical connector. Is the IAT sensor value greater than the specified value?	0 v	Go to Step 7	Go to Step 6
6	Jumper the IAT sensor signal circuit at terminal 1 to ground. Is the IAT sensor value greater than the value specified?	0 v	Go to Step 8	Go to Step 9
7	Check for a poor connection at the IAT sensor electrical connector and replace any malfunctioning terminals if necessary. Is a repair necessary?	-	Go to Step 15	Go to Step 11
8	Check the IAT sensor ground circuit for an open and repair as necessary. Is a repair necessary?	-	Go to Step 15	Go to Step 10
9	Check the IAT sensor signal circuit for an open and repair as necessary. Is a repair necessary?	-	Go to Step 15	Go to Step 10
10	Check for a poor IAT sensor ground circuit at terminal 105 or a poor IAT sensor signal circuit terminal 80 connection at the Engine Control Module (ECM) and repair if neces sary. Is a repair necessary?	-	Go to Step 15	Go to Step 14
11	Replace the IAT sensor. Is the action complete?	-	Go to Step 15	-

DTC P0111 Intake Air Temperature Plausibility (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Turn the ignition switch OFF. 2. Disconnect the Engine Control Module (ECM) red connector. 3. With a test light connected to B+, probe the IAT sensor signal circuit, terminal 1 at the IAT sensor electrical connector. Does the test light illuminate?	-	Go to Step 13	Go to Step 14
13	Repair the short to ground in the IAT sensor signal circuit as necessary. Is the repair complete?	-	Go to Step 15	-
14	1. Turn the ignition switch OFF. 2. Replace the ECM. Is the action 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 ran and passed?	-	Go to Step 16	Go to Step 2
16	Check if any DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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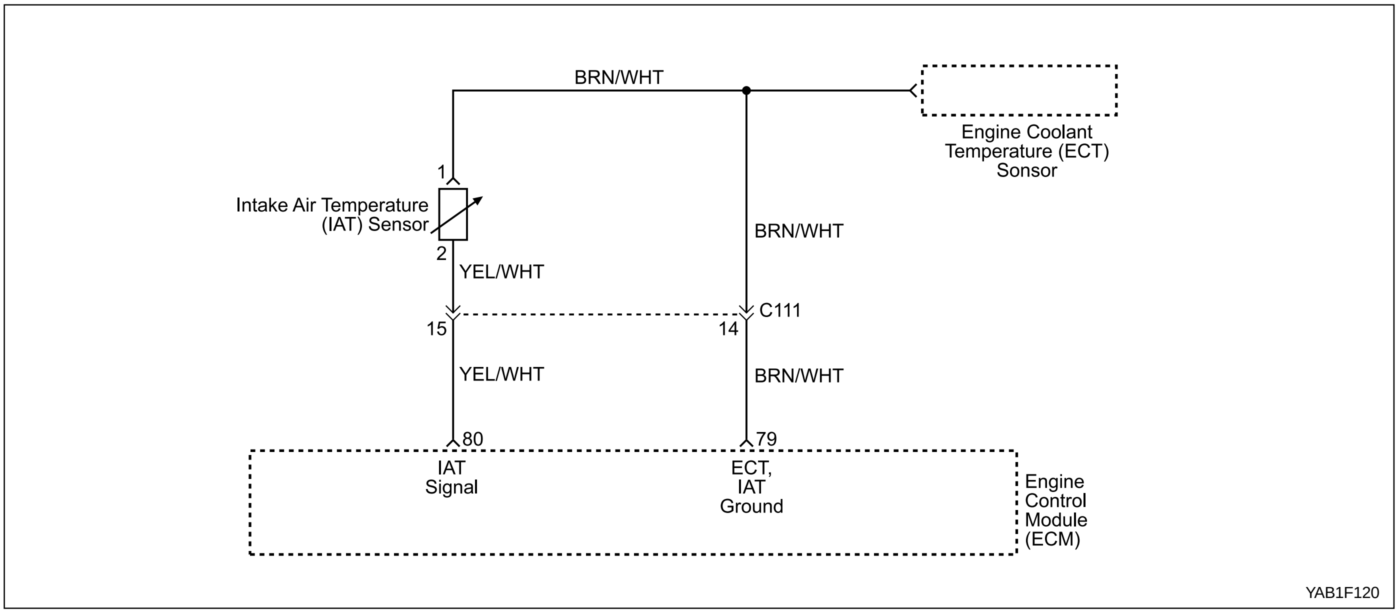


DIAGNOSTIC TROUBLE CODE (DTC) P0112 INTAKE AIR TEMPERATURE LOW VOLTAGE (2.3L DOHC)

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 voltage is less than 0.1 volt.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

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.

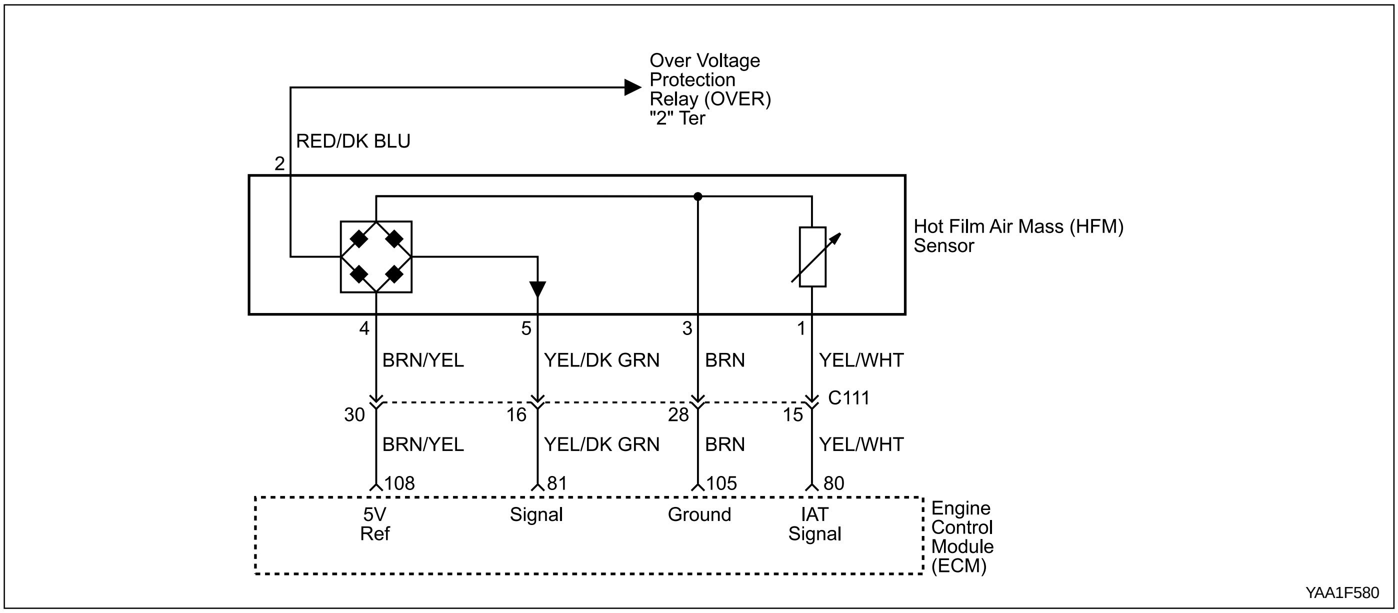
Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
4. This step simulates a DTC P0113 condition. If the scan tool displays the specified value, the IAT signal circuit and the ECM are OK.
9. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0112 Intake Air Temperature Low Voltage (2.3L DOHC)

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 “Euro On-Board Diagnostic System Check”
2	1. Turn ignition ON, with the engine OFF. 2. Install a scan tool. Is the Intake Air Temperature (IAT) value near the specified value?	0 v	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 near the specified value?	0 v	Go to Step 4	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Disconnect the IAT sensor electrical connector. 3. Turn the ignition switch ON. Is the IAT sensor value near the specified value?	4.9 v	Go to Step 5	Go to Step 6
5	Replace the IAT sensor. Is the action complete?	-	Go to Step 10	-
6	With a test light connected to B+, probe the IAT sensor circuit, terminal 1 at the IAT sensor electrical 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 1 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 in the IAT sensor circuit as necessary. Is the repair complete?	-	Go to Step 10	-
9	1. Turn the ignition switch 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 ran and passed?	-	Go to Step 11	Go to Step 2
11	Check if any DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0112 INTAKE AIR TEMPERATURE LOW VOLTAGE (3.2L 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 voltage is less than 0.1 volt.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

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.

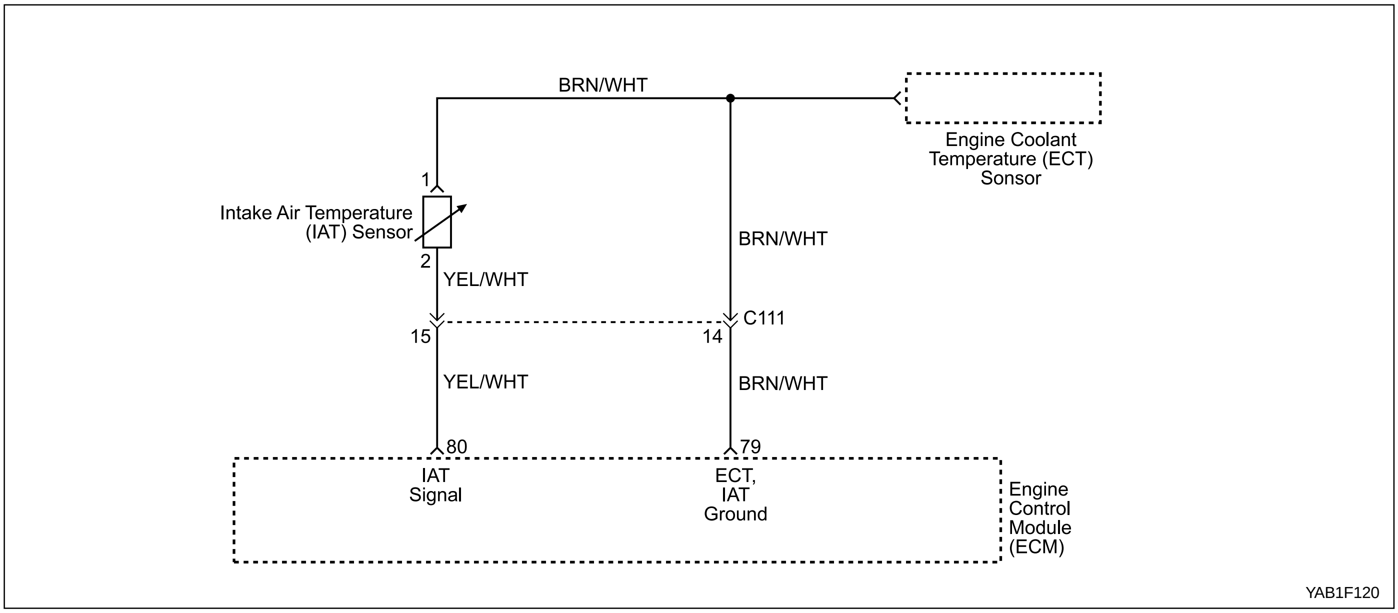
Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
4. This step simulates a DTC P0113 condition. If the scan tool displays the specified value, the IAT signal circuit and the ECM are OK.
9. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0112 Intake Air Temperature Low Voltage (3.2L DOHC)

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 “Euro On-Board Diagnostic System Check”
2	1. Turn ignition ON, with the engine OFF. 2. Install a scan tool. Is the Intake Air Temperature (IAT) value near the specified value?	0 v	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 near the specified value?	0 v	Go to Step 4	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Disconnect the IAT sensor electrical connector. 3. Turn the ignition switch ON. Is the IAT sensor value near the specified value?	4.9 v	Go to Step 5	Go to Step 6
5	Replace the IAT sensor. Is the action complete?	-	Go to Step 10	-
6	With a test light connected to B+, probe the IAT sensor circuit, terminal 3 at the IAT sensor electrical 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 3 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 in the IAT sensor circuit as necessary. Is the repair complete?	-	Go to Step 10	-
9	1. Turn the ignition switch 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 ran and passed?	-	Go to Step 11	Go to Step 2
11	Check if any 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 HIGH VOLTAGE (2.3L 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 re sistance is high; therefore the IAT signal voltage will be high. If the intake air is warm, resistance is low; there fore the IAT signal voltage will be low.

Conditions for Setting the DTC

- IAT voltage is more than 4.9 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

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.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
4. This step simulates a DTC P0112. If the ECM senses the change, the ECM and wiring are OK.
5. This step will determine if the reason the ECM did not sense the change was due to a open ground or signal circuit or malfunctioning ECM.
11. The replacement ECM must be reprogrammed. Re fer to the latest Techline procedure for ECM reprogramming.

DTC P0113 Intake Air Temperature High Voltage (2.3L DOHC)

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 "Euro On-Board Diagnostic System Check"
2	1. Turn ignition ON, with the engine OFF. 2. Install a scan tool. Is the Intake Air Temperature (IAT) value near the specified value?	4.9 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 IAT sensor value near the specified value?	4.9 v	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 at terminal 2 and the IAT sensor ground circuit at terminal 1 together at the IAT sensor electrical connector. Is the IAT sensor value near the specified value?	0 v	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 near the value specified?	0 v	Go to Step 7	Go to Step 8
6	Check for a poor connection at the IAT sensor electrical connector and replace any malfunctioning terminals if necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 10
7	Check the IAT sensor ground circuit for an open and repair as necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 9
8	Check the IAT sensor signal circuit for an open and repair as necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 9
9	Check for a poor IAT sensor ground circuit at terminal 79 or a poor IAT sensor signal circuit terminal 80 connection at the Engine Control Module (ECM) and repair if necessary.	-	Go to Step 12	Go to Step 11
10	Is a repair necessary? Replace the IAT sensor.	-	Go to Step 12	-
11	Is the action complete? 1. Turn the ignition switch OFF. 2. Replace the ECM. Is the action complete?	-	Go to Step 12	-

DTC P0113 Intake Air Temperature High Voltage (2.3L 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 ran and passed?	-	Go to Step 13	Go to Step 2
13	Check if any DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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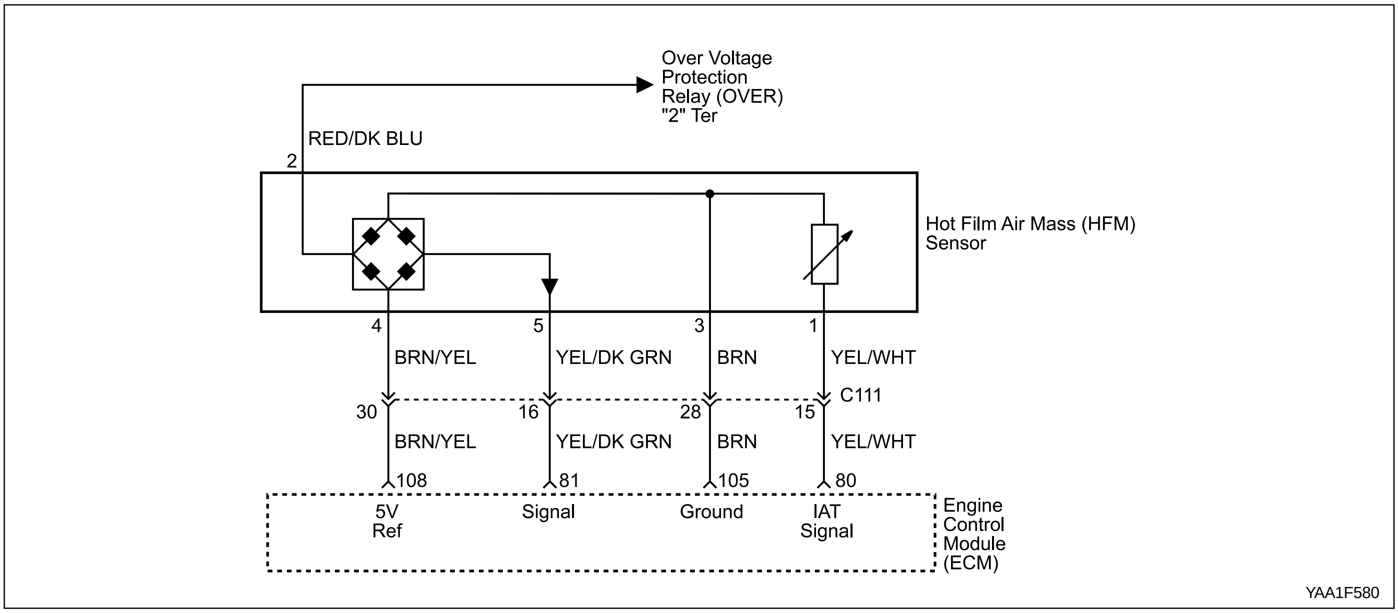

DIAGNOSTIC TROUBLE CODE (DTC) P0113
INTAKE AIR TEMPERATURE HIGH VOLTAGE (3.2L DOHC)

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 re sistance is high; therefore the IAT signal voltage will be high. If the intake air is warm, resistance is low; there fore the IAT signal voltage will be low.

Conditions for Setting the DTC

- IAT voltage is more than 4.9 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

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.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
4. This step simulates a DTC P0112. If the ECM senses the change, the ECM and wiring are OK.
5. This step will determine if the reason the ECM did not sense the change was due to a open ground or signal circuit or malfunctioning ECM.
11. The replacement ECM must be reprogrammed. Re fer to the latest Techline procedure for ECM reprogramming.

DTC P0113 Intake Air Temperature High Voltage (3.2L DOHC)

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 "Euro On-Board Diagnostic System Check"
2	1. Turn ignition ON, with the engine OFF. 2. Install a scan tool. Is the Intake Air Temperature (IAT) value near the specified value?	4.9 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 IAT sensor value near the specified value?	4.9 v	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 at terminal 1 and the IAT sensor ground circuit at terminal 3 together at the IAT sensor electrical connector. Is the IAT sensor value near the specified value?	0 v	Go to Step 6	Go to Step 5
5	Jumper the IAT sensor signal circuit at terminal 1 to ground. Is the IAT sensor value near the value specified?	0 v	Go to Step 7	Go to Step 8
6	Check for a poor connection at the IAT sensor electrical connector and replace any malfunctioning terminals if necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 10
7	Check the IAT sensor ground circuit for an open and repair as necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 9
8	Check the IAT sensor signal circuit for an open and repair as necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 9
9	Check for a poor IAT sensor ground circuit at terminal 105 or a poor IAT sensor signal circuit terminal 80 connection at the Engine Control Module (ECM) and repair if necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 11
10	Replace the IAT 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 P0113 Intake Air Temperature High Voltage (3.2L 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 ran and passed?	-	Go to Step 13	Go to Step 2
13	Check if any DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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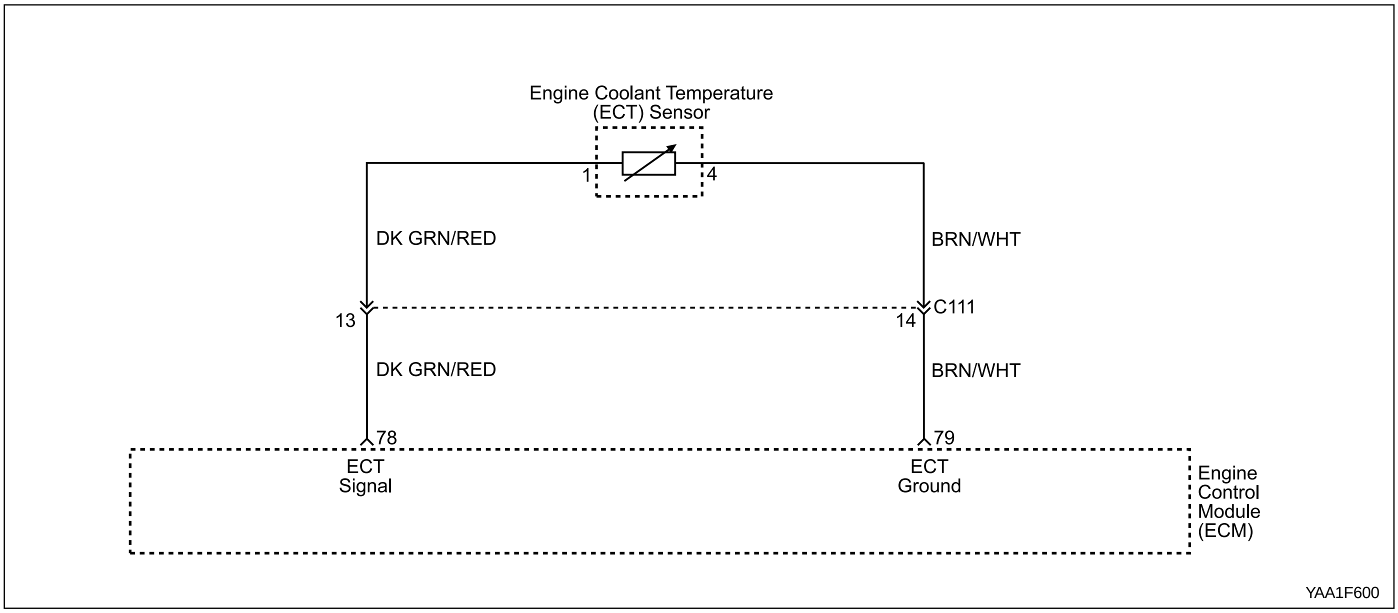


DIAGNOSTIC TROUBLE CODE (DTC) P0116
ENGINE COOLANT TEMPERATURE PLAUSIBILITY

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 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.

The ECT sensor is used to control the following items:

- Fuel delivery
- Ignition
- Evaporative Emission (EVAP) canister purge valve
- Electric cooling fan

Conditions for Setting the DTC

- The temperature threshold is less than 50 °C (112°F) after normal operating temperature.
- The temperature change rate is greater than 20 °C.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.
- Both coolant fans turn on.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

Diagnostic Aids

For checking a loose connection the rate of change between two measurements is monitored. A function counter is increased when between two measurements a calibrated threshold is exceeded. If the counter exceed a limit, a fault code is set. Should the temperature sensor exceed an upper limit and drop below a lower limit afterwards functional problem of the sensor is assumed and a fault code is set. Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to “Temperature vs Resistance” in this sention.

Test Description

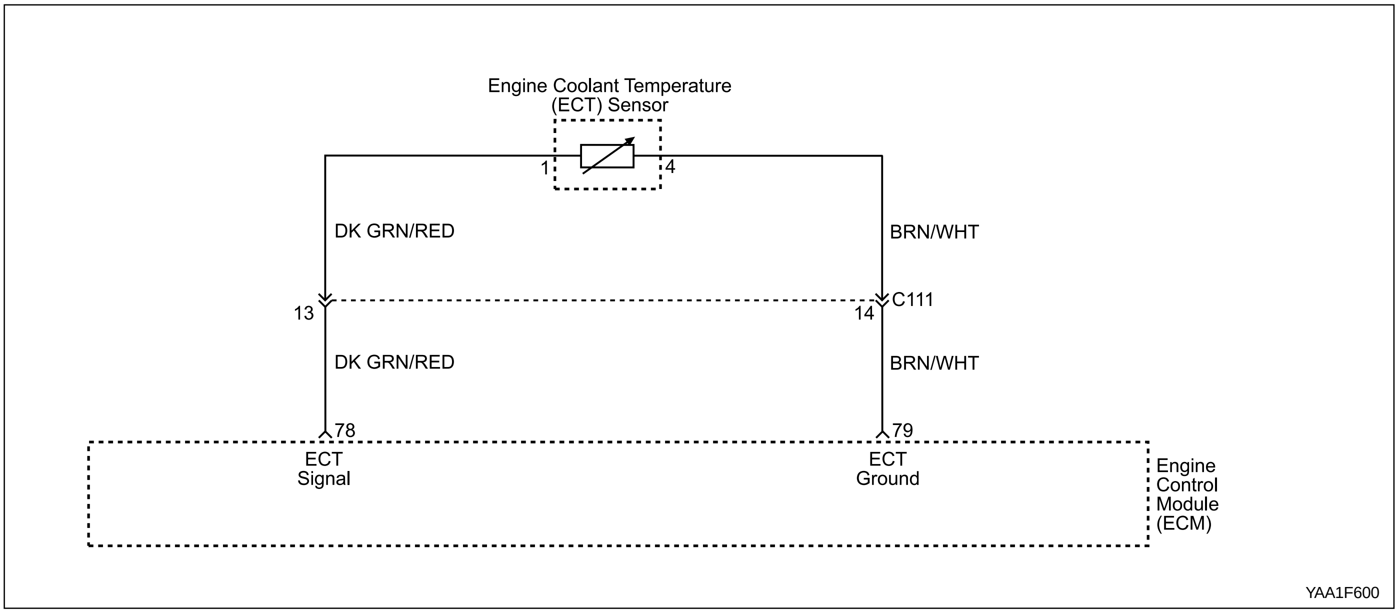
Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

10. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0116 Engine Coolant Temperature Plausibility

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 "Euro On-Board Diagnostic System Check"
2	1. Run the engine until warming up. 2. Install a scan tool. Is the Engine Coolant Temperature (ECT) sensor value less than the specified value?	50 °C (122 °F)	Go to Step 4	Go to Step 3
3	1. Allow the engine to idle. 2. Review 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 ECT sensor value less than the specified value?	50 °C (122 °F)	Go to Step 4	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Disconnect the ECT sensor electrical connector. 3. Turn the ignition ON. Is the ECT sensor value near the specified value?	4.9 v	Go to Step 5	Go to Step 7
5	Check for the ECT sensor signal circuit for an open or short to ground and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 6
6	Check for poor connections at the ECT sensor and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 9
7	Check the ECT sensor ground circuit for an open and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 8
8	Check for a poor ECT sensor ground circuit at terminal 79 or a poor ECT sensor signal circuit at terminal 78 connection at the Engine Control Module (ECM) and replace the terminals if necessary. Do any of the terminal(s) need to be replaced?	-	Go to Step 11	Go to Step 10
9	1. Turn the ignition OFF. 2. Replace the ECT sensor. Is the action complete?	-	Go to Step 11	-
10	1. Turn the ignition OFF. 2. Replace the ECM. Is the action 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 ran and passed?	-	Go to Step 12	Go to Step 2
12	Check if any 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 LOW VOLTAGE

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 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.

The ECT sensor is used to control the following items:

- Fuel delivery
- Ignition
- Evaporative Emission (EVAP) canister purge valve
- Electric cooling fan

Conditions for Setting the DTC

- The Engine Coolant Temperature (ECT) is less than 0.11 volt.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.
- Both coolant fans turn on.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

Diagnostic Aids

The output level of the sensor is compared with an upper and lower threshold value continuously, a special activation condition does not apply. As soon as the output voltage exceeds the lower voltage threshold, a fault code P0117 is set.

Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to “ Temperature vs. Resistance” in this section.

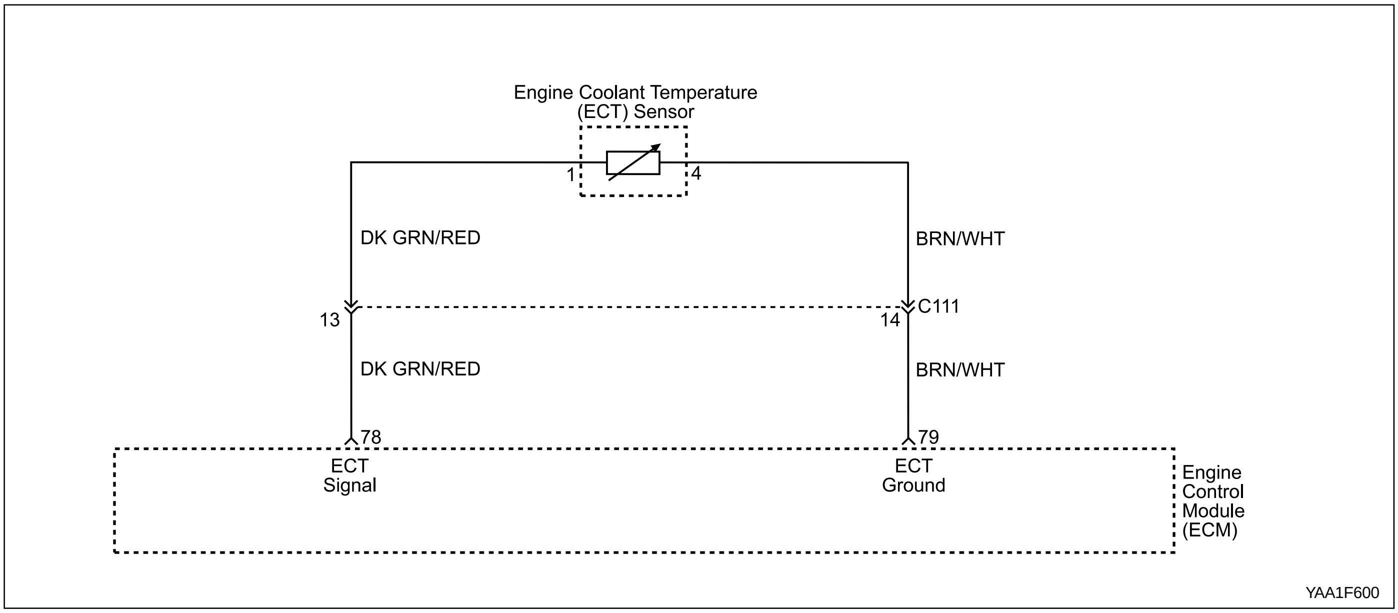
Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
4. This step simulates a DTC P0118 condition. If the ECM senses the change, then the ECM and the ECT wiring are OK.
7. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0117 Engine Coolant Temperature 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 "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install a scan tool. Is the engine coolant temperature (ECT) sensor value near the specified value?	0 v	Go to Step 4	Go to Step 3
3	1. Turn the ignition switch ON with the engine OFF. 2. Review 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 ECT sensor value near the specified value?	0 v	Go to Step 4	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Disconnect the ECT sensor electrical connector. 3. Turn the ignition ON. Is the ECT sensor value near the specified value?	4.9 v	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 necessary. Is a repair necessary?	-	Go to Step 8	Go to Step 7
6	Replace the ECT sensor. Is the action 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 ran and passed?	-	Go to Step 9	Go to Step 2
9	Check if any 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 HIGH VOLTAGE

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 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.

The ECT sensor is used to control the following items:

- Fuel delivery
- Ignition
- Evaporative Emission (EVAP) canister purge valve
- Electric cooling fan

Conditions for Setting the DTC

- Engine Coolant Temperature (ECT) is greater than 4.96 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.
- Both coolant fans turn on.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

Diagnostic Aids

The output level of the sensor is compared with an upper and lower threshold value continuously, a special activation condition does not apply. As soon as the output voltage exceeds the upper voltage threshold, a fault code P0118 is set.

Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to “ Temperature vs. Resistance” in this section.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
4. This step simulates a DTC P0117 condition. If the ECM senses the change, then the ECM and the ECT wiring are OK.
11. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0118 Engine Coolant Temperature 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 “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install a scan tool. Is the Engine Coolant Temperature (ECT) sensor value near the specified value?	4.9 v	Go to Step 4	Go to Step 3
3	1. Turn the ignition switch ON with the engine OFF. 2. Review 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 ECT sensor value near the specified value?	4.9 v	Go to Step 4	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Disconnect the ECT sensor electrical connector. 3. Jumper the ECT sensor signal circuit at terminal 1 and the ECT sensor ground circuit at terminal 4 together at the ECT electrical connector. 4. Turn the ignition ON. Is the ECT sensor value near the specified value?	0 v	Go to Step 6	Go to Step 5
5	Jumper the ECT sensor signal circuit at terminal 1 to chassis ground. Is the ECT sensor value near the specified value?	0 v	Go to Step 7	Go to Step 8
6	Check for poor connections at the ECT sensor and repair as necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 10
7	Check the ECT sensor ground circuit for an open and repair as necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 9
8	Check the ECT sensor signal circuit for an open and repair as necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 9
9	Check for a poor ECT sensor ground circuit at terminal 79 or a poor ECT sensor signal circuit at terminal 78 connection at the Engine Control Module (ECM) and replace the terminals if necessary. Do any of the terminal(s) need to be replaced?	-	Go to Step 12	Go to Step 11
10	1. Turn the ignition OFF. 2. Replace the ECT sensor. Is the action 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 High Voltage (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 ran and passed?	-	Go to Step 13	Go to Step 2
13	Check if any DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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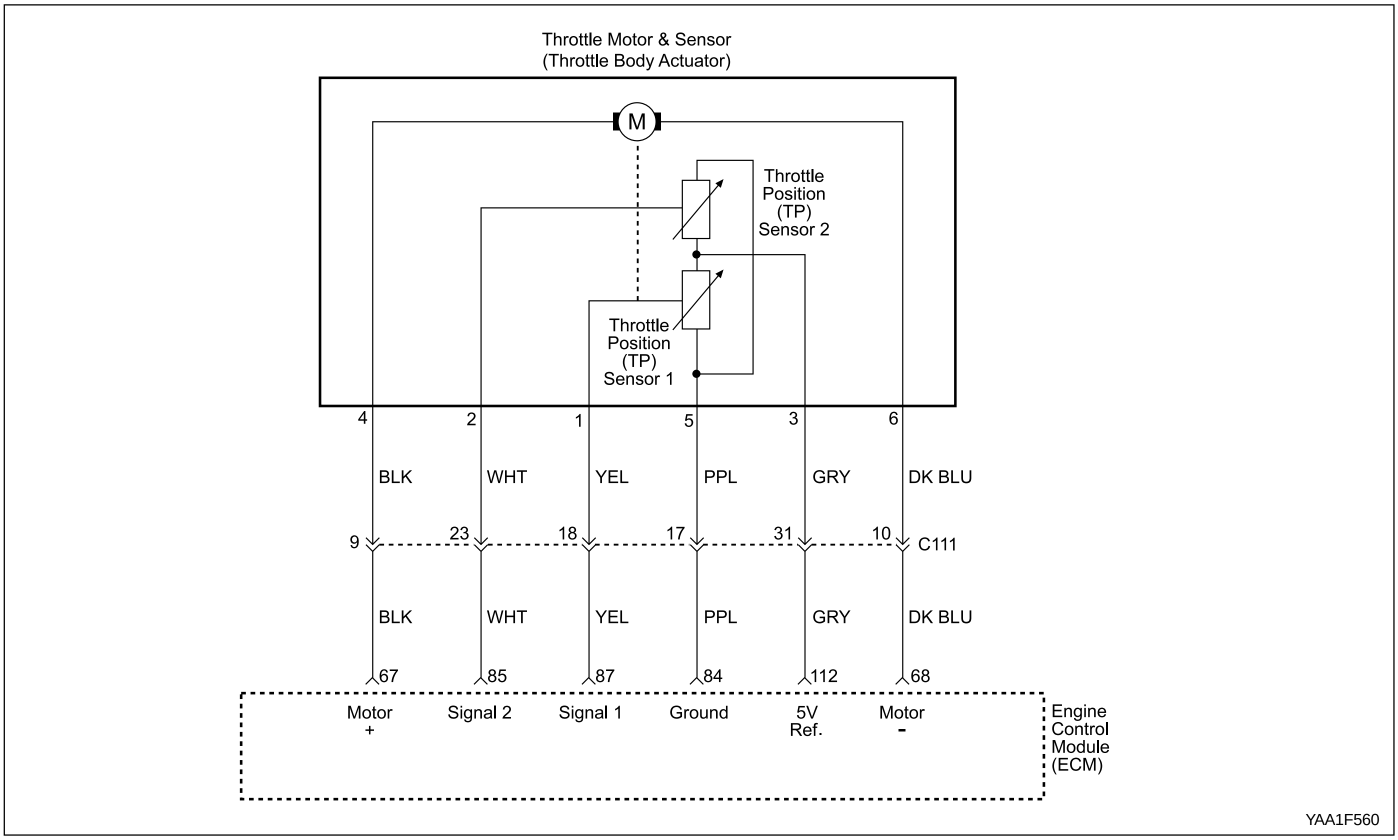


DIAGNOSTIC TROUBLE CODE (DTC) P0120 THROTTLE POSITION SENSORS ERROR

Circuit Description

The Engine Control Module (ECM) supplies a 5 volt ref erence 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 0.3 ~ 0.9 volts at closed throttle, to over 4.0 ~ 4.6 volts at Wide Open Throttle (WOT).

The TP sensors serve for engine load control according to the drive pedal command. Load adjustments independent of the drive pedal command can be implemented; such functions are, for instance, idle control, speed control, drive slip control, load shock damping, and similar functions.

When the actuator current fails, the throttle valve is returned to emergency operating position by a spring. The throttle valve position, and thereby the actuator drive position checkback is provided by two potentiometers. The motor positions the throttle valve against the return spring force. Motor and return spring are two separate energy sources. Each of them is able to position the throttle valve in emergency position alone. Throttle valve position checkback and monitoring is provided by two actual value potentiometers connected to the engine control electronics.

Conditions for Setting the DTC

- Ignition ON.
- Electrical system protection is not active.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

Diagnostic Aids

The throttle actuator includes two potentiometers which are supplied from the ECU. All signals are calculated as voltage ratio (signal voltage divided by supply voltage). This function is diagnosed continuously during ignition on. In the following situations a fault is detected and the system is switched to the mode of reduced operating range:

- voltage ratio of sensor 1 out of limits
- voltage ratio of sensor 2 out of limits
- supply voltage out of limits
- voltage ratio of sensor 1 is not plausible to voltage ratio of sensor 2

If one sensor signal is not plausible to the other one the defective sensor is detected by checking engine speed and air mass.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The Euro 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 malfuction occurred. The information is then stored on the scan tool for later reference.
5. If DTC P0120 cannot be duplicated, the information included in the Freeze Frame/Failure Records data can be useful. Use the scan tool DTC information data to determine the status of the DTC.
11. If additional DTCs are set, check the 5 reference circuits for a short the ground.
13. If additional DTCs are set, check the 5 reference circuits for a short the ground.
15. If the test light illuminates while probing the TP signal circuit, then the TP signal circuit is shorted to ground.
21. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.
23. If no faults have been found at this point and no additional DTCs were set, refer to “Diagnostic Aids” in this section for additional checks and information.

DTC P0120 Throttle Position Sensor Error

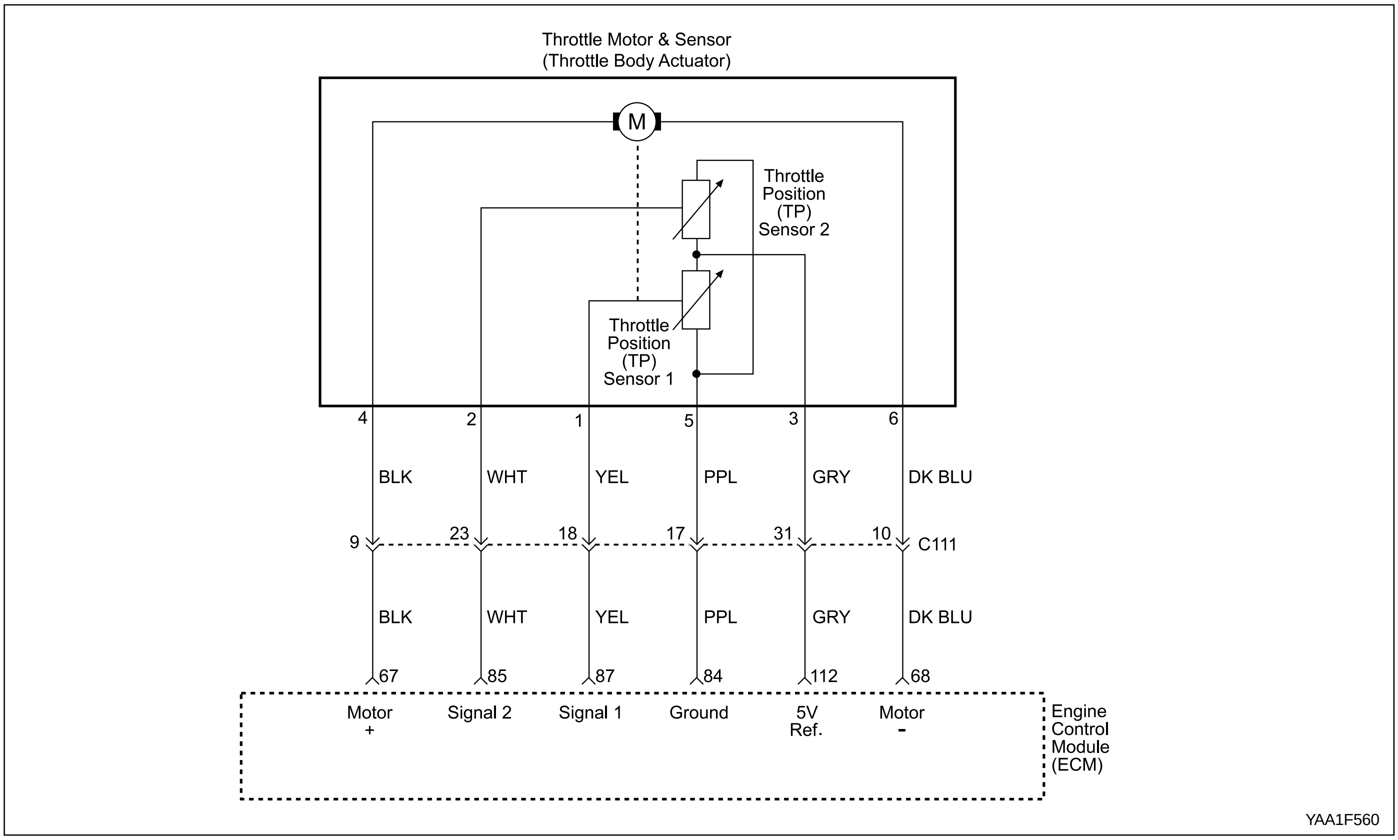
Step	Action	Value(s)	Yes	No
1	1. Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install a scan tool. 3. Select the Throttle Position (TP) angle parameter on the scan tool. 4. Monitor the scan tool while pressing the accelerator pedal to the floor and then slowly releasing the pedal. (Repeat the procedure several times.) Does the TP angle value increase steadily when the accelerator pedal is pressed to greater than the specified value and decrease steadily when the pedal is released to less than the specified value?	98 % 1 %	Go to Step 3	Go to Step 5
3	Does the scan tool display a throttle position (TP) sensor 1 voltage between the specified value when the throttle is fully closed?	0.3 - 0.9 v	Go to Step 4	Go to Step 6
4	Does the scan tool display a throttle position (TP) sensor 2 voltage between the specified value when the throttle is fully closed?	4.0 - 4.6 v	Go to Step 5	Go to Step 6
5	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 DTC P120 set again?	-	Go to Step 6	Go to Step 22

DTC P0120 Throttle Position Sensor Error (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF. 2. Disconnect the TP sensor electrical connector. 3. Turn the ignition ON. 4. Using the a Digital Voltmeter (DVM), measure the signal voltage for TP sensor 1 and 2. Is the TP sensor 1 and 2 voltage near the specified value?	TPS1 : 5 v TPS2 : 0 v	Go to Step 9	If TPS1 value is not near specified value, Goto Step 7 If TPS2 value is not near specified value, Go to Step 8
7	Check the TP sensor 1 signal circuit at the APP sensor 1 harness connector terminal 1 for a short to voltage and repair as necessary. Is a repair necessary?	-	Go to Step 22	Go to Step 21
8	Check the TP sensor 2 signal circuit at the APP sensor 2 harness connector terminal 2 for a short to voltage and repair as necessary. Is a repair necessary?	-	Go to Step 22	Go to Step 21
9	Jumper the 5 volt reference circuit, terminal 3 and the TP sensor 1 signal circuit, terminal 1 together at the TP sensor electrical connector. Is the TP sensor 1 voltage over the specified value?	4.0 v	Go to Step 10	Go to Step 11
10	Jumper the 5 volt reference circuit, terminal 3 and the TP sensor 2 signal circuit, terminal 2 together at the TP sensor electrical connector. Is the TP sensor 2 voltage below the specified value?	1.0 v	Go to Step 17	Go to Step 13
11	Connect a test light between B+ and the TP sensor 1 signal circuit at terminal 1. Is the TP sensor 1 voltage greater than the specified value?	4.0 v	Go to Step 15	Go to Step 12
12	Check the TP sensor 1 signal circuit, terminal 1 for an open or short to ground and repair as necessary. Is the repair complete?	-	Go to Step 22	Go to Step 21
13	Connect a test light between B+ and the TP sensor 2 signal circuit at terminal 2. Is the TP sensor 2 voltage less than the specified value?	1.0 v	Go to Step 15	Go to Step 14
14	Check the TP sensor 2 signal circuit, terminal 2 for an open or short to ground and repair as necessary. Is the repair complete?	-	Go to Step 22	Go to Step 21
15	Check the 5 volt reference circuit for an open or short to ground and repair as necessary. Is the repair complete?	-	Go to Step 22	Go to Step 16
16	Check the 5 volt reference circuit for a poor connection at the Engine Control Module (ECM), terminal 112 and repair the terminal as necessary. Is the repair complete?	-	Go to Step 22	Go to Step 21
17	Connect a test light to B+ and probe the ground circuit at terminal 5 of the TP sensors harness connector. Does the test light illuminate?	-	Go to Step 18	Go to Step 19

DTC P0120 Throttle Position Sensor Error (Cont'd)

Step	Action	Value(s)	Yes	No
18	Check for the motor (+) circuit terminal 4 and the motor (-) circuit terminal 6 for openr and repair as necessary. Is the repair complete?	-	Go to Step 22	Go to Step 20
19	Check the TP sensor ground circuit , terminal 5 for open and repair as necessary? Is the repair complete?	-	Go to Step 22	Go to Step 21
20	1. Turn the ignition OFF. 2. Replace the throttle body (including sensors). Is the action complete?	-	Go to Step 22	-
21	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 22	-
22	1. 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 ran and passed?	-	Go to Step 23	Go to Step 2
23	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) P0121 THROTTLE ADAPTATION OR THROTTLE SPRING CHECK

Circuit Description

The Engine Control Module (ECM) supplies a 5 volt reference 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 0.3 ~ 0.9 volts at closed throttle, to over 4.0 ~ 4.6 volts at Wide Open Throttle (WOT).

The TP sensors serve for engine load control according to the drive pedal command. Load adjustments independent of the drive pedal command can be implemented; such functions are, for instance, idle control, speed control, drive slip control, load shock damping, and similar functions.

When the actuator current fails, the throttle valve is returned to emergency operating position by a spring. The throttle valve position, and thereby the actuator drive position checkback is provided by two potentiometers. The motor positions the throttle valve against the return spring force. Motor and return spring are two separate energy sources. Each of them is able to position the throttle valve in emergency position alone. Throttle valve position checkback and monitoring is provided by two actual value potentiometers connected to the engine control electronics.

Conditions for Setting the DTC

- Ignition status ON.
- Adaptation status is active.
- Electrical system protection is not active.
- Adaptation status after activation is not completed.
- Closing time is more than 300 ms.

Action Taken When the DTC Sets

- The Malfuction Indicator Lamp (MIL) will illuminate after two 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

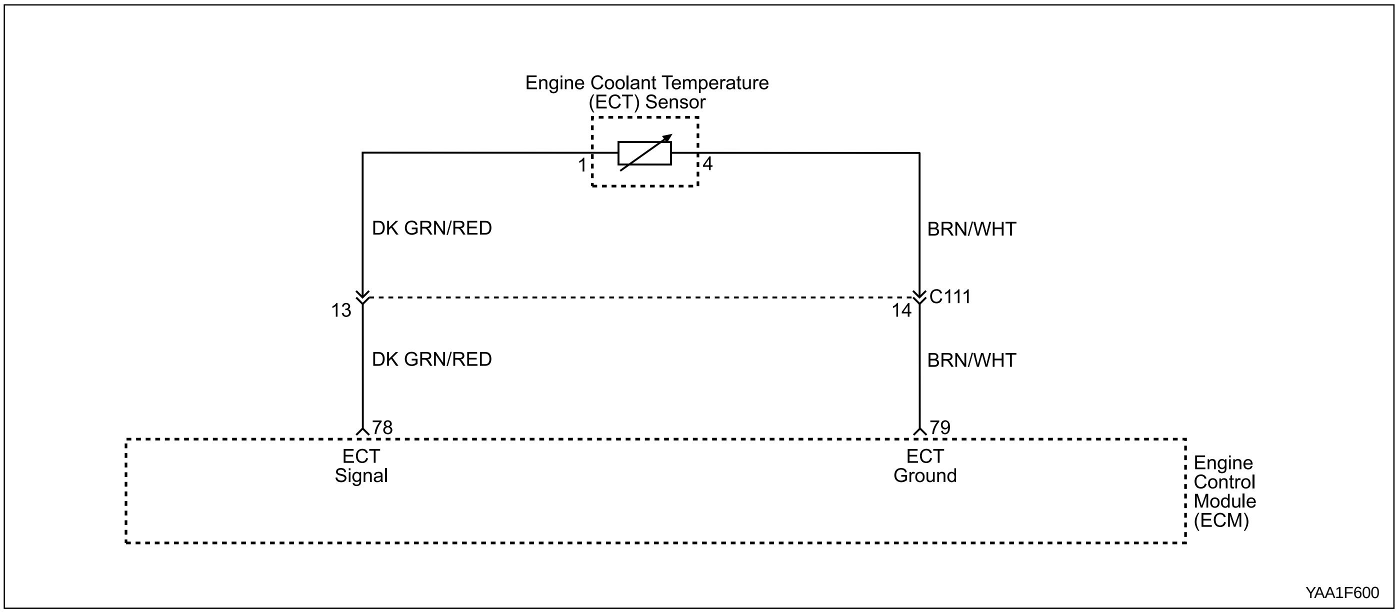
Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The Euro 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 malfuction occurred. The information is then stored on the scan tool for later reference.
7. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0121 Throttle Adaptation or Throttle Spring Check

Step	Action	Value(s)	Yes	No
1	1. Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Are any component Diagnostic Trouble Codes (DTCs) set?	-	Go to applicable DTC table	Go to Step 3
3	1. Measure the voltage between motor (+) circuit, terminal 67 and motor (-) circuit, terminal 68. Is the voltage within the specified value?	0.8 - 2.3 v	Go to Step 4	Go to Step 5
4	1. Check the actuator spring. Is the repair necessary?	-	Go to Step 6	Go to Step 8
5	1. Check for the motor (+) circuit and the motor (-) circuit and repair as necessary. Is the repair complete?	-	Go to Step 8	Go to Step 6
6	1. Turn the ignition OFF. 2. Replace the throttle body (including sensors). 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 ran and passed?	-	Go to Step 8	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) P0125
ENGINE COOLANT TEMPERATURE WARM-UP

Circuit Description

When the vehicle is first started, it operates in Open Loop, ignoring the oxygen sensor 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 oxygen sensor signal for controlling fuel delivery (Closed Loop) when the following conditions are met:

- The engine has run a minimum amount of time based on ECT at engine start up.
- The oxygen sensor has a varying voltage output showing that it is hot enough to operate properly.
- The ECT has increased a minimum amount based on ECT at engine start up.

Conditions for Setting the DTC

- Start-up engine temperature is greater than -40 °C (-40 °F).
- Air temperature is greater than -40 °C (-40 °F).
- P0116, P0117, and P0118 are not set.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

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:

- Improperly mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connection.
- Damaged harness.

Perform an intermittent test. If the connections and the harness check OK, monitor a Digital Voltmeter (DVM) 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 Values table to evaluate the possibility of a skewed sensor. Refer to " Temperature vs. Resistance" in this section.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

10. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0125 Engine Coolant Temperature Warm-Up

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 "Euro On-Board Diagnostic System Check"
2	1. Allow the engine to cool fully to ambient temperature. 2. Turn the ignition switch ON, with the engine OFF and install a scan tool. 3. 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 electrical connector. 3. Turn the ignition ON, engine OFF. 4. Using a Digital Voltmeter (DVM), measure the resistance across the ECT sensor terminals 1 and 4. 5. Check the ECT sensor value to actual coolant 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 electrical connector. 3. Turn the ignition ON. Is the ECT sensor value near the specified value?	4.9 v	Go to Step 5	Go to Step 8
5	Jumper the ECT sensor signal circuit terminal 1 and the sensor ground circuit terminal 4 together at the ECT sensor connector. Is the ECT sensor value near the specified value?	0 v	Go to Step 6	Go to Step 7
6	Check for proper cooling system operation And repair as necessary. Is the repair complete?	-	Go to Step 12	Go to "Diagnostic Aids"
7	Check the ECT sensor electrical connector Terminals 4 and 1 and Engine Control Module (ECM) electrical connector terminals 78 and 79 for poor connectors or malfunctioning terminals and repair as necessary. Is the repair complete?	-	Go to Step 12	Go to Step 8

DTC P0125 Engine Coolant Temperature Warm-Up (Cont'd)

Step	Action	Value(s)	Yes	No
8	Check the ECT sensor signal circuit for an open or short to ground and repair as necessary. Is a repair complete?	-	Go to Step 12	Go to Step 9
9	Check the ECT sensor ground circuit for an open and repair as necessary. Is a repair complete?	-	Go to Step 12	Go to Step 10
10	1. Turn the ignition OFF. 2. Replace the ECM. Is the action complete?	-	Go to Step 12	-
11	Replace the ECT sensor. 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 ran and passed?	-	Go to Step 13	Go to Step 2
13	Check if any DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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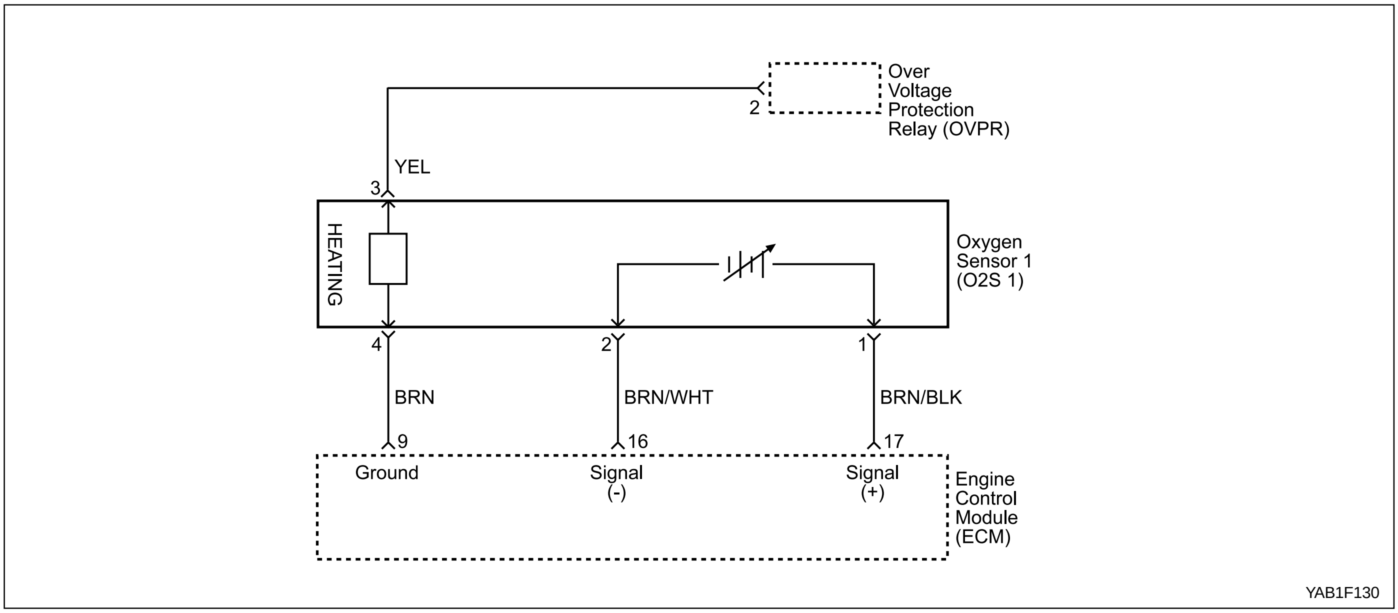

DIAGNOSTIC TROUBLE CODE (DTC) P0131
O2 BANK 1 SENSOR 1 LOW VOLTAGE

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 (O2S 1). The O2S 1 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 O2S 1 pigtail wiring, connector, or terminal is damaged, the entire O2S 1 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 1 wire(s). Any attempt to repair the wires, connector, or terminal and degrade the O2S 1 performance.

Conditions for Setting the DTC

- O2S 1 voltage is less than 0.15 volt.
- O2S 2 voltage is greater than 0.6 volt (2.3L DOHC).
- O2S 2 voltage is greater than 0.55 volt (3.2L DOHC).
- Air mass is greater than 50 kg/h (2.3L DOHC).
- Air mass is greater than 100 kg/h (3.2L DOHC).
- Lambda control status is enabled.
- Lambda control status is at rich stop.
- Injectors 1 ~ 4 status is active (2.3L DOHC).
- Injectors 1 ~ 6 status is active (3.2L DOHC).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An intermittent may be caused by rubbed-through wire insulation or a wire contacting the exhaust.

- 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 O2S 1 pigtail is not contacting the exhaust. heck for the following conditions:
  - improper mating

- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection
- Damaged harness
- Intermittent test - Observe the O2S 1 on the scan tool while moving related connections and the wiring harness with the ignition ON. If the failure is induced, the O2S 1 display will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0131 is the result of a hard failure or an intermittent condition. It may be necessary to operate the vehicle within the Freeze Frame conditions and Conditions for Setting the DTC in order to duplicable the malfunction detected by the ECM.
7. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0131 O2 Bank 1 Sensor 1 Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate engine at normal temperature. Does the Oxygen Sensor (O2S 1) voltage remain below the specified value?	150 mV (0.15 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 1 voltage stay below the specified value?	150 mV (0.15 v)	Go to Step 4	Go to Step 7
4	1. Turn the ignition OFF. 2. Disconnect the O2S 1 electrical connector. 3. Turn the ignition ON, with the engine OFF. Does the scan tool indicate the O2S 1 voltage within the specified values?	450 mV - 550 mV (0.45 v - 0.55 v)	Go to “Diagnostic Aids”	Go to Step 5
5	With a test light connected to ground, probe the O2S 1 circuit terminal1. Does the test light illuminate?	-	Go to Step 7	Go to Step 6
6	1. Check the O2S 1 sensor signal circuit, terminal 1 for a short to ground and repair as necessary. Is the repair complete?	-	Go to Step 8	-
7	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the repair complete?	-	Go to Step 8	-

DTC P0131 O2 Bank 1 Sensor 1 Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. If disconnected, reconnect the O2S 1 electrical 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 the 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

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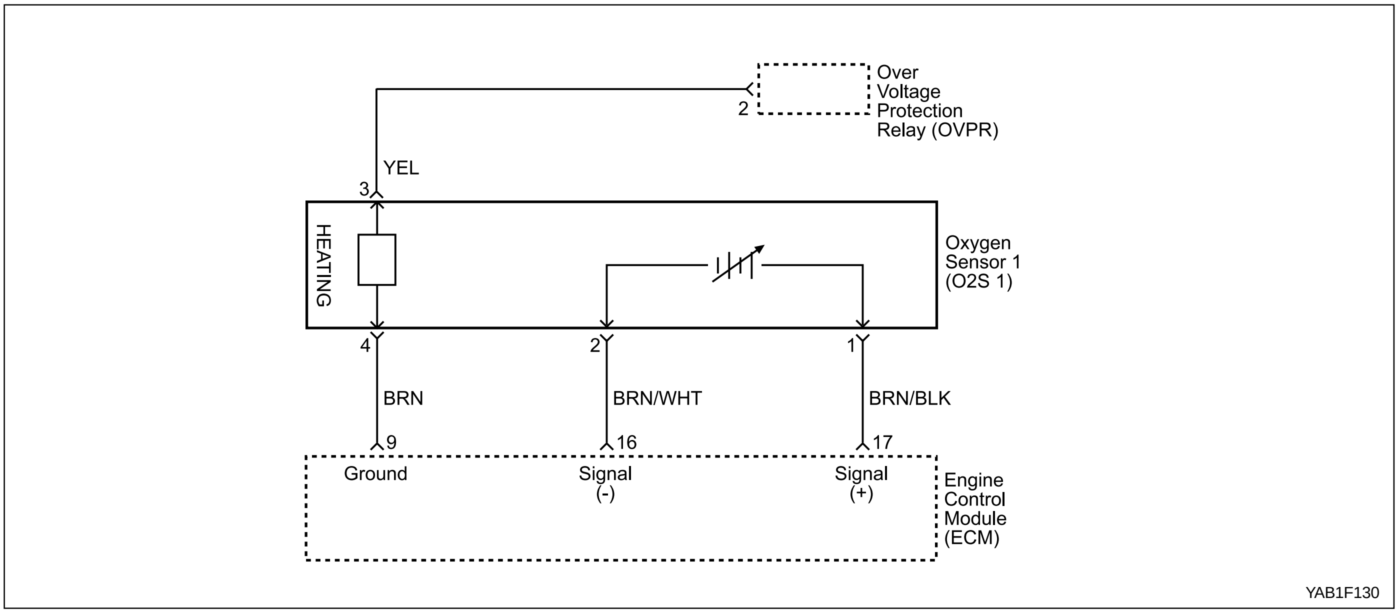

DIAGNOSTIC TROUBLE CODE (DTC) P0132 O2 BANK 1 SENSOR 1 HIGH VOLTAGE

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 (O2S 1). The O2S 1 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 O2S 1 pigtail wiring, connector, or terminal is damaged, the entire O2S 1 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 1 wire(s). Any attempt to repair the wires, connector, or terminal and degrade the O2S 1 performance.

Conditions for Setting the DTC

- O2S 1 voltage is greater than 1.0 volts (2.3L DOHC).
- O2S 1 voltage is greater than 1.05 volts (3.2L DOHC).
- Lambda control status is enabled.
- P0135; lambda heater status is faultless.
- Oxygen sensor heater status is concluded.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An intermittent may be caused by rubbed-through wire insulation or a wire contacting the exhaust.

- 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 O2S 1 pigtail is not contacting the exhaust. heck for the following conditions:
  - improper mating
  - Broken locks
  - Improperly formed
  - Damaged terminals
  - Poor terminal-to-wire connection
  - Damaged harness
- Intermittent test - Observe the O2S 1 on the scan tool while moving related connections and the wiring harness with the ignition ON. If the failure is induced, the O2S 1 display will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0132 is the result of a hard failure or an intermittent condition.
5. Disconnecting the O2S 1 and jumping the sensor signal circuit and the sensor low circuit to ground should cause the scan tool to display O2S 1 voltage below 150 mv (0.15 v). If the signal voltage is still high, the ECM is malfunctioning.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for reprogramming.

DTC P0132 O2 Bank 1 Sensor 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 "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is the Heated Oxygen Sensor (O2S 1) voltage above the specified value?	1050 mV	Go to Step 4	Go to Step 3
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 the DTC as noted. Is the O2S 1 voltage above the specified value?	1050 mV (1.05 v)	Go to Step 4	Go to Step 9
4	1. Turn the ignition switch OFF. 2. Disconnect the O2S 1 electrical connector. 3. Disconnect the Engine Control Module (ECM) electrical connector. 4. With a Digital Voltmeter (DVM) connected to ground, probe the O2S 1 high signal circuit, terminal 17. Does the DVM indicate a voltage of the specified value?	0 v (±0.5 v)	Go to Step 5	Go to Step 6
5	1. Reconnect the ECM electrical connectors. 2. Turn the ignition ON, with the engine OFF. 3. Jumper the high and low circuits at the O2S 1 electrical connector, terminals 1 and 2 to ground. Does the scan tool indicate the O2S 1 voltage below the specified value?	1050 mV (1.05 v)	Go to Step 7	Go to Step 8
6	Repair the short to voltage in the O2S 1 high circuit. Is the repair complete?	-	Go to Step 9	-
7	1. Turn the ignition OFF. 2. Replace the O2S 1. Is the repair complete?	-	Go to Step 9	-

DTC P0132 O2 Bank 1 Sensor 1 High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition OFF. 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 have not been diagnosed?	-	Go to applicable DTC table	System OK

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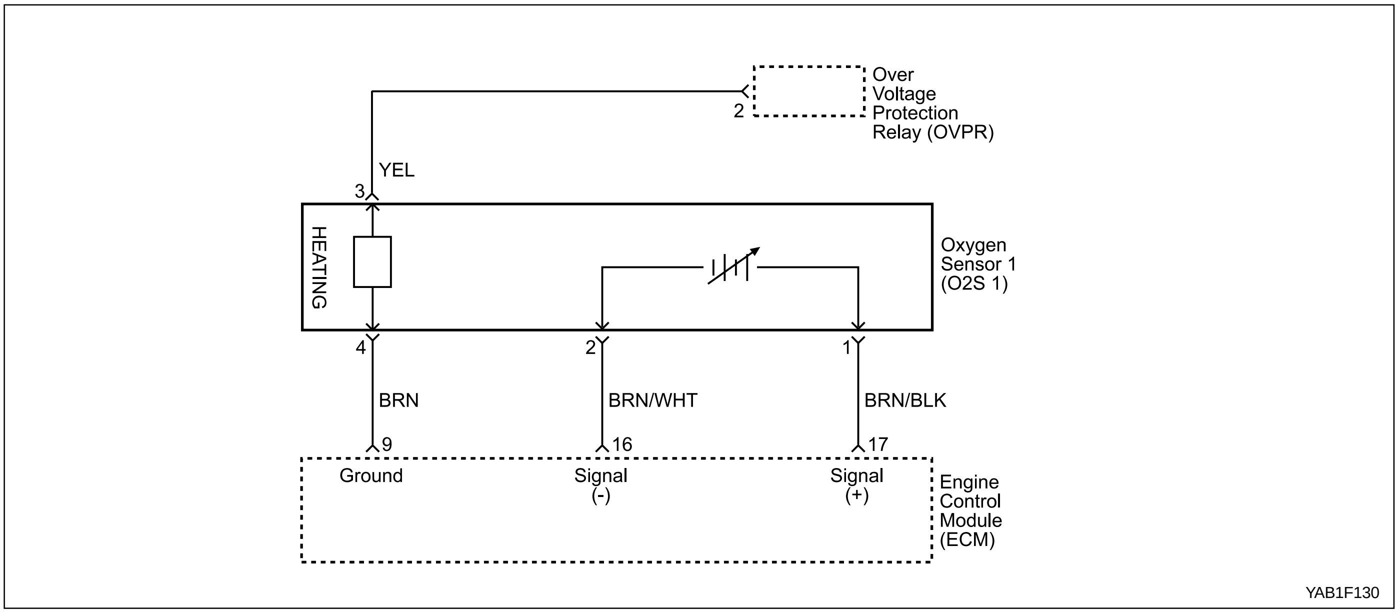

DIAGNOSTIC TROUBLE CODE (DTC) P0133
O2 BANK 1 SENSOR 1 SLOW RESPONSE

Circuit Description

The monitoring starts after the enable conditions have been met without interruption and the delay for the activation condition is elapsed. Should the average period length within a defined number of control cycles of the lambda controller exceed its limit, a DTC P0133 will set.

If the O2S 1 pigtail wiring, connector, or terminal is damaged, the entire O2S 1 assembly must be replaced. Do not attempt to repair the wiring , connector, or terminals could result in the obstruction of the air reference and degrade O2S 1 performance.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0135, P0335 and P0336 are not set.
- Oxygen sensor heater status is concluded.
- Misfire status is none.

2.3L DOHC

- Average period length of 40 lambda control cycles are greater than 1400 milliseconds.
- lambda control status are enabled for 100 seconds and active.
- Engine Speed is between 1800 rpm and 3600 rpm.
- Engine Load is between 0.4 and 0.8.
- Catalyst temperature is greater than 400 °C (752 °F).

3.2L DOHC

- Average period length of 25 lambda control cycles are greater than 1000 milliseconds.
- lambda control status are enabled for 185 seconds and active.
- Engine Speed is between 1890 rpm and 3510 rpm.
- Engine Load is between 0.4 and 0.7.
- Catalyst temperature is greater than 350 °C (662 °F).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three 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.

Diagnostic Aids

The DTC P0133 or slow response is most likely caused by one of the following items:

- 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.
- Leaking injector - A leaking or malfunctioning injector can cause the system to go rich.
- 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 1 contamination - Inspect O2S 1 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.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

13. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

16. If no malfunctions have been found at this point and no additional DTCs were set, refer to “Diagnostic Aids” for additional checks and information.

DTC P0133 O2 Bank 1 Sensor 1 Slow Response

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 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 parameters under Conditions for Setting the DTC. 3. Using the scan tool, monitor the specific DTC information for DTC P0133 until DTC P0133 test runs. Does the scan tool indicate DTC P0133 failed this driving cycle?	-	Go to Step 4	Go to “Diagnostic Aids”
4	Check the exhaust manifold/catalytic converter for a leak and repair as necessary. Is the repair complete?	-	Go to Step 15	Go to Step 5
5	Visually /physically inspect for the following items: • Oxygen sensor (O2S 1) is securely installed. • Corrosion on the terminals. • Terminal tension (at the Engine Control Module[ECM] and the O2S 1). • O2S 1 wiring harness for poor terminal connection or damaged wiring. Is a problem found in any of the above areas?	-	Go to Step 8	Go to Step 6
6	1. Turn the ignition OFF. 2. Disconnect the O2S 1 electrical connector. 3. Jumper the O2S 1 low circuit, terminal 2 to ground. 4. Turn the ignition ON, with the engine OFF. Does the scan tool indicate the voltage between the specified value?	450 - 550 mV	Go to Step 7	Go to Step 9

DTC P0133 O2 Bank 1 Sensor 1 Slow Response (Cont'd)

Step	Action	Value(s)	Yes	No
7	Jumper the O2S 1 signal and low circuits terminals 1 and 2 to ground. Does the scan tool indicate the voltage below the specified value?	200 mV	Go to Step 14	Go to Step 12
8	Repair the condition as necessary. Is the repair complete?	-	Go to Step 15	-
9	1. Turn the ignition OFF. 2. Disconnect the ECM connector (white). 3. Check the O2S 1 low circuit for an open or poor connection and repair as necessary. Is the repair complete?	-	Go to Step 15	Go to Step 10
10	Check the ECM terminal 16 for a poor connection and repair as necessary. Is the repair complete?	-	Go to Step 15	Go to Step 11
11	Check the O2S 1 signal circuit for an open or a short to ground and repair as necessary. Is the repair complete?	-	Go to Step 15	Go to Step 12
12	Check the ECM terminal 17 for a poor connection and repair as necessary. Is the repair complete?	-	Go to Step 15	Go to Step 13
13	Replace the ECM. Is the repair complete?	-	Go to Step 15	-
14	Replace the O2S 1. Is the repair complete?	-	Go to Step 15	-
15	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine. 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 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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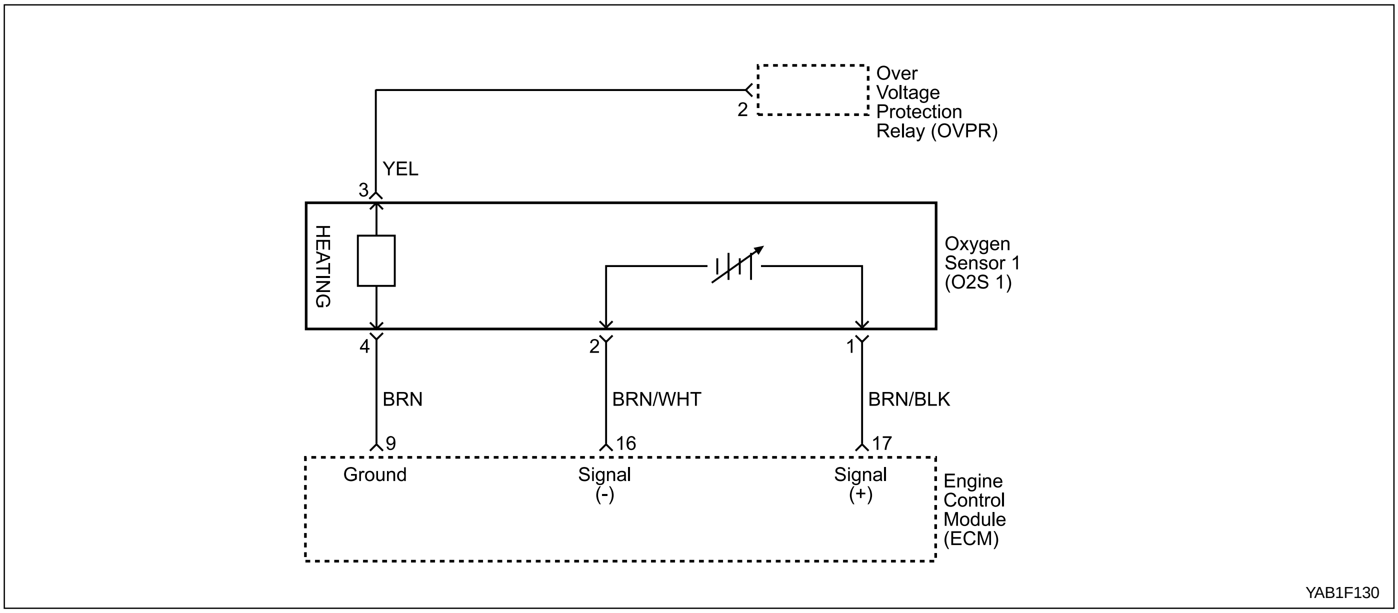

DIAGNOSTIC TROUBLE CODE (DTC) P0134-82
O2 BANK 1 SENSOR 1 NO ACTIVITY DETECTED

Circuit Description

The Engine Control Module (ECM) supplies a voltage of about 0.5 volts between terminals 16 and 17.

The Oxygen sensor (O2S 1) varies the voltage within a range of about 1 volt if the exhaust is rich, down through about 0.10 volt if the exhaust is lean.

If the O2S 1 pigtail wiring, connector, or terminal is damaged, the entire O2S 1 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 1 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 1 performance.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0135, P0335 and P0336 are not set.
- Oxygen sensor heater status is concluded.
- Part load is active.

2.3L DOHC

- Voltage is not out of the window (between 440 mv and 580 mv) for greater than 15 seconds.
- Air mass is greater than 50 kg/h.
- Lambda control status is enabled for 100 seconds and active.
- Engine speed is greater than 4800rpm.
- Engine load is greater than 0.6.

3.2L DOHC

- Voltage is not out of the window (between 450 mv and 550 mv) for greater than 9.9 seconds.
- Air mass is greater than 100 kg/h.
- Lambda control status is enabled for 77 seconds.
- Engine speed is greater than 4500rpm.
- Engine load is greater than 0.7.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three 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.

Diagnostic Aids

An intermittent may be caused by rubbed-through wire insulation or a wire contacting the exhaust.

- Exhaust system - Inspect the exhaust system forleaks. 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 O2S 1 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 O2S 1 on the scan tool while moving related connections and the wiring harness with the ignition ON. If the failure is induced, the O2S 1 display will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. During engine warm-up, the O2S 1 should warm up, and its voltage output should vary between 100 mV and 900 mV. When the O2S 1 voltage varies, the engine will go into Closed Loop. This determines if the O2S 1 is operating properly.
3. This will determine if the sensor is malfunctioning or the wiring or ECM is the cause of the DTC P0134.
6. Use only a high impedance Digital Voltmeter (DVM) for this test. The test checks the continuity of the O2S 1 signal and the ground circuits; if the ground circuit is open, the ECM voltage on the circuit will be over 0.6volts (600mV).

DTC P0134-82 O2 Bank 1 Sensor 1 No Activity Detected

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro 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 2 minutes. Does the scan tool indicate CLOSED LOOP?	95°C (203°F) 1200 rpm	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 the DTC. Does the scan tool indicate CLOSED LOOP?	-	Go to Step 12	Go to Step 4
4	1. Turn the ignition OFF. 2. Disconnect the O2S 1 electrical connector. 3. Jumper O2S 1 sensor harness connector (Engine Control Module (ECM) side), terminal 1 to ground. 4. Turn the ignition ON, with the engine OFF. Is the O2S 1 voltage displayed on the scan tool as specified?	450 - 550 mV	Go to Step 5	Go to Step 8
5	Check the O2S 1 harness electrical connector for malfunctioning terminals or poor connection and Repair as necessary. Is the repair complete?	-	Go to Step 12	Go to Step 6

DTC P0134-82 O2 Bank 1 Sensor 1 No Activity Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove the jumper wire. 2. Reconnect the O2S 1 electrical connector. 3. Idle the engine. 4. Using a Digital Voltmeter (DVM), backprobe the voltage between the O2S 1 sensor harness connector (sensor side) terminal 1 and ground. Does the DVM display a voltage above the specified Value?	600 mV	Go to Step 8	Go to Step 7
7	1. Turn the engine OFF. 2. Using a Digital Voltmeter (DVM), measure the voltage between the O2S 1 sensor harness connector terminal 1 and ground. Does the DVM display a voltage below the specified Value?	300 mV	Go to Step 9	Go to Step 11
8	Check the O2S 1 low circuit for an open or short to ground between the O2S 1 harness connector terminal 2 and the ECM harness connector terminal 16 and repair as necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 10
9	Check the O2S 1 signal circuit for an open or short to ground between the O2S 1 harness connector terminal 1 and the ECM harness connector terminal 17. Is s repair necessary?	-	Go to Step 12	Go to Step 10
10	1. Turn the ignition switch OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 12	-
11	Replace the O2S 1. Is the repair complete?	-	Go to Step 12	-
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting test. 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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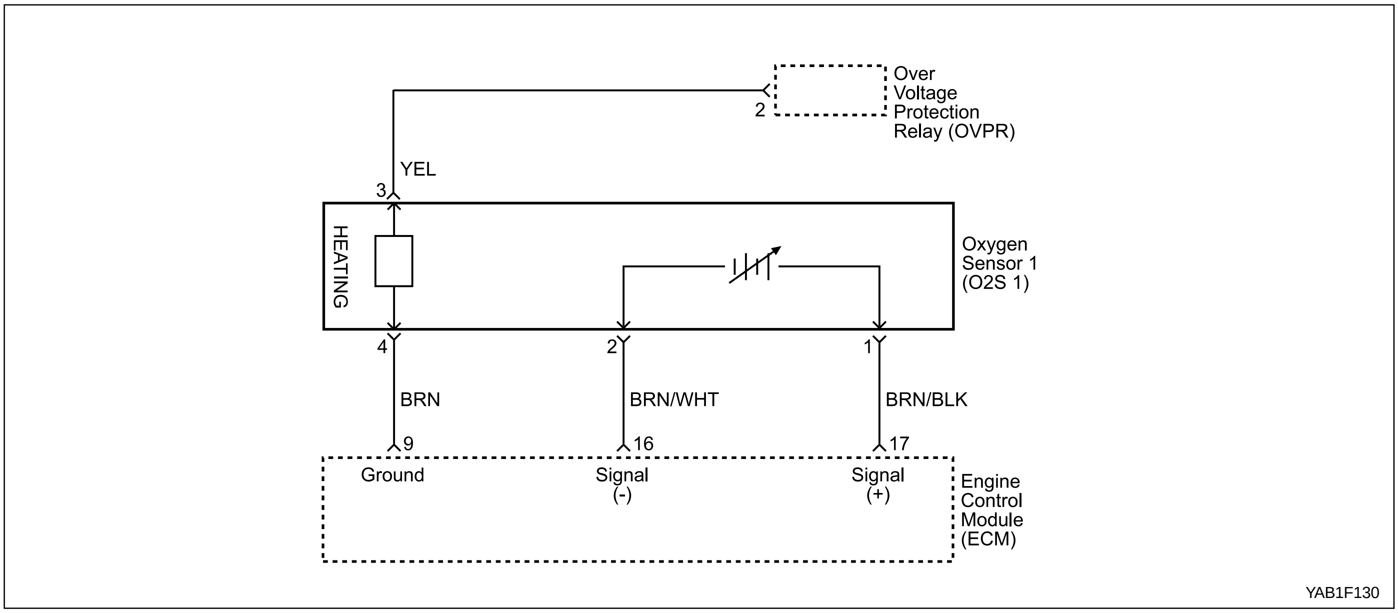

DIAGNOSTIC TROUBLE CODE (DTC) P0134-83
O2 BANK 1 SENSOR 1 NOT LEAN AFTER COASTING SHUT DOWN

Circuit Description

The voltage test at coasting fuel-cut is performed to detect whether the O2S 1 output value represent 'lean' during coasting fuel cut condition. It also applies for checking on short-circuit to battery voltage and disconnected line nespectively.

If the O2S 1 pigtail wiring, connector, or terminal is damaged, the entire O2S 1 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 1 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 1 performance.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0135, P0335 and P0336 are not set.
- Oxygen sensor heater status is concluded.
- Lambda control status is enabled.

2.3L DOHC

- O2S 1 voltage is greater than 0.25 volt and O2S 2 voltage is less than 0.3 volt for 1 second.
- Engine speed is greater than 4800 rpm.
- Engine Load is greater than 0.6.
- Driving mode is trailing throttle fuel cut off active for greater than 5.1 seconds.
- Catalyst temperature is greater than 650 °C (1202 °F).

3.2L DOHC

- O2S 1 voltage is greater than 0.15 volt and O2S 2 voltage is less than 0.2 volt for 1 second.
- Engine speed is greater than 4500 rpm.
- Engine Load is greater than 0.7.
- Driving mode is trailing throttle fuel cut off active for greater than 3.3 seconds.
- Catalyst temperature is greater than 290 °C (554 °F).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three 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.

Diagnostic Aids

An intermittent may be caused by a rubbed-through wire insulation or a wire contacting the exhaust.

Check for the following conditions:

- A poor connection or a damaged harness - Inspect the harness for a short to ground in the sensor signal circuit. Ensure that the O2S 1 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 O2S 1 on the scan tool while moving the related connections and the wiring harness with the ignition ON. If the failure is induced, the O2S 1 display will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0134-83 is the result of a hard failure or an intermittent condition.
4. Disconnecting the O2S 1 and jumping the sensor signal circuit and the sensor low circuit to ground will determine if the ECM or wiring or O2S 1 is malfunctioning.
10. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0134-83 O2 Bank 1 Sensor 1 Not Lean After Coasting Shut Down

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	1. Install a scan tool with the engine to above the specified operating temperature. 2. Run the engine above the specified rpm for two minutes. Does the scan tool display a Heated Oxygen Sensor (O2S 1) voltage between the specified value?	95 °C (203 °F) 1200 rpm 450 mV - 550 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 O2S 1 voltage steady around the specified value?	450 mV - 550 mV	Go to Step 11	Go to Step 4
4	1. Turn the ignition OFF. 2. Disconnect the O2S 1 electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. Jumper O2S 1 high and low circuits, terminals 1 and 2 to ground. Does the scan tool indicate the O2S 1 voltage above the specified value?	150 mV - (0.15 v)	Go to Step 5	Go to Step 6
5	1. Turn the ignition OFF. 2. Check for a malfunctioning connection at the O2S 1 of Engine Control Module (ECM) side and repair as necessary. Is the repair complete?	-	Go to Step 11	Go to Step 7

DTC P0134-83 O2 Bank 1 Sensor 1 Not Lean After Coasting Shut Down (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove the jumper wire. 2. Reconnect the O2S 1 electrical connector. 3. With a Digital Voltmeter (DVM) connected to ground, backprobe the O2S 1 high signal circuit, terminal 1. Does the DVM display a voltage above the specified value?	600 mV	Go to Step 8	Go to Step 9
7	Replace the O2S 1 sensor. Is the repair complete?	-	Go to Step 11	-
8	Check the O2S 1 low circuit for an open or poor connection and repair as necessary. 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 O2S 1 high circuit for continuity and repair as necessary. Is the repair complete?	-	Go to Step 11	-
10	1. Turn the ignition switch OFF. 2. 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. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting test. 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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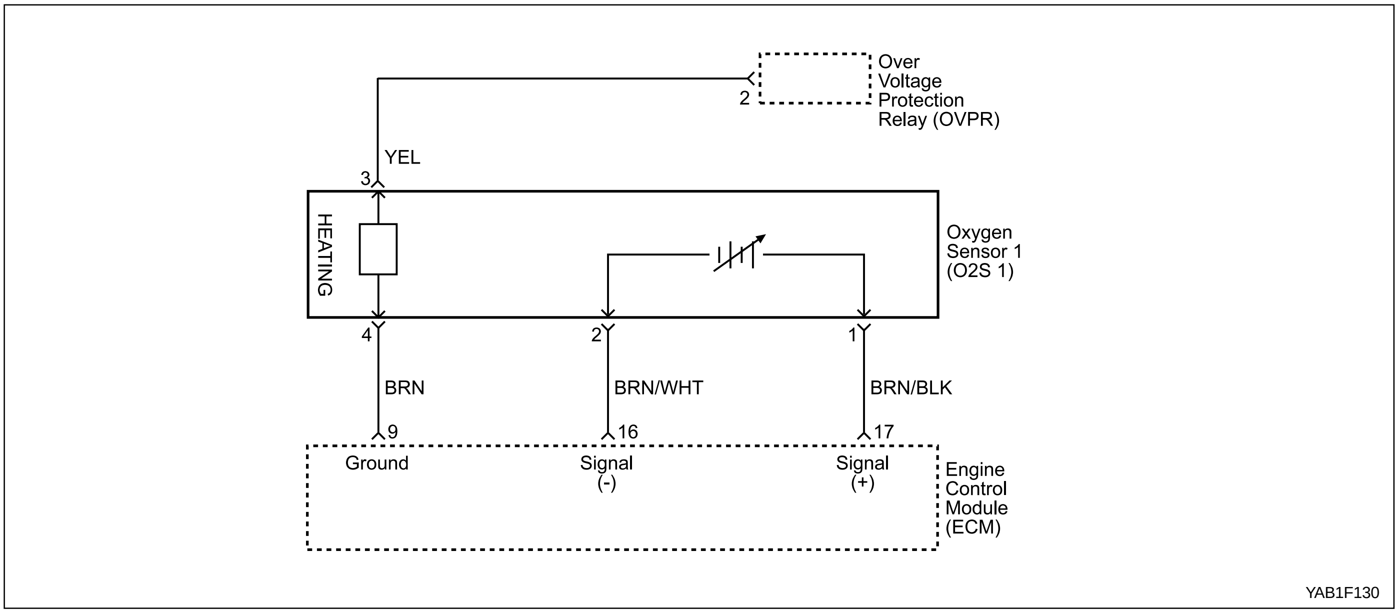


DIAGNOSTIC TROUBLE CODE (DTC) P0135-86
O2 BANK 1 SENSOR 1 HEATER SHORT CIRCUIT TO BATTERY

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 (O2S 1). The O2S 1 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 O2S 1 pigtail wiring, connector, or terminal is damaged, the entire O2S 1 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 1 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 1 performance.

Conditions for Setting the DTC

- Current is between 3 ampares and 6 ampares (depending on driver condition).
- Output stage is active.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

Check for the following conditions:

- 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 and inspect the harness connectors for the following conditions:
  - Improper mating
  - Broken locks
  - Improperly formed
  - Damaged terminals
  - Poor terminal-to-wire connection
  - Damaged harness

Test Description

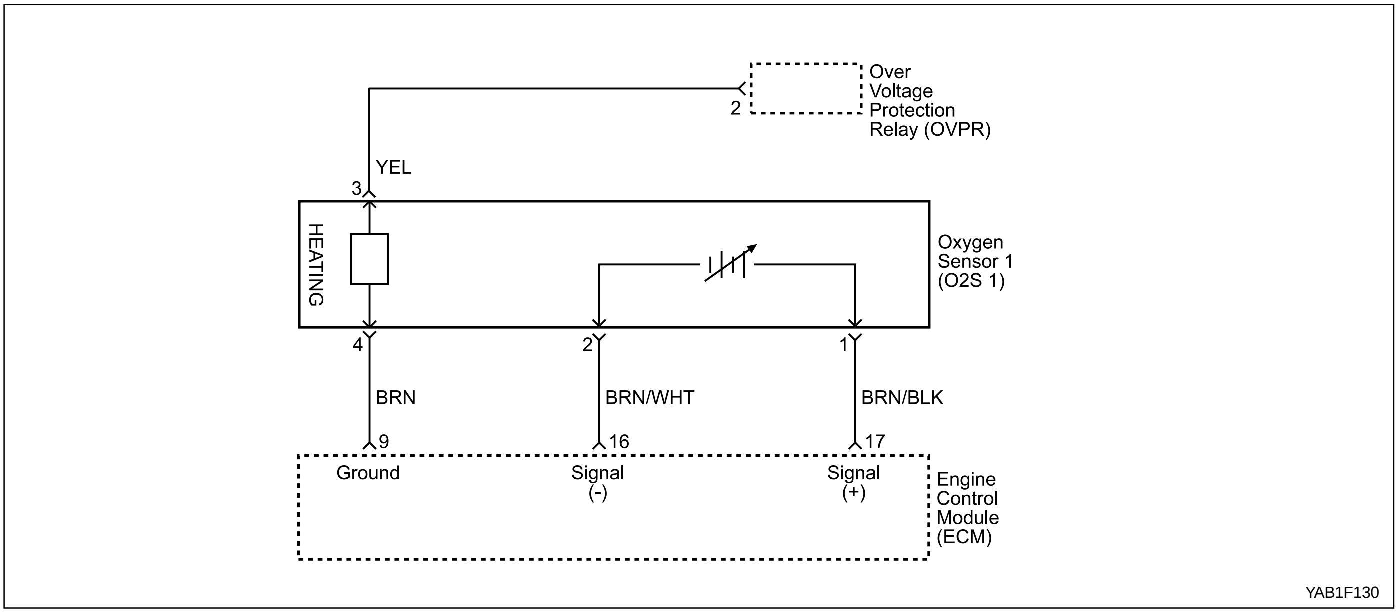
Number(s) below refer to the step number(s) on theDiagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

4. If the test light is still on after disconnecting the ECM connector, the wire between the heater and the ECM is short to voltage. If the test light goes off, the ECM is at fault.

DTC P0135-86 O2 Bank 1 Sensor 1 Heater Short Circuit to Battery

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 "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate the vehicle within the Freeze Frame Conditions for Setting the DTC as noted. Does the heater ampere within the specified value?	0.2 - 2 amps	Go to Step 3	Go to Step 5
3	1. Turn the ignition OFF. 2. Disconnect the O2S 1 electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. With a test light connected to ground, probe the O2S 1 electrical connector, terminal 4. Does the test light illuminate?	-	Go to Step 4	Go to "Diagnostic Aids"
4	1. Disconnect the ECM electrical connector. 2. Check the short to voltage between O2S 1 electrical connector, terminal 4 and ECM electrical connector, terminal 9 and repair as necessary. Is a repair complete?		Go to Step 7	Go to Step 6
5	Replace the O2S 1. Is the repair complete?	-	Go to Step 7	-
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 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 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) P0135-87 O2 BANK 1 SENSOR 1 HEATER SHORT CIRCUIT TO GROUND OR OPEN

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 (O2S 1). The O2S 1 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 O2S 1 pigtail wiring, connector, or terminal is damaged, the entire O2S 1 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 1 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 1 performance.

Conditions for Setting the DTC

- O2S 1 voltage is less than 2 volts for ground.
- O2S 1 voltage is less than 3 volts for open.
- Output stage is inactive.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An intermittent may be caused by rubbed-through wire insulation or a wire contacting the exhaust.

- 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 1 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 O2S 1 on the scan tool while moving related connections and the wiring harness with the ignition ON. If the failure is induced, the O2S 1 display will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
4. This step checks for an open or shorted.

DTC P0135-87 O2 Bank 1 Sensor 1 Heater Short Circuit to Ground or Open

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 “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate the vehicle within the Freeze Frame Conditions for Setting the DTC as noted. Does the heater ampere within the specified value?	0.2 - 2.0 amps	Go to Step 3	Go to Step 8
3	1. Turn the ignition OFF. 2. Disconnect the O2S 1 electrical connector. 3. Turn the ignition ON. 4. With a test light connected to B+, probe the O2S 1 electrical connector, terminal 4. Does the test light illuminate?	-	Go to Step 4	Go to “Diagnostic Aids”
4	1. Check an open or short to ground in wiring between the Over Voltage Protection Relay (OVPR) electrical connector, terminal 2 and O2S 1 electrical connector, terminal 3. 2. Repair as necessary. Is the repair complete?	-	Go to Step 10	Go to Step 5
5	Check the poor connection at the OVPR connector terminal 2 and O2S 1 electrical connector, terminal 3. Did the terminal require replacement?	-	Go to Step 10	Go to Step 6
6	1. Check an open or short to ground in wiring between the O2S 1 electrical connector, terminal 4 and O2S 1 ground circuit, terminal 9. 2. Repair as necessary. Is the repair complete?	-	Go to Step 10	Go to Step 7
7	Check the poor connection at the O2S 1 connector terminal 4 and O2S 1 ground circuit, terminal 9. Did the terminal require replacement?	-	Go to Step 10	Go to Step 9
8	Replace the O2S 1. 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 P0135-87 O2 Bank 1 Sensor 1 Heater Short Circuit to Ground or Open (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 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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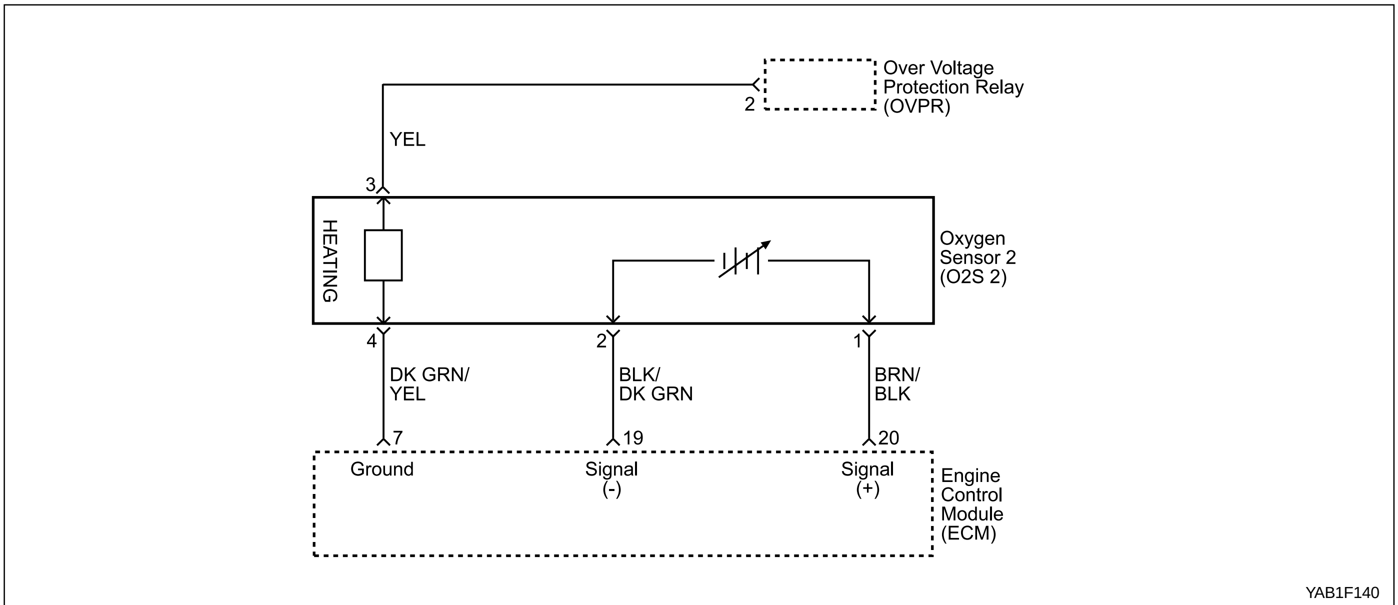

DAGNOSTIC TROUBLE CODE (DTC) P0137
O2 BANK 1 SENSOR 2 LOW VOLTAGE

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 (O2S 2). The O2S 2 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 O2S 2 pigtail wiring, connector, or terminal is damaged, the entire O2S 2 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 2 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 2 performance.

Conditions for Setting the DTC

- O2S 2 voltage is less than 0.05 volt for more than 300 seconds (2.3L DOHC).
- O2S 2 voltage is less than 0.02 volt for more than 300 seconds (3.2L DOHC).
- Lambda control status is enabled.
- Lambda pilot control is active.
- Oxygen sensor heater status is active.
- Injector 1 ~ 4 status is controlled (2.3L DOHC).
- Injector 1 ~ 6 status is controlled (3.2L DOHC).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

Diagnostic Aids

An intermittent may be caused by rubbed-through wire insulation or a wire contacting the exhaust.

- 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 O2S 2 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 O2S 2 on the scan tool while moving related connections and the wiring harness with the ignition ON. If the failure is induced, the O2S 2 display will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0137 is the result of a hard failure or an intermittent condition.
4. Jumping the O2S 2 low circuit, terminal 2 to ground is necessary to allow the ECM to display the supplied bias voltage. If the voltage is between 0.45 and 0.55 volts, then the wiring and the ECM are OK.
6. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for reprogramming.

DTC P0137 O2 Bank 1 Sensor 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 “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is the Heated Oxygen Sensor (O2S 2) voltage less than the specified value?	20 mV (0.02 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 O2S 2 voltage less than the specified value?	20 mV (0.02 v)	Go to Step 4	Go to Step 8
4	1. Turn the ignition switch OFF. 2. Disconnect the O2S 2 electrical connector. 3. Connect a jumper wire between O2S 2 terminal 2 and ground. 4. Turn the ignition ON, with the engine OFF. Does the scan tool indicate that the O2S 2 voltage is within the specified value?	450 mV - 550 mV (0.45 v - 0.55 v)	Go to Step 7	Go to Step 5
5	1. Turn the ignition switch OFF. 2. Disconnect the Engine Control Module (ECM) electrical connectors and check the O2S 2 high circuit, terminal 20 for a short to ground or short to the O2S 2 low circuit terminal 19 and repair as necessary. Is the repair complete?	-	Go to Step 8	Go to Step 6
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 O2S 2. Is the repair complete?	-	Go to Step 8	-

DTC P0137 O2 Bank 1 Sensor 2 Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
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 the DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has 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? Is the action complete?	-	Go to applicable DTC table	System OK

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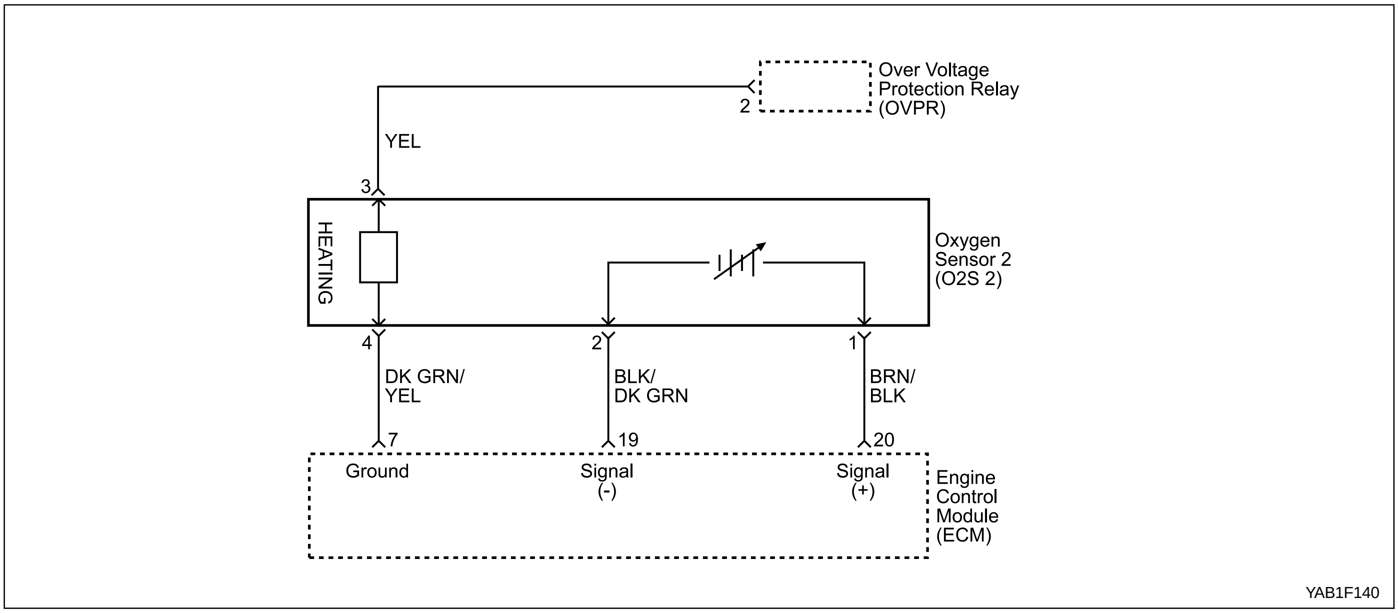

DAGNOSTIC TROUBLE CODE (DTC) P0138
O2 BANK 1 SENSOR 2 HIGH VOLTAGE

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 (O2S 2). The O2S 2 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 O2S 2 pigtail wiring, connector, or terminal is damaged, the entire O2S 2 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 2 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 2 performance.

Conditions for Setting the DTC

- O2S 2 voltage is greater than 1.0 volt (2.3L DOHC).
- O2S 2 voltage is greater than 1.05 volt (3.2L DOHC).
- Lambda control status is enabled.
- P0141; lambda heater status is active/faultless.
- Oxygen sensor heater status concluded.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

Diagnostic Aids

Check for the following conditions:

- Rich exhaust - An overly rich exhaust may load the catalyst, causing high O2S 2 signal voltages.
- Silicone contamination - A false rich condition may be caused by silicone contamination of the O2S 2. This will be indicated by a powdery white deposit on the sensor.
- Faulty O2S 2- If O2S 2 is internally shorted, the O2S 2 voltage displayed on a scan tool will be over 1 volt. Disconnect the O2S 2 and jumper the sensor low circuit to engine ground; if the displayed voltage goes from over 1000 mv to around 450 mv, replace the O2S 2.
- Intermittent test - Observe O2S 2 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 O2S 2 display will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0138 is the result of a hard failure or an intermittent condition.
5. Disconnecting the O2S 2 and jumping the sensor signal circuit and the sensor low circuit to ground should cause the scan tool to display O2S 2 voltage below 20 mv (0.02 v). If the signal voltage is still high, the ECM is malfunctioning.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for reprogramming.

DTC P0138 O2 Bank 1 Sensor 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 “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is the Heated Oxygen Sensor (O2S 2) voltage above the specified value?	1050 mV	Go to Step 4	Go to Step 3
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 the DTC as noted. Is the O2S 2 voltage above the specified value?	1050 mV (1.05 v)	Go to Step 4	Go to Step 9
4	1. Turn the ignition switch OFF. 2. Disconnect the O2S 2 electrical connector. 3. Disconnect the Engine Control Module (ECM) electrical connector. 4. With a Digital Voltmeter (DVM) connected to ground, probe the O2S 2 high signal circuit, terminal 20. Does the DVM indicate a voltage of the specified value?	0 v (±0.5 v)	Go to Step 5	Go to Step 6
5	1. Reconnect the ECM electrical connectors. 2. Turn the ignition ON, with the engine OFF. 3. Jumper the high and low circuits at the O2S 2 electrical connector, terminals 1 and 2 to ground. Does the scan tool indicate the O2S 2 voltage below the specified value?	20 mV (0.02 v)	Go to Step 7	Go to Step 8
6	Repair the short to voltage in the O2S 2 high circuit. Is the repair complete?	-	Go to Step 9	-
7	1. Turn the ignition OFF. 2. Replace the O2S 2. Is the repair complete?	-	Go to Step 9	-

DTC P0138 O2 Bank 1 Sensor 2 High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition OFF. 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 have not been diagnosed?	-	Go to applicable DTC table	System OK

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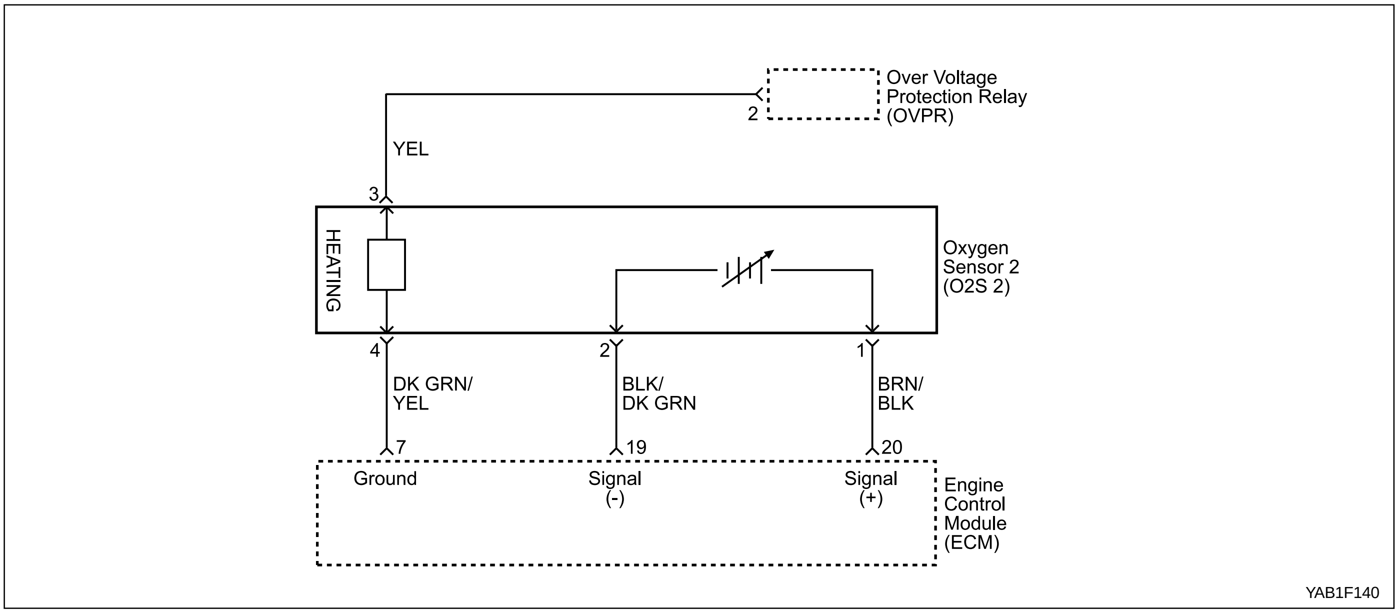

DIAGNOSTIC TROUBLE CODE (DTC) P0140
O2 BANK 1 SENSOR 2 NOT LEAN AFTER COASTING SHUT DOWN

Circuit Description

The voltage test at coasting fuel-cut is performed to detect whether the O2S 2 output value represent 'lean' during coasting fuel cut condition. It also applies for checking on short-circuit to battery voltage and disconnected line respectively.

If the O2S 2 pigtail wiring, connector, or terminal is damaged, the entire O2S 2 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 2 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 2 performance.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0141, P0335 and P0336 are not set.
- Oxygen sensor heater status is concluded.
- Lambda control status is enabled.

2.3L DOHC

- O2S 2 voltage is greater than 0.3 volt and O2S 1 voltage is less than 0.25 volt for 1 second.
- Engine speed is greater than 4800 rpm.
- Engine Load is greater than 0.6.
- Driving mode is trailing throttle fuel cut off active for greater than 5.1 seconds.
- Catalyst temperature is greater than 650 °C (1202 °F).

3.2L DOHC

- O2S 2 voltage is greater than 0.2 volt and O2S 1 voltage is less than 0.15 volt for 1 second.
- Engine speed is greater than 4500 rpm.
- Engine Load is greater than 0.7.
- Driving mode is trailing throttle fuel cut off active for greater than 3.3 seconds.
- Catalyst temperature is greater than 290 °C (554 °F).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three 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.

Diagnostic Aids

An intermittent may be caused by a rubbed-through wire insulation or a wire contacting the exhaust.

Check for the following conditions:

- A poor connection or a damaged harness - Inspect the harness for a short to ground in the sensor signal circuit. Ensure that the O2S 2 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 O2S 2 on the scan tool while moving the related connections and the wiring harness with the ignition ON. If the failure is induced, the O2S 2 display will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0140 is the result of a hard failure or an intermittent condition.
4. Disconnecting the O2S 2 and jumping the sensor signal circuit and the sensor low circuit to ground will determine if the ECM or wiring or O2S 2 is malfunctioning.
10. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0140 O2 Bank 1 Sensor 2 Not Lean After Coasting Shut Down

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Install a scan tool with the engine to above the specified operating temperature. 2. Run the engine above the specified rpm for two minutes. Does the scan tool display a Heated Oxygen Sensor (O2S 2) voltage between the specified value?	95 °C (203 °F) 450 mV - 550 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 O2S 2 voltage steady around the specified value?	450 mV - 550 mV	Go to Step 11	Go to Step 4
4	1. Turn the ignition OFF. 2. Disconnect the O2S 2 electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. Jumper O2S 2 high and low circuits, terminals 1 and 2 to ground. Does the scan tool indicate the O2S 2 voltage above the specified value?	200 mV - (0.20 v)	Go to Step 5	Go to Step 6
5	1. Turn the ignition OFF. 2. Check for a malfunctioning connection at the O2S 2 Engine Control Module (ECM) side and repair as necessary. Is the repair complete?	-	Go to Step 11	Go to Step 7

DTC P0140 O2 Bank 1 Sensor 2 Not Lean After Coasting Shut Down (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove the jumper wire. 2. Reconnect the O2S 2 electrical connector. 3. With a Digital Voltmeter (DVM) connected to ground, backprobe the O2S 2 high signal circuit, terminal 1. Does the DVM display a voltage above the specified value?	600 mV	Go to Step 8	Go to Step 9
7	Replace the O2S 2 sensor. Is the repair complete?	-	Go to Step 11	-
8	Check the O2S 2 low circuit for an open or poor connection and repair as necessary. 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 O2S 2 high circuit for continuity and repair as necessary. Is the repair complete?	-	Go to Step 11	-
10	1. Turn the ignition switch OFF. 2. 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. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting test. 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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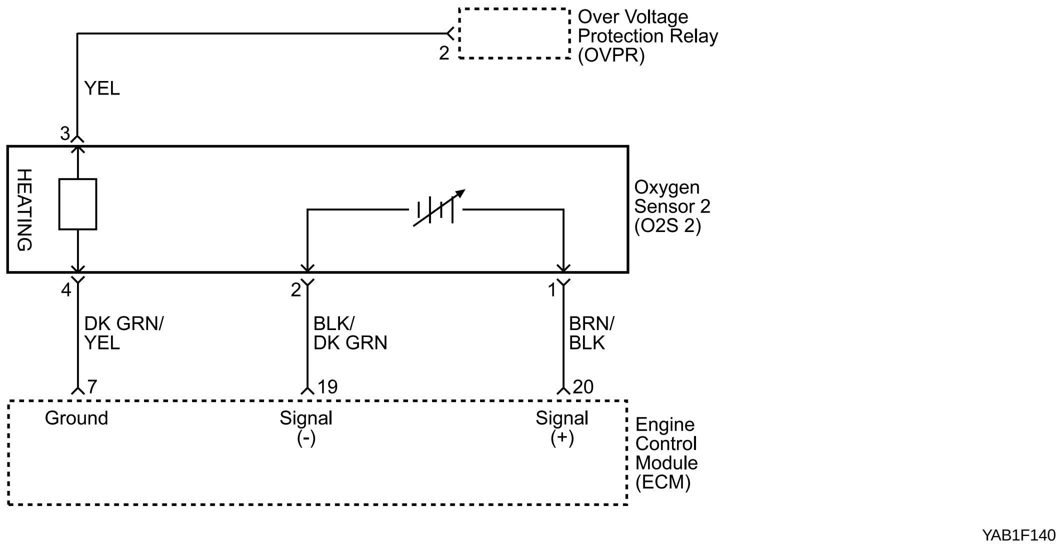


DAGNOSTIC TROUBLE CODE (DTC) P0141-94
O2 BANK 1 SENSOR 2 HEATER SHORT CIRCUIT TO BATTERY

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 (O2S 2). The O2S 2 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 O2S 2 pigtail wiring, connector, or terminal is damaged, the entire O2S 2 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 2 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 2 performance.

Conditions for Setting the DTC

- Current is between 3 ampares and 6 ampares (depending on driver condition).
- Output spage is active.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

Check for the following conditions:

- 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 and inspect the harness connectors for the following conditions:
  - Improper mating
  - Broken locks
  - Improperly formed
  - Damaged terminals
  - Poor terminal-to-wire connection
  - Damaged harness

Test Description

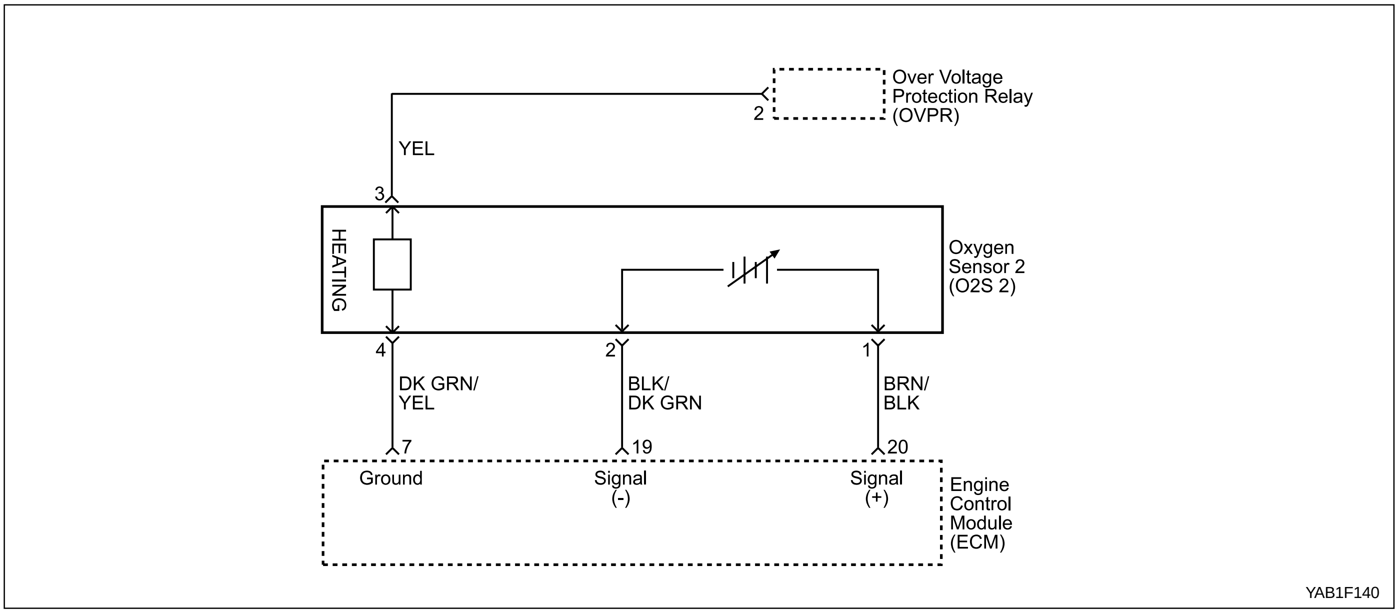
Number(s) below refer to the step number(s) on theDiagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

4. If the test light is still on after disconnecting the ECM connector, the wire between the heater and the ECM is short to voltage. If the test light goes off, the ECM is at fault.

DTC P0141-94 O2 Bank 1 Sensor 2 Heater Short Circuit to Battery

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 "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate the vehicle within the Freeze Frame Conditions for Setting the DTC as noted. Does the heater ampere within the specified value?	0.2 - 2 amps	Go to Step 3	Go to Step 5
3	1. Turn the ignition OFF. 2. Disconnect the O2S 2 electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. With a test light connected to ground, probe the O2S 2 electrical connector, terminal 4. Does the test light illuminate?	-	Go to Step 4	Go to "Diagnostic Aids"
4	1. Disconnect the ECM electrical connector. 2. Check the short to voltage between O2S 2 electrical connector, terminal 4 and ECM electrical connector, terminal 7 and repair as necessary. Is a repair complete?	-	Go to Step 7	Go to Step 6
5	Replace the O2S 2. Is the repair complete?	-	Go to Step 7	-
6	1. Turn the ignition switch OFF. 2. Replace the ECM. 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 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) P0141-95 O2 BANK 1 SENSOR 2 HEATER SHORT CIRCUIT TO GROUND OR OPEN

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 (O2S 2). The O2S 2 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 O2S 2 pigtail wiring, connector, or terminal is damaged, the entire O2S 2 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 2 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 2 performance.

Conditions for Setting the DTC

- O2S 2 voltage is less than 2 volts for ground.
- O2S 2 voltage is less than 3 volts for open.
- Output stage is inactive.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

Check for the following conditions:

An intermittent may be caused by rubbed-through wire insulation or a wire contacting the exhaust.

Check for a poor connection or a damaged harness and inspect the harness connectors for the following conditions:

- improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection
- Damaged harness

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
4. This step checks for an open or shorted.

DTC P0141-95 O2 Bank 1 Sensor 2 Heater Short Circuit to Ground or Open

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 "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate the vehicle within the Freeze Frame Conditions for Setting the DTC as noted. Does the heater ampere within the specified value?	0.2 - 2.0 amps	Go to Step 3	Go to Step 8
3	1. Turn the ignition OFF. 2. Disconnect the O2S 2 electrical connector. 3. Turn the ignition ON. 4. With a test light connected to B+, probe the O2S 2 electrical connector, terminal 3. Does the test light illuminate?	-	Go to Step 4	Go to "Diagnostic Aids"
4	1. Check an open or short to ground in wiring between the Over Voltage Protection Relay (OVPR) electrical connector, terminal 2 and O2S 2 electrical connector, terminal 3. 2. Repair as necessary. Is the repair complete?	-	Go to Step 10	Go to Step 5
5	Check the poor connection at the OVPR connector terminal 2 and O2S 2 electrical connector, terminal 3. Did the terminal require replacement?	-	Go to Step 10	Go to Step 6
6	1. Check an open or short to ground in wiring between the O2S 2 electrical connector, terminal 4 and O2S 2 ground circuit, terminal 7. 2. Repair as necessary. Is the repair complete?	-	Go to Step 10	Go to Step 7
7	Check the poor connection at the O2S 2 connector terminal 4 and O2S 2 ground circuit, terminal 7. Did the terminal require replacement?	-	Go to Step 10	Go to Step 9
8	Replace the O2S 2. Is the repair complete?	-	Go to Step 10	-
9	1. Turn the ignition switch OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 10	-

DTC P0141-95 O2 Bank 1 Sensor 2 Heater Short Circuit to Ground or Open (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 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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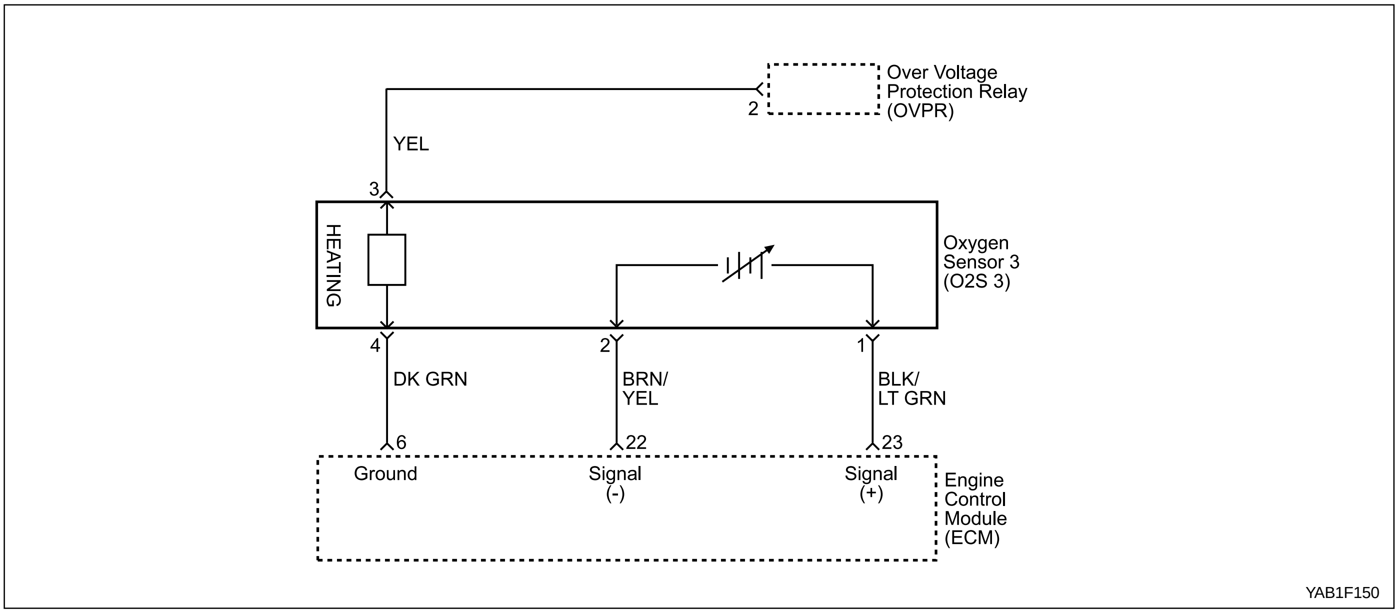

DIAGNOSTIC TROUBLE CODE (DTC) P0151 O2 BANK 2 SENSOR 3 LOW VOLTAGE (3.2L DOHC)

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 (O2S 3). The O2S 3 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 O2S 3 pigtail wiring, connector, or terminal is damaged, the entire O2S 3 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 3 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 3 performance.

Conditions for Setting the DTC

- O2S 3 voltage is less than 0.15 volt.
- O2S 4 voltage is greater than 0.55 volt.
- Air mass is more than 100 kg/h.
- Lambda control status is enabled.
- Lambda control status is at rich stop.
- Injectors 1 ~ 6 status is controlled.
- Part load is active.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An intermittent may be caused by rubbed-through wire insulation or a wire contacting the exhaust.

- 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 O2S 3 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 O2S 3 on the scan tool while moving related connections and the wiring harness with the ignition ON. If the failure is induced, the O2S 3 display will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0151 is the result of a hard failure or an intermittent condition. It may be necessary to operate the vehicle within the Freeze Frame conditions and Conditions for Setting the DTC in order to duplicable the malfunction detected by the ECM.
7. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0151 O2 Bank 2 Sensor 3 Low Voltage (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate engine at normal temperature. Does the Oxygen Sensor (O2S 3) voltage remain below the specified value?	150 mV (0.15 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 3 voltage stay below the specified value?	150 mV (0.15 v)	Go to Step 4	Go to Step 7
4	1. Turn the ignition OFF. 2. Disconnect the O2S 3 electrical connector. 3. Turn the ignition ON, with the engine OFF. Does the scan tool indicate the O2S 3 voltage within the specified values?	450 mV - 550 mV (0.45 v - 0.55 v)	Go to "Diagnostic Aids"	Go to Step 5
5	With a test light connected to ground, probe the O2S 3 circuit terminal1. Does the test light illuminate?	-	Go to Step 7	Go to Step 6
6	Check the O2S 3 sensor signal circuit, terminal 1 for a short to ground and repair as necessary. Is the repair complete?	-	Go to Step 8	-
7	1. Turn the ignition OFF. 2. Replace the Engine Control Module (ECM). Is the repair complete?	-	Go to Step 8	-

DTC P0151 O2 Bank 2 Sensor 3 Low Voltage (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. If disconnected, reconnect the O2S 3 electrical 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 the 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

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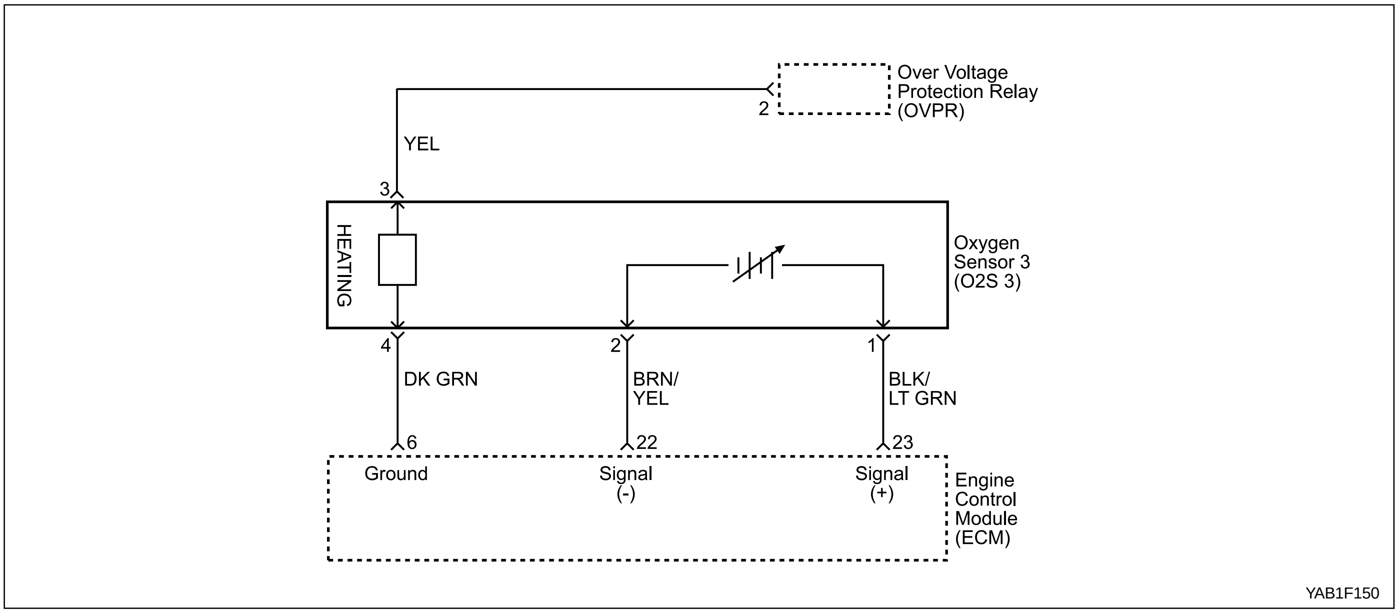

DIAGNOSTIC TROUBLE CODE (DTC) P0152
O2 BANK 2 SENSOR 3 HIGH VOLTAGE (3.2L DOHC)

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 (O2S3). The O2S 3 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 O2S 3 pigtail wiring, connector, or terminal is damaged, the entire O2S 3 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 3 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 3 performance.

Conditions for Setting the DTC

- O2S 3 voltage is greater than 1.05 volts.
- Lambda control status is enabled.
- P0155; lambda heater status is active/faultless.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An intermittent may be caused by rubbed-through wire insulation or a wire contacting the exhaust.

- 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 O2S 3 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 O2S 3 on the scan tool while moving related connections and the wiring harness with the ignition ON. If the failure is induced, the O2S 3 display will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on theDiagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0152 is the result of a hard failure or an intermittent condition.
5. Disconnecting the O2S 3 and jumping the sensor signal circuit and the sensor low circuit to ground should cause the scan tool to display O2S 3 voltage below 150 mv (0.15v). If the signal voltage is still high, the ECM is malfunctioning.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for reprogramming.

DTC P0152 O2 Bank 2 Sensor 3 High Voltage (3.2L DOHC)

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 “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is the Heated Oxygen Sensor (O2S 3) voltage above the specified value?	1050 mV	Go to Step 4	Go to Step 3
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 the DTC as noted. Is the O2S 3 voltage above the specified value?	1050 mV (1.05 v)	Go to Step 4	Go to Step 9
4	1. Turn the ignition switch OFF. 2. Disconnect the O2S 3 electrical connector. 3. Disconnect the Engine Control Module (ECM) electrical connector. 4. With a Digital Voltmeter (DVM) connected to ground, probe the O2S 3 high signal circuit, terminal 23. Does the DVM indicate a voltage of the specified value?	0 v (± 0.5 v)	Go to Step 5	Go to Step 6
5	1. Reconnect the ECM electrical connectors. 2. Turn the ignition ON, with the engine OFF. 3. Jumper the high and low circuits at the O2S 3 electrical connector, terminals 1 and 2 to ground. Does the scan tool indicate the O2S 3 voltage below the specified value?	150 mV (0.15 v)	Go to Step 7	Go to Step 8
6	Repair the short to voltage in the O2S 3 high circuit. Is the repair complete?	-	Go to Step 9	-
7	1. Turn the ignition OFF. 2. Replace the O2S 3. Is the repair complete?	-	Go to Step 9	-

DTC P0152 O2 Bank 2 Sensor 3 High Voltage (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition OFF. 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 have not been diagnosed?	-	Go to applicable DTC table	System OK

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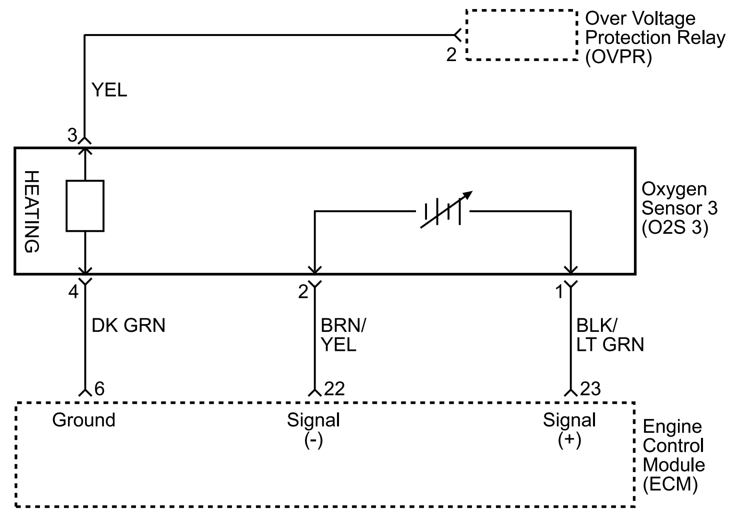

DIAGNOSTIC TROUBLE CODE (DTC) P0153
O2 BANK 2 SENSOR 3 SLOW RESPONSE (3.2L DOHC)

Circuit Description

The monitoring starts after the enable conditions have been met without interruption and the delay for the activation condition is elapsed. Should the average period length within a defined number of control cycles of the lambda controller exceed its limit, a DTC P0133 will set.

If the O2S 3 pigtail wiring, connector, or terminal is damaged, the entire O2S 3 assembly must be replaced. Do not attempt to repair the wiring , connector, or terminals could result in the obstruction of the air reference and degrade O2S 3 performance.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0135, P0335 and P0336 are not set.
- Oxygen sensor heater status is concluded.
- Misfire status is none.
- Average period length of 25 lambda control cycles are greater than 1000 milliseconds.
- Lambda control status are enabled for 85 seconds and active.
- Engine speed is between 1890 rpm and 3510 rpm.
- Engine load is between 0.4 and 0.7.
- Catalyst temperature is greater than 350 °C (662 °F).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three 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.

Diagnostic Aids

The DTC P0153 or slow response is most likely caused by one of the following items:

- 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.
- Leaking injector - A leaking or malfunctioning injector can cause the system to go rich.
- 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 3 contamination - Inspect O2S 3 for silicone contamination from fuel or use of improper room tem-

perature 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.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

13. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

16. If no malfunctions have been found at this point and no additional DTCs were set, refer to "Diagnostic Aids" for additional checks and information.

DTC P0153 O2 Bank 2 Sensor 3 Slow Response (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 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 parameters under Conditions for Setting the DTC. 3. Using the scan tool, monitor the specific DTC information for DTC P0153 until DTC P0153 test runs. Does the scan tool indicate DTC P0133 failed this driving cycle?	-	Go to Step 4	Go to "Diagnostic Aids"
4	Check the exhaust manifold/catalytic converter for a leak and repair as necessary. Is the repair complete?	-	Go to Step 15	Go to Step 5
5	Visually /physically inspect for the following items: • Oxygen sensor (O2S 3) is securely installed. • Corrosion on the terminals. • Terminal tension (at the Engine Control Module[ECM] and the O2S 3). • O2S 3 wiring harness for poor terminal connection or damaged wiring. Is a problem found in any of the above areas?	-	Go to Step 8	Go to Step 6
6	1. Turn the ignition OFF. 2. Disconnect the O2S 3 electrical connector. 3. Jumper the O2S 3 low circuit, terminal 2 to ground. 4. Turn the ignition ON, with the engine OFF. Does the scan tool indicate the voltage between the specified value?	450 - 550 mV	Go to Step 7	Go to Step 9

DTC P0153 O2 Bank 2 Sensor 3 Slow Response (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
7	Jumper the O2S 3 signal and low circuits terminals 1 and 2 to ground. Does the scan tool indicate the voltage below the specified value?	200 mV	Go to Step 14	Go to Step 12
8	Repair the condition as necessary. Is the repair complete?	-	Go to Step 15	-
9	1. Turn the ignition OFF. 2. Disconnect the ECM connector (white). 3. Check the O2S 3 low circuit for an open or poor connection and repair as necessary. Is the repair complete?	-	Go to Step 15	Go to Step 10
10	Check the ECM terminal 22 for a poor connection and repair as necessary. Is the repair complete?	-	Go to Step 15	Go to Step 11
11	Check the O2S 3 signal circuit for an open or a short to ground and repair as necessary. Is the repair complete?	-	Go to Step 15	Go to Step 12
12	Check the ECM terminal 23 for a poor connection and repair as necessary. Is the repair complete?	-	Go to Step 15	Go to Step 13
13	Replace the ECM. Is the repair complete?	-	Go to Step 15	-
14	Replace the O2S 3. Is the repair complete?	-	Go to Step 15	-
15	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine. 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 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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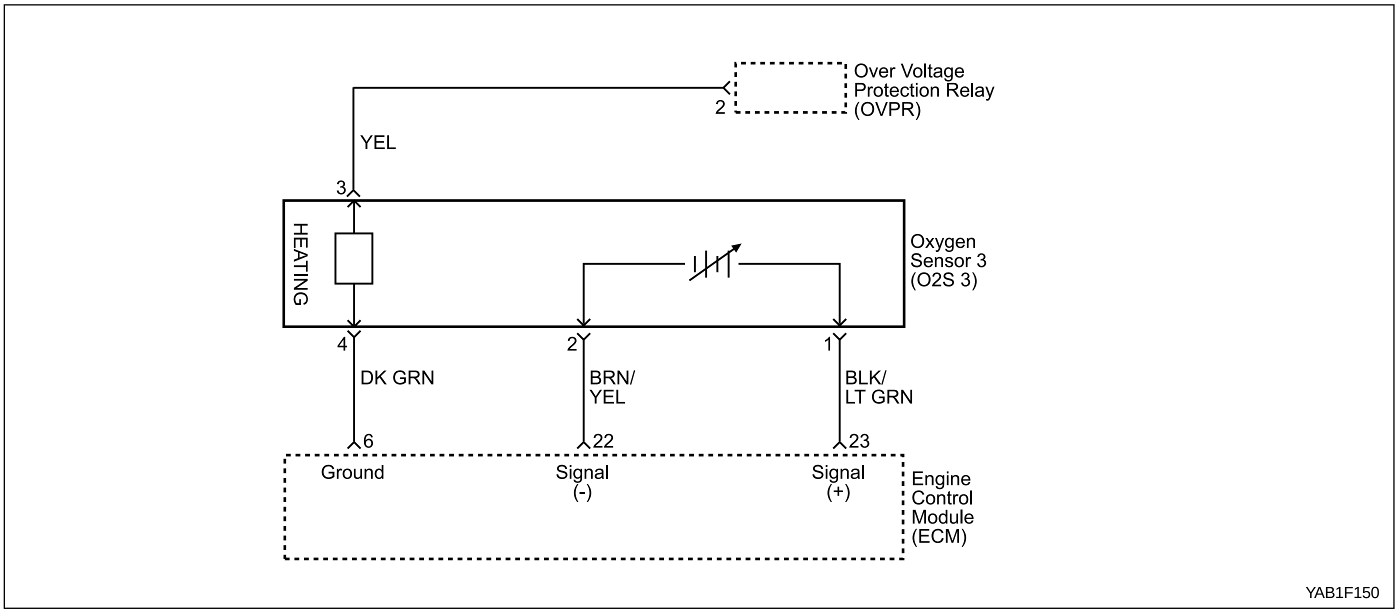

DIAGNOSTIC TROUBLE CODE (DTC) P0154-202
O2 BANK 2 SENSOR 3 NO ACTIVITY DETECTED (3.2L DOHC)

Circuit Description

The Engine Control Module (ECM) supplies a voltage of about 0.5 volts between terminals 22 and 23.

The Oxygen sensor (O2S 3) varies the voltage within a range of about 1 volt if the exhaust the exhaust is lean.

If the O2S 3 pigtail wiring, connector, or terminal is damaged, the entire O2S 3 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 3 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 3 performance.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0135, P0335 and P0336 are not set.
- Oxygen sensor heater status is concluded.
- Part load is active.
- Voltage is not out of the window (between 450 mv and 550 mv) for greater than 9.9 seconds.
- Air mass is greater than 100 kg/h.
- Lambda control status is enabled for 77 seconds.
- Engine speed is greater than 4500 rpm.
- Engine load is greater than 0.7.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three 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.

Diagnostic Aids

An intermittent may be caused by rubbed-through wire insulation or a wire contacting the exhaust.

- Exhaust system - Inspect the exhaust system forleaks. 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 O2S 3 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 O2S 3 on the scan tool while moving related connections and the wiring harness with the ignition ON. If the failure is induced, the O2S 3 display will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. During engine warm-up, the O2S 3 should warm up, and its voltage output should vary between 100 mV and 900 mV. When the O2S 3 voltage varies, the engine will go into Closed Loop. This determines if the O2S 3 is operating properly.
3. This will determine if the sensor is malfunctioning or the wiring or ECM is the cause of the DTC P0154.
6. Use only a high impedance Digital Voltmeter (DVM) for this test. The test checks the continuity of the O2S 3 signal and the ground circuits; if the ground circuit is open, the ECM voltage on the circuit will be over 0.6volts (600 mV).

DTC P0154-202 O2 Bank 2 Sensor 3 No Activity Detected (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro 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 2 minutes. Does the scan tool indicate CLOSED LOOP?	95 °C (176 °F) 1200 rpm	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 the DTC. Does the scan tool indicate CLOSED LOOP?	-	Go to Step 12	Go to Step 4
4	1. Turn the ignition OFF. 2. Disconnect the O2S 3 electrical connector. 3. Jumper O2S 3 sensor harness connector (Engine Control Module (ECM) side), terminal 1 to ground. 4. Turn the ignition ON, with the engine OFF. Is the O2S 3 voltage displayed on the scan tool as specified?	450 - 550 mV	Go to Step 5	Go to Step 8
5	Check the O2S 3 harness electrical connector for malfunctioning terminals or poor connection and repair as necessary. Is the repair complete?	-	Go to Step 12	Go to Step 6

DTC P0154-202 O2 Bank 2 Sensor 3 No Activity Detected (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove the jumper wire. 2. Reconnect the O2S 3 electrical connector. 3. Idle the engine. 4. Using a Digital Voltmeter (DVM), backprobe the voltage between the O2S 3 sensor harness connector (sensor side) terminal 1 and ground. Does the DVM display a voltage above the specified Value?	600 mV	Go to Step 8	Go to Step 7
7	1. Turn the engine OFF. 2. Using a Digital Voltmeter (DVM), measure the voltage between the O2S 3 sensor harness connector terminal 1 and ground. Does the DVM display a voltage below the specified Value?	300 mV	Go to Step 9	Go to Step 11
8	Check the O2S 3 low circuit for an open or short to ground between the O2S 3 harness connector terminal 2 and the ECM harness connector terminal 16 and repair as necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 10
9	Check the O2S 3 signal circuit for an open or short to ground between the O2S 3 harness connector terminal 1 and the ECM harness connector terminal 23. Is s repair necessary?	-	Go to Step 12	Go to Step 10
10	1. Turn the ignition switch OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 12	-
11	Replace the O2S 3. Is the repair complete?	-	Go to Step 12	-
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting test. 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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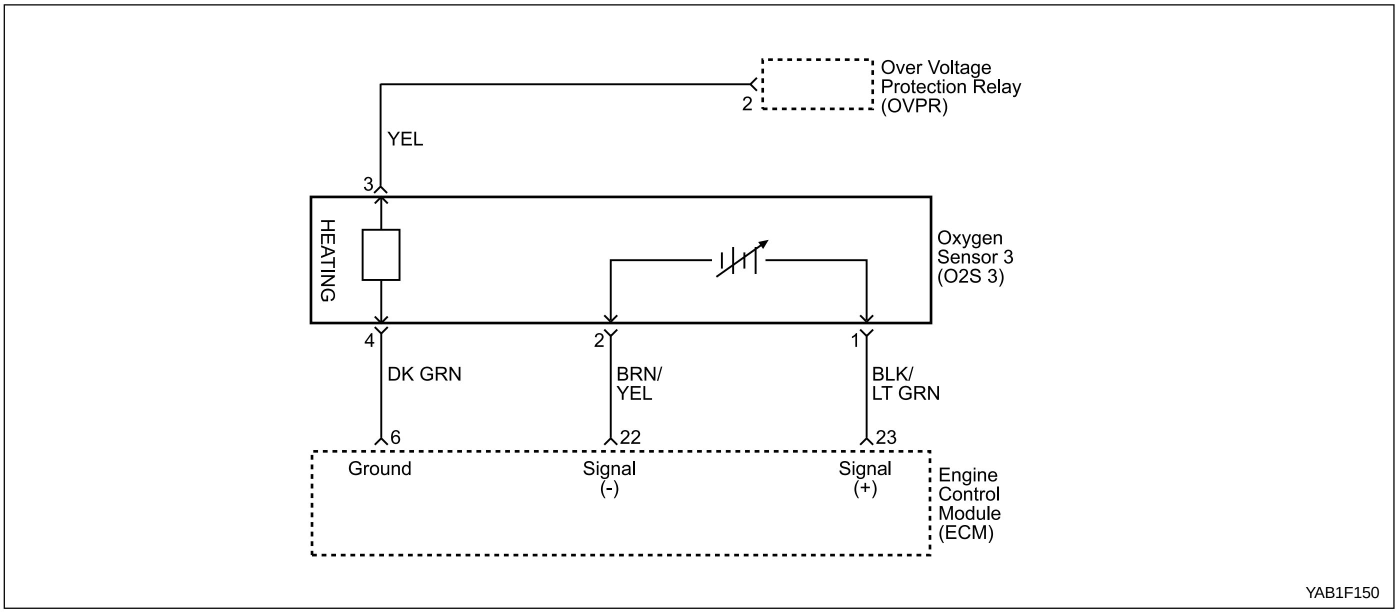

DIAGNOSTIC TROUBLE CODE (DTC) P0154-203 O2 BANK 2 SENSOR 3 NOT LEAN AFTER COASTING SHUT DOWN (3.2L DOHC)

Circuit Description

The voltage test at coasting fuel-cut is performed to detect whether the O2S 3 output value represent 'lean' during coasting fuel cut condition. It also applies for checking on short-circuit to battery voltage and disconnected line respectively.

If the O2S 3 pigtail wiring, connector, or terminal is damaged, the entire O2S 3 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 3 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 3 performance.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0155, P0335 and P0336 are not set.
- Oxygen sensor heater status is concluded.
- Lambda control status is enabled.
- O2S 3 voltage is greater than 0.15 volt and O2S 4 voltage is less than 0.2 volt for 1 second.
- Engine speed is greater than 4500 rpm.
- Engine Load is greater than 0.7.
- Driving mode is trailing throttle fuel cut off active for greater than 3.3 seconds.
- Catalyst temperature is greater than 290 °C (554 °F).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three 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.

Diagnostic Aids

An intermittent may be caused by a rubbed-through wire insulation or a wire contacting the exhaust.

- Check for the following conditions:
- A poor connection or a damaged harness - Inspect the harness for a short to ground in the sensor signal circuit. Ensure that the O2S 3 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 O2S 3 on the scan tool while moving the related connections and the wiring harness with the ignition ON. If the failure is induced, the O2S 3 display will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0154-203 is the result of a hard failure or an intermittent condition.
4. Disconnecting the O2S 3 and jumping the sensor signal circuit and the sensor low circuit to ground will determine if the ECM or wiring or O2S 3 is malfunctioning.
10. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0154-203 O2 Bank 2 Sensor 3 Not Lean After Coasting Shut Down (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Install a scan tool with the engine to above the specified operating temperature. 2. Run the engine above the specified rpm for two minutes. Does the scan tool display a Heated Oxygen Sensor (O2S 3) voltage between the specified value?	95 °C (203 °F) 1200 rpm	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 O2S 3 voltage steady around the specified value?	450 mV - 550 mV	Go to Step 11	Go to Step 4
4	1. Turn the ignition OFF. 2. Disconnect the O2S 3 electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. Jumper O2S 3 high and low circuits, terminals 1 and 2 to ground. Does the scan tool indicate the O2S 3 voltage above the specified value?	150 mV - (0.15 v)	Go to Step 5	Go to Step 6
5	1. Turn the ignition OFF. 2. Check for a malfunctioning connection at the O2S 3 of Engine Control Module (ECM) side and repair as necessary. Is the repair complete?	-	Go to Step 11	Go to Step 7
6	1. Remove the jumper wire. 2. Reconnect the O2S 3 electrical connector. 3. With a Digital Voltmeter (DVM) connected to ground, backprobe the O2S 3 high signal circuit, terminal 1. Does the DVM display a voltage above the specified value?	600 mV	Go to Step 8	Go to Step 9

DTC P0154-203 O2 Bank 2 Sensor 3 Not Lean After Coasting Shut Down (3.2L DOHC)

Step	Action	Value(s)	Yes	No
7	Replace the O2S 3 sensor. Is the repair complete?	-	Go to Step 11	-
8	Check the O2S 3 low circuit for an open or poor connection and repair as necessary. 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 O2S 3 high circuit for continuity and repair as necessary. Is the repair complete?	-	Go to Step 11	-
10	1. Turn the ignition switch OFF. 2. 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. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting test. 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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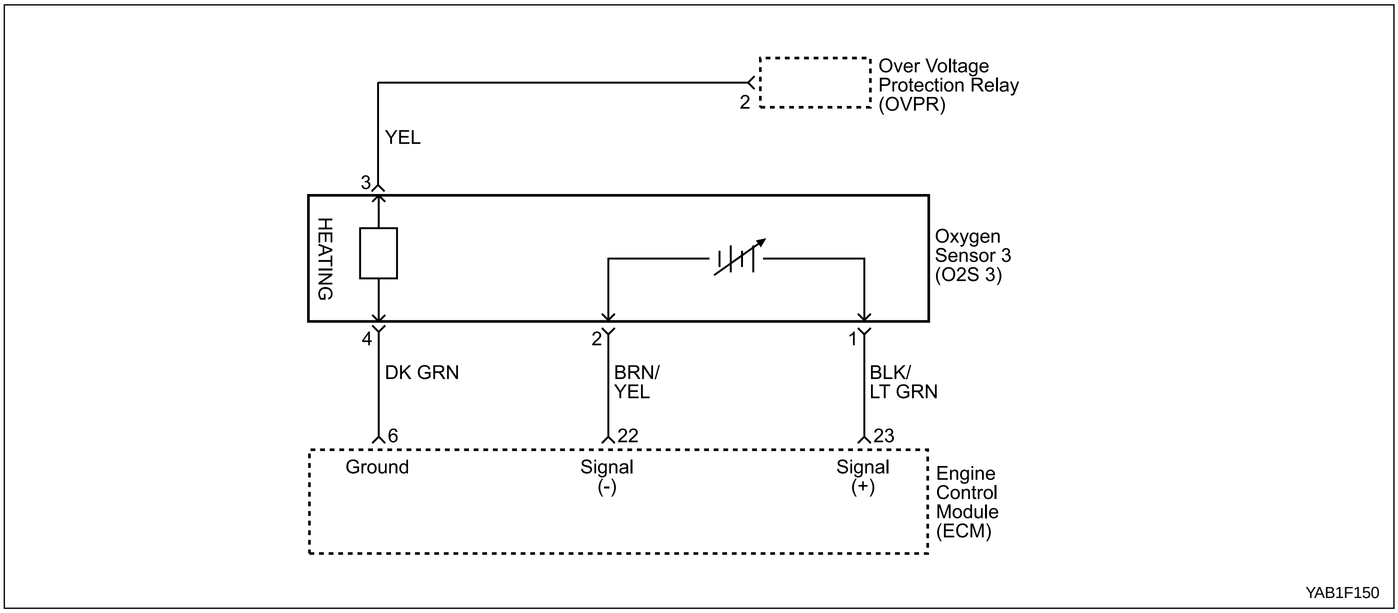


DIAGNOSTIC TROUBLE CODE (DTC) P0155-206
O2 BANK 2 SENSOR 3 HEATER SHORT CIRCUIT TO BATTERY
(3.2L DOHC)

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 (O2S 3). The O2S 3 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 O2S 3 pigtail wiring, connector, or terminal is damaged, the entire O2S 3 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 3 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 3 performance.

Conditions for Setting the DTC

- Current is between 3 ampares and 6 ampares (depending on driver condition).
- Output stage is active.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

Check for the following conditions:

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 and inspect the harness connectors for the following conditions:

- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection
- Damaged harness

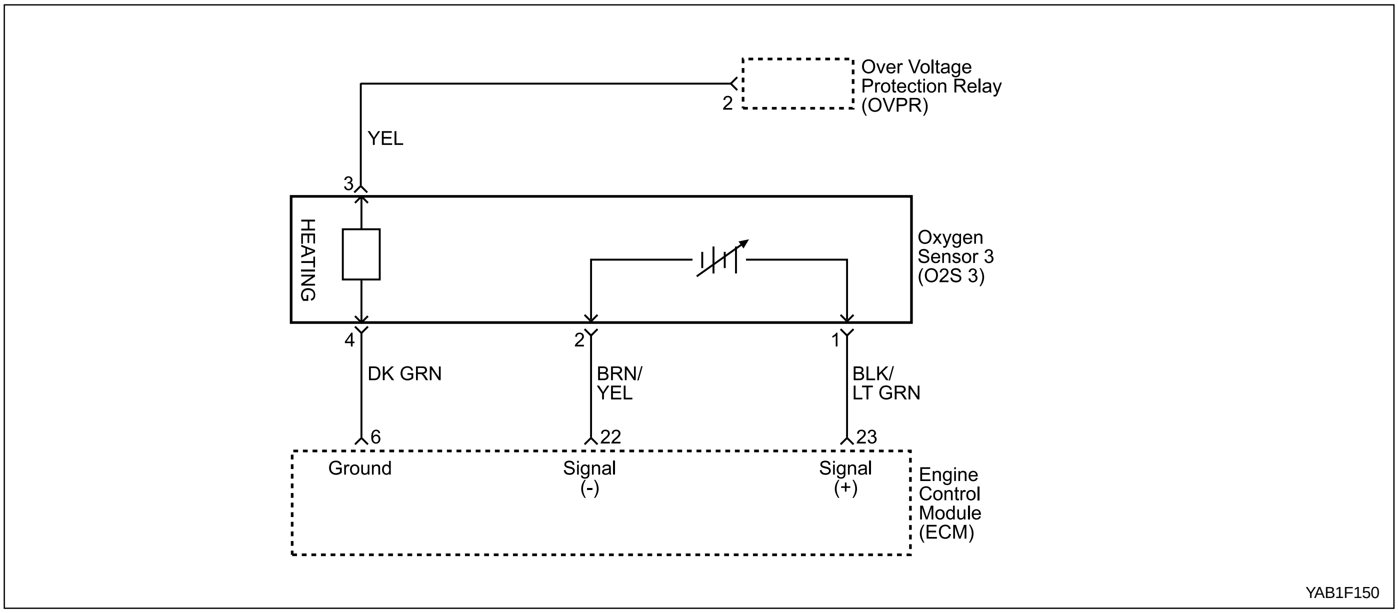
Test Description

Number(s) below refer to the step number(s) on theDiagnostic Table.

1. The Euro On-Board Diagnostic (EOBD) System Ckeck prompts the technician to complete some basic checks and store the freeze frame and failure record data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
4. If the test light is still on after disconnecting the ECM connector, the wire between the heater and the ECM is short to voltage. If the test light goes off, the ECM is at fault.

DTC P0155-206 O2 Bank 2 Sensor 3 Heater Short Circuit to Battery (3.2L DOHC)

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 "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate the vehicle within the Freeze Frame Conditions for Setting the DTC as noted. Does the heater ampere within the specified value?	0.2 - 2 amps	Go to Step 3	Go to Step 5
3	1. Turn the ignition OFF. 2. Disconnect the O2S 3 electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. With a test light connected to ground, probe the O2S 3 electrical connector, terminal 4. Does the test light illuminate?	-	Go to Step 4	Go to "Diagnostic Aids"
4	1. Disconnect the ECM electrical connector. 2. Check the short to voltage between O2S 3 electrical connector, terminal 4 and ECM electrical connector, terminal 6 and repair as necessary. Is a repair complete?	-	Go to Step 7	Go to Step 6
5	Replace the O2S 3. Is the repair complete?	-	Go to Step 7	-
6	1. Turn the ignition switch OFF. 2. Replace the ECM. 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 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) P0155-207 O2 BANK 2 SENSOR 3 HEATER SHORT CIRCUIT TO GROUND OR OPEN (3.2L 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 (O2S 3). The O2S 3 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 O2S 3 pigtail wiring, connector, or terminal is damaged, the entire O2S 3 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 3 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 3 performance.

Conditions for Setting the DTC

- O2S 3 voltage is less than 2 volts for ground.
- O2S 3 voltage is less than 3 volts for open.
- Output stage is inactive.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An intermittent may be caused by rubbed-through wire insulation or a wire contacting the exhaust.

- 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 O2S 3 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 O2S 3 on the scan tool while moving related connections and the wiring harness with the ignition ON. If the failure is induced, the O2S 3 display will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
4. This step checks for an open or shorted.

DTC P0155-207 O2 Bank 2 Sensor 3 Heater Short Circuit to Ground or Open (3.2L DOHC)

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 “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate the vehicle within the Freeze Frame Conditions for Setting the DTC as noted. Does the heater ampere within the specified value?	0.2 - 2.0 amps	Go to Step 3	Go to Step 8
3	1. Turn the ignition OFF. 2. Disconnect the O2S 3 electrical connector. 3. Turn the ignition ON. 4. With a test light connected to B+, probe the O2S 3 electrical connector, terminal 4. Does the test light illuminate?	-	Go to Step 4	Go to “Diagnostic Aids”
4	1. Check an open or short to ground in wiring between the Over Voltage Protection Relay (OVPR) electrical connector, terminal 2 and O2S 3 electrical connector, terminal 3. 2. Repair as necessary. Is the repair complete?	-	Go to Step 10	Go to Step 5
5	Check the poor connection at the OVPR connector terminal 2 and O2S 3 electrical connector, terminal 3. Did the terminal require replacement?	-	Go to Step 10	Go to Step 6
6	1. Check an open or short to ground in wiring between the O2S 3 electrical connector, terminal 4 and O2S 3 ground circuit, terminal 6. 2. Repair as necessary. Is the repair complete?	-	Go to Step 10	Go to Step 7
7	Check the poor connection at the O2S 3 connector terminal 4 and O2S 3 ground circuit, terminal 6. Did the terminal require replacement?	-	Go to Step 10	Go to Step 9
8	Replace the O2S 3. Is the repair complete?	-	Go to Step 10	-
9	1. Turn the ignition switch OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 10	-

DTC P0155-207 O2 Bank 2 Sensor 3 Heater Short Circuit to Ground or Open (3.2L 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 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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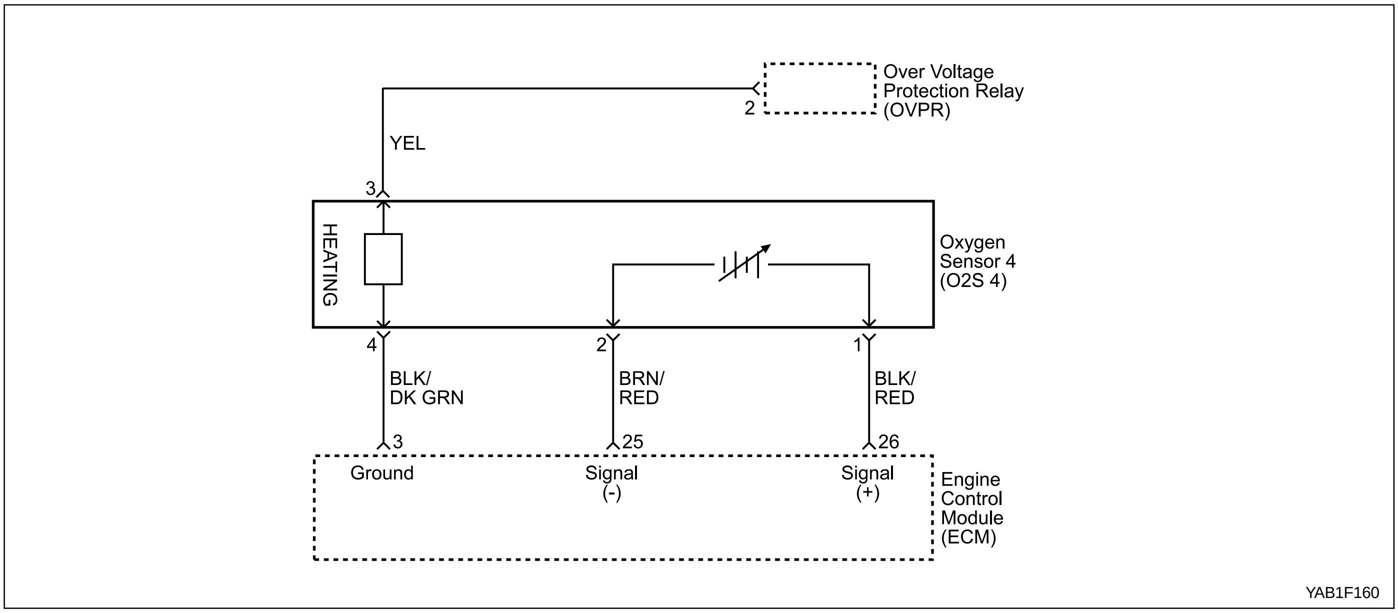

DAGNOSTIC TROUBLE CODE (DTC) P0157
O2 BANK 2 SENSOR 4 LOW VOLTAGE (3.2L DOHC)

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 (O2S 4). The O2S 4 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 O2S 4 pigtail wiring, connector, or terminal is damaged, the entire O2S 4 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 4 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 4 performance.

Conditions for Setting the DTC

- O2S 4 voltage is less than 0.02 volt for greater than 300 seconds.
- Lambda control status is enabled.
- Injector 1 ~ 6 status is active.
- Lambda pilot control status is active.
- Oxygen sensor heater status is concluded.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

Diagnostic Aids

An intermittent may be caused by rubbed-through wire insulation or a wire contacting the exhaust.

- 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 O2S 4 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 O2S 4 on the scan tool while moving related connections and the wiring harness with the ignition ON. If the failure is induced, the O2S 4 display will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0157 is the result of a hard failure or an intermittent condition.
4. Jumping the O2S 4 low circuit, terminal 2 to ground is necessary to allow the ECM to display the supplied bias voltage. If the voltage is between 0.45 and 0.55 volts, then the wiring and the ECM are OK.
6. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for reprogramming.

DTC P0157 O2 Bank 2 Sensor 4 Low Voltage (3.2L DOHC)

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 “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is the Heated Oxygen Sensor (O2S 4) voltage less than the specified value?	20 mV (0.02 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 O2S 4 voltage less than the specified value?	20 mV (0.02 v)	Go to Step 4	Go to Step 8
4	1. Turn the ignition switch OFF. 2. Disconnect the O2S 4 electrical connector. 3. Connect a jumper wire between O2S 4 terminal 2 and ground. 4. Turn the ignition ON, with the engine OFF. Does the scan tool indicate that the O2S 4 voltage is within the specified value?	450 mV - 550 mV (0.45 v - 0.55 v)	Go to Step 7	Go to Step 5
5	1. Turn the ignition switch OFF. 2. Disconnect the Engine Control Module (ECM) electrical connectors and check the O2S 4 high circuit, terminal 26 for a short to ground or short to the O2S 4 low circuit terminal 25 and repair as necessary. Is the repair complete?	-	Go to Step 8	Go to Step 6
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 O2S 4. Is the repair complete?	-	Go to Step 8	-

DTC P0157 O2 Bank 2 Sensor 4 Low Voltage (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
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 the DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has 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

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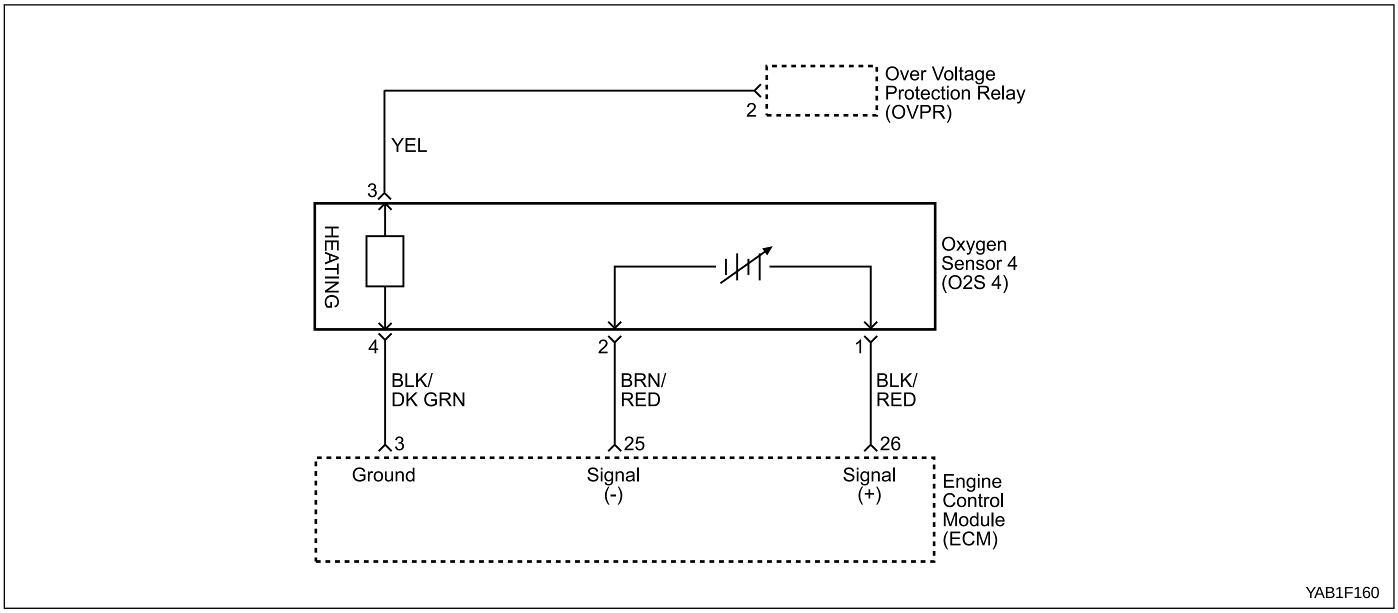

DAGNOSTIC TROUBLE CODE (DTC) P0158
O2 BANK 2 SENSOR 4 HIGH VOLTAGE (3.2L DOHC)

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 (O2S 4). The O2S 4 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 O2S 4 pigtail wiring, connector, or terminal is damaged, the entire O2S 4 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 4 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 4 performance.

Conditions for Setting the DTC

- O2S 4 voltage is greater than 1.05 volt.
- Lambda control status is enabled.
- P0161 is faultless.
- Oxygen sensor heater status is active.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

Diagnostic Aids

Check for the following conditions:

- Rich exhaust - An overly rich exhaust may load the catalyst, causing high O2S 4 signal voltages.
- Silicone contamination - A false rich condition may be caused by silicone contamination of the O2S 4. This will be indicated by a powdery white deposit on the sensor.
- Faulty O2S 4- If O2S 4 is internally shorted, the O2S 4 voltage displayed on a scan tool will be over 1 volt. Disconnect the O2S 4 and jumper the sensor low circuit to engine ground; if the displayed voltage goes from over 1000 mv to around 450 mv, replace the O2S 4.
- Intermittent test - Observe O2S 4 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 O2S 4 display will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The On-Board Diagnostic (OBD II) 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0158 is the result of a hard failure or an intermittent condition.
5. Disconnecting the O2S 4 and jumping the sensor signal circuit and the sensor low circuit to ground should cause the scan tool to display O2S 4 voltage below 20 mv (0.02 v). If the signal voltage is still high, the ECM is malfunctioning.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for reprogramming.

DTC P0158 O2 Bank 2 Sensor 4 High Voltage (3.2L DOHC)

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 “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is the Heated Oxygen Sensor (O2S 4) voltage above the specified value?	1050 mV	Go to Step 4	Go to Step 3
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 the DTC as noted. Is the O2S 4 voltage above the specified value?	1050 mV	Go to Step 4	Go to Step 9
4	1. Turn the ignition switch OFF. 2. Disconnect the O2S 4 electrical connector. 3. Disconnect the Engine Control Module (ECM) electrical connector. 4. With a Digital Voltmeter (DVM) connected to ground, probe the O2S 4 high signal circuit, terminal 26. Does the DVM indicate a voltage of the specified value?	0 v (± 0.5 v)	Go to Step 5	Go to Step 6
5	1. Reconnect the ECM electrical connectors. 2. Turn the ignition ON, with the engine OFF. 3. Jumper the high and low circuits at the O2S 4 electrical connector, terminals 1 and 2 to ground. Does the scan tool indicate the O2S 4 voltage below the specified value?	20 mV (0.02 v)	Go to Step 7	Go to Step 8
6	Repair the short to voltage in the O2S 4 high circuit. Is the repair complete?	-	Go to Step 9	-
7	1. Turn the ignition OFF. 2. Replace the O2S 4. Is the repair complete?	-	Go to Step 9	-

DTC P0158 O2 Bank 2 Sensor 4 High Voltage (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition OFF. 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 have not been diagnosed?	-	Go to applicable DTC table	System OK

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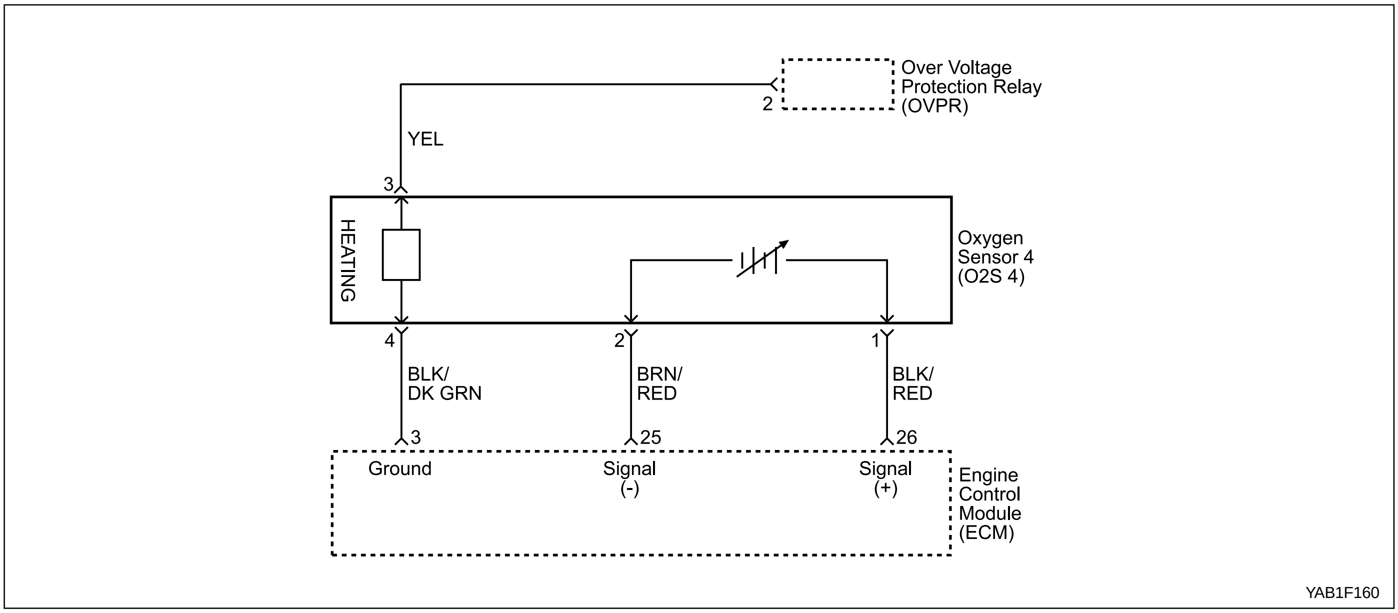

DIAGNOSTIC TROUBLE CODE (DTC) P0160 O2 BANK 2 SENSOR 4 NOT LEAN AFTER COASTING SHUT DOWN (3.2L DOHC)

Circuit Description

The voltage test at coasting fuel-cut is performed to detect whether the O2S 4 output value represent 'lean' during coasting fuel cut condition. It also applies for checking on short-circuit to battery voltage and disconnected line respectively.

If the O2S 4 pigtail wiring, connector, or terminal is damaged, the entire O2S 4 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 4 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 4 performance.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0141, P0335 and P0336 are not set.
- Oxygen sensor heater status is concluded.
- Lambda control status is enabled.
- O2S 4 voltage is greater than 0.2 volt and O2S 3 voltage is less than 0.15 volt for 1 second.
- Engine speed is greater than 4500 rpm.
- Engine Load is greater than 0.7.
- Post catalyst oxygen sensor heater status is concluded for greater than 100 seconds.
- Driving mode is trailing throttle fuel cut off active for greater than 3.3 seconds.
- Catalyst temperature is greater than 290 °C (554 °F).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three 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.

Diagnostic Aids

An intermittent may be caused by a rubbed-through wire insulation or a wire contacting the exhaust.

Check for the following conditions:

- A poor connection or a damaged harness - Inspect the harness for a short to ground in the sensor signal circuit. Ensure that the O2S 4 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 O2S 4 on the scan tool while moving the related connections and the wiring harness with the ignition ON. If the failure is induced, the O2S 4 display will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0160 is the result of a hard failure or an intermittent condition.
4. Disconnecting the O2S 4 and jumping the sensor signal circuit and the sensor low circuit to ground will determine if the ECM or wiring or O2S 4 is malfunctioning.
10. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0160 O2 Bank 2 Sensor 4 Not Lean After Coasting Shut Down (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	1. Install a scan tool with the engine to above the specified operating temperature. 2. Run the engine above the specified rpm for two minutes. Does the scan tool display a Heated Oxygen Sensor (O2S 4) voltage between the specified value?	95 °C (203 °F) 450 mV - 550 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 O2S 4 voltage steady around the specified value?	450 mV - 550 mV	Go to Step 11	Go to Step 4
4	1. Turn the ignition OFF. 2. Disconnect the O2S 4 electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. Jumper O2S 2 high and low circuits, terminals 1 and 2 to ground. Does the scan tool indicate the O2S 4 voltage above the specified value?	200 mV - (0.20 v)	Go to Step 5	Go to Step 6
5	1. Turn the ignition OFF. 2. Check for a malfunctioning connection at the O2S 4 Engine Control Module (ECM) side and repair as necessary. Is the repair complete?	-	Go to Step 11	Go to Step 7
6	1. Remove the jumper wire. 2. Reconnect the O2S 4 electrical connector. 3. With a Digital Voltmeter (DVM) connected to ground, backprobe the O2S 4 high signal circuit, terminal 1. Does the DVM display a voltage above the specified value?	600 mV	Go to Step 8	Go to Step 9

DTC P0160 O2 Bank 2 Sensor 4 Not Lean After Coasting Shut Down (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
7	Replace the O2S 4 sensor. Is the repair complete?	-	Go to Step 11	-
8	Check the O2S 4 low circuit for an open or poor connection and repair as necessary. 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 O2S 4 high circuit for continuity and repair as necessary. Is the repair complete?	-	Go to Step 11	Go to Step 5
10	1. Turn the ignition switch OFF. 2. 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. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting test. 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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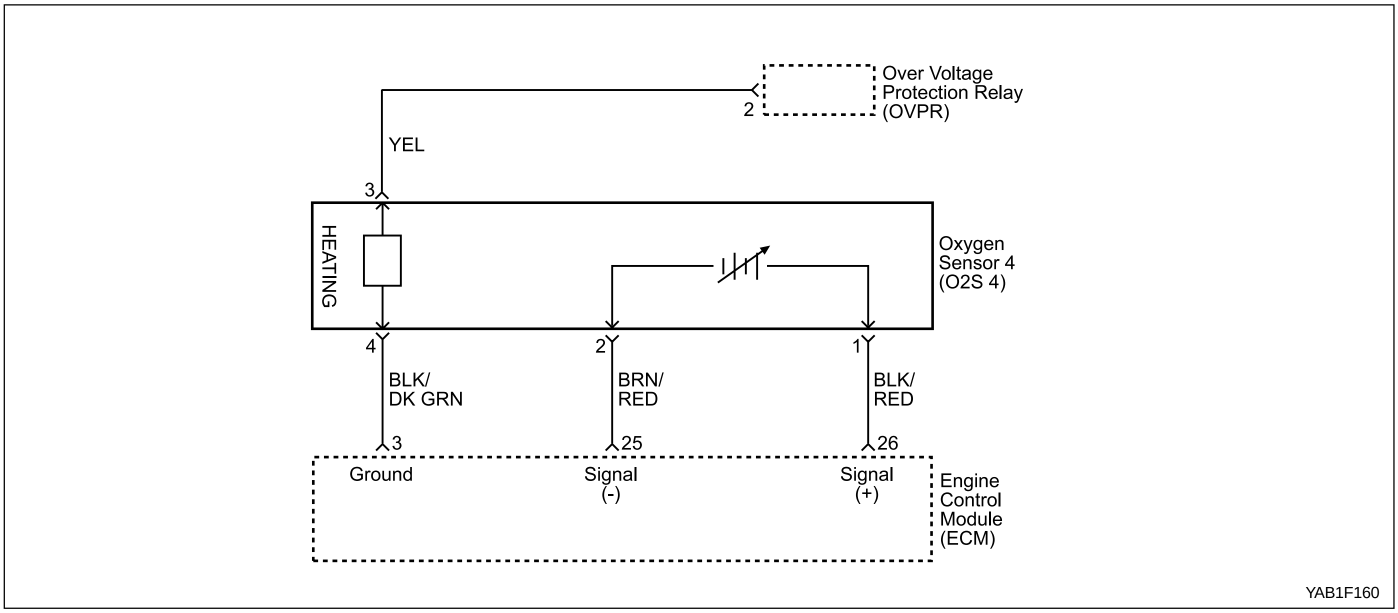


DAGNOSTIC TROUBLE CODE (DTC) P0161-214
O2 BANK 2 SENSOR 4 HEATER SHORT CIRCUIT TO BATTERY (3.2L DOHC)

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 (O2S 4). The O2S 4 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 O2S 4 pigtail wiring, connector, or terminal is damaged, the entire O2S 4 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 4 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 4 performance.

Conditions for Setting the DTC

- Current is between 2.2 ampares and 4.3 ampares (depending on driver condition).
- Output stage is active.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

Check for the following conditions:

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 and inspect the harness connectors for the following conditions:

- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection
- Damaged harness

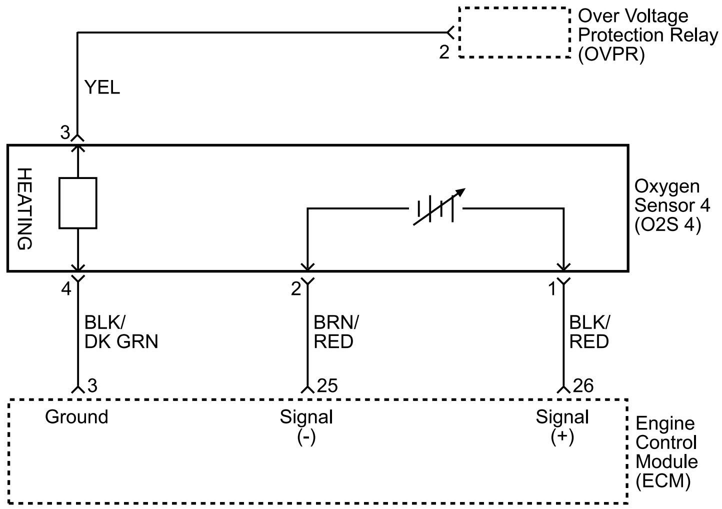
Test Description

Number(s) below refer to the step number(s) on theDiagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
4. If the test light is still on after disconnecting the ECM connector, the wire between the heater and the ECM is short to voltage. If the test light goes off, the ECM is at fault.

DTC P0161-214 O2 Bank 2 Sensor 4 Heater Short Circuit to Battery (3.2L DOHC)

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 “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate the vehicle within the Freeze Frame Conditions for Setting the DTC as noted. Does the heater ampere within the specified value?	0.2 - 2 amps	Go to Step 3	Go to Step 5
3	1. Turn the ignition OFF. 2. Disconnect the O2S 4 electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. With a test light connected to ground, probe the O2S 4 electrical connector, terminal 4. Does the test light illuminate?	-	Go to Step 4	Go to “Diagnostic Aids”
4	1. Disconnect the ECM electrical connector. 2. Check the short to voltage between O2S 4 electrical connector, terminal 4 and ECM electrical connector, terminal 3 and repair as necessary. Is a repair complete?	-	Go to Step 7	GO to Step 6
5	Replace the O2S 4. Is the repair complete?	-	Go to Step 7	-
6	1. Turn the ignition switch OFF. 2. Replace the ECM. 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 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



DAGNOSTIC TROUBLE CODE (DTC) P0161-215
O2 BANK 2 SENSOR 4 HEATER SHORT CIRCUIT TO GROUND OR OPEN (3.2L 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 (O2S 4). The O2S 4 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 O2S 4 pigtail wiring, connector, or terminal is damaged, the entire O2S 4 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 4 wire(s).

Any attempt to repair the wires, connector, or terminal and degrade the O2S 4 performance.

Conditions for Setting the DTC

- O2S 4 voltage is less than 1/3 of battery voltage for ground.
- O2S 4 voltage is less than 2/3 of battery voltage for open.
- Output stage is inactive.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

Check for the following conditions:

An intermittent may be caused by rubbed-through wire insulation or a wire contacting the exhaust.

Check for a poor connection or a damaged harness and inspect the harness connectors for the following conditions:

- improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection
- Damaged harness

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
4. This step checks for an open or shorted.

DTC P0161-215 O2 Bank 2 Sensor 4 Heater Short Circuit to Ground or Open (3.2L DOHC)

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 "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate the vehicle within the Freeze Frame Conditions for Setting the DTC as noted. Does the heater ampere within the specified value?	0.2 - 2.0 amps	Go to Step 3	Go to Step 8
3	1. Turn the ignition OFF. 2. Disconnect the O2S 4 electrical connector. 3. Turn the ignition ON. 4. With a test light connected to B+, probe the O2S 4 electrical connector, terminal 3. Does the test light illuminate?	-	Go to Step 4	Go to "Diagnostic Aids"
4	1. Check an open or short to ground in wiring between the Over Voltage Protection Relay (OVPR) electrical connector, terminal 2 and O2S 4 electrical connector, terminal 3. 2. Repair as necessary. Is the repair complete?	-	Go to Step 10	Go to Step 5
5	Check the poor connection at the OVPR connector terminal 2 and O2S 4 electrical connector, terminal 3. Did the terminal require replacement?	-	Go to Step 10	Go to Step 6
6	1. Check an open or short to ground in wiring between the O2S 4 electrical connector, terminal 4 and O2S 4 ground circuit, terminal 3. 2. Repair as necessary. Is the repair complete?	-	Go to Step 10	Go to Step 7
7	Check the poor connection at the O2S 4 connector terminal 4 and O2S 4 ground circuit, terminal 3. Did the terminal require replacement?	-	Go to Step 10	Go to Step 9
8	Replace the O2S 4. Is the repair complete?	-	Go to Step 10	-
9	1. Turn the ignition switch OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 10	-

DTC P0161-215 O2 Bank 2 Sensor 4 Heater Short Circuit to Ground or Open (3.2L 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 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

BLANK

DIAGNOSTIC TROUBLE CODE (DTC) P0171
BANK 1 SYSTEM TOO LEAN

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 heated oxygen sensor (O2S 1) 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 1 (0 %). If the O2S 1 signal is indicating a lean condition, the ECM will add fuel resulting in fuel trim values above 1 (0 % to 100 %). If a rich condition is detected, the fuel trim values will be below 1 (0 % to -100 %), indicating that the ECM is re- ducing the amount of fuel delivered.

If exhaust emissions reach an excessive level due to a lean condition, a fuel trim Diagnostic Trouble Code (DTC) P0171.

Conditions for Setting the DTC

Short Term Trim

- DTCs P0101, P0102, P0103, P0171, P0172, P0444 and P0445 are not set.
- Short term trim at lean limit is equal to 65 % (2.3L DOHC).
- Short term trim at lean limit is less than or equal to 75 % (3.2L DOHC).

Short Term Adaption

- DTCs P0101, P0102, P0103, P0171, P0172, P0335 and P0336 are not set.
- Short term adaption exceeds lean threshold is less than or equal to 80 % (2.3L DOHC).
- Short term adaption exceeds lean threshold is less than or equal to 78 % (3.2L DOHC).

Long Term Adaption

- DTCs P0101, P0102, P0103, P0111, P0112, P0113, P0116, P0117, P0118, P0125, P0171, P0172, P0335 and P0336 are not set.
- long term adaption exceeds lean threshold is less than or equal to 80 %.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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 buffer.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after 3 consecutive driving 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.

Diagnostic Aids

Important: After repairs use the scan tool ECM Initialization function to reset long term fuel trim to 1 (0 %).

Fuel pressure - System will be lean if 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.

MAF sensor - An output that causes the ECM to sense a lower than normal mass air flow can cause the system to go lean. Disconnecting the MAF sensor will allow the ECM to substitute a fixed (default) value for the MAF sensor. If the lean condition is gone when the sensor is disconnected, substitute a known good sensor and re-check.

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 a poor O2S 1 or MAF (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

Check for a damaged harness. Inspect wiring harness for damage. If the harness appears to be OK, observe the O2S 1 display on the scan tool while moving connectors and 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.

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is stored in the scan tool for later reference.

5. Visually/physically checking items which may cause a lean condition may determine the cause of the DTC being set and save diagnosis time.
9. A vacuum leak can change the Fuel trim index and set DTC P0171. This step checks the intake manifold for vacuum leaks.
10. Contaminants in fuel, such as alcohol or water, can create a lean condition setting DTC P0171. Checking for these contaminants could identify the malfunction.
15. If no faults have been found at this point and no additional DTCs were set, refer to ”Diagnostic Aids” for additional checks and information.

DTC P0171 Bank 1 System Too Lean

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check performed?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Install the scan tool. Are any component related to 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 Bank 1 below the specified value?	20 %	Go to Step 4	Go to Step 5
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 and Conditions for Setting the DTC as noted. Does the Long Term Fuel Trim Bank 1 below the specified value?	20 %	Go to Step 14	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. • O2S 1 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 grouns 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 Mass Air Flow (MAF or MAP) sensor electrical connector. 2. Operate the vehicle in Closed Loop while monitoring the Long Term Fuel Trim Bank 1. Is the Long Term Fuel Trim Bank 1 below the specified value?	20 %	Go to Step 13	Go to Step 9

DTC P0171 Bank 1 System Too Lean (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Repair the malfunction found in Step 5. 2. Check the Long Term Fuel Trim Bank 1 while operating the engine. Is the Long Term Fuel Trim Bank 1 below the specified value?	20 %	Go to Step 8	Go to Step 9
8	Lean condition is not present. Does a driveability problem exist?	-	Go to "Symptoms Diagnosis"	Go to Step 14
9	Visually and physically inspect the following items for vacuum leaks; • Intake manifold • Throttle body • Injector 1, 2 or 3 O-ring • Any other leaks Do any of the above checks isolate a condition requiring a repair?	-	Go to Step 14	Go to Step 10
10	Check the fuel for excessive water, alcohol, or other contaminants and correct the contaminated fuel condition if present. Is the fuel contaminated?	-	Go to Step 14	Go to Step 11
11	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. 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?	3.8 bars	Go to Step 12	Go to "Fuel System Diagnosis"
12	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?	0.6 bars	Go to "Fuel Injector Balance Test"	Go to "Fuel System Diagnosis"
13	Replace the MAF (or MAP) sensor. Is the action 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 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

BLANK

DIAGNOSTIC TROUBLE CODE (DTC) P0172
BANK 1 SYSTEM TOO RICH

Circuit 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 heated oxygen sensor (O2S 1) 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 1 (0 %). If the O2S 1 signal is indicating a lean condition, the ECM will add fuel resulting in fuel trim values above 1 (0 % to 100 %). If a rich condition is detected, the fuel trim values will be below 1 (0 % to - 100 %), indicating that the ECM is re- ducing the amount of fuel delivered.

If exhaust emissions reach an excessive level due to a rich condition, a fuel trim Diagnostic Trouble Code (DTC) P0172 is set.

Conditions for Setting the DTC

Short Term Trim

- DTCs P0101, P0102, P0103, P0171, P0172, P0444 and P0445 are not set.
- Short term trim at rich limit is equal to 125 % (2.3L DOHC).
- Short term trim at lean limit is greater than or equal to 125 % (3.2L DOHC).

Short Term Adaption

- DTCs P0101, P0102, P0103, P0171, P0172, P0335 and P0336 are not set.
- Short term adaption exceeds rich threshold is greater than or equal to 120 % (2.3L DOHC).
- Short term adaption exceeds rich threshold is greater than or equal to 122 % (3.2L DOHC).

Long Term Adaption

- DTCs P0101, P0102, P0103, P0111, P0112, P0113, P0116, P0117, P0118, P0125, P0171, P0172, P0335 and P0336 are not set.
- long term adaption exceeds rich threshold is greater than or equal to 120 %.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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 buffer.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after 3 consecutive driving 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.

Diagnostic Aids

Important: After repairs use the scan tool ECM Initialization function to reset long term fuel trim to 1 (0 %).

Check for a 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

Check for a damaged harness. Inspect wiring harness for damage. If the harness appears to be OK, observe the O2S 1 display on the scan tool while moving connectors and wiring harness related to the engine harness. A change in the display will indicate the location of the fault.

Check for a restricted exhaust system.

A shorted 5 volt reference circuit may cause a DTC P0172 to set. Check the 5 volt reference circuit for abnormal readings.

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is stored in the scan tool for later reference.
5. A clogged air cleaner filter element restricts the air flow coming into the engine. This step checks the condition of the air cleaner element.
17. A loose TP actuator valve may not set a TP actuator related DTC, but may cause the system to become rich by a higher than actual TP reading.

DTC P0172 Bank 1 System Too Rich

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check performed?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	Install the scan tool. Are any component related to 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 Bank 1 above the specified value?	-20 %	Go to Step 4	Go to Step 5
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 and Conditions for Setting the DTC as noted. Does the Long Term Fuel Trim Bank 1 above the specified value?	-20 %	Go to Step 17	Go to Step 5
5	Visually and physically check the air cleaner filter for excessive dirt or being plugged and repair as necessary. Is the action complete?	-	Go to Step 17	Go to Step 6
6	Visually and physically check the air intake system for being collapsed or restricted and repair as necessary. Is the action complete?	-	Go to Step 17	Go to Step 7
7	Inspect the throttle body inlet for damage or foreign objects which may partially block the air flow and repair as necessary. Is the action complete?	-	Go to Step 17	Go to Step 8
8	Turn the ignition OFF and inspect the throttle bore, throttle plate for chocking and foreign objects. Is the action complete?	-	Go to Step 17	Go to Step 9
9	Start the engine with the vehicle in park or neutral and the 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	1. Disconnect the Mass Air Flow (MAF or MAP) sensor electrical connector. 2. Operate the vehicle in Closed Loop while monitoring the Long Term Fuel Trim Bank 1. Is the Long Term Fuel Trim Bank 1 above the specified value?	-20 %	Go to Step 16	Go to Step 11
11	1. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. 2. If fuel is present in the vacuum hose, replace the fuel pressure regulator. Does the fuel pressure regulator require replacement?	-	Go to Step 17	Go to Step 12
12	1. Perform the Fuel System Diagnosis. 2. If the table isolates a problem, repair as necessary. Is the repair complete?	-	Go to Step 17	Go to Step 13

DTC P0172 Bank 1 System Too Rich (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. Perform the EVAP Control System Diagnosis. 2. If the table isolates a problem, repair as necessary. Is the repair complete?	-	Go to Step 17	Go to Step 14
14	1. Perform the Fuel Injector balance Test. 2. If the table isolates a problem, repair as necessary. Is the repair complete?	-	Go to Step 17	Go to Step 15
15	1. Remove and visually/physically inspect the O2S 1 for silicone contamination. This will be indicated by a powdery white deposit on the portion of the O2S 1 sensor exposed to the exhaust stream. 2. If contamination is present on the O2S 1 sensor, find the source of the contamination and repair and also replace the contaminated O2S 1 sensor. Is the problem found and corrected?	-	Go to Step 17	Go to "Diagnostic Aids"
16	Replace the MAF (or MAP) sensor. Is the action complete?	-	Go to Step 17	-
17	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 text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to Step 18	Go to Step 2
18	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) P0174 BANK 2 SYSTEM TOO LEAN (3.2L 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 heated oxygen sensor (O2S 3) 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 1 (0 %). If the O2S 3 signal is indicating a lean condition, the ECM will add fuel resulting in fuel trim values above 1 (0 % to 100 %). If a rich condition is detected, the fuel trim values will be below 1 (0 % to - 100 %), indicating that the ECM is re-ducing the amount of fuel delivered.

If exhaust emissions reach an excessive level due to a lean condition, a fuel trim Diagnostic Trouble Code (DTC) P0174.

Conditions for Setting the DTC

Short Term Trim

- DTCs P0101, P0102, P0103, P0174, P0175, P0444 and P0445 are not set.
- Short term trim at lean limit is less than or equal to 75 %.

Short Term Adaption

- DTCs P0101, P0102, P0103, P0174, P0175, P0335 and P0336 are not set.
- Short term adaption exceeds lean threshold is less than or equal to 78 %.

Long Term Adaption

- DTCs P0101, P0102, P0103, P0111, P0112, P0113, P0116, P0117, P0118, P0125, P0174, P0175, P0335 and P0336 are not set.
- long term adaption exceeds lean threshold is less than or equal to 80 %.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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 buffer.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after 3 consecutive driving 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.

Diagnostic Aids

Important: After repairs use the scan tool ECM Initialization function to reset long term fuel trim to 1 (0 %).

Fuel pressure - System will be lean if 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.

MAF sensor - An output that causes the ECM to sense a lower than normal mass air flow can cause the system to go lean. Disconnecting the MAF sensor will allow the ECM to substitute a fixed (default) value for the MAF sensor. If the lean condition is gone when the sensor is disconnected, substitute a known good sensor and re-check.

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 P0174.

Check for a poor O2S 3 or MAF 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

Check for a damaged harness. Inspect wiring harness for damage. If the harness appears to be OK, observe the O2S 3 display on the scan tool while moving connectors and 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.

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is stored in the scan tool for later reference.
5. Visually/physically checking items which may cause a lean condition may determine the cause of the DTC being set and save diagnosis time

9. A vacuum leak can change the Fuel trim index and set DTC P0174 This step checks the intake manifold for vacuum leaks.
10. Contaminants in fuel, such as alcohol or water, can create a lean condition setting DTC P0174. Checking for these contaminants could identify the malfunction.
15. If no faults have been found at this point and no additional DTCs were set, refer to “Diagnostic Aids” for additional checks and information.

DTC P0174 Bank 2 System Too Lean (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check performed?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Install the scan tool. Are any component related to Diagnostic trouble Codes (DTCs)	-	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 Bank 2 below the specified value?	20 %	Go to Step 4	Go to Step 5
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 and Conditions for Setting the DTC as noted. Does the Long Term Fuel Trim Bank 2 below the specified value?	20 %	Go to Step 14	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. • O2S 3 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 grouns 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 Mass Air Flow (MAF) sensor electrical connector. 2. Operate the vehicle in Closed Loop while monitoring the Long Term Fuel Trim Bank 2. Is the Long Term Fuel Trim Bank 2 below the specified value?	20 %	Go to Step 13	Go to Step 8
7	1. Repair the malfunction found in Step 5. 2. Check the Long Term Fuel Trim Bank 2 while operating the engine. Is the Long Term Fuel Trim Bank 2 below the specified value?	20 %	Go to Step 8	Go to Step 9

DTC P0174 Bank 2 System Too Lean (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
8	Lean condition is not present. Does a driveability problem exist?	-	Go to "Symptoms Diagnosis"	Go to Step 14
9	Visually and physically inspect the following items for vacuum leaks; • Intake manifold • Throttle body • Injector 4, 5 or 6 O-ring • Any other leaks Do any of the above checks isolate a condition requiring a repair?	-	Go to Step 14	Go to Step 10
10	Check the fuel for excessive water, alcohol, or other contaminants and correct the contaminated fuel condition if present. Is the fuel contaminated?	-	Go to Step 14	Go to Step 11
11	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. 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?	3.8 bars	Go to Step 12	Go to "Fuel System Diagnosis"
12	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?	0.6 bars	Go to "Fuel Injector Balance Test"	Go to "Fuel System Diagnosis"
13	Replace the MAF sensor. Is the action 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 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) P0175 BANK 2 SYSTEM TOO RICH (3.2L 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 heated oxygen sensor (O2S 3) 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 1 (0 %). If the O2S 3 signal is indicating a lean condition, the ECM will add fuel resulting in fuel trim values above 1 (0 % to 100 %). If a rich condition is detected, the fuel trim values will be below 1 (0 % to - 100 %), indicating that the ECM is re-ducing the amount of fuel delivered.

If exhaust emissions reach an excessive level due to a rich condition, a fuel trim Diagnostic Trouble Code (DTC) P0175 is set.

Conditions for Setting the DTC

Short Term Trim

- DTCs P0101, P0102, P0103, P0174, P0175, P0444 and P0445 are not set.
- Short term trim at rich limit is greater than or equal to 125%.

Short Term Adaption

- DTCs P0101, P0102, P0103, P0174, P0175, P0335 and P0336 are not set.
- Short term adaption exceeds rich threshold is greater than or equal to 122 %.

Long Term Adaption

- DTCs P0101, P0102, P0103, P0111, P0112, P0113, P0116, P0117, P0118, P0125, P0174, P0175, P0335 and P0336 are not set.
- long term adaption exceeds rich threshold is greater than or equal to 120 %.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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 buffer.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after 3 consecutive driving 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.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Important: After repairs use the scan tool ECM Initialization function to reset long term fuel trim to 1 (0 %).

Check for a 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

Check for a damaged harness. Inspect wiring harness for damage. If the harness appears to be OK, observe the O2S 3 display on the scan tool while moving connectors and wiring harness related to the engine harness. A change in the display will indicate the location of the fault.

Check for a restricted exhaust system.

A shorted 5 volt reference circuit may cause a DTC P0175 to set. Check the 5 volt reference circuit for abnormal readings.

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is stored in the scan tool for later reference.
5. A clogged air cleaner filter element restricts the air flow coming into the engine. This step checks the condition of the air cleaner element.
17. A loose TP actuator valve may not set a TP actuator related DTC, but may cause the system to become rich by a higher than actual TP readin

DTC P0175 Bank 2 System Too Rich (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check performed?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	Install the scan tool. Are any component related to 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 Bank 2 above the specified value?	-20 %	Go to Step 4	Go to Step 5
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 and Conditions for Setting the DTC as noted. Does the Long Term Fuel Trim Bank 2 above the specified value?	-20 %	Go to Step 17	Go to Step 5
5	Visually and physically check the air cleaner filter for excessive dirt or being plugged and repair as necessary. Is the action complete?	-	Go to Step 17	Go to Step 6
6	Visually and physically check the air intake system for being collapsed or restricted and repair as necessary. Is the action complete?	-	Go to Step 17	Go to Step 7
7	Inspect the throttle body inlet for damage or foreign objects which may partially block the air flow and repair as necessary. Is the action complete?	-	Go to Step 17	Go to Step 8
8	Turn the ignition OFF and inspect the throttle bore, throttle plate and Idle Air Control (IAC) passages for chocking and foreign objects. Is the action complete?	-	Go to Step 17	Go to Step 9
9	Start the engine with the vehicle in park or neutral and the 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	1. Disconnect the Mass Air Flow (MAF) sensor electrical connector. 2. Operate the vehicle in Closed Loop while monitoring the Long Term Fuel Trim Bank 2. Is the Long Term Fuel Trim Bank 2 above the specified value?	-20 %	Go to Step 16	Go to Step 11
11	1. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. 2. If fuel is present in the vacuum hose, replace the fuel pressure regulator. Does the fuel pressure regulator require replacement?	-	Go to Step 17	Go to Step 12
12	1. Perform the Fuel System Diagnosis. 2. If the table isolates a problem, repair as necessary. Is the repair complete?	-	Go to Step 17	Go to Step 13

DTC P0175 Bank 2 System Too Rich (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. Perform the EVAP Control System Diagnosis. 2. If the table isolates a problem, repair as necessary. Is the repair complete?	-	Go to Step 17	Go to Step 15
14	1. Perform the Fuel Injector balance Test. 2. If the table isolates a problem, repair as necessary. Is the repair complete?	-	Go to Step 17	Go to Step 16
15	1. Remove and visually/physically inspect the O2S 3 for silicone contamination. This will be indicated by a powdery white deposit on the portion of the O2S 3 sensor exposed to the exhaust stream. 2. If contamination is present on the O2S 3 sensor, find the source of the contamination and repair and also replace the contaminated O2S 3 sensor. Is the problem found and corrected?	-	Go to Step 17	Go to "Diagnostic Aids"
16	Replace the MAF sensor. Is the action complete?	-	Go to Step 17	-
17	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 text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to Step 18	Go to Step 2
18	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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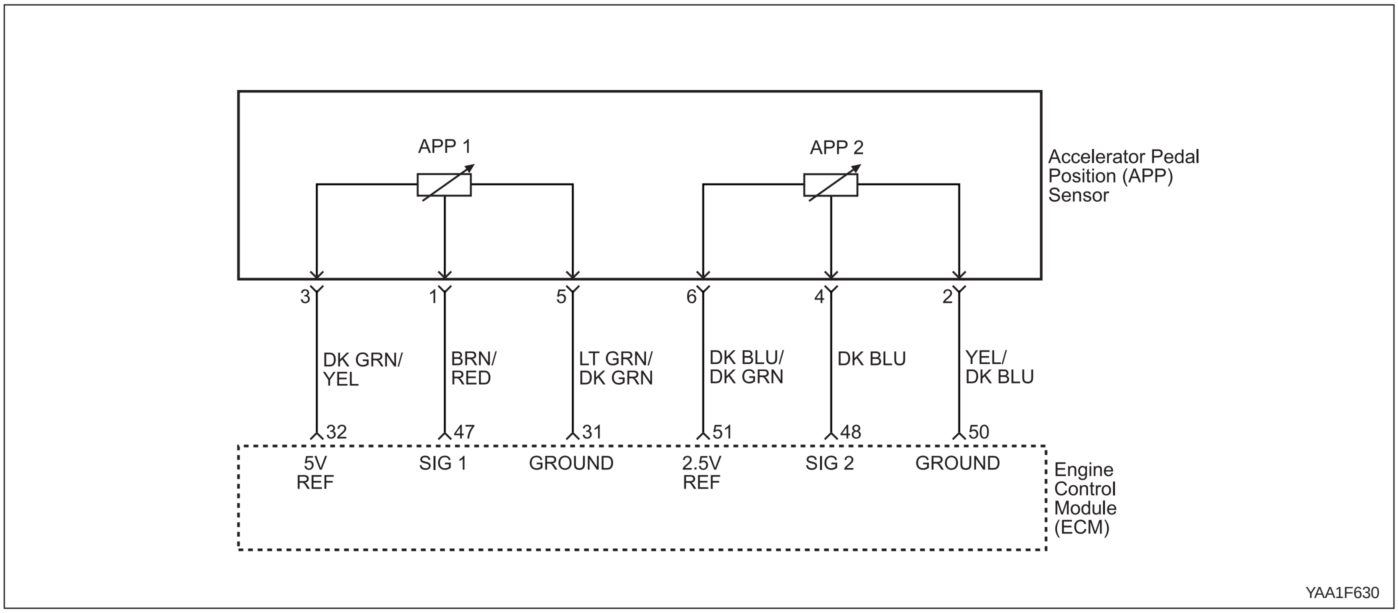


DIAGNOSTIC TROUBLE CODE (DTC) P0220 ACCELERATOR PEDAL POSITION SENSOR MALFUNCTION

Circuit Description

The Engine Control Module (ECM) supplies a 5 or 2.5 volt reference signal and a ground to the Accelerator Pedal Position sensor 1 or 2. The ECM calculates the accelerator pedal position by monitoring the voltages on these signal lines. The APP sensor output changes as the accelerator pedal is moved. The outputs of the APP sensor 1 and sensor 2 are low, about 0.4 - 0.7 volts and 0.2 - 0.35 volts respectively at the closed throttle posi-tion. As pushing the accelerator pedal, the output in-creases so that the output voltages will be about 4.3 - 4.8 volts and 2.1 - 2.4 volts individually when accelerating fully with the kickdown, at Wide Open Throttle (WOT).

Conditions for Setting the DTC

- Ignition ON.
- Electrical system protection is not active.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles in which the diag-nostic 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

Diagnostic Aids

If a DTC P0220 cannot be duplicated, the information included in the Freeze Frame data can be useful. Use the scan tool information data to determine the status of the DTC. If the DTC occurs intermittently, using the Diagnostic table may help isolate the problem.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
3. Normal APP 1 voltage when the throttle plates are ful-ly closed is between 0.4 - 0.7 volts. A sensor will display a higher voltage when the sensor is stuck or a circuit is faulty.
4. Normal APP 2 voltage when the throttle plates are fully closed is between 0.2 - 0.35 volts. A sensor will display a higher voltage when the sensor is stuck or a circuit is faulty.
5. If DTC P0220 cannot be duplicated, the information included in the Freeze Frame / Failure Records data can be useful. Use the scan tool DTC information data to determine the status of the DTC.
6. A disconnected APP sensor should not display a voltage reading on the scan tool. An amount less than the specified value is normal.

20. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

22. If no faults have been found at this point and no additional DTCs were set, refer to “Diagnostic Aids” in this section for additional checks and information.

DTC P0220 Accelerator Pedal Position Sensor Malfunction

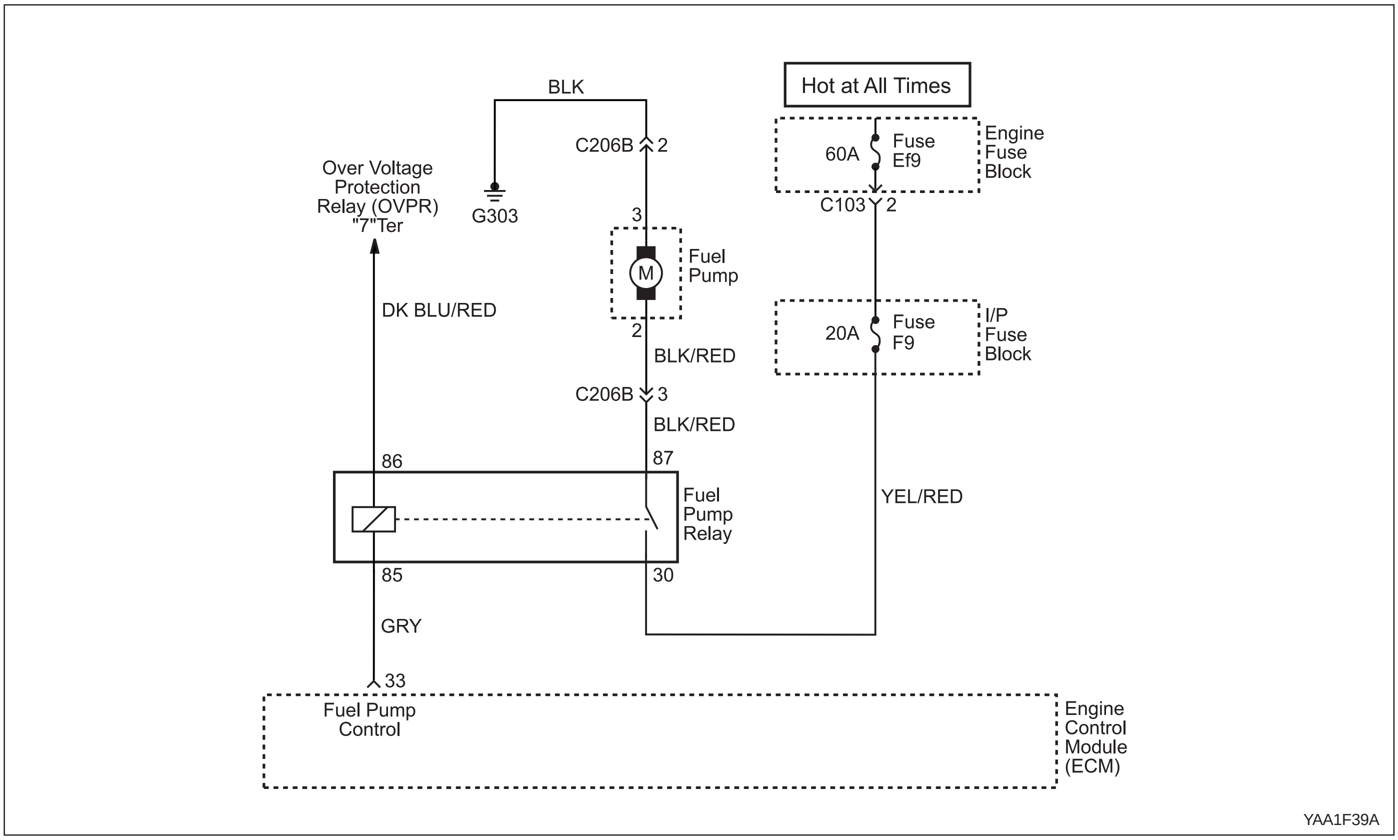
Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install a scan tool. 3. Select the Throttle Position (TP) angle parameter on the scan tool. 4. Monitor the scan tool while pressing the accelerator pedal to the floor and then slowly releasing the pedal. (Repeat the procedure several times.) Does the TP angle value increase steadily when the accelerator pedal is pressed to greater than the specified value and decrease steadily when the pedal is released to less than the specified value?	98 % 1 %	Go to Step 3	Go to Step 5
3	Does the scan tool display a accelerator pedal position (APP) sensor 1 voltage between the specified value when the throttle is fully closed?	0.4 - 0.7 v	Go to Step 4	Go to Step 6
4	Does the scan tool display a accelerator pedal position (APP) sensor 2 voltage between the specified value when the throttle is fully closed?	0.2 - 0.35 v	Go to Step 5	Go to Step 6
5	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 DTC P0220 set again?	-	Go to Step 6	Go to Step 25
6	1. Turn the ignition OFF. 2. Disconnect the APP sensor electrical connector. 3. Turn the ignition ON. Is the APP sensor 1 or 2 voltage near the specified value?	0 v 0 v	Go to Step 9	If APP1 value is more than specified value, Go to Step 7 If APP2 value is more than specified value, Go to Step 8
7	Check the APP sensor 1 signal circuit at the APP sensor 1 harness connector terminal 1 for a short to voltage and repair as necessary. Is a repair necessary?	-	Go to Step 25	Go to Step 24
8	Check the APP sensor 2 signal circuit at the APP sensor 2 harness connector terminal 4 for a short to voltage and repair as necessary. Is a repair necessary?	-	Go to Step 25	Go to Step 24

DTC P0220 Accelerator Pedal Position Sensor Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
9	Jumper the 5 volt reference circuit, terminal 3 and the APP sensor 1 signal circuit, terminal 1 together at the APP sensor electrical connector. Is the APP sensor 1 voltage over the specified value?	4.0 v	Go to Step 10	Go to Step 11
10	Jumper the 2.5 volt reference circuit, terminal 6 and the APP sensor 2 signal circuit, terminal 4 together at the APP sensor electrical connector. Is the APP sensor 2 voltage over the specified value?	2.0 v	Go to Step 19	Go to Step 15
11	Connect a test light between B+ and the APP sensor 1 signal circuit at terminal 1. Is the APP sensor 1 voltage greater than the specified value?	4.0 v	Go to Step 12	Go to Step 14
12	Check the 5 volt reference circuit for an open or short to ground and repair as necessary.	-	Go to Step 25	Go to Step 13
13	Check the 5 volt reference circuit for a poor connection at the Engine Control Module (ECM), terminal 32 and repair the terminal as necessary. Is the repair complete?	-	Go to Step 25	Go to Step 24
14	Check the APP sensor 1 signal circuit, terminal 3 for an open or short to ground and repair as necessary. Is the repair complete?	-	Go to Step 25	Go to Step 24
15	Connect a test light between B+ and the APP sensor 2 signal circuit at terminal 4. Is the APP sensor 2 voltage greater than the specified value?	2.0 v	Go to Step 16	Go to Step 18
16	Check the 2.5 volt reference circuit for an open or short to ground and repair as necessary.	-	Go to Step 17	Go to Step 17
17	Check the 2.5 volt reference circuit for a poor connection at the Engine Control Module (ECM), terminal 51 and repair the terminal as necessary. Is the repair complete?	-	Go to Step 25	Go to Step 24
18	Check the APP sensor 2 signal circuit, terminal 4 for an open or short to ground and repair as necessary. Is the repair complete?	-	Go to Step 25	Go to Step 24
19	Connect a test light to B+ and probe the ground circuit at terminal 5 of the APP sensor 1 harness connector. Does the test light illuminate?	-	Go to Step 20	Go to Step 21
20	Connect a test light to B+ and probe the ground circuit at terminal 2 of the APP sensor 2 harness connector. Does the test light illuminate?	-	Go to Step 23	Go to Step 22
21	Check the APP sensor 1 ground circuit , terminal 5 for open and repair as necessary? Is the repair complete?	-	Go to Step 25	Go to Step 24
22	Check the APP sensor 2 ground circuit , terminal 2 for open and repair as necessary? Is the repair complete?	-	Go to Step 25	Go to Step 24

DTC P0220 Accelerator Pedal Position Sensor Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
23	1. Turn the ignition OFF. 2. Replace the APP sensor. Is the action complete?	-	Go to Step 25	-
24	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 25	-
25	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 26	Go to Step 2
26	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) P0231 FUEL PUMP SHORT CIRCUIT TO GROUND OR OPEN

Circuit Description

When the ignition switch is turned ON, the Engine Control Module (ECM) will activate the 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, engine stopped or engine stalled.

Conditions for Setting the DTC

- Voltage is less the 2 volts for ground.
- Voltage is less the 3 volts for open.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed through wire insulation, or broken wire inside the insulation.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

4. This step checks for the Engine Control Module (ECM) providing a Battery voltage for the operation of the fuel pump relay.

14. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0231 Fuel Pump Short Circuit to Ground or Open

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	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	Go to Step 15	Go to Step 3
3	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 86 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to Step 4	Go to Step 10
4	1. Turn the ignition OFF. 2. Connect a test light between the fuel relay connector terminal 85 and battery positive 3. Turn the ignition ON. 4. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec	Go to Step 5	Go to Step 11
5	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 6	Go to Step 9
6	Check for an open or short to ground in the wire between the fuel pump relay connector terminal 87 and the fuel pump terminal 2. 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 the fuel pump terminal 2. 2. Install the fuel pump relay. 3. Turn the ignition ON. Does the fuel pump operates for the time specified?	2 sec	Go to Step 15	-
8	1. Replace the fuel pump relay. 2. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	Go to Step 15	-
9	1. Repair the wire between the fuel pump relay connector terminal 30 and B+. 2. Install the fuel pump relay. 3. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	Go to Step 15	-

DTC P0231 Fuel Pump Short Circuit to Ground or Open (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check for an open wire between the fuel pump relay connector terminal 86 and the Over Voltage Protection Relay (OVPR) connector terminal 7. Is the problem found?	-	Go to Step 13	Go to "OVPR Circuit Check"
11	Check for an open or short to ground in the wire between the fuel pump relay connector terminal 85 and the Engine Control Module (ECM) connector terminal 33. Is the problem found?	-	Go to Step 12	Go to Step 14
12	1. Repair the wire between the fuel pump relay connector terminal 85 and the ECM connector terminal 33. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	Go to Step 15	-
13	Repair the wire between the fuel pump relay connector terminal 86 and the OVPR connector terminal 7. Is the repair complete?	-	Go to Step 15	-
14	1. Turn the ignition OFF. 2. Replace the ECM. 3. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	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 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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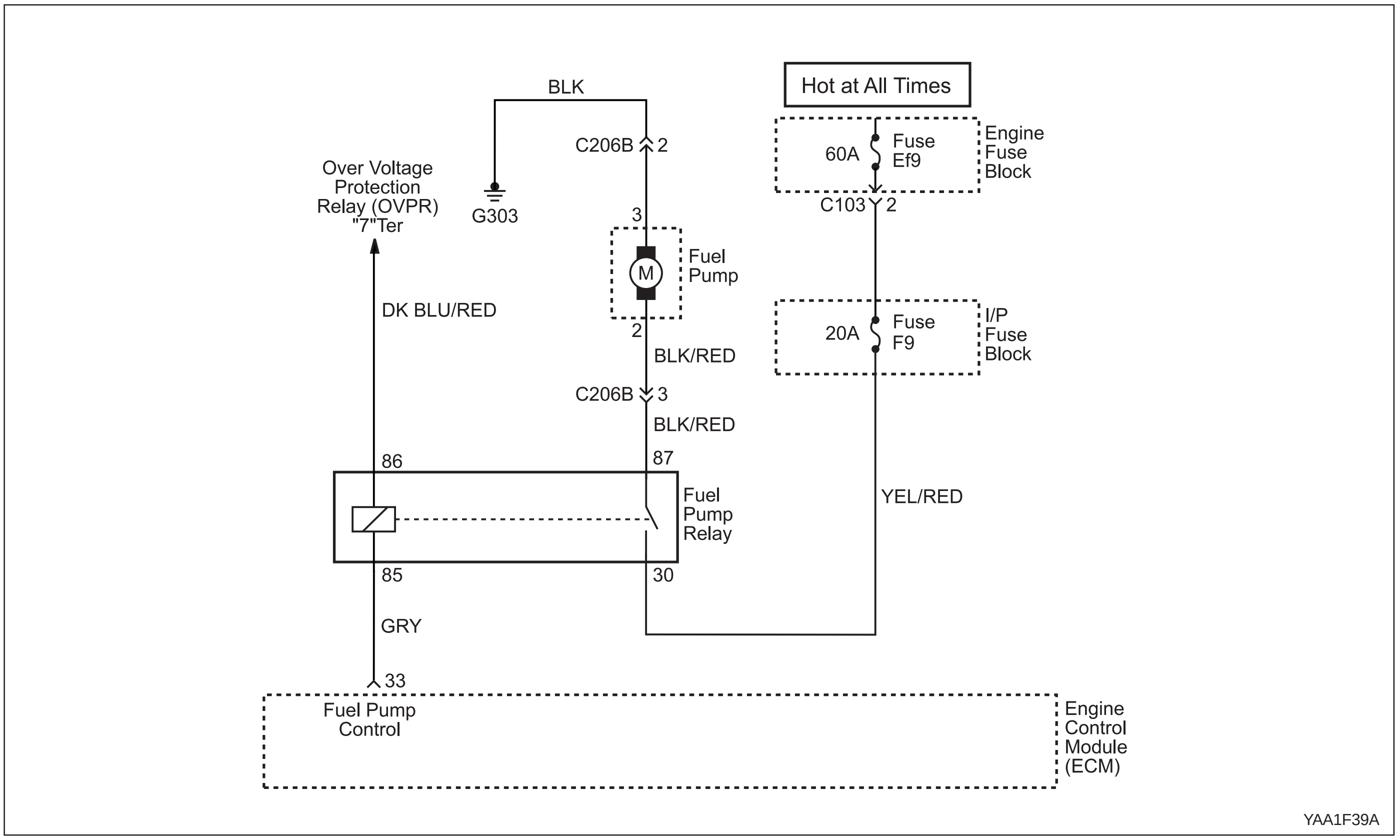

DIAGNOSTIC TROUBLE CODE (DTC) P0232 FUEL PUMP SHORT CIRCUIT TO BATTERY

Circuit Description

When the ignition switch is turned ON, the Engine Control Module (ECM) will activate the 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, engine stopped or engine stalled.

Conditions for Setting the DTC

- Current is between 1 ampare and 2 ampares. (depending on driver condition)

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed through wire insulation, or broken wire inside the insulation.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

4. This step checks for the Engine Control Module (ECM) providing a Battery voltage for the operation of the fuel pump relay.

14. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0232 Fuel Pump Short Circuit to Battery

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	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	Go to Step 15	Go to Step 3
3	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 86 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to Step 4	Go to Step 10
4	1. Turn the ignition OFF. 2. Connect a test light between the fuel relay connector terminal 85 and battery positive 3. Turn the ignition ON. 4. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec	Go to Step 5	Go to Step 11
5	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 6	Go to Step 9
6	Check for an open or short to ground in the wire between the fuel pump relay connector terminal 87 and the fuel pump terminal 2. 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 the fuel pump terminal 2. 2. Install the fuel pump relay. 3. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	Go to Step 15	-
8	1. Replace the fuel pump relay. 2. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	Go to Step 15	-
9	1. Repair the wire between the fuel pump relay connector terminal 30 and B+. 2. Install the fuel pump relay. 3. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	Go to Step 15	-

DTC P0232 Fuel Pump Short Circuit to Battery (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check for an open wire between the fuel pump relay connector terminal 86 and the Over Voltage Protection Relay (OVPR) connector terminal 7. Is the problem found?	-	Go to Step 13	Go to "OVPR Circuit Check"
11	Check for a short to battery in the wire between the fuel pump relay connector terminal 85 and the Engine Control Module (ECM) connector terminal 33. Is the problem found?	-	Go to Step 12	Go to Step 14
12	1. Repair the wire between the fuel pump relay connector terminal 85 and the ECM connector terminal 33. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	Go to Step 15	-
13	Repair the wire between the fuel pump relay connector terminal 86 and the OVPR connector terminal 7. Is the repair complete?	-	Go to Step 15	-
14	1. Turn the ignition OFF. 2. Replace the ECM. 3. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	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 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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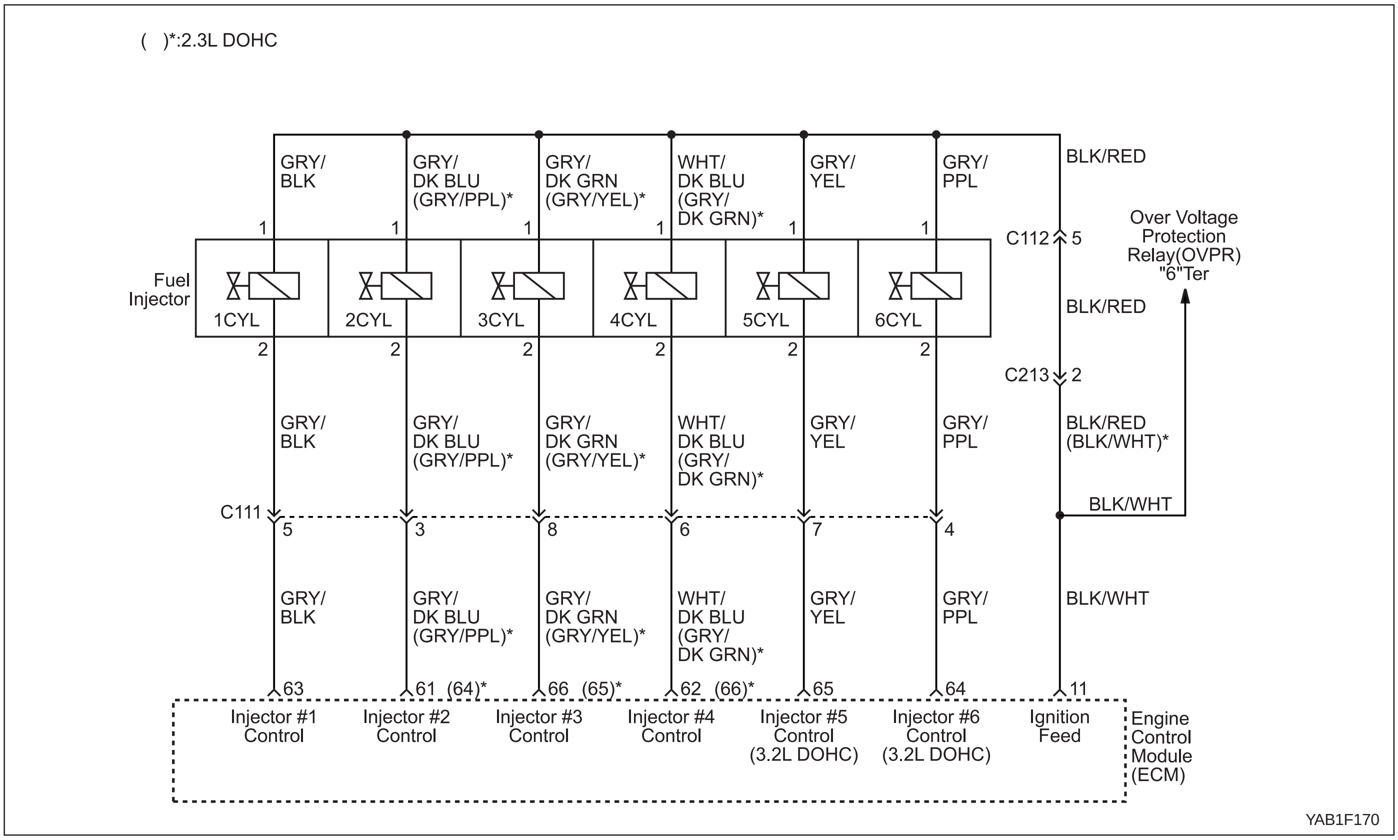

DIAGNOSTIC TROUBLE CODE (DTC) P0261 INJECTOR 1: SHORT CIRCUIT TO GROUND OR OPEN

Circuit Description

The Engine Control Module (ECM) has six (four-2.3L DOHC) 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 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 conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Voltage is less than 1/3 of battery voltage for ground.
- Voltage is less than 2/3 of battery voltage for open.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An injector driver circuit that is open or shorted to ground will cause 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.

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 14.5 - 15 Ω .

Test Description

The number(s) below refer to specific step(s) on thediagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
3. This step determines if DTC P0261 is the result of a hard failure or an intermittent condition.
5. This step tests the wiring harness and the ECM control of the injectors using a test light.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0261 Injector 1: Short Circuit to Ground or Open

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Will the engine start?	-	Go to Step 3	Go to “Engine Cranks But Will Not Run”
3	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle for one minute. Does DTC P0261 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 the DTC P0261 reset?	-	Go to Step 5	Go to “Diagnostic Aids”
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) (gray) connector for injector 1. 3. Turn the ignition ON, with engine OFF. 4. With a test light connected to ground, probe the driver circuit, terminal 63. 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 9	-
7	Check the connections at the ECM and repair as necessary. Is the repair complete?	-	Go to Step 9	Go to Step 8
8	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 9	-

DTC P0261 Injector 1: Short Circuit to Ground or Open (Cont'd)

Step	Action	Value(s)	Yes	No
9	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 10	Go to Step 3
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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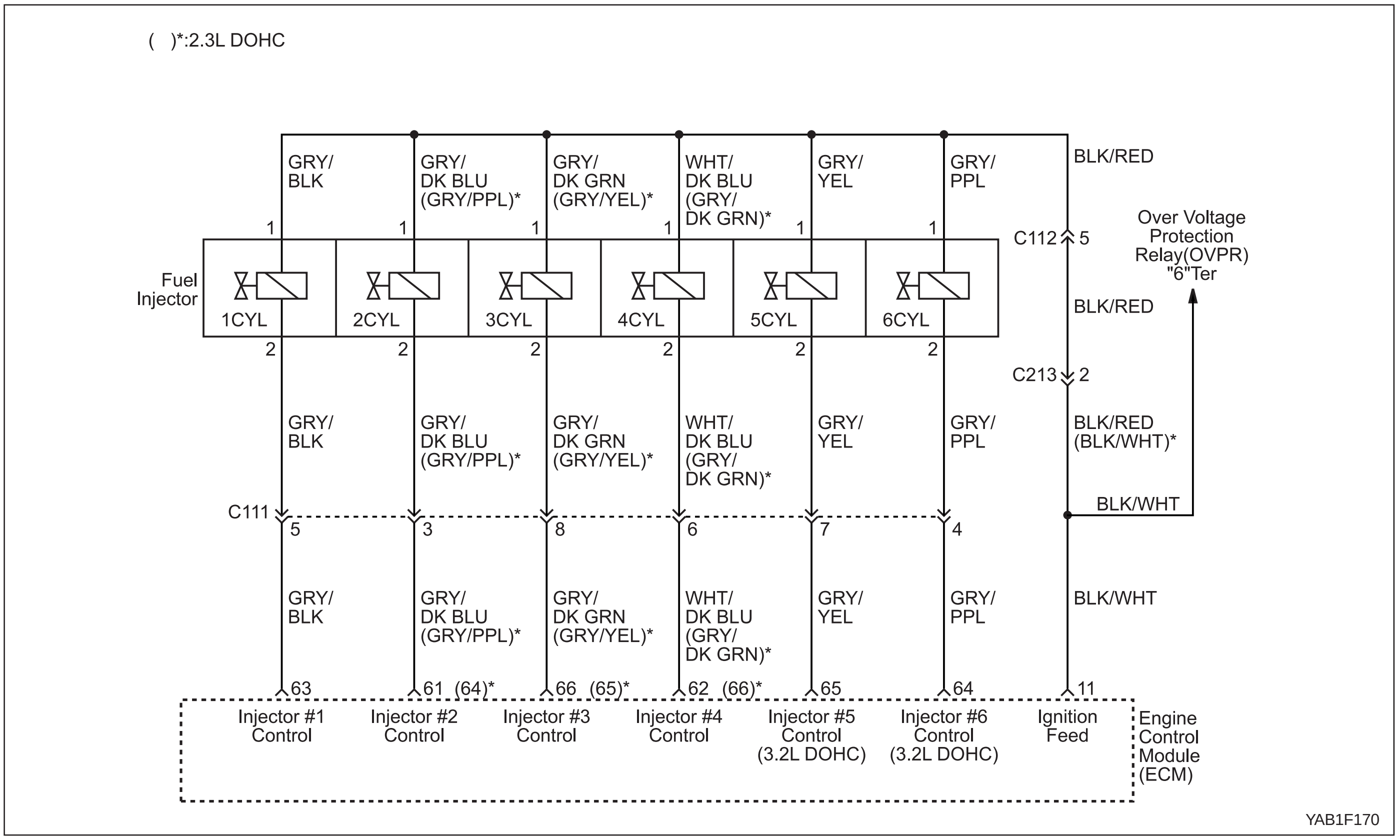

DIAGNOSTIC TROUBLE CODE (DTC) P0262 INJECTOR 1: SHORT CIRCUIT TO BATTERY

Circuit Description

The Engine Control Module (ECM) has six (four-2.3L DOHC) 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 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 battery conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Current is between 2.2 ampares and 4.3 ampares. (depending on driver condition)

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An injector driver circuit that is shorted to voltage will cause 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.

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 14.5 - 15 Ω.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunc-tion occurred. The information is then stored on the scan tool for later reference.

3. This step determines if DTC P0262 is the result of a hard failure or an intermittent condition.
5. This step tests the wiring harness and the ECM control of the injectors using a test light.
6. This step determines if the circuitry is shorted to voltage or if the ECM is faulty.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0262 Injector 1: Short Circuit to Battery

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Will the engine start?	-	Go to Step 3	Go to “Engine Cranks But Will Not Run”
3	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle for one minute. Does DTC P0262 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 the DTC P0262 reset?	-	Go to Step 5	Go to “Diagnostic Aids”
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) (gray) connector for injector 1. 3. Turn the ignition ON, with engine OFF. 4. With a test light connected to ground, probe the driver circuit, terminal 63. Does the test light illuminate?	-	Go to Step 6	-
6	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 7	Go to Step 8
7	Repair the short to voltage in the injector driver circuit. 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 P0262 Injector 1: Short Circuit to Battery (Cont'd)

Step	Action	Value(s)	Yes	No
9	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 10	Go to Step 3
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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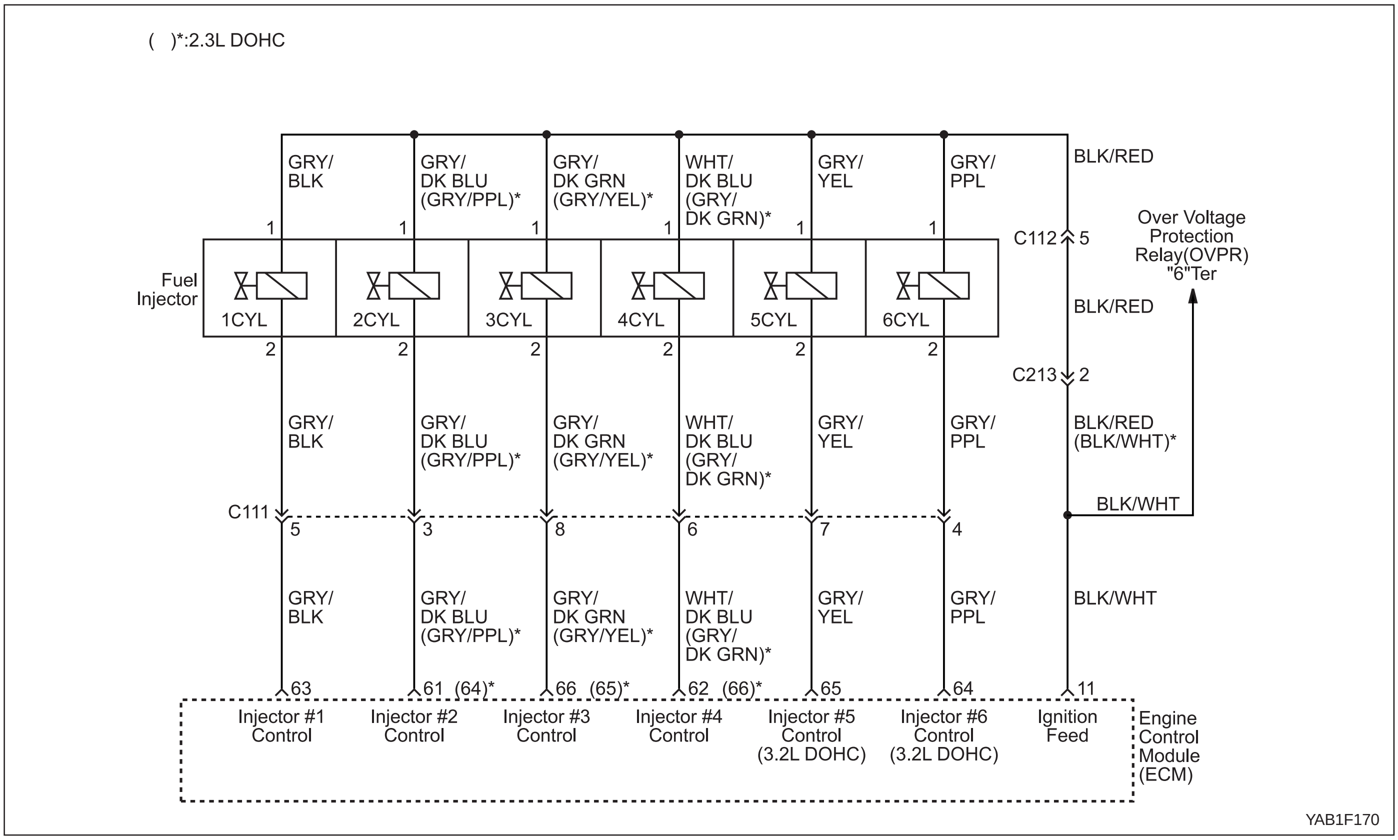

DIAGNOSTIC TROUBLE CODE (DTC) P0264 INJECTOR 2: SHORT CIRCUIT TO GROUND OR OPEN

Circuit Description

The Engine Control Module (ECM) has six (four-2.3L DOHC) individual in jector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors 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 conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Voltage is less than 1/3 of battery voltage for ground.
- Voltage is less than 2/3 of battery voltage for open.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An injector driver circuit that is open or shorted to ground will cause 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.

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 14.5 - 15 Ω.

Test Description

The number(s) below refer to specific step(s) on thediagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
3. This step determines if DTC P0264 is the result of a hard failure or an intermittent condition.
5. This step tests the wiring harness and the ECM control of the injectors using a test light.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0264 Injector 2: Short Circuit to Ground or Open

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Will the engine start?	-	Go to Step 3	Go to “Engine Cranks But Will Not Run”
3	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle for one minute. Does DTC P0264 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 the DTC P0264 reset?	-	Go to Step 5	Go to “Diagnostic Aids”
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) (gray) connector for injector 2. 3. Turn the ignition ON, with engine OFF. 4. With a test light connected to ground, probe the driver circuit, terminal 61 (64 - 2.3L DOHC). 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 9	-
7	Check the connections at the ECM and repair as necessary. Is the repair complete?	-	Go to Step 9	Go to Step 8
8	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 9	-

DTC P0264 Injector 2: Short Circuit to Ground or Open (Cont'd)

Step	Action	Value(s)	Yes	No
9	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 10	Go to Step 3
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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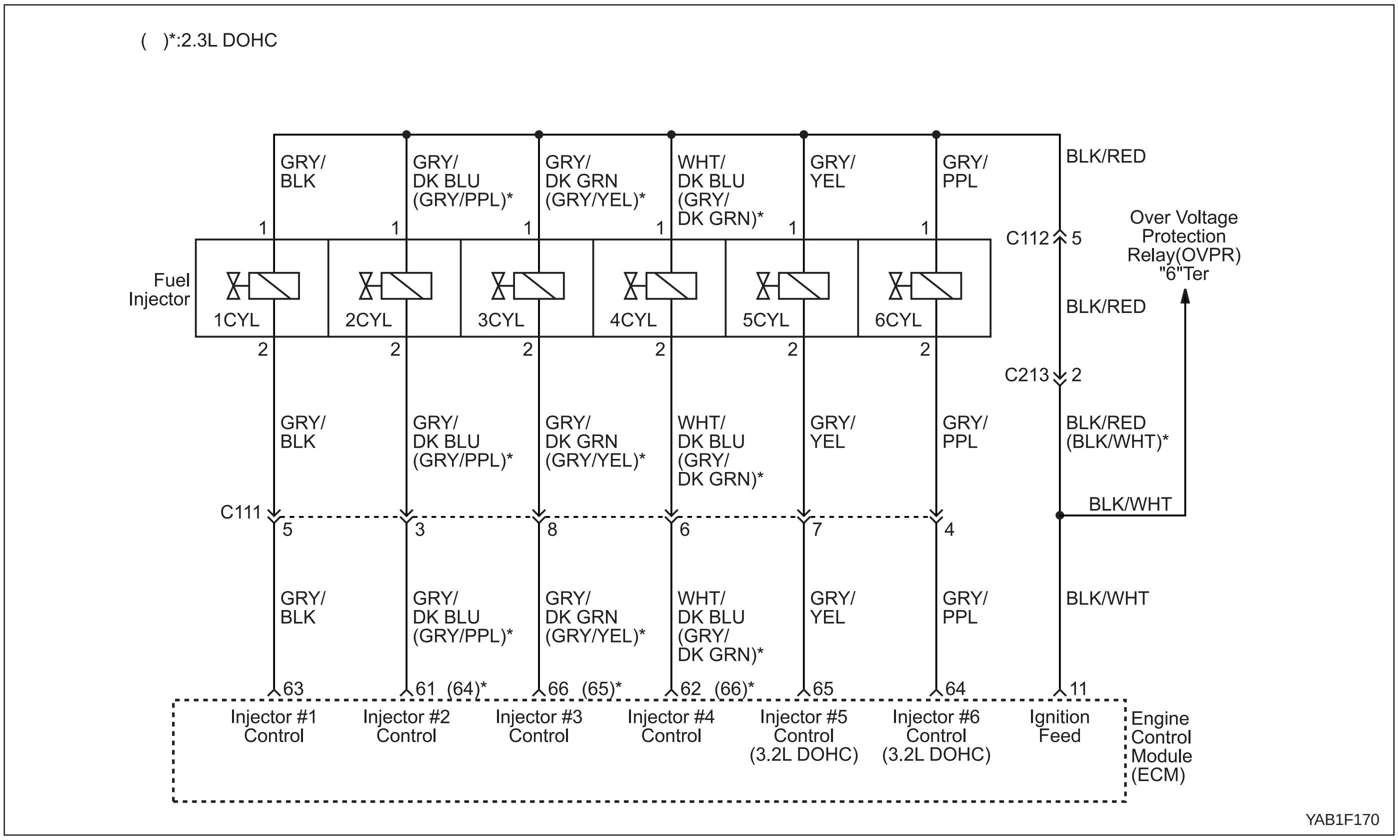

DIAGNOSTIC TROUBLE CODE (DTC) P0265 INJECTOR 2: SHORT CIRCUIT TO BATTERY

Circuit Description

The Engine Control Module (ECM) has six (four-2.3L DOHC) 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 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 battery conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Current is between 2.2 ampares and 4.3 ampares. (depending on driver condition)

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An injector driver circuit that is shorted to voltage will cause 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.

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 14.5 - 15 Ω.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro OnBoard 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 malfunction occurred. The information is then stored on the scan tool for later reference.

3. This step determines if DTC P0265 is the result of a hard failure or an intermittent condition.
5. This step tests the wiring harness and the ECM control of the injectors using a test light.
6. This step determines if the circuitry is shorted to voltage or if the ECM is faulty.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0265 Injector 2: Short Circuit to Battery

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Will the engine start?	-	Go to Step 3	Go to “Engine Cranks But Will Not Run”
3	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle for one minute. Does DTC P0265 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 the DTC P0265 reset?	-	Go to Step 5	Go to “Diagnostic Aids”
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) (gray) connector for injector 2. 3. Turn the ignition ON, with engine OFF. 4. With a test light connected to ground, probe the driver circuit, terminal 61 (64-2.3L DOHC). Does the test light illuminate?	-	Go to Step 6	-
6	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 7	Go to Step 8
7	Repair the short to voltage in the injector driver circuit. 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 P0265 Injector 2: Short Circuit to Battery (Cont'd)

Step	Action	Value(s)	Yes	No
9	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 10	Go to Step 3
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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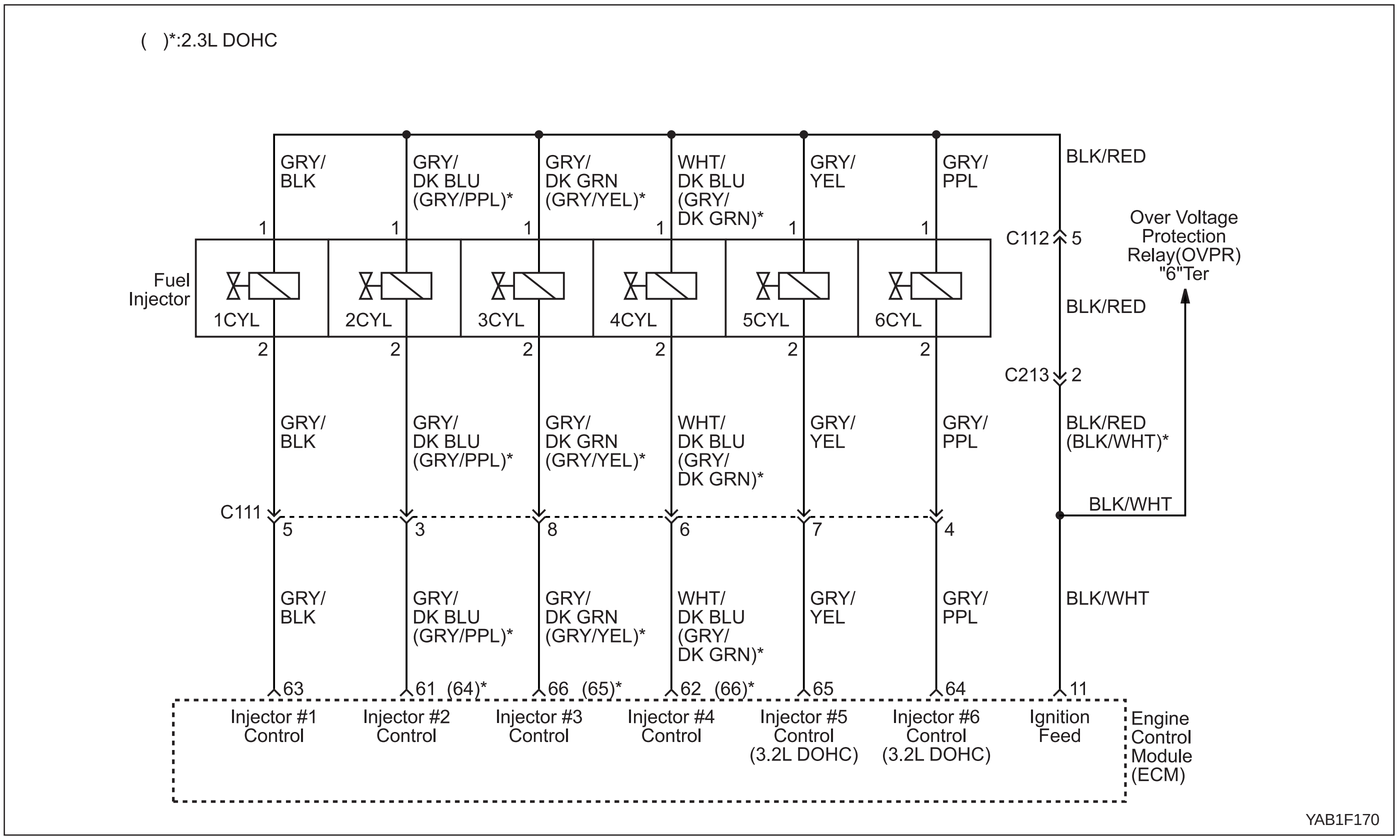

DIAGNOSTIC TROUBLE CODE (DTC) P0267 INJECTOR 3: SHORT CIRCUIT TO GROUND OR OPEN

Circuit Description

The Engine Control Module (ECM) has six (four-2.3L DOHC) 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 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 conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Voltage is less than 1/3 of battery voltage for ground.
- Voltage is less than 2/3 of battery voltage for open.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An injector driver circuit that is open or shorted to ground will cause 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.

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 14.5 - 15 Ω.

Test Description

The number(s) below refer to specific step(s) on thediagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
3. This step determines if DTC P0267 is the result of a hard failure or an intermittent condition.
5. This step tests the wiring harness and the ECM control of the injectors using a test light.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0267 Injector 3: Short Circuit to Ground or Open

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Will the engine start?	-	Go to Step 3	Go to “Engine Cranks But Will Not Run”
3	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle for one minute. Does DTC P0267 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 the DTC P0267 reset?	-	Go to Step 5	Go to “Diagnostic Aids”
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) (gray) connector for injector 3. 3. Turn the ignition ON, with engine OFF. 4. With a test light connected to ground, probe the driver circuit, terminal 66 (65-2.3L DOHC). 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 9	-
7	Check the connections at the ECM and repair as necessary. Is the repair complete?	-	Go to Step 9	Go to Step 8
8	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 9	-

DTC P0267 Injector 3: Short Circuit to Ground or Open (Cont'd)

Step	Action	Value(s)	Yes	No
9	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 10	Go to Step 3
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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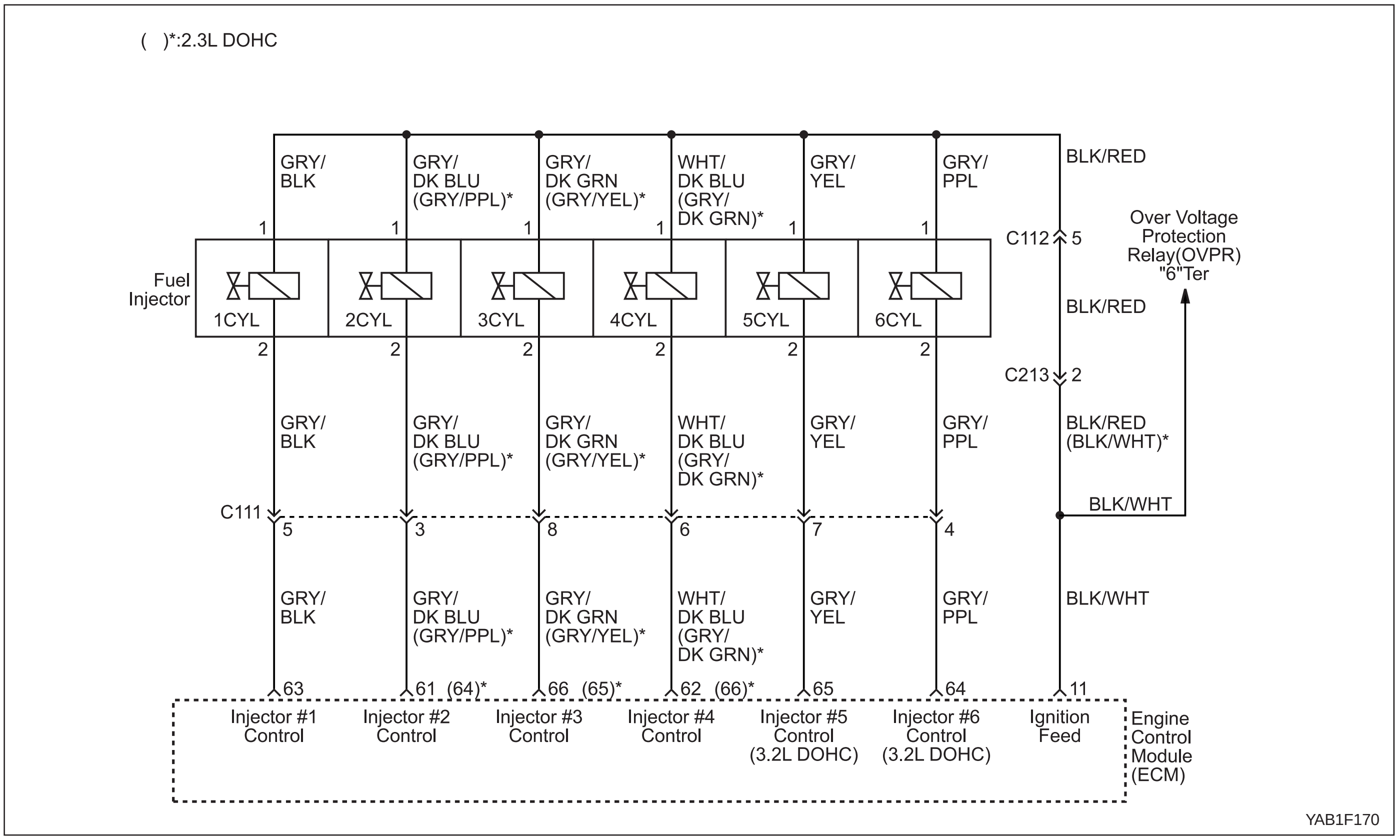

DIAGNOSTIC TROUBLE CODE (DTC) P0268 INJECTOR 3: SHORT CIRCUIT TO BATTERY

Circuit Description

The Engine Control Module (ECM) has six (four-2.3L DOHC) 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 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 battery conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Current is between 2.2 ampares and 4.3 ampares. (depending on driver condition)

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An injector driver circuit that is shorted to voltage will cause 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.

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 14.5 - 15 Ω.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

3. This step determines if DTC P0268 is the result of a hard failure or an intermittent condition.
5. This step tests the wiring harness and the ECM control of the injectors using a test light.
6. This step determines if the circuitry is shorted to voltage or if the ECM is faulty.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0268 Injector 3: Short Circuit to Battery

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Will the engine start?	-	Go to Step 3	Go to “Engine Cranks But Will Not Run”
3	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle for one minute. Does DTC P0268 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 the DTC P0268 reset?	-	Go to Step 5	Go to “Diagnostic Aids”
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) (gray) connector for injector 3. 3. Turn the ignition ON, with engine OFF. 4. With a test light connected to ground, probe the driver circuit, terminal 66 (65-2.3L DOHC). Does the test light illuminate?	-	Go to Step 6	-
6	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 7	Go to Step 8
7	Repair the short to voltage in the injector driver circuit. 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 P0268 Injector 3: Short Circuit to Battery (Cont'd)

Step	Action	Value(s)	Yes	No
9	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 10	Go to Step 3
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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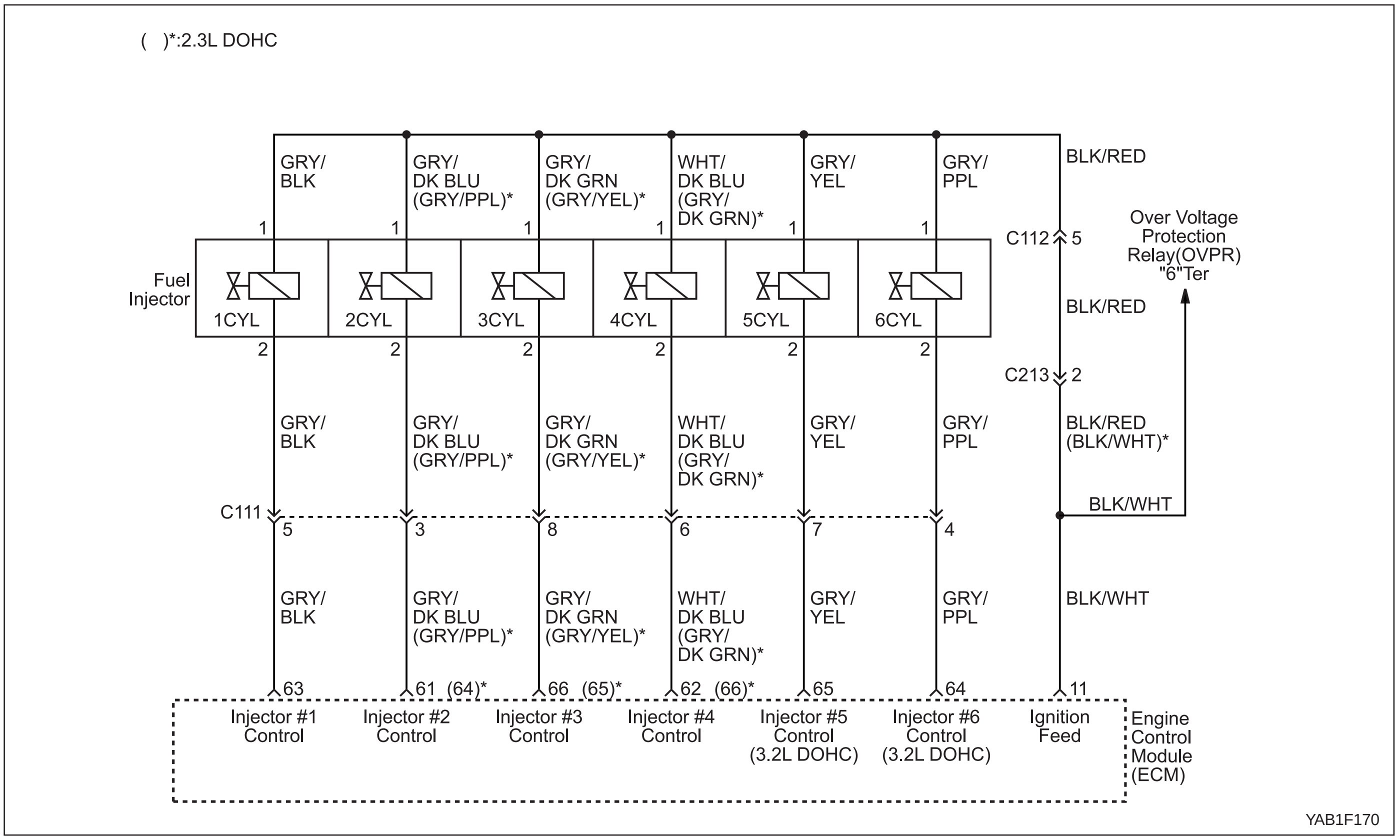

DIAGNOSTIC TROUBLE CODE (DTC) P0270 INJECTOR 4: SHORT CIRCUIT TO GROUND OR OPEN

Circuit Description

The Engine Control Module (ECM) has six (four-2.3L DOHC) 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 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 conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Voltage is less than 1/3 of battery voltage for ground.
- Voltage is less than 2/3 of battery voltage for open.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An injector driver circuit that is open or shorted to ground will cause 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.

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 14.5 - 15 Ω.

Test Description

The number(s) below refer to specific step(s) on thediagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
3. This step determines if DTC P0270 is the result of a hard failure or an intermittent condition.
5. This step tests the wiring harness and the ECM control of the injectors using a test light.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0270 Injector 4: Short Circuit to Ground or Open

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (Euro) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Will the engine start?	-	Go to Step 3	Go to “Engine Cranks But Will Not Run”
3	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle for one minute. Does DTC P0270 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 the DTC P0270 reset?	-	Go to Step 5	Go to “Diagnostic Aids”
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) (gray) connector for injector 4. 3. Turn the ignition ON, with engine OFF. 4. With a test light connected to ground, probe the driver circuit, terminal 62 (66-2.3L DOHC). 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 9	-
7	Check the connections at the ECM and repair as necessary. Is the repair complete?	-	Go to Step 9	Go to Step 8
8	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 9	-

DTC P0270 Injector 4: Short Circuit to Ground or Open (Cont'd)

Step	Action	Value(s)	Yes	No
9	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 10	Go to Step 3
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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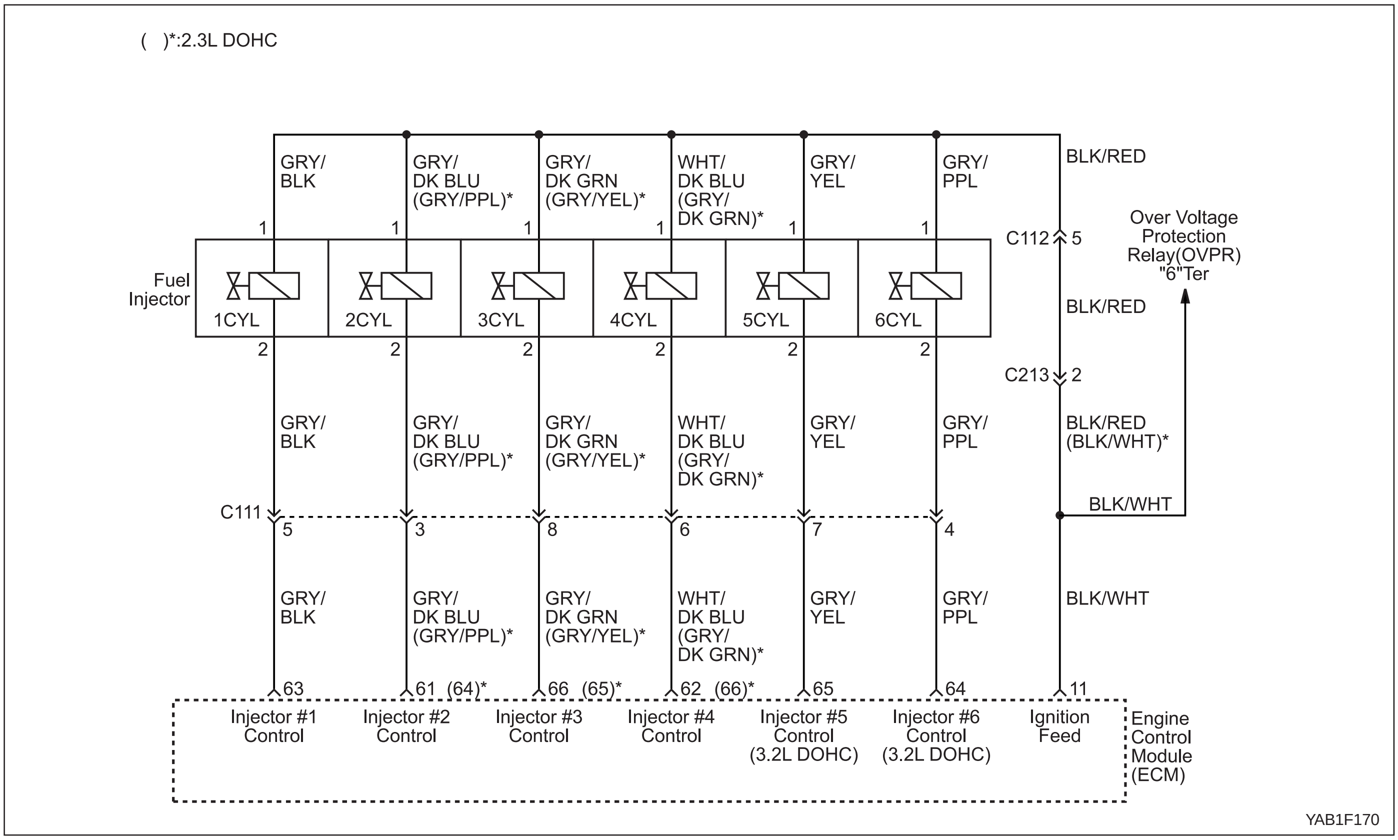

DIAGNOSTIC TROUBLE CODE (DTC) P0271 INJECTOR 4: SHORT CIRCUIT TO BATTERY

Circuit Description

The Engine Control Module (ECM) has six (four-2.3L DOHC) 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 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 battery conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Current is between 2.2 ampares and 4.3 ampares. (depending on driver condition)

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An injector driver circuit that is shorted to voltage will cause 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.

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 14.5 - 15 Ω.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

3. This step determines if DTC P0271 is the result of a hard failure or an intermittent condition.
5. This step tests the wiring harness and the ECM control of the injectors using a test light.
6. This step determines if the circuitry is shorted to voltage or if the ECM is faulty.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0271 Injector 4: Short Circuit to Battery

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Will the engine start?	-	Go to Step 3	Go to “Engine Cranks But Will Not Run”
3	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle for one minute. Does DTC P0271 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 the DTC P0271 reset?	-	Go to Step 5	Go to “Diagnostic Aids”
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) (gray) connector for injector 4. 3. Turn the ignition ON, with engine OFF. 4. With a test light connected to ground, probe the driver circuit, terminal 62 (66-2.3L DOHC). Does the test light illuminate?	-	Go to Step 6	-
6	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 7	Go to Step 8
7	Repair the short to voltage in the injector driver circuit. 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 P0271 Injector 4: Short Circuit to Battery (Cont'd)

Step	Action	Value(s)	Yes	No
9	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 10	Go to Step 3
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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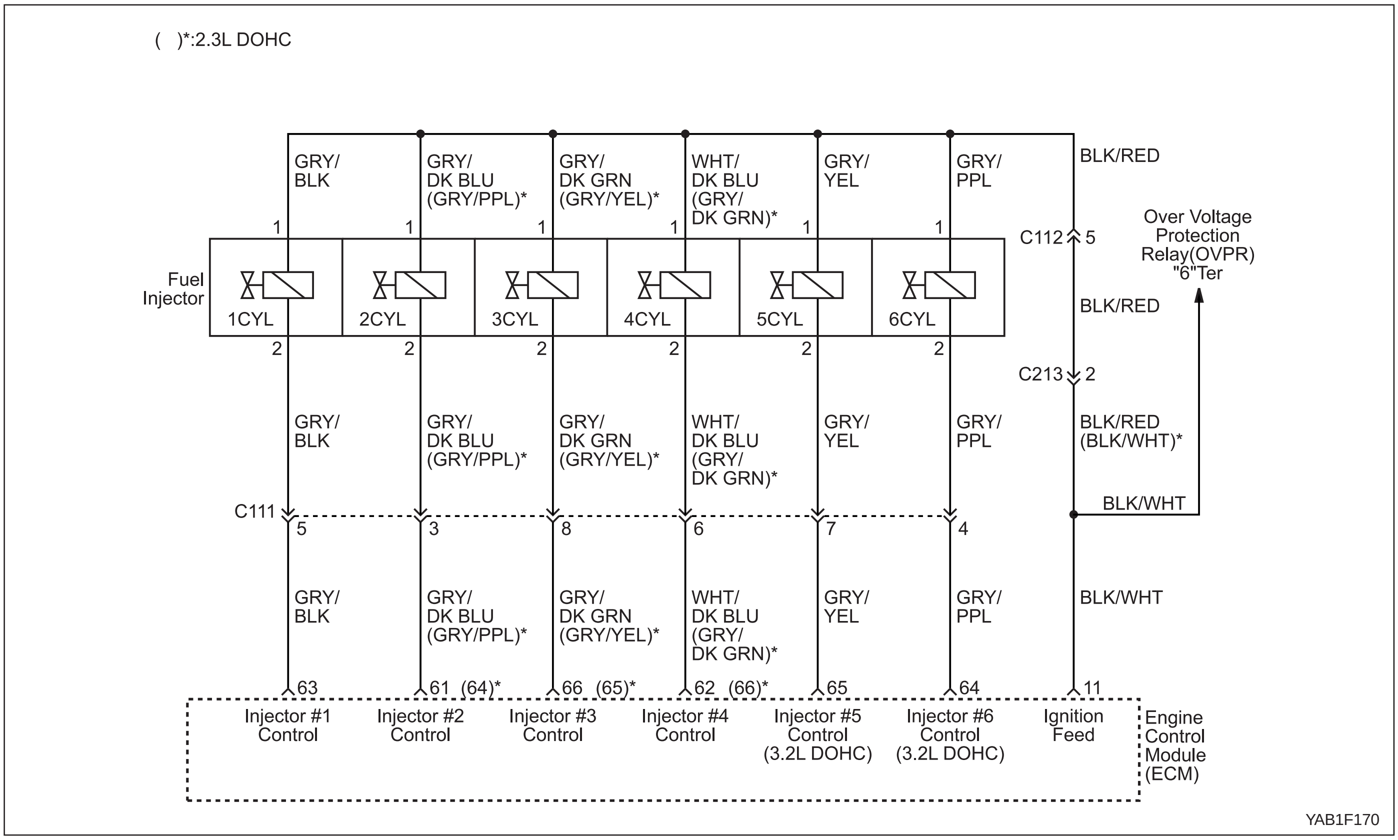


DIAGNOSTIC TROUBLE CODE (DTC) P0273 INJECTOR 5: SHORT CIRCUIT TO GROUND OR OPEN (3.2L DOHC)

Circuit Description

The Engine Control Module (ECM) has six 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 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 conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Voltage is less than 1/3 of battery voltage for ground.
- Voltage is less than 2/3 of battery voltage for open.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An injector driver circuit that is open or shorted to ground will cause a DTC P0273 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.

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 14.5 - 15 Ω.

Test Description

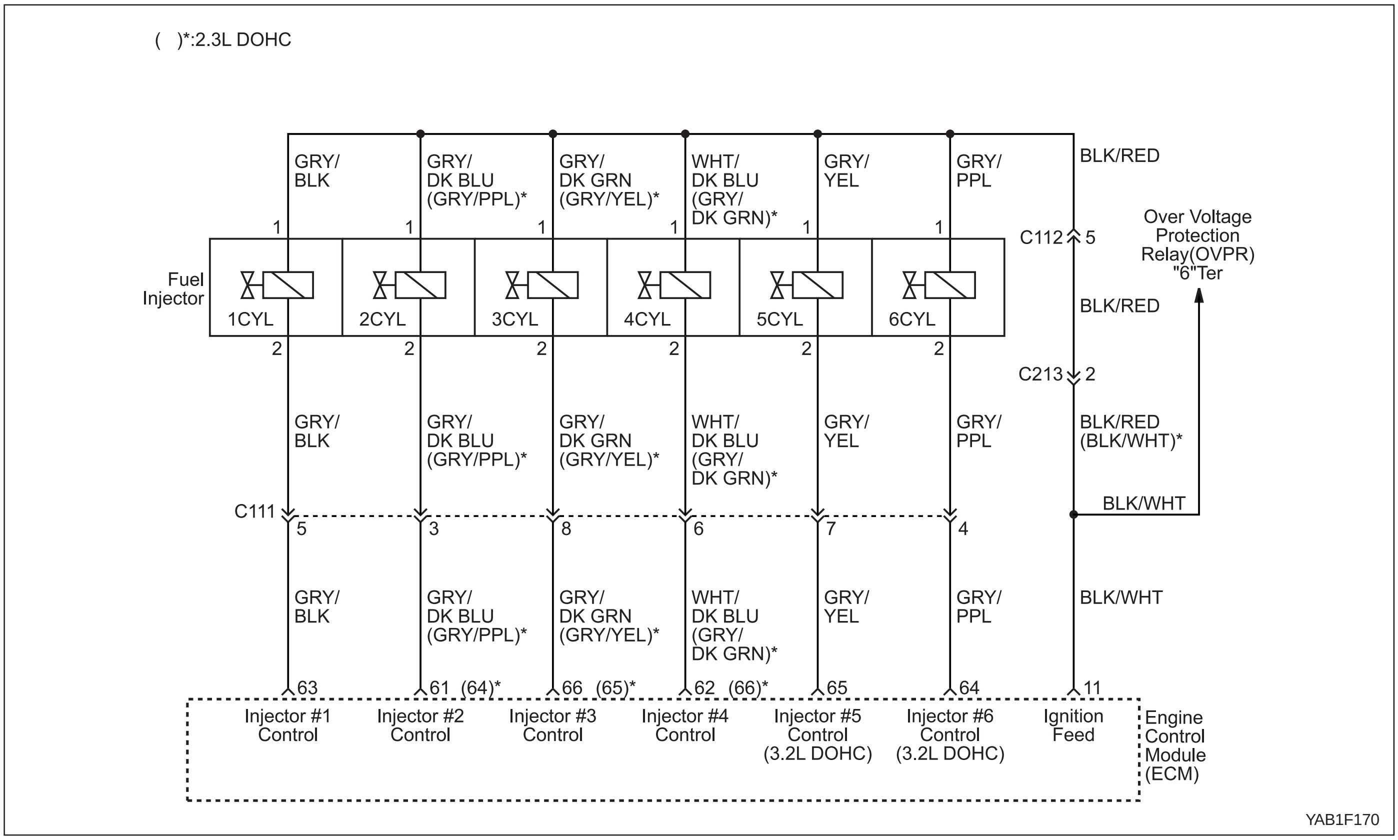
The number(s) below refer to specific step(s) on thediagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

3. This step determines if DTC P0273 is the result of a hard failure or an intermittent condition.
5. This step tests the wiring harness and the ECM control of the injectors using a test light.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0273 Injector 5: Short Circuit to Ground or Open (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Will the engine start?	-	Go to Step 3	Go to “Engine Cranks But Will Not Run”
3	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle for one minute. Does DTC P0273 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 the DTC P0273 reset?	-	Go to Step 5	Go to “Diagnostic Aids”
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) (gray) connector for injector 5. 3. Turn the ignition ON, with engine OFF. 4. With a test light connected to ground, probe the driver circuit, terminal 65. 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 9	-
7	Check the connections at the ECM and repair as necessary. Is the repair complete?	-	Go to Step 9	Go to Step 8
8	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 9	-
9	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 10	Go to Step 3
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) P0274 INJECTOR 5: SHORT CIRCUIT TO BATTERY (3.2L DOHC)

Circuit Description

The Engine Control Module (ECM) has six 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 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 battery conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Current is between 2.2 ampares and 4.3 ampares. (depending on driver condition)

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An injector driver circuit that is shorted to voltage will cause a DTC P0274 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.

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 14.5 - 15 Ω.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

3. This step determines if DTC P0274 is the result of a hard failure or an intermittent condition.
5. This step tests the wiring harness and the ECM control of the injectors using a test light.
6. This step determines if the circuitry is shorted to voltage or if the ECM is faulty.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0274 Injector 5: Short Circuit to Battery (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Will the engine start?	-	Go to Step 3	Go to “Engine Cranks But Will Not Run”
3	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle for one minute. Does DTC P0274 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 zconditions as noted. Does the DTC P0274 reset?	-	Go to Step 5	Go to “Diagnostic Aids”
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) (gray) connector for injector 5. 3. Turn the ignition ON, with engine OFF. 4. With a test light connected to ground, probe the driver circuit, terminal 65. Does the test light illuminate?	-	Go to Step 6	-
6	1. Disconnect the injector 5 wiring connection. 2. With a test light connected to ground, probe the driver circuit, terminal 2. Does the test light illuminate?	-	Go to Step 7	Go to Step 8
7	Repair the short to voltage in the injector driver circuit. 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 P0274 Injector 5: Short Circuit to Battery (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
9	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 10	Go to Step 3
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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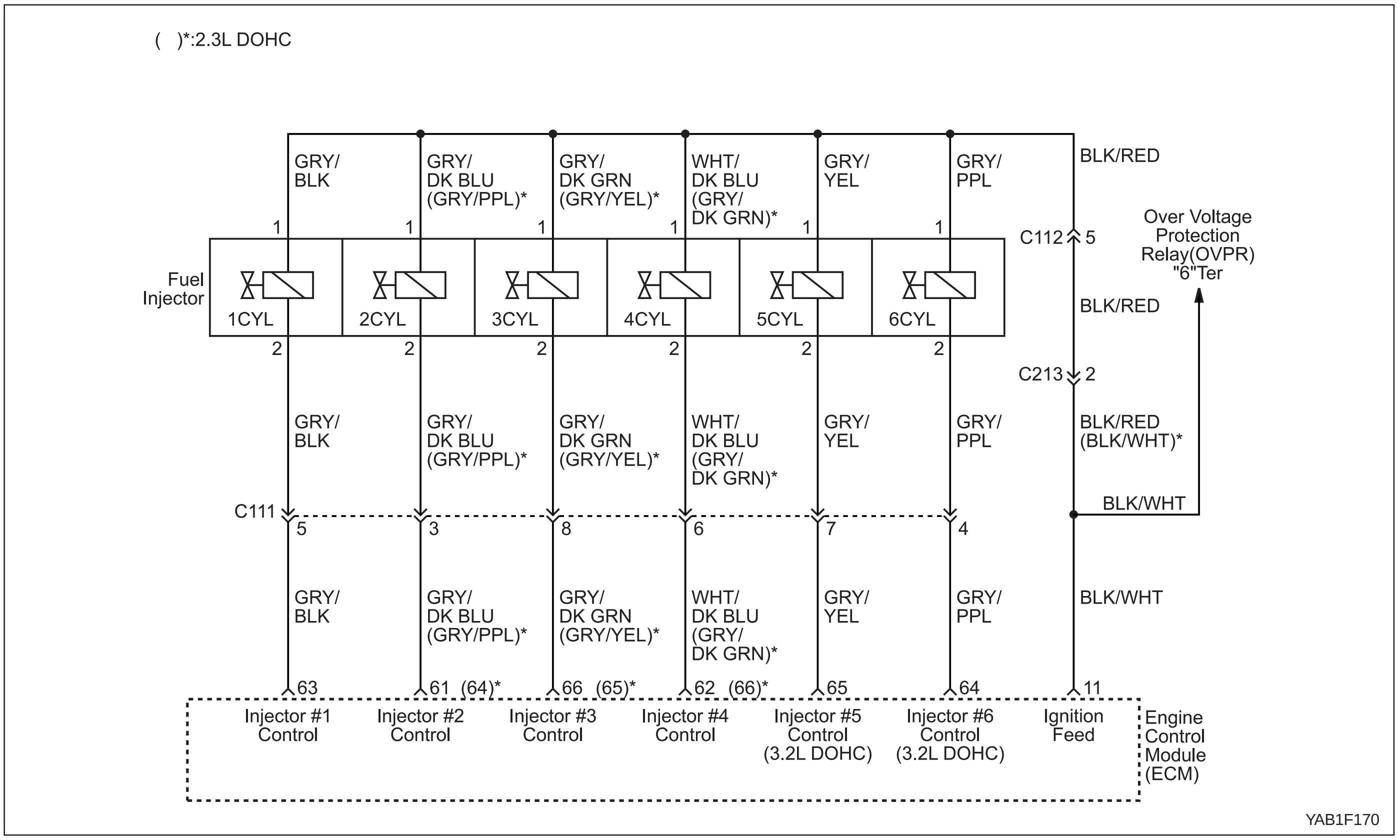


DIAGNOSTIC TROUBLE CODE (DTC) P0276 INJECTOR 6: SHORT CIRCUIT TO GROUND OR OPEN (3.2L DOHC)

Circuit Description

The Engine Control Module (ECM) has six 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 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 conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Voltage is less than 1/3 of battery voltage for ground.
- Voltage is less than 2/3 of battery voltage for open.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An injector driver circuit that is open or shorted to ground will cause a DTC P0276 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.

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 14.5 - 15 Ω.

Test Description

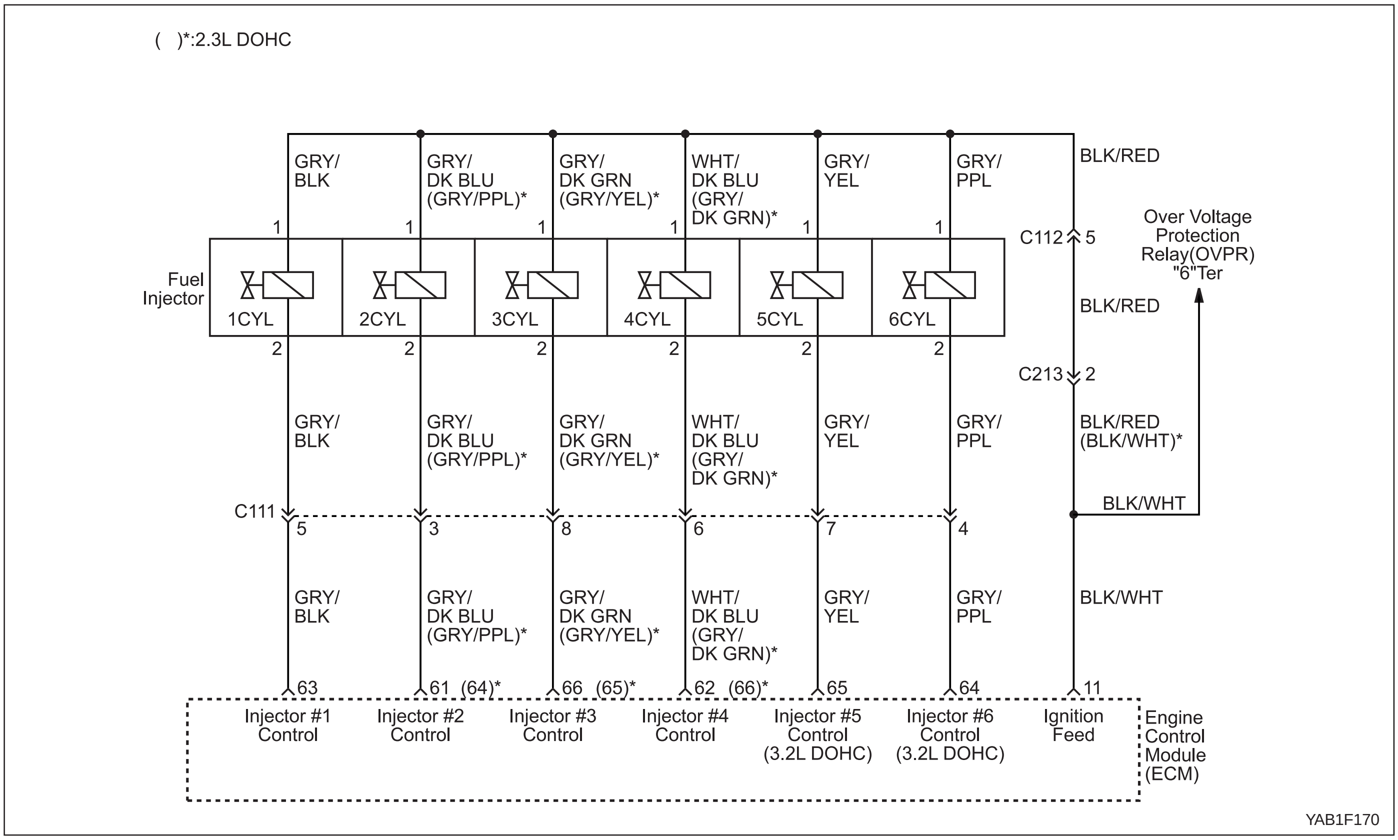
The number(s) below refer to specific step(s) on thediagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

3. This step determines if DTC P0276 is the result of a hard failure or an intermittent condition.
5. This step tests the wiring harness and the ECM control of the injectors using a test light.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0276 Injector 6: Short Circuit to Ground or Open (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Will the engine start?	-	Go to Step 3	Go to “Engine Cranks But Will Not Run”
3	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle for one minute. Does DTC P0276 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 the DTC P0276 reset?	-	Go to Step 5	Go to “Diagnostic Aids”
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) (gray) connector for injector 6. 3. Turn the ignition ON, with engine OFF. 4. With a test light connected to ground, probe the driver circuit, terminal 64. 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 9	-
7	Check the connections at the ECM and repair as necessary. Is the repair complete?	-	Go to Step 9	Go to Step 8
8	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 9	-
9	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 10	Go to Step 3
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) P0277 INJECTOR 6: SHORT CIRCUIT TO BATTERY (3.2L DOHC)

Circuit Description

The Engine Control Module (ECM) has six 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 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 battery conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Current is between 2.2 ampares and 4.3 ampares. (depending on driver condition)

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

An injector driver circuit that is shorted to voltage will cause a DTC P0277 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.

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 14.5 - 15 Ω.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

3. This step determines if DTC P0277 is the result of a hard failure or an intermittent condition.
5. This step tests the wiring harness and the ECM control of the injectors using a test light.
6. This step determines if the circuitry is shorted to voltage or if the ECM is faulty.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0277 Injector 6: Short Circuit to Battery (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Will the engine start?	-	Go to Step 3	Go to “Engine Cranks But Will Not Run”
3	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle for one minute. Does DTC P0277 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 the DTC P0277 reset?	-	Go to Step 5	Go to “Diagnostic Aids”
5	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) (gray) connector for injector 6. 3. Turn the ignition ON, with engine OFF. 4. With a test light connected to ground, probe the driver circuit, terminal 64. Does the test light illuminate?	-	Go to Step 6	-
6	1. Disconnect the injector 6 wiring connection. 2. With a test light connected to ground, probe the driver circuit, terminal 2. Does the test light illuminate?	-	Go to Step 7	Go to Step 8
7	Repair the short to voltage in the injector driver circuit. 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 P0277 Injector 6: Short Circuit to Battery (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
9	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 10	Go to Step 3
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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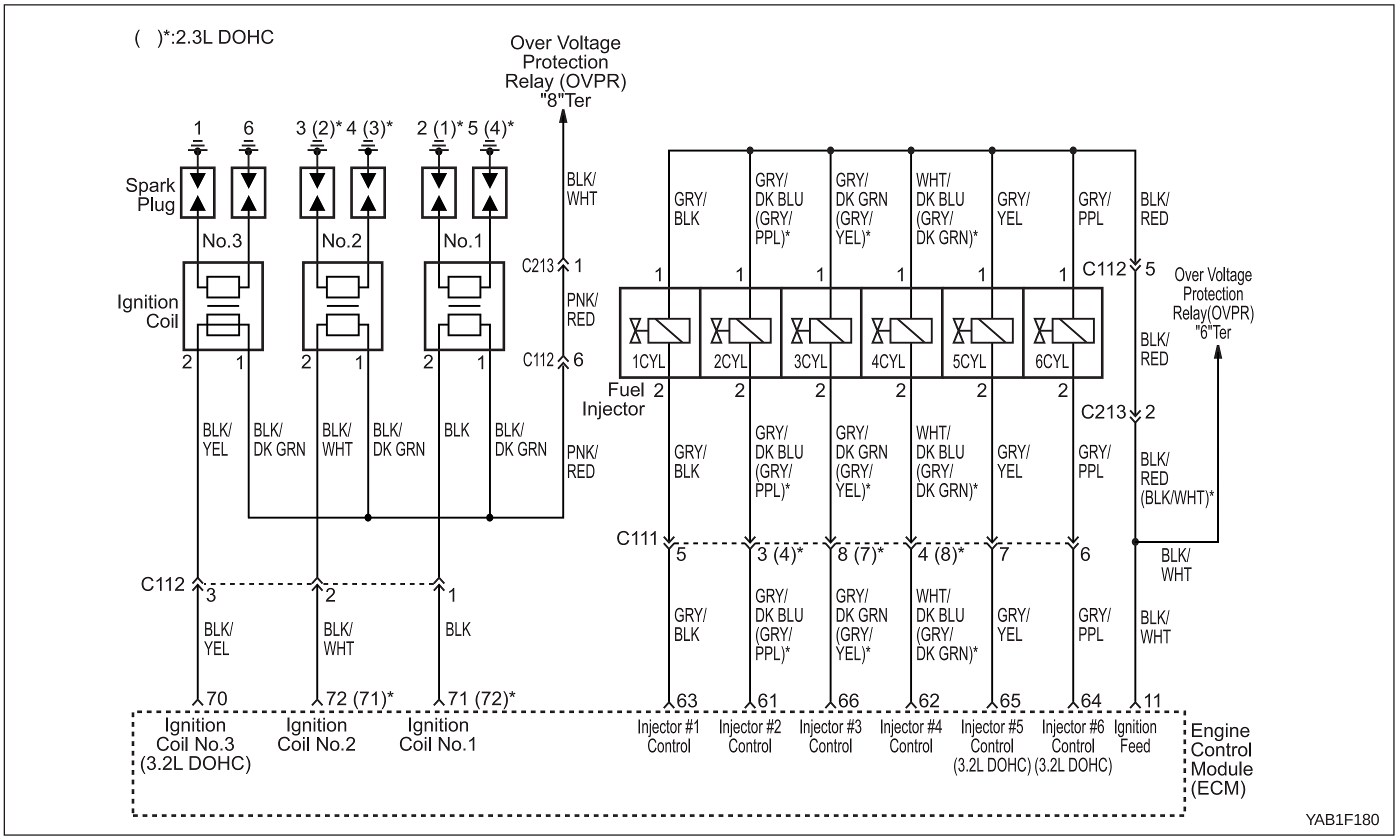


DIAGNOSTIC TROUBLE CODE (DTC) P0300 MULTIPLE CYLINDER MISFIRE

Circuit 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. 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. Misfire multiple cylinder is monitored by engine roughness measuring. The actual roughness value is compared with the actual (emission and catalyst damage) threshold.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0111, P0112, P0113, P0335, P0336, P0341, P0351, P0352, P0353 (3.2L DOHC) and P0600 are not set.
- Counting of misfire within 1000 revolutions and exceeding misfire EC emissions threshold is 70 for A/T and 102 for M/T (2.3L DOHC)
- Counting of misfire within 1000 revolutions and exceeding misfire EC emissions threshold is 3.5% (3.2L DOHC)
- Counting of misfire within 200 revolution and exceeding misfire catalyst damage is greater than 18 weighted (MIL BLINK after 1st exceed).
- Misfire starting end (500 rpm) is reached.
- At least one injector is reversible shut down by limiter is not present.
- Engine speed is between 500 and 5700 rpm (2.3L DOHC).
- Engine speed is between 450 and 4000 rpm (3.2L DOHC).
- Load gradient is between 0.05 and -0.05.
- At least two injectors are irreversible shut down or marked for shut down is not present.
- Load below threshold is between 0.17 and 0.34 (2.3L DOHC).
- Load below threshold is between 0.18 and 0.35 (3.2L DOHC).
- Increment wheel compensation precess is successful finished.
- Gear shift (A/T) is not active.
- Crankshaft/camshaft synchronizationis no fault.
- Tip down during cruise control active is not active.
- Tank level is greater than 13 liters.
- Clutch switch signal (M/T) is not active.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles in which the diagnostic runs with the fault active.

OR

- The MIL will illuminate immediately and flash if the catalyst darnage 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 three consecutive driving 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.

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.

The Scan tool active misfire counts should pick up an intermittent misfire problem. Watch the scan tool misfire counter. When a specific cylinder misfires under certain load, conditions may be duplicated in the stall.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

3. A visual/physical inspection should include checking the following components:
   - The wiring for proper connections, pinches or cuts.
   - The ECM grounds for being clean and tight.
   - The vacuum hoses for splits, kinks, and improper connections as shown on the Vehicle Emission Information label.
   - Check thoroughly for any type of leak or restriction.
   - Check for air leaks at the throttle body mounting area and intake manifold sealing surface.

5. When all the accumulators are relatively equal, the misfire is being caused by something that affects the entire engine. When they are not, the misfire is being caused by something that is specific to two or more cylinders.

6. Whenever the misfire is not present, operating the vehicle may be necessary to duplicate the conditions in the Freeze Frame Data in order to detect misfire. Depending on the engine load, the conditions may have to be maintained for up to 20 seconds. When the misfire is present. A history misfire counter will store the number of misfires that have occurred until the DTC is cleared.

8. Check fuel for water, alcohol, etc. (Water in the fuel can cause an occasional random misfire.)

9. A basic engine problem that affects all cylinders is the only possibility at this point. (Cam timing, throttle body leak, restricted air flow, etc.)

11. Tests the ignition system voltage output using a spark tester.

12. Replace any spark plugs that are worn, cracked or fouled.

13. Checks for voltage at the ignition feed circuits.

18. Whenever the driver circuit is shorted to ground, the light will be on steady. When the driver circuit is shorted to voltage or open, the light will be off.

19. Since voltage is supplied to the fuel injector on a single circuit, the malfunction can only be a poor connection or open in the fuel injector harness. An open before the harness would result in an ”Engine Cranks But Will Not Run” complaint.

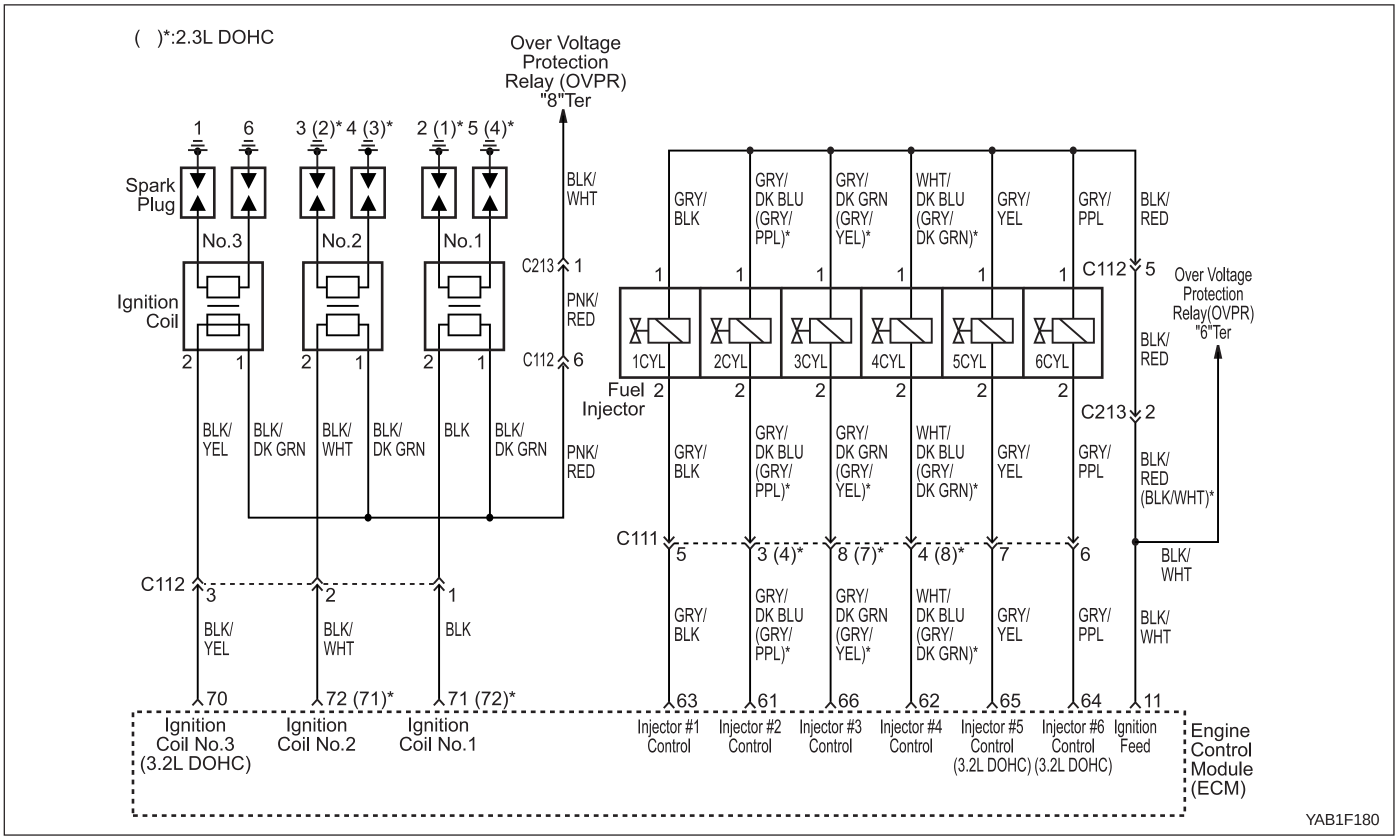
24. Before replacing the ECM, check terminals for improper mating, broken locks, or physical damage to the wiring harness. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0300 Multiple Cylinder Misfire

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is a DTC P0300 set with no other active injector fault or EI system DTCs?	-	Go to Step 3	Go to applicable DTC table
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 ignition 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?	320 - 380 kPa (46 - 55 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 ignition 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, #4, #5, and #6. Is a spark observed on all 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

DTC P0300 Multiple Cylinder Misfire (Cont'd)

Step	Action	Value(s)	Yes	No
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 63, 61, 66, 62, 65 and 64 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 between the specified value?	1.8 - 2.2 kΩ	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
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 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

Circuit 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. 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.

Misfire of cylinder 1 is monitored by cylinder selective engine roughness measuring. The actual roughness value is compared with the actual (emission and catalyst damage) threshold.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0111, P0112, P0113, P0335, P0336, P0341, P0351, P0352, P0353 (3.2L DOHC) and P0600 are not set.
- Counting of misfire within 1000 revolutions and exceeding misfire EC emissions threshold is 70 for A/T and 102 for M/T (2.3L DOHC)
- Counting of misfire within 1000 revolutions and exceeding misfire EC emissions threshold is 3.5% (3.2L DOHC)
- Counting of misfire within 200 revolution and exceeding misfire catalyst damage is greater than 18 weighted (MIL BLINK after 1st exceed).
- Misfire starting end (500 rpm) is reached.
- At least one injector is reversible shut down by limiter is not present.
- Engine speed is between 500 and 5700 rpm (2.3L DOHC).
- Engine speed is between 450 and 4000 rpm (3.2L DOHC).
- Load gradient is between 0.05 and -0.05.
- At least two injectors are irreversible shut down or marked for shut down is not present.
- Load below threshold is between 0.17 and 0.34 (2.3L DOHC).
- Load below threshold is between 0.18 and 0.35 (3.2L DOHC).
- Increment wheel compensation precess is successful finished.
- Gear shift (A/T) is not active.
- Crankshaft/camshaft synchronizationis no fault.
- Tip down during cruise control active is not active.
- Tank level is greater than 13 liters.
- Clutch lever is greater than 13 liters.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles in which the diagnostic runs with the fault active.

OR

- The MIL will illuminate immediately and flash if the catalyst darnage 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 three consecutive driving 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.

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.

The Scan tool active misfire counts should pick up an intermittent misfire problem. Watch the scan tool misfire counter. When a specific cylinder misfires under certain load, conditions may be duplicated in the stall.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

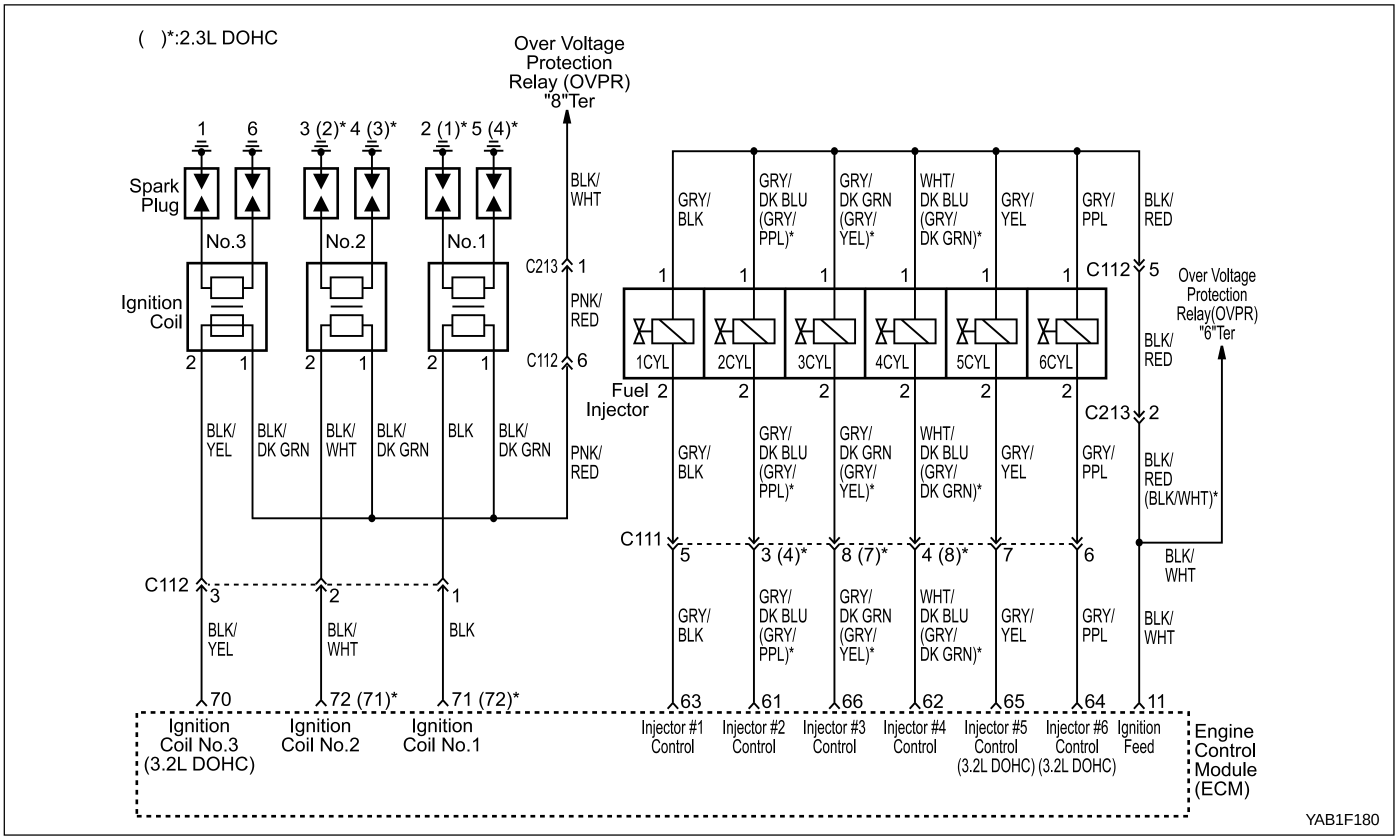
1. Euro On-Board Diagnostic (EOBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
3. A visual/physical inspection should include checking the following components:
   - The wiring for proper connections, pinches or cuts.
   - The ECM grounds for being clean and tight.
   - The vacuum hoses for splits, kinks, and improper connections as shown on the Vehicle Emission Information label.
   - Check thoroughly for any type of leak or restriction.
   - Check for air leaks at the throttle body mounting area and intake manifold sealing surface.
5. When all the accumulators are relatively equal, the misfire is being caused by something that affects the entire engine. When they are not, the misfire is being caused by something that is specific to two or more cylinders.
6. Whenever the misfire is not present, operating the vehicle may be necessary to duplicate the conditions in the Freeze Frame Data in order to detect misfire. Depending on the engine load, the conditions may have to be maintained for up to 20 seconds. When the misfire is present. A history misfire counter will store the number of misfires that have occurred until the DTC is cleared.
8. Check fuel for water, alcohol, etc. (Water in the fuel can cause an occasional random misfire.)
9. A basic engine problem that affects all cylinders is the only possibility at this point. (Cam timing, throttle body leak, restricted air flow, etc.)
11. Tests the ignition system voltage output using a spark tester.
12. Replace any spark plugs that are worn, cracked or fouled.
13. Checks for voltage at the ignition feed circuits.
18. Whenever the driver circuit is shorted to ground, the light will be on steady. When the driver circuit is shorted to voltage or open, the light will be off.
19. Since voltage is supplied to the fuel injector on a single circuit, the malfunction can only be a poor connection or open in the fuel injector harness. An open before the harness would result in an ”Engine Cranks But Will Not Run” complaint.
24. Before replacing the ECM, check terminals for improper mating, broken locks, or physical damage to the wiring harness. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0301 Cylinder 1 Misfire

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is an Ignition Coil, injector or P0300 DTC 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 ignition 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?	320 - 380 kPa (46 - 55 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 ignition 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 the spark plug cable?	-	Go to Step 12	Go to Step 20
12	Replace the malfunctioning spark plug if necessary. 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 connector 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

DTC P0301 Cylinder 1 Misfire (Cont'd)

Step	Action	Value(s)	Yes	No
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 63 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 between the specified value?	1.8 - 2.2 kΩ	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
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 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

Circuit 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. 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.

Misfire of cylinder 2 is monitored by cylinder selective engine roughness measuring. The actual roughness value is compared with the actual (emission and catalyst damage) threshold.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0111, P0112, P0113, P0335, P0336, P0341, P0351, P0352, P0353 (3.2L DOHC) and P0600 are not set.
- Counting of misfire within 1000 revolutions and exceeding misfire EC emissions threshold is 70 for A/T and 102 for M/T (2.3L DOHC)
- Counting of misfire within 1000 revolutions and exceeding misfire EC emissions threshold is 3.5% (3.2L DOHC)
- Counting of misfire within 200 revolution and exceeding misfire catalyst damage is greater than 18 weighted (MIL BLINK after 1st exceed).
- Misfire starting end (500 rpm) is reached.
- At least one injector is reversible shut down by limiter is not present.
- Engine speed is between 500 and 5700 rpm (2.3L DOHC).
- Engine speed is between 450 and 4000 rpm (3.2L DOHC).
- Load gradient is between 0.05 and -0.05.
- At least two injectors are irreversible shut down or marked for shut down is not present.
- Load below threshold is between 0.17 and 0.34 (2.3L DOHC).
- Load below threshold is between 0.18 and 0.35 (3.2L DOHC).
- Increment wheel compensation precess is successful finished.
- Gear shift (A/T) is not active.
- Crankshaft/camshaft synchronizationis no fault.
- Tip down during cruise control active is not active.
- Tank level is greater than 13 liters.
- Clutch lever is greater than 13 liters.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles in which the diagnostic runs with the fault active.

OR

- The MIL will illuminate immediately and flash if the catalyst darnage 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 three consecutive driving 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.

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.

The Scan tool active misfire counts should pick up an intermittent misfire problem. Watch the scan tool misfire counter. When a specific cylinder misfires under certain load, conditions may be duplicated in the stall.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

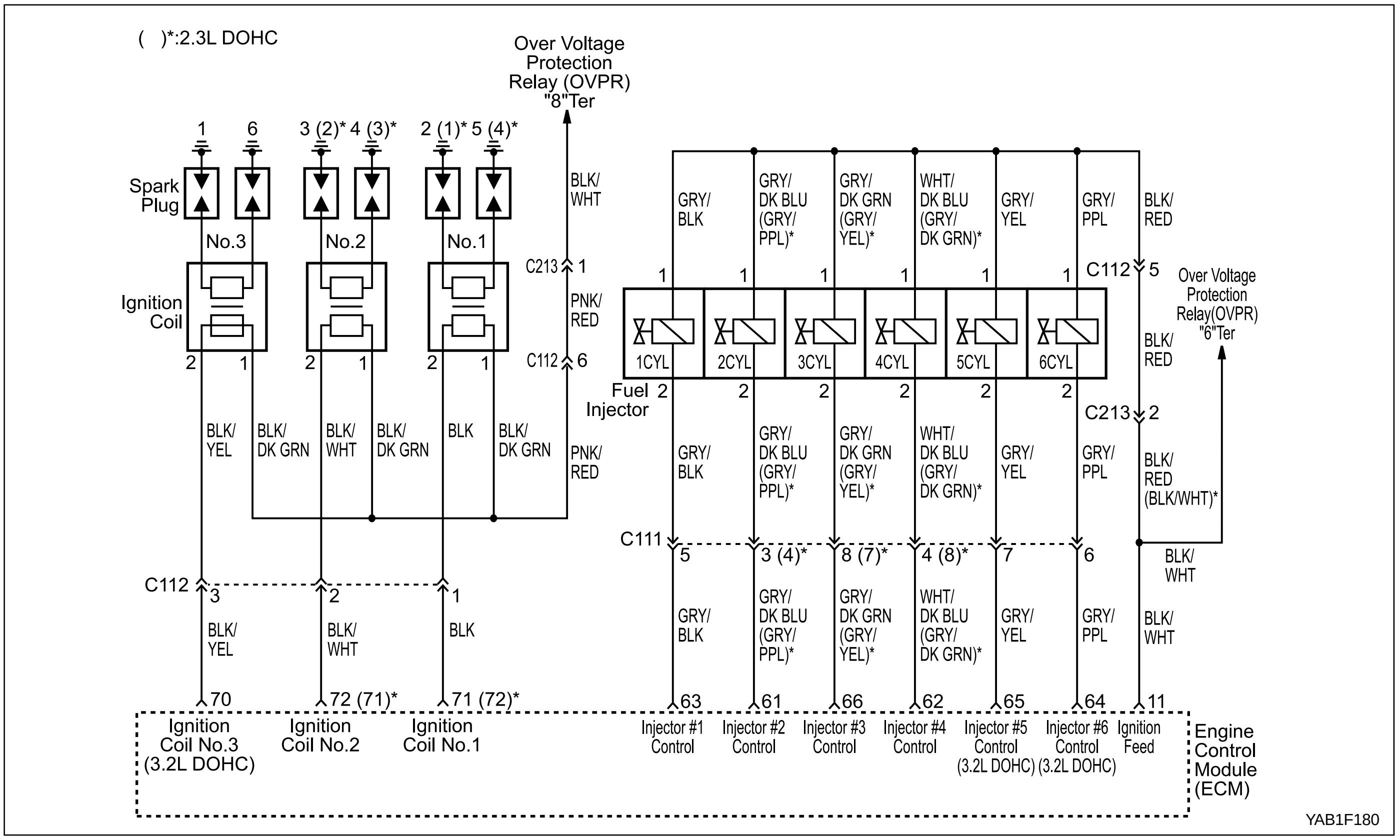
1. Euro On-Board Diagnostic (EOBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
3. A visual/physical inspection should include checking the following components:
   - The wiring for proper connections, pinches or cuts.
   - The ECM grounds for being clean and tight.
   - The vacuum hoses for splits, kinks, and improper connections as shown on the Vehicle Emission Information label.
   - Check thoroughly for any type of leak or restriction.
   - Check for air leaks at the throttle body mounting area and intake manifold sealing surface.
5. When all the accumulators are relatively equal, the misfire is being caused by something that affects the entire engine. When they are not, the misfire is being caused by something that is specific to two or more cylinders.
6. Whenever the misfire is not present, operating the vehicle may be necessary to duplicate the conditions in the Freeze Frame Data in order to detect misfire. Depending on the engine load, the conditions may have to be maintained for up to 20 seconds. When the misfire is present. A history misfire counter will store the number of misfires that have occurred until the DTC is cleared.
8. Check fuel for water, alcohol, etc. (Water in the fuel can cause an occasional random misfire.)
9. A basic engine problem that affects all cylinders is the only possibility at this point. (Cam timing, throttle body leak, restricted air flow, etc.)
11. Tests the ignition system voltage output using a spark tester.
12. Replace any spark plugs that are worn, cracked or fouled.
13. Checks for voltage at the ignition feed circuits.
18. Whenever the driver circuit is shorted to ground, the light will be on steady. When the driver circuit is shorted to voltage or open, the light will be off.
19. Since voltage is supplied to the fuel injector on a single circuit, the malfunction can only be a poor connection or open in the fuel injector harness. An open before the harness would result in an ”Engine Cranks But Will Not Run” complaint.
24. Before replacing the ECM, check terminals for improper mating, broken locks, or physical damage to the wiring harness. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0302 Cylinder 2 Misfire

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is an Ignition Coil, injector or P0300 DTC 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 ignition 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?	320 - 380 kPa (46 - 55 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 ignition 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 the spark plug cable?	-	Go to Step 12	Go to Step 20
12	Replace the malfunctioning spark plug if necessary. 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 connector from the injectors. 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

DTC P0302 Cylinder 2 Misfire (Cont'd)

Step	Action	Value(s)	Yes	No
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 61 (64-2.3L DOHC) 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 between the specified value?	1.8 - 2.2 kΩ	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
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 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

Circuit 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. 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.

Misfire of cylinder 3 is monitored by cylinder selective engine roughness measuring. The actual roughness value is compared with the actual (emission and catalyst damage) threshold.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0111, P0112, P0113, P0335, P0336, P0341, P0351, P0352, P0353 (3.2L DOHC) and P0600 are not set.
- Counting of misfire within 1000 revolutions and exceeding misfire EC emissions threshold is 70 for A/T and 102 for M/T (2.3L DOHC)
- Counting of misfire within 1000 revolutions and exceeding misfire EC emissions threshold is 3.5% (3.2L DOHC)
- Counting of misfire within 200 revolution and exceeding misfire catalyst damage is greater than 18 weighted (MIL BLINK after 1st exceed).
- Misfire starting end (500 rpm) is reached.
- At least one injector is reversible shut down by limiter is not present.
- Engine speed is between 500 and 5700 rpm (2.3L DOHC).
- Engine speed is between 450 and 4000 rpm (3.2L DOHC).
- Load gradient is between 0.05 and -0.05.
- At least two injectors are irreversible shut down or marked for shut down is not present.
- Load below threshold is between 0.17 and 0.34 (2.3L DOHC).
- Load below threshold is between 0.18 and 0.35 (3.2L DOHC).
- Increment wheel compensation precess is successful finished.
- Gear shift (A/T) is not active.
- Crankshaft/camshaft synchronizationis no fault.
- Tip down during cruise control active is not active.
- Tank level is greater than 13 liters.
- Clutch lever is greater than 13 liters.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles in which the diagnostic runs with the fault active.

OR

- The MIL will illuminate immediately and flash if the catalyst darnage 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 three consecutive driving 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.

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.

The Scan tool active misfire counts should pick up an intermittent misfire problem. Watch the scan tool misfire counter. When a specific cylinder misfires under certain load, conditions may be duplicated in the stall.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

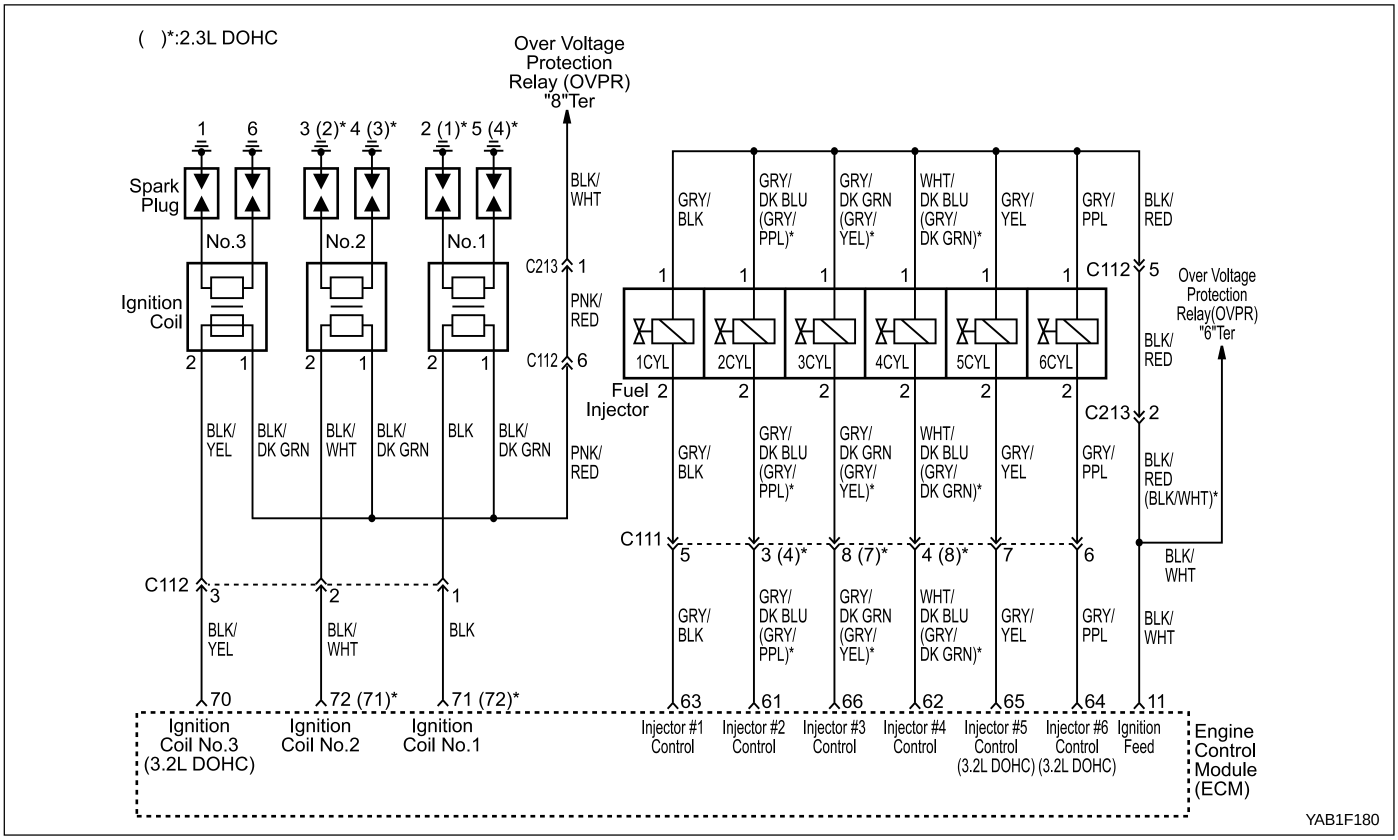
1. Euro On-Board Diagnostic (EOBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
3. A visual/physical inspection should include checking the following components:
   - The wiring for proper connections, pinches or cuts.
   - The ECM grounds for being clean and tight.
   - The vacuum hoses for splits, kinks, and improper connections as shown on the Vehicle Emission Information label.
   - Check thoroughly for any type of leak or restriction.
   - Check for air leaks at the throttle body mounting area and intake manifold sealing surface.
5. When all the accumulators are relatively equal, the misfire is being caused by something that affects the entire engine. When they are not, the misfire is being caused by something that is specific to two or more cylinders.
6. Whenever the misfire is not present, operating the vehicle may be necessary to duplicate the conditions in the Freeze Frame Data in order to detect misfire. Depending on the engine load, the conditions may have to be maintained for up to 20 seconds. When the misfire is present. A history misfire counter will store the number of misfires that have occurred until the DTC is cleared.
8. Check fuel for water, alcohol, etc. (Water in the fuel can cause an occasional random misfire.)
9. A basic engine problem that affects all cylinders is the only possibility at this point. (Cam timing, throttle body leak, restricted air flow, etc.)
11. Tests the ignition system voltage output using a spark tester.
12. Replace any spark plugs that are worn, cracked or fouled.
13. Checks for voltage at the ignition feed circuits.
18. Whenever the driver circuit is shorted to ground, the light will be on steady. When the driver circuit is shorted to voltage or open, the light will be off.
19. Since voltage is supplied to the fuel injector on a single circuit, the malfunction can only be a poor connection or open in the fuel injector harness. An open before the harness would result in an ”Engine Cranks But Will Not Run” complaint.
24. Before replacing the ECM, check terminals for improper mating, broken locks, or physical damage to the wiring harness. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0303 Cylinder 3 Misfire

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is an Ignition Coil, injector or P0300 DTC 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 ignition 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?	320 - 380 kPa (46 - 55 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 ignition 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 the spark plug cable?	-	Go to Step 12	Go to Step 20
12	Replace the malfunctioning spark plug if necessary. 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 connector from the injectors. 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

DTC P0303 Cylinder 3 Misfire (Cont'd)

Step	Action	Value(s)	Yes	No
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 66 (65-2.3L DOHC) 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 between the specified value?	1.8 - 2.2 kΩ	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
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 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

Circuit 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. 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.

Misfire of cylinder 4 is monitored by cylinder selective engine roughness measuring. The actual roughness value is compared with the actual (emission and catalyst damage) threshold.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0111, P0112, P0113, P0335, P0336, P0341, P0351, P0352, P0353 (3.2L DOHC) and P0600 are not set.
- Counting of misfire within 1000 revolutions and exceeding misfire EC emissions threshold is 70 for A/T and 102 for M/T (2.3L DOHC)
- Counting of misfire within 1000 revolutions and exceeding misfire EC emissions threshold is 3.5% (3.2L DOHC)
- Counting of misfire within 200 revolution and exceeding misfire catalyst damage is greater than 18 weighted (MIL BLINK after 1st exceed).
- Misfire starting end (500 rpm) is reached.
- At least one injector is reversible shut down by limiter is not present.
- Engine speed is between 500 and 5700 rpm (2.3L DOHC).
- Engine speed is between 450 and 4000 rpm (3.2L DOHC).
- Load gradient is between 0.05 and -0.05.
- At least two injectors are irreversible shut down or marked for shut down is not present.
- Load below threshold is between 0.17 and 0.34 (2.3L DOHC).
- Load below threshold is between 0.18 and 0.35 (3.2L DOHC).
- Increment wheel compensation precess is successful finished.
- Gear shift (A/T) is not active.
- Crankshaft/camshaft synchronizationis no fault.
- Tip down during cruise control active is not active.
- Tank level is greater than 13 liters.
- Clutch lever is greater than 13 liters.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles in which the diagnostic runs with the fault active.

OR

- The MIL will illuminate immediately and flash if the catalyst darnage 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 three consecutive driving 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.

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.

The Scan tool active misfire counts should pick up an intermittent misfire problem. Watch the scan tool misfire counter. When a specific cylinder misfires under certain load, conditions may be duplicated in the stall.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

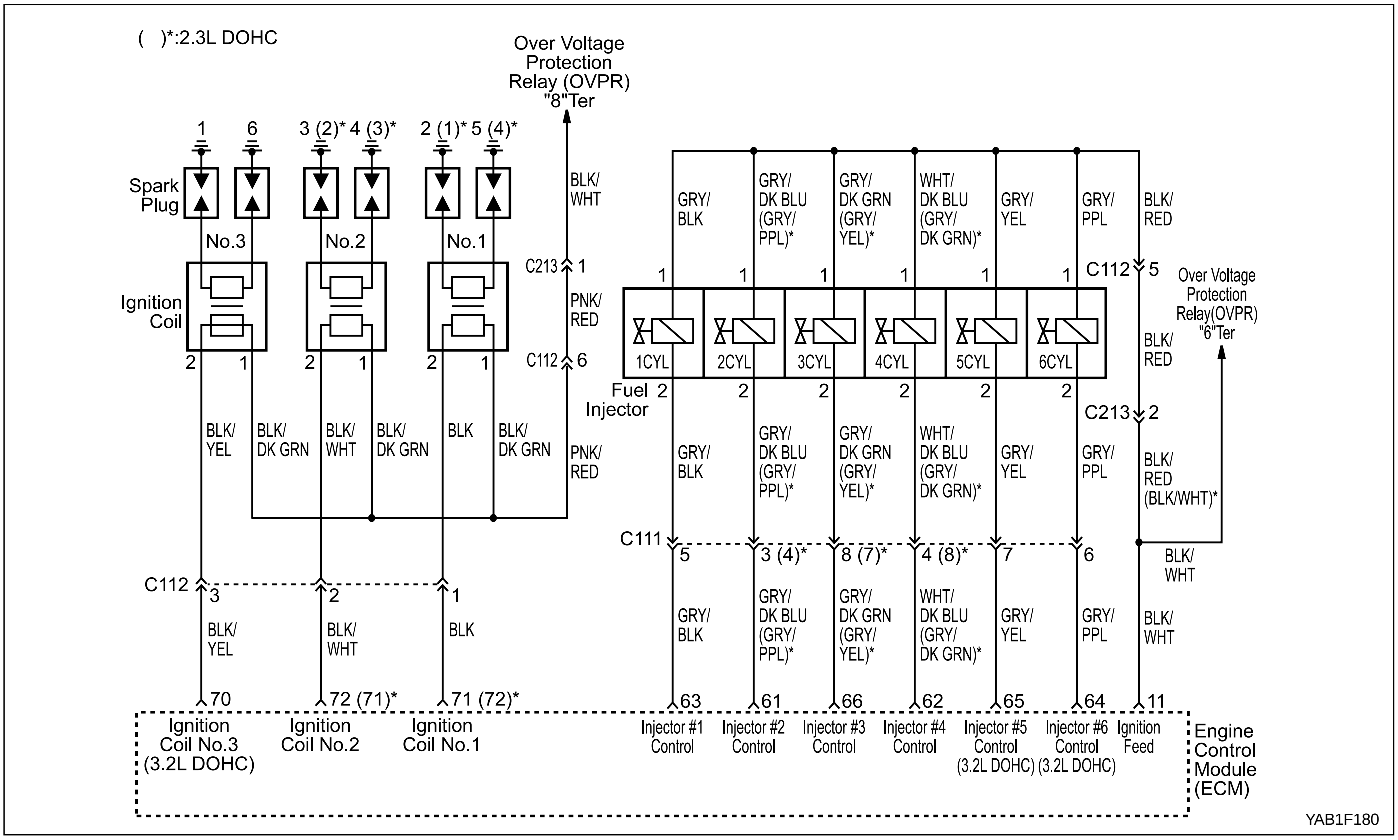
1. Euro On-Board Diagnostic (EOBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
3. A visual/physical inspection should include checking the following components:
   - The wiring for proper connections, pinches or cuts.
   - The ECM grounds for being clean and tight.
   - The vacuum hoses for splits, kinks, and improper connections as shown on the Vehicle Emission Information label.
   - Check thoroughly for any type of leak or restriction.
   - Check for air leaks at the throttle body mounting area and intake manifold sealing surface.
5. When all the accumulators are relatively equal, the misfire is being caused by something that affects the entire engine. When they are not, the misfire is being caused by something that is specific to two or more cylinders.
6. Whenever the misfire is not present, operating the vehicle may be necessary to duplicate the conditions in the Freeze Frame Data in order to detect misfire. Depending on the engine load, the conditions may have to be maintained for up to 20 seconds. When the misfire is present. A history misfire counter will store the number of misfires that have occurred until the DTC is cleared.
8. Check fuel for water, alcohol, etc. (Water in the fuel can cause an occasional random misfire.)
9. A basic engine problem that affects all cylinders is the only possibility at this point. (Cam timing, throttle body leak, restricted air flow, etc.)
11. Tests the ignition system voltage output using a spark tester.
12. Replace any spark plugs that are worn, cracked or fouled.
13. Checks for voltage at the ignition feed circuits.
18. Whenever the driver circuit is shorted to ground, the light will be on steady. When the driver circuit is shorted to voltage or open, the light will be off.
19. Since voltage is supplied to the fuel injector on a single circuit, the malfunction can only be a poor connection or open in the fuel injector harness. An open before the harness would result in an ”Engine Cranks But Will Not Run” complaint.
24. Before replacing the ECM, check terminals for improper mating, broken locks, or physical damage to the wiring harness. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0304 Cylinder 4 Misfire

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is an Ignition Coil, injector or P0300 DTC 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 ignition 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?	320 - 380 kPa (46 - 55 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 ignition 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 the spark plug cable?	-	Go to Step 12	Go to Step 20
12	Replace the malfunctioning spark plug if necessary. 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 connector from the injectors. 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

DTC P0304 Cylinder 4 Misfire (Cont'd)

Step	Action	Value(s)	Yes	No
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 62 (66-2.3L DOHC) 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 between the specified value?	1.8 - 2.2 kΩ	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
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 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) P0305 CYLINDER 5 MISFIRE (3.2L DOHC)

Circuit 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. 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.

Misfire of cylinder 5 is monitored by cylinder selective engine roughness measuring. The actual roughness value is compared with the actual (emission and catalyst damage) threshold.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0111, P0112, P0113, P0335, P0336, P0341, P0351, P0352, P0353 (3.2L DOHC) and P0600 are not set.
- Counting of misfire within 1000 revolutions and exceeding misfire EC emissions threshold is 70 for A/T and 102 for M/T (2.3L DOHC)
- Counting of misfire within 1000 revolutions and exceeding misfire EC emissions threshold is 3.5% (3.2L DOHC)
- Counting of misfire within 200 revolution and exceeding misfire catalyst damage is greater than 18 weighted (MIL BLINK after 1st exceed).
- Misfire starting end (500 rpm) is reached.
- At least one injector is reversible shut down by limiter is not present.
- Engine speed is between 500 and 5700 rpm (2.3L DOHC).
- Engine speed is between 450 and 4000 rpm (3.2L DOHC).
- Load gradient is between 0.05 and -0.05.
- At least two injectors are irreversible shut down or marked for shut down is not present.
- Load below threshold is between 0.17 and 0.34 (2.3L DOHC).
- Load below threshold is between 0.18 and 0.35 (3.2L DOHC).
- Increment wheel compensation precess is successful finished.
- Gear shift (A/T) is not active.
- Crankshaft/camshaft synchronizationis no fault.
- Tip down during cruise control active is not active.
- Tank level is greater than 13 liters.
- Clutch lever is greater than 13 liters.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles in which the diagnostic runs with the fault active.

OR

- The MIL will illuminate immediately and flash if the catalyst darnage 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 three consecutive driving 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.

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.

The Scan tool active misfire counts should pick up an intermittent misfire problem. Watch the scan tool misfire counter. When a specific cylinder misfires under certain load, conditions may be duplicated in the stall.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

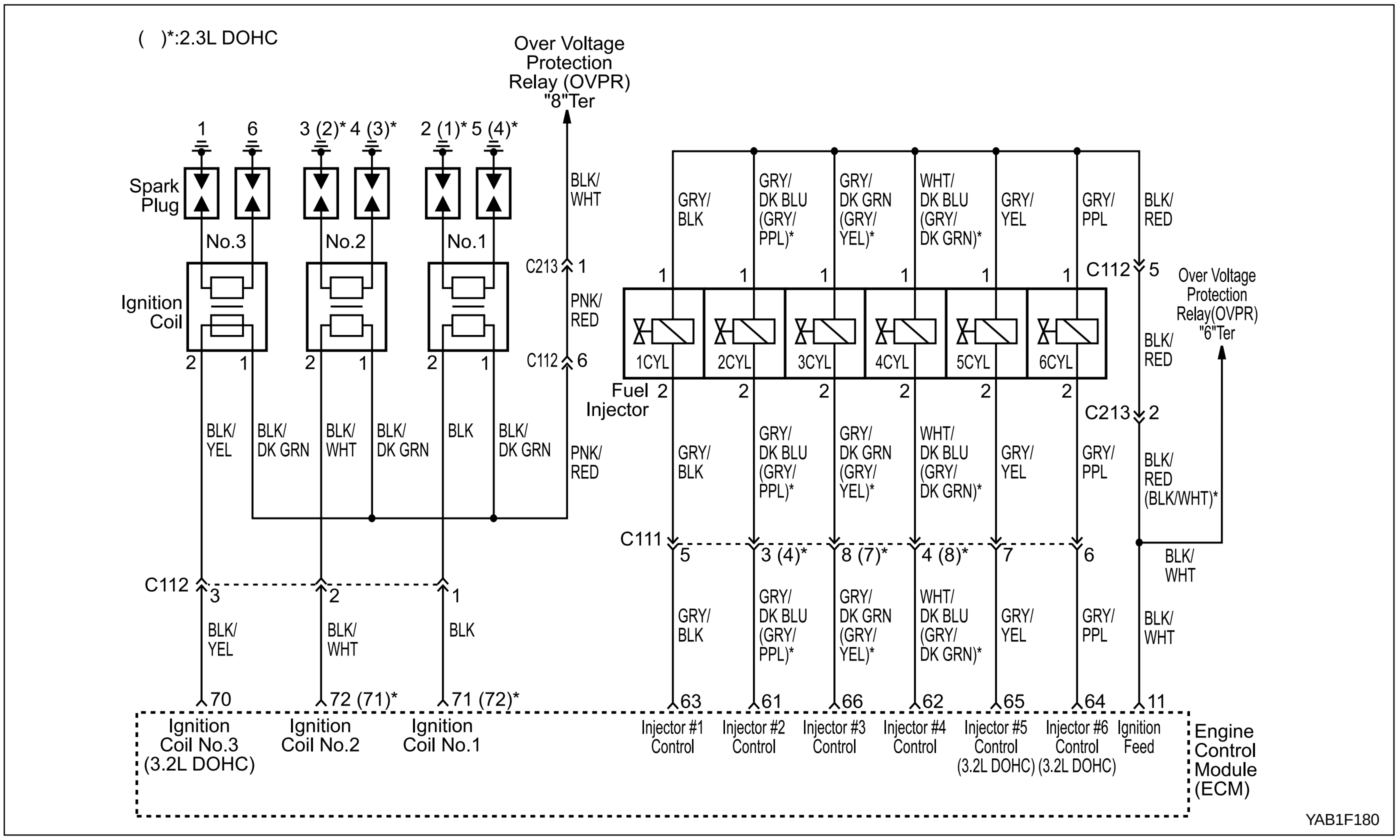
1. Euro On-Board Diagnostic (EOBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
3. A visual/physical inspection should include checking the following components:
   - The wiring for proper connections, pinches or cuts.
   - The ECM grounds for being clean and tight.
   - The vacuum hoses for splits, kinks, and improper connections as shown on the Vehicle Emission Information label.
   - Check thoroughly for any type of leak or restriction.
   - Check for air leaks at the throttle body mounting area and intake manifold sealing surface.
5. When all the accumulators are relatively equal, the misfire is being caused by something that affects the entire engine. When they are not, the misfire is being caused by something that is specific to two or more cylinders.
6. Whenever the misfire is not present, operating the vehicle may be necessary to duplicate the conditions in the Freeze Frame Data in order to detect misfire. Depending on the engine load, the conditions may have to be maintained for up to 20 seconds. When the misfire is present. A history misfire counter will store the number of misfires that have occurred until the DTC is cleared.
8. Check fuel for water, alcohol, etc. (Water in the fuel can cause an occasional random misfire.)
9. A basic engine problem that affects all cylinders is the only possibility at this point. (Cam timing, throttle body leak, restricted air flow, etc.)
11. Tests the ignition system voltage output using a spark tester.
12. Replace any spark plugs that are worn, cracked or fouled.
13. Checks for voltage at the ignition feed circuits.
18. Whenever the driver circuit is shorted to ground, the light will be on steady. When the driver circuit is shorted to voltage or open, the light will be off.
19. Since voltage is supplied to the fuel injector on a single circuit, the malfunction can only be a poor connection or open in the fuel injector harness. An open before the harness would result in an ”Engine Cranks But Will Not Run” complaint.
24. Before replacing the ECM, check terminals for improper mating, broken locks, or physical damage to the wiring harness. The replacement ECM must be reprogrammed. Refer to the latest Techline proce-dure for ECM reprogramming.

DTC P0305 Cylinder 5 Misfire (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is an Ignition Coil, injector or P0300 DTC 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 ignition 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?	320 - 380 kPa (46 - 55 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 ignition OFF. 2. Disconnect the fuel injector harness connector. 3. Install a spark tester on cylinder #5 spark plug cable. 4. Crank the engine and check for spark. Is a spark observed on the spark plug cable?	-	Go to Step 12	Go to Step 20
12	Replace the malfunctioning spark plug if necessary. Is the repair complete?	-	Go to Step 27	Go to Step 13
13	1. Turn the engine OFF. 2. Disconnect the cylinder #5 fuel injector connector from the injectors. 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

DTC P0305 Cylinder 5 Misfire (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
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 65 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 between the specified value?	1.8 - 2.2 kΩ	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
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 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) P0306 CYLINDER 6 MISFIRE (3.2L DOHC)

Circuit 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. 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.

Misfire of cylinder 6 is monitored by cylinder selective engine roughness measuring. The actual roughness value is compared with the actual (emission and catalyst damage) threshold.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0111, P0112, P0113, P0335, P0336, P0341, P0351, P0352, P0353 (3.2L DOHC) and P0600 are not set.
- Counting of misfire within 1000 revolutions and exceeding misfire EC emissions threshold is 70 for A/T and 102 for M/T (2.3L DOHC)
- Counting of misfire within 1000 revolutions and exceeding misfire EC emissions threshold is 3.5% (3.2L DOHC)
- Counting of misfire within 200 revolution and exceeding misfire catalyst damage is greater than 18 weighted (MIL BLINK after 1st exceed).
- Misfire starting end (500 rpm) is reached.
- At least one injector is reversible shut down by limiter is not present.
- Engine speed is between 500 and 5700 rpm (2.3L DOHC).
- Engine speed is between 450 and 4000 rpm (3.2L DOHC).
- Load gradient is between 0.05 and -0.05.
- At least two injectors are irreversible shut down or marked for shut down is not present.
- Load below threshold is between 0.17 and 0.34 (2.3L DOHC).
- Load below threshold is between 0.18 and 0.35 (3.2L DOHC).
- Increment wheel compensation precess is successful finished.
- Gear shift (A/T) is not active.
- Crankshaft/camshaft synchronizationis no fault.
- Tip down during cruise control active is not active.
- Tank level is greater than 13 liters.
- Clutch lever is greater than 13 liters.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles in which the diagnostic runs with the fault active.

OR

- The MIL will illuminate immediately and flash if the catalyst darnage 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 three consecutive driving 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.

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.

The Scan tool active misfire counts should pick up an intermittent misfire problem. Watch the scan tool misfire counter. When a specific cylinder misfires under certain load, conditions may be duplicated in the stall.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

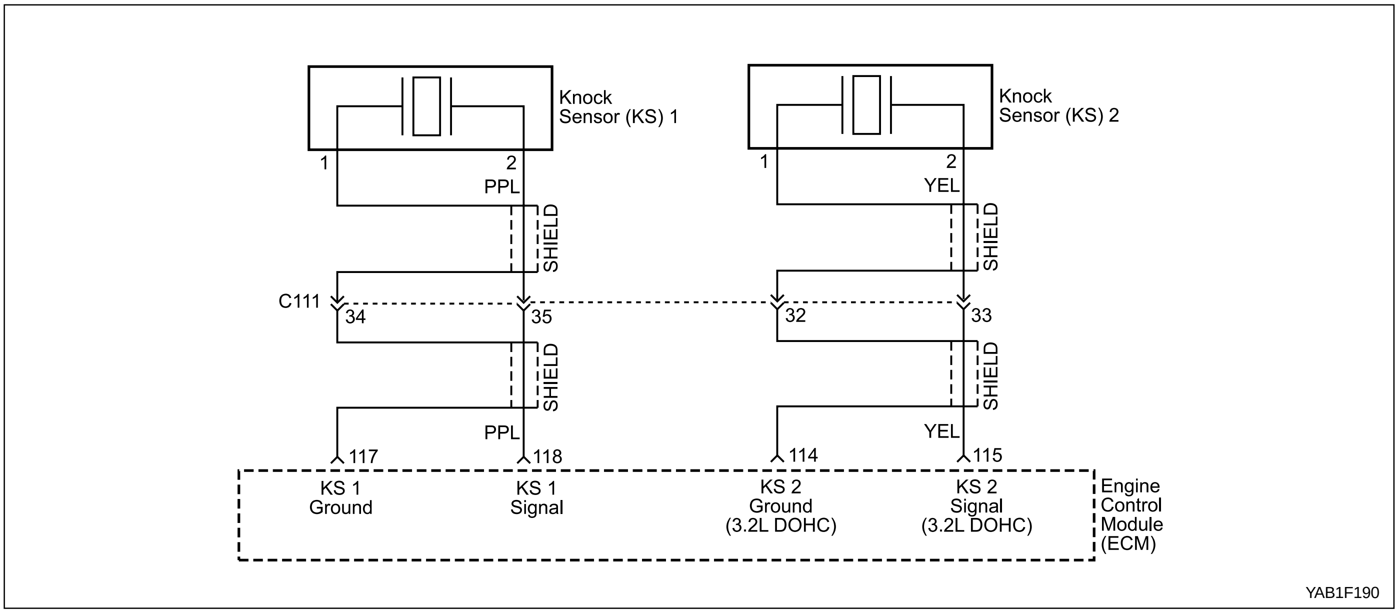
1. Euro On-Board Diagnostic (EOBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
3. A visual/physical inspection should include checking the following components:
   - The wiring for proper connections, pinches or cuts.
   - ECM grounds for being clean and tight.
   - The vacuum hoses for splits, kinks, and improper connections as shown on the Vehicle Emission Information label.
   - Check thoroughly for any type of leak or restriction.
   - Check for air leaks at the throttle body mounting area and intake manifold sealing surface.
5. When all the accumulators are relatively equal, the misfire is being caused by something that affects the entire engine. When they are not, the misfire is being caused by something that is specific to two or more cylinders.
6. Whenever the misfire is not present, operating the vehicle may be necessary to duplicate the conditions in the Freeze Frame Data in order to detect misfire. Depending on the engine load, the conditions may have to be maintained for up to 20 seconds. When the misfire is present. A history misfire counter will store the number of misfires that have occurred until the DTC is cleared.
8. Check fuel for water, alcohol, etc. (Water in the fuel can cause an occasional random misfire.)
9. A basic engine problem that affects all cylinders is the only possibility at this point. (Cam timing, throttle body leak, restricted air flow, etc.)
11. Tests the ignition system voltage output using a spark tester.
12. Replace any spark plugs that are worn, cracked or fouled.
13. Checks for voltage at the ignition feed circuits.
18. Whenever the driver circuit is shorted to ground, the light will be on steady. When the driver circuit is shorted to voltage or open, the light will be off.
19. Since voltage is supplied to the fuel injector on a single circuit, the malfunction can only be a poor connection or open in the fuel injector harness. An open before the harness would result in an ”Engine Cranks But Will Not Run” complaint.
24. Before replacing the ECM, check terminals for improper mating, broken locks, or physical damage to the wiring harness. The replacement ECM must be reprogrammed. Refer to the latest Techline proce-dure for ECM reprogramming.

DTC P0306 Cylinder 6 Misfire (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is an Ignition Coil, injector or P0300 DTC 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 ignition 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?	320 - 380 kPa (46 - 55 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 ignition OFF. 2. Disconnect the fuel injector harness connector. 3. Install a spark tester on cylinder #6 spark plug cable. 4. Crank the engine and check for spark. Is a spark observed on the spark plug cable?	-	Go to Step 12	Go to Step 20
12	Replace the malfunctioning spark plug if necessary. Is the repair complete?	-	Go to Step 27	Go to Step 13
13	1. Turn the engine OFF. 2. Disconnect the cylinder #6 fuel injector connector from the injectors. 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

DTC P0306 Cylinder 6 Misfire (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
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 64 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 between the specified value?	1.8 - 2.2 kΩ	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
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 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) P0325 KNOCK SENSOR 1 : NOISE LEVEL CHECK

Circuit 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 signal's amplitude and frequency depend upon the amount of knock being experienced. The ECM monitors the KS signal and can diagnose the KS sensor and circuitry.

Conditions for Setting the DTC

- The amplification at maximum level is greater than or equal to 4.
- DTCs P0116, P0117, P0118, P0125, P0335, P0336 and P0341 are not set.
- Knock control is active.
- Engine temperature is greater than 75 °C (167 °F).
- Engine speed is greater than or equal to 3000 rpm.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.
- The ECM will use a calculated spark retard value to minimize knock during conditions when knock is likely to occur. The calculated value will vary based on engine speed and load.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

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

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. Euor 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 malfunction occurred. The information is then stored on the scan tool for later reference.

2. If the conditions for the test as described above are met, a DTC P0325 will set and the MIL will illuminate.
4. If the engine has an internal knock or audible noise that causes a knocking type noise on the engine block, the KS may be responding to the noise.
6. Checking the internal resistance of the KS or the wiring to the KS is OK.
7. Any circuitry, that is suspected as causing the 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
11. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

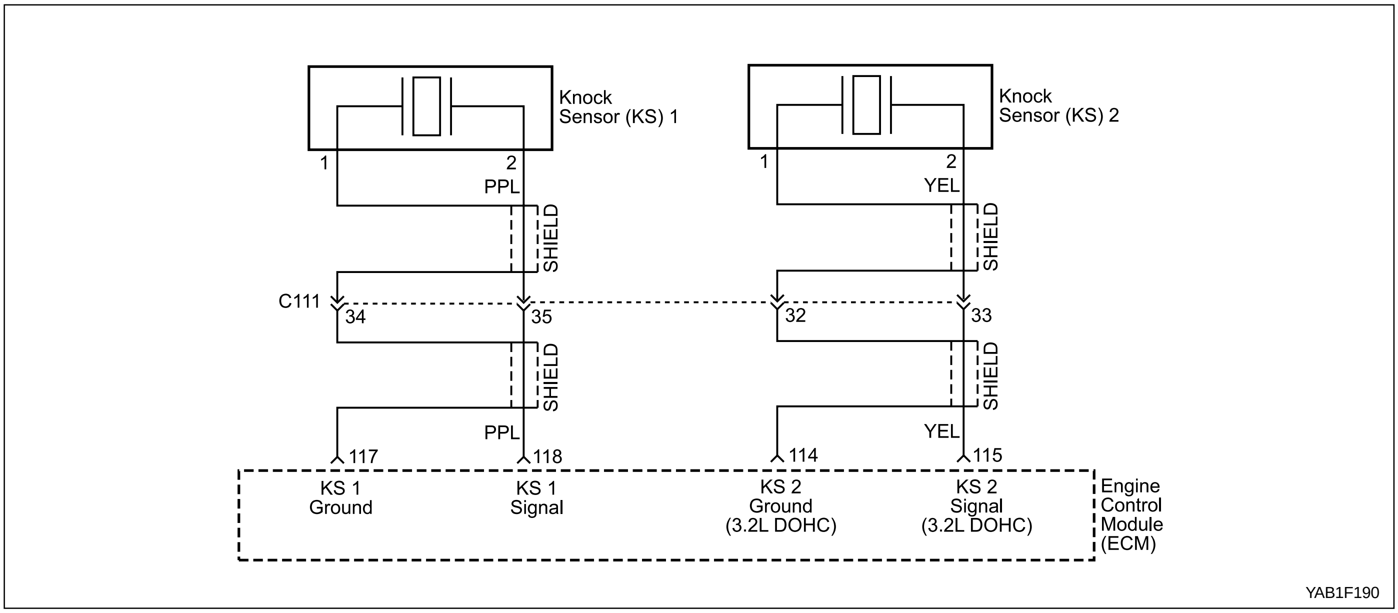
DTC P0325 Knock Sensor 1 : Noise Level Check

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 “Euro On-Board Diagnostic System Check”
2	1. Start the engine. 2. Install the 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 Lamp (MIL) illuminate?	-	Go to Step 4	Go to Step 3
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 the DTC as noted. Does the 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 as necessary. Is the repair complete?	-	Go to Step 12	-
6	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector (gray) at the ECM. 3. With a Digital Voltmeter (DVM), measure the resistance of the Knock Sensor (KS) between KS terminal 1 and 2. Does the measured value within the specified value?	9 - 11 MΩ	Go to Step 7	Go to Step 10
7	Check for a poor connection at the ECM connector KS signal circuit and repair as necessary. Is the repair complete?	-	Go to Step 12	Go to Step 8
8	Check the KS electrical connector for a poor connection and repair as necessary. Is the repair complete?	-	Go to Step 12	Go to Step 9

DTC P0325 Knock Sensor 1 : Noise Level Check (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the KS signal circuit for an open or a short to ground or voltage and repair as necessary. Is the repair complete?	-	Go to Step 12	Go to Step 11
10	Replace the KS. Is the repair complete?	-	Go to Step 12	-
11	Replace the ECM. Is the repair complete?	-	Go to Step 12	-
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 the 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

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) P0330
KNOCK SENSOR 2 : NOISE LEVEL CHECK (3.2L DOHC)

Circuit 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 signal's amplitude and frequency depend upon the amount of knock being experienced. The ECM monitors the KS signal and can diagnose the KS sensor and circuitry.

Conditions for Setting the DTC

- The amplification at maximum level is greater than or equal to 4.
- DTCs P0116, P0117, P0118, P0125, P0335, P0336 and P0341 are not set.
- Knock control is active.
- Engine temperature is greater than 75 °C (167 °F).
- Engine speed is greater than or equal to 3000 rpm.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.
- The ECM will use a calculated spark retard value to minimize knock during conditions when knock is likely to occur. The calculated value will vary based on engine speed and load.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

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

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

2. If the conditions for the test as described above are met, a DTC P0330 will set and the MIL will illuminate.
4. If the engine has an internal knock or audible noise that causes a knocking type noise on the engine block, the KS may be responding to the noise.
6. Checking the internal resistance of the KS or the wiring to the KS is OK.
7. Any circuitry, that is suspected as causing the 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
11. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0330 Knock Sensor 2 : Noise Level Check (3.2L DOHC)

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 "Euro On-Board Diagnostic System Check"
2	1. Start the engine. 2. Install the 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 Lamp (MIL) illuminate?	-	Go to Step 4	Go to Step 3
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 the DTC as noted. Does the 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 as necessary. Is the repair complete?	-	Go to Step 12	-
6	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector (gray) at the ECM. 3. With a Digital Voltmeter (DVM), measure the resistance of the Knock Sensor (KS) between KS terminal 1 and 2. Does the measured value within the specified value?	9 - 11 MΩ	Go to Step 7	Go to Step 10
7	Check for a poor connection at the ECM connector KS signal circuit and repair as necessary. Is the repair complete?	-	Go to Step 12	Go to Step 8
8	Check the KS electrical connector for a poor connection and repair as necessary. Is the repair complete?	-	Go to Step 12	Go to Step 9

DTC P0330 Knock Sensor 2 : Noise Level Check (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the KS signal circuit for an open or a short to ground or voltage and repair as necessary. Is the repair complete?	-	Go to Step 12	Go to Step 11
10	Replace the KS. Is the repair complete?	-	Go to Step 12	-
11	Replace the ECM. Is the repair complete?	-	Go to Step 12	-
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 the 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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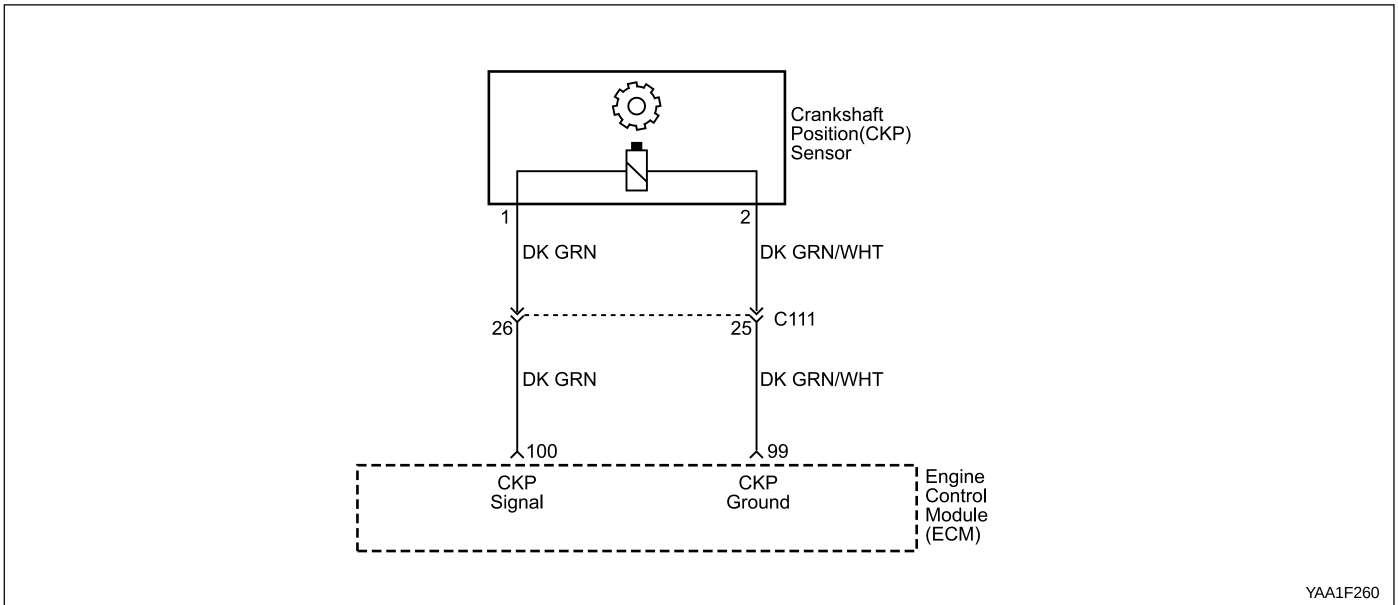

DIAGNOSTIC TROUBLE CODE (DTC) P0335 CRANKSHAFT POSITION SENSOR MALFUNCTION

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) P0335 will set.

Conditions for Setting the DTC

- Error counter of undetected gap is greater than 40.
- The number of camshaft signals while no crankshaft signal is greater than 5.
- The change of adaptation value is greater than 0.08 % for 2.3L DOHC and greater than 0.5 % for 3.2L DOHC. (every driving cycle after end of line)
- The change of adaptation value is greater than 1.6 %. (first driving cycle at end of line)
- DTC P0336 is not set.
- Coasting shut down is active.
- Engine speed is between 1800 and 5010 rpm (2.3L DOHC).
- Engine speed is between 1500 and 4200 rpm (3.2L DOHC).
- Engine speed is difference between consecutive revolutions is less than 7 rpm for 2.3L DOHC and less than 8 rpm for 3.2L DOHC.
- Brake is not active.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

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.

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0335 is the result of a hard failure or an intermittent condition. It may be necessary to operate the vehicle within the Freeze Frame conditions and Conditions for Setting the DTC in order to duplicable the malfunction detected by the ECM.
12. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0335 Crankshaft Position Sensor 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 "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Clear Diagnostic Trouble Code (DTC) P0335. 4. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting the DTC as notedIs DTC P0335 set?	-	Go to Step 6	Go to Step 3
3	Monitor scan tool rpm on initial start-up. Does rpm increase by several thousand, then return to normal?	-	Go to Step 4	Go to Step 6
4	1. Turn the ignition OFF. 2. Disconnect the Crankshaft Position (CKP) sensor connector. 3. With the Digital Voltmeter (DVM), measure the resistance between CKP sensor terminal 1 and 2. Is the measured value within the specified value?	1,090 ± 164 Ω	Go to Step 5	Go to Step 11
5	Inspect for the following items: • Air gap between sensor and drive plate. • Drive plate teeth condition. Is a problem found in any of the above areas?	-	Go to Step 10	Go to "Diagnostic Aids"
6	Turn the ignition ON Using a DVM measure the CKP sensor ground circuit terminal 2. Does the voltage displayed as specified?	0 v	Go to Step 7	Go to Step 8
7	Using a DVM, measure the CKP sensor signal circuit terminal 1. Does the voltage displayed as specified?	0 v	Go to Step 11	Go to Step 9
8	Check the CKP sensor ground circuit for an open or short to voltage and repair as necessary. Is the repair complete?	-	Go to Step 13	Go to Step 12
9	Check the CKP sensor signal circuit for an open or short to voltage and repair as necessary. Is the repair complete?	-	Go to Step 13	Go to Step 12
10	Repair the condition as necessary. Is the repair complete?	-	Go to Step 13	-

DTC P0335 Crankshaft Position Sensor Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition OFF. 2. Replace the CKP 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	-
13	1. If disconnected, reconnect the CKP electrical 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 the 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 displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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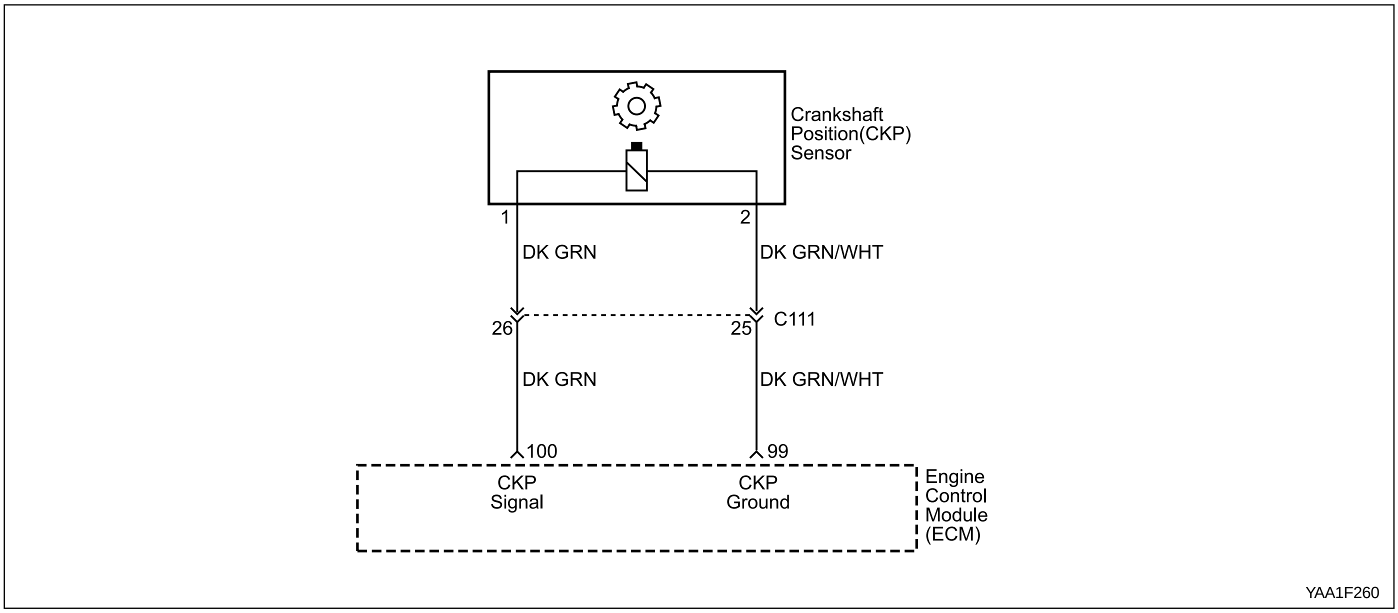

DIAGNOSTIC TROUBLE CODE (DTC) P0336 CRANKSHAFT POSITION SENSOR SIGNAL RANGE

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 speed signal threshold is greater than 7620 rpm.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

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.

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0336 is the result of a hard failure or an intermittent condition. It may be necessary to operate the vehicle within the Freeze Frame conditions and Conditions for Setting the DTC in order to duplicable the malfunction detected by the ECM.

12. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0336 Crankshaft Position Sensor Signal Range

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 "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Clear Diagnostic Trouble Code (DTC) P0336. 4. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting the DTC as noted Is DTC P0336 set?	-	Go to Step 6	Go to Step 3
3	Monitor scan tool rpm on initial start-up. Does rpm increase by several thousand, then return to normal?	-	Go to Step 4	Go to Step 6
4	1. Turn the ignition OFF. 2. Disconnect the Crankshaft Position (CKP) sensor connector. 3. With the Digital Voltmeter (DVM), measure the resistance between CKP sensor terminal 1 and 2. Is the measured value within the specified value?	1,090 ± 164 Ω	Go to Step 5	Go to Step 11
5	Inspect for the following items: • Air gap between sensor and drive plate. • Drive plate teeth condition. Is a problem found in any of the above areas?	-	Go to Step 10	Go to "Diagnostic Aids"
6	1. Turn the ignition ON. 2. Using a DVM measure the CKP sensor ground circuit terminal 2. Does the voltage displayed as specified?	0 v	Go to Step 7	Go to Step 8
7	Using a DVM, measure the CKP sensor signal circuit terminal 1. Does the voltage displayed as specified?	0 v	Go to Step 11	Go to Step 9
8	Check the CKP sensor ground circuit for an open or short to voltage and repair as necessary. Is the repair complete?	-	Go to Step 13	Go to Step 12
9	Check the CKP sensor signal circuit for an open or short to voltage and repair as necessary. Is the repair complete?	-	Go to Step 13	Go to Step 12
10	Repair the condition as necessary. Is the repair complete?	-	Go to Step 13	-
11	1. Turn the ignition OFF. 2. Replace the CKP 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 P0336 Crankshaft Position Sensor Signal Range (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. If disconnected, reconnect the CKP electrical 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 the 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 displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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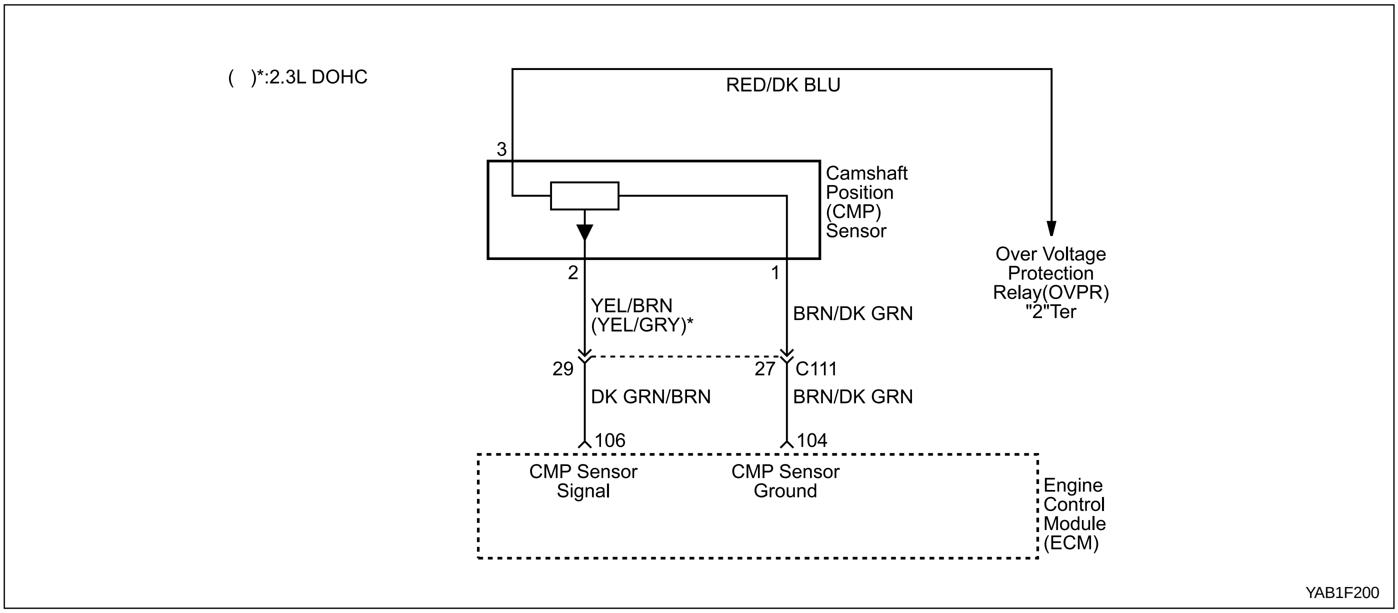


DIAGNOSTIC TROUBLE CODE (DTC) P0341 CAMSHAFT POSITION SENSOR SIGNAL: CYLINDER 1 MISSING

Circuit Description

The Camshaft Position (CMP) sensor sends a cam position signal to the Engine Control Module (ECM), which uses it as a sync pulse to trigger the injectors in proper sequence. The ECM uses the CMP signal to indicate the position of the #1 piston during it's intake stroke. This allows the ECM to calculate true sequential fuel injection mode of operation.

If the CMP signal is lost while the engine is running, the fuel injection system shifts to a calculated sequential fuel injection mode based on the last fuel injection pulse, and the engine continuous to run.

Conditions for Setting the DTC

- Constant low level during 24 (16-2.3L DOHC) revolutions.
- Constant high level during 24 (16-2.3L DOHC) revolutions.
- DTCs P0335 and P0336 are not set.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

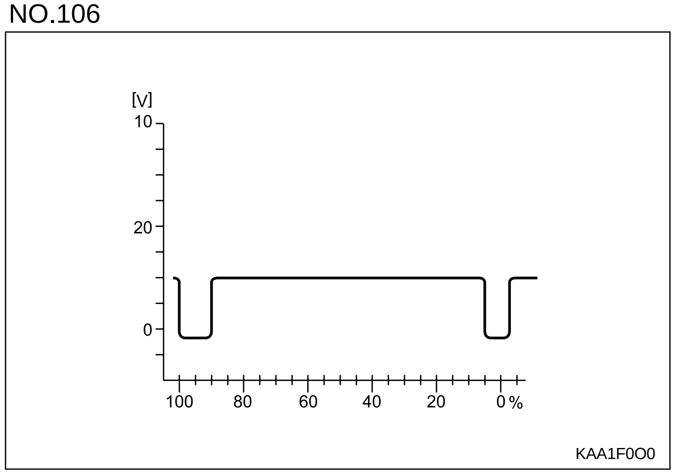
Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

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.

Output wave between the ECM terminal NO.104 and NO.106



Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
3. This step checks for a voltage supplied by the ECM to CMP sensor.
14. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0341 Camshaft Position Sensor: Cylinder 1 Missing

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 “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate the vehicle within the Freeze Frame 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 electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. Using a Digital Voltmeter (DVM), check the voltage between the CMP sensor connector terminal 2 and ground. Does the DVM indicate over the specified value?	10 v	Go to Step 4	Go to Step 5
4	Using a DVM, check the voltage between the CMP sensor circuit terminal 3 and ground. Is the DVM indicate between the specified values?	11 - 14 v	Go to Step 6	Go to Step 10
5	With a test light connected to ground, probe the CMP sensor connector terminal 2. Does the test light illuminate?	-	Go to Step 8	Go to Step 9
6	With a test light connected to B+, probe the CMP sensor connector terminal 1. Does the test light illuminate?	-	Go to Step 7	Go to Step 11
7	Check for poor connections at the CMP sensor electrical connections and repair as necessary. Is the repair complete?	-	Go to Step 15	Go to Step 13
8	1. Turn the ignition OFF. 2. Disconnected the Engine Control Module (ECM) connector (gray). 3. Repair the short to voltage on the CMP sensor signal circuit. Is the repair complete?	-	Go to Step 15	Go to Step 14
9	Check the CMP sensor signal circuit for an open or short to ground and repair as necessary. Is the repair complete?	-	Go to Step 15	Go to Step 12

DTC P0341 Camshaft Position Sensor: Cylinder 1 Missing (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check for a poor connection or open between the CMP sensor terminal 3 and Over Voltage Protection Relay (OVPR) connector terminal 2 and repair as necessary. Is the repair complete?	-	Go to Step 15	Go to "OVER Circuit Check"
11	Check for a poor connection or open between the CMP sensor terminal 3 and OVPR terminal 2 and repair as necessary. Is the repair complete?	-	Go to Step 15	-
12	Check for a poor connection in the CMP sensor signal circuit terminal and repair as necessary. 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	-
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 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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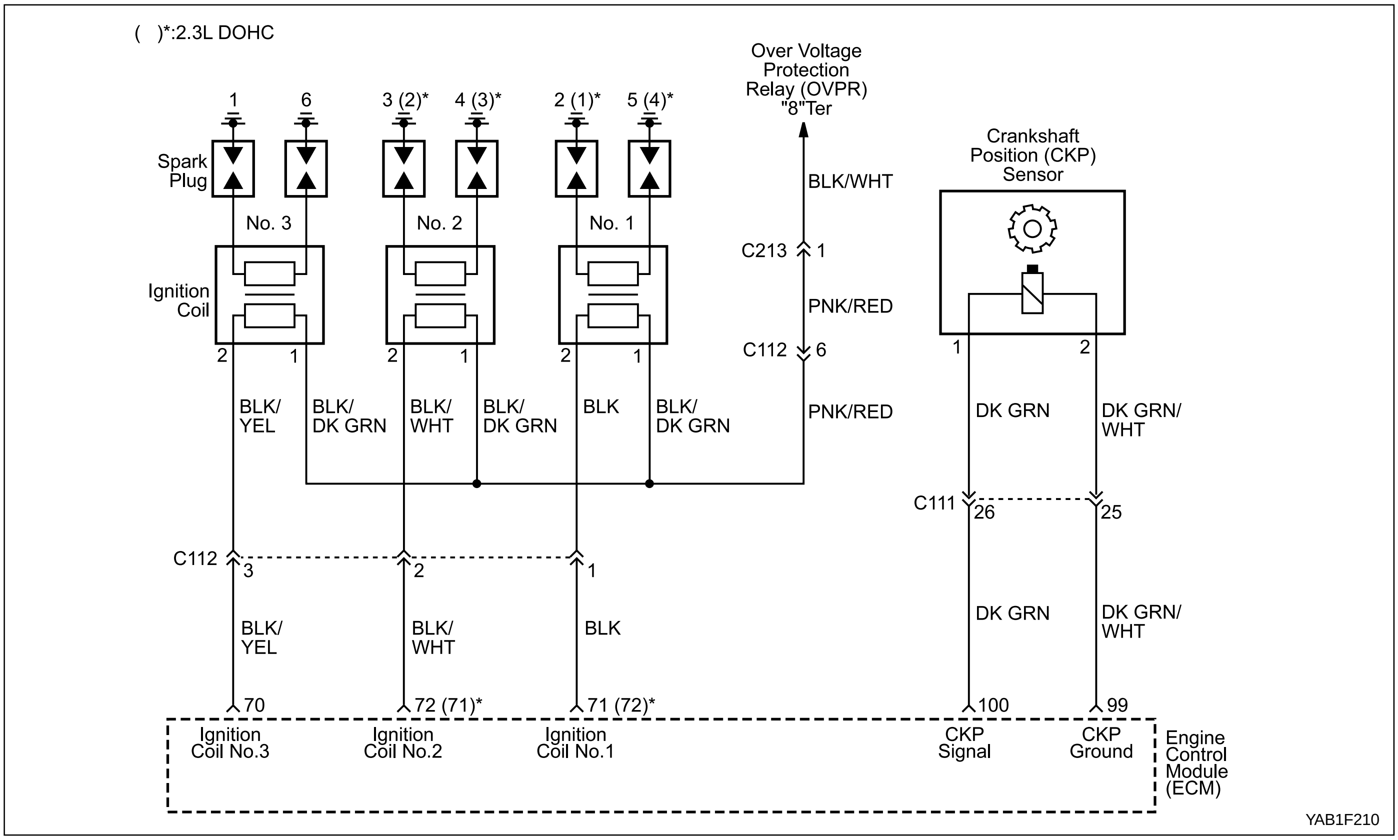

DIAGNOSTIC TROUBLE CODE (DTC) P0351 CYLINDER 2/5 (1/4-2.3L DOHC) COIL: IGNITION DRIVER OUTPUT CIRCUIT CHECK

Circuit Description

The Engine Control Module (ECM) provides a ground for the ignition coil control 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 fire two spark plugs at the same time on ”companion” cylinders, i.e. cylinders with pistons at top of the their stroke (TDC) at the same time. One of these pistons would be at the top of its compression stroke, the other piston would be at the top of its exhaust stroke.

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 ignition coil No. 1 circuit, it will set Diagnostic Trouble Code (DTC) P0351

Conditions for Setting the DTC

- Current threshold (less than 5.8 A) not reached in time.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

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 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.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

6. Inspect the spark plug for wet, crack, wear, improper gap, burned electrodes or heavy deposit.

13. Before replacing the ECM, check terminals for improper mating, broken locks, or physical damage to the wiring harness. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming

DTC P0351 Cylinder 2/5 (1/4-2.3L DOHC) Coil: Ignition Driver Output Circuit Check

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 “Euro On-Board Diagnostic System Check”
2	Check for a fault connection or a damaged terminal 2 at the ignition coil No. 1 and terminal 71 (72-2.3L DOHC) at the Engine Control Module (ECM) connector and repair as necessary. Is the repair complete?	-	Go to Step 14	Go to Step 3
3	1. Turn the ignition OFF. 2. Disconnect the ECM connector (gray). 3. Check for a short circuit or open in the wire between ECM connector terminal 71 (72-2.3L DOHC) and ignition coil No. 1 terminal 2. Is the problem found?	-	Go to Step 12	Go to Step 4
4	1. Disconnect the ignition coil No. 1. 2. Turn the ignition ON. 3. With the test connected to ground, prove the ignition coil No. 1 terminal 1. Does the test light on?	-	Go to Step 5	Go to Step 10
5	1. Turn the ignition OFF. 2. Disconnect the fuel injector harness connector. 3. Install a spark tester on cylinder #2 (#1-2.3L DOHC) spark plug cable. 4. Crank the engine and check for spark. 5. Repeat the above procedure on cylinder #5 (#4-2.3L DOHC). Is a spark observed on two spark plug cables?	-	Go to Step 6	Go to Step 7
6	Replace malfunctioning spark plugs if necessary. Is the repair complete?	-	Go to Step 14	-
7	Measure the resistance of the spark plug cable that the spark plug tester did not spark. Is the resistance of the spark plug cable between the specified value?	1.8 - 2.2 kΩ	Go to Step 8	Go to Step 9

DTC P0351 Cylinder 2/5 (1/4-2.3L DOHC) Coil: Ignition Driver Output Circuit Check (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition OFF. 2. Replace ignition cable No. 1. Is the repair complete?	-	Go to Step 14	Go to Step 13
9	Replace the spark plug cable. Is the repair complete?	-	Go to Step 14	-
10	Check for a short circuit or open in the wire between ignition coil No. 1 terminal 1 and Over Voltage Protection Relay (OVPR) connector terminal 8. Is the problem found?	-	Go to Step 11	Go to "OVER Circuit Check"
11	Repair the short circuit or open in the wire between ignition coil No. 1 terminal 1 and OVPR connector terminal 8. Is the repair complete?	-	Go to Step 14	-
12	Repair the short circuit or open in the wire between ECM connector terminal 71 (72-2.3L DOHC) and ignition coil No. 1 terminal Is the repair complete?	-	Go to Step 14	-
13	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 supported in the text. Does the scan tool indicate that this diagnostic ran 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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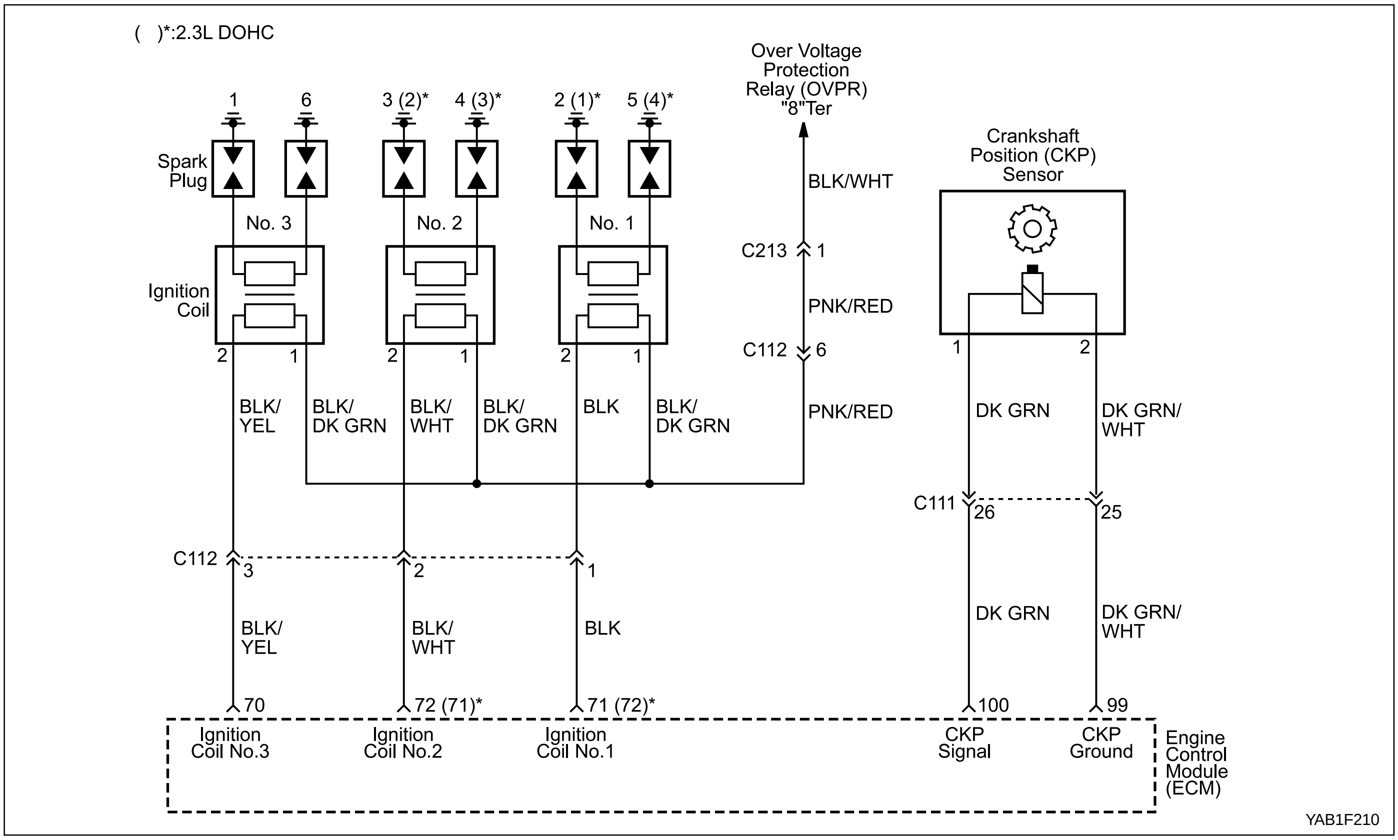

DIAGNOSTIC TROUBLE CODE (DTC) P0352 CYLINDER 3/4 (2/3-2.3L DOHC) COIL: IGNITION DRIVER OUTPUT CIRCUIT CHECK

Circuit Description

The Engine Control Module (ECM) provides a ground for the ignition coil control 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 fire two spark plugs at the same time on ”companion” cylinders, i.e. cylinders with pistons at top of the their stroke (TDC) at the same time. One of these pistons would be at the top of its compression stroke, the other piston would be at the top of its exhaust stroke.

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 ignition coil No. 2 circuit, it will set Diagnostic Trouble Code (DTC) P0352

Conditions for Setting the DTC

- Current threshold (less than 5.8A) not reached in time.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

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 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.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

6. Inspect the spark plug for wet, crack, wear, improper gap, burned electrodes or heavy deposit.

13. Before replacing the ECM, check terminals for improper mating, broken locks, or physical damage to the wiring harness. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming

DTC P0352 Cylinder 3/4 (2/3-2.3L DOHC) Coil: Ignition Driver Output Circuit Check

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Check for a fault connection or a damaged terminal 2 at the ignition coil No. 2 and terminal 72 (71-2.3L DOHC) at the Engine Control Module (ECM) connector and repair as necessary. Is the repair complete?	-	Go to Step 14	Go to Step 3
3	1. Turn the ignition OFF. 2. Disconnect the ECM connector (gray). 3. Check for a short circuit or open in the wire between ECM connector terminal 72 (71-2.3L DOHC) and ignition coil No. 2 terminal 2. Is the problem found?	-	Go to Step 12	Go to Step 4
4	1. Disconnect the ignition coil No. 2. 2. Turn the ignition ON. 3. With the test connected to ground, prove the ignition coil No. 2 terminal 1. Does the test light on?	-	Go to Step 5	Go to Step 10
5	1. Turn the ignition OFF. 2. Disconnect the fuel injector harness connector. 3. Install a spark tester on cylinder #3 (#2-2.3L DOHC) spark plug cable. 4. Crank the engine and check for spark. 5. Repeat the above procedure on cylinder #4 (#3-2.3L DOHC) . Is a spark observed on two spark plug cables?	-	Go to Step 6	Go to Step 7
6	Replace malfunctioning spark plugs if necessary. Is the repair complete?	-	Go to Step 14	-
7	Measure the resistance of the spark plug cable that the spark plug tester did not spark. Is the resistance of the spark plug cable between the specified value?	1.8 - 2.2 kΩ	Go to Step 8	Go to Step 9

DTC P0352 Cylinder 2/5 (1/4-2.3L DOHC) Coil: Ignition Driver Output Circuit Check (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition OFF. 2. Replace ignition cable No. 2. Is the repair complete?	-	Go to Step 14	Go to Step 13
9	Replace the spark plug cable. Is the repair complete?	-	Go to Step 14	-
10	Check for a short circuit or open in the wire between ignition coil No. 2 terminal 1 and Over Voltage Protection Relay (OVPR) connector terminal 8. Is the problem found?	-	Go to Step 11	Go to "OVER Cricuit Check"
11	Repair the short circuit or open in the wire between ignition coil No. 2 terminal 1 and OVPR connector terminal 8. Is the repair complete?	-	Go to Step 14	-
12	Repair the short circuit or open in the wire between ECM connector terminal 72 (71-2.3L DOHC) and ignition coil No. 2 terminal 2. Is the repair complete?	-	Go to Step 14	-
13	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 supported in the text. Does the scan tool indicate that this diagnostic ran 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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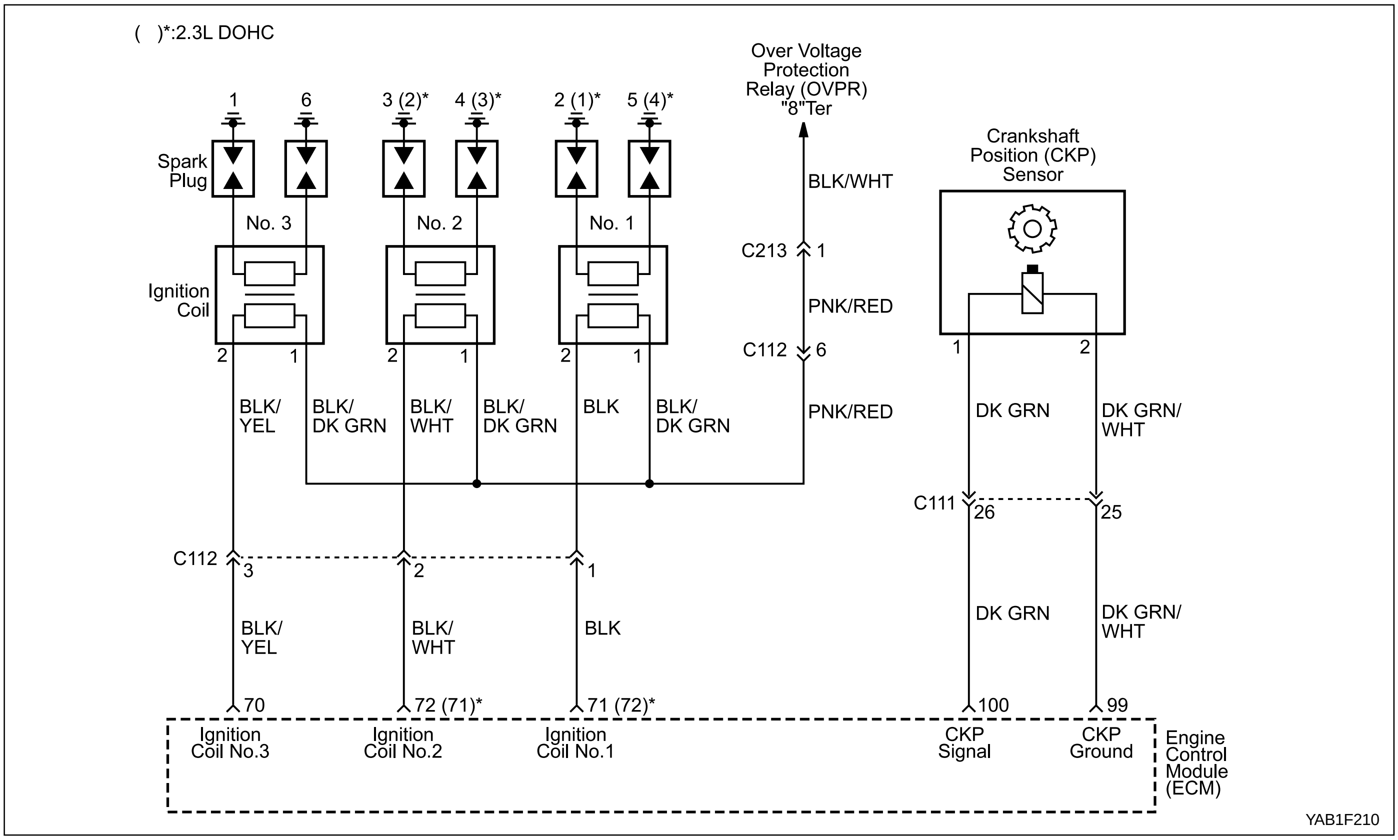

DIAGNOSTIC TROUBLE CODE (DTC) P0353 CYLINDER 1/6 COIL: IGNITION DRIVER OUTPUT CIRCUIT CHECK (3.2L DOHC)

Circuit Description

The Engine Control Module (ECM) provides a ground for the ignition coil control 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 fire two spark plugs at the same time on ”companion” cylinders, i.e. cylinders with pistons at top of the their stroke (TDC) at the same time. One of these pistons would be at the top of its compression stroke, the other piston would be at the top of its exhaust stroke. 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 ignition coil No. 3 circuit, it will set Diagnostic Trouble Code (DTC) P0353

Conditions for Setting the DTC

- Current threshold (less than 5.8 A) not reached in time.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

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 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.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

6. Inspect the spark plug for wet, crack, wear, improper gap, burned electrodes or heavy deposit.

13. Before replacing the ECM, check terminals for improper mating, broken locks, or physical damage to the wiring harness. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming

DTC P0353 Cylinder 1/6 Coil: Ignition Driver Output Circuit Check (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Check for a fault connection or a damaged terminal 2 at the ignition coil No. 3 and terminal 70 at the Engine Control Module (ECM) connector and repair as necessary. Is the repair complete?	-	Go to Step 14	Go to Step 3
3	1. Turn the ignition OFF. 2. Disconnect the ECM connector (gray). 3. Check for a short circuit or open in the wire between ECM connector terminal 70 and ignition coil No. 3 terminal 2. Is the problem found?	-	Go to Step 12	Go to Step 4
4	1. Disconnect the ignition coil No. 3. 2. Turn the ignition ON. 3. With the test connected to ground, prove the ignition coil No. 3 terminal 1. Does the test light on?	-	Go to Step 5	Go to Step 10
5	1. Turn the ignition OFF. 2. Disconnect the fuel injector harness connector. 3. Install a spark tester on cylinder #1 spark plug cable. 3. Crank the engine and check for spark. 4. Repeat the above procedure on cylinder #6. Is a spark observed on two spark plug cables?	-	Go to Step 6	Go to Step 7
6	Replace malfunctioning spark plugs if necessary. Is the repair complete?	-	Go to Step 14	-
7	Measure the resistance of the spark plug cable that the spark plug tester did not spark. Is the resistance of the spark plug cable between the specified value?	1.8 - 2.2 kΩ	Go to Step 8	Go to Step 9

DTC P0353 Cylinder 1/6 Coil: Ignition Driver Output Circuit Check (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition OFF. 2. Replace ignition cable No. 3. Is the repair complete?	-	Go to Step 14	Go to Step 13
9	Replace the spark plug cable. Is the repair complete?	-	Go to Step 14	-
10	Check for a short circuit or open in the wire between ignition coil No. 3 terminal 1 and Over Voltage Protection Relay (OVPR) connector terminal 8. Is the problem found?	-	Go to Step 11	Go to "OVER Cricuit Check"
11	Repair the short circuit or open in the wire between ignition coil No. 3 terminal 1 and OVPR connector terminal 8. Is the repair complete?	-	Go to Step 14	-
12	Repair the short circuit or open in the wire between ECM connector terminal 70 and ignition coil No. 3 terminal 2. Is the repair complete?	-	Go to Step 14	-
13	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 supported in the text. Does the scan tool indicate that this diagnostic ran 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

AMPLITUDE RATIO OF POST AND PRE HEATED OXYGEN SENSORS BANK 1 (2.3L DOHC)

System Description

The catalyst monitoring strategy is based on oxygen storage measurement determined using the oxygen sensors.

This function will detect a catalyst system which will increase the HC emission over the diagnosis thresholds.

The catalyst diagnosis is carried out once per driving cycle.

For measuring the oxygen storage capacity the function calculates the amplitude ratio between downstream and upstream oxygen sensor amplitude. Several amplitude ratios will be calculated in different load-speed windows. The function calculates the mean value of each window separately and transforms the amplitude ratio to a calculated conversion rate. If the mean value of the calculated conversion rate from a window is below the conversion limit and the required number of amplitude ratios in this window is reached then this window is marked as failed.

If in one window the mean value is below the emission threshold and the required number of calculated amplitude ratios is reached then this window is marked as failed.

If two windows are marked as failed in one driving cycle the catalyst system is detected as failed.

In the case of the HC conversion rate fault P0420 is set.

Conditions for Setting the DTC

- Catalyst monitoring is not finished.
- Lambda control closed loop is active.
- DTCs P0116, P0117, P0118, P0125, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0140, P0141, P0171, P0172, P0300, P0301, P0302, P0303, P0304, P0305, and P0306 are not set.
- Calculated catalyst temperature is greater than 600 °C (1112 °F).
- Engine temperature is greater than 70 ° C (158 ° F).
- Purge factor is less than 10.
- Vehicle for deactivation is less than 120 km/h.
- Lambda pilot controller is greater than 5.1 seconds for active.
- Vehicle speed is less than 120 km/h for activation.
- Vehicle speed is greater than 140 km/h for deactivation.
- Lambda control period time is between 100 and 3000 ms.

Fault detection if calculated catalyst conversion rate in two different windows is less than threshold value. (depending on load-speed window)

Threshold value is less than 12 %

- Load/speed in one window is between 0.25/1800 and 0.40/2700 for M/T and 0.30/1800 and 0.45/2700 for A/T.
- Load gradient is less than 0.07 [1/s].
- Engine speed gradient is less than 50 [rpm/s].

Threshold value is less than 8 %

- Load/speed in one window is between 0.40/2490 and 0.06/3000 for M/T and 0.45/2100 and 0.60/3390 for A/T.
- Load gradient is less than 0.07 [1/s].
- Engine speed gradient is less than 120 [rpm/s].

Threshold value is less than 6 %

- Load/speed in one window is between 0.60/2490 and 0.08/3600 for M/T and 0.60/2490 and 0.80/3900 for A/T.
- Load gradient is less than 0.05 [1/s].
- Engine speed gradient is less than 15 [rpm/s].

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycle 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

The catalyst test may abort due to a change in the engineload. Do not change the engine load (i.e. A/C, cooling fan, heater motor) while a catalyst test is in progress.

Mean value calculation of amplitude ratios between post and pre O2 sensor bank 1 in four different load-speed windows and transformed to conversion rate.

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

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. If any component DTCs are set, diagnose those DTCs first. A fault in a component can cause the converter to appear degraded or may have caused its failure.
3. This step includes checks for conditions that can cause the TWC to appear degraded. Repair any problems found before proceeding with this table.
5. If the TWC needs to be replaced, make sure that another condition is not present which would cause the converter to become damaged. These conditions may include: misfire; high engine oil or coolant consumption, retarded spark timing or weak spark. To avoid damaging the replacement converter, correct any possible causes of converter damage before replacing the catalytic converter.
6. Clearing DTCs allows the catalyst test to be run up to 6 times this ignition cycle. Once the ignition is cycled, the test will run only once. Driving the vehicle heats the catalyst to a test temperature. The ECM must see a predetermined amount of time at above idle before allowing the catalyst test to run at idle. Once at idle, the ECM will allow the system to stabilize and then test the catalyst in 2 stages.
7. If no faults have been found at this point and no addi-tional DTCs were set, refer to “Diagnostic Aids” in this section for additional checks and information.

DTC P0420 Amplitude Ratio of Post and Pre Heated Oxygen Sensors Bank 1 (2.3L DOHC)

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 “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install the scan tool. 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 leaks. • Heated Oxygen Sensor (O2S 2). Is a problem found?	-	Go to Step 4	Go to Step 5
4	Repair the exhaust system as necessary. 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 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 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	Go to Step 9

DIAGNOSTIC TROUBLE CODE (DTC) P0420 AMPLITUDE RATIO OF POST AND PRE HEATED OXYGEN SENSORS BANK 1 (3.2L DOHC)

System Description

The vehicle with 6 cylinder has two independent manifold coupled catalysts: one for cylinder 1, 2, 3 called bank 1 and the other one for 4, 5, 6 called bank2.

For measuring the oxygen storage capacity the function calculates the amplitude ratio between downstream and upstream oxygen sensor amplitude for each bank separately.

Several amplitude ratios will be calculated in different load-speed windows. The function calculates the mean value of each window for bank 1 and for bank 2, separately and transforms the amplitude ratio to a calculated conversion rate.

If the mean value of the calculated conversion rate from a window for one bank is below the conversion limit and the required number of amplitude ratios in this window is reached then this window and this bank are marked as failed.

If in one window the mean value of bank1 and bank2, is below the emission threshold and the required number of calculated amplitude ratios is reached for each bank then this window is marked as failed for both banks.

If two windows of one bank are marked as failed in one driving cycle the catalyst system is detected as failed.

Catalyst diagnosis is carried out once in each driving cycle.

Conditions for Setting the DTC

- Catalyst monitoring is not finished.
- Lambda control closed loop is active.
- DTCs P0116, P0117, P0118, P0125, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0140, P0141, P0171, P0172, P0300, P0301, P0302, P0303, P0304, P0305 and P0306 are not set.
- Calculated catalyst temperature is greater than 570 °C (1058 °F) for activation.
- Calculated catalyst temperature is less than 500 °C (932 °F) for deactivation.
- Engine temperature is greater than 60 °C (140 °F).
- Purge factor is less than 16.
- Vehicle speed for activation is less than 120 km/h.
- Vehicle speed for deactivation is greater than 140 km/h.
- Lambda pilot controller active for time since ‘start finished’ is greater than 1.5 seconds.

Fault detection if calculated catalyst conversion rate in two different windows is less than threshold value. (depending on load-speed window)

Threshold value is less than 15 %

- Load/speed in one window is between 0.18/1290 and 0.27/2400 for M/T and 0.02/1050 and 0.34/2010 for A/T.
- Load gradient is less than 0.05 [1/100ms].
- Engine speed gradient is less than 90[rpm/100ms].
- Lambda control period time is between 160 and 2000 ms for M/T and 180 and 2000 ms for A/T.

Threshold value is less than 14 %

- Load/speed in one window is between 0.27/1290 and 0.37/2400 for M/T and 0.34/1200 and 0.40/2100 for A/T.
- Load gradient is less than 0.045 [1/100ms].
- Engine speed gradient is less than 80[rpm/100ms].
- Lambda control period time is between 120 and 1800 ms for M/T and 160 and 1800 ms for A/T.

Threshold value is less than 13 %

- Load/speed in one window is between 0.37/1500 and 0.45/2400 for M/T and 0.40/1320 and 0.52/2490 for A/T.
- Load gradient is less than 0.04 [1/100ms].
- Engine speed gradient is less than 75 [rpm/100ms].
- Lambda control period time is between 120 and 1600 ms for M/T and 160 and 1600 ms for A/T.

Threshold value is less than 12 %

- Load/speed in one window is between 0.47/1710 and 0.60/2610 for M/T and 0.52/1590 and 0.63/2490 for A/T.
- Load gradient is less than 0.035 [1/100ms].
- Engine speed gradient is less than 70 [rpm/100ms].
- Lambda control period time is between 80 and 1400 ms for M/T and 1400 ms for A/T.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycle 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

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, cooling fan, heater motor) while a catalyst test is in progress.

Mean value calculation of amplitude ratios between post and pre O2 sensor bank 1 in four different load-speed windows and transformed to conversion rate.

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

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. If any component DTCs are set, diagnose those DTCs first. A fault in a component can cause the converter to appear degraded or may have caused its failure.
3. This step includes checks for conditions that can cause the TWC to appear degraded. Repair any problems found before proceeding with this table.
5. If the TWC needs to be replaced, make sure that another condition is not present which would cause the converter to become damaged. These conditions may include: misfire; high engine oil or coolant consumption, retarded spark timing or weak spark. To avoid damaging the replacement converter, correct any possible causes of converter damage before replacing the catalytic converter.
6. Clearing DTCs allows the catalyst test to be run up to 6 times this ignition cycle. Once the ignition is cycled, the test will run only once. Driving the vehicle heats the catalyst to a test temperature. The ECM must see a predetermined amount of time at above idle before allowing the catalyst test to run at idle. Once at idle, the ECM will allow the system to stabilize and then test the catalyst in 2 stages.
7. If no faults have been found at this point and no additional DTCs were set, refer to “Diagnostic Aids” in this section for additional checks and information.

DTC P0420 Amplitude Ratio of Post and Pre Heated Oxygen Sensors Bank 1 (3.2L DOHC)

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 "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install the scan tool. 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 leaks. • Heated Oxygen Sensor (O2S 2). Is a problem found?	-	Go to Step 4	Go to Step 5
4	Repair the exhaust system as necessary. 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 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 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	Go to Step 9

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DIAGNOSTIC TROUBLE CODE (DTC) P0430 AMPLITUDE RATIO OF POST AND PRE HEATED OXYGEN SENSORS BANK 2 (3.2L DOHC)

System Description

The vehicle with 6 cylinder has two independent manifold coupled catalysts: one for cylinder 1, 2, 3 called bank 1 and the other one for 4, 5, 6 called bank2.

For measuring the oxygen storage capacity the function calculates the amplitude ratio between downstream and upstream oxygen sensor amplitude for each bank separately.

Several amplitude ratios will be calculated in different load-speed windows. The function calculates the mean value of each window for bank 1 and for bank 2, separately and transforms the amplitude ratio to a calculated conversion rate.

If the mean value of the calculated conversion rate from a window for one bank is below the conversion limit and the required number of amplitude ratios in this window is reached then this window and this bank are marked as failed.

If in one window the mean value of bank1 and bank2, is below the emission threshold and the required number of calculated amplitude ratios is reached for each bank then this window is marked as failed for both banks.

If two windows of one bank are marked as failed in one driving cycle the catalyst system is detected as failed.

Catalyst diagnosis is carried out once in each driving cycle.

Conditions for Setting the DTC

- Catalyst monitoring is not finished.
- Lambda control closed loop is active.
- DTCs P0116, P0117, P0118, P0125, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0140, P0141, P0171, P0172, P0300, P0301, P0302, P0303, P0304, P0305 and P0306 are not set.
- Calculated catalyst temperature is greater than 570 °C (1058 °F) for activation.
- Calculated catalyst temperature is less than 500 °C (932 °F) for deactivation.
- Engine temperature is greater than 60 °C (140 °F).
- Purge factor is less than 16.
- Vehicle speed for activation is less than 120 km/h.
- Vehicle speed for deactivation is greater than 140 km/h.
- Lambda pilot controller active for time since 'start finished' is greater than 1.5 seconds.

Fault detection if calculated catalyst conversion rate in two different windows is less than threshold value. (depending on load-speed window)

Threshold value is less than 15 %

- Load/speed in one window is between 0.18/1290 and 0.27/2400 for M/T and 0.02/1050 and 0.34/2010 for A/T.
- Load gradient is less than 0.05 [1/100ms].
- Engine speed gradient is less than 90[rpm/100ms].
- Lambda control period time is between 160 and 2000 ms for M/T and 180 and 2000 ms for A/T.

Threshold value is less than 14 %

- Load/speed in one window is between 0.27/1290 and 0.37/2400 for M/T and 0.34/1200 and 0.40/2100 for A/T.
- Load gradient is less than 0.045 [1/100ms].
- Engine speed gradient is less than 80[rpm/100ms].
- Lambda control period time is between 120 and 2700 ms for M/T and 160 and 1800 ms for A/T.

Threshold value is less than 13 %

- Load/speed in one window is between 0.37/1500 and 0.45/2400 for M/T and 0.40/1320 and 0.52/2490 for A/T.
- Load gradient is less than 0.04 [1/100ms].
- Engine speed gradient is less than 75 [rpm/100ms].
- Lambda control period time is between 120 and 1600 ms for M/T and 160 and 1600 ms for A/T.

Threshold value is less than 12 %

- Load/speed in one window is between 0.47/1710 and 0.60/2610 for M/T and 0.52/1590 and 0.63/2490 for A/T.
- Load gradient is less than 0.035 [1/100ms].
- Engine speed gradient is less than 70 [rpm/100ms].
- Lambda control period time is between 80 and 1400 ms for M/T and 1400 ms for A/T.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycle 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

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, cooling fan, heater motor) while a catalyst test is in progress.

Mean value calculation of amplitude ratios between post and pre O2 sensor bank 2 in four different load-speed windows and transformed to conversion rate.

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

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunc- tion occurred. The information is then stored on the scan tool for later reference.
2. If any component DTCs are set, diagnose those DTCs first. A fault in a component can cause the converter to appear degraded or may have caused its failure.
3. This step includes checks for conditions that can cause the TWC to appear degraded. Repair any problems found before proceeding with this table.
5. If the TWC needs to be replaced, make sure that another condition is not present which would cause the converter to become damaged. These conditions may include: misfire; high engine oil or coolant consumption, retarded spark timing or weak spark. To avoid damaging the replacement converter, correct any possible causes of converter damage before replacing the catalytic converter.
6. Clearing DTCs allows the catalyst test to be run up to 6 times this ignition cycle. Once the ignition is cycled, the test will run only once. Driving the vehicle heats the catalyst to a test temperature. The ECM must see a predetermined amount of time at above idle before allowing the catalyst test to run at idle. Once at idle, the ECM will allow the system to stabilize and then test the catalyst in 2 stages.
7. If no faults have been found at this point and no additional DTCs were set, refer to ”Diagnostic Aids” in this section for additional checks and information.

DTC P0430 Amplitude Ratio of Post and Pre Heated Oxygen Sensors Bank 2 (3.2L DOHC)

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 “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install the scan tool. 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 leaks. • Heated Oxygen Sensor (O2S 4). Is a problem found?	-	Go to Step 4	Go to Step 5
4	Repair the exhaust system as necessary. 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 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 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	Go to Step 9

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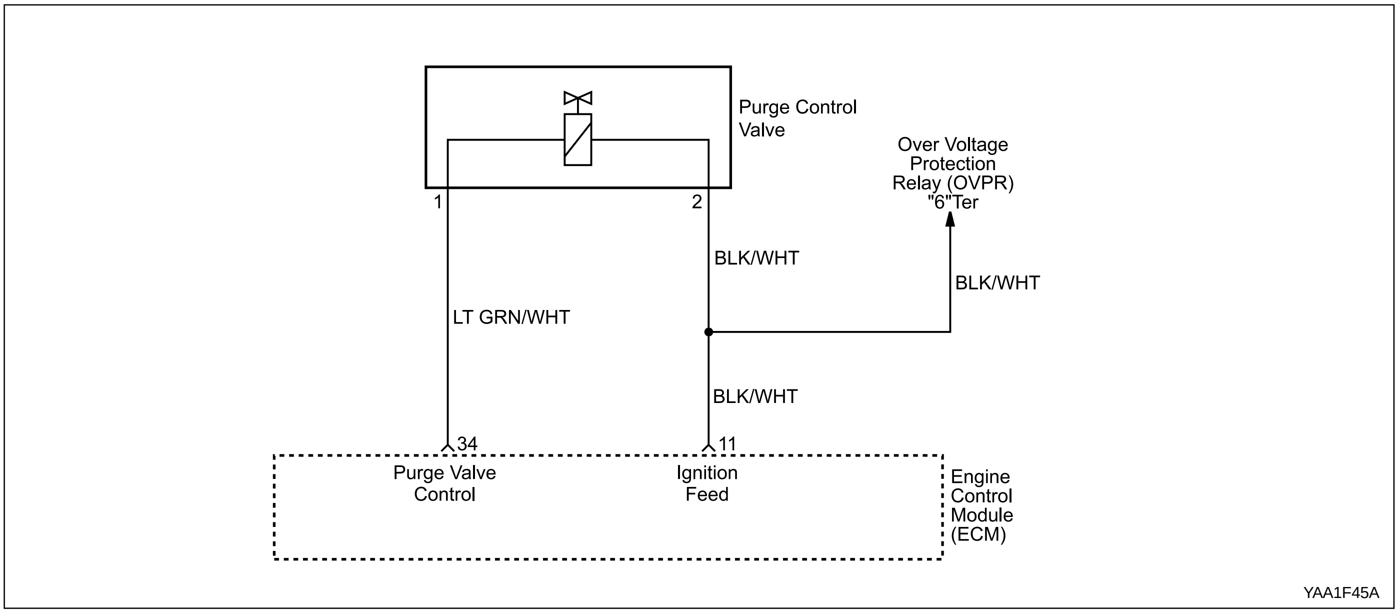

DIAGNOSTIC TROUBLE CODE (DTC) P0444 PURGE VALVE SHORT CIRCUIT TO GROUND OR OPEN

Circuit Description

The Evaporative Emission (EVAP) system is installed to inhibit the fuel vaporized gas from discharging into the atmosphere. The fuel vaporized gas that is accumulated in the canister abstracts through the EVAP canister purge valve purification during the engine combustion (except the decreasing mode) and coolant temperature of over 80 °C. For this reason, the Engine Control Module (ECM) transacts the engine speed, air inflow quantity, coolant temperature, and intake temperature.

The EVAP canister purge valve is activated by ECM frequency according with the engine rotating speed to adjust the purification rate. The purification rate is determined by the continuous valve opening interval.

The EVAP canister purge valve is activated by the ECM for following conditions:

- Coolant temperature of over 80 °C (176°F)
- Engine speed of over 1000 rpm
- 2 Minutes after starting
- When the fuel cut-off mode is not activated

Conditions for Setting the DTC

- Voltage is less than 2 volts for ground, 5 consecutive test.
- Voltage is less than 2 volts for open, 5 consecutive test.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM - Inspect harness connections for backed out terminals, improper mating, broken locks, improper 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 EVAP canister purge valve driver circuit at the ECM harness connector while moving connectors and wiring harness related to the canister purge valve. A change in voltage will indicate the location of the fault.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 whenthe malfunction occurred. The information is then stored on the scan tool for later reference.
3. This check can detect a partially shorted coil which would cause excessive current flow, Leaving the circuit energized for 2 minutes allows the coil to warm up. When warm, the coil may open (amp drop to 0), or short (amp go above 0.3-0.5).
13. If no trouble is found in the control circuit the connection at the ECM, the ECM may be faulty, but this is an extremely unlikely failure. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0444 Purge Valve Short Circuit to Ground or Open

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install the scan tool. 3. Command the Evaporative Emission (EVAP) canister purge valve ON and OFF. Does the valve ON and OFF with each command?	ON-99 % OFF-0 %	Go to Step 3	Go to Step 4
3	1. Turn the ignition OFF. 2. Disconnect the EVAP canister purge valve connector. 3. With a jumper wire connect the EVAP canister purge valve wiring harness connector terminal 2 and EVAP canister purge valve terminal 2. 4. Turn the ignition ON, with the engine OFF. 5. Using a Digital Voltmeter (DVM) on a 10 amp scale, measure the current between the EVAP canister purge valve terminal 1 and ground for 2 minutes. Does the current draw measure less than the specified value?	0.3 - 0.5 amps	Go to “Diagnostic Aids”	Go to Step 4
4	1. Turn the ignition OFF. 2. Disconnect the EVAP canister purge valve connector. 3. Turn the ignition ON. 4. With the test light connected to ground, probe the ignition feed circuit, terminal 2 in the valve harness connector. Does the test light illuminate?	-	Go to Step 5	Go to Step 11
5	1. Turn the ignition OFF. 2. Connect a test light between the terminal 1 and 2 in the valve in the valve wiring harness connector. 3. Turn the ignition ON, with the engine OFF. 4. Using the scan tool, command the valve ON and OFF. Does the test light turn ON and OFF with each command?	-	Go to Step 8	Go to Step 6
6	Check the test light. Does the test light turn ON with each command?	-	Go to Step 7	Go to Step 10

DTC P0444 Purge Valve Short Circuit to Ground or Open (Cont'd)

Step	Action	Value(s)	Yes	No
7	Check the valve control circuit at terminals 34 for a short to ground and repair as necessary. Is the repair complete?	-	Go to Step 14	Go to Step 9
8	Check the connections at the valve and repair as necessary. Is the repair complete?	-	Go to Step 14	Go to Step 12
9	Check the connections at the Engine Control Module (ECM) and repair as necessary. Is the repair complete?	-	Go to Step 14	Go to Step 13
10	Check the valve control circuit at terminals 34 for an open and repair as necessary. Is the repair complete?	-	Go to Step 14	-
11	Repair the faulty ignition feed circuit. Is the repair complete?	-	Go to Step 14	-
12	1. Turn the ignition OFF. 2. Replace the valve. Is the repair complete?	-	Go to Step 14	-
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 supported in the text. Does the scan tool indicate that this diagnostic ran 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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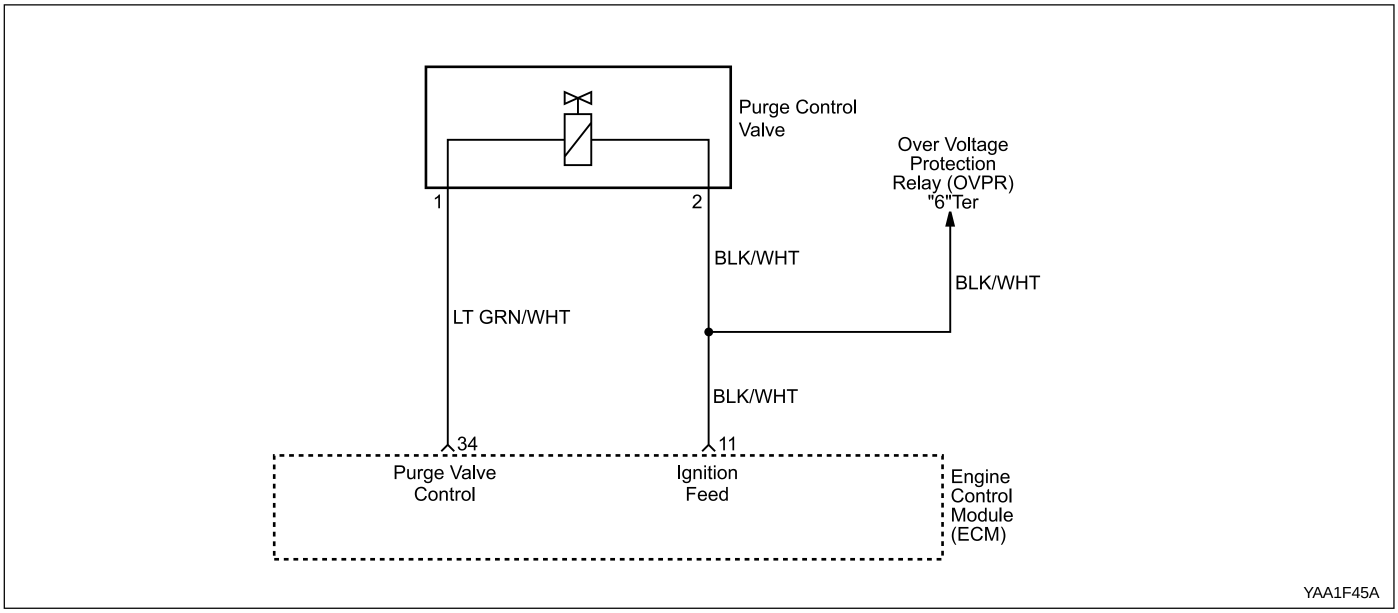

DIAGNOSTIC TROUBLE CODE (DTC) P0445 PURGE VALVE SHORT CIRCUIT TO BATTERY

Circuit Description

The Evaporative Emission (EVAP) system is installed to inhibit the fuel vaporized gas from discharging into the atmosphere. The fuel vaporized gas that is accumulated in the canister abstracts through the EVAP canister purge valve purification during the engine combustion (except the decreasing mode) and coolant temperature of over 80 °C. For this reason, the Engine Control Module (ECM) transacts the engine speed, air inflow quantity, coolant temperature, and intake temperature.

The EVAP canister purge valve is activated by ECM frequency according with the engine rotating speed to adjust the purification rate. The purification rate is determined by the continuous valve opening interval.

The EVAP canister purge valve is activated by the ECM for following conditions:

- Coolant temperature of over 80 °C (176°F)
- Engine speed of over 1000 rpm
- 2 Minutes after starting
- When the fuel cut-off mode is not activated

Conditions for Setting the DTC

- Current is between 1 and 2 ampares. (depending on driver condition)

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM - Inspect harness connections for backed out terminals, improper mating, broken locks, improper 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 EVAP canister purge valve driver circuit at the ECM harness connector while moving connectors and wiring harness related to the canister purge valve. A change in voltage will indicate the location of the fault.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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. Thiscreates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.

3. This check can detect a partially shorted coil which would cause excessive current flow, Leaving the circuit energized for 2 minutes allows the coil to warm up. When warm, the coil may open (amp drop to 0), or short (amp go above 0.3-0.5).

12. If no trouble is found in the control circuit the connection at the ECM, the ECM may be faulty, but this is an extremely unlikely failure. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0445 Purge Valve Short Circuit to Battery

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install the scan tool. 3. Command the Evaporative Emission (EVAP) canister purge valve ON and OFF. Does the valve ON and OFF with each command?	ON-99 % OFF- 0 %	Go to Step 3	Go to Step 4
3	1. Turn the ignition OFF. 2. Disconnect the EVAP canister purge valve connector. 3. With a jumper wire connect the EVAP canister purge valve wiring harness connector terminal 2 and EVAP canister purge valve terminal 2. 4. Turn the ignition ON, with the engine OFF. 5. Using a Digital Voltmeter (DVM) on a 10 amp scale, measure the current between the EVAP canister purge valve terminal 1 and ground for 2 minutes. Does the current draw measure less than the specified value?	0.3 - 0.5 amps	Go to "Diagnostic Aids"	GO to Step 4
4	1. Turn the ignition OFF. 2. Disconnect the EVAP canister purge valve connector. 3. Turn the ignition ON. 4. With the test light connected to ground, probe the ignition feed circuit, terminal 2 in the valve harness connector. Does the test light illuminate?	-	Go to Step 5	GO to Step 10
5	1. Turn the ignition OFF. 2. Connect a test light between the terminal 1 and 2 in the valve in the valve wiring harness connector. 3. Turn the ignition ON, with the engine OFF. 4. Using the scan tool, command the valve ON and OFF. Does the test light turn ON and OFF with each command?	-	Go to Step 8	Go to Step 6

DTC P0445 Purge Valve Short Circuit to Battery (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF. 2. Disconnect the ECM connector (black). 3. With the test light connected to ground, probe the ignition feed circuit, terminal 34 in the ECM harness connector. Does the test light illuminate?	-	Go to Step 7	-
7	Check the valve control circuit at terminals 34 for a short to battery and repair as necessary. Is the repair complete?	-	Go to Step 13	Go to Step 9
8	Check the connections at the valve and repair as necessary. Is the repair complete?	-	Go to Step 13	Go to Step 11
9	Check the connections at the ECM and repair as necessary. Is the repair complete?	-	Go to Step 13	Go to Step 12
10	Repair the faulty ignition feed circuit. Is the repair complete?	-	Go to Step 13	-
11	1. Turn the ignition OFF. 2. Replace the valve. 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	-
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 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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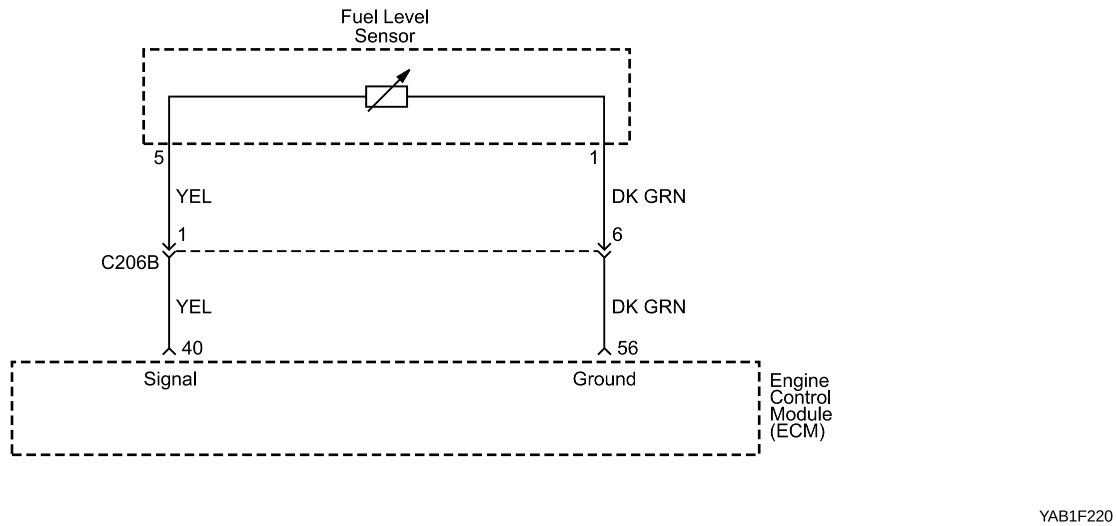

DIAGNOSTIC TROUBLE CODE (DTC) P0460 FUEL LEVEL SENSOR PLAUSIBILITY

Circuit 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. Vapor pressure is critical in determining if the Evaporative Emission (EVAP) system is operating properly. The fuel level signal 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 fuel level sensor that sends out a noisy signal.

Conditions for Setting the DTC

Consumption test

- Fuel level change is less than 2L.
- Consumption since plausibilization start is greater than 35 L.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycle 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Diagnostic Aids

Resistance checks for the fuel level sensor:

- Empty = 280 ohms or more.
- Half full = about 110 ohms.
- Full = 38 ohms or less.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
9. The replacement ECM must be reprogrammed. Refer zto the least Techline procedure for ECM reprogramming.

DTC P0460 Fuel Level Sensor Plausibility

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate the vehicle over the specified mileage. Is either Diagnostic Trouble Code (DTC) P0462 or P0463 set?	155 miles (250 km)	Go to applicable DTC table	Go to Step 3
3	1. Turn the ignition OFF. 2. Disconnect the fuel pump connector from the fuel pump. 3. Turn the ignition ON, with the engine OFF. 4. Using the Digital Voltmeter (DVM), measure the voltage in the signal circuit at the fuel pump harness connector terminal 1. Is the voltage near the specified value?	4 - 5 volts	Go to Step 4	Go to Step 5
4	1. Turn the ignition OFF. 2. Disconnect Engine Control Module (ECM) connector (gray). 3. Check the fuel level sensor ground circuit for an open between the fuel level sensor harness connector terminal 56 and terminal 6 and repair as necessary. Is the repair complete?	-	Go to Step 10	Go to Step 6
5	Using a DVM, measure the voltage at ECM connector terminal 40 by back-probing the ECM connector. Is the voltage within the specified value?	4 - 5 volts	Go to Step 8	Go to Step 9
6	1. Removed the fuel pump from the fuel tank. 2. Reconnect the fuel pump connector. 3. Turn the ignition ON, with the engine OFF. 4. 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. 5. 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 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 for an open or short to ground between the ECM harness connector terminal 40 and the fuel pump harness connector terminal 1 and repair as necessary. Is the repair complete?	-	Go to Step 10	-

DTC P0460 Fuel Level Sensor Plausibility (Cont'd)

Step	Action	Value(s)	Yes	No
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 Diagnostic Trouble Codes (DTCs). 2. Start the engine. 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 11	Go to Step 2
11	Check if any additional DTCs are set. Are any DTCs displayed the have not been diagnosed?	-	Go to applicable DTC Table	System OK

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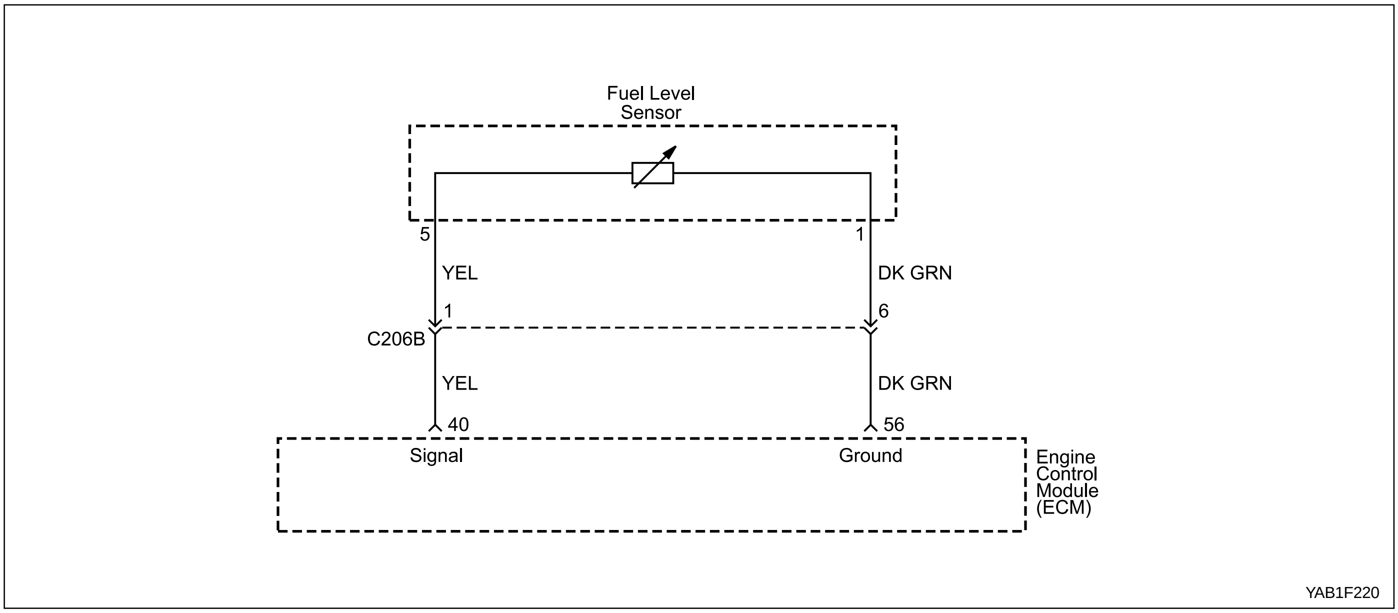

DIAGNOSTIC TROUBLE CODE (DTC) P0462 FUEL LEVEL SENSOR SHORT CIRCUIT TO GROUND OR OPEN

Circuit 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. Vapor pressure is critical in determining if the Evaporative Emission (EVAP) system is operating properly. The fuel level signal 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 continuous short to low or open in either the signal circuit or the fuel level sensor.

Conditions for Setting the DTC

- Voltage is less than 8 volts. (2.3 L DOHC)
- Voltage is greater than 8 volts. (3.2 L DOHC)
- Battery voltage is less than 15 volts.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycle 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

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 P0462 cannot be duplicated, the information included in the Failure Record data can be useful in determining vehicle operating conditions when the DTC was first set.

Resistance checks for the fuel level sensor:

- Empty = 280 ohms or more.
- Half full = about 110 ohms.
- Full = 38 ohms or less.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

10. The replacement ECM must be reprogrammed. Refer to the least Techline procedure for ECM reprogramming.

DTC P0462 Fuel Level Sensor Short Circuit to Ground or Open

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate the vehicle within Failure Record condition as noted. Is Diagnostic Trouble Code (DTC) P0462 set?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the fuel pump electrical connector from the fuel pump. 3. Turn the ignition ON, with the engine OFF. 4. Using a Digital Voltmeter (DVM), measure the voltage in the signal circuit at terminal 1. Is the voltage is less than 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 necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 5
5	1. Remove the fuel pump 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 ground in the fuel level sensor circuit and repair as necessary. Is a repair necessary?	-	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 the fuel level sensor. Is the repair complete?	-	Go to Step 11	-
8	Replace the fuel pump assembly. Is the repair complete?	-	Go to Step 11	-
9	1. Turn the ignition OFF. 2. Connector the fuel pump electrical connector. 3. Disconnect the Engine Control Module (ECM) connector from the ECM. 4. Turn the ignition ON, with the engine OFF. 5. Using a DVM measure the voltage in the signal circuit, at terminal 40. Does the DVM read within the specified value?	0.4 - 4.5 v	Go to Step 10	Go to *Section 9E, Instrumentation / Driver Information*
10	Replace the ECM. Is the repair complete?	-	Go to Step 11	-

DTC P0462 Fuel Level Sensor Short Circuit to Ground or Open (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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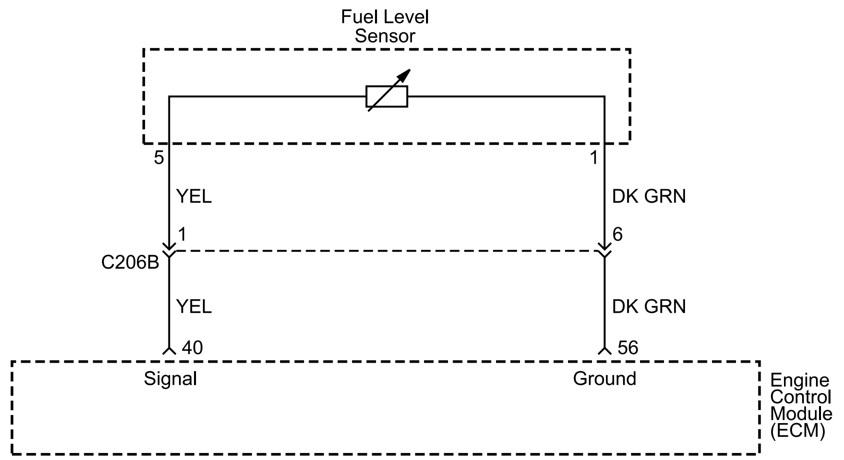

DIAGNOSTIC TROUBLE CODE (DTC) P0463 FUEL LEVEL SENSOR SHORT CIRCUIT TO BATTERY

Circuit 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. Vapor pressure is critical in determining if the Evaporative Emission (EVAP) system is operating properly. The fuel level signal 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 continuous short to high in either the signal circuit or the fuel level sensor.

Conditions for Setting the DTC

- Voltage is greater than 9 volts.
- Voltage is less than 1.2 volts.
- Battery voltage is less than 15 volts.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycle 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

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 Failure Record data can be useful in determining vehicle operating conditions when the DTC was first set.

Resistance checks for the fuel level sensor:

- Empty = 280 ohms or more.
- Half full = about 110 ohms.
- Full = 38 ohms or less.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
9. The replacement ECM must be reprogrammed. Refer to the least Techline procedure for ECM reprogramming.

DTC P0463 Fuel Level Sensor Short Circuit to Battery

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate the vehicle within Failure Record condition as noted. Is Diagnostic Trouble Code (DTC) P0463 set?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the fuel pump electrical connector from the fuel pump. 3. Turn the ignition ON, with the engine OFF. 4. Using a Digital Voltmeter (DVM), measure the voltage in the signal circuit at 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 necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 5
5	1. Remove the fuel pump 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 a short to voltage in the fuel level sensor circuit and repair as necessary. Is a repair necessary?	-	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 the fuel level sensor. Is the repair complete?	-	Go to Step 11	-
8	Replace the fuel pump assembly. Is the repair complete?	-	Go to Step 11	-
9	1. Turn the ignition OFF. 2. Connector the fuel pump electrical connector. 3. Disconnect the Engine Control Module (ECM) connector from the ECM. 4. Turn the ignition ON, with the engine OFF. 5. Using a DVM measure the voltage in the signal circuit, at terminal 40. Does the DVM read within the specified value?	0.4 - 4.5 v	Go to Step 10	Go to *Section 9E, Instrumentation / Driver Information*
10	Replace the ECM. Is the repair complete?	-	Go to Step 11	-

DTC P0463 Fuel Level Sensor Short Circuit to Battery (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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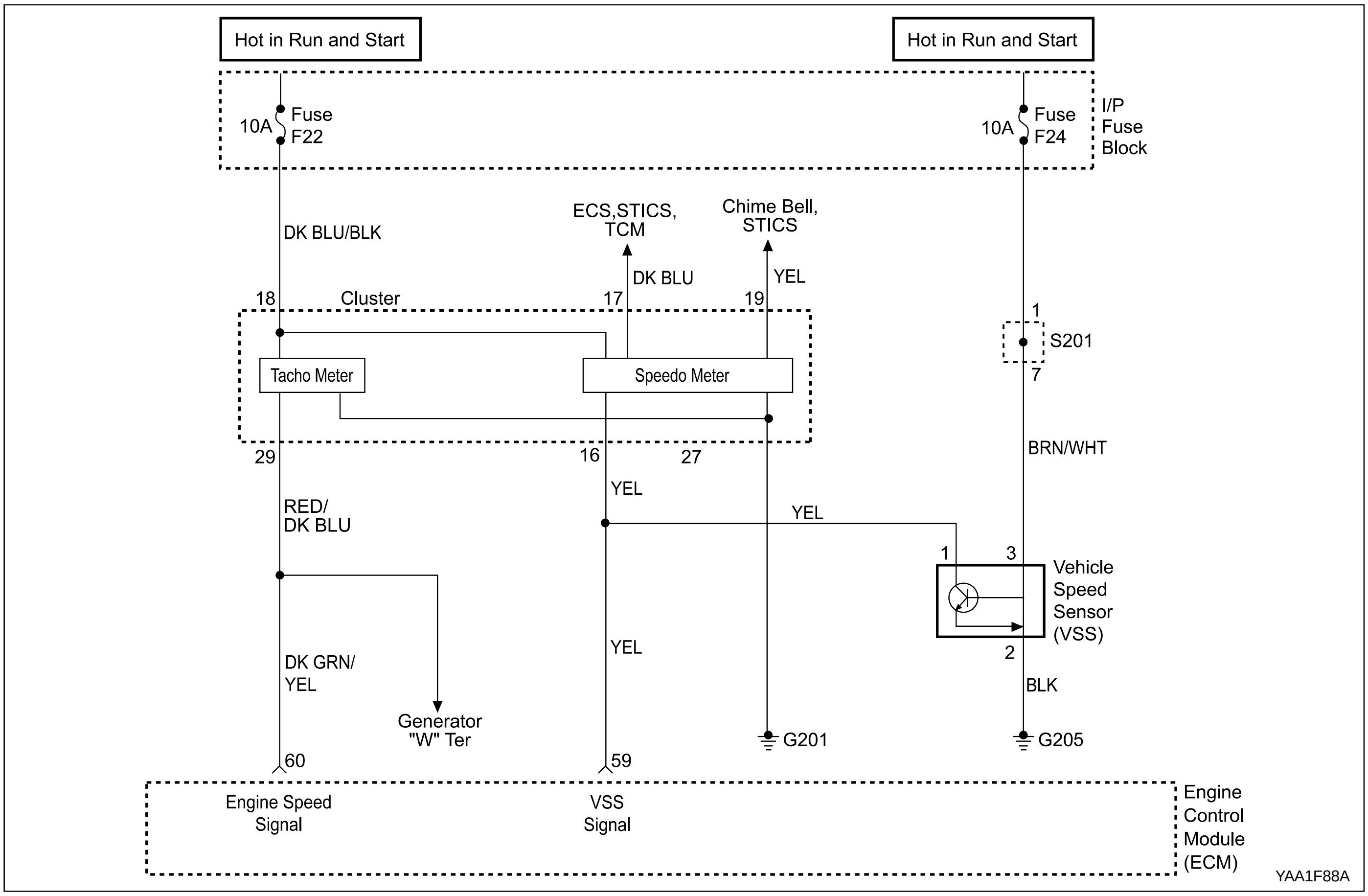

DIAGNOSTIC TROUBLE CODE (DTC) P0501 VEHICLE SPEED SENSOR NO SIGNAL

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 and produces a pulsing voltage vehicle. 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

- Vehicle speed signal threshold is more than 265km/h (165 mph) or less than 2.4km/h (1.5 mph).
- Engine speed threshold is between 2790 rpm and 3600 rpm for A/T and 3000 rpm and 3900 rpm for M/T.
- P/N switch is off.
- Time threshold is more than 3.0 seconds for A/T and more than 5.0 seconds for M/T.
- Engine speed limitation is not active.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

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

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
3. Proper engine loads cannot be achieved in a shop environment to properly run the vehicle within the Freeze Frame Data conditions. It will be necessary to drive the vehicle on the road to obtain the proper engine loads.
4. This step verifies that the ECM is supplying a signal voltage to the vehicle speed sensor.
11. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0501 Vehicle Speed Sensor No Signal

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro 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 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 km/h	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 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, with the engine OFF. 4. Using a Digital Voltmeter (DVM) connected to ground, measure the voltage in the Vehicle Speed Sensor (VSS) signal circuit, at terminal 1. Is the voltage near the specified value?	7.40 v	Go to Step 5	Go to Step 7
5	Using a DVM, measure the voltage at terminal 3 of the VSS harness connector. Is the voltage near the specified value?	11 - 14 v	Go to Step 6	Go to Step 8
6	Probe the VSS ground circuit, terminal 2 at the VSS harness connector with a test light connected to B+. Does the test light illuminate?	-	Go to Step 10	Go to Step 9

DTC P0501 Vehicle Speed Sensor No Signal (Cont'd)

Step	Action	Value(s)	Yes	No
7	Check the VSS signal circuit for an open or short to ground and repair as necessary. Is the repair complete?	-	Go to Step 12	Go to Step 11
8	Check the ignition circuit for an open and repair as necessary. Is the repair complete?	-	Go to Step 12	-
9	Check the VSS ground circuit for an open and repair as necessary. 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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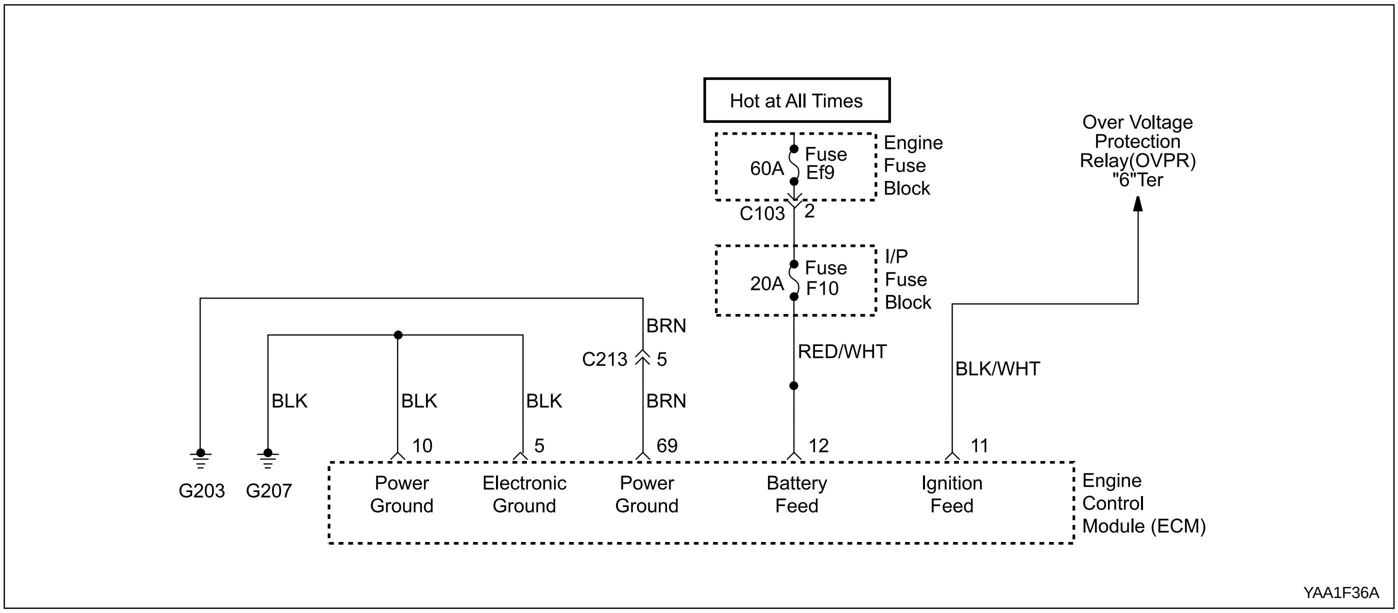


DIAGNOSTIC TROUBLE CODE (DTC) P0562 BATTERY VOLTAGE LOW

Circuit Description

The Engine Control Module (ECM) monitors the ignition voltage on the ignition feed circuit to terminal 11 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 system voltage is less than 8 volts and the engine speed signal threshold is less than 2000 rpm.
- The system voltage is less than 10 volts and the engine speed signal threshold is more than or equal to 2000 rpm.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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 using the scan tool.

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 compliant should be thoroughly checked for the following conditions:

- Back-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wiring connections
- Physical damage to the wiring harness

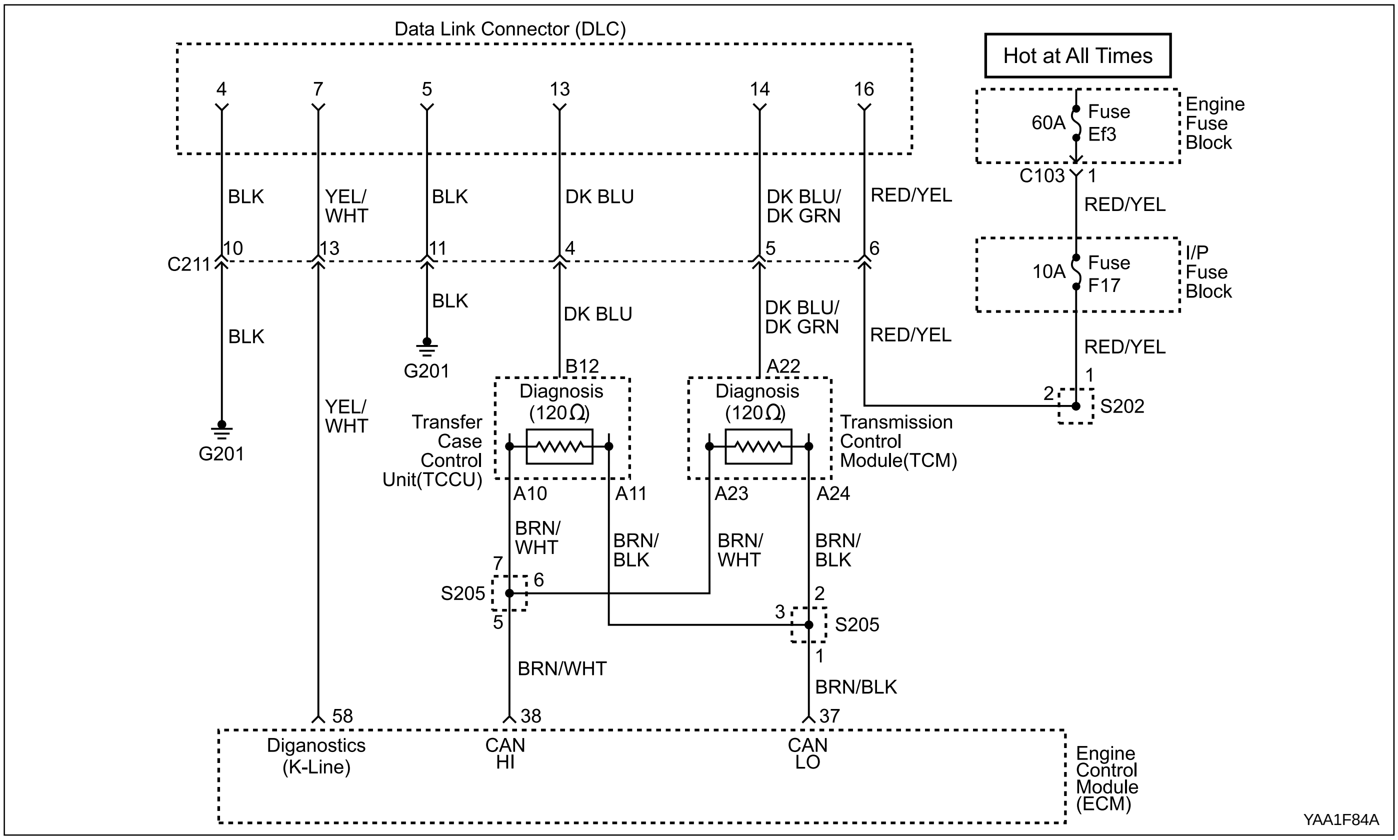
Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. This checks if the generator is malfunctioning under load conditions.
4. Checks the ignition feed circuit for excessive resistance. An open circuit will cause a no-start condition.
7. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.
9. If no malfunctions have been found at this point and no additional DTCs were set, refer to “Diagnostic Aids” in this section for additional checks and information.

DTC P0562 Battery Voltage Low

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 "Euro 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?	2000 rpm 10 v	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?	2000 rpm 10 v	Go to Step 4	Go to "Diagnostic Aids"
4	1. Turn the ignition switch OFF. 2. Disconnect the Engine Control Module (ECM) connector at the ECM. 3. Turn the ignition ON, with the engine OFF. 4. Using a DVM, measure the ignition voltage at the ignition feed circuit, terminal 11. Is the ignition voltage greater than the specified value?	10 v	Go to Step 5	Go to Step 6
5	Check for a malfunctioning connection at the ECM harness terminals and repair as necessary. 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	Replace the 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 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) P0600 CAN COMMUNICATION MALFUNCTION

Circuit Description

The provision for communicating with the Engine Control Module (ECM) is the Data Link Connector (DLC). It is located in the instrument panel fuse box. The DLC is used to connect the scan tool. Battery power and ground is supplied for the scan tool through the DLC. CAN line is used to communicate with the other module such as the Transmission Control Module (TCM) and Transfer Case Control Unit (TCCU).

Conditions for Setting the DTC

- Message missing.
- No initialization.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycle 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

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.

An intermittent 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 terminals to wiring connection.
- Physical damage to the wiring harness.
- Corrosion

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

14. If no trouble is found in the control circuit the connection at the ECM, the ECM may be faulty. However, this is an extremely unlikely failure. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0600 CAN Communication Malfunction

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Attempt to select Transmission Control Module (TCM) data with the scan tool. Can TCM data be displayed?	-	Go to Step 3	Go to Step 5
3	Attempt to select Transfer Case Control Unit (TCCU) data with the scan tool. Can TCCU data be displayed?	-	Go to Step 4	Go to Step 6
4	Attempt to select Engine Control Module (ECM) data with the scan tool. Can ECM data be displayed?	-	Go to Step 15	Go to Step 7
5	Check for an open or short in the wire from the TCM connector terminal B22 to the Data Link Connector (DLC) terminal 14 and repair as necessary. Is the repair is complete?	-	Go to Step 15	Go to Step 11
6	Check for an open or short in the wire from the TCCU connector terminal A12 to the DLC terminal 13 and repair as necessary. Is the repair is complete?	-	Go to Step 15	Go to Step 8
7	Check for an open or short in the wire from the ECM connector terminal 58 to the DLC terminal 7 and repair as necessary. Is the repair is complete?	-	Go to Step 15	Go to Step 14
8	Check for an open or short in the wire from the TCCU connector terminal B10 to ECM connector terminal 38 and repair as necessary. Is the repair is complete?	-	Go to Step 15	Go to Step 9
9	Check for an open or short in the wire from the TCCU connector terminal B11 to ECM connector 37 and repair as necessary. Is the repair is complete?	-	Go to Step 15	Go to Step 10
10	1. Turn the ignition OFF. 2. Replace the TCCU. Is the repair complete?	-	Go to Step 15	Go to Step 14

DTC P0600 CAN Communication Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open or short in the wire from the TCM connector terminal B23 to ECM connector terminal 38 and repair as necessary. Is the repair is complete?	-	Go to Step 15	Go to Step 12
12	Check for an open or short in the wire from the TCCU connector terminal B24 to ECM connector 37 and repair as necessary. Is the repair is complete?	-	Go to Step 15	Go to Step 13
13	1. Turn the ignition OFF. 2. Replace the TCM. Is the repair complete?	-	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 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

DIAGNOSTIC TROUBLE CODE (DTC) P0601
CPU CHECK

Conditions for Setting the DTC

- Internal fault.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycle 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. The replacement ECM must be reprogrammed. Refer to the least Techline procedure for ECM reprogramming.

DTC P0601 CPU Check

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 “Euro 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 ran 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) P0602 CODING PLAUSIBILITY

System Description

When malfunction of ECM coding or faulty of variant coding of transmission, a DTC P0602 will be set.

Conditions for Setting the DTC

- Coding fault.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycle 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
4. The replacement ECM must be reprogrammed. Refer to the least Techline procedure for ECM reprogramming.

DTC P602 Coding Plausibility

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 “Euro On-Board Diagnostic System Check”
2	1. Install the scan tool 2. Inspect the coding condition and repair as necessary. Is the repair complete?	-	Go to Step 5	Go to Step 3
3	Fulfill the Engine Control Module (ECM) variant coding Is the repair complete?	-	Go to Step 5	Go to Step 4
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 ran and passed?	-	Go to Step 3	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) P0604
RAM TEST

System Description

Random Access Memory (RAM) is the microprocessor “scratch pad.” The processor can write into, or read from this memory as needed. This memory is volatile and needs a constant supply of voltage to be retained. If the voltage is lost, the memory is lost.

Conditions for Setting the DTC

- RAM fault.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycle 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. The replacement ECM must be reprogrammed. Refer to the least Techline procedure for ECM reprogramming.

DTC P604 RAM Test

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 “Euro 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 ran 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 CHECKSUM TEST

Circuit Description

The Engine Control Module (ECM) is the control center of the fuel injection system. It constantly looks at the in-formation form various sensors, and controls the systems that effect vehicle performance. The ECM also performs the 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 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

- Checksum fault.

Action Taken When the DTC Sets

- The MIL will illuminate after two consecutive driving cycle 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
2. The replacement ECM must be reprogrammed. Refer to the least Techline procedure for ECM reprogramming.

DTC P0605 Checksum Test

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 “Euro 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 ran 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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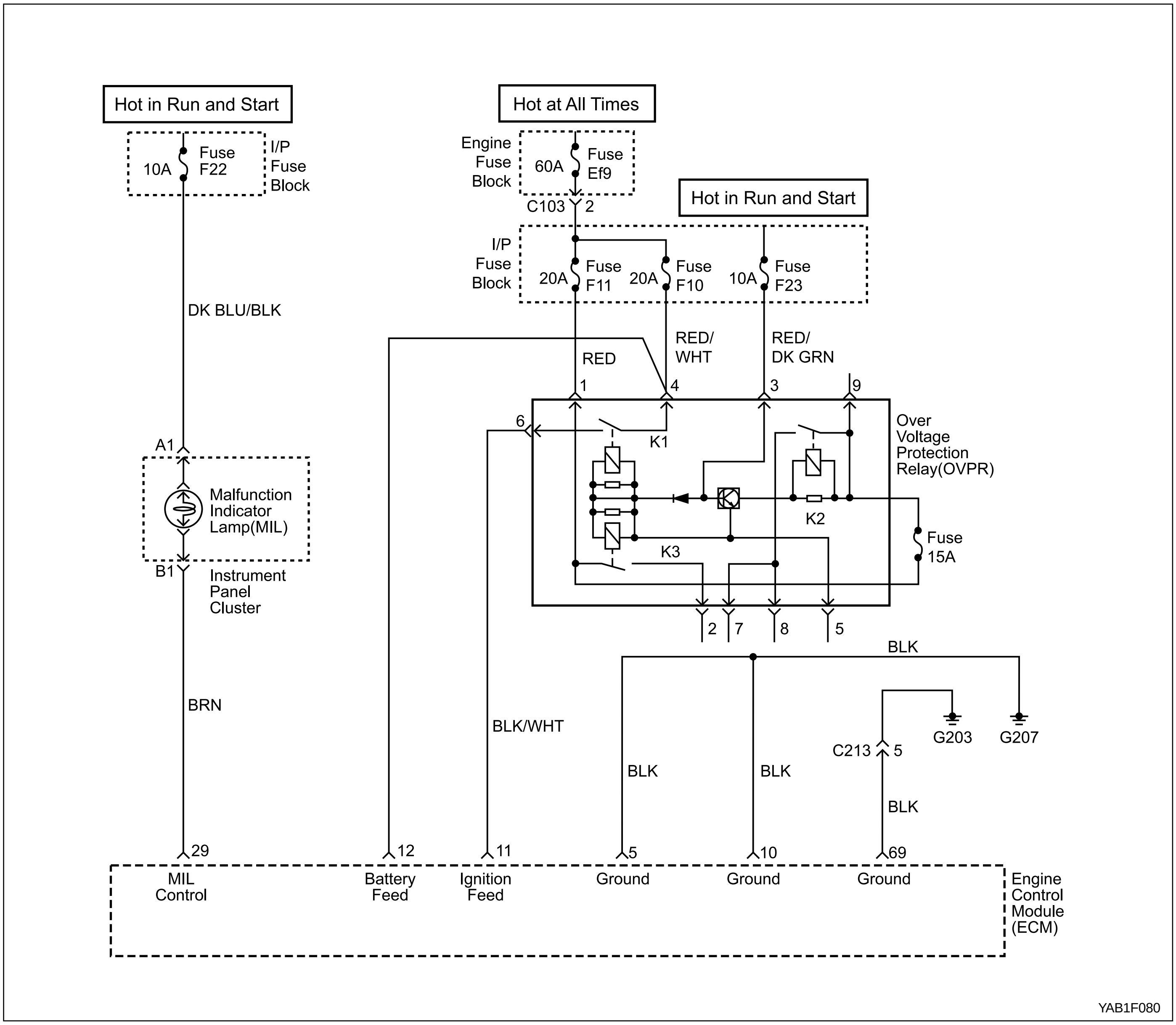

DIAGNOSTIC TROUBLE CODE (DTC) P0650-224
MIL SHORT CIRCUIT TO BATTERY

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.

DTC P0650-224 sets when the MIL circuit is short to battery.

Conditions for Setting the DTC

- Current is between 1 ampare and 2 ampares (depending on driver condition).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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 buffer.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after 3 consecutive driving 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.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the MIL and ECM connectors. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.
- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. The Euro On-Board Diagnostic (EOBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on then scan tool, if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is stored in the scan tool for later reference.
2. When the ignition is turned ON, the MIL should be turned ON and remain ON until the engine is running or if an emission related DTC is stored.
3. This step checks the short to battery at the MIL control circuit.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline information for reprogramming procedures.

DTC P0650-224 MIL Short Circuit to Battery

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check performed?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Turn the ignition ON, with the engine OFF. Is the Malfunction Indicator Lamp (MIL) OFF?	-	Go to Step 3	Go to “Diagnostic Aids”
3	1. Turn the ignition OFF. 2. Disconnect the MIL connector. 3. With a test light connected to ground, probe the MIL control circuit terminal B1. Does the test light illuminate?	-	Go to Step 4	Go to Step 7
4	1. Disconnect the Engine Control Module (ECM) connector. 2. With a test light connected to ground, probe the MIL control circuit terminal 29. Does the test light illuminate?	-	Go to Step 5	Go to Step 6
5	Repair the MIL control circuit for a short to battery. Is the action complete?	-	Go to Step 9	-
6	Check the malfunctioning ECM connector terminals and repair as necessary. Is the repair complete?	-	Go to Step 9	Go to Step 8
7	Replace the instrument panel cluster. Refer to *Section 9E, Instrumentation/Driver Information.* Is the repair complete?	-	Go to Step 9	-

DTC P0650-224 MIL Short Circuit to Battery (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition OFF. 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 ran 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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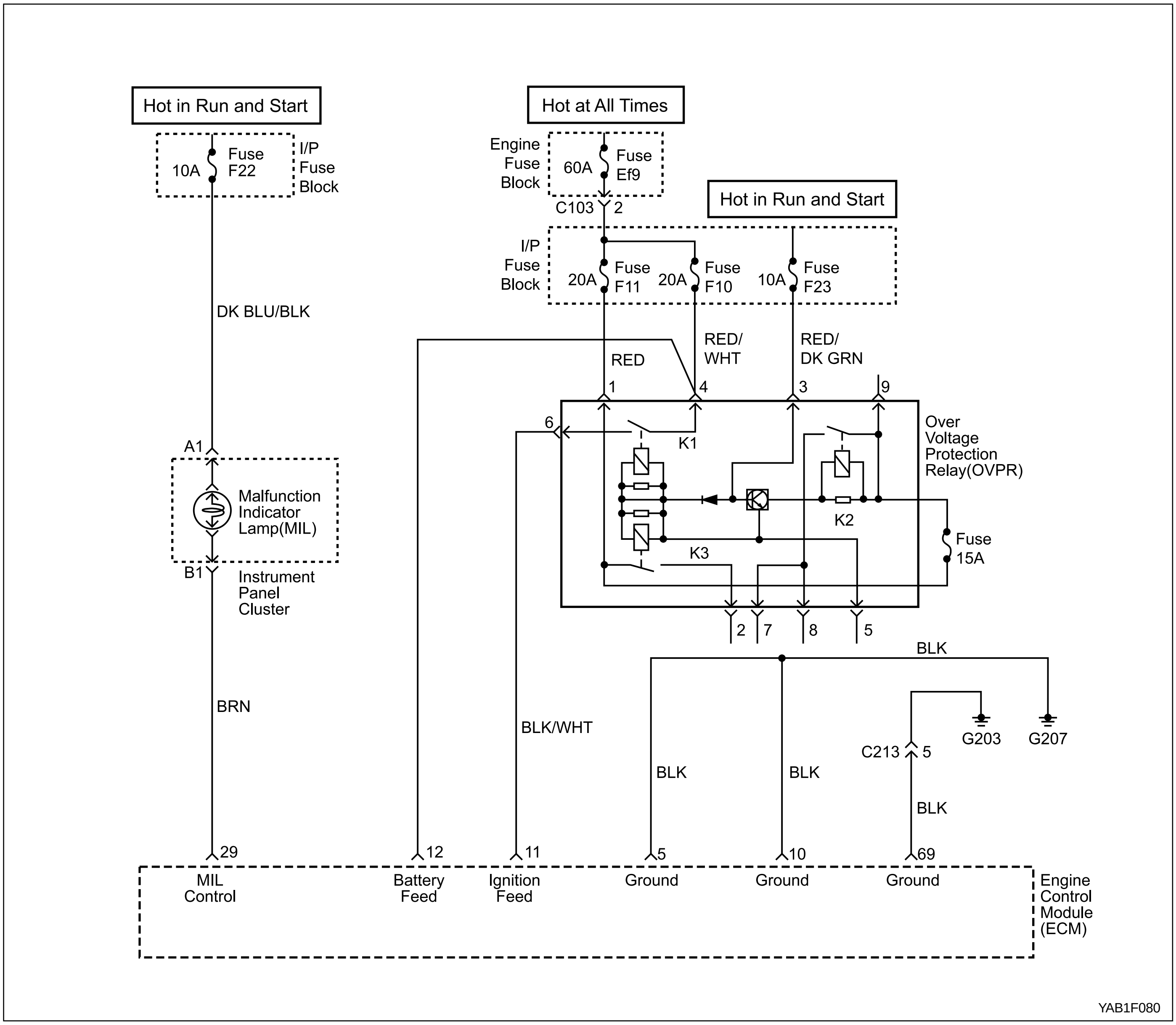

DIAGNOSTIC TROUBLE CODE (DTC) P0650-225 MIL SHORT CIRCUIT TO GROUND OR OPEN

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.

DTC P0650-225 sets when the MIL circuit is short to ground/ open.

Conditions for Setting the DTC

- Voltage is less than 2 volts for ground, 5 consecutive tesrs.
- Voltage is less than 3 volts for open, 5 consecutive tests.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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 buffer.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after 3 consecutive driving 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.

Diagnostic Aids

An open ignition F30 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. If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. The Euro 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 malfunction occurred. The information is stored in the scan tool for later reference.
4. Connections that are suspected of being faulty should be thoroughly checked as described in the diagnostic aids.
12. Before replacing the ECM, check for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring harness. Replacement ECMs must be reprogrammed. Refer to the latest Techline information for reprogramming procedures.

DTC P0650-225 MIL Short Circuit to Ground or Open

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check performed?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	Turn the ignition ON, with the engine OFF. Is the Malfunction Indicator Lamp (MIL) ON?	-	Go to Step 3	Go to Step 6
3	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector. 3. Turn the ignition ON. Is the MIL ON?	-	Go to Step 4	Go to Step 5
4	1. Turn the ignition OFF. 2. Disconnect the MIL connector. 3. With a test light connected to battery, probe the MIL control circuit terminal B1. Does the test light illuminate?	-	Go to Step 5	Go to Step 11
5	Repair the MIL control circuit for a short to ground. Is the action complete?	-	Go to Step 14	-
6	1. Check the I/P fuse block fuse F30 for an open and replace the fuse as needed. 2. Before replacing the fuse, check a short to ground in the circuit that was open and repair if necessary. Is the action complete?	-	Go to Step 14	Go to Step 7

DTC P0650-225 MIL Short Circuit to Ground or Open (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Turn the ignition OFF. 2. Disconnect the MIL connector. 3. With a test light connected to ground, probe the MIL control circuit terminal A1. Does the test light illuminate?	-	Go to Step 9	Go to Step 8
8	Repair the ignition feed circuit to the MIL between I/P fuse block fuse F30 and MIL connector terminal A1 for as open. Is the action complete?	-	Go to Step 14	-
9	1. With a test light connected to battery, probe the MIL control circuit terminal B1. 2. Turn the ignition ON. Does the test light illuminate?	-	Go to Step 13	Go to Step 10
10	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector. 3. Check for an open or a poor connection in the MIL control circuit between ECM connector terminal 29 and MIL connector terminal B1 and repair as necessary. Is the repair necessary?	-	Go to Step 14	Go to Step 11
11	Check the malfunctioning ECM connector terminals and repair as necessary. Is the repair complete?	-	Go to Step 14	Go to Step 12
12	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 14	-
13	Replace the instrument panel cluster. Refer to *Section 9E, Instrumentation/Driver Information.* 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 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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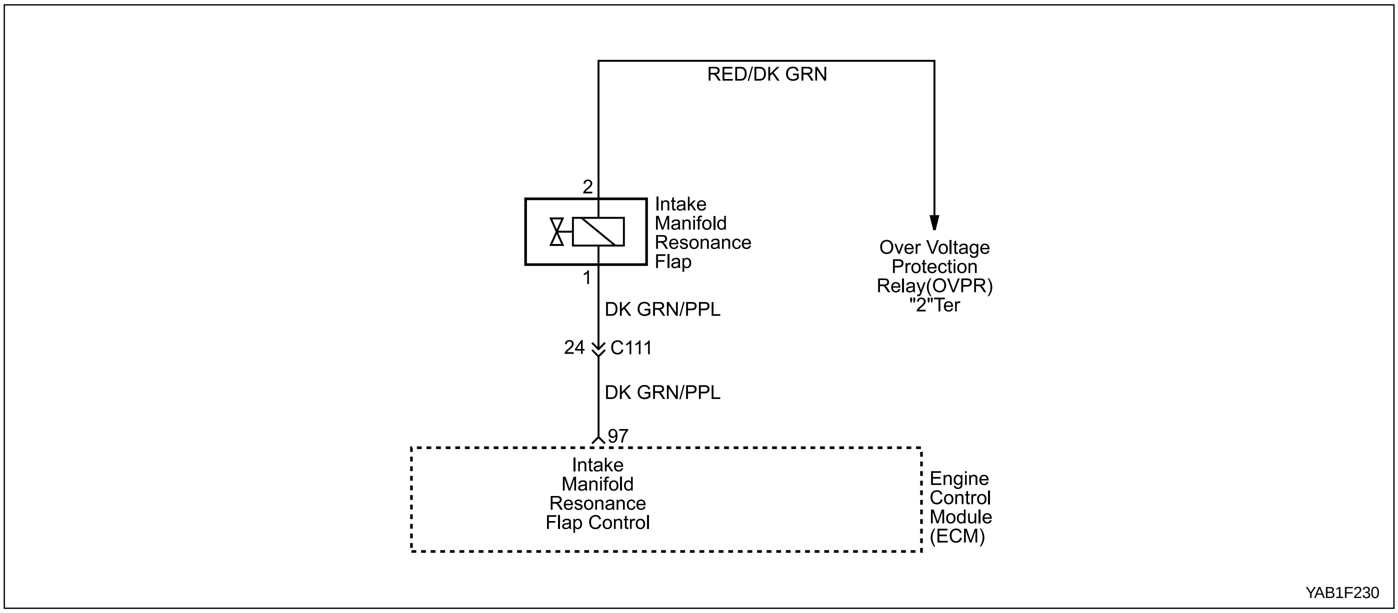

DIAGNOSTIC TROUBLE CODE (DTC) P0661 RESONANCE FLAP SHORT CIRCUIT TO GROUND OR OPEN (3.2L DOHC)

Circuit Description

A pneumatically actuated resonance flap is located on the intake manifold, and will be opened and closed by load, which operates resonance flap according to engine and controlled by ECM and rpm.

Resonance flap is closed at idle/partial load (less than 3,800/rpm.).The switch valve will be adjusted by ECM and resonance flap will be closed. By increasing air flow passage through dividing intaking air flow toward both air collection housing. This leads to a significant increase in the torque in the lower speed range.

Resonance flap is open at full load (at full load : over 3,800/rpm). The switch valve will not be adjusted by ECM and resonance flap will be open. The collected air in the air collection housing will not be divided and intaking air passage will be shorten.

Conditions for Setting the DTC

- Voltage is less than 2/3 battery voltage for open, 5 consecutive tests.
- Voltage is less than 1/3 battery voltage for ground, 5 consecutive tests.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing The MIL/DTC

- The MIL will turn off after three consecutive driving cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-upcycles without a fault.
- The DTC(s) can be cleared by using the scan tool.

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, 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

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.

10. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0661 Resonance Flap Short Circuit to Ground or Open (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate engine at normal temperature. 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 parameters under conditions and Conditions For Setting The DTC. Does the scan tool indicate DTC P0661 this driving cycle?	-	Go to Step 4	Go to “Diagnostic Aids”
4	1. Turn the ignition OFF. 2. Disconnect the resonance flap electrical connector. 3. Turn the ignition ON. 4. Using a Digital Voltmeter (DVM), measure the resonance flap connector terminal 2. Does the voltage displayed as specified?	B+	Go to Step 5	Go to Step 11
5	Using a DVM measure the resonance flap connector terminal 1. Does the voltage displayed as specified?	7 v	Go to Step 6	Go to Step 7
6	1. Turn the ignition OFF. 2. Replace the resonance flap. Is the repair complete?	-	Go to Step 12	-
7	With a test light connected to the battery, probe the resonance flap circuit terminal 1. Does the test light illuminate?	-	Go to Step 8	Go to Step 9
8	Check the resonance flap circuit from terminal 1 to ECM for short to ground and repair as necessary. Is the repair complete?	-	Go to Step 12	Go to Step 10
9	Check the resonance circuit from terminal 1 to ECM for open and repair as necessary. 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	Check for open in the wire between resonance flap terminal 2 and Over Voltage Protection Relay (OVPR) connector terminal 2 and repair as necessary. Is the repair complete?	-	Go to Step 12	Go to “OVPR Circuit Check”

DTC P0661 Resonance Flap Short Circuit to Ground or Open (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. If disconnected, reconnect the resonance flap electrical 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 the 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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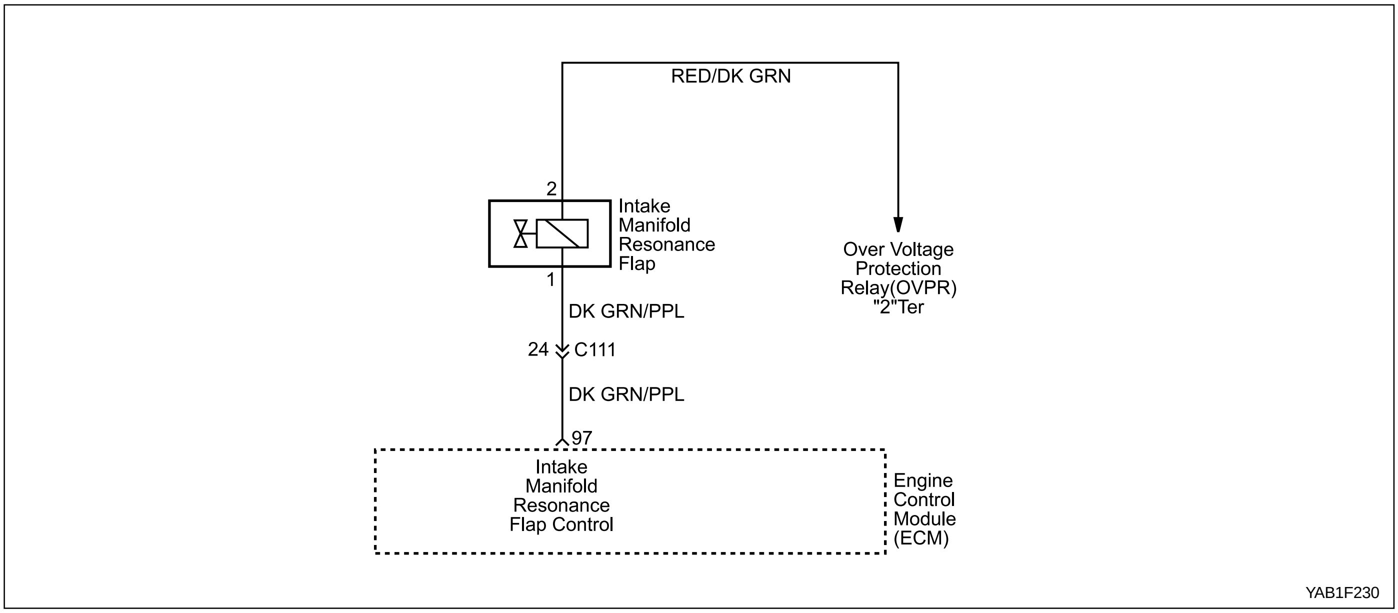

DIAGNOSTIC TROUBLE CODE (DTC) P0662 RESONANCE FLAP SHORT CIRCUIT TO BATTERY (3.2L DOHC)

Circuit Description

A pneumatically actuated resonance flap is located on the intake manifold, and will be opened and closed by load, which operates resonance flap according to engine and controlled by ECM and rpm.

Resonance flap is closed at idle/partial load (less than 3,800/rpm.). The switch valve will be adjusted by ECM and resonance flap will be closed. By increasing air flow passage through dividing intaking air flow toward both air collection housing. This leads to a significant increase in the torque in the lower speed range.

Resonance flap is open at full load (at full load : over 3,800/rpm). The switch valve will not be adjusted by ECM and resonance flap will be open. The collected air in the air collection housing will not be divided and intaking air passage will be shorten.

Conditions for Setting the DTC

- The current is between 2.2 and 4.3 amperes. (depending on driver condition)

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

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, 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

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

1. Euro 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 malfunction occurred. The information is then stored on the scan tool for later reference.
9. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0662 Resonance Flap Short Circuit to Battery (3.2L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Operate engine at normal temperature. 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 parameters under conditions and Conditions for Setting The DTC. Does the scan tool indicate DTC P0662 this driving cycle?	-	Go to Step 4	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Disconnect the resonance flap electrical connector. 3. Turn the ignition ON. 4. Using a Digital Voltmeter (DVM), measure the resonance flap connector terminal 2. Does the voltage displayed as specified?	B+	Go to Step 5	Go to Step 10
5	Using a DVM measure the voltage at resonance flap connector terminal 1. Does the voltage displayed as specified?	7 v	Go to Step 7	Go to Step 6
6	With a test light connected to ground, probe the resonance flap circuit terminal1. Does the test light illuminate?	-	Go to Step 8	Go to "Diagnostic Aids"
7	1. Turn the ignition OFF. 2. Replace the resonance flap. Is the repair complete?	-	Go to Step 11	-
8	Check the resonance flap circuit from terminal 1 to ECM for short to battery and repair as necessary. Is the repair complete?	-	Go to Step 11	Go to Step 9
9	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	-	Go to Step 11	-
10	Check for short in the wire between resonance flap terminal 2 and Over Voltage Protection Relay (OVPR) connector terminal 2 and repair as necessary. Is the repair complete?	-	Go to Step 11	Go to "OVPR Circuit Check"

DTC P0662 Resonance Flap Short Circuit to Battery (3.2L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. If disconnected, reconnect the resonance flap electrical 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 the 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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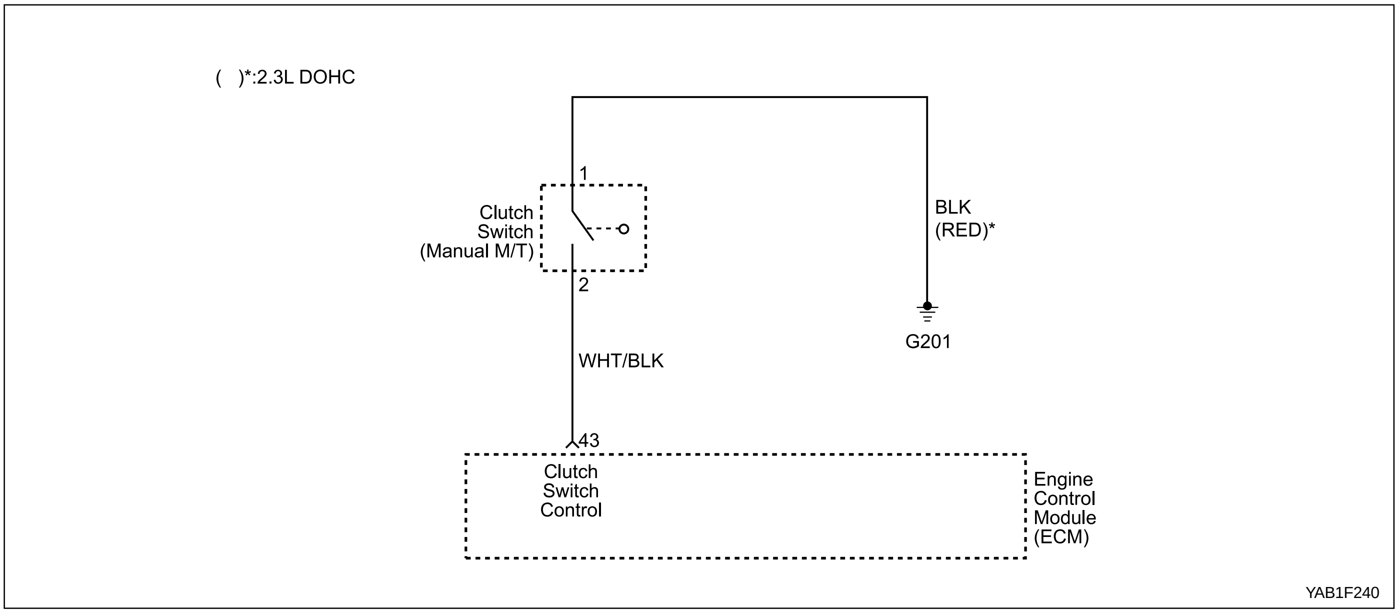


DIAGNOSTIC TROUBLE CODE (DTC) P1813 CLUTCH SWITCH PLAUSIBILITY

Circuit Description

Clutch switch plausibility diagnosis detects whether no clutch switch signal detects in the corresponding range (vehicle speed, engine speed) and engine load exceeds upper load threshold for more than minimum time.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0335, P0336 and P0501 are not set.
- Vehicle speed is less than 2.4 km/h.
- Ignition status is on.
- Engine speed is less than 1800 rpm.
- Engine load is greater than 0.6 for more than 5 seconds.
- Start end is reached.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive driving cycles 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.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive driving 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.

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, 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

Test Description

Number(s) below refer to the step(s) number on the Diagnostic Table.

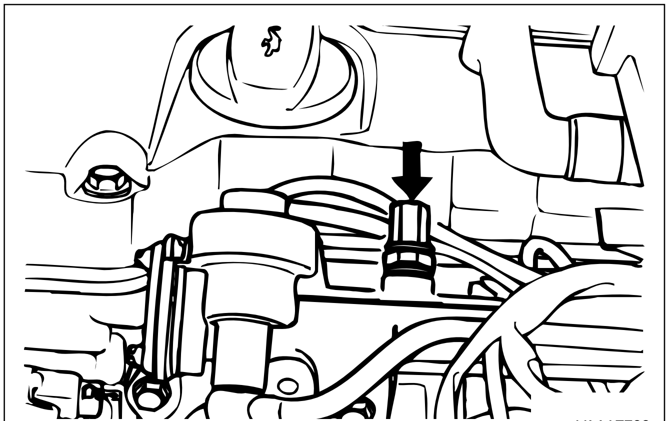
1. Euro On-Board Diagnostic (EOBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
9. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P1813 Clutch Switch Plausibility

Step	Action	Value(s)	Yes	No
1	Perform the Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	-	Go to Step 2	Go to "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Press the clutch pedal. Does the scan tool indicate that the CLUTCH SWITCH is changed OFF to ON?	-	Go to "Diagnostic Aids"	Go to Step 3
3	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) connector. 3. Turn the ignition ON. 4. Using a Digital Voltmeter (DVM), measure the clutch switch connector terminal 2 and ECM connector terminal 43. Does the resistance near the specifies value?	0 Ω	Go to Step 5	Go to Step 8
5	With a test light connected to battery postive, probe the clutch switch connector terminal 1. Does the test light illuminate?	-	Go to Step 6	Go to Step 7
6	1. Turn the ignition OFF. 2. Replace the clutch switch. Is the repair complete?	-	Go to Step 10	Go to Step 9
7	Check the clutch switch connector terminal 1 to ground for open or short and repair if necessary. Is the repair complete?	-	Go to Step 10	-
8	Check for open or short in the wire between clutch switch connector terminal 2 and ECM connector terminal 43 and repair if necessary. 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. If disconnected, reconnect the clutch switch electrical 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 the 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

MAINTENANCE AND REPAIR

ON VEHICLE SERVICE


YAA1F700

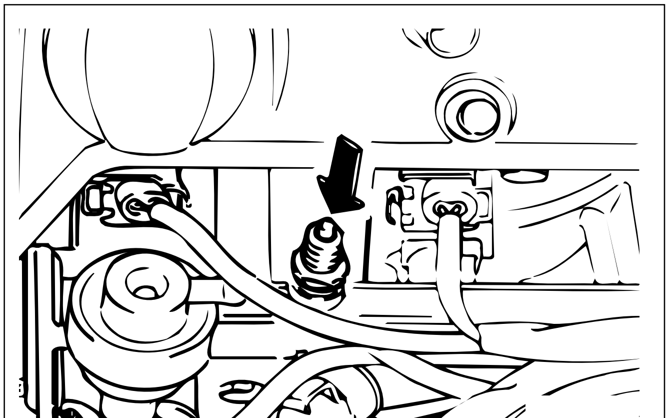
DISCHARGING THE PRESSURE IN FUEL SYSTEM (2.3L DOHC)

Removal and Installation Procedure

1. Remove the fuel pressure test connector.

   Installation Notice

Tightening Torque	25 N•m (18 lb-ft)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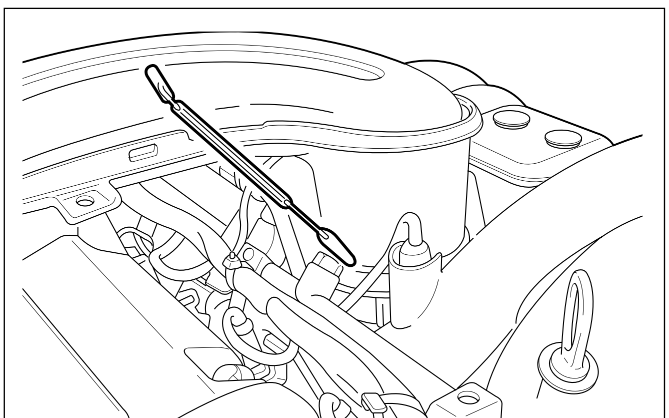
2. Remove the fuel pressure in fuel system by pressing the service valve with a clean, pointy tool.

Notice: Place a cloth so that the fuel doesn't stain around.

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


KAA1F430

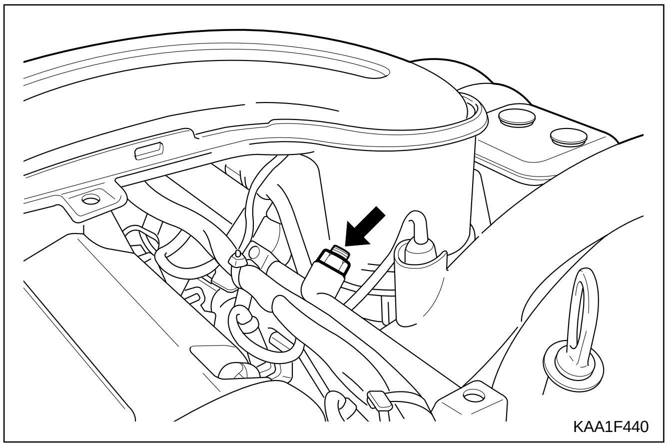
DISCHARGING THE PRESSURE IN FUEL SYSTEM (3.2L DOHC)

Removal and Installation Procedure

1. Remove the fuel pressure test connector.

   Installation Notice

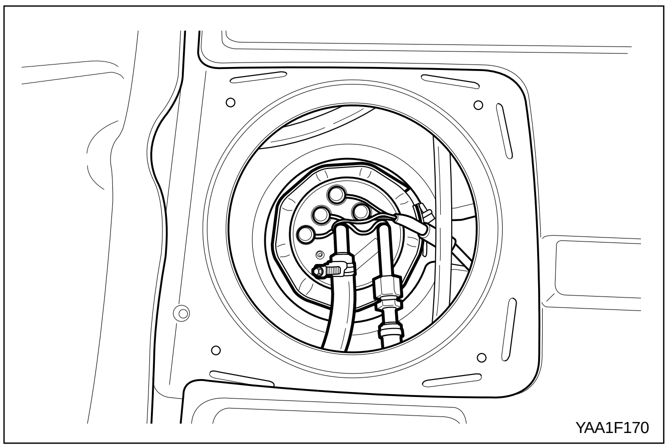
Tightening Torque	25 N•m (18 lb-ft)



2. Remove the fuel pressure in fuel system by pressing the service valve with a clean, pointy tool.

Notice: Place a cloth so that the fuel doesn't stain around.

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



FUEL PUMP

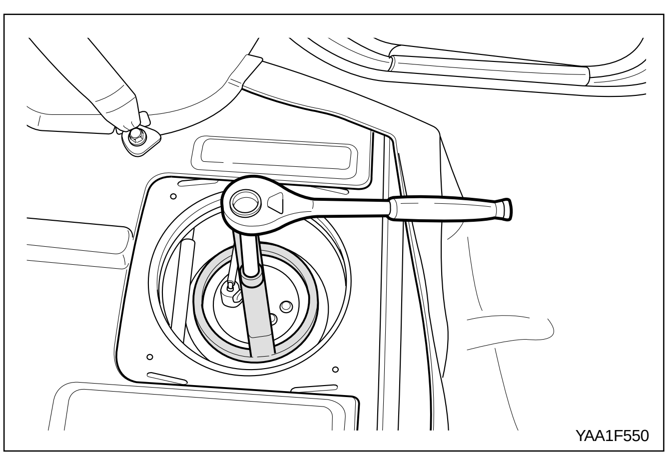
Tool Required

661 589 00 46 00 Fuel Tank Cap Wrench

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.

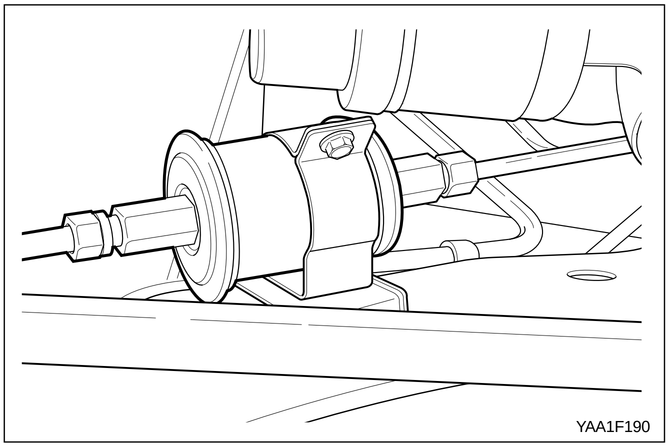
1. Relieve the fuel system pressure. Refer to "Discharging the Pressure in Fuel System" in this section.
2. Disconnect the negative battery cable.
3. Put aside the floor carpet to remove the fuel pump access cover.
4. Remove the fuel pump access cover.
5. Remove the fuel pump wiring connectors.
6. Disconnect the fuel supply and return pipes.
7. Remove the fuel pump locking cap band.



8. Using the fuel tank cap wrench 661 589 00 46 00, remove the locking cap.
9. Remove the pump from the fuel tank.

Notice: Check the condition of the seal and replace if necessary, Drain the fuel before removing the pump.

10. Perform an operational check of the fuel pump.
11. Installation should follow the removal procedure in the reverse order.



FUEL FILTER

Removal and Installation Procedure

1. Disconnect the negative battery cable.

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.

2. Relieve the fuel system pressure. Refer to "Discharging the Pressure in Fuel System" in this section.
3. Disconnect the fuel lines from the fuel filter

Installation Notice

Tightening Torque	28 N•m (21 lb-ft)

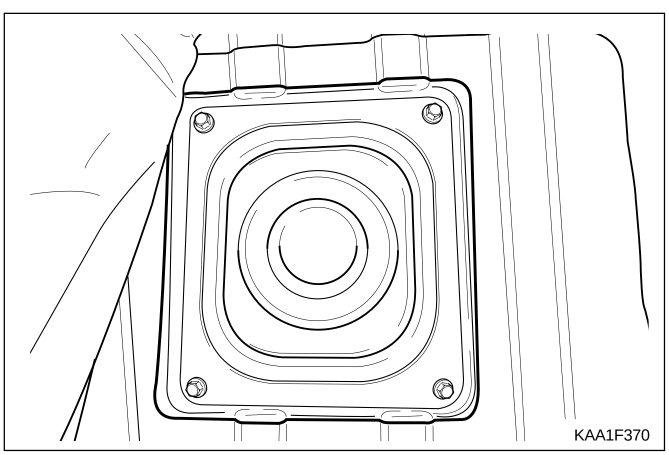
4. Remove the fuel filter mounting bracket bolt.

Installation Notice

Tightening Torque	6 N•m (53 lb-ft)

Notice: Place the fuel pump pad. There may be a corrosion due to the contact between the fuel filter and the bracket.

5. Remove the fuel filter.
6. Install the fuel filter.
7. Perform a leak test of the fuel filter.
8. Installation should follow the removal procedure in the reverse order.

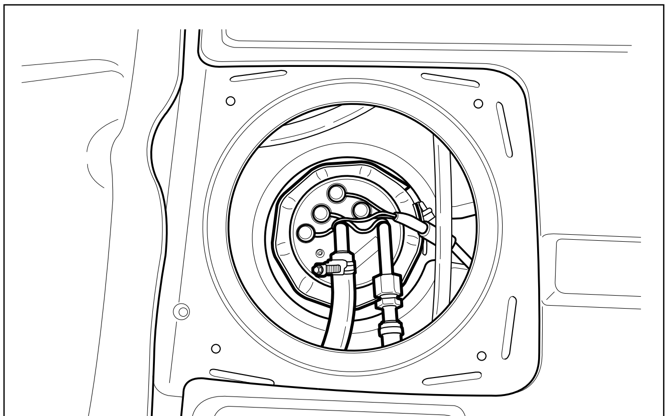


FUEL TANK

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 "Discharging the Pressure in Fuel System" in this section.
2. Disconnect the negative battery cable.
3. Drain the fuel tank.
4. Put aside the floor carpet to remove the fuel pump access cover.
5. Remove the fuel pump access cover.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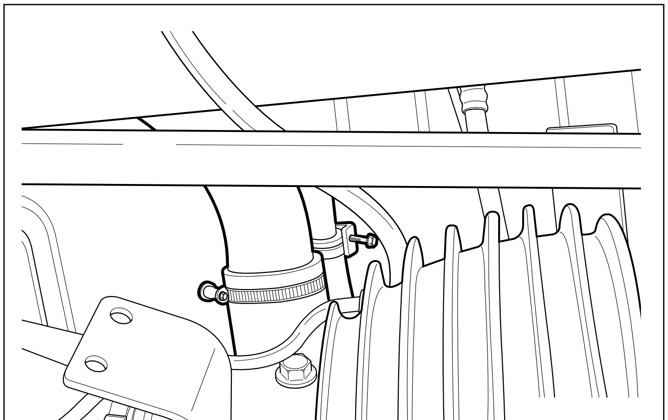
6. Disconnect the return line.
7. Disconnect the supply line.
8. Disconnect the fuel tank-to-canister hose from the fuel tank.
9. Disconnect the fuel pump wiring connector.

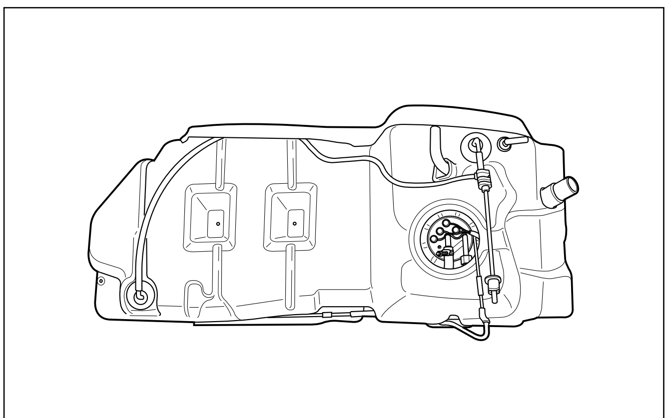

YAA1F160

10. Disconnect the fuel filler hose and air vent hose from the fuel tank.
11. Support the fuel tank.
12. Remove the fuel tank retaining nuts.

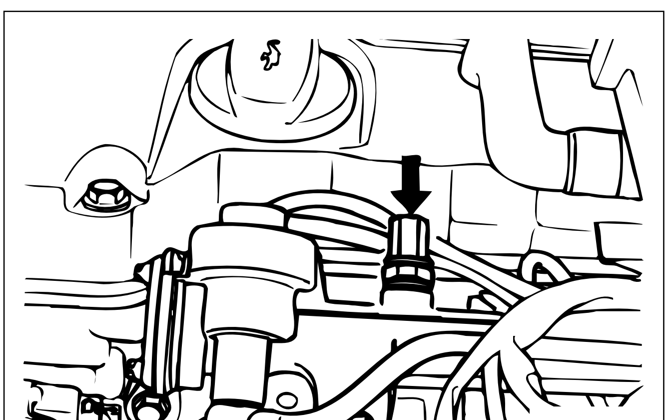
Installation Notice

Tightening Torque	38 N•m (28 lb-ft)

13. Carefully lower the fuel tank.


YAA1F180

14. Turn the roll over valves counterclockwise at an angle of 90 degrees.
15. Turn the lock ring counterclockwise.
16. Remove and discard the gasket.
17. Installation should follow the removal procedure in the reverse order.


YAA1F700

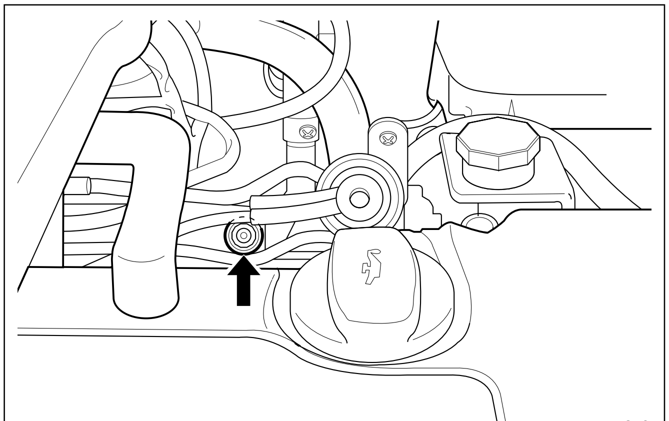
FUEL PRESSURE REGULATOR (2.3L DOHC)

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the fuel pressure test connector

Installation Notice

Tightening Torque	25 N•m (18 lb-ft)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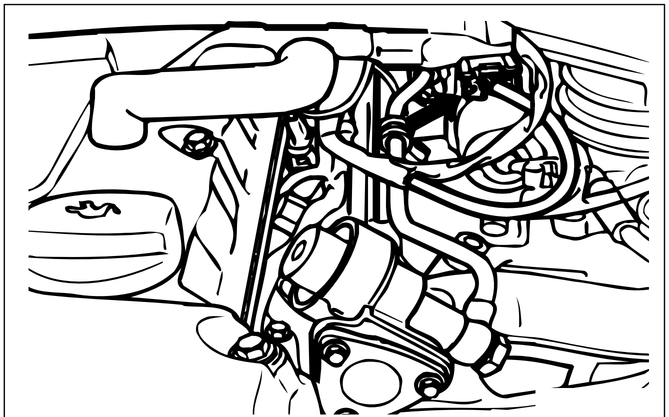
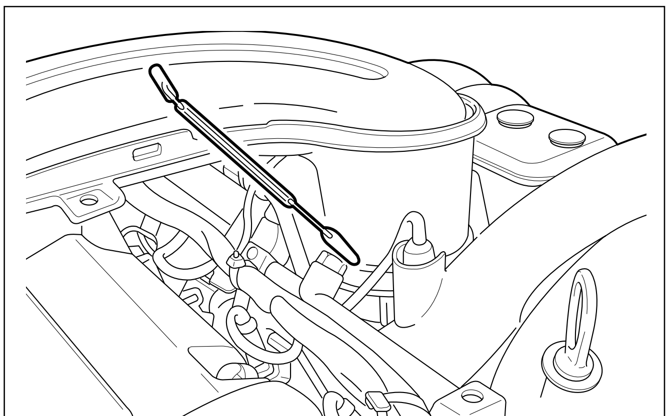
Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

3. Relieve the fuel pressure in fuel supply system by pressing the service valve.


YAA1F730

4. Disconnect the vacuum hose.
5. Disconnect the circlip and remove the fuel pressure regulator.
6. Apply the oil to O-ring lightly and then replace it.
7. Perform a leak test of the fuel pressure regulator with the engine off and the ignition on.
8. Installation should follow the removal procedure in the reverse order.


KAA1F430

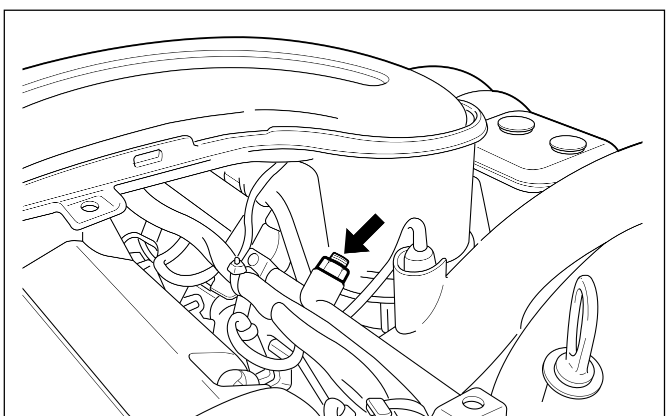
FUEL PRESSURE REGULATOR (3.2L DOHC)

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the fuel pressure test connector

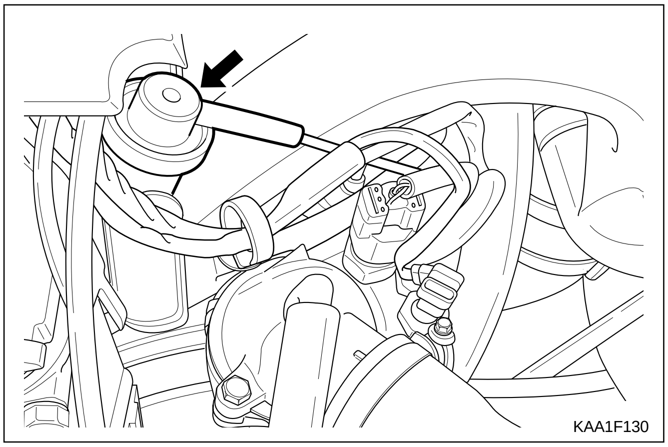
Installation Notice

Tightening Torque	25 N•m (18 lb-ft)

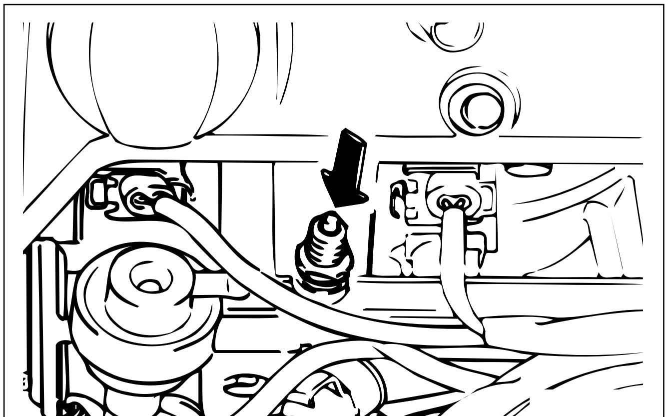

KAA1F440

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.

3. Relieve the fuel pressure in fuel supply system by pressing the service valve.


KAA1F130

4. Disconnect the vacuum hose.
5. Disconnect the circlip and remove the fuel pressure regulator.
6. Apply the oil to O-ring lightly and then replace it.
7. Perform a leak test of the fuel pressure regulator with the engine off and the ignition on.
8. Installation should follow the removal procedure in the reverse order.

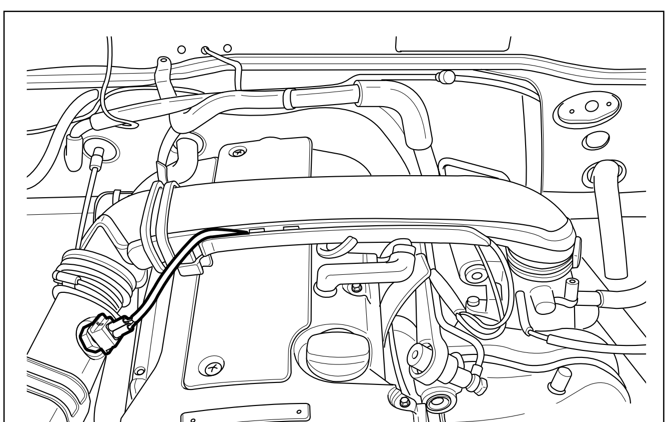

YAA1F710

FUEL RAIL AND INJECTORS (2.3L DOHC)

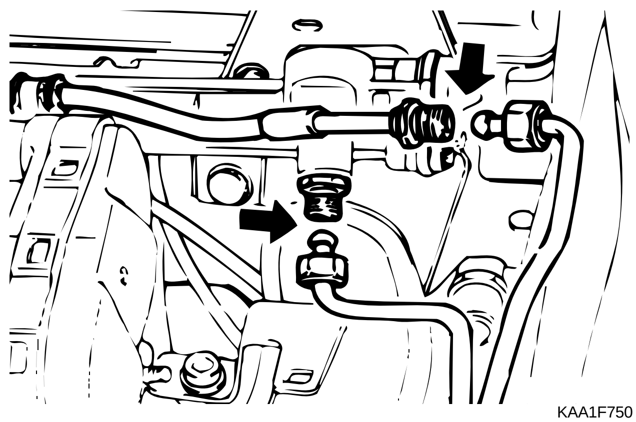
Removal and Installation Procedure

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. Discharge the fuel pressure from the fuel pressure test connector.
2. Disconnect the negative cable.
3. Disconnect the vacuum hose from the fuel pressure regulator.


KAC1F250

4. Disconnect the Intake Air Temperature (IAT) sensor connector.
5. Remove the intake air duct clamps.
6. Remove the intake air duct.


KAA1F750

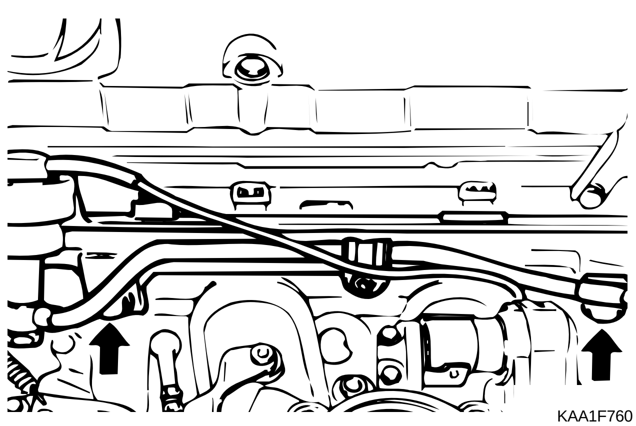
7. Remove the fuel return and supply line.

Notice: For removal, cover around parts with cloths not to be stained by fuel. In case of checking the injector only, do not remove the fuel return and supply line.

Installation Notice

Tightening Torque	25 N•m (18 lb-ft)

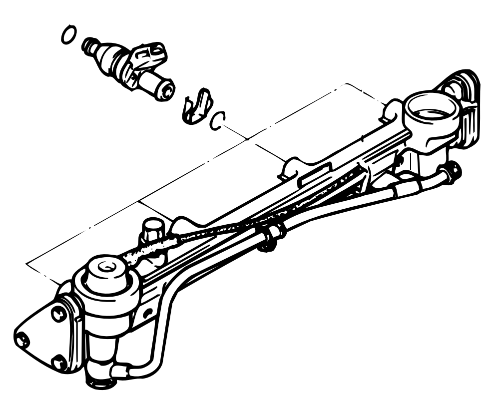
8. Remove the for injector connectors.


KAA1F760

9. Remove the two combination bolts.

Installation Notice

Tightening Torque	25 N•m (18 lb-ft)


KAA1F770

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 injector spray tips. Prevent dire and other contaminants from entering open lines and passages. Fittings should be capped and holes plugged during service

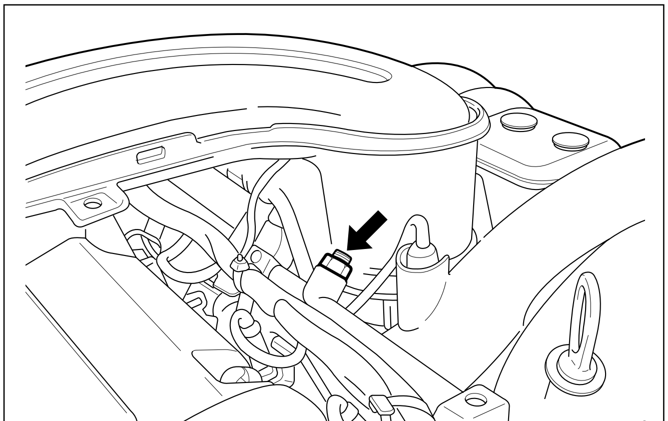
Important: If an injection becomes separated from the rail and remains the cylinder head, replace the injector O-ring seals and the retaining clip.

10. Remove the injectors and the fuel rail carefully.
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. Lubricate the new fuel injector O-ring with engine oil. Install the new O-ring on the fuel injectors.
15. Perform a leak check of the fuel rail and fuel injectors.
16. Installation should follow the removal procedure in the reverse order.

FUEL RAIL AND INJECTORS (3.2L DOHC)

Removal and Installation Procedure

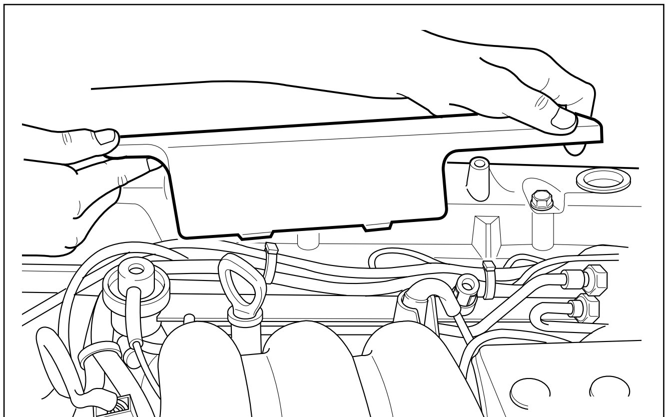
Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.


KAA1F440

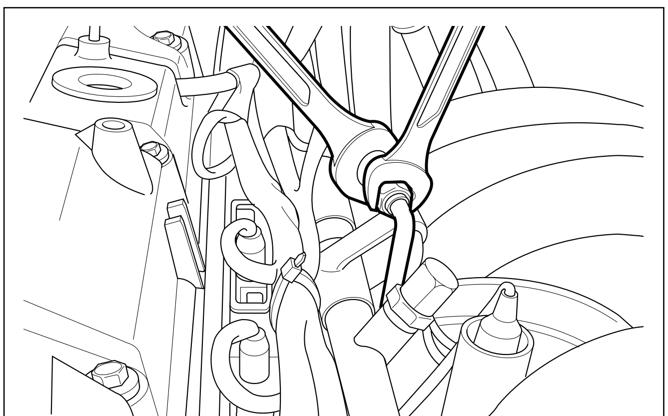
1. Discharge the fuel pressure from the fuel pressure test connector.
2. Disconnect the negative cable.
3. Disconnect the vacuum hose from the fuel pressure regulator.
4. Remove the cable guide.
5. Disconnect the Hot Film Air Mass (HFM) sensor connector.
6. Remove the intake air duct mounting bolts.

Installation Notice

Tightening Torque	9 N•m (80 lb-in)


KAA1F060

7. Remove the intake air duct clamps.
8. Remove the intake air duct.


KAA1F070

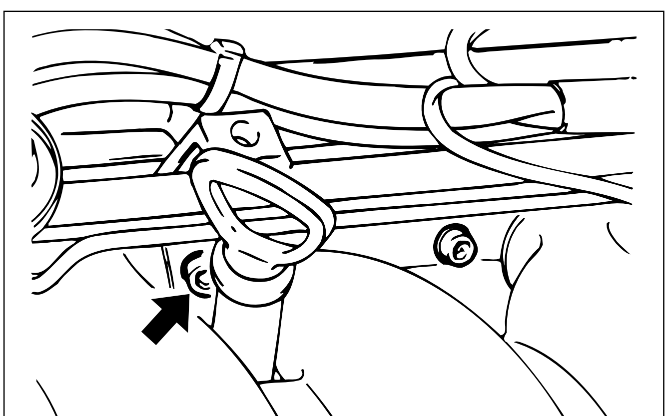
9. Remove the fuel return and supply line.

Notice: For removal, cover around parts with cloths not to be stained by fuel. In case of checking the injector only, do not remove the fuel return and supply line.

Installation Notice

Tightening Torque	25 N•m (18 lb-ft)

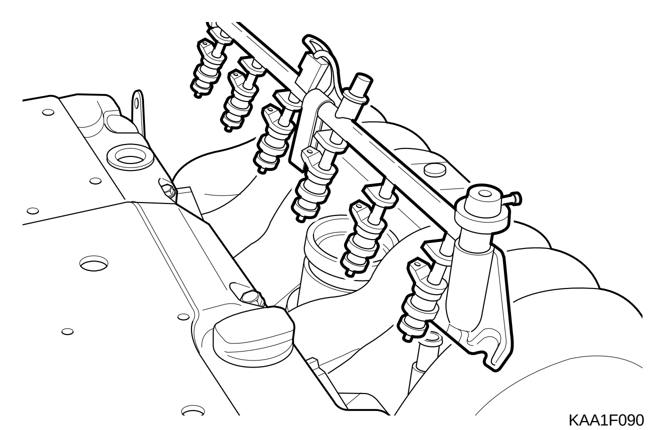
10. Remove the six injector connectors.


KAA1F080

11. Remove the two left and two right bolts and one center bolt of the fuel rail assembly from the intake manifold.

Installation Notice

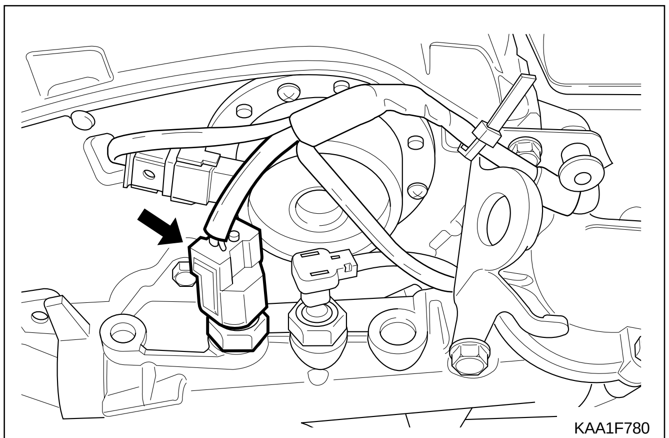
Tightening Torque	25 N•m (18 lb-ft)


KAA1F090

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 injector spray tips. Prevent dire and other contaminants from entering open lines and passages. Fittings should be capped and holes plugged during service

Important: If an injection becomes separated from the rail and remains the cylinder head, replace the injector O-ring seals and the retaining clip.

12. Remove the injectors and the fuel rail carefully.
13. Remove the fuel injector retainer clips.
14. Remove the fuel injectors by pulling them down and out.
15. Discard the fuel injector O-rings.
16. Lubricate the new fuel injector O-ring with engine oil. Install the new O-ring on the fuel injectors.
17. Perform a leak check of the fuel rail and fuel injectors.
18. Installation should follow the removal procedure in the reverse order.


KAA1F780

ENGINE COOLANT TRMPERATURE SENSOR (2.3L DOHC)

Removal and Installation Procedure

1. Relieve the coolant system pressure.
2. Disconnect the negative battery cable.
3. Remove the protection cover.
4. Disconnect the Engine Coolant Temperature (ECT) sensor connector.

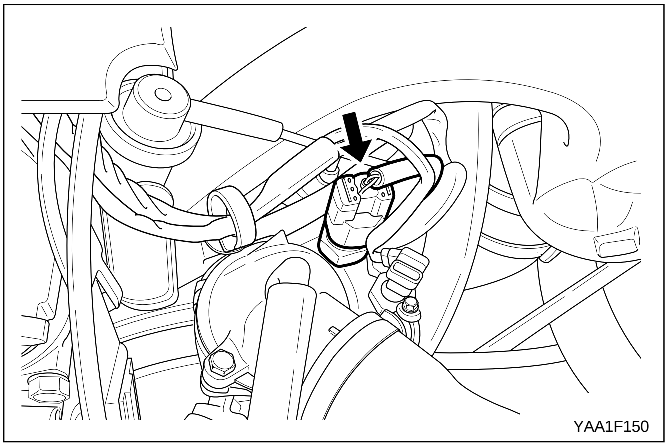
Notice: Take care when handling the ETC sensor. Damage to the sensor will affect the proper operation of the fuel injection system.

5. Remove the ECT sensor.

Installation Notice

Tightening Torque	30 N•m (22 lb-ft)

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


YAA1F150

ENGINE COOLANT TRMPERATURE SENSOR (3.2L DOHC)

Removal and Installation Procedure

1. Relieve the coolant system pressure.
2. Disconnect the negative battery cable.
3. Disconnect the Engine Coolant Temperature (ECT) sensor connector.

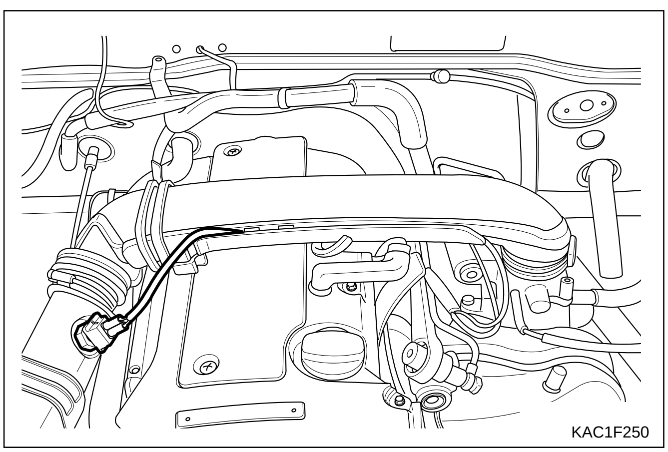
Notice: Take care when handling the ETC sensor. Damage to the sensor will affect the proper operation of the fuel injection system.

4. Remove the ECT sensor.

Installation Notice

Tightening Torque	30 N•m (22 lb-ft)

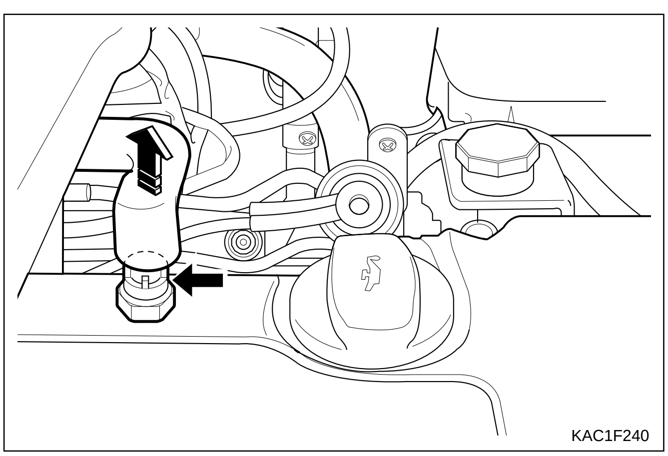
5. Installation should follow the removal procedure in the reverse order.


KAC1F250

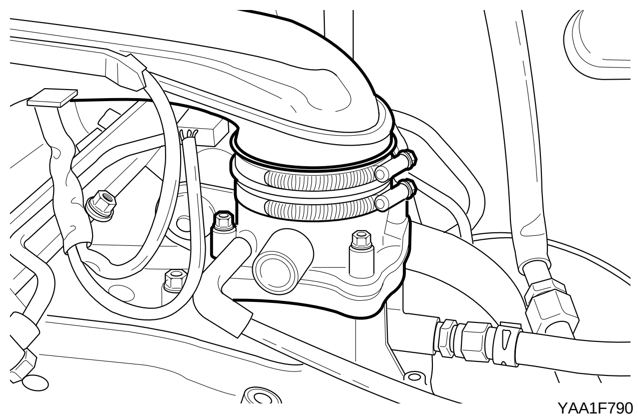
THROTTLE BODY (INTEGRATED WITH THE ACTUATOR) (2.3L DOHC)

Removal and Installation Procedure

1. Disconnect the negative batterry cable.
2. Disconnect Intake Air Temperature (IAT) sensor connector.
3. Remove the intake air duck clamps.


KAC1F240

4. Remove the blow-by hose.
5. Remove the intake air duck.

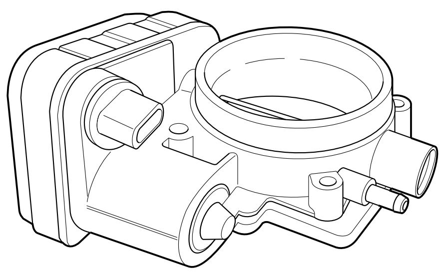

YAA1F790

6. Disconnect the throttle body electrical connector.
7. Remove the throttle body bolts.

Installation Notice

Tightening Torque	12 N•m (106 lb-in)

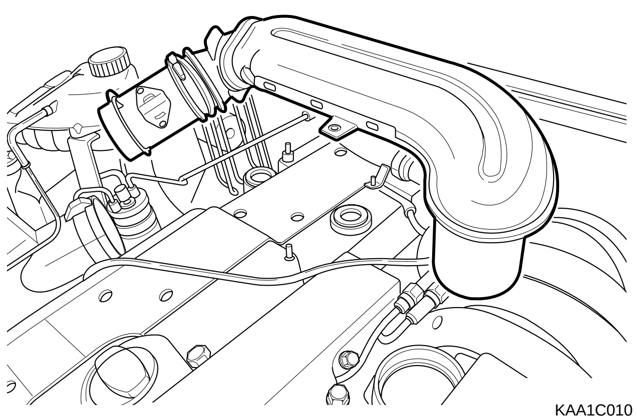
8. Remove the vacuum hose.


KAA1D240

9. Remove the throttle body and discard the gasket.

Important: Use care in cleaning old gasket material. Sharp tools may damage sealing surfaces.

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


KAA1C010

THROTTLE BODY (INTEGRATED WITH THE ACTUATOR) (3.2L DOHC)

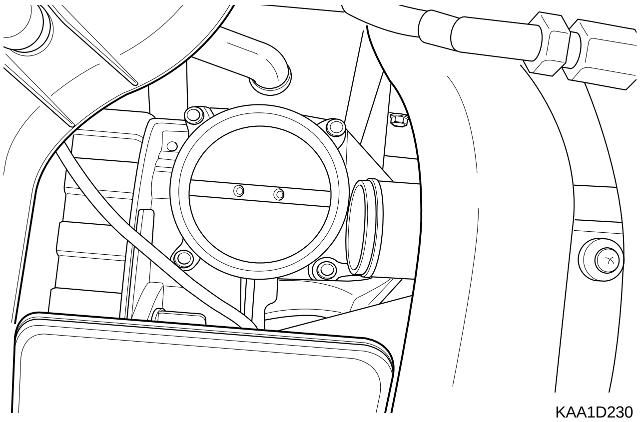
Removal and Installation Procedure

1. Disconnect the negative batterry cable.
2. Disconnect the Hot Film Air Mass (HFM) sensor connector.
3. Disconnect the HFM sensor from the air filter housing.
4. Remove the intake air duct mounting bolts.

Installation Notice

Tightening Torque	9 N•m (80 lb-in)

5. Remove the intake air duck clamps.
6. Remove the intake air duck.



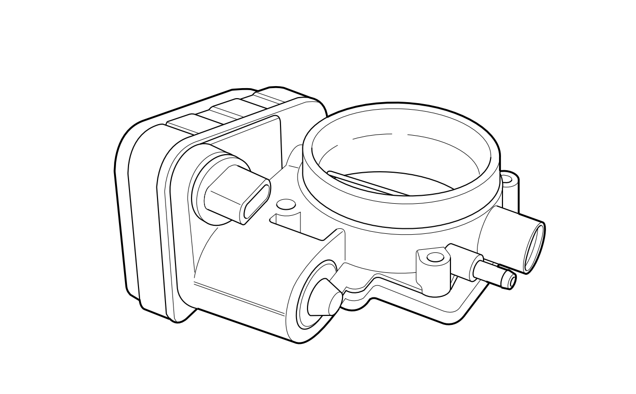
KAA1D230

7. Disconnect the throttle body electrical connector.
8. Remove the throttle body bolts.

Installation Notice

Tightening Torque	12 N•m (106 lb-in)

9. Remove the vacuum hose.

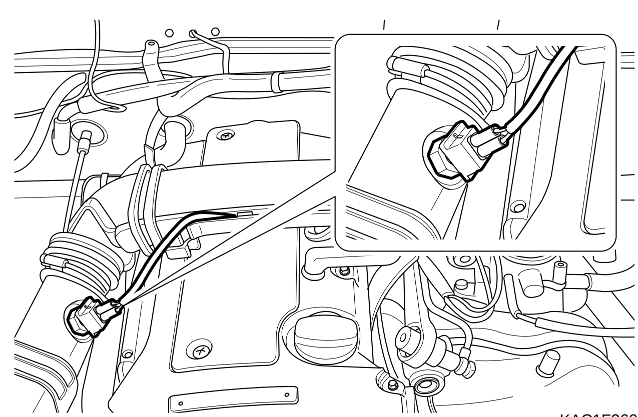


KAA1D240

10. Remove the throttle body and discard the gasket.

Important: Use care in cleaning old gasket material. Sharp tools may damage sealing surfaces.

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



KAC1F260

INTAKE AIR TEMPERATURE SENSOR (2.3L DOHC)

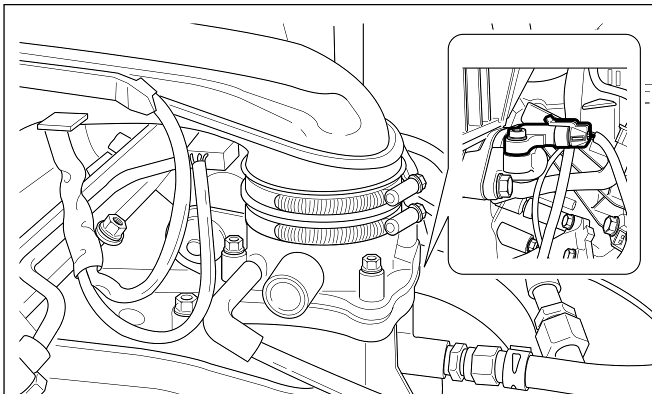
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the Intake Air Temperature (IAT) sensor connector.
3. Remove the IAT sensor.

Installation Notice

Tightening Torque	22 N•m (16 lb-ft)

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



KAC1F270

MANIFOLD ABSOLUTE PRESSURE SENSOR (2.3L DOHC)

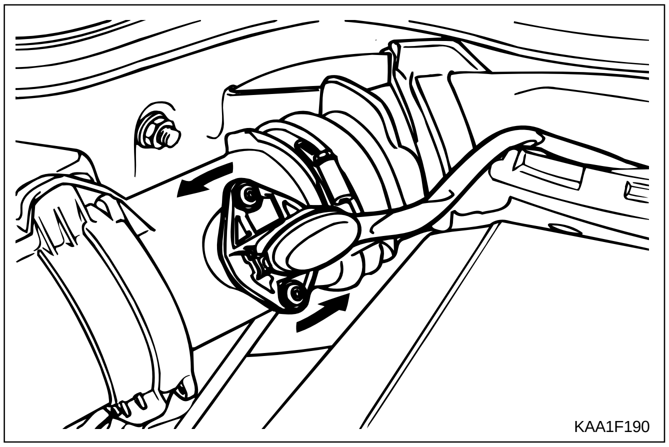
Removal and Installation Procedure

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	8 N•m (71 lb-in)

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


KAA1F190

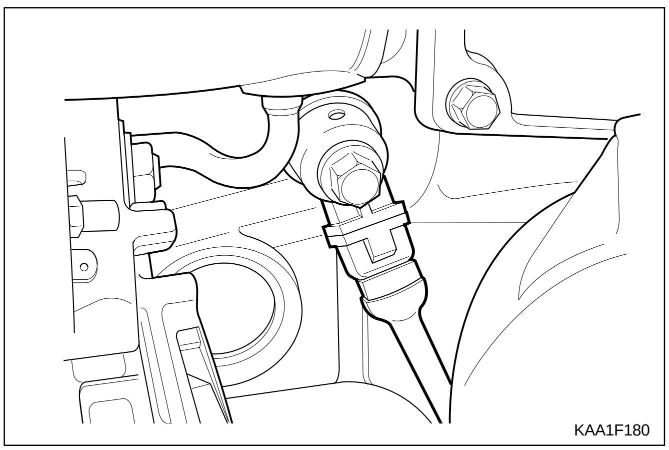
HOT FILM AIR MASS SENSOR (3.2L DOHC)

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the Hot Film Air Mass (HFM) sensor electrical connector.
3. Remove the HFM sensor retaining screws.
4. Turn the HFM sensor coupling in the direction shown in the figure in the left so that it gets separated from the contact surface.

Notice: Make sure the HFM sensor coupling connects completely with the contact surface installation.

5. Remove the HFM sensor.
6. Installation should follow the removal procedure in the reverse order.


KAA1F180

KONCK SENSOR

Removal and installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the knock sensor electrical connector from the intake manifold bracket.
3. Remove the knock sensor mounting bolt from the knock sensor installed on the cylinder bolck.

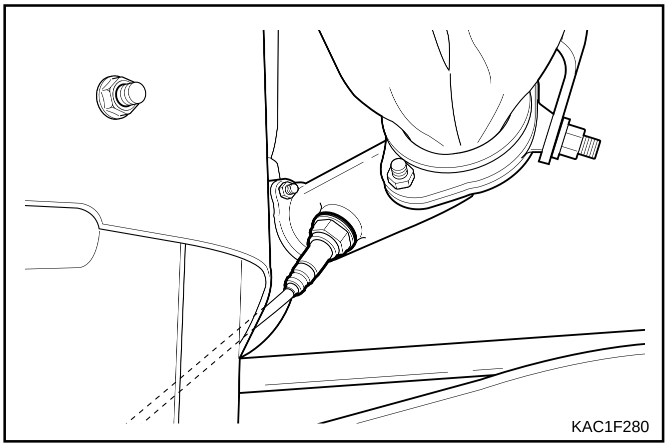
Installation Notice

Tightening Torque	25 N•m (18 lb-ft)

4. Remove the knock sensor.
5. Installation should follow the removal procedure in the reverse order.

OXYGEN SENSOR (2.3L DOHC)

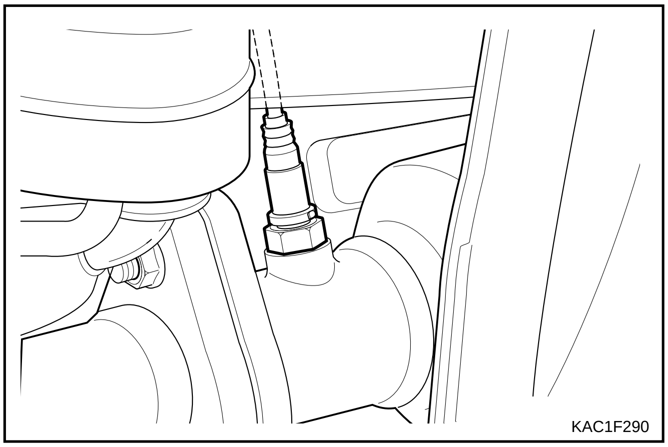
Removal and Installation Procedure



1. Disconnect the negative battery cable.

Notice: The Oxygen (O2) sensor uses a permanently attached pigtail and connector. This pigtail should not be removed from the O2 sensor. Damage or removal of the pigtail or the connector could affect proper operation of the O2 sensor. Do not drop the O2 sensor.

2. Disconnect the electrical connector.



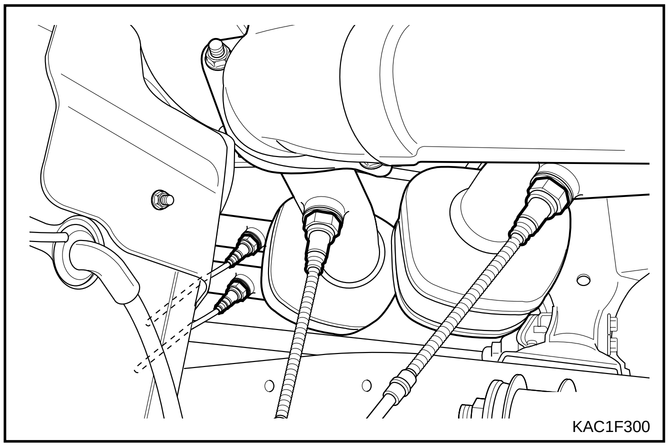
3. Carefully remove the O2 from the exhaust pipe.

Installation Notice

Tightening Torque	55 N•m (41 lb-ft)

Important: a special anti-seize compound is used on the O2 sensor threads. This compound consists consists of a liquid graphite and glass beads. The graphite will burn away, but the glass beads will remain, making the sensor easier to remove. New or serviced sensors will already have the compound applied to the threads. If a sensor is removed from any engine and is to be reinstalled, the threads must have an anti-seize compound applied before reinstallation.

4. Coat the threads of the O2 sensor with an anti-seize compound, if needed.
5. Installation should follow the removal procedure in the reverse order.



OXYGEN SENSOR (3.2L DOHC)

Removal and Installation Procedure

1. Disconnect the negative battery cable.

Notice: The Oxygen (O2) sensor uses a permanently attached pigtail and connector. This pigtail should not be removed from the O2 sensor. Damage or removal of the pigtail or the connector could affect proper operation of the O2 sensor. Do not drop the O2 sensor.

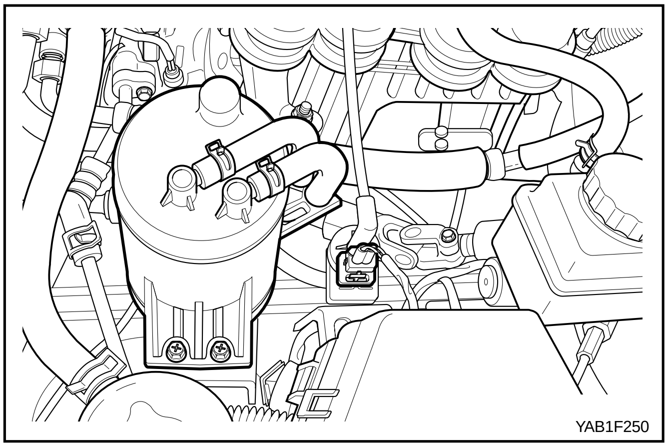
2. Disconnect the electrical connector.
3. Carefully remove the O2 from the exhaust pipe.

Installation Notice

Tightening Torque	55 N•m (41 lb-ft)

Important: a special anti-seize compound is used on the O2 sensor threads. This compound consists consists of a liquid graphite and glass beads. The graphite will burn away, but the glass beads will remain, making the sensor easier to remove. New or serviced sensors will already have the compound applied to the threads. If a sensor is removed from any engine and is to be reinstalled, the threads must have an anti-seize compound applied before reinstallation.

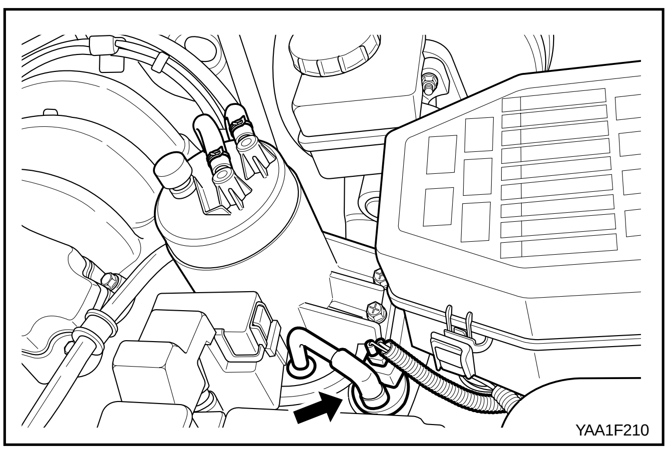
4. Coat the threads of the O2 sensor with an anti-seize compound, if needed.
5. Installation should follow the removal procedure in the reverse order.



PURGE CONTROL VALVE (2.3L DOHC)

Removal and Installation Procedure

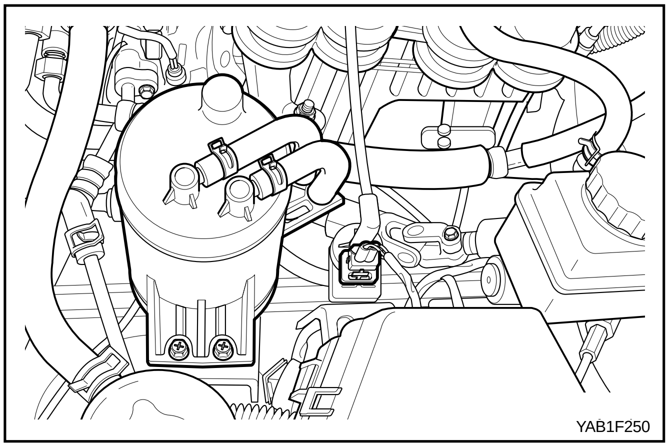
1. Disconnect the negative battery cable.
2. Disconnect the purge control valve connector.
3. Disconnect the throttle body-to-purge control valve hose from the purge control valve.
4. Disconnect the canister-to-purge control valve hose from the purge control valve.
5. Remove the purge control valve.
6. Installation should follow the removal procedure in the reverse order.



PURGE CONTROL VALVE (3.2L DOHC)

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the purge control valve connector.
3. Disconnect the throttle body-to-purge control valve hose from the purge control valve.
4. Disconnect the canister-to-purge control valve hose from the purge control valve.
5. Remove the purge control valve.
6. Installation should follow the removal procedure in the reverse order.


YAB1F250

CANISTER (2.3L DOHC)

Removal and Installation Procedure

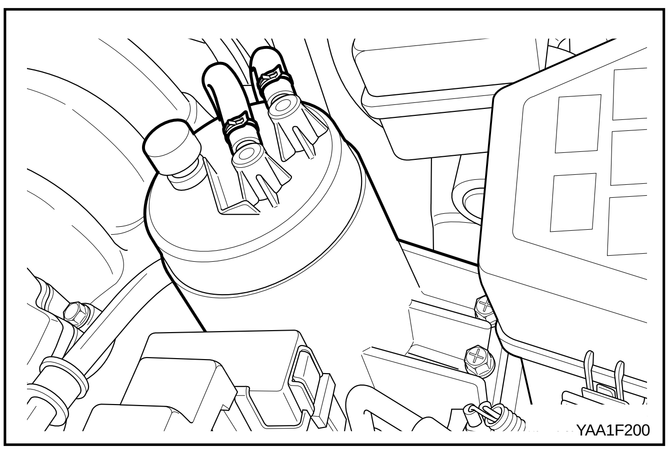
Caution: Canister and vacuum hoses contain fuel vapors. Do not smoke in the area or permit an open flame.

1. Disconnect the fuel tank-to-canister hose form the canister.
2. Disconnect the canister-to-purge control valve hose form the canister.
3. Remove the canister mounting bolts.

   Installation Notice

Tightening Torque	6 N•m (53 lb-in)

4. Remove the canister.
5. Installation should follow the removal procedure in the reverse order.


YAA1F200

CANISTER (3.2L DOHC)

Removal and Installation Procedure

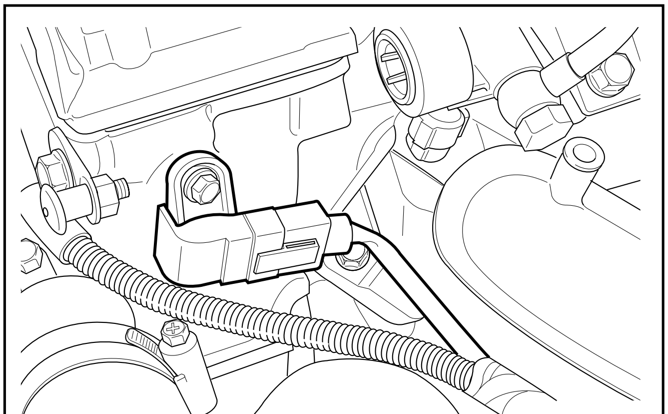
Caution: Canister and vacuum hoses contain fuel vapors. Do not smoke in the area or permit an open flame.

1. Disconnect the fuel tank-to-canister hose form the canister.
2. Disconnect the canister-to-purge control valve hose form the canister.
3. Remove the canister mounting bolts.

   Installation Notice

Tightening Torque	6 N•m (53 lb-in)

4. Remove the canister.
5. Installation should follow the removal procedure in the reverse order.


YAA1F810

CAMSHAFT POSITION SENSOR (2.3L DOHC)

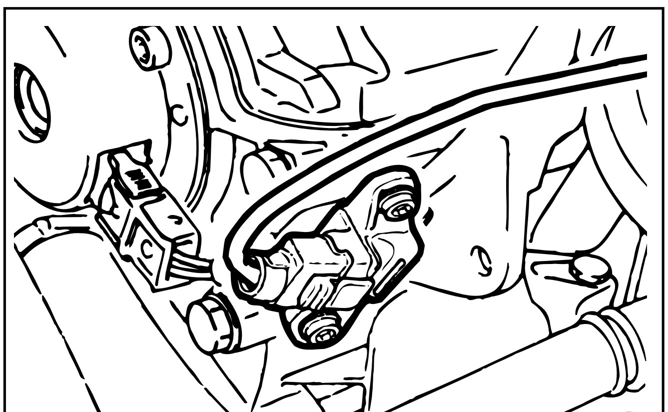
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the Camshaft Position (CMP) sensor.
3. Remove the CMP sensor retaining bolt.

Installation Notice

Tightening Torque	10 N•m (89 lb-in)

4. Check the O-ring for damage and replace it if necessary
5. Installation should follow the removal procedure in the reverse order.


KAA1C170

CAMSHAFT POSITION SENSOR (3.2L DOHC)

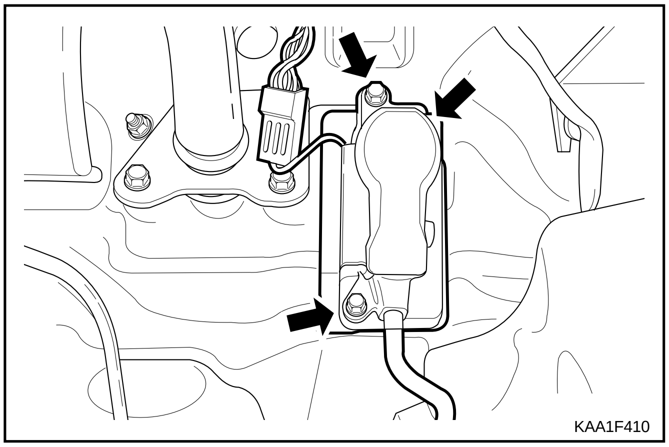
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the Camshaft Position (CMP) sensor.
3. Remove the CMP sensor retaining bolt.

Installation Notice

Tightening Torque	10 N•m (89 lb-in)

4. Check the O-ring for damage and replace it if necessary
5. Installation should follow the removal procedure in the reverse order.



ACCELERATOR PEDAL POSITION SENSOR

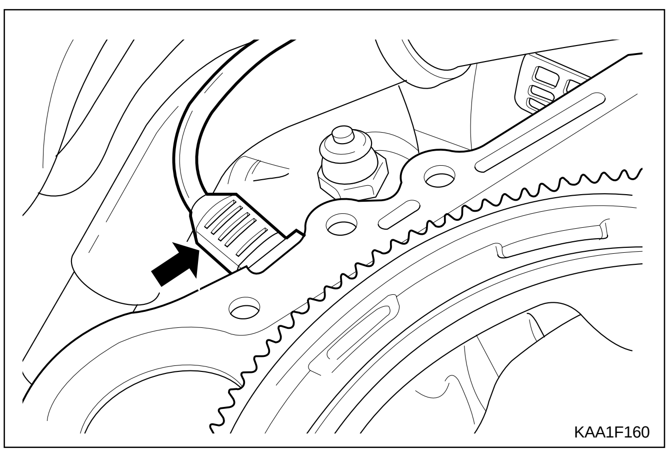
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the accelerator pedal position sensor connector.
3. Unscrew the bolts and nut.

Installation Notice

Tightening Torque	6 N•m (53 lb-in)

4. Remove the accelerator pedal and sensor assembly.
5. Installation should follow the removal procedure in the reverse order.



CRANKSHAFT POSITION SENSOR

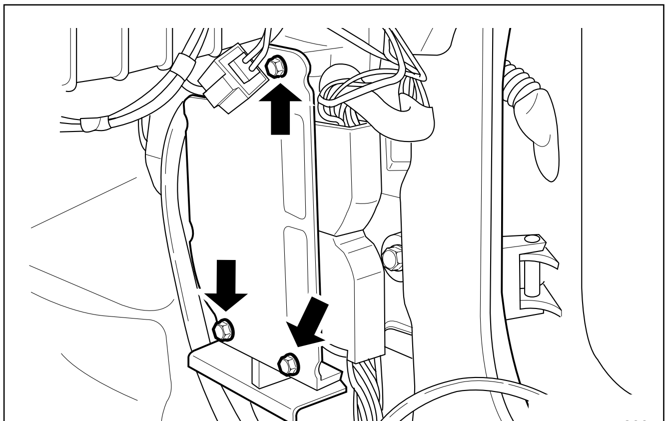
Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector at the Crankshaft Position (CKP) sensor.
3. Remove the CKP sensor retaining bolt.

Installation Notice

Tightening Torque	10 N•m (89 lb-in)

4. Installation should follow the removal procedure in the reverse order.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ENGINE CONTROL MODULE

Removal and installation Procedure

1. Disconnect the negative battery cable.
2. Remove the cowl side trim form passenger side. Refer to *Section 9G, Interior trim.*
3. Remove the four securing nuts for the Engine Control Module (ECM) from the mounting bracket.

Installation Notice

Tightening Torque	10 N•m (89 lb-in)

4. Pull out the ECM from the bracket.
5. Disconnect the vehicle side coupling.
6. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N · m	Lb - Ft	Lb - In
Camshaft Position Sensor Retaining Bolt	10	-	89
Canister Mounting Bolts	6	-	53
Combination Bolts	25	18	-
Coolant Temperature Sensor	30	22	-
Crankshaft Position Sensor Retaining Bolt	10	-	89
Engine Control Module (ECM) Mounting Nuts	10	-	89
Fuel Filler Mounting Bracket Bolt	6	-	53
Fuel Filter Lines	28	21	-
Fuel Pressure Test Connector	25	18	-
Fuel Rail Assembly Bolts	25	18	-
Fuel Return and Supply Lines	25	18	-
Fuel Tank Retaining Nuts	38	28	-
Intake Air Duct Mounting Bolts	9	-	80
Intake Air Temperature Sensor	22	16	-
Knock Sensor Mounting Bolt	25	18	-
Manifold Absolute Pressure Sensor Retaining Bolt	8	-	71
Oxygen Sensor	55	41	-
Pedal Position Sensor Mounting Bolts and Nut	6	-	53
Throttle Body Bolts	12	-	106

ENGINE DATA DISPLAY TABLES

Parameter	Unit	Value
Engine Coolant Temp	°C	greater than 95 °C after warm up
Intake Air Temp	°C	-40 ~ 30 °C (varies with ambient temp. or engine mode)
Engine RPM	rpm	700 ± 50 (P/N), 600 ± 50 (D)
Regular RPM	rpm	700 ± 50 (P/N), 600 ± 50 (D)
Engine Load	%	18 ~ 25 %
Mass Air Flow Meter	Kg/h	16 ~ 25 Kg/h
Throttle Position Sensor	%	0 % (up to 100 % at the wide open throttle)
Spark Advance	°	8 ° (6 ~ 9 °)
Indicated Engine Torque	Nm	Varies with engine condition
Injection Time	ms	3 ~ 5 ms
Battery Voltage	V	13.5 ~ 14.1 v (engine running)
Front Axle Speed	Km/h	0 ~ 265 Km/h
Rear Axle Speed	Km/h	0 ~ 265 Km/h
Accel. Pedal Position 1	V	0.4 ~ 4.8 V
Accel. Pedal Position 2	V	0.2 ~ 2.4 V
Throttle Position 1	V	0.3 ~ 4.6 V
Throttle Position 2	V	0.3 ~ 4.6 V
Fuel Integrator	[ ]	0.8 ~ 1.2
Oxygen Sensor	mV	100 ~ 90 mV
A/C S/W Condition	1=ON/0=OFF	-
Full Load State	1=ON/0=OFF	-
Shift Gear State (A/T)	1=ON/0=OFF	-
A/C Control State	1=ON/0=OFF	-
Clutch Switch (M/T)	1=ON/0=OFF	-
Cam Actuator State	1=ON/0=OFF	-
Knocking Control	1=ON/0=OFF	-
Protect Mission	1=ON/0=OFF	-
Purge Control Valve	1=ON/0=OFF	-
Lambda Function	1=ON/0=OFF	-
Catalyst Heating	1=ON/0=OFF	-
Overrun Fuel Cut	1=ON/0=OFF	-
Full Fuel Cut	1=ON/0=OFF	-
Brake Switch	1=ON/0=OFF	-
Idle RPM Setting (P/N)	rpm	-
Idle RPM Setting (D/R)	rpm	-

ENGINE DATA DISPLAY TABLE DEFINITION

ECM Data Description

The following information will assist in diagnosing emission or drivability problems. A first technician can view the displays while the vehicle is being driven by second technician. Refer to Euro On-Board Diagnostic (EOBD) System Check for additional information.

Accel. Pedal Position

This sensor works with the TP sensor to provide input to the ECM regarding driver requested accelerator pedal and throttle angle at the throttle body.

A/C S/W Condition

The A/C Relay represents the commanded state of the A/C clutch control relay. The A/C clutch should be engaged when the scan tool displays ON.

Engine Coolant Temperature

The Engine Coolant Temperature (ECT) sensor sends engine temperature information to the ECM. The ECM supplies 5 volts to the engine coolant temperature sensor circuit. The sensor is a thermistor which changes in-ternal resistance as temperature changes. When the sensor is cold (internal resistance high), the ECM monitors a high voltage which it interprets as a cold engine. As the sensor warms (internal resistance decreases), the voltage signal will decrease and the ECM will interpret the lower voltage as a warm engine.

Engine Load

Indicates engine load based on manifold absolute pressure. The higher the percentage, the more load the engine is under.

Engine RPM

Engine RPM is computed by the ECM from the fuel control reference input. It should remain close to desired idle under the various engine loads with the engine idling.

Fuel Integrator

The fuel integrator is derived from the short term fuel trim value. The fuel integrator is used for the long term correction of the fuel delivery. A value of 1 (0%) indicates that the fuel delivery requires no compensation in order to maintain a 14.7:1 air to fuel ratio. A value below 1 means that the fuel system is too rich and the fuel delivery is being reduced. The ECM is decreasing the injector pulse width. A value above 1 indicates that a lean condition exists for which the ECM is compensating.

Injection Time

Indicates the base Pulse Width Modulation (PWM) or ON time of the indicated cylinder injector in milliseconds.

When the engine load is increased, the injector pulse width will increase.

Intake Air Temperature

The ECM converts the resistance of the Intake Air Temperature (IAT) sensor to degrees in the same manner as the Engine Coolant Temperature (ECT) sensor. Intake air temperature is used by the ECM to adjust fuel delivery and spark timing according to incoming air density.

Mass Air Flow

Hot film air flow sensor detects the air mass supplied to the engine and intake temperature. The air mass supplied to the engine flows through the mass air flow sensor in the air intake port and thus influence at the hot film sensor. At the same time, the intake air temperature is detected by an integrated NTC resistor.

Misfire Count for catalyst damage #1-6

Indicates the number of current misfires that are present in the indicated cylinder. Increments only when misfire is current.

Oxygen Sensor

The pre-converter Oxygen Sensor (O2S 1and O2S 3) reading represents the exhaust oxygen sensor output voltage. This voltage will fluctuate constantly between 100 mv (lean exhaust) and 900 mv (rich exhaust) when the system is operating in a Closed Loop.

The post-converter Heated Oxygen Sensor (O2S 2 and O2S 4) represents the exhaust oxygen output voltage past the catalytic converter. This voltage remains inactive, or the voltage will appear lazy within a range of 100 mv (lean exhaust) and 900 mV (rich exhaust) when operating in a Closed Loop.

Purge Control Valve

The purge control valve is activated by the ECM frequency according with the engine rotating speed to adjust the purification rate. The purification rate is determined by the continuous solenoid opening interval.

Regular RPM

The ECM commands the idle speed. The ECM compensates for various engine loads in order to maintain the desired idle speed. The actual engine speed should remain close to the desired idle under the various engine loads with the engine idling.

Spark Advance

This is a display of the spark advance Ignition Coil calculation which the ECM is programming in the ignition system. It computes the desired spark advance using data such as engine temperature, rpm, engine load, vehicle speed and operating mode.

FUEL SYSTEM SPECIFICATION

Use Only Unleaded Fuel Rated at 89 Octane or Higher

Fuel quality and additives contained in fuel have a significant effect on power output, drivability, and life of the engine. Fuel with too low an octane number can cause engine knock.

Caution: Use of fuel with an octane number lower than 89 may damage engine and exhaust system.

Notice: To prevent accidental use of leaded fuel, the nozzles for leaded fuel are larger, and will not fit the fuel filler neck of your vehicle.

Do Not Use Methanol

Fuels containing methanol (wood alcohol) should not be used in vehicle.

This type of fuel can reduce vehicle performance and damage components of the fuel system.

Caution: Use of methanol may damage the fuel system.

Vehicle Fueling from Drums or Storage Containers

For safety reasons (particularly when using noncommercial fueling systems) fuel containers, pumps and hoses must be properly earthed.

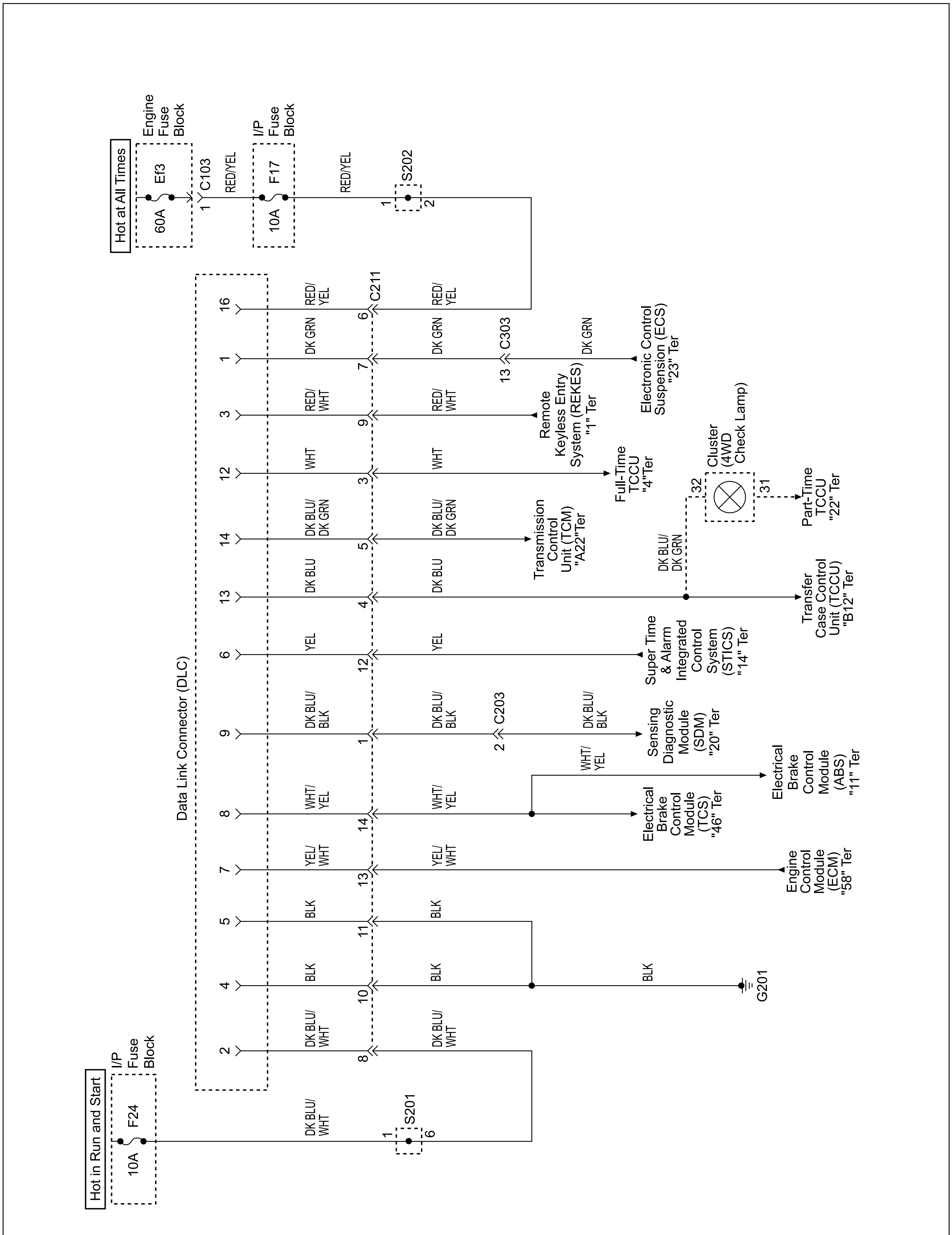
Static electricity build up can occur under certain atmospheric and fuel flow conditions if unearthed hoses, particularly plastic, are fitted to the fuel-dispensing pump. It is therefore recommended that earthed pumps with in-tegrally earthed hoses be used, and that storage containers be properly earthed during all noncommercial fueling operations.

Temperature Vs Resistance

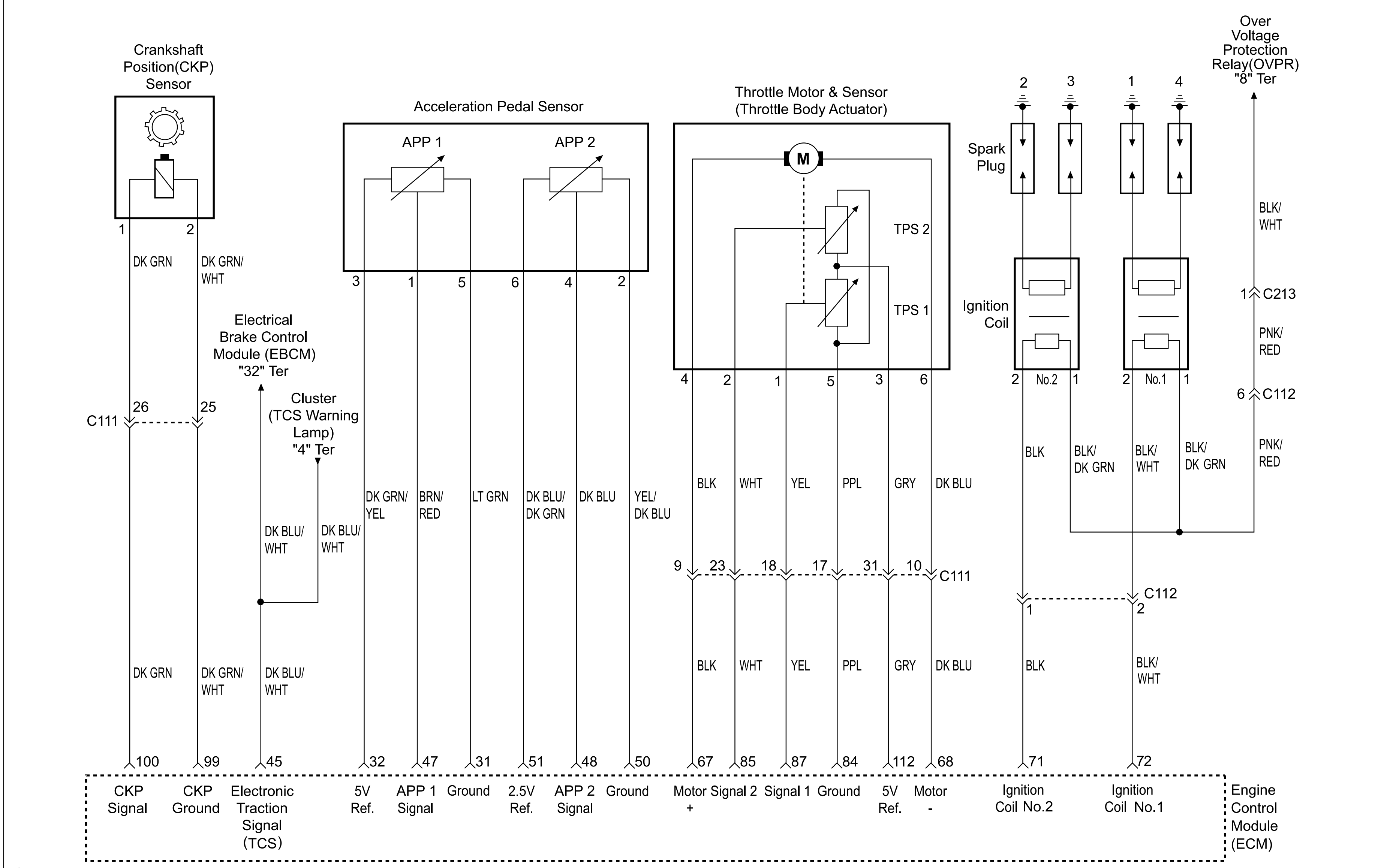
℃	°F	ECT sensor	IAT sensor
		OHMS (Ω)	
Temperature vs Resistance Values (Approximate)			
130	266	88	102
120	248	111.6	127
110	230	143	159
100	212	202	202
90	194	261	261
80	176	340	340
70	158	452	452
60	140	609	609
50	122	835	835
40	113	1166	1166
30	86	1662	1662
20	68	2420	2420
10	50	3604	3604
0	32	5499	5499
-10	14	8609	8609
-20	-4	13850	13850
-30	-22	22960	22960
-40	-40	39260	39260

SCHEMATIC AND ROUTING DIAGRAMS

ECM WIRING DIAGRAM (2.3L DOHC - 1 OF 7) (MSE 3.53D)



ECM WIRING DIAGRAM (2.3L DOHC - 2 OF 7) (MSE 3.53D)



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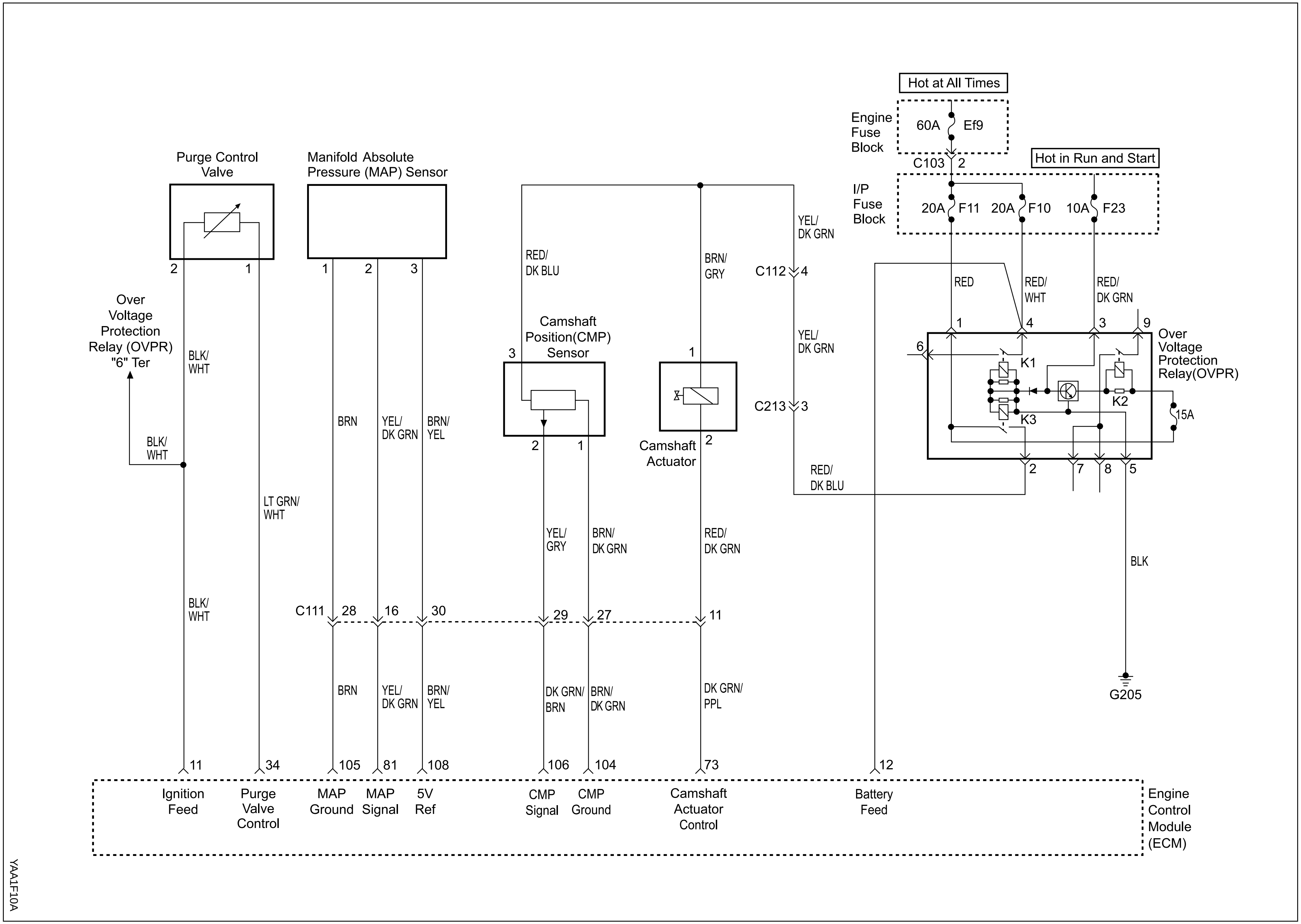
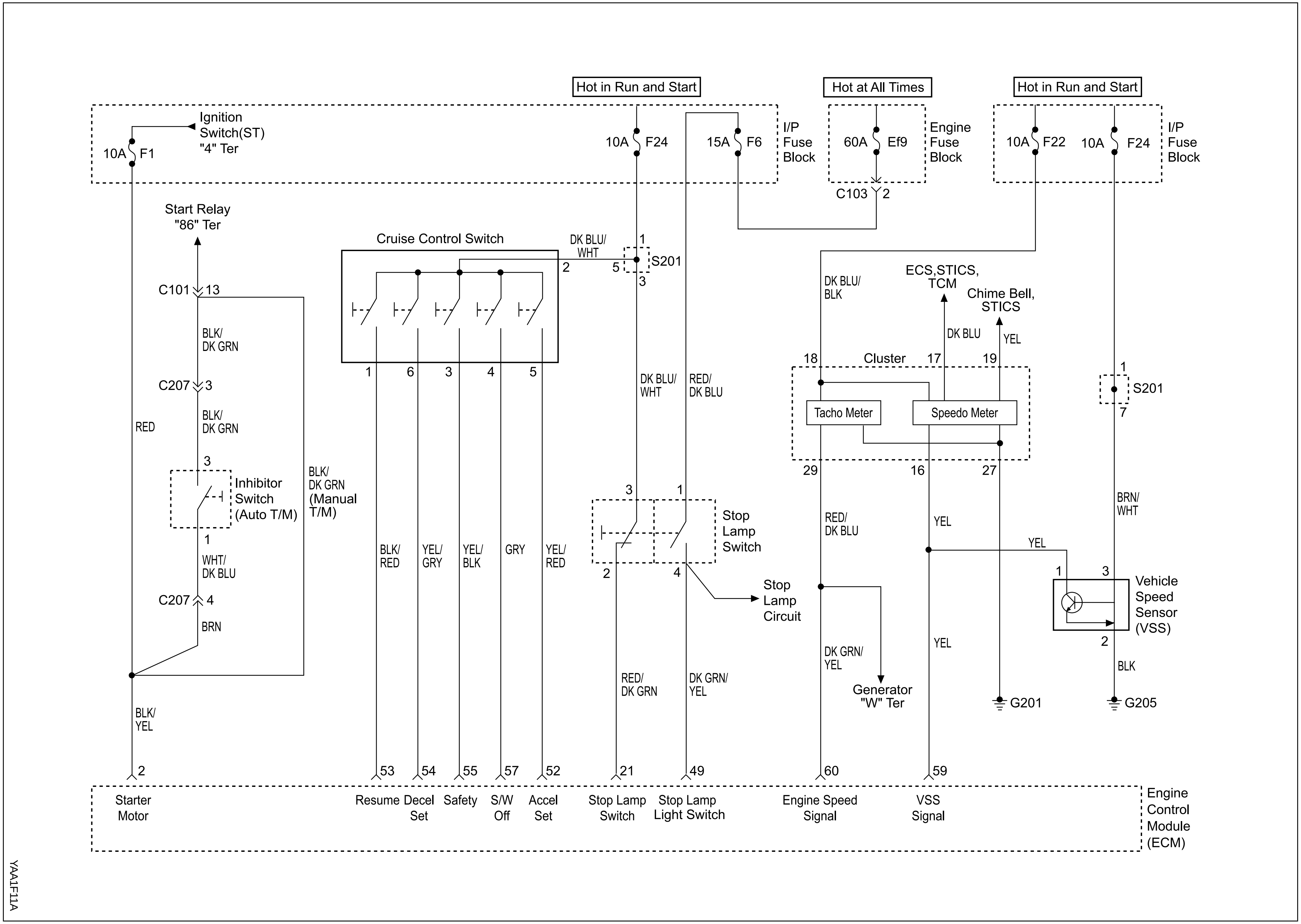
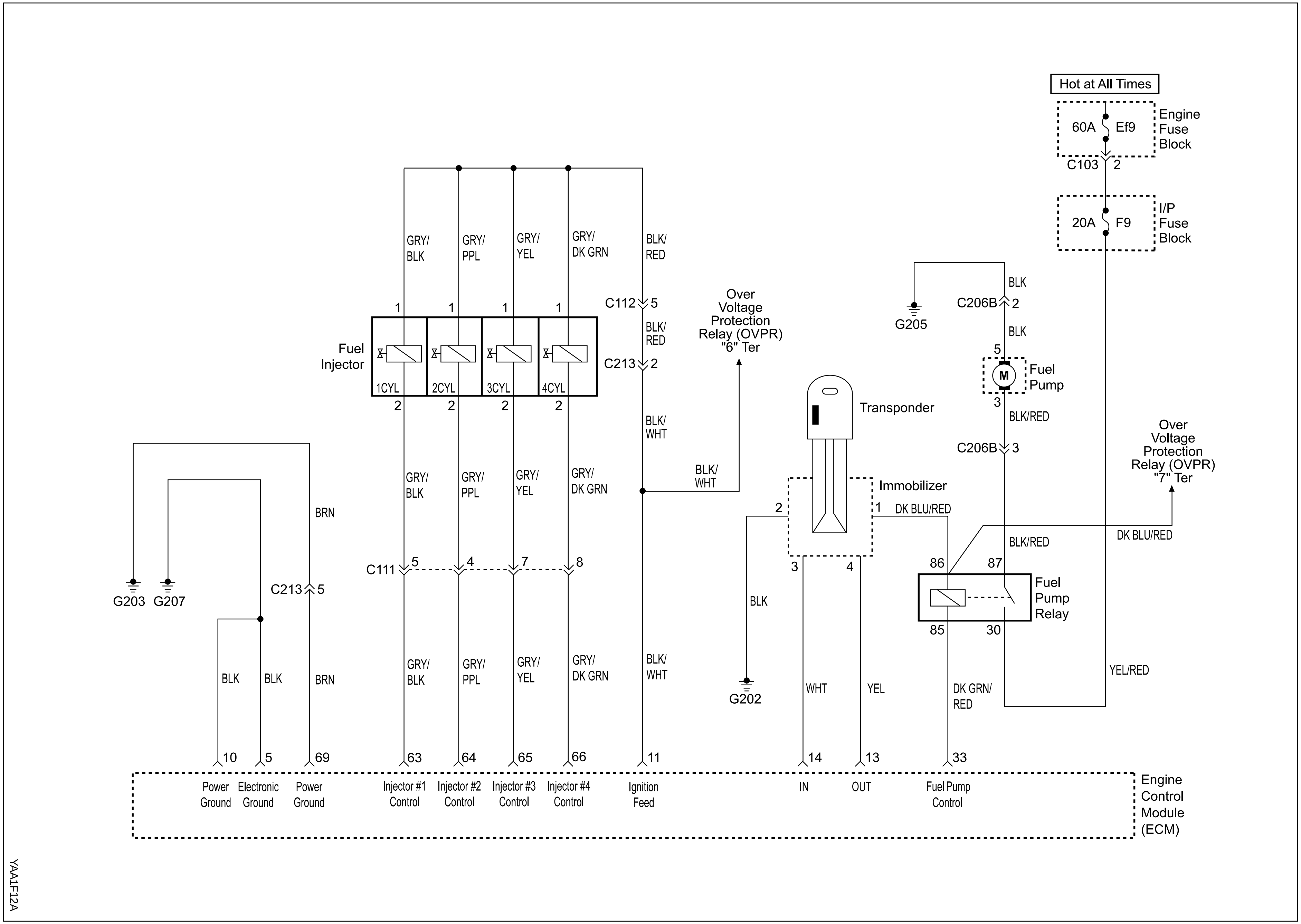
ECM WIRING DIAGRAM (2.3L DOHC - 3 OF 7) (MSE 3.53D)



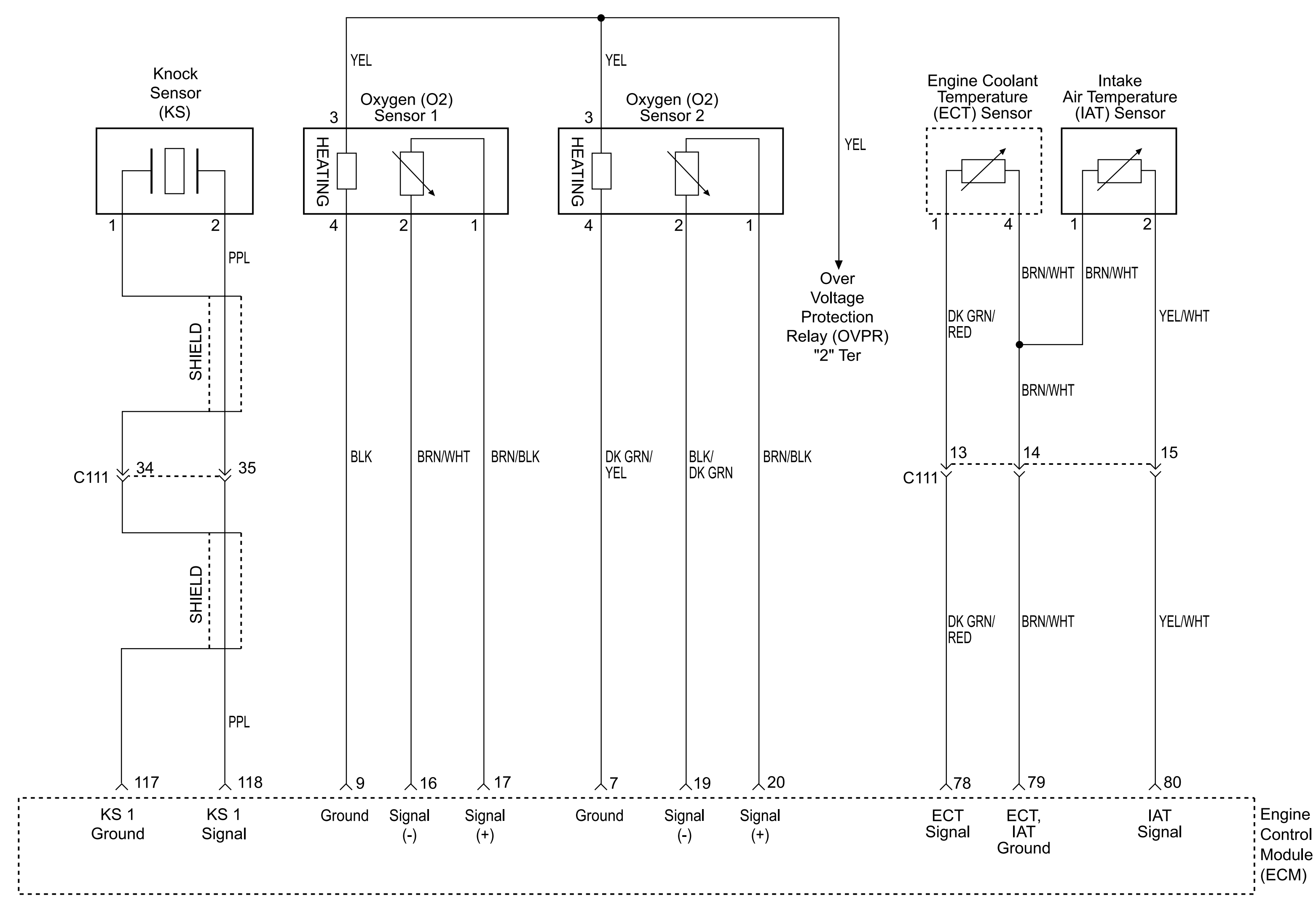
ECM WIRING DIAGRAM (2.3L DOHC - 4 OF 7) (MSE 3.53D)



ECM WIRING DIAGRAM (2.3L DOHC - 5 OF 7) (MSE 3.53D)



ECM WIRING DIAGRAM (2.3L DOHC - 6 OF 7) (MSE 3.53D)



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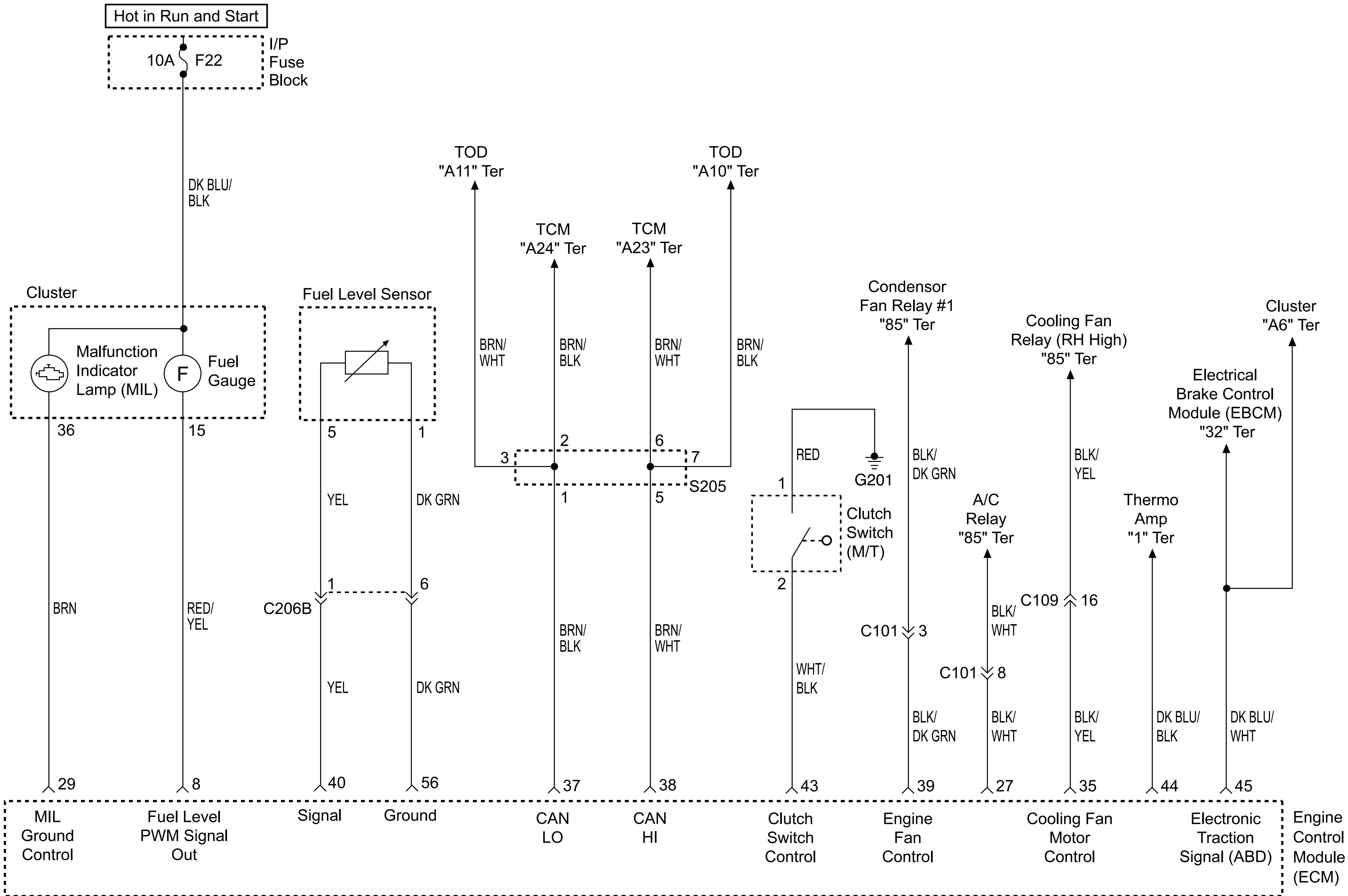
ECM WIRING DIAGRAM (2.3L DOHC - 7 OF 7) (MSE 3.53D)



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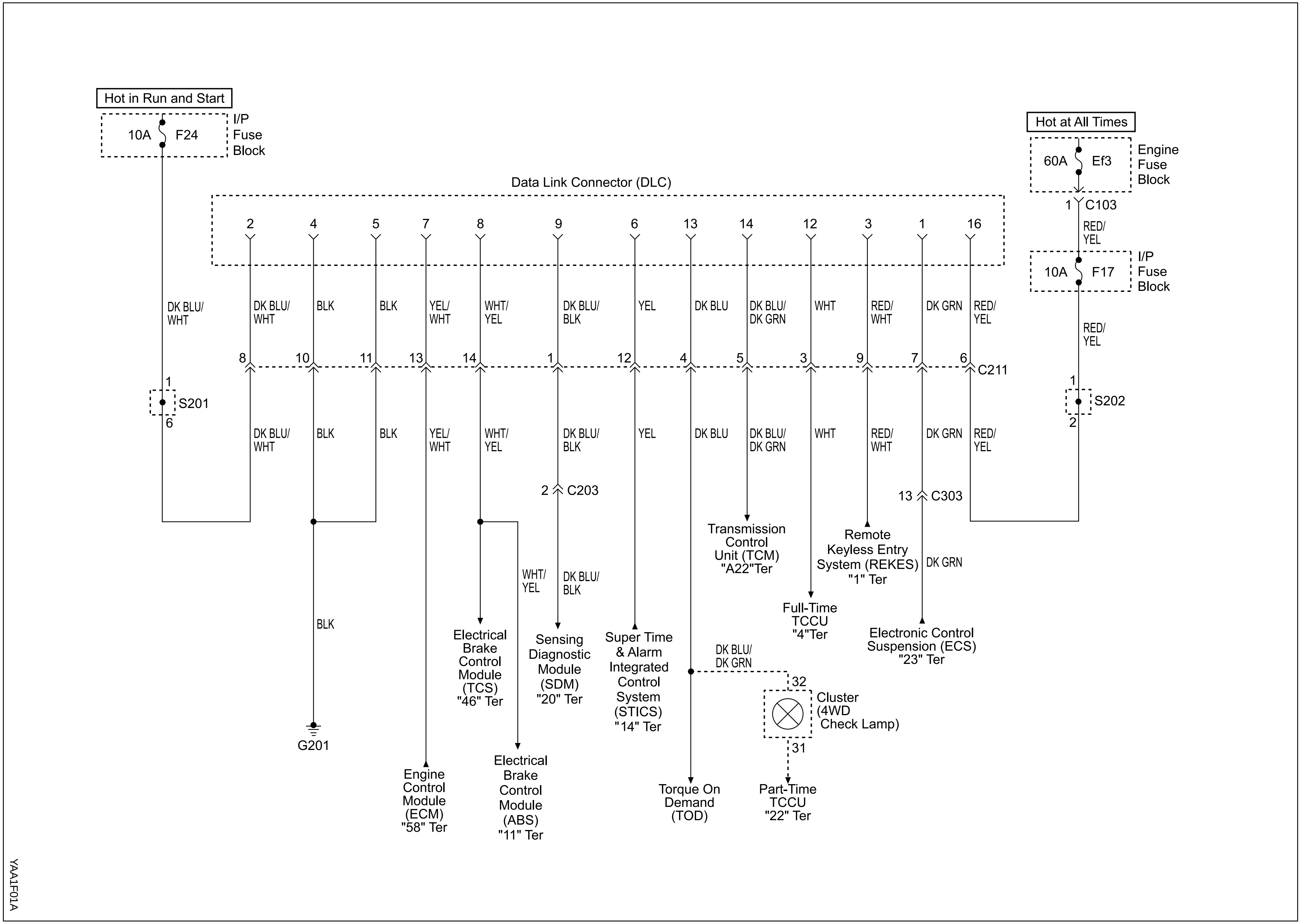
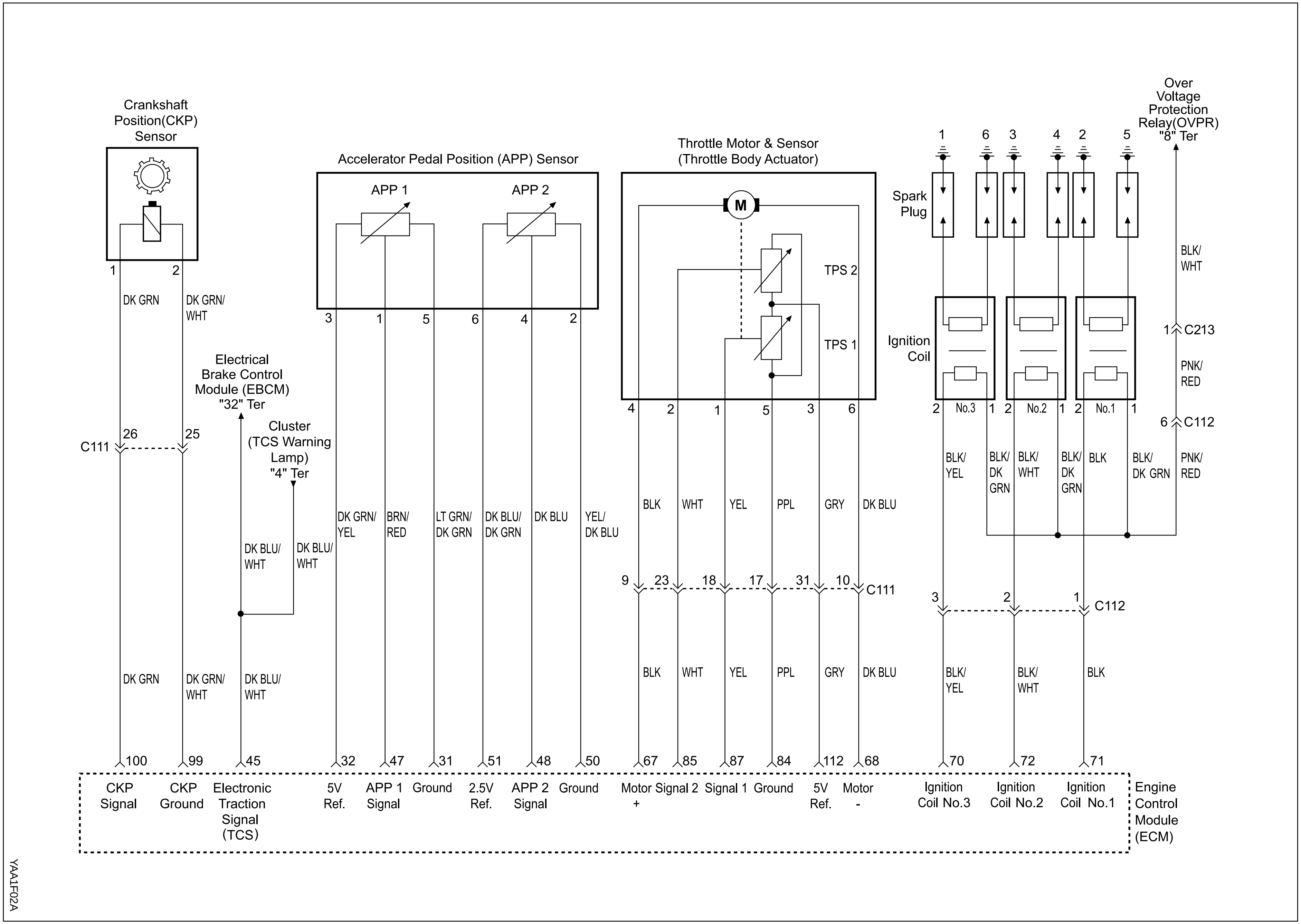
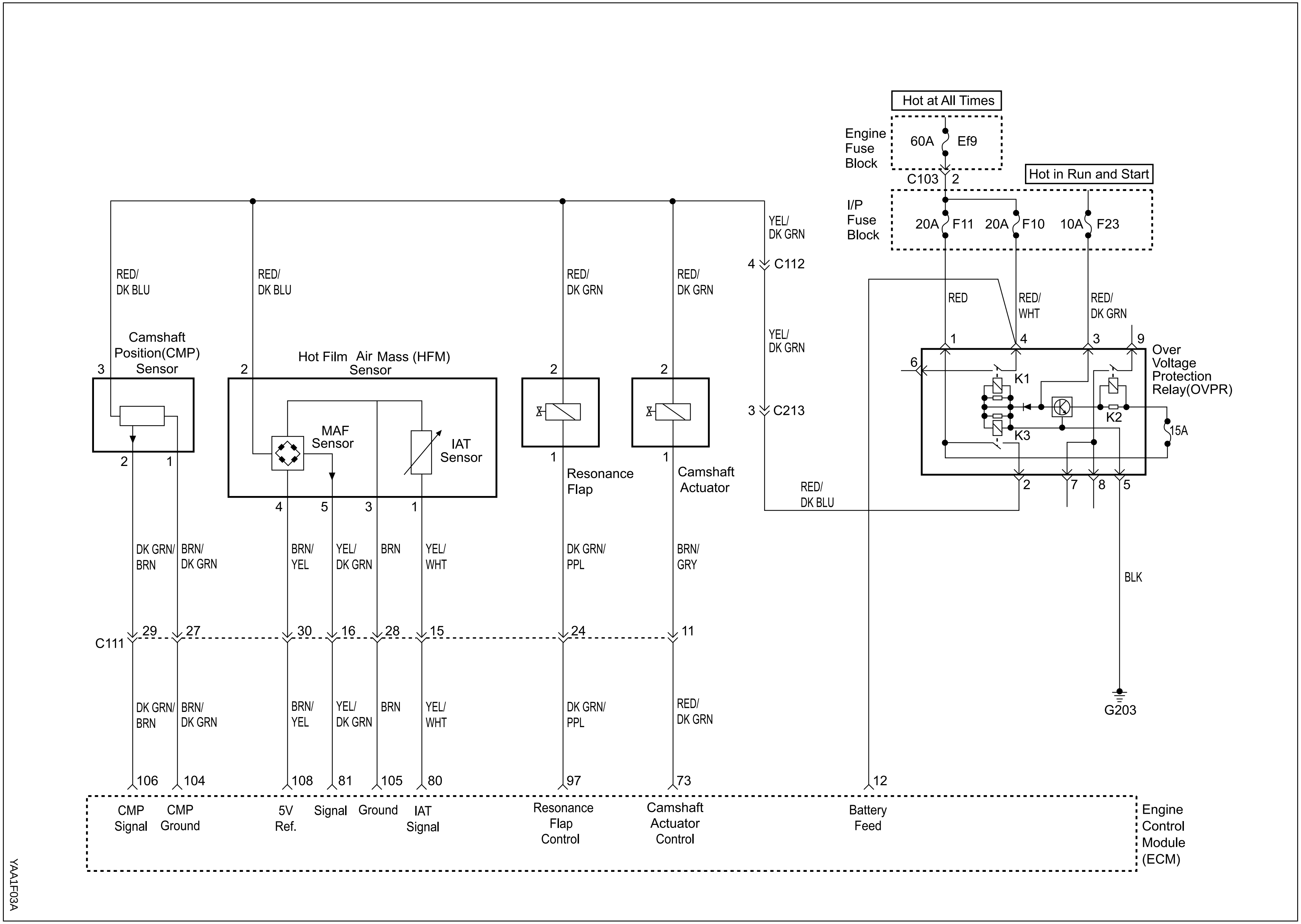
ECM WIRING DIAGRAM (3.2L DOHC - 1 OF 8) (MSE 3.63D)



ECM WIRING DIAGRAM (3.2L DOHC - 2 OF 8) (MSE 3.63D)



ECM WIRING DIAGRAM (3.2L DOHC - 3 OF 8) (MSE 3.63D)



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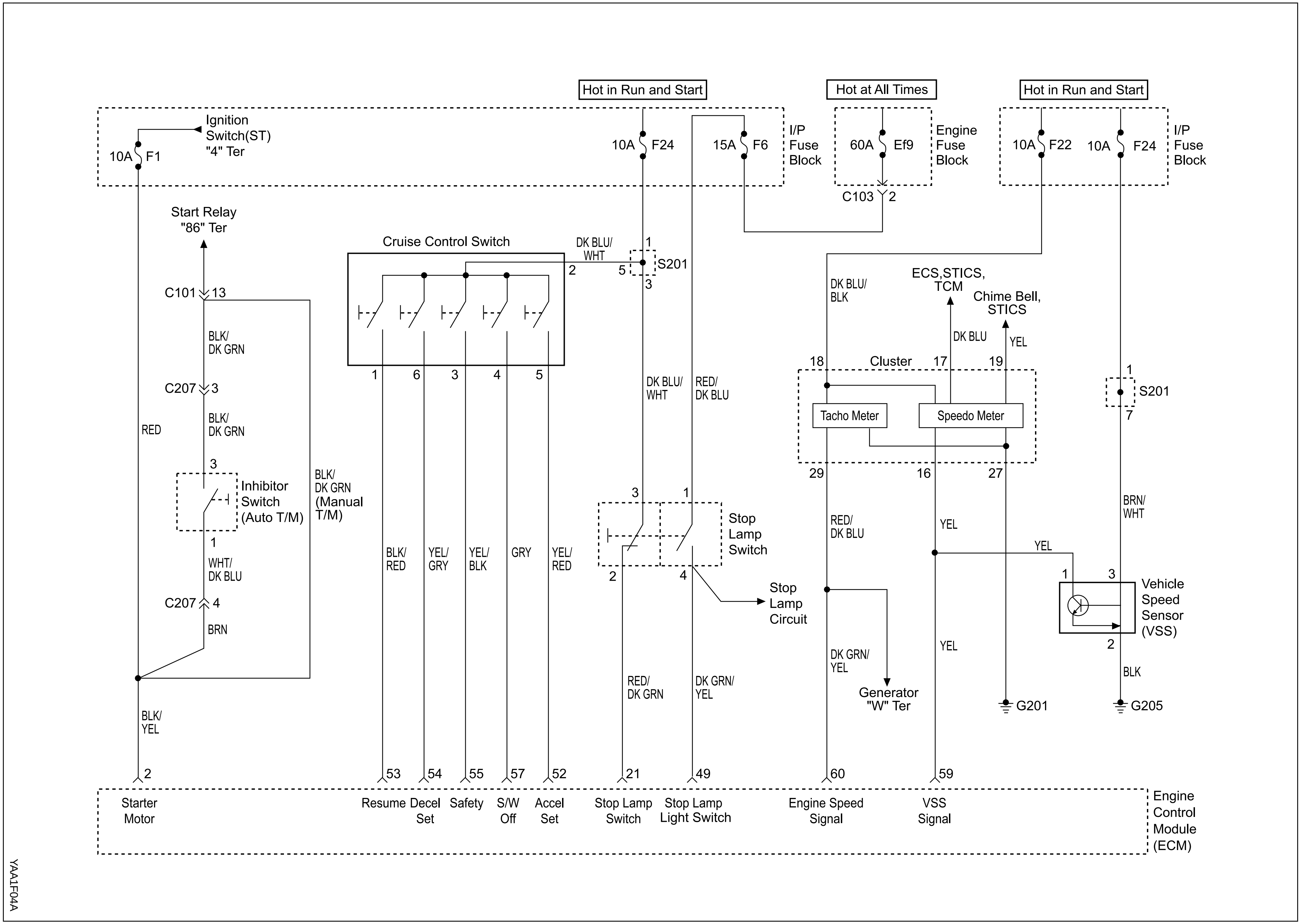
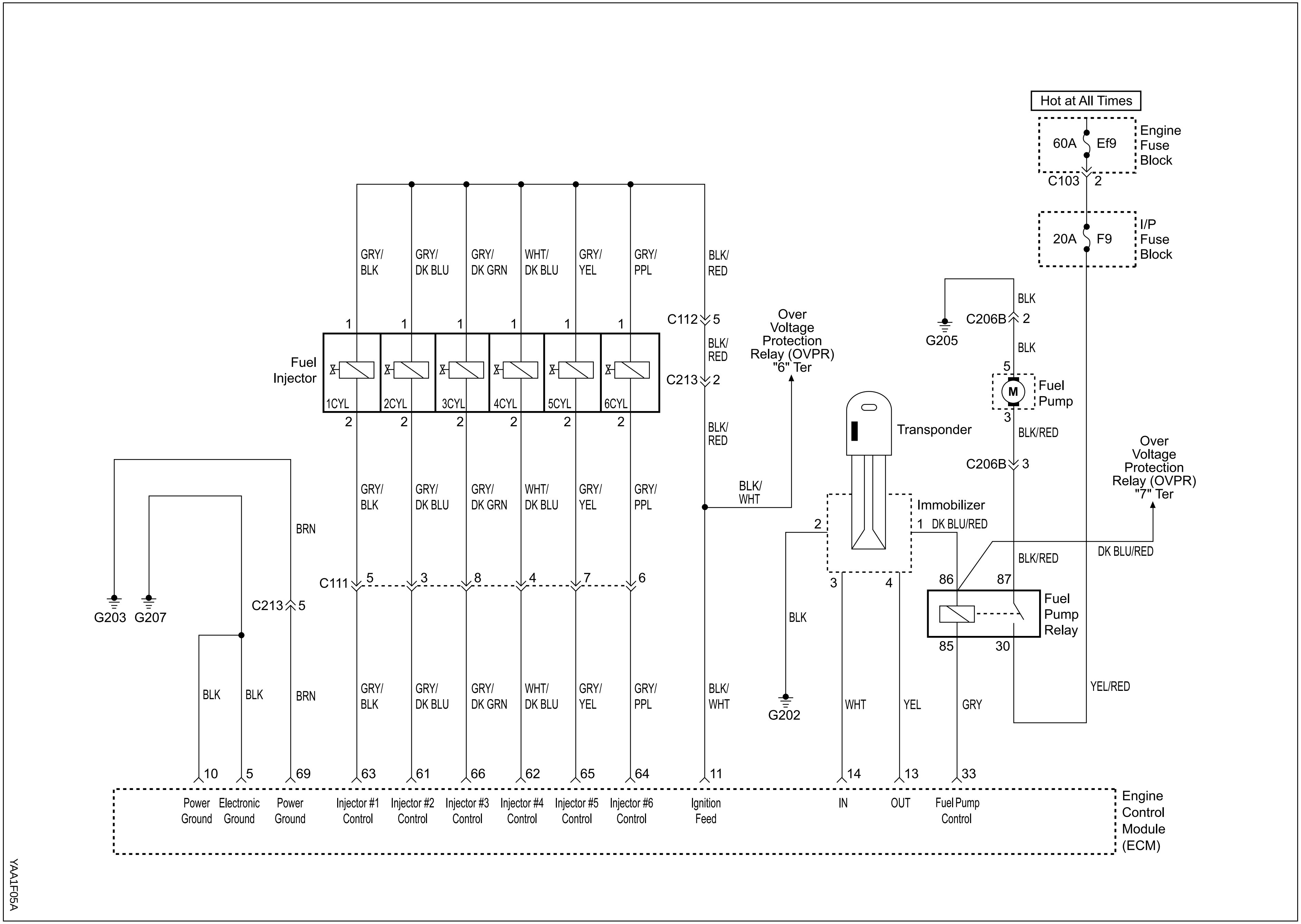
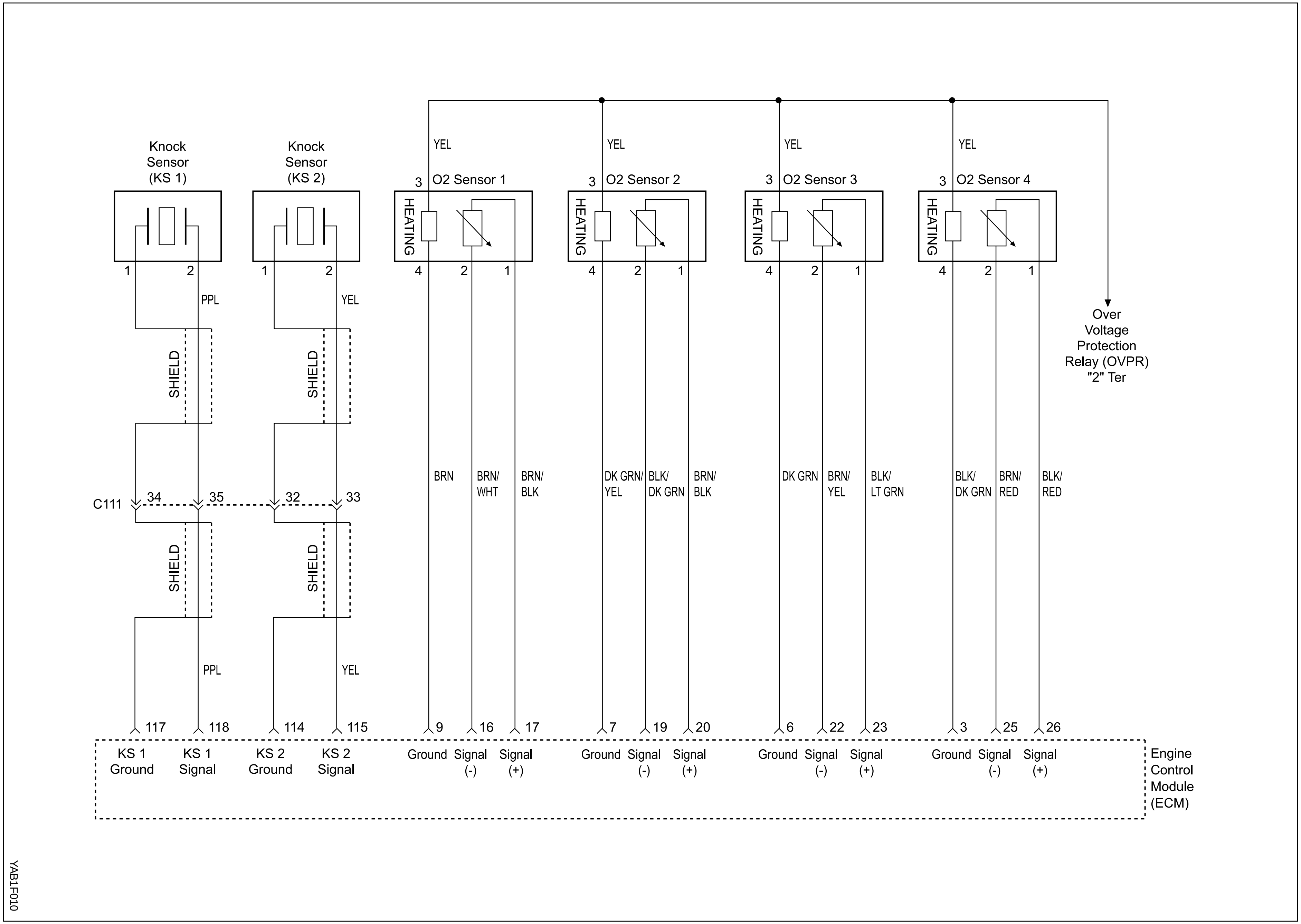
ECM WIRING DIAGRAM (3.2L DOHC - 4 OF 8) (MSE 3.63D)



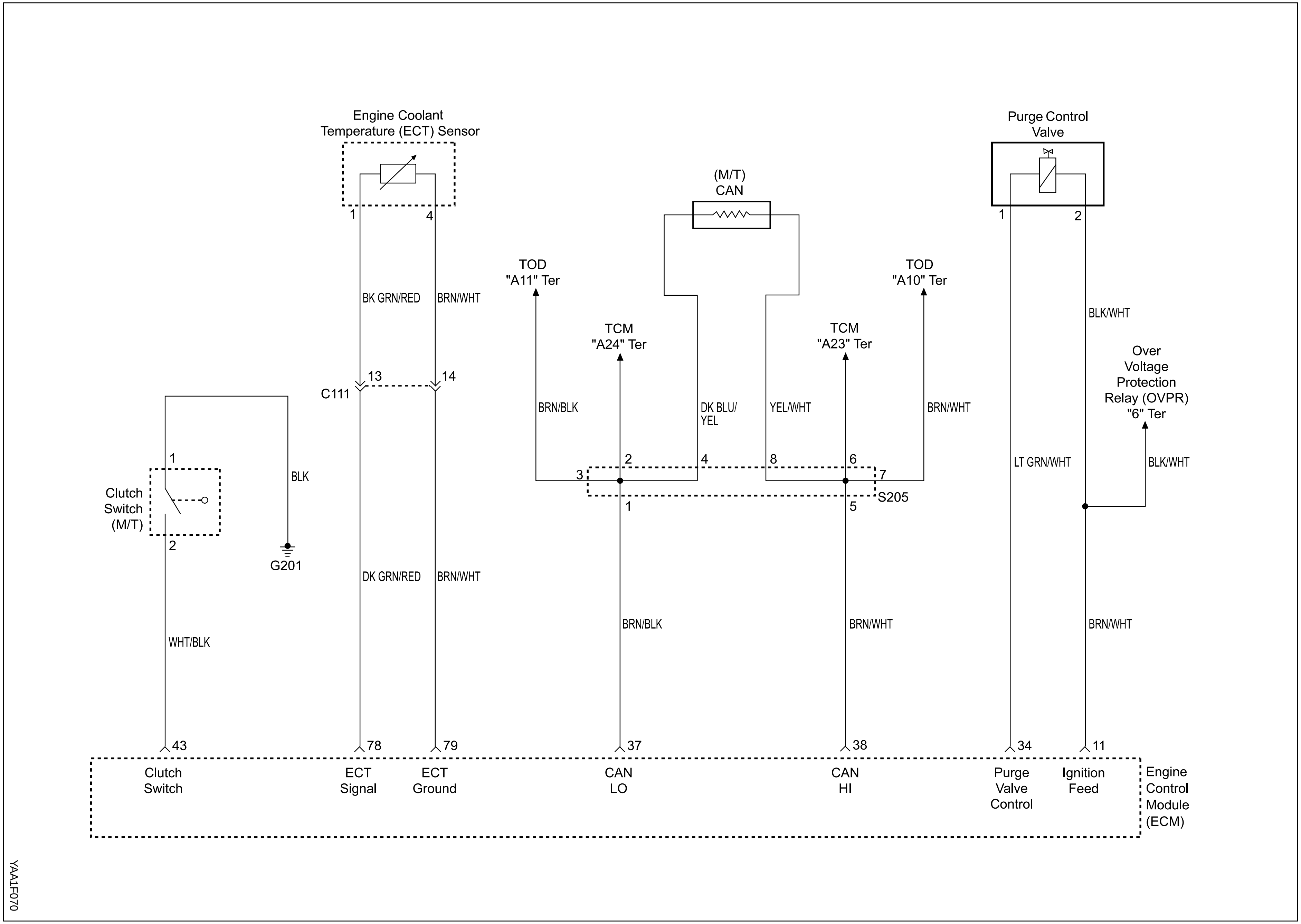
ECM WIRING DIAGRAM (3.2L DOHC - 5 OF 8) (MSE 3.63D)



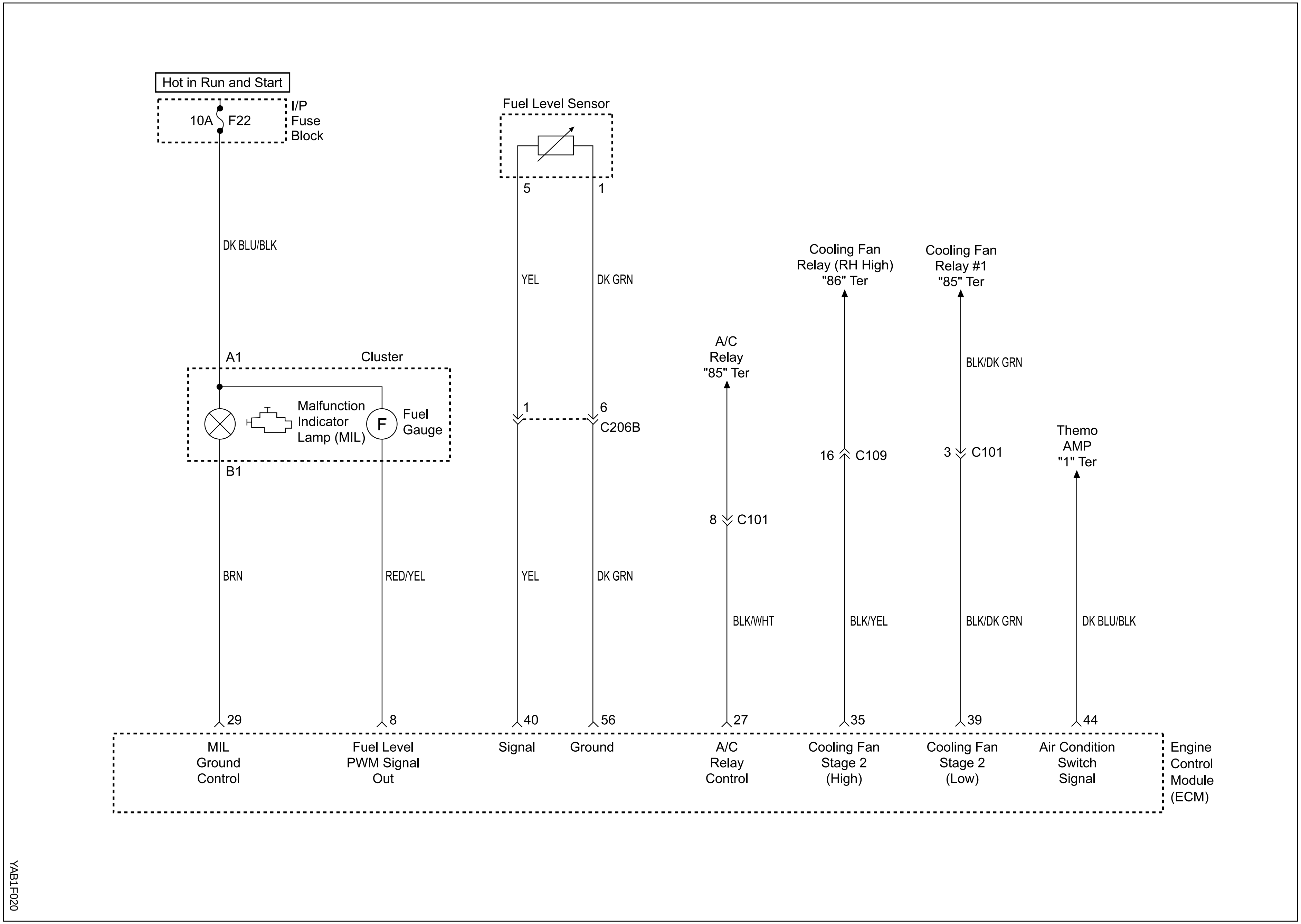
ECM WIRING DIAGRAM (3.2L DOHC - 6 OF 8) (MSE 3.63D)



ECM WIRING DIAGRAM (3.2L DOHC - 7 OF 8) (MSE 3.63D)

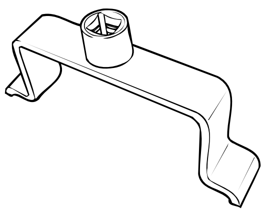
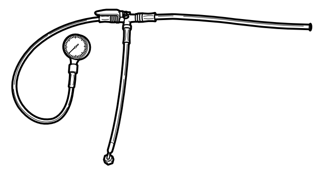


ECM WIRING DIAGRAM (3.2L DOHC - 8 OF 8) (MSE 3.63D)



SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 KAA1F450	**DW 150 - 010** **Fuel Cap Remover**	 KAA1F490	**103 589 00 21 00** **Fuel Pressure Gauge**

TRANSMISSION

CONTENTS

SECTION 5A

AUTOMATIC TRANSMISSION

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

BTRA M74 4WD AUTOMATIC TRANSMISSION

The BTR Automotive Model 74 Four Speed Automatic Transmission is an electronically controlled overdrive four speed unit with a lock-up torque converter. The lock-up torque converter results in lower engine speeds at cruise and eliminates unnecessary slippage. These features benefit the customer through improved fuel economy and noise reduction.

Max. Torque (N•m)	Max. Power (kW)	Configuration
320	160	260 mm Torque Converter-Wide Ratio Gear Set Splined Output for Transfer Case

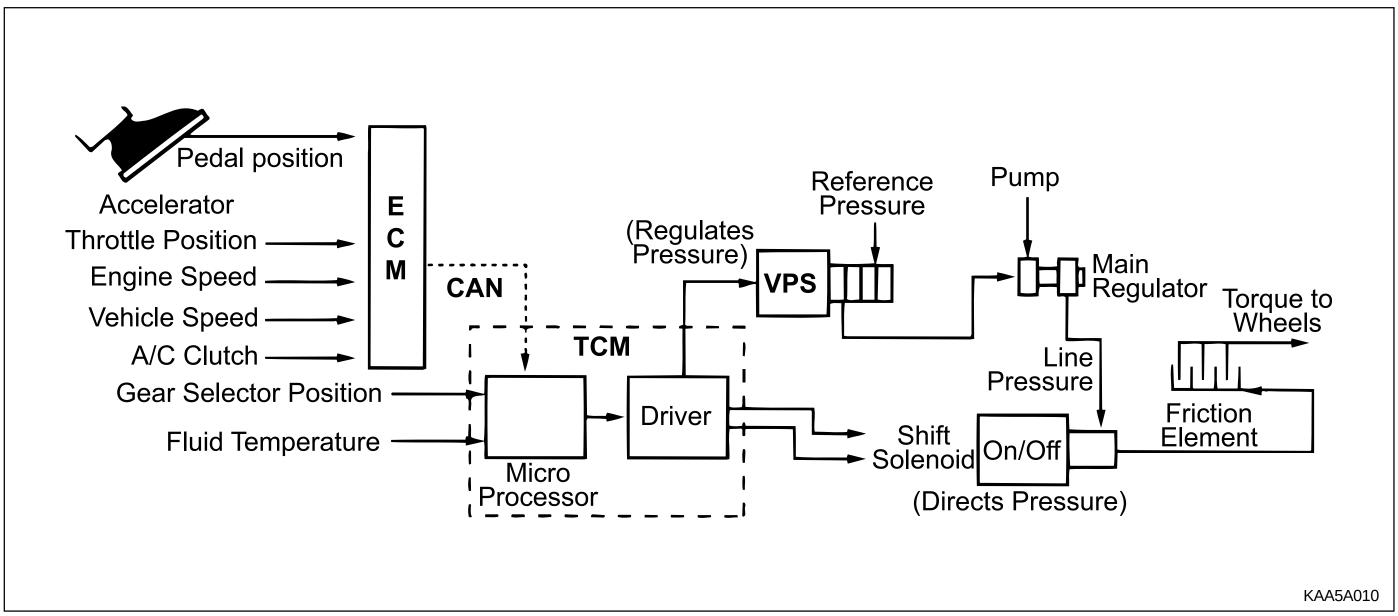
Of primary significance is the Transmission Control Module (TCM) which is a microprocessor based control system.

The TCM utilizes throttle position, rate of throttle opening, engine speed, vehicle speed, transmission fluid temperature, gear selector position and mode selector inputs, and in some applications a Kickdown Switch to control all shift feel and shift schedule aspects.

The TCM drives a single proportional solenoid multiplexed to three regulator valves to control all shift feel aspects. The output pressure of this solenoid is controlled as a function of transmission fluid temperature to maintain consistent shift feel throughout the operating range.

Shift scheduling is highly flexible, and several independent schedules are programmed depending on the vehicle.

Typically the NORMAL schedule is used to maximize fuel economy and driveability, and a POWER schedule is used to maximize performance. WINTER schedule is used to facilitate starting in second gear.



OPERATORS INTERFACES

There are three operator interfaces as the following;

- Gear Shift Control Lever
- Driving Mode Selector
- Indicator Light

Gear Shift Control lever

The transmission uses a conventional shift control lever. The gear shift control lever can be moved from one position to another within the staggered configuration of the shift control lever gate to positively indicate the gear selection.

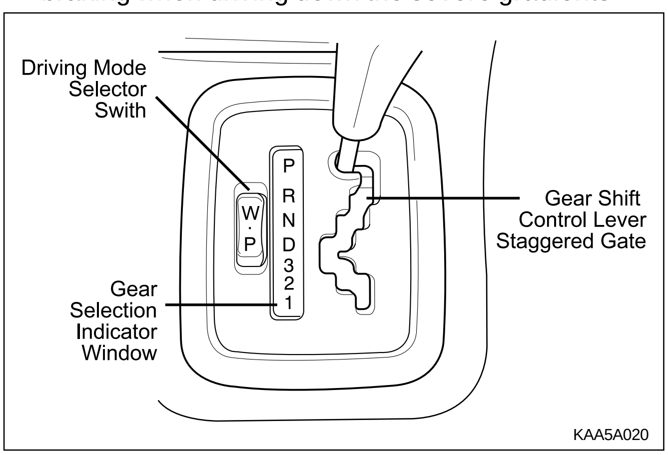
- P - Park position prevents the vehicle from rolling either forward or backward by locking the transmission output shaft. The inhibitor switch allows the engine to be started. For safety reasons, the parking should be used in addition to the park position. Do not select the Park position until the vehicle comes to a complete stop because it mechanically locks the output shaft.
- R - Reverse allows the vehicle to be operated in a rearward direction. The inhibitor switch enables reverse lamp operation.
- N - Neutral allows the engine to be started and operated while driving the vehicle. The inhibitor switch al-

lows the engine to be started. There is no power transferred through the transmission in Neutral. But the final drive is not locked by the parking pawl, so thewheels are free to rotate.

- D - Overdrive range is used for all normal driving conditions. 4th gear (overdrive gear) reduces the fuel consumption and the engine noise. Engine braking is applied with reduced throttle.

  First to second (1 → 2), first to third (1 → 3), second to third (2 → 3), second to fourth (2 → 4), third to fourth (3 → 4), fourth to third (4 → 3), fourth to second (4 → 2), third to second (3 → 2), third to first (3 → 1) and second to first (2 → 1) shifts are all available as a function of vehicle speed, throttle position and the time change rate of the throttle position.

  Downshifts are available for safe passing by depressing the accelerator. Lockup clutch may be enabled in 3rd and 4th gears depending on vehicle type.
- 3 - Manual 3 provides three gear ratios (first through third) and prevents the transmission from operating in 4th gear. 3rd gear is used when driving on long hill roads or in heavy city traffic. Downshifts are available by depressing the accelerator.
- 2 - Manual 2 provides two gear ratios (first and second). It is used to provide more power when climbing hills or engine braking when driving down a steep hill or starting off on slippery roads.
- 1 - Manual 1 is used to provide the maximum engine braking when driving down the severe gradients.



Driving Mode Selector

The driving mode selector consists of a driving mode selector switch and indicator light. The driving mode selector is located on the center console and allows the driver to select the driving mode.

The driving modes available to be selected vary with vehicle types. Typically the driver should have the option to select among NORMAL, POWER and WINTER modes.

When NORMAL mode is selected upshifts will occur to maximize fuel economy. When POWER mode is selected, upshifts will occur to give maximum performance and the POWER mode indicator light is switched ON.

When WINTER mode is selected, starting in second gear is facilitated, the WINTER mode indicator light is switched ON and the POWER mode indicator light is switched OFF.

Indicator Light

The indicator light is located on the instrument panel.

- Auto shift indicator light comes ON when the ignition switch ON and shows the gear shift control lever position.
- POWER mode indicator light comes ON when the POWER mode is selected and when the kickdown switch is depressed.
- WINTER mode indicator light comes ON when the WINTER mode is selected.

CONTROL SYSTEMS

BTRA M74 4WD automatic transmission consists of two control systems. One is the electronic control system that monitors vehicle parameters and adjusts the transmission performance. Another is the hydraulic control system that implements the commands of the electronic control system commands.

ELECTRONIC CONTROL SYSTEM

The electronic control system comprises of sensors, a TCM and seven solenoids. The TCM reads the inputs and activates the outputs according to values stored in Read Only Memory (ROM).

The TCM controls the hydraulic control system. This control is via the hydraulic valve body, which contains seven electromagnetic solenoids. Six of the seven solenoids are used to control the line pressure, operate the shift valves and the torque converter lock-up clutch, and to turn ON and OFF the two regulator valves that control the shift feel.

The seventh solenoid is the proportional or Variable Pressure Solenoid (VPS) which works with the two regulator valves to control shift feel.

Transmission Control Module (TCM)

The TCM is an in-vehicle micro-processor based transmission management system. It is mounted under the driver's side front seat in the vehicle cabin.

The TCM contains:

- Processing logic circuits which include a central microprocessor controller and a back-up memory system.
- Input circuits.
- Output circuits which control external devices such as the Variable Pressure Solenoid (VPS) driver, On/Off solenoid drivers, a diagnostics output and the driving mode indicator light.

Processing Logic

Shift schedule and calibration information is stored in an Erasable Programmable Read Only Memory (EPROM).

Throttle input calibration constants and the diagnostics information are stored in Electrically Erasable Programmable Read Only Memory (EEPROM) that retains the memory even when power to the TCM is disconnected. TCM continuously monitors the input values and uses these, via the shift schedule, to determine the required gear state. At the same time it monitors, via the solenoid outputs, the current gear state, whenever the input conditions change such that the required gear state is different to the current gear state, the TCM initiates a gear shift to bring the two states back into line.

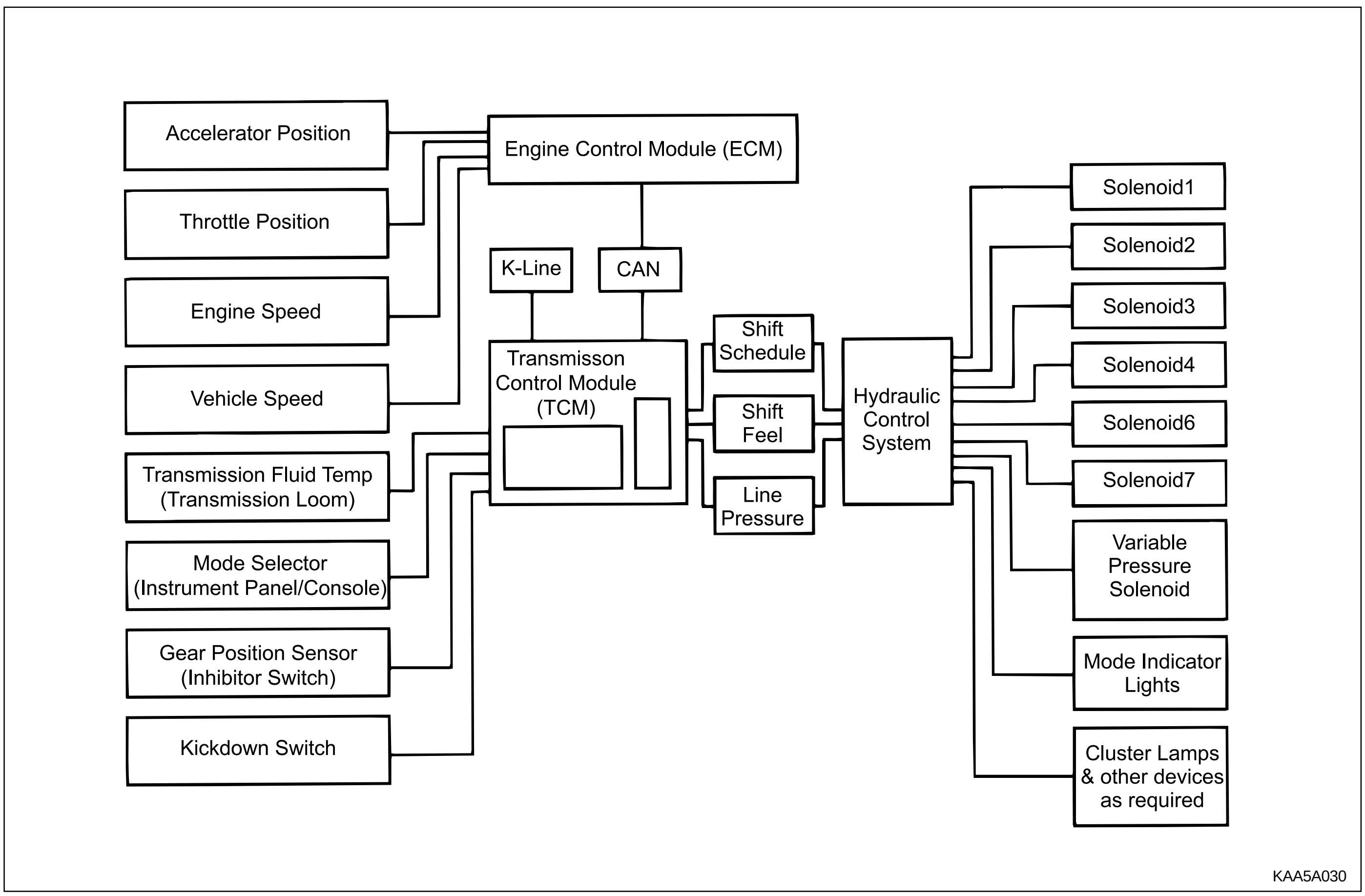
Once the TCM has determined the type of gearshift required the TCM accesses the shift logic, estimates the engine torque output, adjusts the variable pressure solenoid ramp pressure then executes the shift.

The TCM continuously monitors every input and output circuit for short or open circuits and operating range.

When a failure or abnormal operation is detected the TCM records the condition code in the diagnostics memory and implements a Limp Home Mode (LHM).

The actual limp home mode used depends upon the failure detected with the object to maintain maximum driveability without damaging the transmission. In general input failures are handled by providing a default value. Output failures, which are capable of damaging the transmission, result in full limp mode giving only third or fourth gear and reverse. For further details of limp modes and memory retention refer to the Diagnostic Trouble Code Diagnosis Section.

The TCM is designed to operate at ambient temperatures between - 40 and 85 °C (- 40 and 185 °F). It is also protected against electrical noise and voltage spikes,



however all the usual precautions should be observed, for example when arc welding or jump starting.

TCM Inputs

To function correctly, the TCM requires engine speed, vehicle speed, transmission fluid temperature, throttle position, gear position and Kickdown Switch inputs to determine the variable pressure solenoid current ramp and on/off solenoid states. This ensures the correct gear selection and shift feel for all driving conditions.

The inputs required by the TCM are as follows;

- Engine Speed

  The engine speed signal is derived from the Controller Area Network (CAN) via Engine Control Module (ECM).

- Vehicle Speed

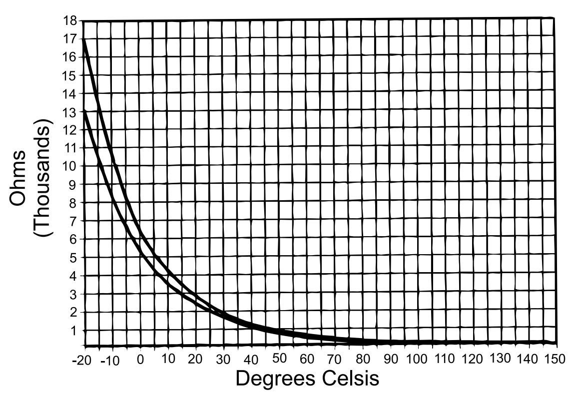
  The vehicle speed sensor, which is located in the transfer case, sends the output shaft speed signal to the Engine Control Module (ECM). The information is then transferred to the TCM via the CAN.

- Transmission Fluid Temperature

  The transmission fluid temperature sensor is a thermistor located in the solenoid wiring loom within the valve body of the transmission. This sensor is a typical Negative Temperature Coefficient (NTC) resistor with low temperatures producing a high resistance and high temperatures producing a low resistance.

If the transmission fluid temperature exceeds 135 °C (275 °F), the TCM will impose converter lock-up at lower vehicle speeds and in some vehicles flashes the mode indicator light. This results in maximum oil flow through the external oil cooler and eliminates slippage in the torque converter. Both these actions combine to reduce the oil temperature in the transmission.

Temperature (°C)	Resistance (Ohms)	
	Minimum	Maximum
-20	13,638	17,287
0	5,177	6,616
20	2,278	2, 723
100	117	196
135 (Overheat Mode Threshold)	75	85



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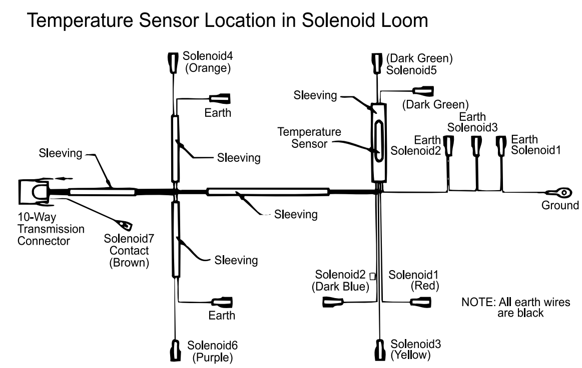
Pin No. Codes and colors in Solenoid Loom

Pin No.	Wire Color	Connects to
1	Red	Solenoid 1
2	Blue	Solenoid 2
3	Yellow	Solenoid 3
4	Orange	Solenoid 4
5	Green	Solenoid 5
6	Violet	Solenoid 6
7	Brown	Solenoid 7
8	Green	Solenoid 5
9	White	Temperature Sensor
10	Red	Temperature Sensor



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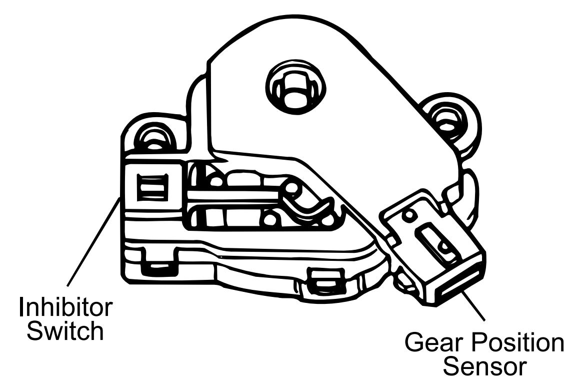
Throttle Position Sensor

The throttle position signal is sent from the ECM to the TCM via the CAN. Refer to Engine Section for further details.

Gear Position Sensor

The gear position sensor is incorporated in the inhibitor switch mounted on the side of the transmission case.



KAA5A060

The gear position sensor is a multi-function switch providing three functions;

- Inhibit starting of the vehicle when the shift lever is in a position other than Park or Neutral
- Illuminate the reverse lamps when Reverse is selected
- Indicate to the TCM which lever position has been se-lected by way of a varying resistance.

Readings for Resistance / Shift Lever Positions

Shift Lever Position	Resistance (kΩ)
Manual 1	1 ~ 1.4
Manual 2	21.8 ~ 2.2
Manual 3	3 3 ~ 3.4
Drive	4.5 ~ 4.9
Neutral	6.8 ~ 7.2
Reverse	10.8 ~ 11.2
Park	18.6 ~ 19

Kickdown Switch

The Kickdown Switch is used to signal the TCM that the driver has pressed the acclerator to the floor and requires a kickdown shift. When this switch is used, the POWER light comes ON and the POWER shift pattern is used.

Diagnostic Inputs

The diagnostic control input or K-line is used to initiate the outputting of diagnostic data from the TCM to a diagnostic test instrument. This input may also be used to clear the stored fault history data from the TCM's retentive memory. Connection to the diagnostic input of the TCM is via a connector included in the vehicle's wiring harness or computer interface.

Battery Voltage Monitoring Input

The battery voltage monitoring input is connected to the positive side of the battery. This signal is taken from the main supply to the TCM.

If the battery voltage at the TCM falls below 11.3V, the transmission will adopt a low voltage mode of operating in which shifts into first gear are inhibited. All other shifts are allowed but may not occur because of the reduced voltage. This condition normally occurs only when the battery is in poor condition.

If the battery voltage is greater than 16.5 V, the transmission will adopt limp home mode and all solenoids are turned OFF.

When system voltage recovers, the TCM will resume normal operation after a 30 seconds delay period.

TCM Outputs

The outputs from the TCM are supplied to the components described below;

- Solenoids
- Mode Indicator Light

Solenoids

The TCM controls seven solenoids. Solenoids 1 to 6 (S1 to S6) are mounted in the valve body, while Solenoid 7 (S7) is mounted in the pump cover.

- Solenoid 1 and 2: S1 and S2 are normally open ON/OFF solenoids that set the selected gear. These solenoids determine static gear position by operating the shift valves. Note that S1 and S2 solenoids also send signal pressure to allow or prohibit rear band engagement.
- Solenoid 3 and 4: S3 and S4 are normally open ON/OFF solenoids that combine to control shift quality and sequencing. S3 switches the clutch regulator valve OFF or ON. S4 switches the front band regulator valve OFF or ON. S5 also provides the signal pressure for the converter clutch regulator valve.
- Solenoid 5: S5 is a variable pressure solenoid that ramps the pressure during gear changes. This solenoid provides the signal pressure to the clutch and band regulator, thereby controlling the shift pressures. S5 also provides the signal pressure for the converter clutch regulator valve.
- Solenoid 6: S6 is a normally open ON/OFF solenoid that sets the high/low level of line pressure. Solenoid OFF gives high pressure.
- Solenoid 7: S7 is a normally open ON/OFF solenoid that controls the application of the converter clutch. Solenoid ON activates the clutch.

Solenoid Logic for Static Gear States

Gear	S1	S2
1st	ON	ON
2nd	OFF	ON
3rd	OFF	OFF
4th	ON	OFF
Reverse	OFF	OFF
Neutral	OFF	OFF
Park	OFF	OFF

Solenoid Operation during Gearshifts

Shift	**To Initiate Shift**	**Typical S5 Current Ramp**	**To Complete Shift**
1-2	S1 OFF S4 ON	750mA to 600mA	S4 OFF
1-3	S1 OFF S2 OFF S3 ON S4 ON	850mA to 750mA	S3 OFF S4 OFF
1-4	S2 OFF S3 ON S4 ON	850mA to 750mA	S3 OFF S4 OFF
2-3	S2 OFF S3 ON S4 ON	700mA to 500mA	S3 OFF S4 OFF
3-4	S1 ON S4 ON	750mA to 600mA	S4 OFF
4-3	S4 ON	750mA to 900mA	S1 OFF S4 OFF
4-2	S3 ON	750mA to 950mA	S1 OFF S2 ON S3 OFF
4-1	S3 ON S4 ON	600mA to 1000mA	S2 ON S3 OFF S4 OFF
3-2	S2 ON S4 ON	600mA to 450mA @ 20 kph. 550mA to 400mA @ 60 kph. 800mA to 650mA @ 100 kph.	S4 OFF
3-1	S3 ON S4 ON	700mA to 950mA	S1 ON S2 ON S3 OFF S4 OFF
2-1	S4 ON	800mA to 950mA	S1 ON S4 OFF
Conv. Clutch ON OFF	S7 ON	700mA to 400mA 600mA to 100mA	S7 OFF

Solenoid Valve Symbols

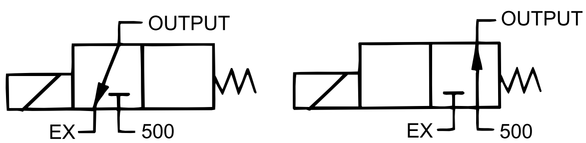
(ON/OFF Solenoids)

The solenoid symbol shown adjacent to each solenoid on the hydraulic system schematics indicates the state of the oil flow through the solenoid valve with the power ON or OFF.

Normally Open (NO) Solenoid

POWER ON: Line 500 port is closed. The output port is open to exhaust at the solenoid valve.

POWER OFF: The exhaust port is closed. The output port is open to line 500.



(a) POWER ON (b) POWER OFF

KAA5A070

Variable Pressure Solenoid Multiplexing System

Friction element shifting pressures are controlled by the Variable Pressure Solenoid (VPS).

Line pressure is completely independent of shift pressure and is a function of throttle position, gear state and engine speed.

S5 is a proportional or variable pressure solenoid that provides the signal pressure to the clutch and band regulator valves thereby controlling shift pressures.

VPS pressure is multiplexed to the clutch regulator valve, the band regulator valve and the converter clutch regulator valve during automatic gearshifts.

A variable pressure solenoid produces a hydraulic pressure inversely proportional to the current applied. During a gearshift the TCM applies a progressively increasing or decreasing (ramped) current to the solenoid. Current applied will vary between a minimum of 200 mA and a maximum of 1000 mA. Increasing current decreases output (S5) pressure. Decreasing current increases output (S5) pressure.

Line 500 pressure, (approximately 440 to 560 kPa), is the reference pressure for the VPS, and the VPS output pressure is always below line 500 pressure.

When the VPS is at standby, that is no gearshift is taking place, the VPS current is set to 200 mA giving maximum output pressure.

Under steady state conditions the band and clutch regulator valve solenoids are switched OFF. This applies full Line 500 pressure to the plunger and because Line 500 pressure is always greater than S5 pressure it squeezes the S5 oil out between the regulator valve and the plunger. The friction elements are then fed oil pressure equal to Line 500 multiplied by the amplification ratio.

When a shift is initiated the required ON/OFF solenoid is switched ON cutting the supply of Line 500 to the plunger.

At the same time the VPS pressure is reduced to the ramp start value and assumes control of the regulator valve by pushing the plunger away from the valve. The VPS then carries out the required pressure ramp and the timed shift is completed by switching OFF the ON/OFF solenoid and returning the VPS to the standby pressure.

This system enables either the band or clutch or both to be electrically controlled for each gearshift.

Mode Indicator Light

Depending on the application, the mode indicator light may be used to indicate the mode that has been selected or if an overheat condition exists. The mode indicator light is usually located on the instrument cluster.

Communication Systems

CAN

The Controller Area Network (CAN) connects various control modules by using a twisted pair of wires, to share common information. This results in a reduction of sensors and wiring. TCM obtains the actual engine speed and throttle position, vehicle speed and accelerator position etc. from ECM via CAN without any additional sensors.

K-Line

The K-line is typically used for obtaining diagnostic information from the TCM. A scan tool with a special interface is connected to the TCM via Data Link Connector (DLC) and all current faults, stored faults, runtime parameters are then available. The stored trouble codes can also be cleared by scan tool.

The K-line can be used for vehicle coding at the manufacturer’s plant or in the workshop. This allows for one TCM design to be used over different vehicle models.

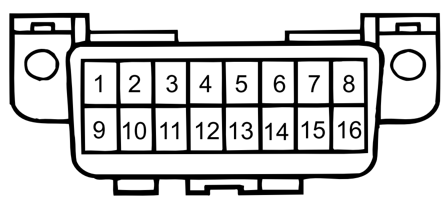
The particular code is sent to the microprocessor via the K-line and this results in the software selecting the correct shift and VPS ramp parameters.

Data Link Connector (DLC)

The Data Link Connector (DLC) is a multiple cavity connector. The DLC provides the means to access the serial data from the TCM.

The DLC allows the technician to use a scan tool to monitor the various systems and display the Diagnostic Trouble Codes (DTCs).

The DLC connector is located within the driver's compartment, directly below the instrument panel on the driver's side.



HYDRAULIC CONTROL SYSTEM

The hydraulic controls are located in the valve body, pump body and main case.

The valve body contains the following;

- Manual valve
- Three shift valves
- Sequence valve
- Solenoid supply pressure regulator valve
- Line pressure control valve
- Clutch apply feed regulator valve
- Band apply feed regulator valve
- Solenoid S1 to S6
- Reverse lockout valve

The pump cover contains the following;

- Primary regulator valve for line pressure
- Converter clutch regulator valve
- Converter clutch control valve
- Solenoid S7

The main case contains the following;

- B1R exhaust valve

All upshifts are accomplished by simultaneously switching on a shift valve(s), switching VPS pressure to the band and/or clutch regulator valve, and then sending the VPS a ramped current. The shift is completed by switching the regulators OFF and at the same time causing the VPS to reach maximum pressure.

All downshifts are accomplished by switching VPS pressure to the band and/or clutch regulator valve and sending a ramped current to the VPS. The shift is completed by simultaneously switching the regulators OFF, switching the shift valves and at the same time causing the VPS to return to stand-by pressure.

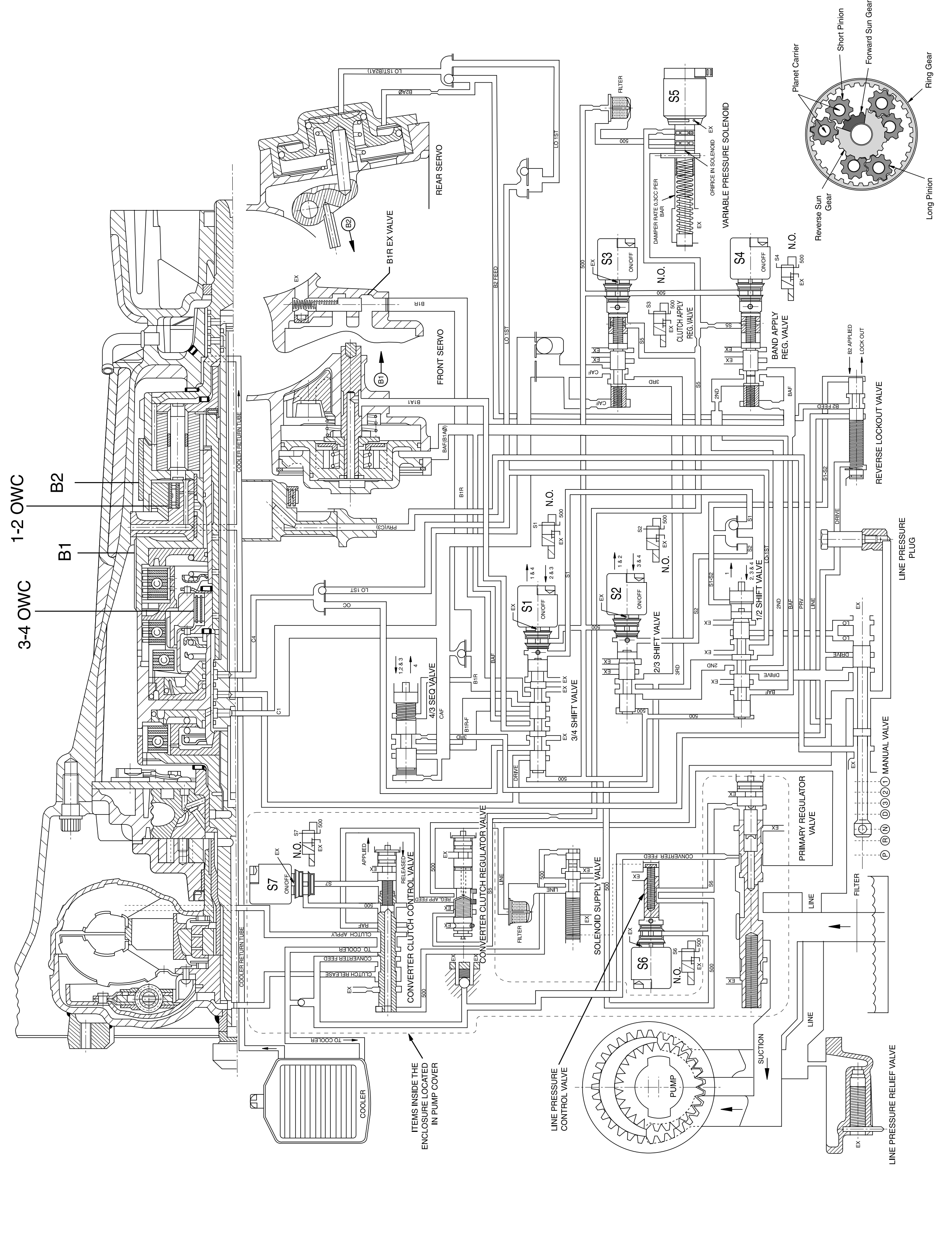
The primary regulator valve is located in the pump cover and supplies four line pressures; high and low for forward gears, and high and low for reverse. This pressure has no effect on shift quality and merely provides static clutch capacity during steady state operation. Low pressure can be obtained by activating an ON/OFF solenoid with high line pressure being the default mode.

Torque converter lock-up is initiated by toggling the converter clutch control valve with an ON/OFF solenoid.

The actual apply and release of the clutch is regulated by the VPS via the converter clutch regulator valve.

The solenoid supply pressure regulator valve provides reference pressure for all the solenoids.

HYDRAULIC CONTROL CIRCUIT



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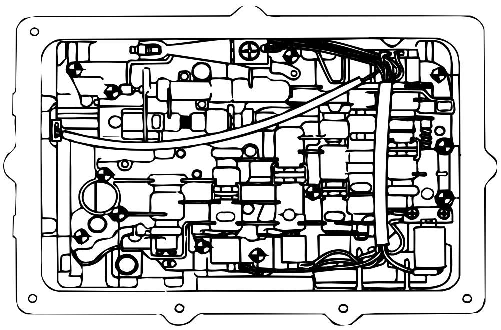
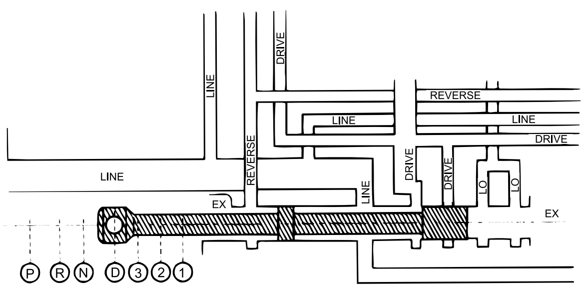
Valve Body



KAA5A090

Manual Valve

The manual valve is connected to the vehicle selector mechanism and controls the flow of oil to the forward and reverse circuits. The manual valve function is identical in all forward gear positions except that in the Manual 1 position an additional supply of oil is directed to the 1-2 shift valve for application of the rear band and the C4 overrun clutch. The manual valve directs the line pressure into the PRND fluid circuits.



KAA5A100

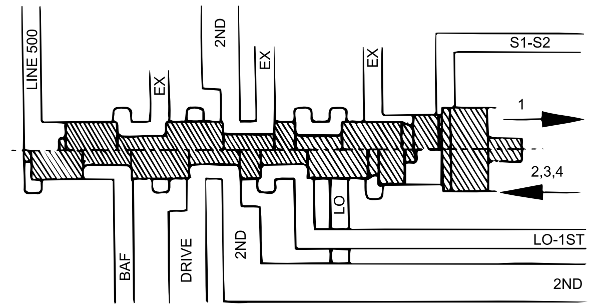
1-2 Shift Valve

The 1-2 shift valve is a two position valve that must be switched to the 2, 3 and 4 position in order to get any forward gear other than first gear. It is used for all 1-2 and 2-1 gearshifts.

The switching of this valve is achieved by using S1 and/ or S2.

During a 1-2 gearshift drive oil from the manual valve passes through to the second gear circuit. During a 2-1 gearshift the band apply feed oil is allowed to exhaust via the 1-2 shift valve.

The 1-2 shift valve works in conjunction with the 3-4 shift valve to disengage the C4 clutch in first gear, and engage C4 in second gear. When Manual 1 is selected the C4 clutch and rear band (B2) are engaged.



KAA5A110

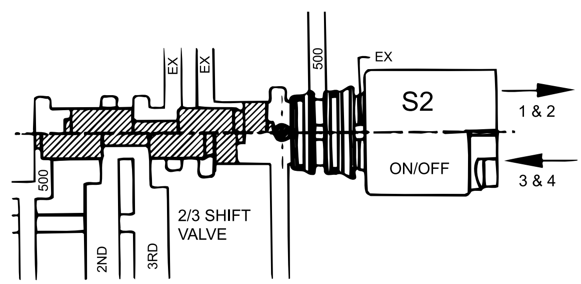
2-3 Shift Valve

The 2-3 shift valve is a two position valve. It is used on all 2-3 and 3-2 gearshifts.

The switching of this valve is achieved by S2 which is located at the end of the valve spool.

In the 1, 2 position, second gear oil from the 1-2 shift valve is prevented from entering the third gear circuit.

When the valve is moved to the 3, 4 position, oil from the second gear circuit is routed to the third gear circuit and the transmission is changed to third gear.



KAA5A120

3-4 Shift Valve

The 3-4 shift valve is a two position valve. It is used for all 3-4 and 4-3 gearshifts.

The switching of this valve is achieved by S1 which is located at the end of the valve spool.

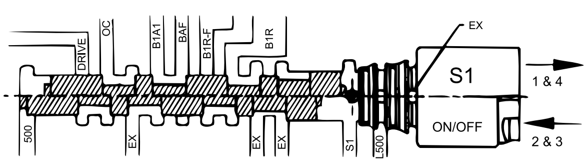
During a 3-4 gearshift the 3-4 shift valve:

- Exhausts the front band release (B1R) circuit thereby allowing the application of the front band (B1).
- Connects the inner apply area of the front servo (B1AI) to the Band Apply Feed (BAF) circuit thus allowing greater apply forces to the front band.
- Exhausts the Overrun Clutch (OC) circuit which allows the C4 clutch to disengage.

During a 4-3 gearshift, the C4 clutch is engaged and the front band (B1) is released. These actions are sequenced by the 4-3 sequence valve.

The 3-4 shift valve also switches during 1-2 and 2-1 gearshifts where its function is to apply the overrun clutch (C4) in second gear but to release it in first gear.

Note that the C4 clutch is applied in Manual 1 by virtue of the manual valve and the 1-2 shift valve. Refer to “1-2 Shift Valve” in this section.

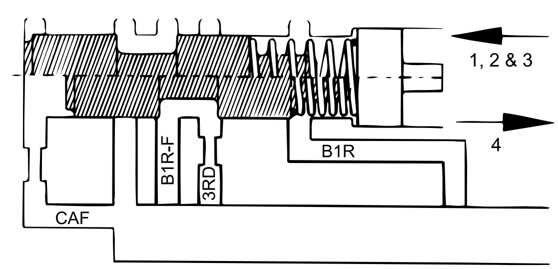


KAA5A130

4-3 Sequence Valve

The 4-3 sequence valve is a two position spring loaded valve. It switches during 3-4 and 4-3 gearshifts although it performs no function during the 3-4 shift.

During the 4-3 shift the 4-3 sequence valve delays the connection of the Clutch Apply Feed (CAF) circuit to the B1R circuit until the B1R circuit has been fully pressurized by using the third gear circuit. This prevents objectionable engine flare on completion of the 4-3 gearshift.



KAA5A140

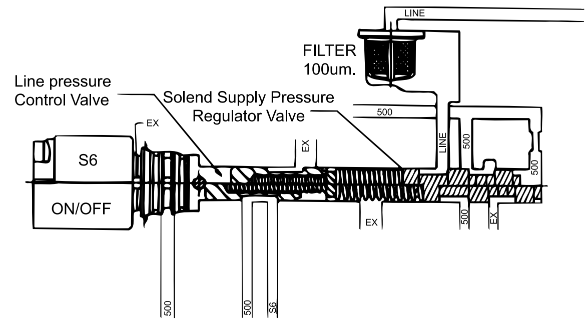
Solenoid Supply Pressure Regulator Valve

The solenoid supply pressure regulator valve supplies a constant pressure to all solenoids (S1 to S7). Line pressure is used as the feeding oil to this regulator and the output is termed line 500.

Line Pressure Control Valve

Line pressure is controlled by S6, which acts as the line pressure control valve. When S6 pressure is applied to the end of the Primary Regulator Valve (PRV), it is opposed by spring force and causes LOW line pressure for light throttle application and cruising.

Heavy throttle application causes the normally open S6 to open (switch Off) thus closing line 500 and opening S6 to exhaust. Removal of S6 pressure from the PRV results in HIGH line pressure.

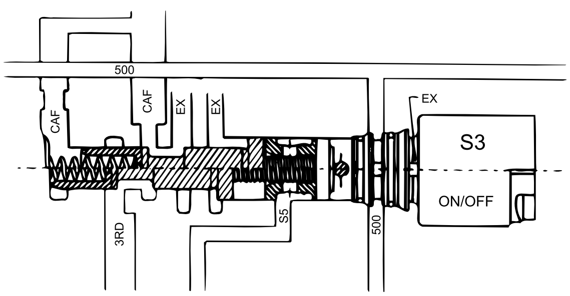


KAA5A150

Clutch Apply Feed Regulator Valve

The clutch apply feed regulator valve is a fixed ratio (2.25:1) valve. This valve provides a regulated pressure to the C1 clutch and controls the change rate of the clutch state to give the desired shift quality.

Third gear oil supplied to the valve is regulated to provide an output pressure, Clutch Apply Feed (CAF) pressure, of 2.25 times the S5 signal pressure when S3 is ON. When S3 is OFF, the output pressure is 2.25 times the line 500 pressure.

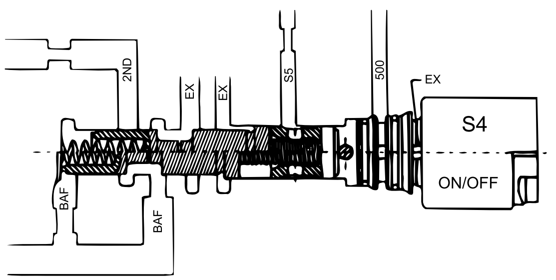


KAA5A160

Band Apply Feed Regulator Valve

The band apply feed regulator valve is a fixed ratio (1.4:1) valve. It provides a regulated pressure to the front servo, and controls the change rate of the front band (B1) state to give the desired shift quality.

Second gear oil supplied to the valve is regulated to provide an output pressure, Band Apply Feed (BAF) pressure, of 1.4 times the S5 signal pressure when S4 is ON. When S4 is OFF the output pressure is 1.4 times the line 500 pressure.

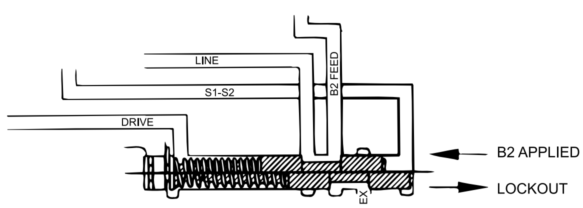


KAA5A170

Reverse Lockout Valve

The reverse lockout valve is a two position valve contained in the upper valve body. This valve uses S1-S2 pressure as a signal pressure and controls the application of the rear band (B2).

While the manual valve is in D, 3, 2 or 1 positions, drive oil is applied to the spring end of the valve, overriding any signal pressures and holding the valve in the lockout position. This prevents the application of B2 in any of the forward driving gears except M1.



KAA5A180

When the manual valve is in P, R or N positions, drive oil is exhausted and the reverse lockout valve may be toggled by S1-S2 pressure.

B2 is applied in P, R, and N if the following conditions are satisfied;

- In P or N, vehicle speed = 3 km/h.
- In R, vehicle speed = 10 km/h.
- Engine speed = 1600 rpm.
- Throttle position = 12 %.

Under these conditions, the TCM switches solenoids S1 and S2 to OFF. The reverse lockout valve toggles under the influence of the S1-S2 pressure, to connect the line pressure to the B2 feed. Oil is fed to both the inner and outer apply areas of the rear servo piston, applying B2.

If any of the above conditions are not satisfied, the TCM switches solenoids S1 and S2 to ON. S1- S2 pressure is exhausted and the valve is held in the lockout position by the spring. In this position, engagement of B2 is prohibited.

This feature protects the transmission from abuse by preventing the undesirable application of B2 at high speed, and by providing a reverse lockout function.

Note that if the transmission is in failure mode, the rear band will be applied at all times in P, R and N.

Pump Cover


KAA5A190

Primary Regulator Valve

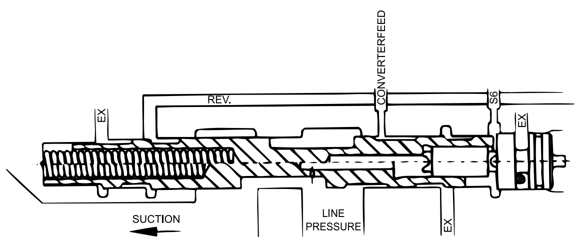
The Primary Regulator Valve (PRV) regulates the transmission line pressure (or pump output pressure). This valve gives either high or low line pressure depending on whether S6 is switched OFF or ON. When S6 is switched ON, S6 pressure is applied to the PRV moving it against spring pressure and opening the line pressure circuit to the pump suction port resulting in reduced line pressure.

Low line pressure is used during light throttle applications and cruising. Heavy throttle will cause S6 to switch OFF and thereby cause high line pressure.

This stepped line pressure control has no detrimental effect on shift feel because all shifting pressures are controlled by separate band and clutch regulator valves, and the output of S5.

When reverse gear is selected, both the low and high line pressure values are boosted to guard against slippage. This is achieved by applying reverse oil line pressure to the PRV to assist the spring load. The other end of the valve contains ports for line pressure feedback and S6 pressure.

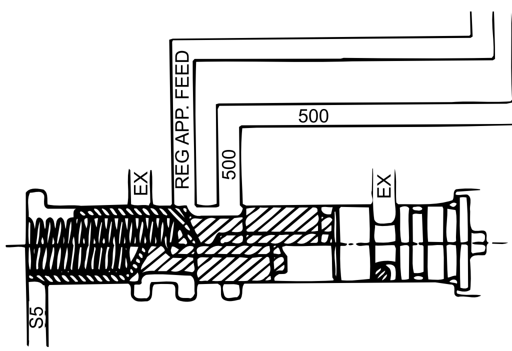
The PRV also regulates the supply of oil to the converter via the converter feed port. The cascade effect of the PRV ensures the first priority of the valve is to maintain line pressure at very low engine speeds. When the engine speed increases and the pump supplies an excess of oil the PRV moves to uncover the converter feed port thereby pressurizing the converter. If there is an excess of oil for the transmission's needs then the PRV moves further to allow oil to return to the suction port.



KAA5A200

Converter Clutch Regulator Valve

The converter clutch regulator valve regulates the pressure of the oil which applies the converter clutch. Input oil from the line 500 circuit is regulated within the valve, with the output pressure being variable according to the signal pressure from the S5 circuit. Converter clutch apply and release application is smoothed by electronically varying the S5 circuit pressure.



KAA5A210

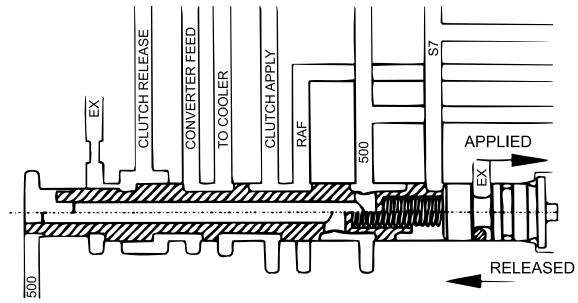
Converter Clutch Control Valve

The converter clutch control valve is a two position valve which applies or releases the converter clutch.

The switching of this valve is governed by the signal pressure from S7.

When the valve is in the OFF or released position, converter feed oil from the PRV is directed to the release side of the converter clutch. After flowing through the converter, oil returns to the converter clutch control valve and is then directed to the oil cooler.

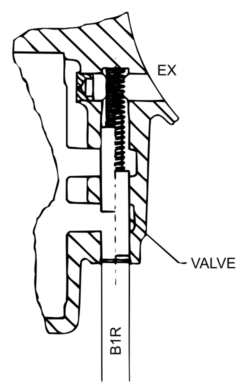
When the valve is in the ON or applied position, regulated oil from the converter clutch regulator valve is directed to the apply side of the converter clutch. This oil remains within the converter because the converter clutch piston is sealed against the flat friction surface of the converter cover. To provide oil flow to the cooler the converter clutch control valve directs converter feed oil from the PRV directly to the cooler circuit.



KAA5A220

B1R Exhaust Valve

The B1R exhaust valve is a two position spring loaded valve located in the transmission case directly adjacent to the front servo. It permits the servo release oil to be rapidly exhausted into the transmission case during application of the front band (B1). This prevents the need to force the oil back from the front servo through the valve body and through the 3-4 shift valve. The spring positions the valve to prevent oil entering the release area of the servo until the B1R circuit oil pressure reaches approximately 100 kPa.



KAA5A240

POWER TRAIN SYSTEM

The Power Train System consists of;

- A torque converter with single face lock-up clutch
- Four multi-plate clutch assemblies
- Two brake bands
- Two one-way clutches
- Planetary gear set
- Parking mechanism

A conventional six pinion Ravigneaux compound planetary gear set is used with overdrive (fourth gear) being obtained by driving the carrier.

The cross-sectional arrangement is very modular in nature.

Four main sub-assemblies are installed within the case to complete the build. These sub-assemblies are;

- Gear set-sprag-centre support
- C1 -C2 -C3 -C4 clutch sub-assembly
- Pump assembly
- Valve body assembly

One, or a combination of selective washers are used between the input shaft flange and the number 4 bearing to control the transmission end float. This arrangement allows for extensive subassembly testing and simplistic final assembly during production.

A general description of the operation of the Power Train System is detailed below.

First gear is engaged by applying the C2 clutch and locking the 1-2 One Way Clutch (1-2 OWC). The 1-2 shift is accomplished by applying the B1 band and overrunning the 1-2 OWC. The 2-3 shift is accomplished by applying the C1 clutch and releasing the B1 band.

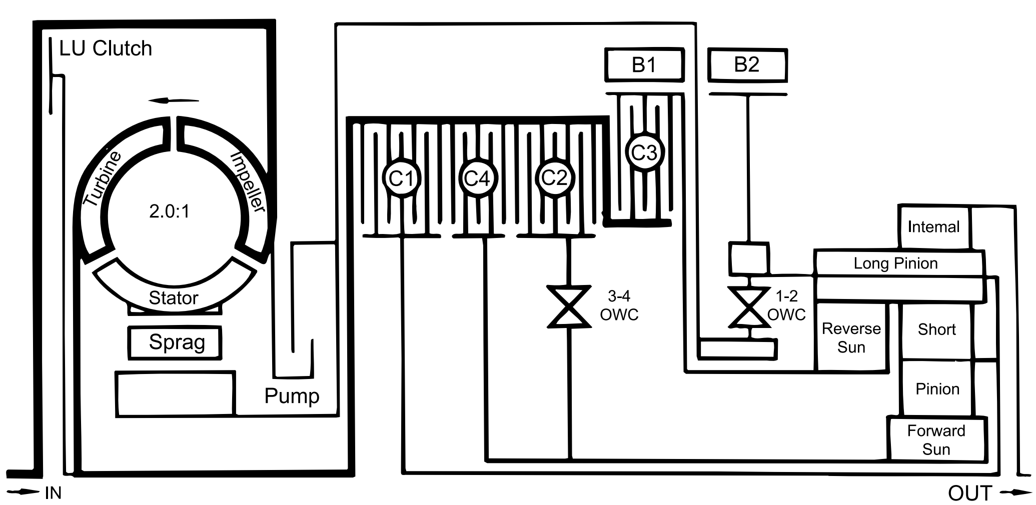
The 3-4 shift is accomplished by re-applying the B1 band and overrunning the 3-4 OWC. Reverse gear is engaged by applying the C3 clutch and the B2 band.

The C4 clutch is applied in the Manual 1, 2 and 3 ranges to provide engine braking. In addition, the C4 clutch is also applied in the Drive range for second and third gears to eliminate objectionable freewheel coasting.

The B2 band is also applied in the Manual 1 range to accomplish the low-overrun shift.

Both the front and rear servos are dual area designs to allow accurate friction element matching without the need for secondary regulator valves. All the friction elements have been designed to provide low shift energies and high static capacities when used with the new low static co-efficient transmission fluids. Non-asbestos friction materials are used throughout.

		ELEMENTS ENGAGED								
Gear	**Gear Ratio**	**C1**	**C2**	**C3**	**C4**	**B1**	**B2**	**1-2 OWC**	**3-4 OWC**	**LU CLUTCH**
First	2.741		X					X	X	
Second	1.508		X			X			X	
Third	1.000	X	X		X	X			X	X*
Fourth	0.708	X	X		X				X	X
Reverse	2.428			X			X			
Manual 1	2.741		X		X		X		X	
* For Certain Vehicle Applications, Refer to the Owner's Manual.										



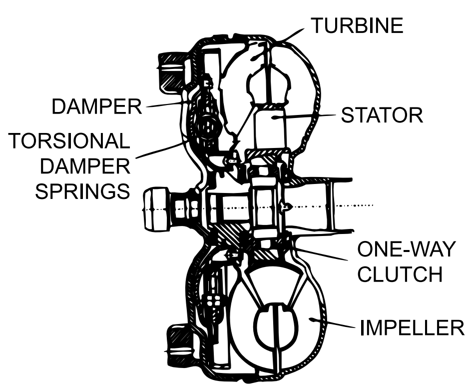
KAA5A250

Torque Converter

The torque converter consists of a turbine, stator pump, impeller and a lock-up damper and piston assembly. As in conventional torque converters, the impeller is attached to the converter cover, the turbine is splined to the input shaft and the stator is mounted on the pump housing via a one way clutch (sprag).

The addition of the damper and piston assembly enables the torque converter to lock-up under favorable conditions. Lock-up is only permitted to occur in third and fourth gears under specified throttle and vehicle speed conditions.

Lock-up is achieved by applying hydraulic pressure to the damper and piston assembly which couples the turbine to the converter cover, locking-up the converter and eliminating unwanted slippage. Whenever lock-up occurs, improved fuel consumption is achieved. Torsional damper springs are provided in the damper and piston assembly to absorb any engine torque fluctuations during lock-up.



KAA5A260

Clutch Packs

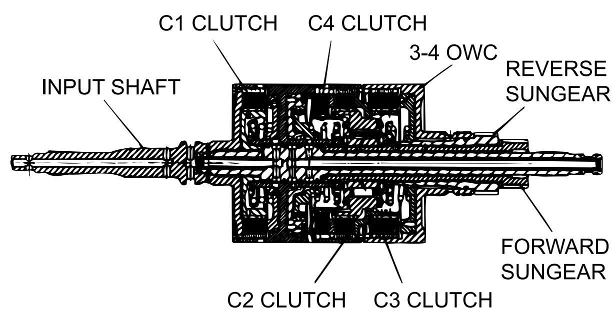
There are four clutch packs. All clutch packs are composed of multiple steel and friction plates.

C1 CLUTCH: When applied, this clutch pack allows the input shaft to drive the planet carrier. This occurs in third and fourth gears.

C2 CLUTCH: When applied this clutch pack allows the input shaft to drive the forward sun gear via the 3-4 OWC. This occurs in all forward gears.

C3 CLUTCH: When applied this clutch pack allows the input shaft to drive the reverse sun gear. This only occurs in reverse gear.

C4 CLUTCH: When applied this clutch provides engine braking on overrun. This occurs in Manual 1, 2 and 3 and also Drive 2 and Drive 3 to prevent objectionable free wheel coasting.



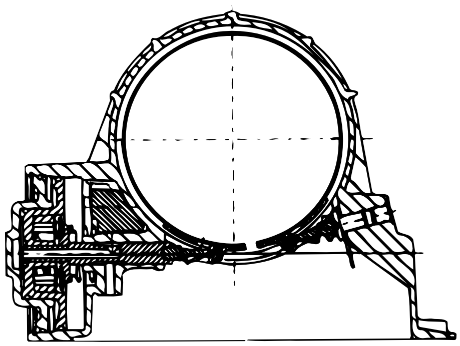
KAA5A270

Bands

The transmission utilizes two bands, the B1 band (sometimes known as the 2-4 band), and the B2 band (sometimes known as the low-reverse band).

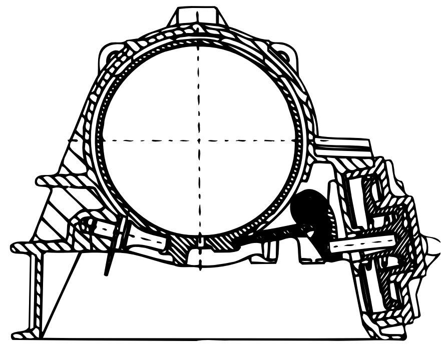
The B1 band is a flexible band which is engaged by the front servo piston. B1 is activated in second and fourth gear. When activated B1 prevents the reverse sun gear from rotating by holding the C3 clutch assembly stationary. In second gear only the outer area of the apply piston is utilized. In fourth gear both areas are utilized for greater clamping force.

The B2 band is a solid band which is engaged by the rear servo piston. B2 is activated in Park, Reverse, Neutral and Manual 1. When activated B2 prevents the planet carrier assembly from rotating. In Manual 1 only the inner area of the apply piston is utilized. In Park, Reverse and Neutral, both areas are utilized for greater clamping force.



FRONT SERVO AND BAND

KAA5A280



REAR SERVO AND BAND

KAA5A290

One Way Clutches

The transmission uses two OWCs, the 1-2 OWC and the 3-4 OWC. (Note that a third OWC is located in the torque converter, also known as a sprag.)

The 1-2 OWC is located between the planetary carrier assembly and the center support. This allows the carrier to rotate around the center support in one direction only. The one way clutch is engaged only in Drive 1.

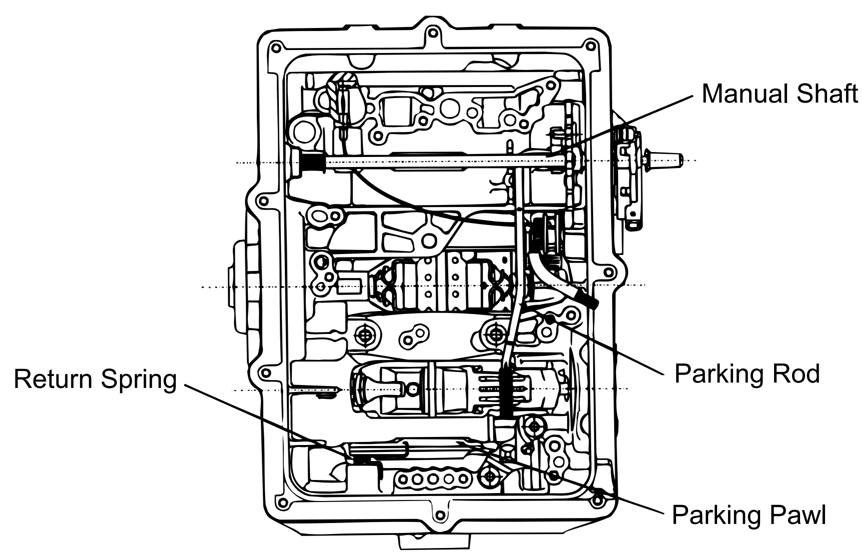
This 3-4 OWC is located between the C4 and the C2 clutch assemblies. This allows the C2 clutch to drive the forward sun gear in first, second and third gears but unlocks in fourth gear and during overrun.

Planetary Gear Set

The planetary gear set used in the transmission is a conventional six pinion Ravigneaux compound gear set.

Parking Mechanism

When Park is selected the manual lever extends the park rod rearwards to engage the parking pawl. The pawl will engage the external teeth on the ring gear thus locking the output shaft to the transmission case. When Park is not selected a return spring holds the parking pawl clear of the output shaft, preventing accidental engagement of Park.



KAA5A300

BLANK

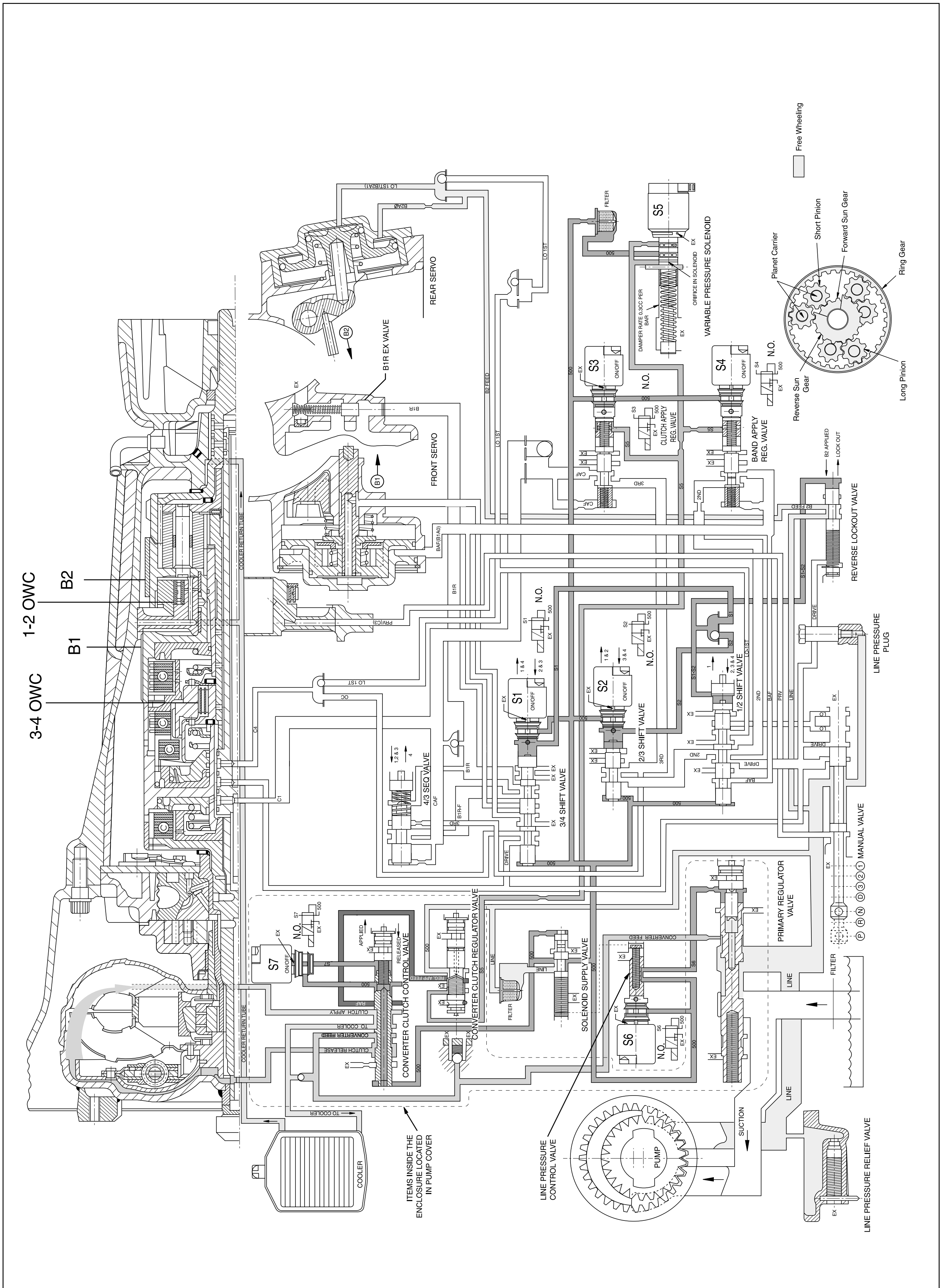
POWER FLOWS

The power flows for the various transmission selections are listed below;

- Power Flow - Neutral and Park
- PowerFlow - Reverse
- Power Flow - Manual 1
- PowerFlow - Drive 1
- PowerFlow - Drive 2
- PowerFlow - Drive 3
- PowerFlow - Drive 3 Lock Up
- Power Flow - Drive 4 (Overdrive)
- PowerFlow - Drive 4 Lock Up

The following table details the engaged elements versus the gear selected for all transmission selections.

	ELEMENTS ENGAGED								
Gear State	**C1**	**C2**	**C3**	**C4**	**B1**	**B2**	**1-2 OWC**	**3-4 OWC**	**LU CLUTCH**
Park and Neutral	-	-	-	-	-	X	-	-	-
Reverse	-	-	X	-	-	X	-	-	-
Manual 1	-	X	-	X	-	X	-	X	-
Drive 1	-	X	-	-	-	-	X	X	-
Drive 2 and Manual 2	-	X	-	X	X	-	-	X	-
Drive 3 and Manual 3	X	X	-	X	-	-	-	X	-
Drive 3 Lock Up and Manual 3 Lock Up	X	X	-	X	-	-	-	X	X
Drive 4 Overdrive	X	X	-	-	X	-	-	X	-
Drive 4 Lock Up	X	X	-	-	X	-	-	X	X


PARK AND NEUTRAL
3-4 OWC
B1
1-2 OWC
B2
REAR SERVO
FRONT SERVO
B1R EX VALVE
VARIABLE PRESSURE SOLENOID
S5
S3
S4
N.O.
CLUTCH APPLY REG. VALVE
BAND APPLY REG. VALVE
REVERSE LOCKOUT VALVE
LINE PRESSURE PLUG
S1
S2
1/2 SHIFT VALVE
2/3 SHIFT VALVE
3/4 SHIFT VALVE
4/3 SEQ VALVE
MANUAL VALVE
PRIMARY REGULATOR VALVE
S7
S6
CONVERTER CLUTCH CONTROL VALVE
CONVERTER CLUTCH REGULATOR VALVE
SOLENOID SUPPLY VALVE
COOLER
ITEMS INSIDE THE ENCLOSURE LOCATED IN PUMP COVER
LINE PRESSURE CONTROL VALVE
PUMP
SUCTION
FILTER
LINE PRESSURE RELIEF VALVE
COOLER RETURN TUBE
Free Wheeling
Planet Carrier
Short Pinion
Forward Sun Gear
Ring Gear
Reverse Sun Gear
Long Pinion
KAA5A31A

Power Flow - Park and Neutral

In Park and Neutral, there is no drive to the planetary gear set. The rear band is applied to eliminate 'clunk' on engagement of the reverse gear, and to improve the low range engagement for 4WD applications. No other clutches or bands are applied.

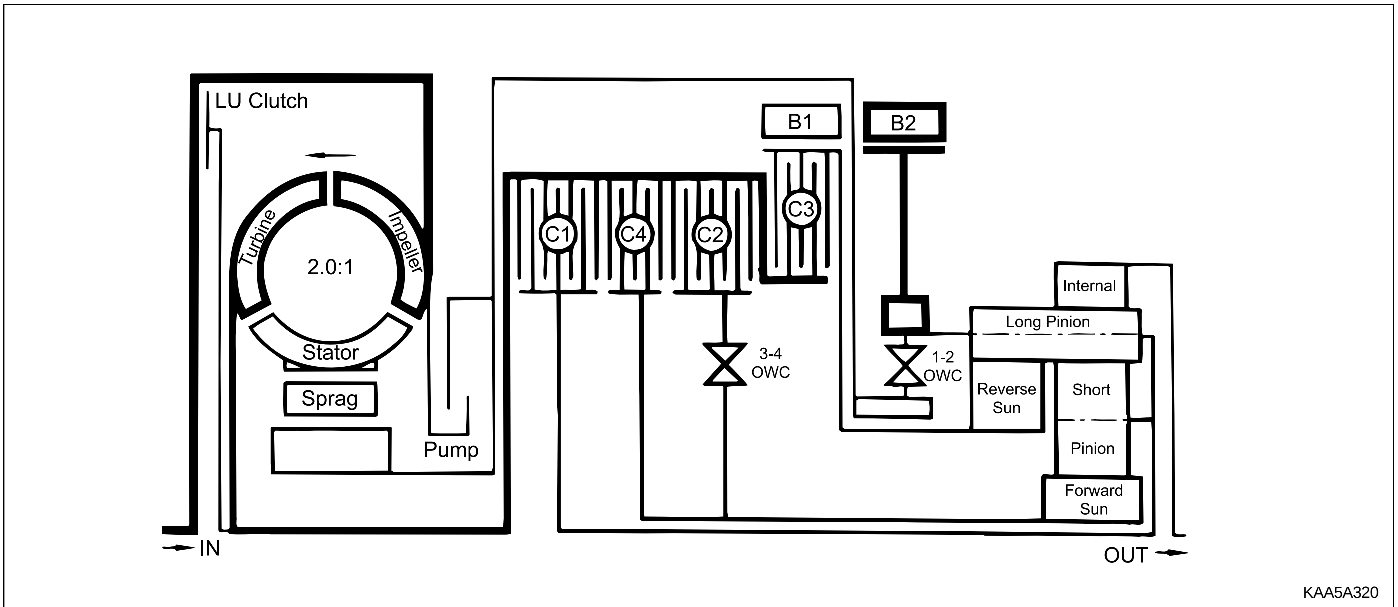
In Park the transmission is mechanically locked by engaging a case mounted pawl with teeth on the output shaft ring gear.

Control

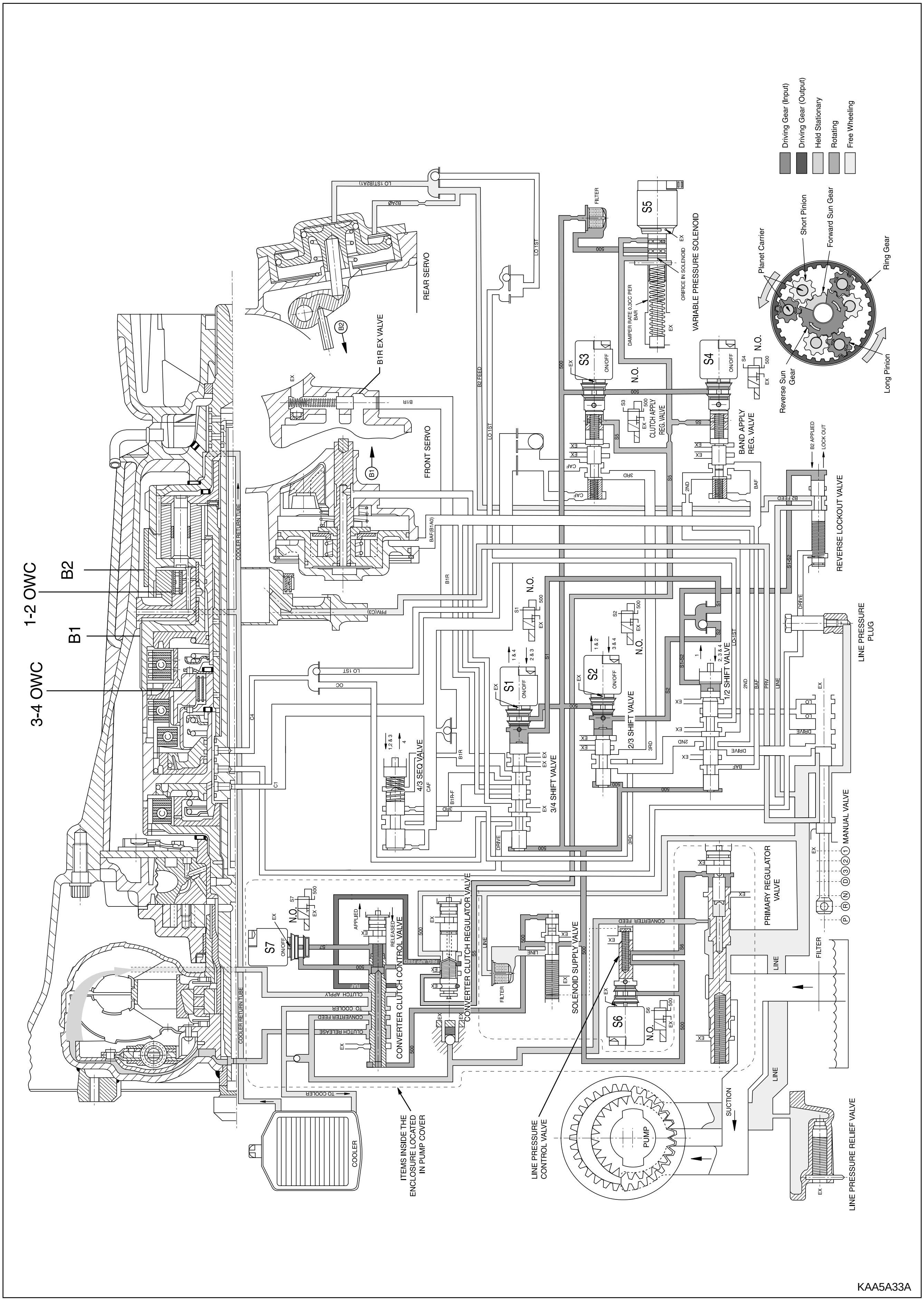
To maintain this arrangement in the steady state solenoids and valves are activated as follows:

- Solenoids S1 and S2 are switched OFF.
- Line (pump) pressure is applied to the Primary Regulator Valve (PRV) and to the solenoid supply pressure regulator valve.
- The converter, oil cooler, and lubrication circuits are charged from the primary regulator valve.
- The line 500 circuit is charged by the solenoid supply pressure regulator valve.
- The S5 circuit is charged by the variable pressure solenoid (S5).
- Line pressure is prevented from entering the drive circuit by the manual valve.
- The B1 circuit and all clutch circuits are open to exhaust.

	ELEMENTS ENGAGED								
Gear State	**C1**	**C2**	**C3**	**C4**	**B1**	**B2**	**1-2 OWC**	**3-4 OWC**	**LU CLUTCH**
Park and Neutral	-	-	-	-	-	X	-	-	-



REVERSE



B2
1-2 OWC
B1
3-4 OWC
REAR SERVO
B1R EX VALVE
FRONT SERVO
VARIABLE PRESSURE SOLENOID
S5
S3
S4
N.O.
CLUTCH APPLY REG. VALVE
BAND APPLY REG. VALVE
REVERSE LOCKOUT VALVE
LINE PRESSURE PLUG
S1
S2
1/2 SHIFT VALVE
2/3 SHIFT VALVE
3/4 SHIFT VALVE
4/3 SEQ VALVE
MANUAL VALVE
PRIMARY REGULATOR VALVE
S7
CONVERTER CLUTCH CONTROL VALVE
CONVERTER CLUTCH REGULATOR VALVE
SOLENOID SUPPLY VALVE
S6
PUMP
COOLER
ITEMS INSIDE THE ENCLOSURE LOCATED IN PUMP COVER
LINE PRESSURE CONTROL VALVE
LINE PRESSURE RELIEF VALVE
Driving Gear (Input)
Driving Gear (Output)
Held Stationary
Rotating
Free Wheeling
Planet Carrier
Short Pinion
Forward Sun Gear
Ring Gear
Reverse Sun Gear
Long Pinion
KAA5A33A

Power Flow - Reverse

In Reverse, transmission drive is via the input shaft and the forward clutch cylinder to the hub of the C3 clutch. The elements of the transmission function as follows;

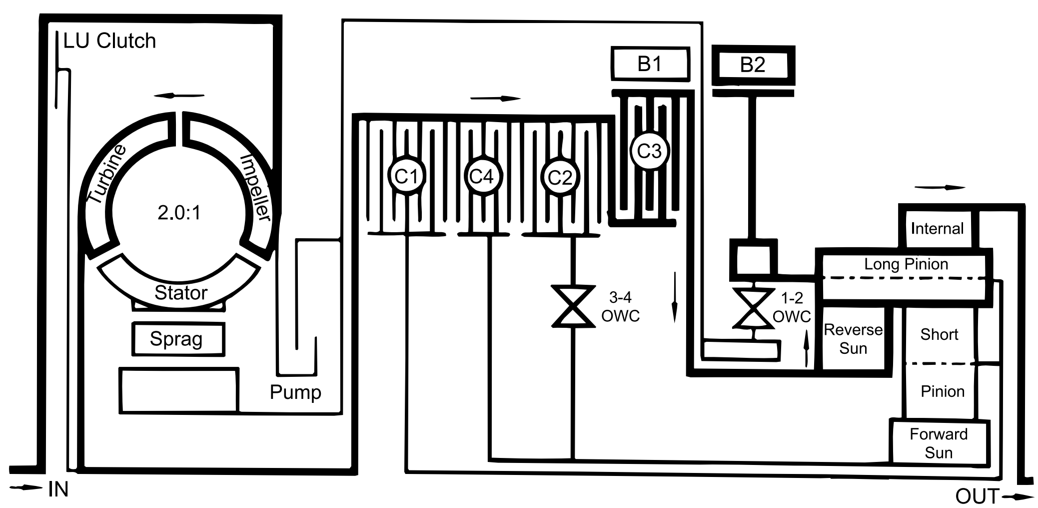
- The C3 clutch is engaged and drives the reverse sun gear in a clock-wise direction.
- The B2 band is engaged and holds the planetary gear carrier stationary causing the long pinion to rotate anti-clockwise about its axis on the pinion shaft.
- The long pinion drives the internal ring gear in the same direction.
- The internal ring being splined to the output shaft drives it in an anti-clockwise or reverse direction.

Control

To maintain this arrangement in the steady state solenoids and valves are activated as follows;

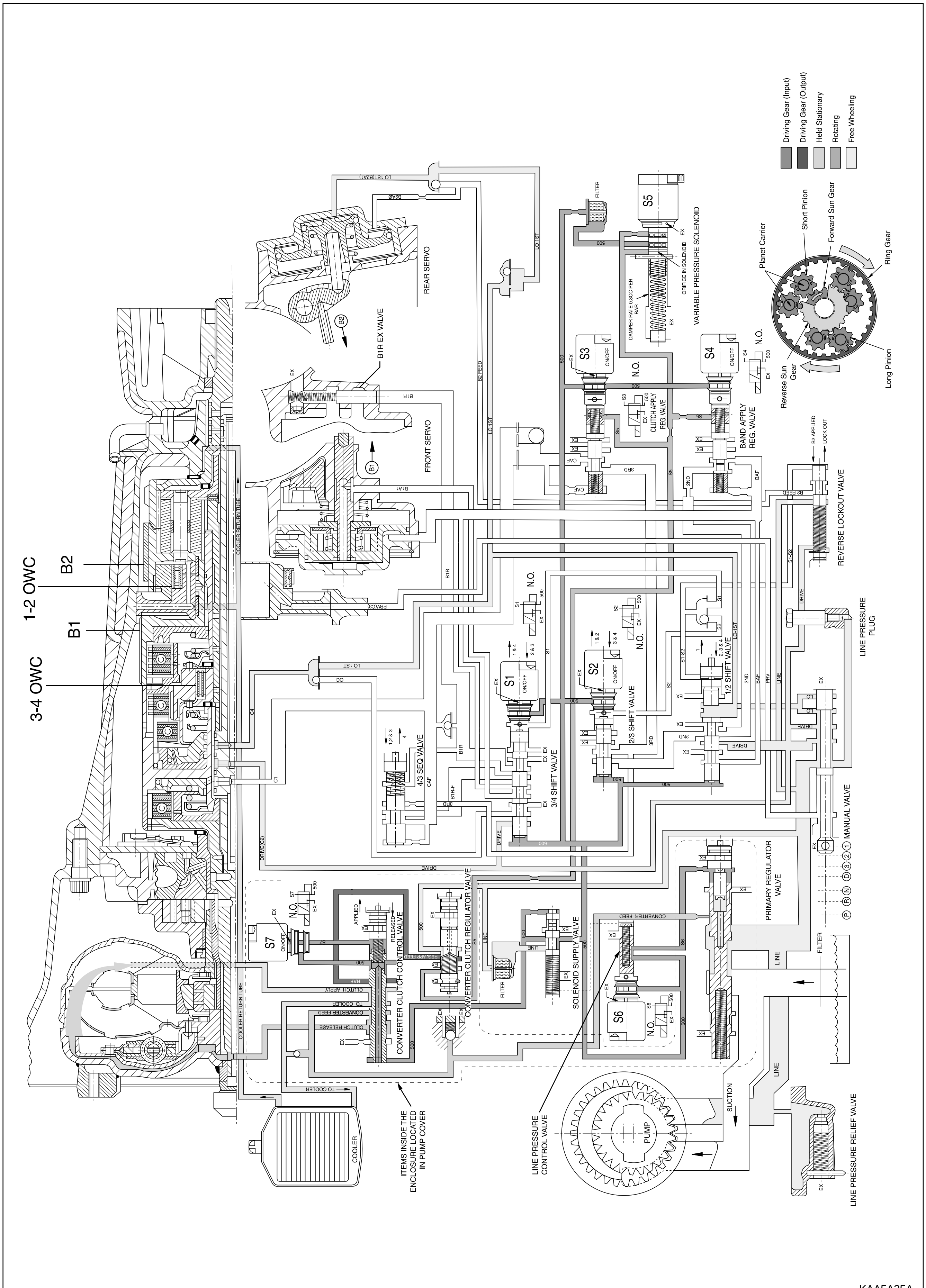
- Solenoids S1 and S2 are switched OFF.
- Line pressure is directed through the reverse lockout valve to both the inner and outer apply areas of the rear servo piston for B2 band application.
- Line pressure feeds the reverse oil circuit via the manual valve.
- Reverse oil is routed from the manual valve to the C3 clutch.
- Reverse oil is also applied to the spring end of the primary regulator valve to assist the spring and to boost the line pressure value.
- All other clutch and band apply circuits are open to exhaust.

	ELEMENTS ENGAGED								
Gear State	C1	C2	C3	C4	B1	B2	1-2 OWC	3-4 OWC	LU CLUTCH
Reverse	-	-	X	-	-	X	-	-	-



KAA5A340

MANUAL 1



3-4 OWC
B1
1-2 OWC
B2
REAR SERVO
B1R EX VALVE
FRONT SERVO
4/3 SEQ VALVE
3/4 SHIFT VALVE
2/3 SHIFT VALVE
1/2 SHIFT VALVE
S1
S2
S3
S4
S5
S6
S7
N.O.
ON/OFF
VARIABLE PRESSURE SOLENOID
CLUTCH APPLY REG. VALVE
BAND APPLY REG. VALVE
REVERSE LOCKOUT VALVE
LINE PRESSURE PLUG
MANUAL VALVE
PRIMARY REGULATOR VALVE
P R N D 3 2 1
FILTER
LINE PRESSURE RELIEF VALVE
PUMP
SUCTION
LINE PRESSURE CONTROL VALVE
SOLENOID SUPPLY VALVE
CONVERTER CLUTCH REGULATOR VALVE
CONVERTER CLUTCH CONTROL VALVE
ITEMS INSIDE THE ENCLOSURE LOCATED IN PUMP COVER
COOLER
COOLER RETURN TUBE
TO COOLER
Planet Carrier
Short Pinion
Forward Sun Gear
Ring Gear
Long Pinion
Reverse Sun Gear
Driving Gear (Input)
Driving Gear (Output)
Held Stationary
Rotating
Free Wheeling
KAA5A35A

Power Flow - Manual 1

In Manual 1, transmission drive is via the input shaft to the forward clutch cylinder. The elements of the transmission function as follows;

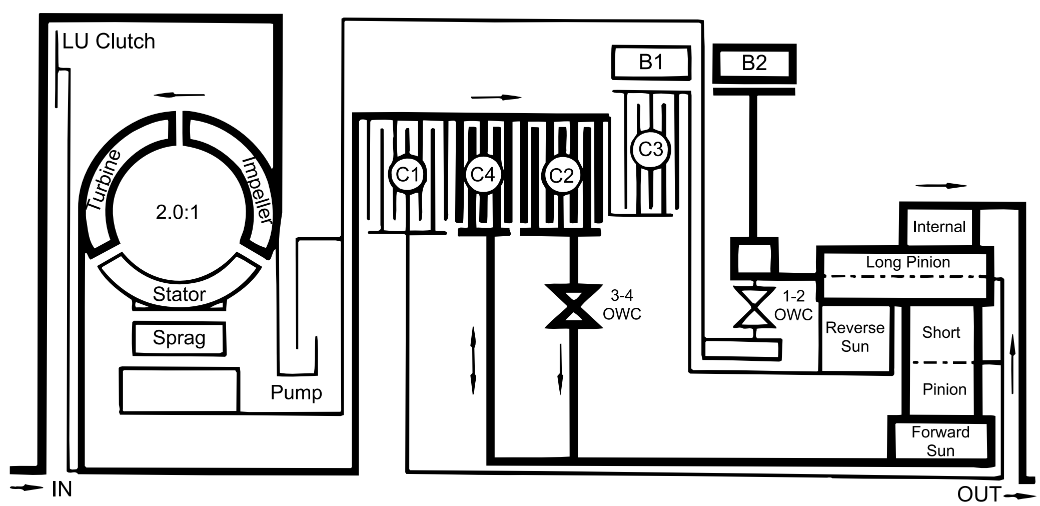
- The C2 clutch is engaged to drive the forward sun gear, via the 3-4 OWC.
- The B2 band is engaged to hold the planetary gear carrier stationary.
- The forward sun gear drives the short pinion anti-clockwise.
- The short pinion drives the long pinion clockwise.
- The long pinion rotating about its axis drives the internal ring gear and the output shaft in a clockwise or forward direction.
- The C4 clutch provides engine braking through the 3-4 OWC on overrun.

Control

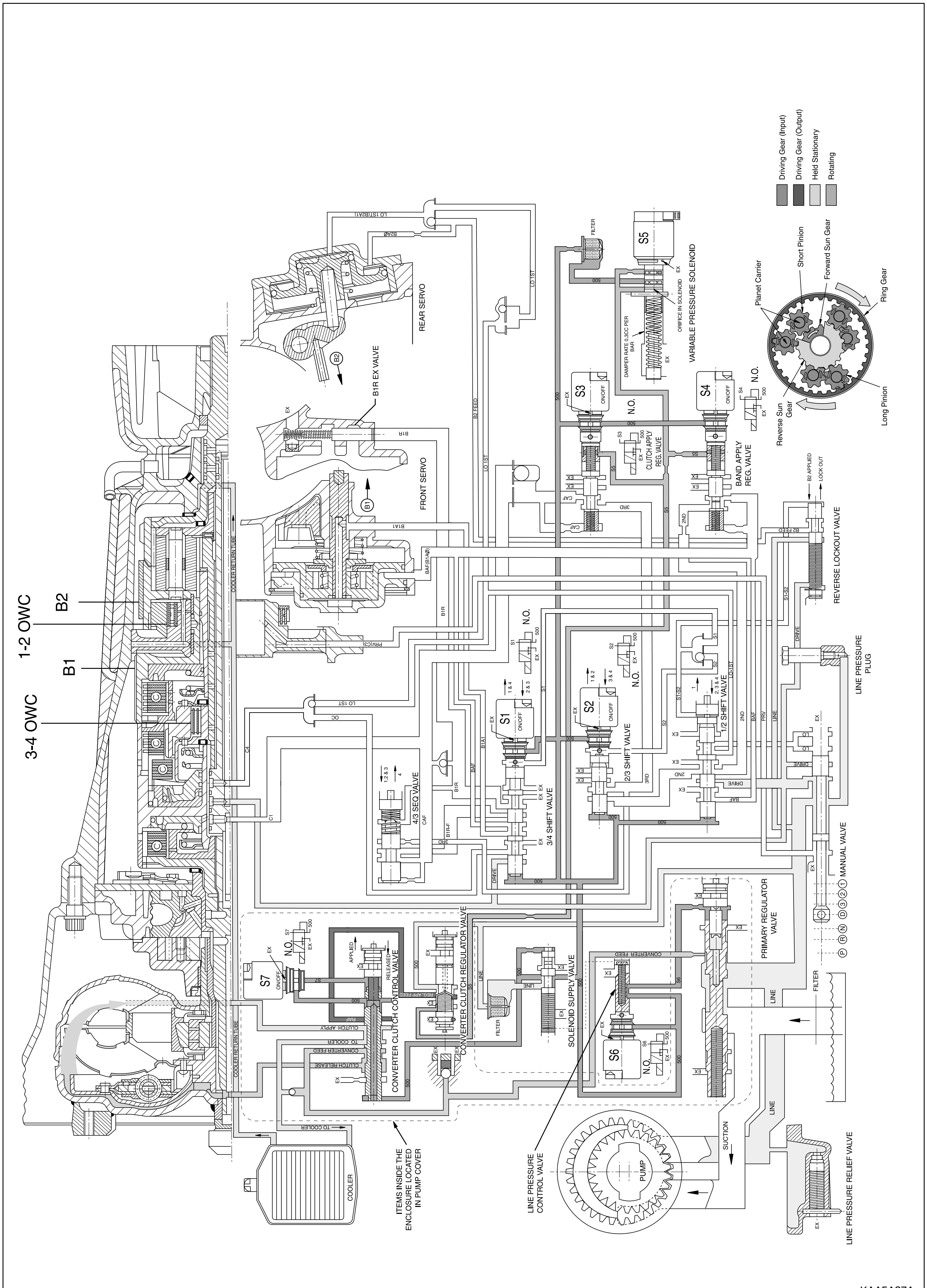
To maintain this arrangement in the steady state solenoids and valves are activated as follows;

- Solenoids S1 and S2 are switched ON.
- The 1-2, 2-3, and 3-4 shift valves are held in their first gear positions by line 500 pressure.
- Drive (line pressure) oil from the manual valve engages the C2 clutch.
- Lo-1st (line pressure) oil is routed through the 1-2 shift valve to the C4 clutch, and to the inner apply area of the rear servo piston for B2 band application.

	ELEMENTS ENGAGED								
Gear State	C1	C2	C3	C4	B1	B2	1-2 OWC	3-4 OWC	LU CLUTCH
Manual 1	-	X	-	X	-	X	-	X	-



KAA5A360


DRIVE 1
B2
1-2 OWC
B1
3-4 OWC
REAR SERVO
B1R EX VALVE
FRONT SERVO
VARIABLE PRESSURE SOLENOID
ORIFICE IN SOLENOID
DAMPER RATE 0.3CC PER BAR
S5
S3
S4
N.O.
CLUTCH APPLY REG. VALVE
BAND APPLY REG. VALVE
REVERSE LOCKOUT VALVE
LINE PRESSURE PLUG
S1
S2
1/2 SHIFT VALVE
2/3 SHIFT VALVE
3/4 SHIFT VALVE
4/3 SEQ VALVE
MANUAL VALVE
P R N D 3 2 1
PRIMARY REGULATOR VALVE
S7
S6
CONVERTER CLUTCH CONTROL VALVE
CONVERTER CLUTCH REGULATOR VALVE
SOLENOID SUPPLY VALVE
LINE PRESSURE CONTROL VALVE
ITEMS INSIDE THE ENCLOSURE LOCATED IN PUMP COVER
COOLER
PUMP
SUCTION
FILTER
LINE PRESSURE RELIEF VALVE
COOLER RETURN TUBE
Driving Gear (Input)
Driving Gear (Output)
Held Stationary
Rotating
Planet Carrier
Short Pinion
Forward Sun Gear
Ring Gear
Long Pinion
Reverse Sun Gear
KAA5A37A

Power Flow - Drive 1

In Drive 1, transmission drive is via the input shaft to the forward clutch cylinder. The elements of the transmission function as follows :

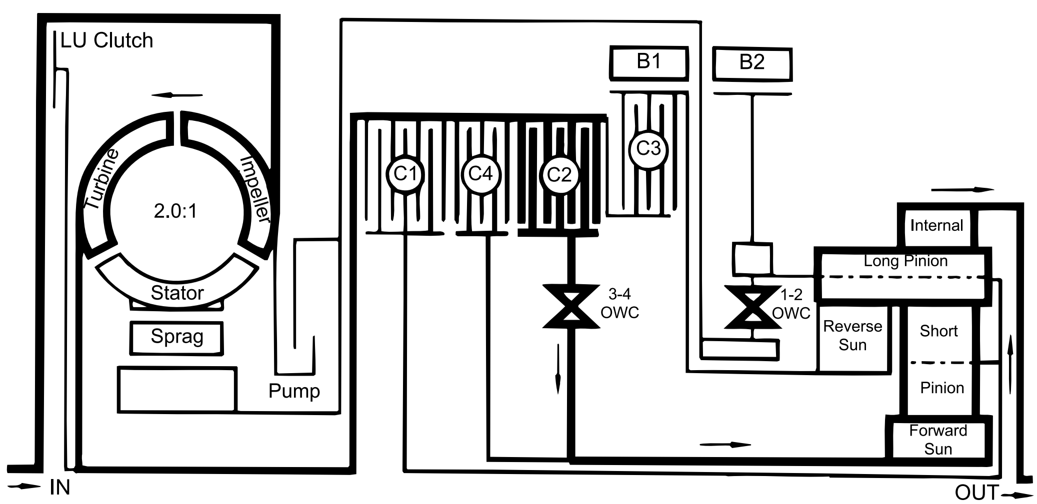
- The C2 clutch is engaged to drive the forward sun gear via the 3-4 OWC.
- The forward sun gear drives the short pinion anticlockwise.
- The short pinion drives the long pinion clockwise.
- The 1-2 OWC prevents the planetary gear carrier from rotating under reaction force and the long pinion rotates on its axis driving the internal ring gear and output shaft in a clockwise or forward direction.
- There is no engine braking on overrun.

Control

To maintain this arrangement in the steady state solenoids and valves are activated as follows:

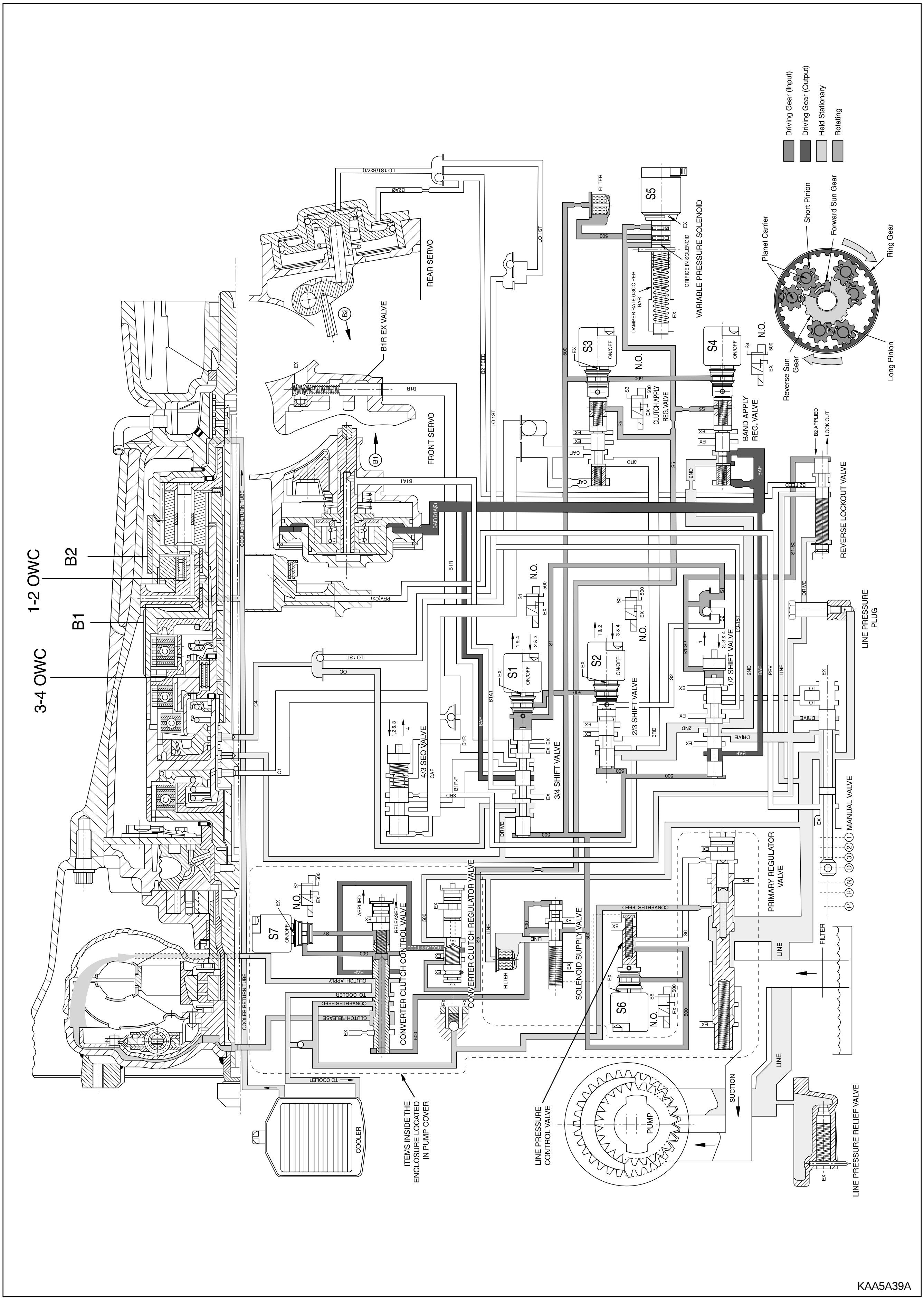
- Solenoids S1 and S2 are switched ON.
- The 1-2, 2-3, and 3-4 shift valves are held in their first gear positions by line 500 pressure.
- Drive (line pressure) oil from the manual valve engages the C2 clutch.

	ELEMENTS ENGAGED								
Gear State	C1	C2	C3	C4	B1	B2	1-2 OWC	3-4 OWC	LU CLUTCH
Drive 1	-	X	-	-	-	-	X	X	-



KAA5A380

DRIVE 2 AND MANUAL 2



Power Flow - Drive 2 and Manual 2

In Drive 2 and Manual 2, transmission drive is via the input shaft and forward clutch cylinder. The elements of the transmission function as follows;

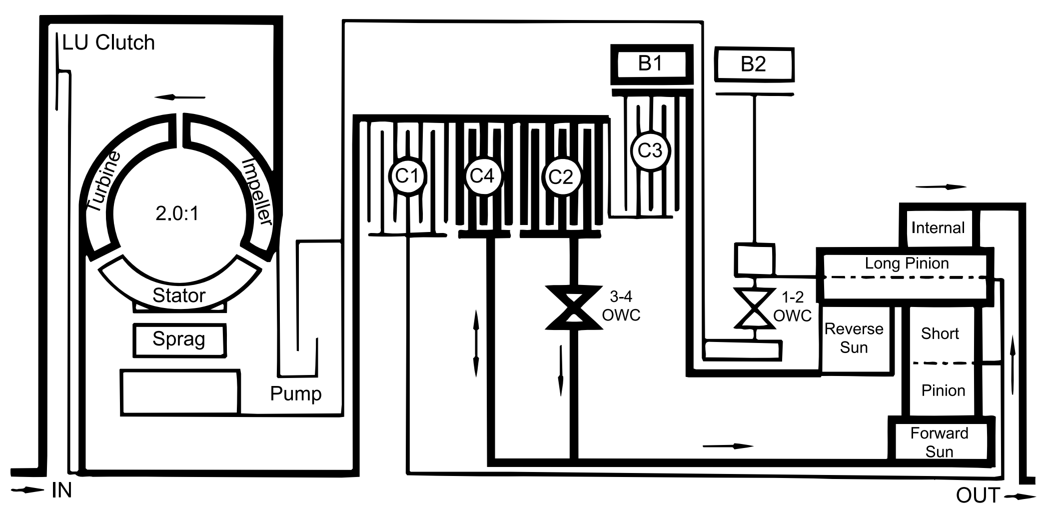
- The C2 clutch is applied to drive the forward sun gear.
- The forward sun gear drives the short pinion anticlockwise.
- The short pinion drives the long pinion clockwise.
- The B1 band is applied holding the reverse sun gear stationary therefore the long pinion walks around the reverse sun gear taking the internal ring gear and output shaft with it in a clockwise or forward direction.
- The C4 clutch is applied to bypass the 3-4 OWC and provide engine braking on overrun.

Control

To maintain this arrangement in the steady state solenoids and valves are activated as follows;

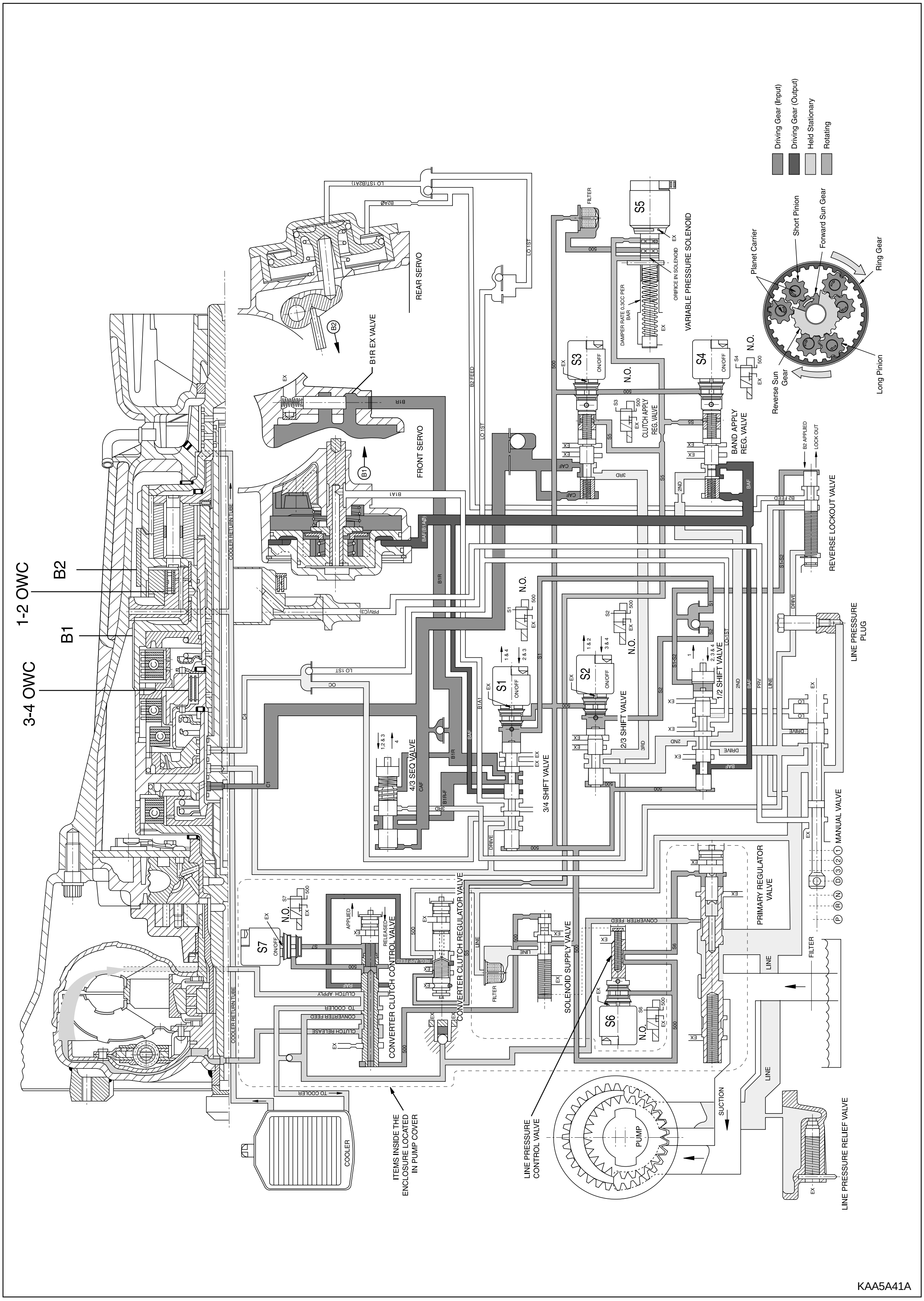
- Solenoid S1 is switched OFF. S2 is switched ON.
- Drive (line pressure) oil from the manual valve engages the C2 clutch.
- When S1 switches OFF, S1 oil pressure, which is derived from line 500 pressure, moves the 3-4 shift valve to the left. At the same time S1 oil is directed to the 1-2 shift valve which moves the valve to the second gear position.
- 2nd oil (line pressure) from the 1-2 shift valve is directed to the band apply regulator valve, and to the 2-3 shift valve.
- The band apply feed regulator valve supplies 2nd oil (regulated to line pressure multiplied by the valve ratio) to the Band Apply Feed (BAF) circuit.
- Band apply feed oil is directed to;
  - The outer apply area of the front servo
  - The 1-2 shift valve to provide an exhaust port when the transmission is shifted to first gear
  - The 3-4 shift valve for use when the transmission is shifted into fourth gear
- Drive (line pressure) is routed through the 3-4 shift valve to apply the C4 clutch.

	ELEMENTS ENGAGED								
Gear State	C1	C2	C3	C4	B1	B2	1-2 OWC	3-4 OWC	LU CLUTCH
Drive 2 and Manual 2	-	X	-	X	X	-	-	X	-



KAA5A400

DRIVE 3 AND MANUAL 3



Power Flow - Drive 3 and Manual 3

In Drive 2 and Manual 2, transmission drive is via the input shaft and forward clutch cylinder. The elements of the transmission function as follows;

- The C2 clutch is engaged to drive the forward sun gear.
- The C1 clutch is engaged to drive the planet carrier.
- The short pinion drives the long pinion clockwise.
- The forward sun gear and the planet carrier are driven clockwise at the same speed therefore there is no relative motion between the sun gear and the pinions.
- The ring gear and output shaft are driven in a clockwise or forward direction at input shaft speed.
- The C4 clutch is applied to bypass the 3-4 OWC and provide engine braking on overrun.

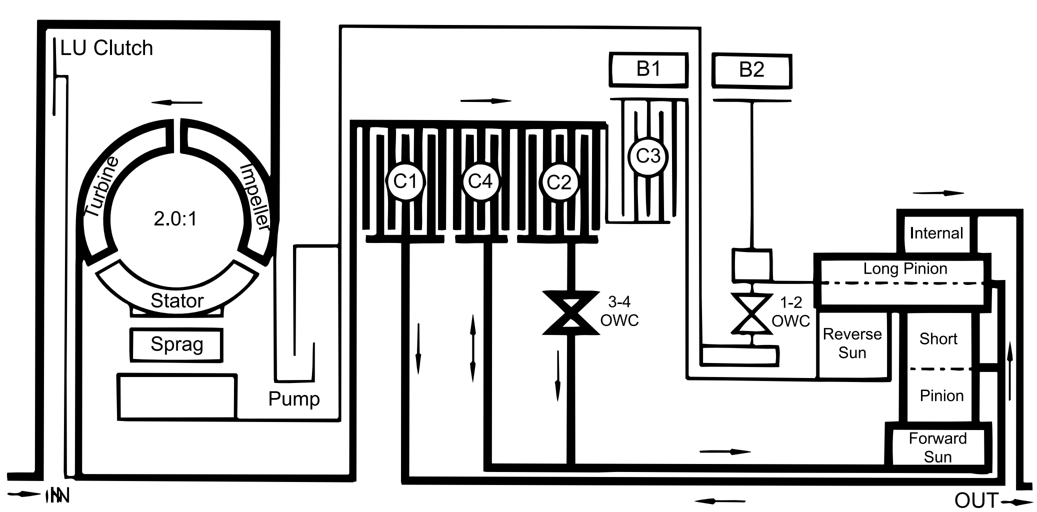
Control

To maintain this arrangement in the steady state solenoids and valves are activated as follows:

- Solenoid S1 is switched OFF. S2 is switched OFF.
- With S1 and S2 switched OFF, the 2-3 and 3-4 shift valves are held in the third gear position by line 500 pressure.
- The 1-2 shift valve is held in the third gear position by S1-S2 oil pressure.
- 2nd oil (line pressure) from the 1-2 shift valve is directed to the band apply feed regulator valve and to the 2-3 shift valve.
- The band apply feed regulator valve supplies 2nd oil (regulated to line pressure multiplied by the valve ratio) to the Band Apply Feed (BAF) circuit.
- Band apply feed oil is directed to;
  - The outer apply area of the front servo
  - The 1-2 shift valve to provide an exhaust port when the transmission is shifted to first gear
  - The 3-4 shift valve for use when the transmission is shifted into fourth gear
- 2nd oil at the 2-3 shift valve is directed to the 3rd oil circuit.
- 3rd oil from the 2-3 shift valve is directed to the clutch apply regulator valve, and to the 4-3 sequence valve.
- The clutch apply regulator valve supplies oil (regulated to line 500 pressure multiplied by the valve ratio) to the Clutch Apply Feed (CAF) circuit.

  The CAF oil is directed to;
  - The C1clutch
  - The 4-3 sequence valve
- At the 4-3 sequence valve the CAF oil becomes Band 1 Release Feed (B1R-F) oil, and is directed through the 3-4 shift valve to the spring end of the 4-3 sequence valve, and to the release side of the front servo piston to hold band 1 OFF.
- Drive (line pressure) is routed through the 3-4 shift valve to apply the C4 clutch.

Gear State	ELEMENTS ENGAGED								
	C1	C2	C3	C4	B1	B2	1-2 OWC	3-4 OWC	LU CLUTCH
Drive 3 and Manual 3	X	X	-	X	-	-	-	X	-



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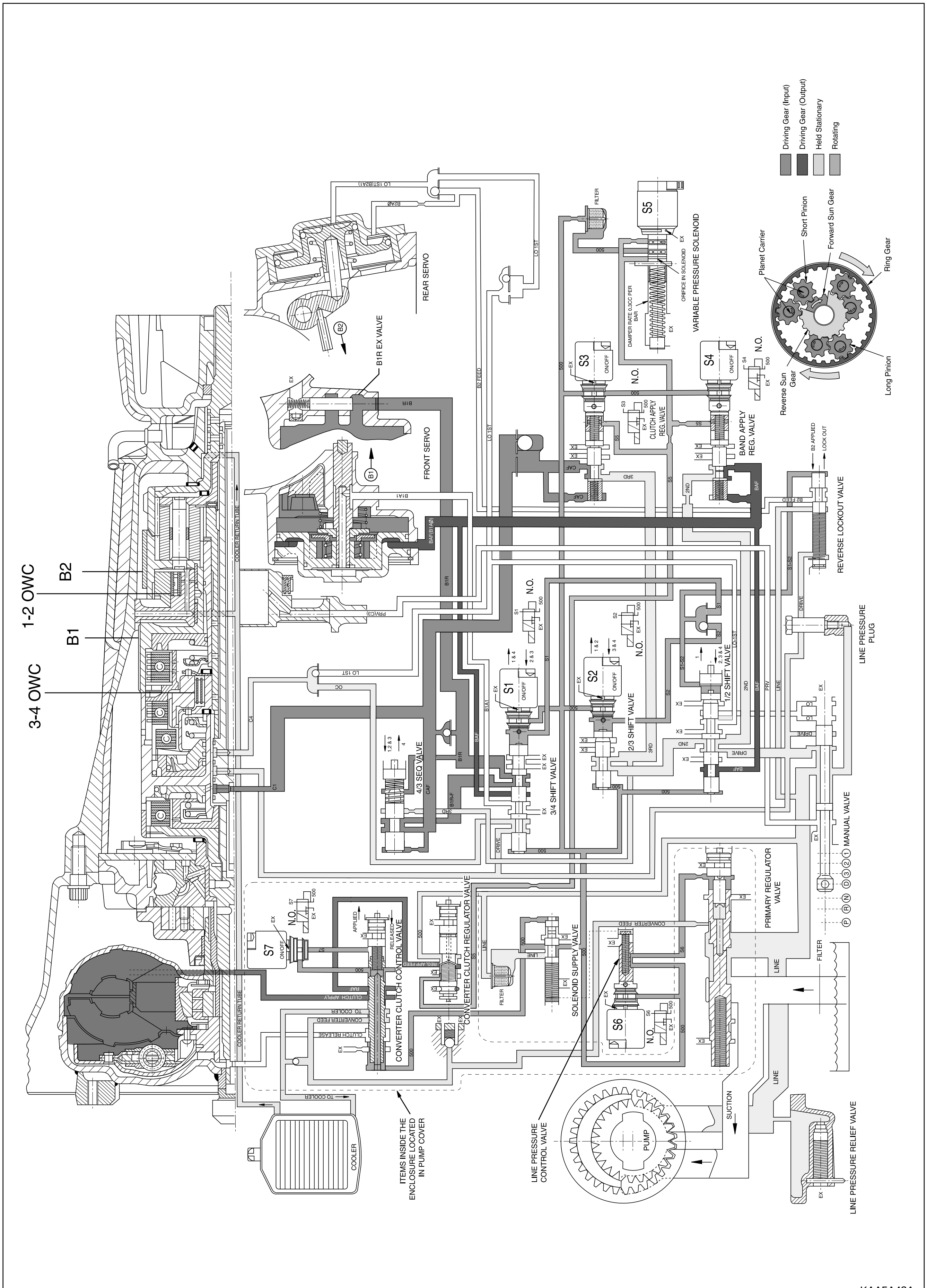
DRIVE 3 LOCK UP AND MANUAL 3 LOCK UP



Power Flow - Drive 3 Lock Up and Manual 3 Lock Up

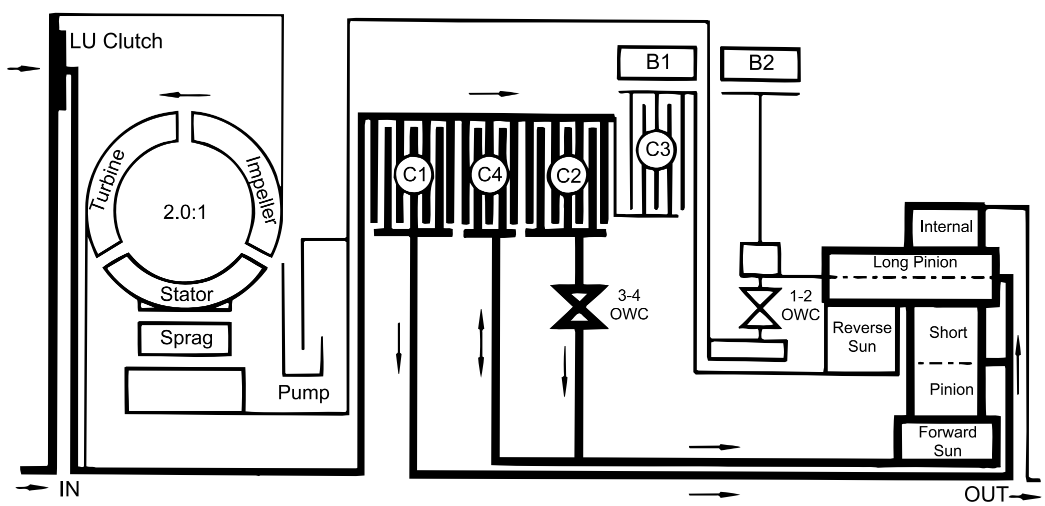
In Drive 3 Lock Up and Manual 3 Lock Up, transmission drive is the same as for Drive 3 but with the application of the converter lock up clutch to provide positive no-slip converter drive.

Control

Control for Drive 3 Lock Up and Manual 3 Lock Up is the same as for Drive 3 with the addition of the converter clutch circuit activated by solenoid S7.

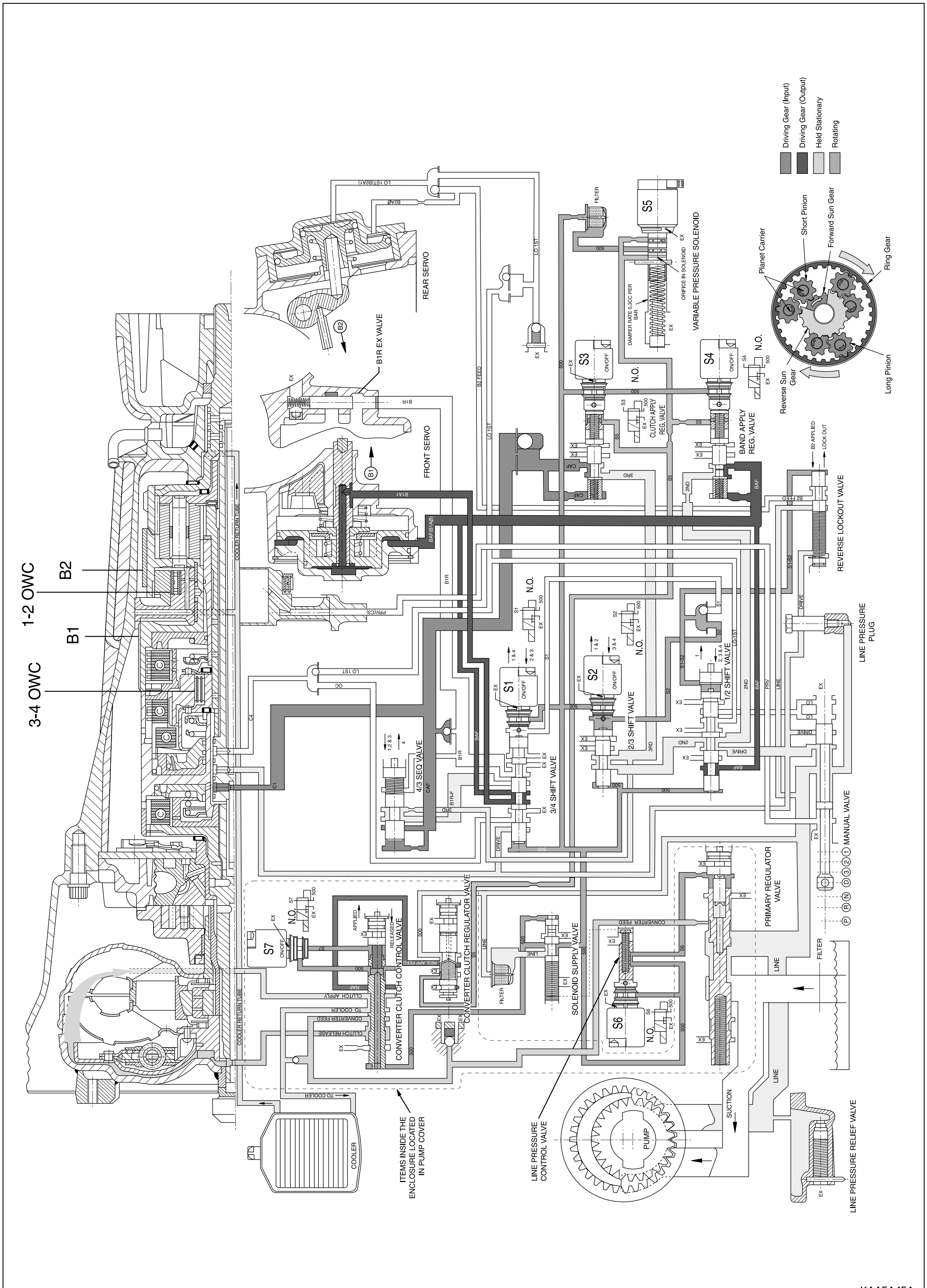
- When S7 is switched ON, S7 feed oil to the converter clutch control valve is switched OFF and allowed to exhaust through the S7 solenoid. This allows the valve to move to the clutch engage position.
- Regulated apply feed oil, drive oil at the converter clutch regulator valve, is directed by the converter clutch control valve to the engage side of the converter clutch.
- Converter clutch release oil is exhausted at the converter clutch control valve.
- Converter feed oil is re-routed by the converter clutch control valve directly to the oil cooler and lubrication circuit.

	ELEMENTS ENGAGED								
Gear State	C1	C2	C3	C4	B1	B2	1-2 OWC	3-4 OWC	LU CLUTCH
Drive 3 Lock Up and Manual 3 Lock Up	X	X	-	X	-	-	-	X	X



KAA5A440

DRIVE 4 (OVERDRIVE)



Power Flow - Drive 4 (Overdrive)

In Drive 4 (Overdrive), transmission drive is via the input shaft to the forward clutch cylinder.

The elements of the transmission function as follows;

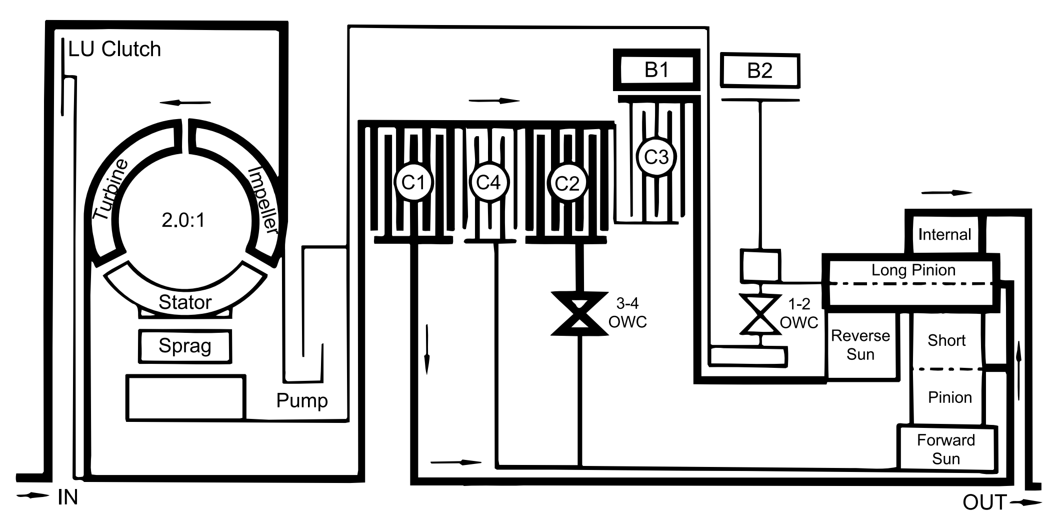
- The C1 clutch is applied to drive the planet carrier clockwise.
- The B1 band is applied to hold the reverse sun gear stationary.
- As the planet carrier tuns, the long pinion walks around the stationary reverse sun gear and rotates around its axis driving the internal ring gear and output shaft in a clockwise or forward direction at a speed faster than the input shaft i.e. in overdrive ratio.
- The forward sun gear is also driven faster than the input shaft and overruns the 3-4 OWC.
- The C2 clutch is engaged to reduce the speed differential across the 3-4 OWC.

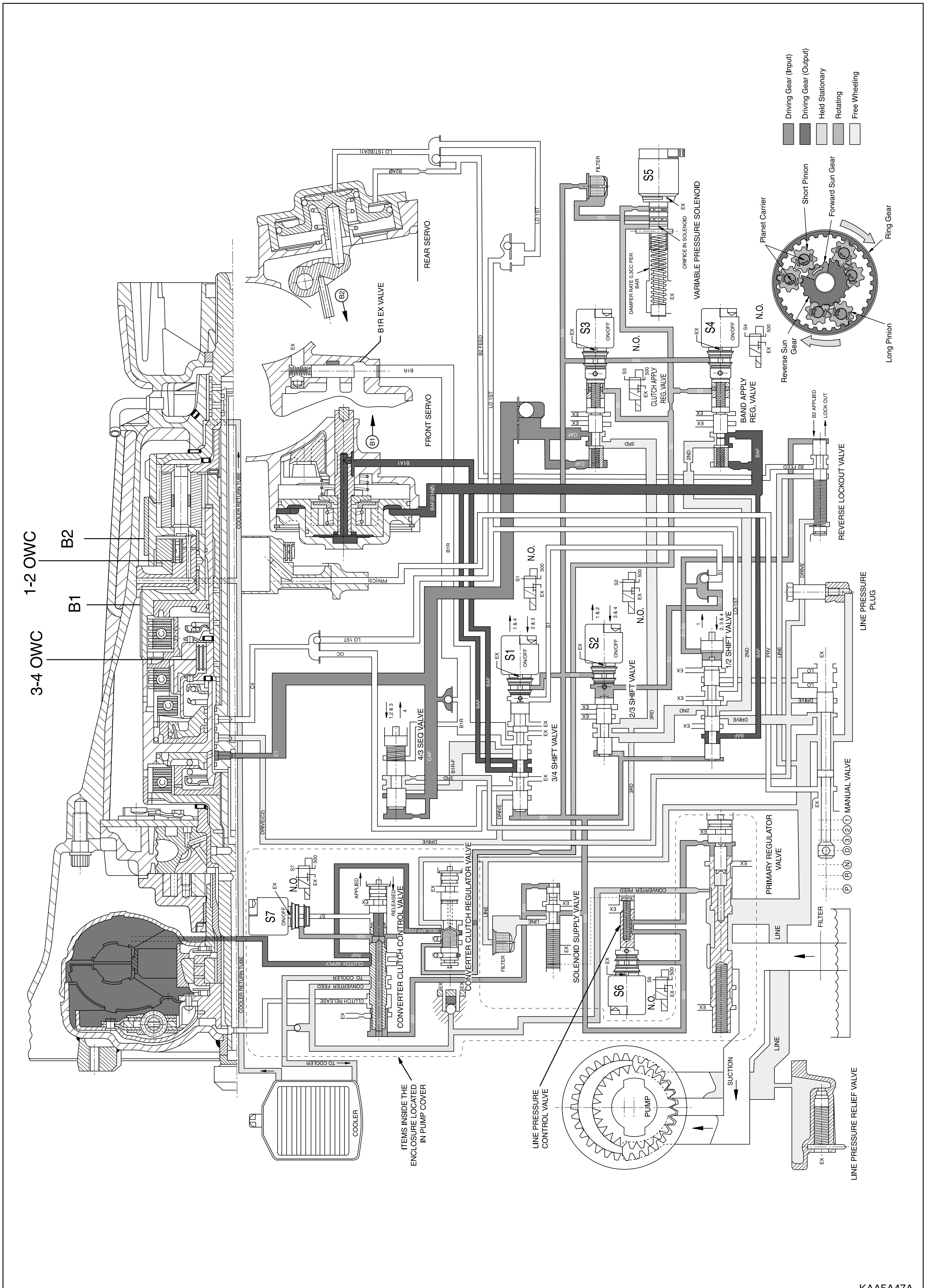
Control

To maintain this arrangement in the steady state solenoids and valves are activated as follows;

- Solenoid S1 is switched ON. S2 is switched OFF.
- With S1 switched ON, the 3-4 shift valve is held in the fourth gear position by line 500 pressure on the small end of the valve.
- With S2 switched OFF, the 2-3 shift valve is held in the fourth gear position by line 500 pressure on the large end of the valve.
- The 1-2 shift valve is held in the fourth gear position by S2 oil pressure.
- 2nd oil (line pressure) from the 1-2 shift valve is directed to the band apply feed regulator valve, and to the 2-3 shift valve.
- The band apply feed regulator valve supplies 2nd oil (regulated to line pressure multiplied by the valve ratio) to the Band Apply Feed (BAF) circuit.
- Band apply feed oil is directed to;
  - the outer apply area of the front servo
  - the inner apply area of the front servo piston via the 3-4 shift valve
  - the 1-2 shift valve to provide an exhaust port when the transmission is shifted to first gear
- 2nd oil at the 2-3 shift valve is directed to the 3rd oil circuit.
- 3rd oil from the 2-3 shift valve is directed to the clutch apply regulator valve, and to the 4-3 sequence valve.
- The clutch apply regulator valve supplies oil (regulated to line 500 pressure multiplied by the valve ratio) to the Clutch Apply Feed (CAF) circuit.
- The CAF oil is directed to;
  - the C1 clutch
  - the 4-3 sequence valve
- Drive oil (line pressure) from the manual valve engages the C2 clutch.

	ELEMENTS ENGAGED								
Gear State	C1	C2	C3	C4	B1	B2	1-2 OWC	3-4 OWC	LU CLUTCH
Drive 4 Overdrive	X	X	-	-	X	-	-	-	-




DRIVE 4 LOCK UP
3-4 OWC
B1
1-2 OWC
B2
REAR SERVO
B1R EX VALVE
FRONT SERVO
VARIABLE PRESSURE SOLENOID
S5
S3
S4
N.O.
CLUTCH APPLY REG. VALVE
BAND APPLY REG. VALVE
REVERSE LOCKOUT VALVE
LINE PRESSURE PLUG
S1
S2
1/2 SHIFT VALVE
2/3 SHIFT VALVE
3/4 SHIFT VALVE
4/3 SEQ VALVE
MANUAL VALVE
P R N D 3 2 1
PRIMARY REGULATOR VALVE
SOLENOID SUPPLY VALVE
S6
S7
CONVERTER CLUTCH CONTROL VALVE
CONVERTER CLUTCH REGULATOR VALVE
COOLER RETURN TUBE
COOLER
ITEMS INSIDE THE ENCLOSURE LOCATED IN PUMP COVER
LINE PRESSURE CONTROL VALVE
PUMP
SUCTION
FILTER
LINE PRESSURE RELIEF VALVE
Planet Carrier
Short Pinion
Forward Sun Gear
Ring Gear
Long Pinion
Reverse Sun Gear
Driving Gear (Input)
Driving Gear (Output)
Held Stationary
Rotating
Free Wheeling
KAA5A47A

Power Flow - Drive 4 Lock Up

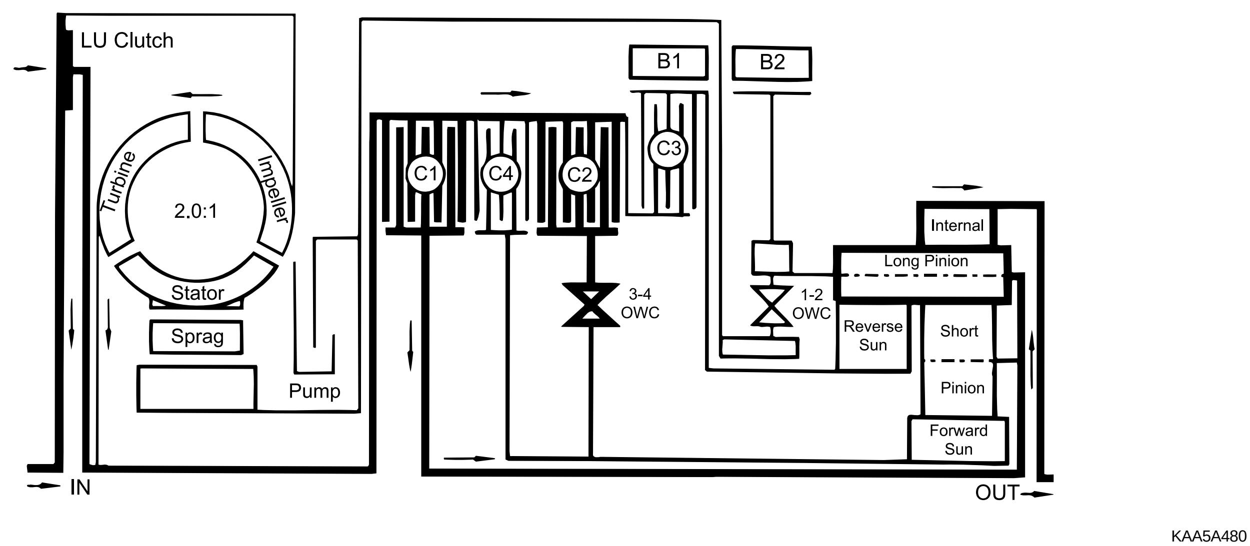
In Drive 4 Lock Up, transmission drive is the same as for Drive 4 but with the application of the converter lock up clutch to provide positive no-slip converter drive.

Control

To maintain this arrangement in the steady state solenoids and valves are activated as follows;

- When S7 is switched ON, S7 feed oil to the converter clutch control valve is switched OFF and allowed to exhaust through the S7 solenoid. This allows the valve to move to the clutch engage position.
- Regulated apply feed oil, drived from drive oil at the converter clutch regulator valve, is directed by the converter clutch control valve to the engage side of the converter clutch.
- Converter clutch release oil is exhausted at the converter clutch control valve.
- Converter feed oil is re-routed by the converter clutch control valve directly to the oil cooler and lubrication circuit.

	ELEMENTS ENGAGED								
Gear State	**C1**	**C2**	**C3**	**C4**	**B1**	**B2**	**1-2 OWC**	**3-4 OWC**	**LU CLUTCH**
Drive 4 Lock Up	X	X	-	-	X	-	-	-	-



DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSIS

BASIC KNOWLEDGE REQUIRED

You must be familliar 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 transmission when performing diagnostic procedures could result in incorrect diagnostic performance or damage to transmission components. Do not, under any circumstances, attempt to diagnose a transmission 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 transmission. This will eliminate the unnecessary removal of transmission components.

FUNCTIONAL CHECK PROCEDURE

Begin with the Functional Check Procedure which provides a general outline of how to diagnose automatic transmission. The following functional check procedure will indicate the proper path of diagnosing the transmission by describing the basic checks and then referencing the locations of the specific checks.

- Check the fluid level according to the Fluid Level Service Procedure.
- Check the transmission fluid leak.
- Check if the transmission fluid is not burnt by smell. **Notice:** The specific fluid used in this transmission turns brown during normal operation. Brown fluid does not indicate a transmission fault.
- Ensure that the transmission 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 transmission 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.

TRANSMISSION 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 transmission 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 transmission fluid level is low, a loss of drive may occur when the transmission 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 transmission.

When adding or changing transmission fluid use only Castrol TQ 95 automatic transmission fluid. The use of incorrect fluid will cause the performance and durability of the transmission 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 or, if possible, drive the vehicle for a few kilometers. This will allow the transmission to be within the correct temperature range. Transmission fluid level should be checked at temperature 50 - 60 °C (82 - 140 °F).

Caution: Removal of the fluid filler plug when the transmission fluid is hot may cause injury if fluid drains from the filler hole.

2. With the brake pedal pressed, move the gear shift control lever through the gear ranges, pausing a few seconds in each range. Return the gear shift control lever to P (Park). Turn the engine OFF.
3. Park the vehicle on a hoist, inspection pit or similar raised level surface. The vehicle must be control level to obtain a correct fluid level measurement.

4. Place a fluid container below the fluid filler plug.
5. 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 transmission may have been overfilled. When the fluid stops draining the fluid level is correct. Install the fluid filler plug and tighten it to 33 N•m (24 lb-ft).
   - If fluid does not drain through the filler hole, the transmission fluid level may be low. Install the filler pump into the filler hole. Lower the vehicle with the filler pump still connected and partially fill the fluid through the filler hole.

     Start the vehicle in P (Park) with the parking brake and the brake applied. With the engine idling, move the gear shift. control 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. When the three minutes passed after the engine stopped, remove the filler pump.

     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 33 N•m (24 lb-ft).
   - If fluid does not drain through the filler hole although adding a total of 1.5 liters, the transmission should be inspected for fluid leaks and any leaks should be fixed before setting the transmission fluid level.
6. 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:

Converter empty	8.0 liters	(8.5 quarts)
Converter full	3.8 liters	(4.0 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 control 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 litres 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 33 N•m (24 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 transmission temperature being in the range 50 - 60 °C (82 - 140 °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 en-gine 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 33 N•m (24 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 transmission in the vehicle.

Methods for Locating Leaks

General Method

1. Verify that the leak is transmission fluid.
2. Thoroughly clean the suspected leak area.
3. Drive the vehicle for approximately 25 km (15 miles) or until the transmission 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 transmission 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 transmission through the transmission 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 misaligned, damaged or worn.
- Damaged, warped or scratched seal bore or gasket surface.
- Loose or worn bearing causing excess seal or sleeve wear.
- 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 are connected and operating. If the inputs are not checked before operating the transmission, a simple electrical condition could be misdiagnosed as a major transmission condition.

A scan tool provides valuable information and must be used on the automatic transmission 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
   - TRANSMISSION GEAR STATE
   - GEAR SHIFT LEVER POSITION
   - TRANSMISSION FLUID TEMPERATURE
   - CLOSED THROTTLE POSITION LEARN
   - OPEN THROTTLE POSITION LEARNT
   - CLOSED ACCEL. PEDAL POSITION LEARNT
   - OPEN ACCEL. PEDAL POSITION LEARNT
   - A/C COMPRESSOR STATUS
   - KICKDOWN SWITCH STATUS
   - 4WD STATUS
   - MODE SWITCH
   - THROTTLE POSITION VOLTAGE
   - GEAR SHIFT LEVER POSITION VOLTAGE
   - TRANS. FLUID TEMPERATURE VOLTAGE
   - A/C SWITCH
   - KICKDOWN SWITCH VOLTAGE
   - 4WD LAMP LOW VOLTAGE
   - 4WD LAMP HIGH VOLTAGE
   - 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 turn 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.

ELECTRONIC ADJUSTMENTS

Idle Speed Adjustments

Carry out the adjustments to the idle speed as detailed in the workshop manual.

Vehicle Coding

The vehicle coding is integrated as part of the diagnostic software. A scan tool has the function to code the vehicle through the K-line.

SYMPTOM DIAGNOSIS

DRIVE FAULTS

Condition	Possible Causes	Action
No Drive in D	• Insufficient auto transmission fluid.	• Check the fluid level. Top up as necessary.
	• Blocked feed in C1/C2 cylinder.	• Inspect and clean C1/C2 feed.
	• 'Z' link displaced.	• Reinstall/renew the 'z' link.
	• Primary Regulator Valve (PRV) jammed open.	• Remove, clean and re-install the PRV.
	• Overdrive shaft or input shaft seal rings failed.	• Inspect and replace as necessary.
	• 3-4 or 1-2 One Way Clutch (OWC) installed backwards or failed.	• Inspect and replace as necessary.
	• C2 piston broken or cracked.	• Inspect and replace as necessary.
No Drive in Reverse No engine braking in Manual 1 Engine braking in Manual 1 is OK	• Rear band or servo faulty.	• Check servo adjustment or replace rear band as necessary.
	• Failure in C3, C3 hub or C1/C2 cylinder.	• Check for failure in C3, C3 hub or C1/C2 cylinder. Repair as necessary.
	• Damaged input shaft sealing rings.	• Inspect and replace as necessary.
No drive in Drive and Reverse	• Jammed Primary Regulator Valve (PRV).	• Inspect and clean PRV.
	• Damaged/broken pump gears.	• Inspect and replace pump gears as necessary.
	• Dislodged output shaft snap ring.	• Inspect and repair as necessary.

FAULTY SHIFT PATTERN

Condition	Possible Causes	Action
2-3 shift only (no 4th or 1st)	• S1 always OFF.	• Inspect S1. Repair or replace as necessary. • Check for 12 Volts applied to S1 at all times or for wiring fault.
1-4 shift only1-3-4 (Delayed 1-2 shift)	• S1 always ON.	• Inspect S1. Repair or replace as necessary. • Check for 12 Volts applied to S1 at all times or for wiring fault.
4-3 shift only	• S2 always OFF.	• Inspect S2. Repair or replace as necessary. • Check for open circuit or wiring fault.
1-2-Neutral (1st over run)	• S2 always ON.	• Inspect S2. Repair or replace as necessary. • Check for open circuit or wiring fault.
1-3 shift only	• B1 failed. • Loose band adjustment. • Front servo piston or seal failed. • S1/S2 ball misplaced,	• Inspect and repair as necessary. • Inspect and adjust as necessary. • Inspect and repair as necessary. • Inspect and replace or refit as necessary
1-3-4 only	• Smaller 'O' ring on front servo piston failed or missing. • 2-3 shift valve jammed.	• Inspect 'O' ring. Refit or replace as necessary. • Inspect the 2-3 shift valve. Repair or replace as necessary.
1-2-1 only	• C1 clutch failed or slipping in 3rd and 4th. (Gives 1st in 3rd and 2nd in 4th.)	• Inspect C1 clutch. Repair or replace as necessary.
No manual 4-3, 3-2 or 2-1	• Over-run Clutch (OC) /low ball misplaced.	• Inspect ball. Refit or replace as necessary.
No manual 1st	• Rear band slipping when hot. • Reverse/Low-1st ball misplaced. • Rear servo inner 'O' ring missing.	• Inspect rear band adjustment. Adjust as necessary. • Inspect ball. Refit or replace as necessary. • Inspect 'O' ring. Refit or replace as necessary.
1st gear only or 2nd,3rd, and 4th only	• 1-2 shift valve jammed.	• Inspect the 1-2 shift valve. Repair or replace as necessary.
1st and 2nd only or 1st, 3rd and 4th only	• 2-3 shift valve jammed.	• Inspect the 2-3 shift valve. Repair or replace as necessary.
1st, 2nd and 4th only or 1st, 2nd, and 3rd (tied up in 3rd)	• Inhibitor switch fault, 1-2-3 only. • 3-4 shift valve jammed.	• Inspect inhibitor switch. Repair or replace as necessary. • Inspect the 3-4 shift valve. Repair or replace as necessary.

Condition	Possible Causes	Action
Harsh 2-3 shift	• Jammed band 1 release valve.	• Inspect the release valve. Repair or replace as necessary.
	• Faulty S3 or S2 solenoid.	• Inspect S3 or S2. Repair or replace as necessary.
	• Faulty clutch apply regulator valve.	• Inspect the regulator valve. Repair or replace as necessary.
	• Missing or damaged clutch apply feed ball.	• Inspect the ball. Refit or replace as necessary.
	• Damaged input shaft sealing rings.	• Inspect the sealing rings. Refit or replace as necessary.
	• Damaged C1 piston ‘O’ rings.	• Inspect the ‘O’ rings. Refit or replace as necessary.
	• Damaged or dislodged C1 piston bleedball.	• Inspect the bleed ball. Refit or replace as necessary.
Harsh 3-4 shift	• Faulty S1 or S4 solenoid.	• Inspect S1 or S4. Repair or replace as necessary.
	• Jammed band 1 release valve.	• Inspect the release valve. Repair or replace as necessary.
	• Incorrect front band adjustment.	• Inspect the band. Adjust as necessary.
	• Damaged front servo piston ‘O’ rings.	• Inspect the ‘O’ rings. Refit or replace as necessary.
	• Faulty or damaged variable pressure solenoid (S5).	• Inspect S5. Repair or replace as necessary.
	• Faulty band apply regulator valve.	• Inspect the regulator valve. Repair or replace as necessary.

SHIFT QUALITY FAULTS

Condition	Possible Causes	Action
All Shifts Firm	• Incorrect auto transmission fluid (ATF). • S5 faulty won, or incorrectly fitted. • Band apply and clutch apply regulator springs misplaced.	• Drain and fill with specified ATF. • Check that S5 is fitted correctly, or replace S5. • Inspect band apply and clutch apply regulator springs. Refit or replace as necessary
Manual 4-3-2-1 is soft delayed or missing	• Over-run Clutch (OC) /Low-1st ball misplaced. • C4 clutch worn or burnt. • C4 wave plate not lined up with the holes in the piston.	• Inspect the ball. Refit or replace as necessary. • Inspect C4 clutch. Replace or repair as necessary. • Check the alignment. Realign as necessary.
Firm 1-2 Hot	• S5 worn.	• Inspect S5 and replace as necessary.
4th Tied up	• Incorrect C4 pack clearance. • Damaged C4 clutch. • Cracked C2 piston (leaking into C4).	• Check the clearance and adjust as necessary. • Inspect C4. Repair or replace as necessary. • Inspect piston. Repair or replace as necessary.
Tied up on 2-3	• Incorrect band adjustment • Front servo plastic plug missing • B1R spring broken.	• Inspect and adjust band as necessary. • Replace the plug. • Replace the spring.
Flare on 2-3	• B1R spring/plug left out. • C1/B1R ball misplaced. • C1 clutch damaged. • Restriction in C1 feed. • C1 piston check ball jammed. • Overdrive or input shaft sealing rings damaged.	• Replace the spring/plug. • Refit the ball. • Inspect the clutch. Repair the clutch as necessary. • Inspect and clean C1 feed. • Replace the piston. • Inspect and replace the sealing rings and/or shaft as necessary.
Slips in 4th	• C1/B1R ball misplaced. • Overdrive or input shaft sealing rings damaged. • C1 clutch damaged.	• Inspect and replace the ball. • Inspect and replace the sealing rings and/or shaft as necessary. • Inspect and repair the C1 clutch as necessary.
Slips in reverse, no manual 1st	• Rear band incorrectly adjusted or damage • Low-1st check ball misplaced.	• Inspect and adjust or replace rear band. • Inspect and re-fit the ball.
Flare on 4-3, Flare on 3-2	• 4-3 sequence valve in backwards.	• Refit the valve.
Firm Manual low shift-high line press.	• Low-1st check ball misplaced.	• Replace the ball.

Condition	Possible Causes	Action
Harsh 1-2 shift	• Faulty inhibitor switch.	• Check the resistance. Replace the inhibitor switch as necessary.
	• Faulty throttle position sensor.	• Inspect and replace the sensor as necessary.
	• Incorrect front band adjustment.	• Inspect and adjust the band as necessary.
	• Damaged front servo piston 'O' rings.	• Inspect and replace the 'O' rings as necessary.
	• Faulty or damaged variable pressure solenoid (S5).	• Inspect, repair or replace S5 as necessary.
	• Faulty S1 or S4 solenoid.	• Inspect, repair or replace S1 or S4 as necessary.
	• Faulty Band Apply Regulator (BAR) valve.	• Inspect, repair or replace the BAR as necessary.
	• Misassembled front servo return spring.	• Inspect and repair as necessary.
Stalls when Drive Or Reverse	• Jammed Converter Clutch Control Valve (CCCV).	• Inspect and clean CCCV.
Selected Shudder on Rolldown	• Faulty solenoid 7.	• Inspect, repair or replace as necessary.

AFTER TEARDOWN FAULTS

Condition	Possible Causes	Action
C2 burnt	• Gear shift lever linkage out of adjustment. • S6 foiled - stuck low. • Overdrive/output shaft sealing rings damaged. • C2 piston cracked.	• Inspect, repair C2 and adjust the linkage as necessary. • Repair C2. Inspect, repair or replace S6 as necessary. • Repair C2. Inspect, replace the sealing rings and/or shaft as necessary. • Repair C2. Inspect, repair or replace the C2 piston as necessary.
C4 burnt	• Incorrect C4 pack clearance. • C4 wave plate not lined up properly. • Overdrive or output shaft sealing rings damaged. • C2 piston cracked. • Over-run Clutch (OC) /low-1st ball misplaced.	• Inspect C4 and repair as necessary. • Inspect and adjust the C4 pack clearance as necessary. • Repair C4. Inspect and realign the wave plate as necessary. • Repair C4. Inspect and realign the sealing rings and/or shaft as necessary. • Repair C4. Inspect and replace the C2 piston as necessary. • Repair C4. Inspect and refit the ball as necessary.
B1 burnt	• B1R spring broken. • Input shaft sealing ring cut. • C1/B1R ball misplaced.	• Inspect and repair B1 and replace the spring as necessary. • Replace sealing ring. • Repair B1. Refit the ball as necessary.
C1 burnt	• B1R spring left out. • Overdrive or input shaft sealing rings damaged. • C1 piston cracked. • Ball capsule jammed. • 4-3 sequence valve in backwards. • Clutch Apply Feed (CAF) /B1R ball left out.	• Inspect and repair C1 and replace the spring. • Repair C1. Inspect and replace the sealing tongs and/or shaft as necessary. • Repair C1. Inspect and replace the C1 piston as necessary. • Repair C1. Inspect and refit the capsule as necessary. • Repair C1. Inspect and refit the valve as necessary. • Repair C1. Inspect and replace the ball as necessary.
B2 burnt (Slips in reverse - no manual 1st)	• Rear band incorrectly adjusted or damaged. • Reverse-low/first ball misplaced.	• Inspect and adjust the band as necessary. • Inspect and refit the ball as necessary.

Condition	Possible Causes	Action
Firm converter lock or unlock	• Input shaft 'O' ring missing or damaged. • Converter clutch regulator valve in backwards.	• Inspect and replace the 'O' ring as necessary. • Inspect and refit the valve as necessary.
No lock up at light throttle	• Input shaft 'O' ring missing or damaged. • C1 bias valve in backwards.	• Inspect and replace the 'O' ring as necessary. • Inspect and refit the valve as necessary.

TROUBLE CODE DIAGNOSIS - GASOLINE VEHICLE

TCM DIAGNOSTIC SYSTEM OVERVIEW

Notice: To prevent Transmission Control Module (TCM) damage. The ignition key must be OFF when disconnection or reconnection the power to the TCM (for example bttery cable, TCM pigtail connector, TCM fuse, jumper cables, etc.).

When the TCM detects a system fault, a Diagnostic Trouble Code (DTC) is set in the TCM. This code is present while the fault conditions are met and is stored as a 'History DTC' until cleared. Condition for setting and clearing each TCM DTC are provided in the relevant sections.

Inthe case where the vehicle type is certified for Eure On-Board Diagnostic (EOBD) compliance, the Engine Control Module (ECM) provides the communication link to the EOBD scan tool to pass on any EOBD relevant codes from the TCM. The table below contains a list of all supported DTCs and the classification of each for EOBD purposes. Where a type B DTC has been set in an EOBD vehicle, the response to the fault may include action by the ECM, including the illumination of the Malfunction Indicator Lamp (MIL). Refer to *Section 1F, Engine Control,* for details on EOBD system function, checks and fault clearing.

CLEARING TROUBLE CODES

TCM DTCs should be cleared after repairs have been completed. Some diagnostic tables will tell you to clear the codes before using the chart, which will help to find the cause of the problem more quickly. Always note the DTCs present before clearing - this information may be helpful in the diagnostic process."

DIAGNOSTIC TROUBLE CODES

DTC	Description	Type
P0706	Transmission Range Sensor Circuit Range/Performance	B
P0707	Transmission Range Sensor Circuit Low input	B
P0708	Transmission Range Sensor Circuit High input	B
P0710	Transmission Fluid Temperature Sensor Circuit Malfunction	D
P0790	Normal/Performance Switch Circuit Malfunction	D
P1703	Engine Speed Signal Error	D
P1704	Shaft Speed Signal Error	D
P1708	TCM Supply Voltage Low	D
P1709	TCM Supply Voltage High	D
P1712	Kickdown Switch Circuit Malfunction	D
P1713	Pedal Signal Error	D
P1714	EEPROM Vehicle Code Error	D
P1715	VPS Offset Error	D
P1717	RAM Error	D
P1718	ROM Error	D
P1719	CAN Bus Error	D
P1720	EEPROM Error	D
P1721	Throttle Signal Error	D
P1722	Vehicle Type Determination Error	D
P1733	Solenoid 1 Circuit Open	D
P1734	Solenoid 2 Circuit Open	D
P1735	Solenoid 3 Circuit Open	D
P1736	Solenoid 4 Circuit Open	D
P1737	Solenoid 5 Circuit Open	D

DIAGNOSTIC TROUBLE CODES (Cont'd)

DTC	Description	Type
P1738	Solenoid 6 Circuit Open	D
P1739	Solenoid 7 Circuit Open	D
P1741	Solenoid 1 Circuit Short	D
P1742	Solenoid 2 Circuit Short	D
P1743	Solenoid 3 Circuit Short	D
P1744	Solenoid 4 Circuit Short	D
P1745	Solenoid 5 Circuit Short	D
P1746	Solenoid 6 Circuit Short	D
P1747	Solenoid 7 Circuit Short	D

DTC Types

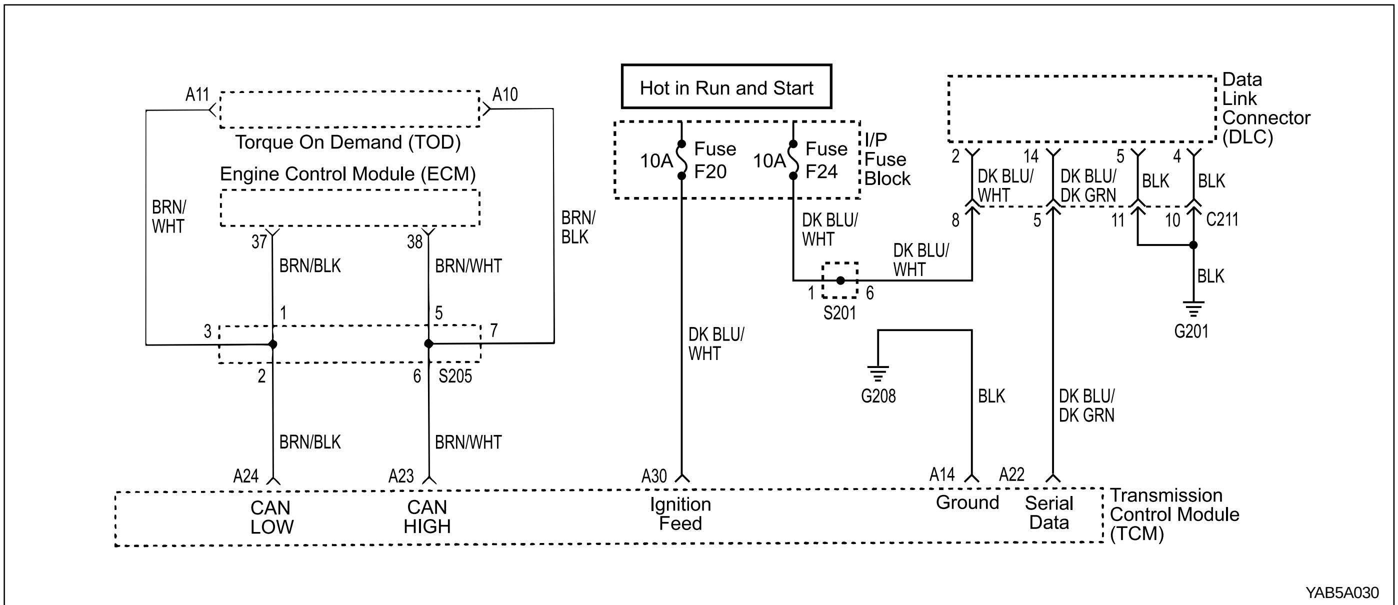
Each DTC is directly related to a diagnostic test. The Diagnostic management system sets DTCs based on the failure of the tests during a driving cycle or cycles. The following are the two types of DTCs and the characteristics of those codes;

Type B

- Emissions related.
- EOBD system "Armed" after one driving cycle with a fail.
- EOBD system "Disarmed" after one driving cycle with a pass.
- Illuminates the MIL on the second con-secutive driving cycle with a fail.
- TCM stores a history DTC on the first driving cycle with a fail.
- EOBD system stores a history DTC on the second consecutive driving cycle with a fail, (the DTC will be armed after the first fail).
- EOBD system stores a freeze frame on the second consecutive driving cycle with a fail, (if empty).

Type D

- Non-Emissions related.
- Does not request illumination of any lamp.
- Stores a history DTC on the first driving cycle with a fail.
- EOBD system does not store a freeze frame.



TCM DIAGNOSTIC SYSTEM CHECK

Circuit Description

The Transmission Control Module (TCM) Diagnistic System Check is the starting point for any driveability complaint diagnosis. Before using this procedure, perform a careful visual/ physical check of the Transmission Control Module (TCM) and the transmission grounds for cleanliness and tightness.

The TCM Diagnostic System Check is an organized approach to identifying a problem created by an electronic transmission control system malfunction.

Diagnostic Aids

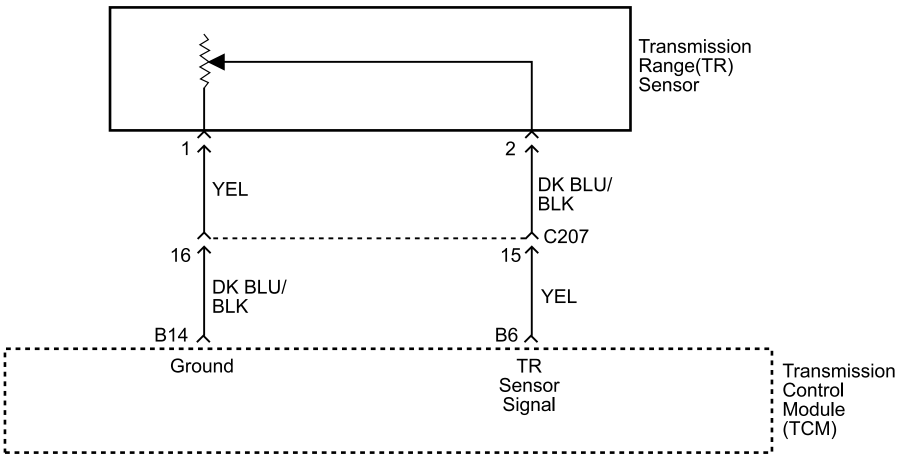
An intermittent fault may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for poor connections or a damaged harness. Inspect the TCM harness and connections for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

TCM Diagnostic System Check

Step	Action	Value(s)	Yes	No
1	1 Turn the ignition OFF. 2. Install the scan tool. 3. Turn the ignition ON, with the engine OFF. 4. Attempt to display the Transmission Control Module (TCM) Data List with the scan tool. Does the scan tool display the TCM data?	-	Go to Step 2	Go to Step 3
2	Select the Trouble Code with the scan tool. Are any Diagnostic Trouble Codes (DTCs) stored?	-	Go to applicable DTC table	System OK, Check Complete

TCM Diagnostic System Check (Cont'd)

Step	Action	Value(s)	Yes	No
3	1. Turn the ignition OFF. 2. Disconnect the TCM connector B. 3. Turn the ignition ON. 4. Check the serial data line from TCM connector terminal A22 to Data Link Connector (DLC) connector terminal 14 for an open, short to ground, or short to voltage. Also, check the DLC ignition feed circuit for an open or short to ground and the DLC ground circuit for an open. Is a problem found?	-	Go to Step 4	Go to Step 5
4	Repair the open, short to ground or short to voltage in the serial data circuit or the DLC ignition feed circuit or the DLC ground circuit. Is a repair complete?	-	Go to Step 1	-
5	Check the TCM ignition feed circuit for an open or short to ground and the TCM ground circuit for an open. Is a problem found?	-	Go to Step 6	Go to Step 7
6	Repair the open or short to ground in the TCM ignition feed circuit or the TCM ground circuit. Is a repair complete?	-	Go to Step 1	-
7	1. Turn the ignition OFF. 2. Disconnect the TCM connector. 3. Replace the TCM.	-	Go to Step 1	-



DIAGNOSTIC TROUBLE CODE (DTC) P0706
TRANSMISSION RANGE SENSOR CIRCUIT RANGE/PERFORMANCE

Circuit Description

The Transmission Range (TR) sensor is incorporated in the inhibitor switch mounted on the side of the transmission case. The TR sensor Indicates to the TCM which gear position has been selected by way of a varying resistance.

The TR sensor signal has discrete values indicating the positions selected by the gear shift control lever (PRND321). The Transmission Control Module (TCM) receives that signal with a voltage varying from 0 V to 5 V. DTC P0706 sets when the TR sensor signal is not feasi ble.

Conditions for Setting the DTC

- The engine temperature is greater than 60 °C (140 °F).
- The engine speed is greater than 2000 RPM and less than 4000 RPM.
- Engine load is greater than 60 %.
- DTCs P0707, P0708, P1703 and P1719 are not set.
- Transmission temperature is greater than 0 °C (32 °F) or if P0710 is present the engine coolant temperature is greater than 60 °C (140 °F).
- The TR sensor indicates that the transmission is in a neutral state, however the engine output torque indicates that a drive gear load is present. This condition must be continuously present for 5 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate on the second consecutive driving cycle with the DTC present.
- The EOBD system will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- TR signal is assumed to be in the Drive position.
- The transmission is limited to 2nd and R gears only. Namely 1st, 3rd and 4th gears are inhibited.
- Torque Converter Clutch (TCC) is disabled.

Conditions for Clearing the DTC

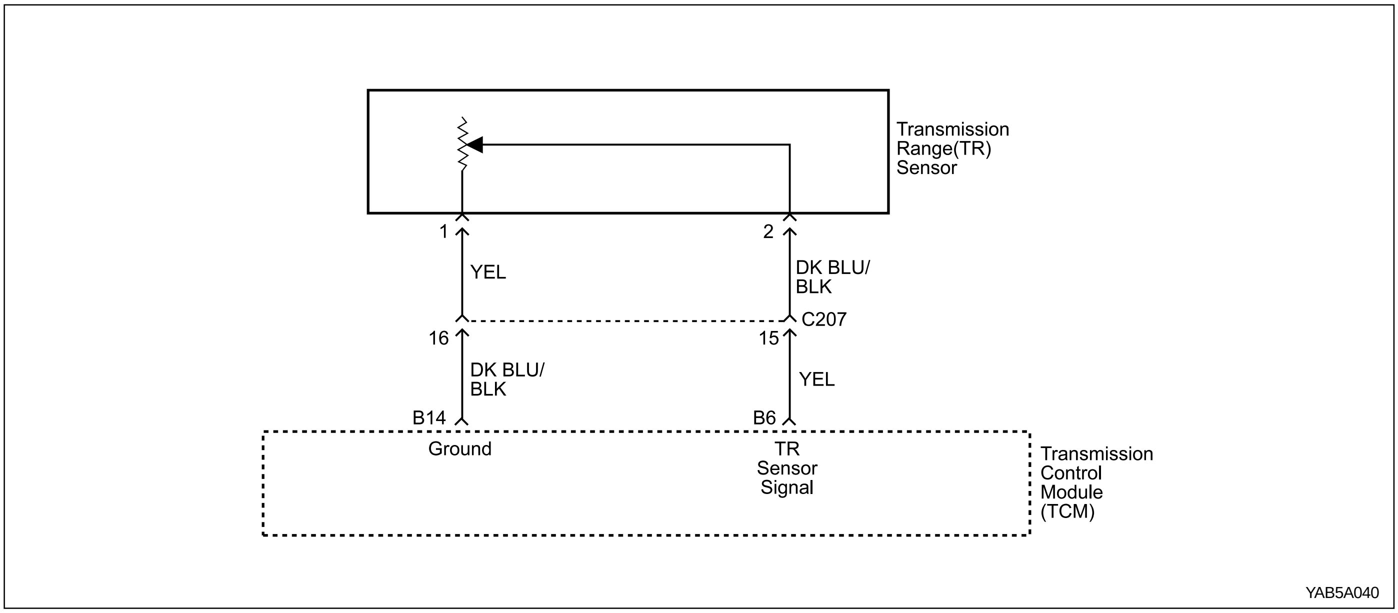
- The DTC will clear when the malfunction has not occurred for 30 seconds and TR is in P, R, N or D.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM and at the TR sensor connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also, check for chafed wires that could short to bare metal or other wiring. Inspect for broken wires inside the in-sulation.

DTC P0706 Transmission Range Sensor Circuit Range/Performance

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P0706?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Select Gear Lever Position on scan tool Data List. 2. Move the gear shift control lever through all of the gear ranges (P, R, N, D, 3, 2, 1). Does the scan tool display the correct gear lever positions?	-	Go to Step 6	Go to Step 4
4	1. Inspect the TR sensor for damage to its rotating part or its mountings. 2. Inspect the shaft driving the TR sensor for damage. Is a repair necessary?	-	Go to Step 5	Go to Step 6
5	Replace the TR sensor or driving shaft as appropriate. Is the acting complete?	-	Go to Step 7	-
6	Check for damage to the z-link within the transmission and repair as necessary. Is a repair necessary?	-	Go to Step 7	-
7	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 8	Go to Step 2
8	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete



DIAGNOSTIC TROUBLE CODE (DTC) P0707 TRANSMISSION RANGE SENSOR CIRCUIT LOW INPUT

Circuit Description

The Transmission Range (TR) sensor is incorporated in the inhibitor switch mounted on the side of the transmis sion case. The TR sensor Indicates to the TCM which gear position has been selected by way of a varying resistance.

The TR sensor signal has discrete values indicating the positions selected by the gear shift control lever (PRND321). The Transmission Control Module (TCM) receives that signal with a voltage varying from 0 V to 5 V. DTC P0707 sets when the TR sensor signal is faulty, causing the gear lever position signal to be less than 0.87 V.

Conditions for Setting the DTC

- TR sensor signal is less than 0.87 V.
- The above condition must be continuously present for 100 milliseconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate on the second consecutive driving cycle with the DTC present.
- The EOBD system will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Transmission range is assumed to be in the Drive position.
- The transmission is limited to 2nd and R gears only. Namely 1st,3rd and 4th gears are inhibited.
- Torque Converter Clutch (TCC) is disabled.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred for 3 seconds.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- The voltage measured by the TCM across the TR sensor input terminals has been below on acceptable level for a significant length of time.
- This would typically be caused by a short to ground in the wiring to, or within, the inhibitor switch which has caused the signal at the TCM to read about 0 V.
- Inspect the wiring for poor electrical connections at the TCM and at the TR sensor connector. Look for possible bent, deformed or damaged terminals. Also, check for chafed wires that could short to bare metal or other wiring.
- In searching for a possible intermittent short or open condition, move or massage the wiring harness while observing the test equipment for a change.

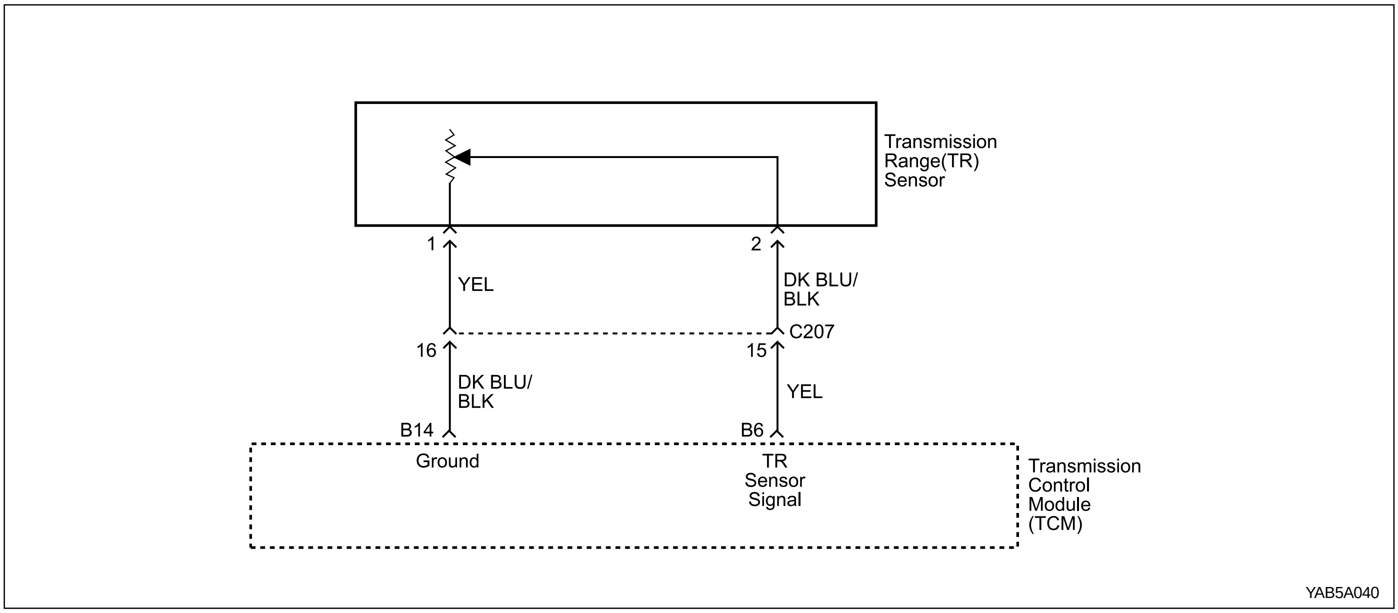
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. This step simulates a DTC P0708 condition. If the scan tool displays the specified value, the TR sensor signal circuit and the TCM are OK.

DTC P0707 Transmission Range Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. 5. Review the TR Sensor value on the scan tool. Is the TR Sensor value less than the specified value?	0.87 v	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the Transmission Range (TR) sensor connector. 3. Turn the ignition ON. Is the TR Sensor value greater than specified value?	4.12 v	Go to Step 4	Go to Step 5
4	Replace the TR sensor. Is the action complete?	-	Go to Step 10	-
5	With a test light connected to B+, probe the TR sensor signal circuit at terminal 2. Does the test light illuminate?	-	Go to Step 6	Go to Step 8
6	1. Turn the ignition OFF. 2. Disconnect the Transmission Control Module (TCM) connector A. 3. Turn the ignition ON. 4. With a test light connected to B+, probe the TR sensor signal circuit at terminal 2. Does the test light illuminate?	-	Go to Step 7	Go to Step 9
7	Repair the short to ground in the TR sensor signal circuit. Is a repair complete?	-	Go to Step 10	-
8	Check for a poor connection at the TR sensor connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 10	-
9	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 10	-
10	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 11	Go to Step 2
11	Check if any DTCs are set. Are there any DTCs displayed or DTC previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete



DIAGNOSTIC TROUBLE CODE (DTC) P0708 TRANSMISSION RANGE SENSOR CIRCUIT HIGH INPUT

Circuit Description

The Transmission Range (TR) sensor is incorporated in the inhibitor switch mounted on the side of the transmission case. The TR sensor Indicates to the TCM which gear position has been selected by way of a varying resistance.

The TR sensor signal has discrete values indicating the positions selected by the gear shift control lever (PRND321). The Transmission Control Module (TCM) receives that signal with a voltage varying from 0 V to 5 V.

The transmission range sensor is faulty, causing the gear lever position signal to be greater than 4.12 V.

Conditions for Setting the DTC

- TR sensor signal is greater than 4.12 V.
- The above condition must be continuously present for 100 milliseconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate on the second consecutive driving cycle with the DTC present.
- The EOBD system will record operating conditions at the time the diagnostic fails. This information will be stored in the Failure Records buffer.
- Transmission range (gear lever) is assumed to be in the Drive position.
- The transmission is limited to 2nd and R gears only. Namely 1st,3rd and 4th gears are inhibited.
- Torque Converter Clutch (TCC) is disabled.
- Manually initiated downshifts will not be available.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred for 3 seconds.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- The voltage measured by the TCM across the shift lever input terminals has been above an acceptable level for a significant length of time.
- This would typically be caused by a loose connection or an open or short to B+ in the wiring to, or within, the inhibitor switch which has caused the signal at the TCM to read 5 V.
- If the DTC sets when an accessory is operated, check for a poor connection or excessive current draw.
- Inspect the wiring for poor electrical connections at the TCM and at the TR sensor connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also, check for chafed wires that could short to other wiring. Inspect for broken wires inside the insulation.
- In searching for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

4. This step simulates a DTC P0707 condition. If the scan tool displays the specified value, the TR sensor signal circuit and the TCM are OK.

DTC P0707 Transmission Range Sensor Circuit High Input

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. 5. Review the TR Sensor value on the scan tool. Is the TR Sensor value greater than the specified value?	4.12 v	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the Transmission Range (TR) sensor connector. 3. Turn the ignition ON. 4. With a test light connected to ground, probe the TR sensor signal circuit at terminal 2. Is the TR sensor value less than specified value?	0.87 v	Go to Step 4	Go to Step 7
4	With a test light connected to B+, probe the TR sensor ground circuit at terminal 1. Does the test light illuminate?	-	Go to Step 5	Go to Step 8
5	Check for a poor connection at the TR sensor connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 6
6	Replace the TR sensor. Is the action complete?	-	Go to Step 11	-
7	1. Turn the ignition OFF. 2. Disconnect the Transmission Control Module (TCM) connector A. 3. Check the TR sensor signal circuit at terminal 1 for an open or short to voltage and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 9
8	Check the TR sensor ground circuit at terminal 1 for an open and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 9
9	Check for a poor connection at the TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 10
10	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 11	-

DTC P0707 Transmission Range Sensor Circuit High Input (Cont'd)

Step	Action	Value(s)	Yes	No
11	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 12	Go to Step 2
12	Check if any DTCs are set. Are there any DTCs displayed or DTCs previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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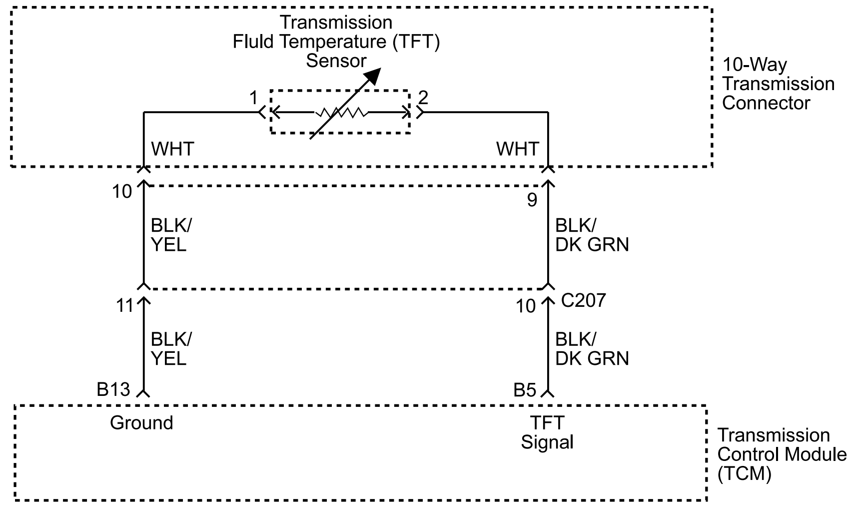

DIAGNOSTIC TROUBLE CODE (DTC) P0710 TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT MALFUNCTION

Circuit Description

The Transmission Fluid Temperature (TFT) sensor is a thermistor located in the solenoid wiring loom within the valve body of the transmission. This sensor is a typical Negative Temperature Coefficient (NTC) resistor with low temperatures producing a high resistance and high temperatures producing a low resistance.

If the transmission fluid temperature exceeds 135 °C (275 °F), the TCM will impose converter lock-up at lower vehicle speeds. Favour a lower gear to increase engine speed, and in some vehicles flashes the mode indicator lamp. This results in maximum oil flow through the external oil cooler and eliminates slippage in the torque converter. Both these actions combine to reduce the oil temperature in the transmission.

The DTC P0710 sets when the TFT sensor signal is not feasible.

Conditions for Setting the DTC

- Transmission fluid temperature sensor signal is greater than 4.88 volts (immediate detection).
- Transmission fluid temperature sensor signal is less than 0.21 volts (immediate detection).
- Transmission temperature has not changed by 2 °C in 15 minutes since ignition on and temperature is less than 20 °C or greater than 125 °C.

Action Taken When the DTC Sets

- Transmission fluid temperature is assumed to be 120 °C (248 °F).
- All shifts will be firm until the transmission has warmed up because a high transmission fluid temperature is assumed.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred for 3 seconds.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- The voltage measured by the TCM across the transmission fluid temperature input terminals has been outside acceptable levels.
- If the DTC sets when an accessory is operated, check for a poor connection or excessive current draw.
- Inspect the wiring for poor electrical connections at the TCM and at the 10-way transmission connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also, check for chafed wires that could short to bare metal or other wiring. Inspect for broken wires inside the insulation.
- In searching for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

5. This step simulates a DTC P0710 condition. If the scan tool displays the specified value, the TFT sensor signal circuit and the TCM are OK.

DTC P0710 Transmission Fluid Temperature Sensor Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Select T/M Fluid Temperature on scan tool Data List. Is the TFT sensor value less than specified value?	0.21 v	Go to Step 4	Go to Step 3
3	Is the TFT sensor value greater than specified value?	4.88 v	Go to Step 7	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Disconnect the 10-way transmission connector (additional DTCs will set). 3. Turn the ignition ON. Is the TFT sensor value greater than the specified value?	4.88 v	Go to Step 6	Go to Step 5
5	1. Turn the ignition OFF. 2. Disconnect the TCM connector B. 3. Turn the ignition ON. 4. With a test light connected to B+, probe the TFT sensor signal circuit, terminal 9 at the 10-way transmission connector. Does the test light illuminate?	-	Go to Step 8	Go to Step 14
6	Replace the TFT sensor. Is the action complete?	-	Go to Step 16	-
7	1. Turn the ignition OFF. 2. Disconnect the 10-way transmission connector (additional DTCs will set). 3. Turn the ignition ON. 4. Jumper the TFT ground circuit terminal 10 to the TFT sensor signal circuit terminal 9 at the 10-way transmission connector. Is the TFT sensor value less than specified value?	0.21 v	Go to Step 6	Go to Step 9
8	Repair the short to ground in the TFT sensor signal circuit as necessary. Is the repair complete?	-	Go to Step 16	-
9	With a test light connected to B+, probe the TFT sensor ground circuit at terminal 10 at the 10-way transmission connector. Does the test light illuminate?	-	Go to Step 10	Go to Step 11
10	1. Turn the ignition OFF. 2. Disconnect the TCM connector B. 3. Turn the ignition ON. 4. Check the TFT sensor signal circuit, terminal 9 at the 10-way transmission connector for an open or short to voltage. Is a problem found?	-	Go to Step 13	Go to Step 14

DTC P0710 Transmission Fluid Temperature Sensor Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition OFF. 2. Disconnect the TCM connector B. 3. Turn the ignition ON. 4. Check the TFT sensor ground circuit for an open. Is a problem found?	-	Go to Step 12	Go to Step 14
12	Repair the TFT ground circuit for an open. Is a repair complete?	-	Go to Step 16	-
13	Repair an open or short to voltage in the TFT sensor signal circuit as necessary. Is the repair complete?	-	Go to Step 16	-
14	Check for a poor connection at the 10-way transmission connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 16	Go to Step 15
15	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 16	-
16	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 17	Go to Step 2
17	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 3 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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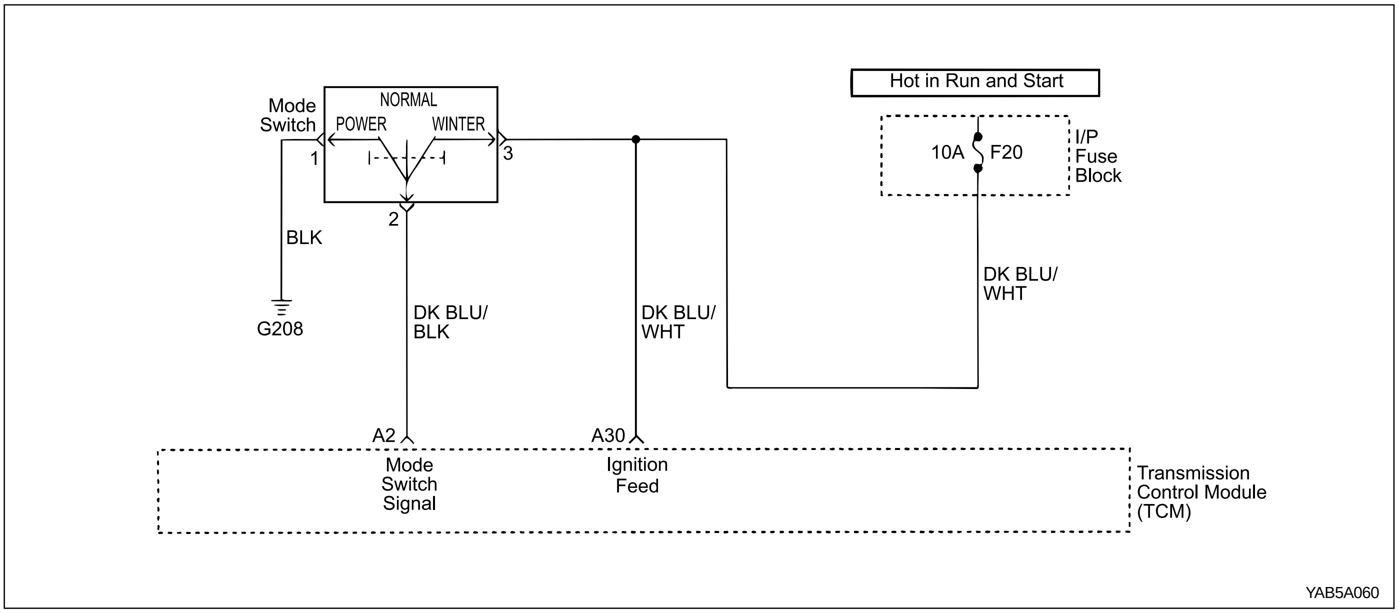

DIAGNOSTIC TROUBLE CODE (DTC) P0790 NORMAL/PERFORMANCE SWITCH CIRCUIT MALFUNCTION

Circuit Description

The driving mode selector switch is located on the center console and allows the driver to select the driving mode.

When NORMAL mode is selected upshifts will occur to maximize fuel economy. When POWER mode is selected, upshifts will occur to give maximum performance and the POWER mode indicator light is switched ON.

When WINTER mode is selected, starting in second gear is facilitated, the WINTER mode indicator light is switched ON and the POWER mode indicator light is switched OFF.

The DTC P0790 sets when an intermittent connection in the mode selector switch (mode switch) circuit has been detected. The mode switch input is rapidly changing states. The switching frequency is greater than 8.3 Hz.

Conditions for Setting the DTC

- The mode switching frequency is greater than 8.3 Hz.
- The above condition must be continuously present for 4 state changes.

Action Taken When the DTC Sets

- All shifts will occur as if the mode is set to NORMAL.
- The mode indicator will always be OFF indicating that NORMAL mode is selected.
- The mode indicator will not respond to the changes in switch setting.

Conditions for Clearing the DTC

- The DTC will clear after 3 seconds without the fault.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- This fault is caused by too many changes in the mode input signal over a period of time.
- Typical causes would be an intermittent connection in the switch or wiring or an intermittent short to ground in the wiring.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Check mode switch signal circuit for an intermittent open / short
5. Check mode switch ground circuit for an intermittent open / short
8. Check mode switch feed circuit for an intermittent open / short

DTC P0790 Normal/Performance Switch Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P0790?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the mode switch connector. Refer to Shift Control Lever in this section. 3. Turn the ignition ON. 4. Select Mode Switch on scan tool Data List. Is the Mode Switch value frequently changing?	-	Go to Step 4	Go to Step 5
4	1. Turn the ignition OFF. 2. Disconnect the TCM connector A. 3. Check the mode switch signal circuit for an intermittent open or short and repair as necessary. Is a repair necessary?	-	Go to Step 13	Go to Step 10
5	Jumper the mode switch ground terminal 1 to the signal terminal 2. Is the Mode Switch value frequently changing?	-	Go to Step 6	Go to Step 7
6	1. Turn the ignition OFF. 2. Disconnect the TCM connector A. 3. Check the mode switch ground circuit for an intermittent open and repair as necessary. Is a repair complete?	-	Go to Step 13	-
7	Check the fuse F20 for a malfunctioning and replace as necessary? Is a repair necessary?	-	Go to Step 13	Go to Step 8
8	Jumper the mode switch feed terminal 3 to the signal terminal 2. Is the Mode Switch value frequently changed?	-	Go to Step 9	Go to Step 11
9	1. Turn the ignition OFF. 2. Disconnect the TCM connector A. 3. Check the mode switch feed circuit for an intermittent open and repair as necessary. Is a repair complete?	-	Go to Step 13	-
10	Check for a poor connection at the mode switch and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 13	Go to Step 12

DTC P0790 Normal/Performance Switch Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the mode switch. Refer to Shift Control Lever in this section. Is the action complete?	-	Go to Step 13	-
12	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 13	-
13	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 14	Go to Step 2
14	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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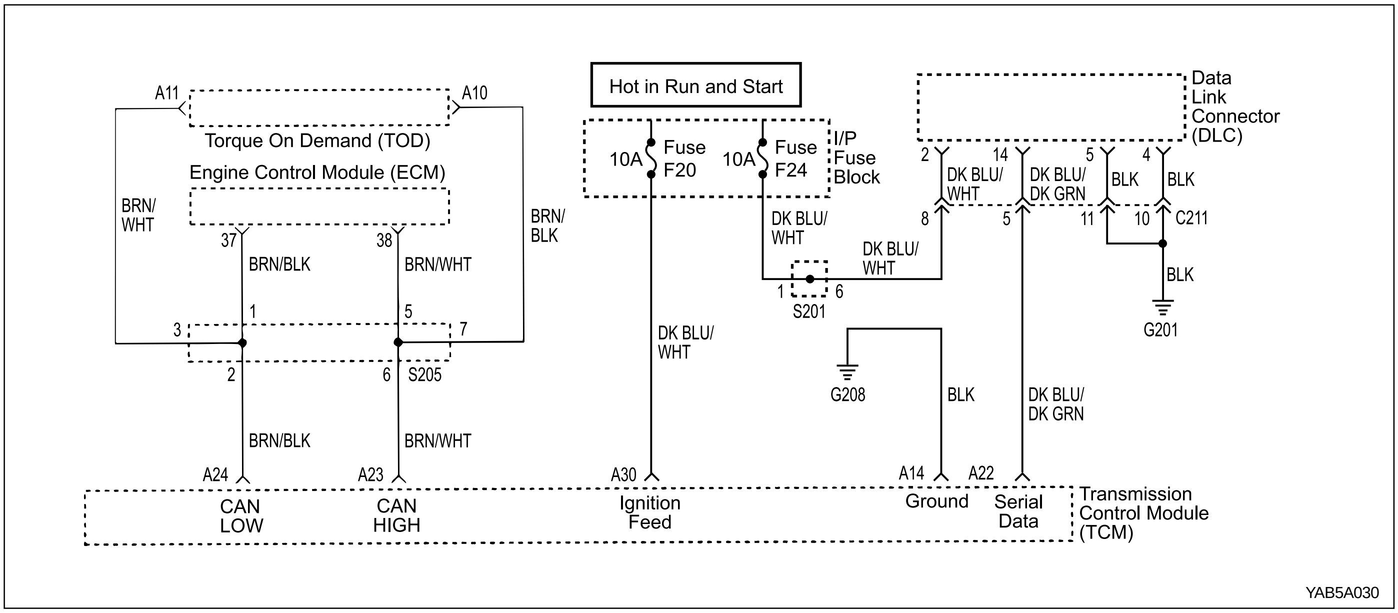


DIAGNOSTIC TROUBLE CODE (DTC) P1703 ENGINE SPEED SIGNAL ERROR

Circuit Description

The Controller Area Network (CAN) connects various control modules by using a twisted pair of wires, to share common information. This results in a reduction of sensors and wiring. TCM obtains the actual engine speed and throttle position, vehicle speed and accelerator position etc. from ECM via CAN without any additional sensors.

The DTC P1703 sets when the engine speed signal via CAN is out of range or not feasible: The engine speed signal is greater than 7000 rpm or less than 0 rpm, or the indicated engine speed is low while other signals indicate the car is moving (i.e. the vehicle speed has increased more than 125 rpm).

Conditions for Setting the DTC

- Immediately upon the test indicating malfunction as follows.
- The engine speed signal is greater than 7000 rpm or less than 0 rpm under the pre-condition that DTC P1719 is not set.
- The indicated engine speed is low while other signals indicate the car is moving, i.e. the vehicle speed has increased more than 125 rpm under the following pre-condition;
  - Driving gear is selected.
  - The applied throttle is greater than 5 %.
  - The engine speed is less than 550 rpm.
  - DTCs P0706, P0707, P0708, P1704, P1719 and 1721 are not set.

Action Taken When the DTC Sets

- Fault detection of some other signals will not possible.

Conditions for Clearing the DTC

- The DTC will clear after 30 seconds without the fault.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM and ECM connectors. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.
- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.
- When ECM finds a fault on the engine speed signals, ECM will adopt a default mode and send the default value and trouble message to TCM via CAN.

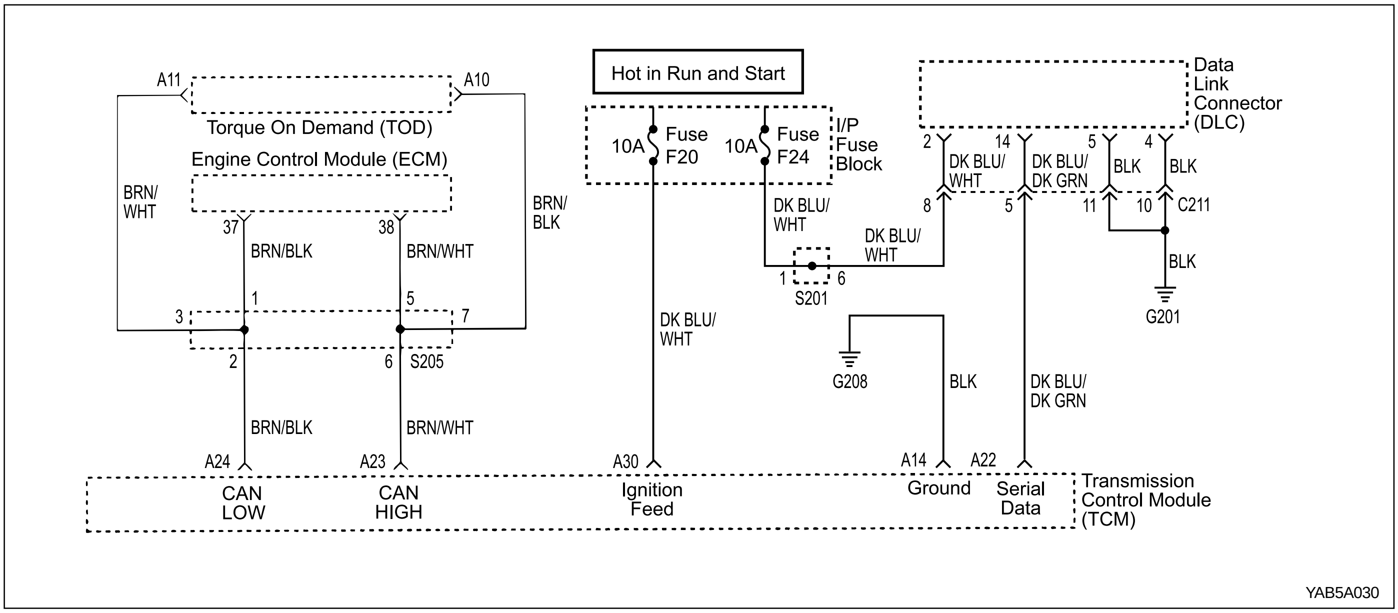
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Check if there are any DTCs related to the engine speed sensor on the ECM side.
4. Check for a poor connection at the ECM and TCM connectors.

DTC P1703 Engine Speed Signal Error

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1703?	-	Go to Step 3	Go to "Diagnostic Aids"
3	Check if there are any DTCs related to the engine speed sensor on the ECM side. Are any DTCs related to engine speed sensor found?	-	Go to *Section 1F, Engine Controls*	Go to Step 4
4	Check for a poor connection at the ECM connector or TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 6	Go to Step 5
5	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 6	-
6	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 7	Go to Step 2
7	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete



DIAGNOSTIC TROUBLE CODE (DTC) P1704
SHAFT SPEED SIGNAL ERROR

Circuit Description

The Controller Area Network (CAN) connects various control modules by using a twisted pair of wires, to share common information. This results in a reduction of sensors and wiring. TCM obtains the actual engine speed and throttle position, vehicle speed and accelerator position etc. from ECM via CAN without any additional sensors.

The DTC P1704 sets when the indicated drive shaft speed signal via CAN is out of range or not feasible or a shaft speed of 0 is present while other signals indicate the ve-hicle is being driven.

Conditions for Setting the DTC

- Immediately upon the test indicating malfunction as follows.
- The shaft speed signal is greater than 9000 rpm or less than 0 rpm under the pre-condition that DTC P1719 is not set.
- The shaft speed indicates 0 rpm while all other signals indicate the car is moving under the following pre-condition;
  - Driving gear is selected.
  - The transmission range sensor has not recently changed state.
  - The engine speed is greater than 2800 rpm.
  - DTCs P0706, P0707, P0708, P1703 and P1719 are not set.
- The shaft speed has dropped from above 2100 rpm to 0 rpm within 20ms.

Action Taken When the DTC Sets

- All skip downshifts disabled and fourth gear will be in-hibited.
- The torque converter will be unlocked at all times.
- Gears are selected by the shift control lever but all downshifts are inhibited by engine speed limits to prevent over-revving.
- D position selects 3rd gear.
- 1st and 2nd gears can be manually selected.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred for 30 seconds and a non-zero speed is detected.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM and ECM connectors. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.

- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.
- When ECM finds a fault on the vehicle speed signals, ECM will adopt a default mode and send the default value and trouble message to TCM via CAN.

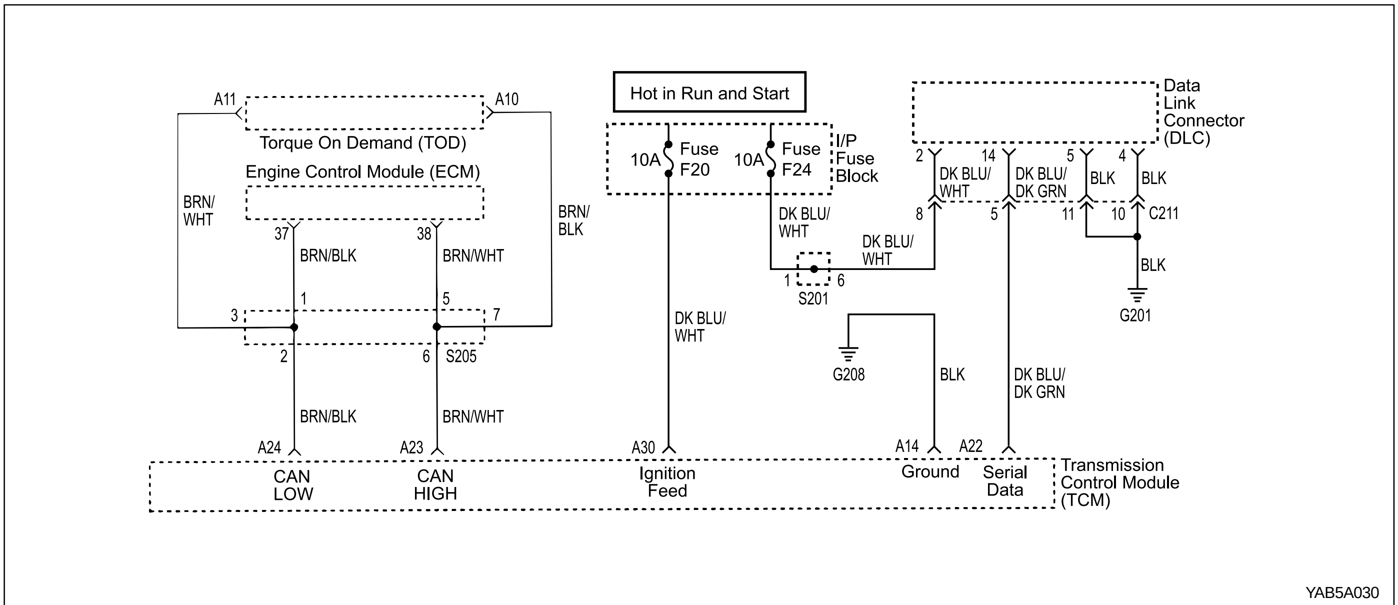
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Check if there are any DTCs related to the vehicle speed sensor on the ECM side.
4. Check a poor connection at the ECM and TCM connectors.

DTC P1704 Shaft Speed Signal Error

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1704?	-	Go to Step 3	Go to "Diagnostic Aids"
3	Check if there are any DTCs related to the vehicle speed sensor on the ECM side. Are any DTCs related to vehicle speed sensor found?	-	Go to *Section 1F, Engine Controls*	Go to Step 4
4	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 5	-
5	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 6	Go to Step 2
6	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete



DIAGNOSTIC TROUBLE CODE (DTC) P1708 TCM SUPPLY VOLTAGE LOW

Circuit Description

The battery voltage monitoring input is connected to the positive side of the battery. This signal is taken from the main supply to the TCM.

If the battery voltage at the TCM falls below the threshold value, DTC P1708 will be set and the transmission will adopt a low voltage mode of operating in which shifts into first gear are inhibited. All other shifts are attempted but may not occur because of the reduced voltage. This condition normally occurs only when the battery is in poor condition.

When system voltage recovers, the TCM will resume normal operation after a 30 seconds delay period.

Conditions for Setting the DTC

- The engine speed is greater than 550 RPM.
- A driving gear is selected or one of DTCs P0706, P0707 and P0708 is set.
- The indicated supply voltage falls below a linear temperature characteristic threshold or below that required to operate the CPU. If the TCM measures the supply voltage at less than that required for it to be operating, the DTC sets immediately.

Action Taken When the DTC Sets

- 1st gear is inhibited.
- S6 is inhibited.
- S5 standby current is zero.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred for 30 seconds.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- The minimum operating voltage depends on the transmission temperature but is typically between 8-9 V for a warm transmission.
- If the DTC sets when an accessory is operated, check for a poor connection.
- Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also, check for chafed wires that could short to bare metal or other wiring. Inspect for broken wires inside the insulation.
- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

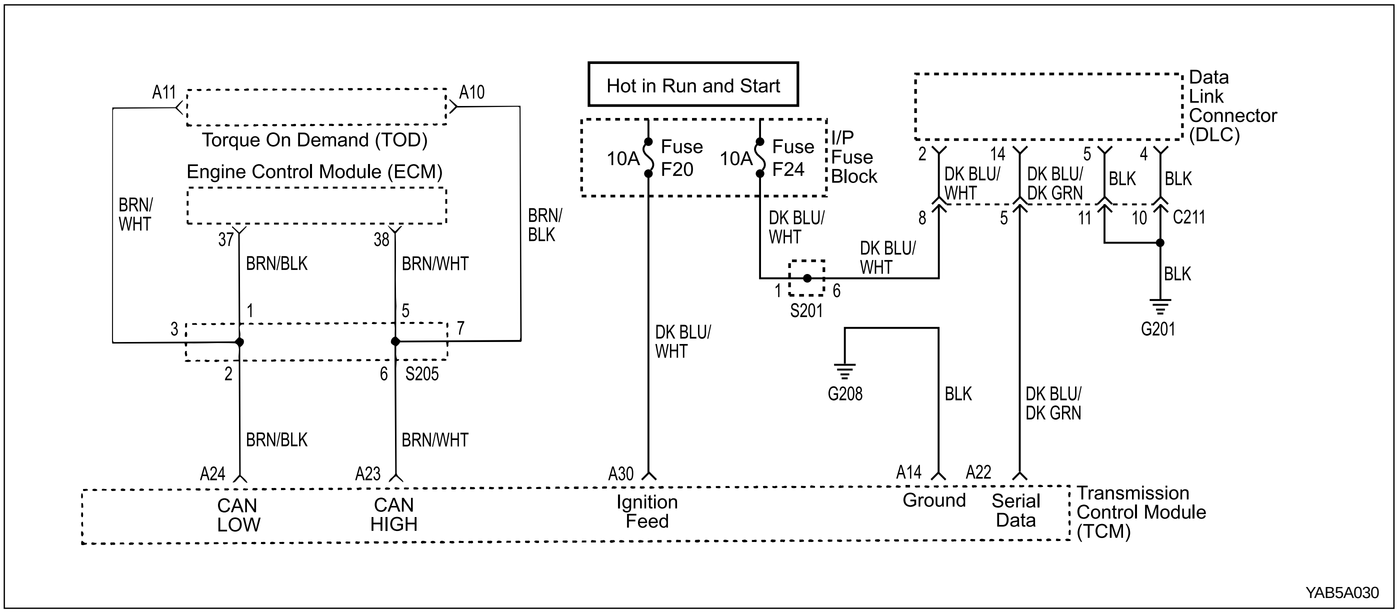
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

4. Check if the generator is malfunctioning under load condition.
8. Check the ignition feed circuit for excessive resistance.

DTC P1708 TCM Supply Voltage Low

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1708?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Isolate the driven wheels from the ground and apply the hand brake. 2. Start the engine and allow it to idle. 3. Move the gear lever to Drive. 4. Select the Ignition Voltage on the scan tool Data List. Is the Ignition Voltage less than the specified value?	10 v	Go to Step 4	Go to Step 10
4	While running the engine at the specified value, measure the battery voltage at the battery using a DVM. Is the battery voltage greater than the specified value?	Idle in Drive 12 v	Go to Step 5	Go to *Section 1E, Engine Electrical*
5	Check the fuse F20 for a malfunction and replace as necessary? Is a repair necessary?	-	Go to Step 10	Go to Step 6
6	1. Turn the ignition OFF. 2. Disconnect the TCM connector A. 3. Start the engine and raise the engine speed to specified value. 4. While running the engine at the specified value, measure the ignition voltage at the ignition feed circuit terminal A30 using a DVM. Is the ignition voltage greater than the specified value?	Idle in Drive 10 v	Go to Step 7	Go to Step 8
7	Check for a malfunctioning connection at the TCM harness terminals and repair as necessary. Is a repair necessary?	-	Go to Step 10	Go to Step 9
8	Repair the poor connection (high resistance) at the ignition feed circuit. Is the action complete?	-	Go to Step 10	-
9	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 10	-
10	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 11	Go to Step 2
11	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete



DIAGNOSTIC TROUBLE CODE (DTC) P1709
TCM SUPPLY VOLTAGE HIGH

Circuit Description

The battery voltage monitoring input is connected to the positive side of the battery. This signal is taken from the main supply to the TCM.

If the battery voltage is greater than 16.5 V, DTC P1709 will be set and the transmission will adopt limp home mode and all solenoids are turned OFF.

Conditions for Setting the DTC

- The indicated supply voltage is greater than 16.5 V.
- The malfunction triggers immediately after this condition exists.

Action Taken When the DTC Sets

- All solenoids are turned OFF while the high battery voltage condition is detected.
- The transmission goes into Limp Home Mode (LHM).

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred for 30 seconds.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- The voltage measured by the TCM corresponding to the battery supply voltage has been outside the range of the maximum operating voltage of 16.5 V.
- Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also, check for chafed wires that could short to bare metal or other wiring. Inspect for broken wires inside the insulation.
- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

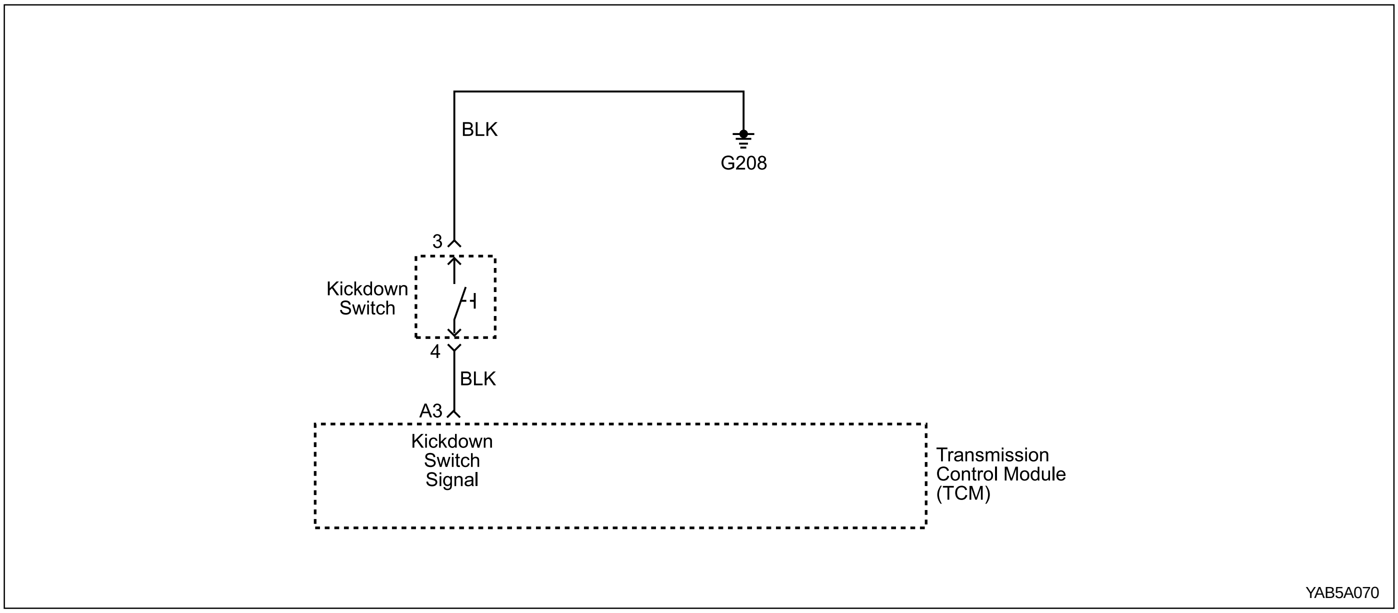
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

4. Checks if the generator is malfunctioning under load conditions.
5. Check connection of other connectors

DTC P1709 TCM Supply Voltage High

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1709?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Start the engine and raise the engine speed to the specified value. 2. Select the Ignition Voltage on the scan tool Data List. Is the Ignition Voltage greater than the specified value?	1500 rpm 16.5 v	Go to Step 4	Go to Step 8
4	While running the engine at the specified value, measure the battery voltage at the battery using a DVM. Is the battery voltage less than the specified value?	2000 rpm 16.5 v	Go to Step 5	Go to *Section 1E, Engine Electrical*
5	1. Turn the ignition OFF. 2. Disconnect the TCM connector A. 3. Start the engine and raise the engine speed to the specified vale. 4. While running the engine at the specified value, measure the ignition voltage at the ignition feed circuit terminal A30 with respect to the ground terminal A14. Is the ignition voltage greater than the specified value?	1500 rpm 16.5 v	Go to Step 6	Go to Step 7
6	Check the wiring harness from the fuse F20 to TCM terminal A30 and from the ground G208 to TCM terminal A14 for damage	-	Go to Step 8	-
7	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 8	-
8	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 9	Go to Step 2
9	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete



DIAGNOSTIC TROUBLE CODE (DTC) P1712 KICKDOWN SWITCH CIRCUIT MALFUNCTION

Circuit Description

The Kickdown Switch is used to signal the TCM that the driver requires kickdown indicating the driver pressed the accelerator to the floor. When this switch is used in high range non-winter mode driving, the POWER light comes ON.

The DTC sets when the kickdown switch has an intermittent connection or is stuck ON. Kickdown Switch is closed when other signals indicate otherwise, i.e. the accelerator pedal is released and the engine is running. Or the switch is cycling open/closed more rapidly than the normal operation allows.

Conditions for Setting the DTC

- DTCs P1703, P1713 and P1719 are not set.
- Kickdown Switch is closed when other signals indicate otherwise, i.e. the accelerator pedal is released and the engine is running.
- The switch is cycling open/closed more rapidly than normal operation allows : 10 state changes in less than 30 milliseconds.

Action Taken When the DTC Sets

- Kickdown Switch feature is disabled while the fault exists.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred for 30 seconds.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- Typical causes would be an short circuit within the switch, or a short circuit to ground in the wiring to the switch.
- Inspect the wiring for poor electrical connections at the TCM and at the Kickdown Switch connector. Look for possible bent, backed out, deformed or damagednterminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.
- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

4. Checks if the kickdown signal circuit is malfunctioning.
7. Checks if the kickdown ground circuit is malfunctioning.
8. Check resistance between Kickdown Switch terminal 4 and 2.
12. Check connections of other connectors.

DTC P1712 Kickdown Switch Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Select the Kickdown Switch on the scan tool. Is the Kickdown Switch value frequently changed ON/OFF or continuously ON?	-	Go to Step 4	Go to Step 3
3	Push the accelerator pedal fully to the Kickdown Switch. Is the Kickdown Switch value frequently changed OFF/ON?	-	Go to Step 7	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Disconnect the Kickdown Switch connector. Refer to the Kickdown Switch in this section. 3. Turn the ignition ON, with the engine OFF. Is the Kickdown Switch value frequently changed ON/OFF or continuously ON?	-	Go to Step 5	Go to Step 8
5	1. Turn the ignition OFF. 2. Disconnect the TCM connector A. 3. Check the Kickdown Switch signal circuit from Kickdown Switch connector terminal 4 to TCM terminal A3 for a short to ground. Is a short to ground found?	-	Go to Step 6	Go to Step 14
6	Repair the short to ground or an open in the Kickdown Switch signal circuit. Is the action complete?	-	Go to Step 15	-
7	1. Turn the ignition OFF. 2. Disconnect the Kickdown Switch connector. Refer to the Kickdown Switch in this section. 3. With a test light connected to B+, probe the Kickdown Switch ground circuit, terminal 3. Does the test light illuminate?	-	Go to Step 10	Go to Step 11
8	Check the resistance between Kickdown Switch terminal 3 and 4 when pushing the switch and not pushing. Is the resistance within the specified value?	Push: less than 5 Ω No push: Open Loop	Go to "Diagnostic Aids"	Go to Step 9
9	Replace the Kickdown Switch. Is the action complete?	-	Go to Step 15	-
10	1. Turn the ignition OFF. 2. Disconnect the TCM connector A. 3. Check the Kickdown Switch signal circuit from Kickdown Switch connector terminal 4 to TCM terminal A3 for an open. Is an open founded?	-	Go to Step 6	Go to Step 12
11	Repair the open in the Kickdown Switch ground circuit. Is the action complete?	-	Go to Step 15	-

DTC P1712 Kickdown Switch Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check for a poor connection at the Kickdown Switch connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 15	Go to Step 13
13	Check the resistance between kickdown switch terminal 3 and 4 when pushing the switch. Is the resistance within the specified value and steady?	less than 5 Ω	Go to Step 14	Go to Step 9
14	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 15	-
15	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 16	Go to Step 2
16	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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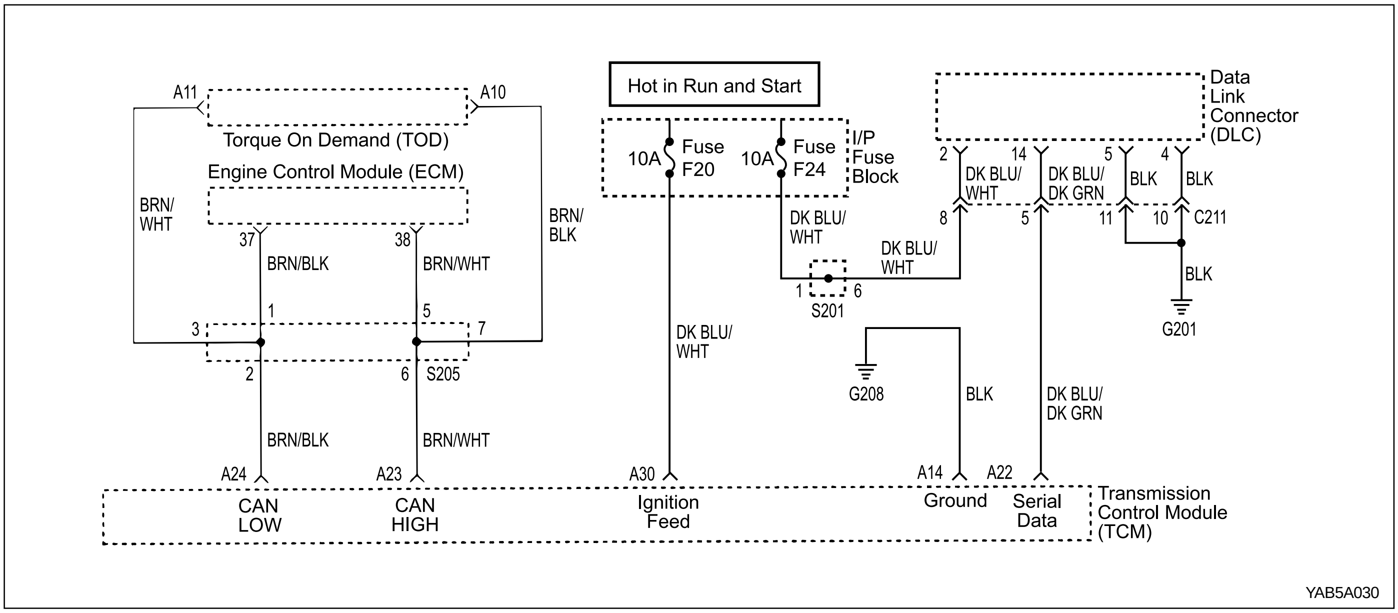


DIAGNOSTIC TROUBLE CODE (DTC) P1713 PEDAL SIGNAL ERROR

Circuit Description

The Controller Area Network (CAN) connects various control modules by using a twisted pair of wires, to share common information. This results in a reduction of sensors and wiring. TCM obtains the actual engine speed and throttle position, vehicle speed and accelerator pedal position etc. from ECM via CAN without any additional sensors.

The DTC P1713 sets when the accelerator pedal signal via CAN is out of range. The accelerator pedal signal is greater than 254 steps.

Conditions for Setting the DTC

- DTCs P1719 is not set.
- The accelerator pedal signal is greater than 254 steps. The malfunction is triggered immediately after this condition exists.

Action Taken When the DTC Sets

- 4th gear is inhibited.
- Torque Converter Clutch (TCC) is inhibited.
- Default value is adopted for shift point decisions.
- Accelerator pedal is not used for P, R, or N B2 activation decisions.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred for 30 seconds.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM and ECM connectors. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.
- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.
- When ECM finds a fault on the accelerator pedal signals, ECM will adopt a default mode and send the de-fault value and trouble message to TCM via CAN.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Check if there are any DTCs related to the accelerator pedal sensor on the ECM side.
4. Check for a poor connection at the ECM and TCM connectors.

DTC P1713 Pedal Signal Error

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1713?	-	Go to Step 3	Go to "Diagnostic Aids"
3	Check if there are any DTCs related to the accelerator pedal sensor on the ECM side. Are any DTCs related to accelerator pedal sensor found?	-	Go to *Section 1F, Engine Controls*	Go to Step 4
4	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 5	-
5	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 6	Go to Step 2
6	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

DIAGNOSTIC TROUBLE CODE (DTC) P1714
EEPROM VEHICLE CODE ERROR

System Description

The Electrically Erasable Programmable Read-Only Memory (EEPROM) is a permanent memory chip that is physically soldered within the Transmission Control Module (TCM) The EEPROM contains the program and the calibration information required for transmission and transmission diagnostics operation.

The DTC P1714 sets when the vehicle ID stored in EEPROM is out of range when checked on initialization. The EEPROM Vehicle identification Number (VIN) value does not lie within the range 0-13.

Conditions for Setting the DTC

- DTC P1720 is not set.
- The vehicle type is not recognized. The EEPROM Vehicle Identification Number (VIN) value does not lie within the range 0-13. The malfunction is triggered immediately after this condition exists.

Action Taken When the DTC Sets

- If CAN is detected, OBD N32D VIN is selected. Or If CAN is not detected, P29 STi VIN is selected.
- Shift quality may by degraded.

Conditions for Clearing the DTC

- This DTC can only be cleared by reprogramming the EEPROM with the correct vehicle code and than cycling power to the TCM. This is a factor procedure.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Perform the vehicle coding.

DTC P1714 EEPROM Vehicle Code Error

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1714?	-	Go to Step 3	Go to Step 6
3	1. Select the required VIN on TCM Coding of scan tool. 2. Perform the vehicle coding. 3. Turn the ignition OFF. 4. Turn the ignition ON, with the engine OFF. Does the scan tool display P1714?	-	Go to Step 4	Go to Step 5
4	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 5	-
5	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 6	Go to Step 2
6	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

DIAGNOSTIC TROUBLE CODE (DTC) P1715 VPS OFFSET ERROR

Circuit Description

The VPS is used to regulate the clutch and band pressures during a shift. The TCM compares TP voltage, engine rpm and other inputs to determine the pressure appropriate for a given shift. The TCM will regulate pressure by applying a varying amperage to the Variable Pressure Solenoid (VPS) valve. The applied amperage can vary from 0 to 1.275 amps. The TCM then monitors the amperage at the return line.

This VPS offsets calibrate the accuracy between actual and expected VPS current.

The DTC P1715 sets when the VPS offset value stored in EEPROM is out of range when checked on initialization. The VPS offset is greater than 120 mA from nominal.

Conditions for Setting the DTC

- DTC P1720 is not set.
- The VPS offset is greater than 120 mA from nominal. The malfunction is triggered immediately after this condition exists.

Action Taken When the DTC Sets

- Default values are used which are typical of the calibrated values.
- Shift quality may be degraded.

Conditions for Clearing the DTC

- This DTC can only be cleared by recalibrating the VPS and then cycling power to the TCM. This is a factory procedure.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

DTC P1715 VPS Offset Error

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1715?	-	Go to Step 3	Go to Step 5
3	1. Turn the ignition OFF. 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	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

DIAGNOSTIC TROUBLE CODE (DTC) P1717 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 P1717 sets when the Random Access Memory (RAM) is not operating correctly when checked on initialization. An area of RAM has failed a read/ write test.

Conditions for Setting the DTC

- An area of RAM has failed a read/ write test.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- Adopt Limp Home Mode (LHM)
- Outputs are disabled.
- The transmission adopts the third gear LHM strategy of operation, independent of the vehicle speed. The operation of TCM under this condition is difficult to predict. Its operation may be erratic.

Conditions for Clearing the DTC

- The DTC will clear if the malfunction is not present after cycling the ignition.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- When DTC P1717 sets, the replacement of TCM is recommended.

DTC P1717 RAM Error

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. Does the scan tool display P1717?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 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	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

DIAGNOSTIC TROUBLE CODE (DTC) P1718 ROM 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 ROM memory allocations. This function is called a checksum.

The DTC P1718 sets when the Read Only Memory (ROM), program memory, is corrupted when checked on initialization. The calculated checksum disagrees with the stored checksum.

Conditions for Setting the DTC

- TCM has been powered ON for greater than 7 seconds.
- The calculated checksum disagrees with the stored checksum. The malfunction is triggered immediately after this condition exists.

Action Taken When the DTC Sets

- Adopt Limp Home Mode (LHM)
- The transmission adopts the third gear LHM strategy of operation, independent of the vehicle speed. The operation of TCM under this condition cannot be predicted. Its operation may be erratic.

Conditions for Clearing the DTC

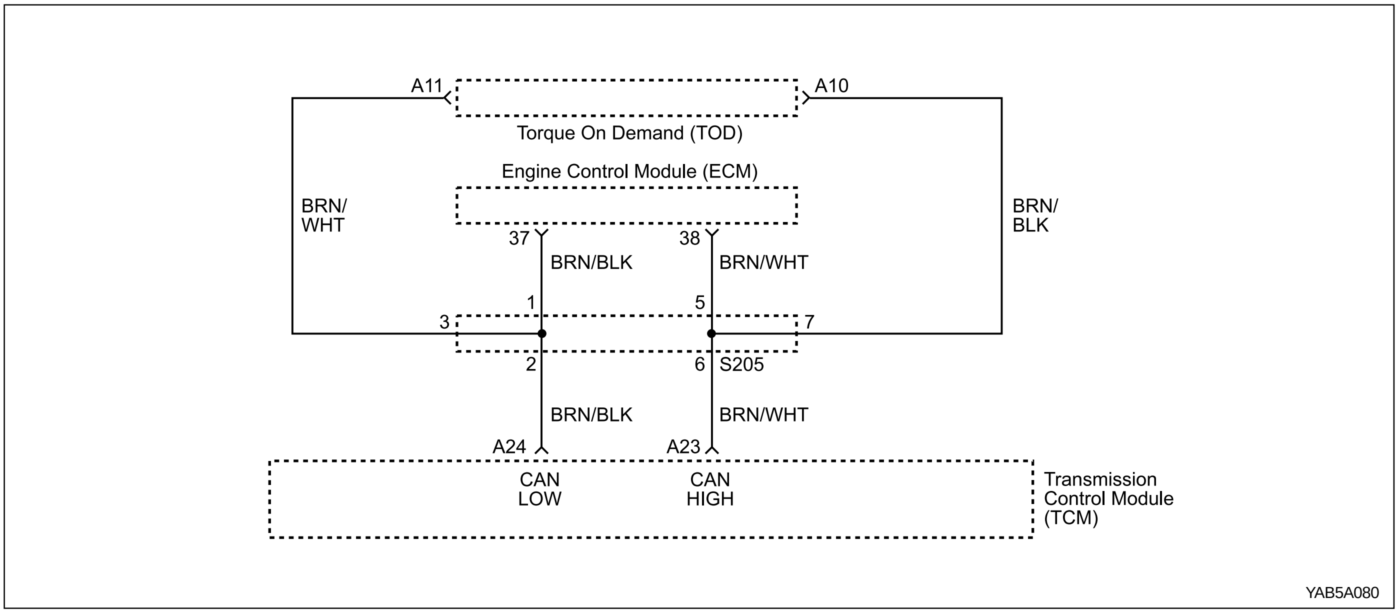
- The DTC will clear if the malfunction is not present after cycling the ignition.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- When DTC P1718 sets, the replacement of TCM is recommended.

DTC P1718 ROM Error

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. Does the scan tool display P1718?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 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	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete



DIAGNOSTIC TROUBLE CODE (DTC) P1719 CAN BUS ERROR

Circuit Description

The Controller Area Network (CAN) connects various control modules by using a twisted pair of wires, to share common information. This results in a reduction of sensors and wiring. TCM obtains the actual engine speed and throttle position, vehicle speed and accelerator position etc. from ECM via CAN without any additional sensors.

The DTC P1719 sets when the information required by TCM is not available on the CAN. One or more CAN messages used by the TCM is timed out, i.e. not refreshed for 1 second.

Conditions for Setting the DTC

- One or more CAN messages used by the TCM are timed out, i.e. not refreshed for 1 second.

Action Taken When the DTC Sets

- TCM uses default values for all CAN dependent signals.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred for 30 seconds.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM and ECM connectors. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.
- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

6. Check for a poor connection at the ECM and TCM connectors.

DTC P1719 CAN Bus Error

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1719?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the TCM connector A. 3. Disconnect the Engine Control Module (ECM) connector. 4. Check the wiring harness from ECM connector terminal 38 to TCM connector terminal A23 for an open or a short. Is a problem found?	-	Go to Step 4	Go to Step 5
4	Repair the malfunctioning wiring harness. Is a repair complete?	-	Go to Step 10	-
5	Check the wiring harness from ECM connector terminal 37 to TCM connector terminal A24 for an open or a short. Is a problem found?	-	Go to Step 4	Go to Step 6
6	Check for a poor connection at the ECM connector or TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 10	Go to Step 7
7	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 8	-
8	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 10	Go to Step 9
9	1. Turn the ignition OFF. 2. Replace the TCM with the original.	-	Go to *Section 1F, Engine Control*	-
10	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 11	Go to Step 2
11	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

DIAGNOSTIC TROUBLE CODE (DTC) P1720 EEPROM ERROR

System Description

The Electrically Erasable Programmable Read-Only Memory (EEPROM) is a permanent memory chip that is physically soldered within the Transmission Control Module (TCM) The EEPROM contains the calibration information required for transmission and transmission diagnostics operation. When the EEPROM malfunctions, DTC P1720 will set. The EEPROM memory is corrupted and the calculated checksum disagrees with the stored checksum or an EEPROM communication failure has occurred when checked on initialization.

Conditions for Setting the DTC

- The calculated checksum disagrees with the stored checksum or an EEPROM communication failure has occurred when checked on initialization.
- Immediately after the above condition occurs.

Action Taken When the DTC Sets

- If CAN is detected, OBD N32D VIN is selected. Or If CAN is not detected, P29 STi VIN is selected.
- Default values are used which are typical of calibrated values.
- Shift quality may be degraded.

Conditions for Clearing the DTC

- The DTC will only clear if the malfunction is not present after cycling the ignition.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- When DTC 1720 is set, it is likely the TCM will need replacing.

DTC P1720 EEPROM Error

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1720?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 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	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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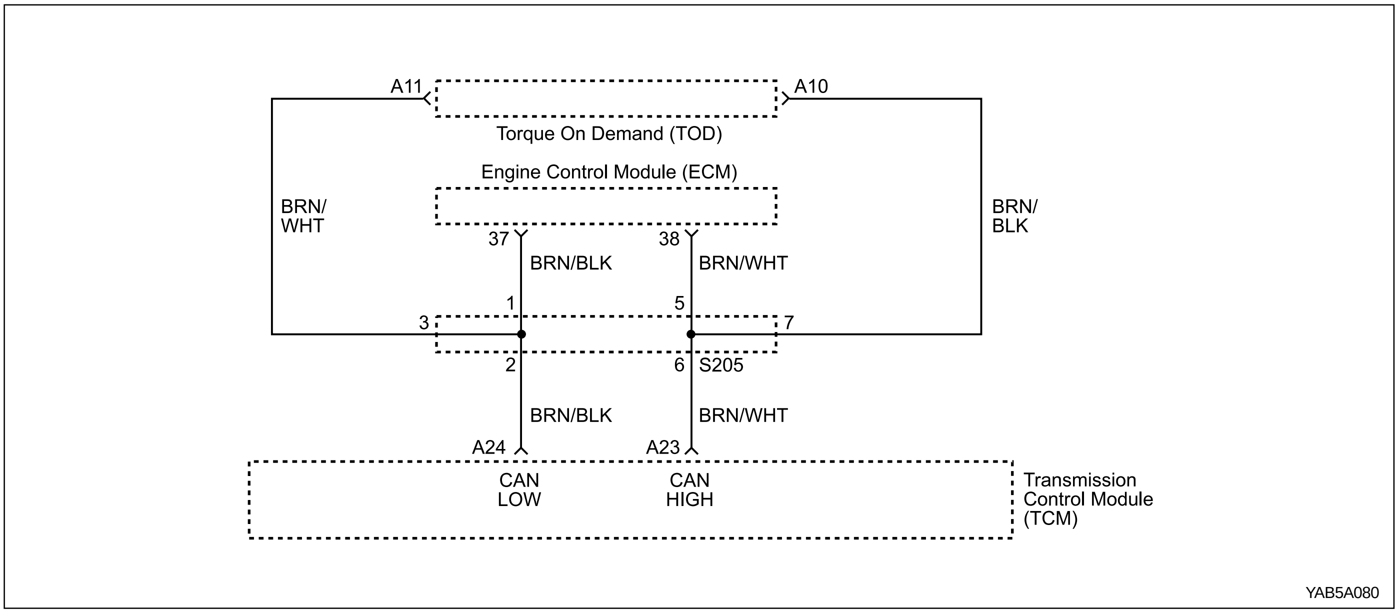


DIAGNOSTIC TROUBLE CODE (DTC) P1721 THROTTLE SIGNAL ERROR

Circuit Description

The Controller Area Network (CAN) connects various control modules by using a twisted pair of wires, to share common information. This results in a reduction of sensors and wiring. TCM obtains the actual engine speed and throttle position, vehicle speed and accelerator etc. from ECM via CAN without any additional sensors.

The DTC P1721 sets when the throttle signal via CAN is out of range. The throttle is greater than 254 steps.

Conditions for Setting the DTC

- DTC P1719 is not set.
- The throttle is greater than 254 steps. The malfunction triggers immediately after the above condition occurs.

Action Taken When the DTC Sets

- The throttle signal is defaulted to 100 %.
- Shift quality is degraded.
- All shifts will be firm as full throttle and hence high engine torque is assumed.
- Line pressure will always stay high (S6 OFF) to cope with the assumed high throttle/ torque.
- Manual 1 gear selection is inhibited.

Conditions for Clearing the DTC

- The DTC will clear if the malfunction is not present for 30 seconds.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM and ECM connectors. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.
- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.
- When ECM finds a fault on the throttle signals, ECM will adopt a default mode and send the default value and trouble message to TCM via CAN.

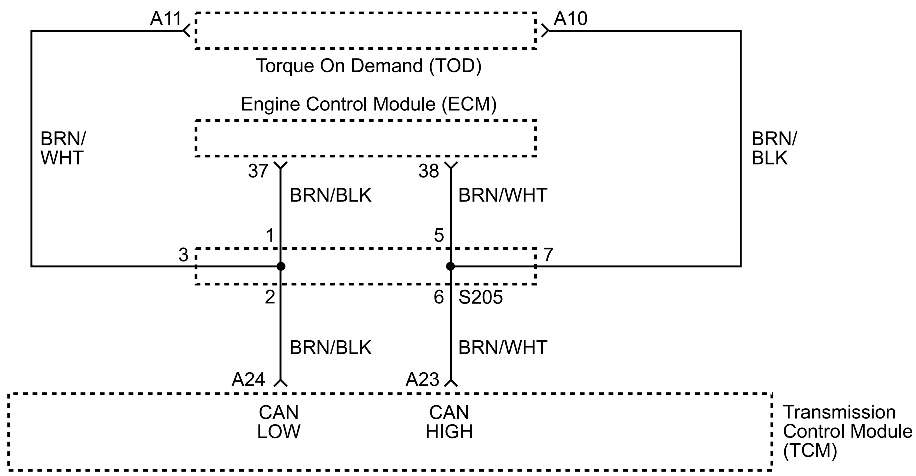
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Check if there are any DTCs related to the throttle position sensor on the ECM side.
4. Check for a poor connection at the ECM and TCM connectors.

DTC P1721 Throttle Signal Error

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1721?	-	Go to Step 3	Go to "Diagnostic Aids"
3	Check if there are any DTCs related to the throttle position sensor on the ECM side. Are any DTCs related to throttle position sensor found?	-	Go to *Section 1F, Engine Controls*	Go to Step 4
4	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 5	-
5	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 6	Go to Step 2
6	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete



DIAGNOSTIC TROUBLE CODE (DTC) P1722
VEHICLE TYPE DETERMINATION ERROR

Circuit Description

The Electrically Erasable Programmable Read-Only Memory (EEPROM) is a permanent memory chip that is physically soldered within the Transmission Control Module (TCM) The EEPROM contains the program and the calibration information required for the transmission and transmission diagnostics operation.

The DTC P1722 sets when TCM is unable to determine the vehicle type from EEPROM or CAN. CAN vehicle type information is in error or unavailable in time.

By definition, there must by on EEPROM fault (P1720) or an EEPROM vehicle code error (P1714) to cause the TCM to try and determine the vehicle code by other means.

The DTC P1722 is a reflection of the significance of the problem caused by the other error.

Conditions for Setting the DTC

- EEPROM information is in error or unreliable.
- Vehicle type information on the CAN is not present or in error.
- The above condition exists for 1 second after power up.

Action Taken When the DTC Sets

- If CAN is detected, OBD N32D VIN is selected. Or If CAN is not detected, P29 STi VIN is selected.
- Shift quality may be degraded.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred after ignition cycle.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.
- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change

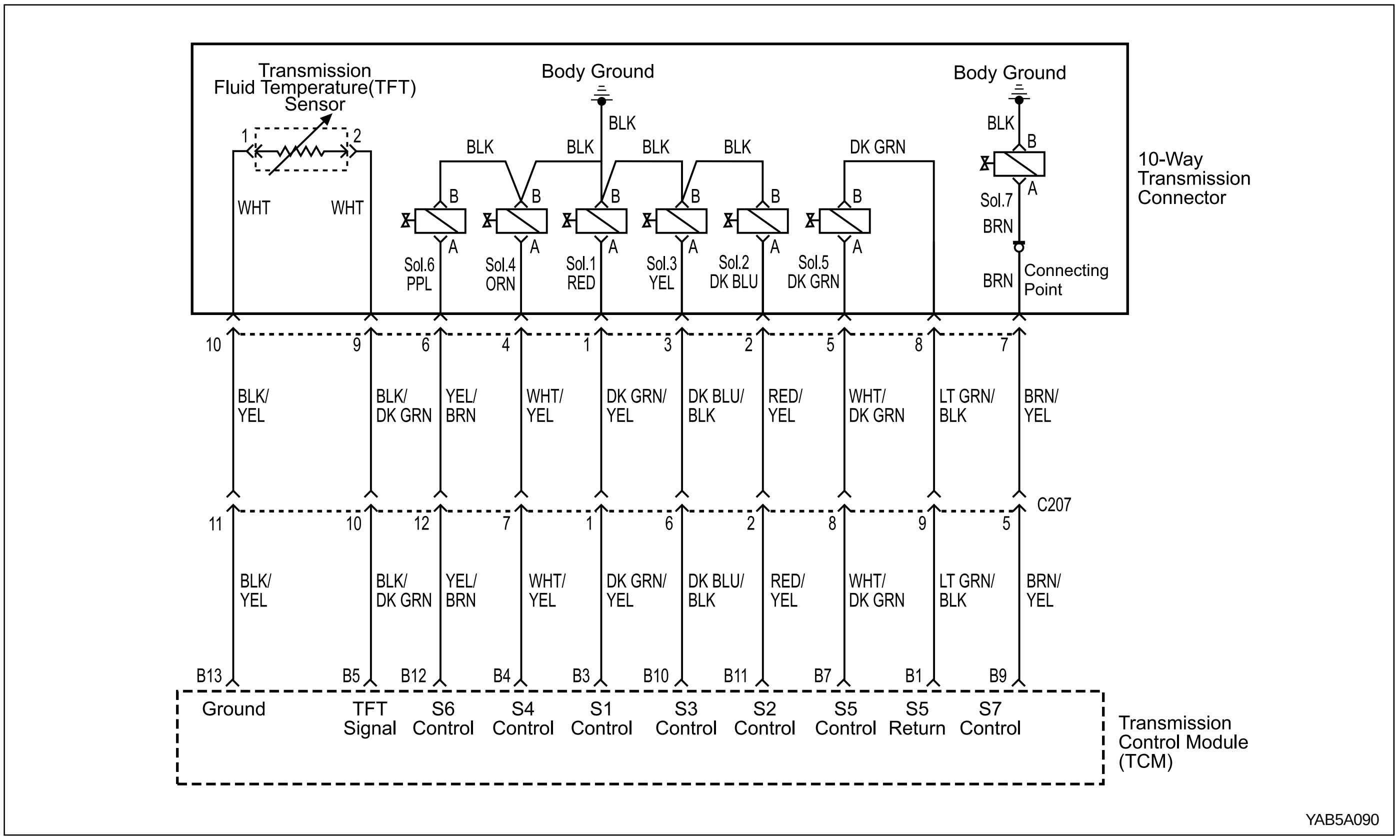
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. If there are any other DTCs like P1714 or P1720, troubleshoot those prior to P1722.

DTC P1722 Vehicle Type Determination Error

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. Does the scan tool display P1722?	-	Go to Step 3	Go to "Diagnostic Aids"
3	Does the scan tool display DTC P1714.	-	Go to applicable DTC table	Go to DTC P1720 table



DIAGNOSTIC TROUBLE CODE (DTC) P1733 SOLENOID 1 CIRCUIT OPEN

Circuit Description

The solenoid 1 is used to control fluid flow acting on the 1-2 shift valve. The solenoid 1 is a normally open ON/OFF type solenoid that is used in conjunction with the solenoid 2 to allow four different shifting combinations. Refer to Solenoid Logic for Static Gear States. The solenoid is attached to the valve body within the transmission. Voltage is supplied directly to the solenoid through the Transmission Control Module (TCM).

The DTC P1733 sets when the Solenoid 1 (S1) circuit is open or the switched leg of the solenoid 1 is shorted to battery positive.

Conditions for Setting the DTC

- DTCs P1717 and P1718 are not set.
- S1 is OFF.
- S2 is OFF.
- The solenoid 1's driver Integrated Chip (IC) status indicates a faulty circuit. This condition must be continuously present for 60 milliseconds.

Action Taken When the DTC Sets

- The solenoid 1 is always OFF.
- TCM adopts a Limp Home Mode (LHM) operation.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred after ignition cycle.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- During the TCM's testing, solenoid 1 is turned OFF/ON by a very small (4 millisecond) pulse. This pulse is too short for the solenoid to react so the transmission operation is not affected.
- The solenoid feedback voltage is measured before the (4 millisecond) pulse and again during the pulse. If the difference is outside the acceptable limits the relevant fault is recorded.
- Typical causes would be an open circuit in the wiring to or within the solenoid, or a short circuit to power in the wiring to or within the solenoid.
- If several faults of solenoids are present, check the wiring or connectors that are common to the selected solenoids, especially the earth connections.

- Inspect the wiring for poor electrical connections at the TCM and at the 10-way transmission connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.
- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.
- Solenoid Logic for Static Gear States

Gear	S1	S2
1^{st}	ON	ON
2^{nd}	OFF	ON
3^{rd}	OFF	OFF
4^{th}	ON	OFF
Reverse	OFF	OFF
Neutral	OFF	OFF
Park	OFF	OFF

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Checks if the S1 circuit in the transmission is malfunctioning.
4. Check cable in the transmission for open / short.
6. Check resistance between S1 terminal A and B. Standard value is 22 - 30 Ω.
9. Check poor connections of other connectors

DTC P1733 Solenoid 1 Circuit Open

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1733?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the 10-way transmission connector. (additional DTCs will set) 3. Connect Solenoid/Thermistor Electrical Tester (STET) to the 10-way transmission connector of transmission side and to the good ground. 4. Turn the mode knob of STET to 1 and push the red button. Does the bulb of open circuit on the solenoids side of STET illuminate?	-	Go to Step 4	Go to Step 8
4	1. Remove the valve cover. Refer to the Transmission in this section. 2. Check the wiring harness from 10-way transmission connector to Solenoid 1 (S1) on the valve body for an open or short to positive and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 5
5	Check the S1 ground circuit for an open and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 6

DTC P1733 Solenoid 1 Circuit Open (Cont'd)

Step	Action	Value(s)	Yes	No
6	Using a Digital Volt Meter (DVM), measure the resistance between S1 terminal A and B. Is the resistance within the specified value?	22 - 30 Ω	Go to "Diagnostic Aids"	Go to Step 7
7	Replace the S1. Is the action complete?	-	Go to Step 11	-
8	1. Disconnect the TCM connector A. 2. Check the wiring harness from 10-way transmission connector terminal 1 to TCM terminal B3 for an open or short to positive and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 9
9	Check for a poor connection at the 10-way transmission connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 10
10	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 11	-
11	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 12	Go to Step 2
12	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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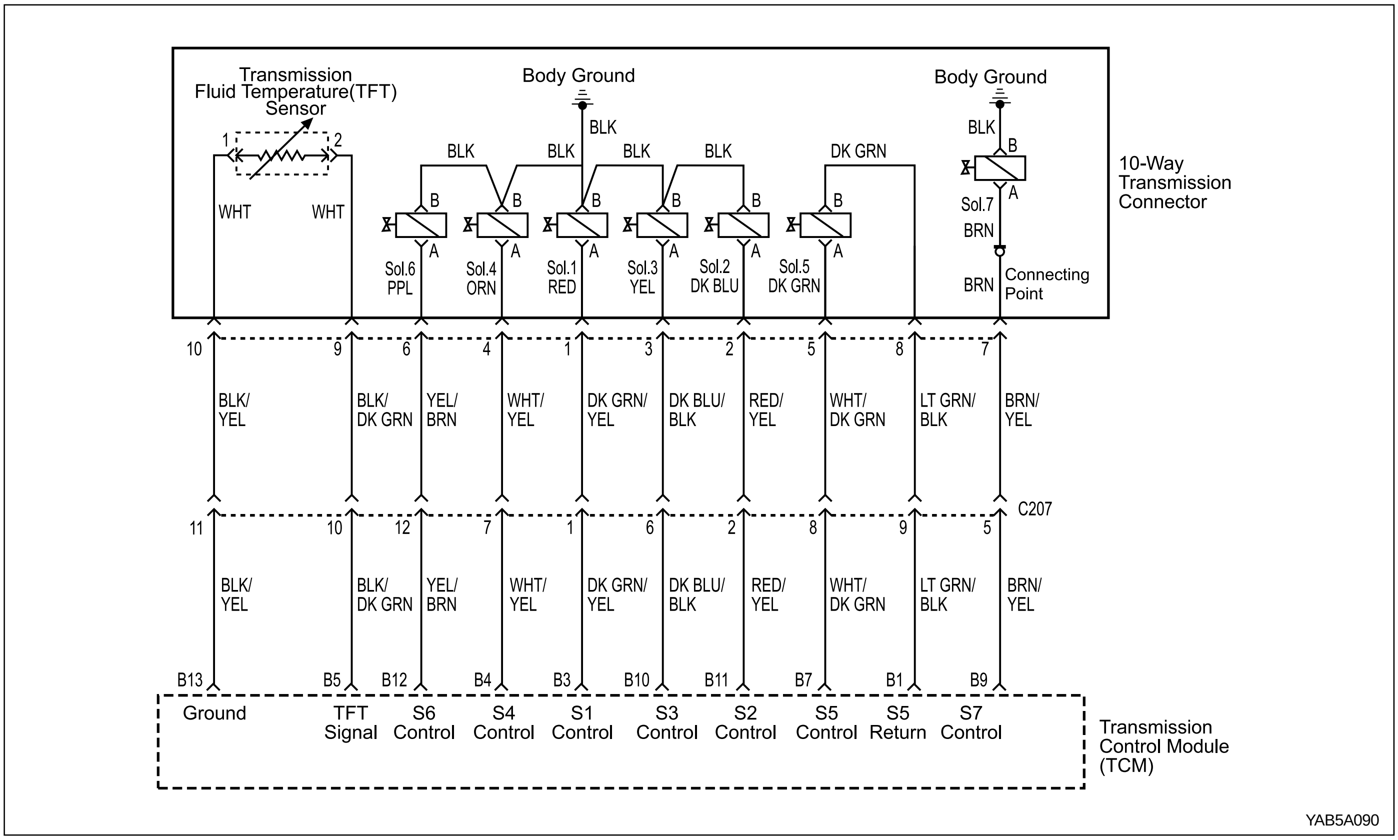

DIAGNOSTIC TROUBLE CODE (DTC) P1734
SOLENOID 2 CIRCUIT OPEN

Circuit Description

The solenoid 2 is used to control fluid flow acting on the 2-3 shift valve. The solenoid 2 is a normally open ON/ OFF type solenoid that is used in conjunction with the solenoid 1 to allow four different shifting combinations. Refer to Solenoid Logic for Static Gear States.

The solenoid is attached to the valve body within the transmission. Voltage is supplied directly to the solenoid through the Transmission Control Module (TCM).

The DTC P1734 sets when the Solenoid 2 (S2) circuit is open or the switched leg of the solenoid 2 is shorted to battery positive.

Conditions for Setting the DTC

- DTCs P1717 and P1718 are not set.
- S2 is OFF.
- S1 is OFF.
- The solenoid 2's driver Integrated Chip (IC) status indicates a faulty circuit. This condition must be continuously present for 60 milliseconds.

Action Taken When the DTC Sets

- The solenoid 2 is always OFF.
- TCM adopts a Limp Home Mode (LHM) operation.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred after ignition cycle.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- During the TCM's testing, solenoid 2 is turned OFF/ ON by a very small (4 millisecond) pulses. This pulse is too short for the solenoid to react so the transmission operation is not affected.
- The solenoid feedback voltage is measured before the (4 millisecond) pulse and again during the pulse. If the difference is outside the acceptable limits the relevant fault is recorded.
- Typical causes would be an open circuit in the wiring to or within the solenoid, or a short circuit to power in the wiring to or within the solenoid.
- If several faults of solenoids are present, check the wiring or connectors that are common to the selected solenoids, especially the earth connections.

- Inspect the wiring for poor electrical connections at the TCM and at the 10-way transmission connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.
- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.
- Solenoid Logic for Static Gear States

Gear	S1	S2
1st	ON	ON
2nd	OFF	ON
3rd	OFF	OFF
4th	ON	OFF
Reverse	OFF	OFF
Neutral	OFF	OFF
Park	OFF	OFF

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Checks if the S2 circuit in the transmission is malfunctioning.
4. Check cable in the transmission for open / short.
6. Check resistance between S2 terminal A and B. Standard value is 22 - 30 Ω.
9. Check connections of other connectors

DTC P1734 Solenoid 2 Circuit Open

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1734?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the 10-way transmission connector. (additional DTCs will set) 3. Connect Solenoid/Thermistor Electrical Tester (STET) to the 10-way transmission connector of transmission side and to the good ground. 4. Turn the mode knob of STET to 2 and push the red button. Does the bulb of open circuit on the solenoids side of STET illuminate?	-	Go to Step 4	Go to Step 8
4	1. Remove the valve cover. Refer to the Transmission in this section. 2. Check the wiring harness from 10-way transmission connector to Solenoid 2 (S2) on the valve body for an open or short to positive and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 5
5	Check the S2 necessarycircuit for an open and repair as necessary. Is a repair complete?	-	Go to Step 11	Go to Step 6

DTC P1734 Solenoid 2 Circuit Open (Cont'd)

Step	Action	Value(s)	Yes	No
6	Using a Digital Volt Meter (DVM), measure the resistance between S2 terminal A and B. Is the resistance within the specified value?	22 - 30 Ω	Go to "Diagnostic Aids"	Go to Step 7
7	Replace the S2. Is the action complete?	-	Go to Step 11	-
8	1. Disconnect the TCM connector A. 2. Check the wiring harness from 10-way transmission connector terminal 2 to TCM terminal B11 for an open or short to positive and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 9
9	Check for a poor connection at the 10-way transmission connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 10
10	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 11	-
11	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 12	Go to Step 2
12	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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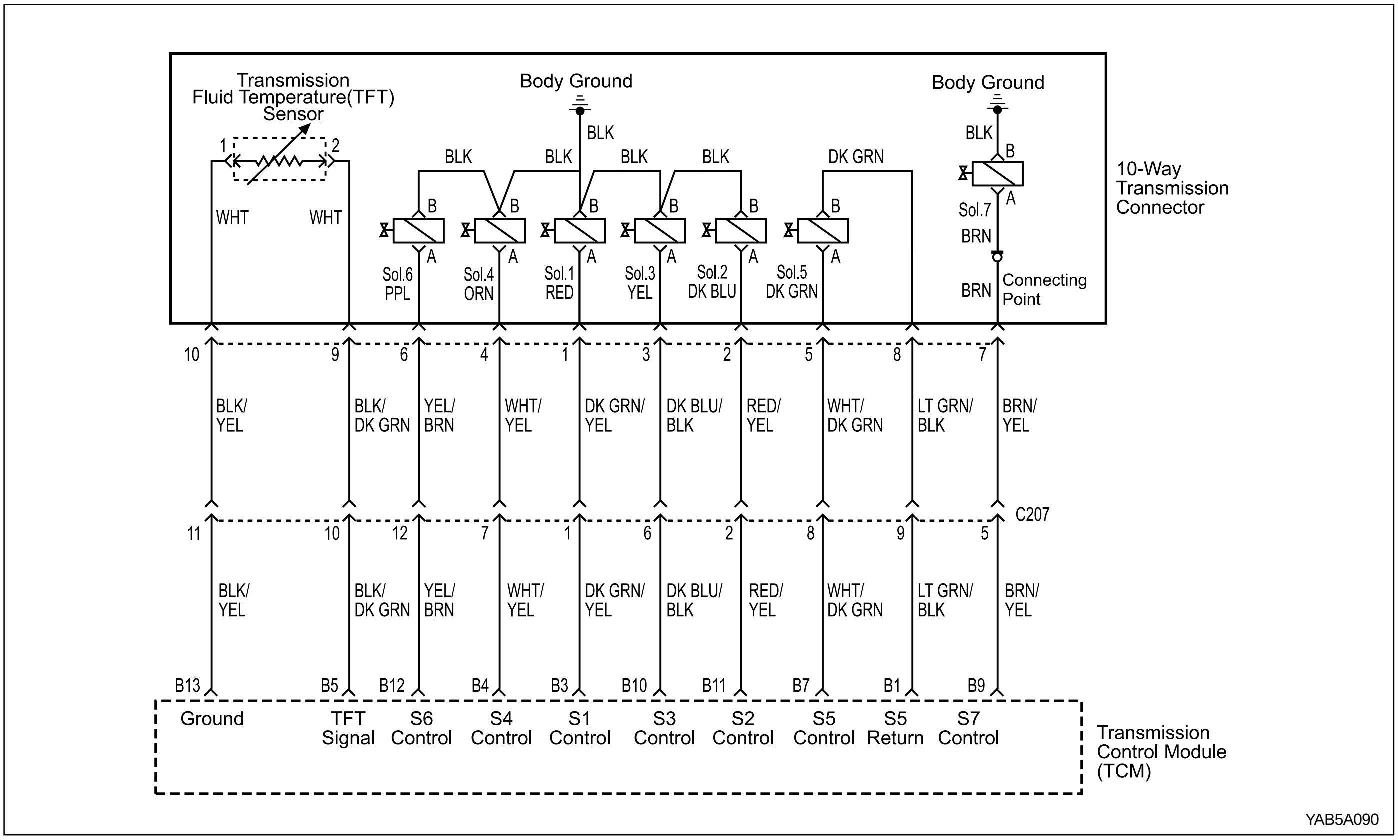

DIAGNOSTIC TROUBLE CODE (DTC) P1735 SOLENOID 3 CIRCUIT OPEN

Circuit Description

The solenoid 3 is a normally open ON/OFF type solenoid that is used in conjunction with the solenoid 4 to control the shift quality and sequencing.

The solenoid 3 switches the clutch regulator valve OFF or ON and is attached to the valve body within the transmission. Voltage is supplied directly to the solenoid through the Transmission Control Module (TCM).

The DTC P1735 sets when the Solenoid 3 (S3) circuit is open or the switched leg of the solenoid 3 is shorted to battery positive. The solenoid 3's driver Integrated Chip (IC) status indicates a faulty circuit.

Conditions for Setting the DTC

- DTCs P1717 and P1718 are not set.
- S3 is OFF.
- S7 is OFF.
- The solenoid 3's driver Integrated Chip (IC) status indicates a faulty circuit. This condition must be continuously present for 60 milliseconds.

Action Taken When the DTC Sets

- The solenoid 3 is always OFF.
- The 1 → 3, 1 → 4, 2 → 3, 2 → 4, 3 → 1, 3 → 2, 4 → 2 and 4 → 1 shift quality is degraded.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred after ignition cycle.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- During the TCM's testing, solenoid 3 is turned OFF/ON by a very small (4 millisecond) pulses. This pulse is too short for the solenoid to react so the transmission operation is not affected.
- The solenoid feedback voltage is measured before the (4 millisecond) pulse and again during the pulse. If the difference is outside the acceptable limits the relevant fault is recorded.
- Typical causes would be an open circuit in the wiring to or within the solenoid, or a short circuit to power in the wiring to or within the solenoid.
- If several faults of solenoids are present, check the wiring or connectors that are common to the selected solenoids, especially the earth connections.

- Inspect the wiring for poor electrical connections at the TCM and at the 10-way transmission connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.
- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Checks if the S3 circuit in the transmission is malfunctioning.
4. Check cable in the transmission for open / short.
6. Check resistance between S3 terminal A and B. Standard value is 22 - 30 Ω.
9. Check connections of other connectors

DTC P1735 Solenoid 3 Circuit Open

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1735?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the 10-way transmission connector. (additional DTCs will set) 3. Connect Solenoid/Thermistor Electrical Tester (STET) to the 10-way transmission connector of transmission side and to the good ground. 4. Turn the mode knob of STET to 3 and push the red button. Does the bulb of open circuit on the solenoids side of STET illuminate?	-	Go to Step 4	Go to Step 8
4	1. Remove the valve cover. Refer to the Transmission in this section. 2. Check the wiring harness from 10-way transmission connector to Solenoid 3 (S3) on the valve body for an open or short to positive and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 5
5	Check the S3 ground circuit for an open and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 6
6	Using a Digital Volt Meter (DVM), measure the resistance between S3 terminal A and B. Is the resistance within the specified value?	22 - 30 Ω	Go to "Diagnostic Aids"	Go to Step 7
7	Replace the S3. Is the action necessary?	-	Go to Step 11	-
8	1. Disconnect the TCM connector A. 2. Check the wiring harness from 10-way transmission connector terminal 3 to TCM terminal B10 for an open or short to positive and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 9

DTC P1735 Solenoid 3 Circuit Open (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check for a poor connection at the 10-way transmission connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 10
10	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 11	-
11	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 12	Go to Step 2
12	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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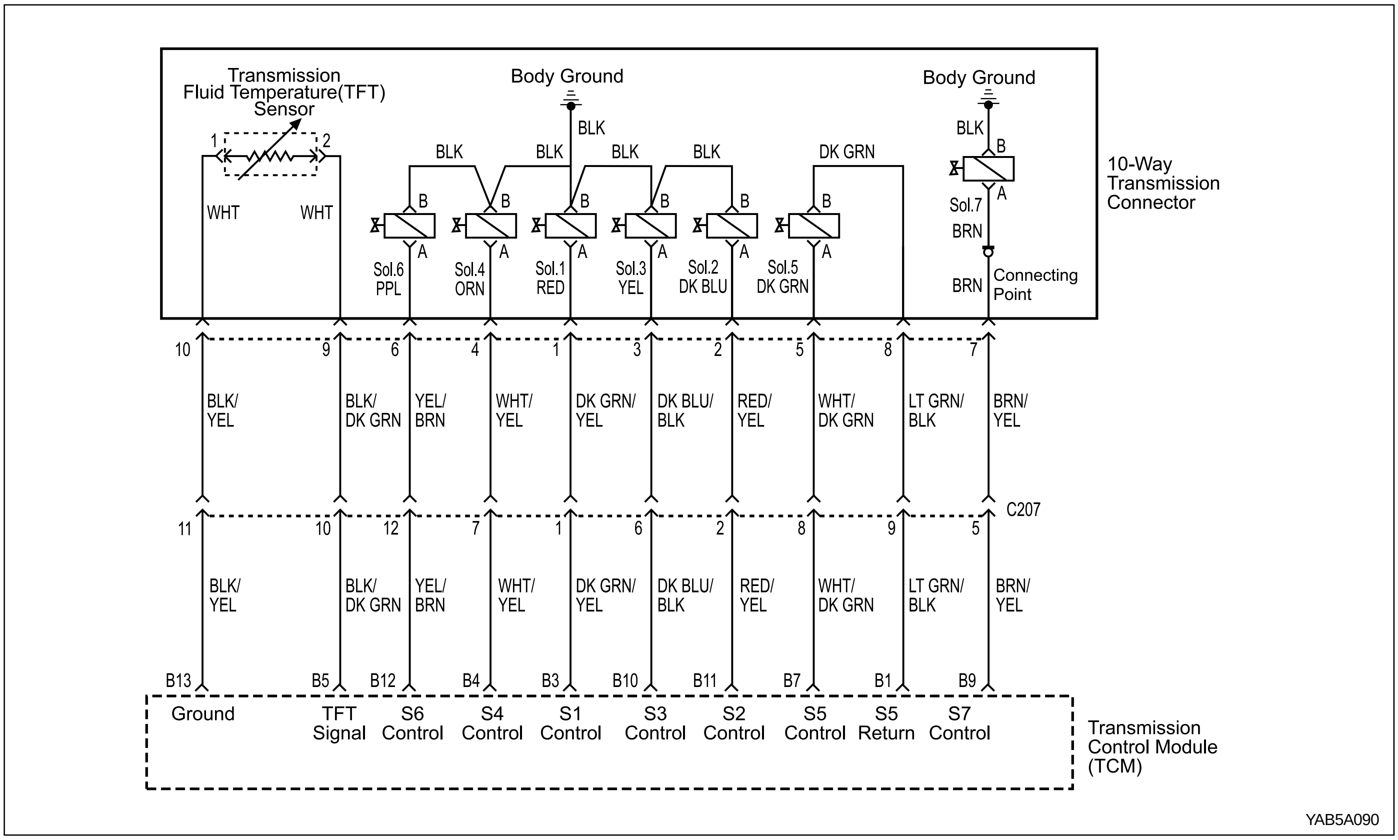

DIAGNOSTIC TROUBLE CODE (DTC) P1736 SOLENOID 4 CIRCUIT OPEN

Circuit Description

The solenoid 4 is a normally open ON/OFF type solenoid that is used in conjunction with the solenoid 3 to control the shift quality and sequencing.

The solenoid 4 switches the clutch regulator valve OFF or ON and is attached to the valve body within the transmission. Voltage is supplied directly to the solenoid through the Transmission Control Module (TCM).

The DTC P1736 sets when the Solenoid 4 (S4) circuit is open or the switched leg of the solenoid 4 is shorted to battery positive. The solenoid 4's driver Integrated Chip (IC) status indicates a faulty circuit.

Conditions for Setting the DTC

- DTCs P1717 and P1718 are not set.
- S4 is OFF.
- S6 is OFF.
- The solenoid 3's driver Integrated Chip (IC) status indicates a faulty circuit. This condition must be continuously present for 60 milliseconds.

Action Taken When the DTC Sets

- The solenoid 4 is always OFF.
- The 1 → 2, 1 → 4, 2 → 3, 2 → 4, 3 → 2 (all including manual), 3 → 4, 4 → 1 and 4 → 3 shift quality is degraded.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred after ignition cycle.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- During the TCM's testing, solenoid 4 is turned OFF/ON by a very small (4 millisecond) pulses. This pulse is too short for the solenoid to react so the transmission operation is not affected.
- The solenoid feedback voltage is measured before the (4 millisecond) pulse and again during the pulse. If the difference is outside the acceptable limits the relevant fault is recorded.
- Typical causes would be an open circuit in the wiring to or within the solenoid, or a short circuit to power in the wiring to or within the solenoid.
- If several faults of solenoids are present, check the wiring or connectors that are common to the selected solenoids, especially the earth connections.

- Inspect the wiring for poor electrical connections at the TCM and at the 10-way transmission connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.
- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Checks if the S4 circuit in the transmission is malfunctioning.
4. Check cable in the transmission for open / short.
6. Check resistance between S4 terminal A and B. Standard value is 22 - 30 Ω.
9. Check connections of other connectors

DTC P1736 Solenoid 4 Circuit Open

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) Diagnostic System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1736?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the 10-way transmission connector. (additional DTCs will set) 3. Connect Solenoid/Thermistor Electrical Tester (STET) to the 10-way transmission connector of transmission side and to the good ground. 4. Turn the mode knob of STET to 4 and push the red button. Does the bulb of open circuit on the solenoids side of STET illuminate?	-	Go to Step 4	Go to Step 8
4	1. Remove the valve cover. Refer to the Transmission in this section. 2. Check the wiring harness from 10-way transmission connector to Solenoid 4 (S4) on the valve body for an open or short to positive and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 5
5	Check the S4 ground circuit for an open and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 6
6	Using a Digital Volt Meter (DVM), measure the resistance between S4 terminal A and B. Is the resistance within the specified value?	22 - 30 Ω	Go to "Diagnostic Aids"	Go to Step 7
7	Replace the S4. Is the action necessary?	-	Go to Step 11	-
8	1. Disconnect the TCM connector A. 2. Check the wiring harness from 10-way transmission connector terminal 4 to TCM terminal B4 for an open or short to positive and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 9

DTC P1736 Solenoid 4 Circuit Open (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check for a poor connection at the 10-way transmission connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 10
10	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 11	-
11	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 12	Go to Step 2
12	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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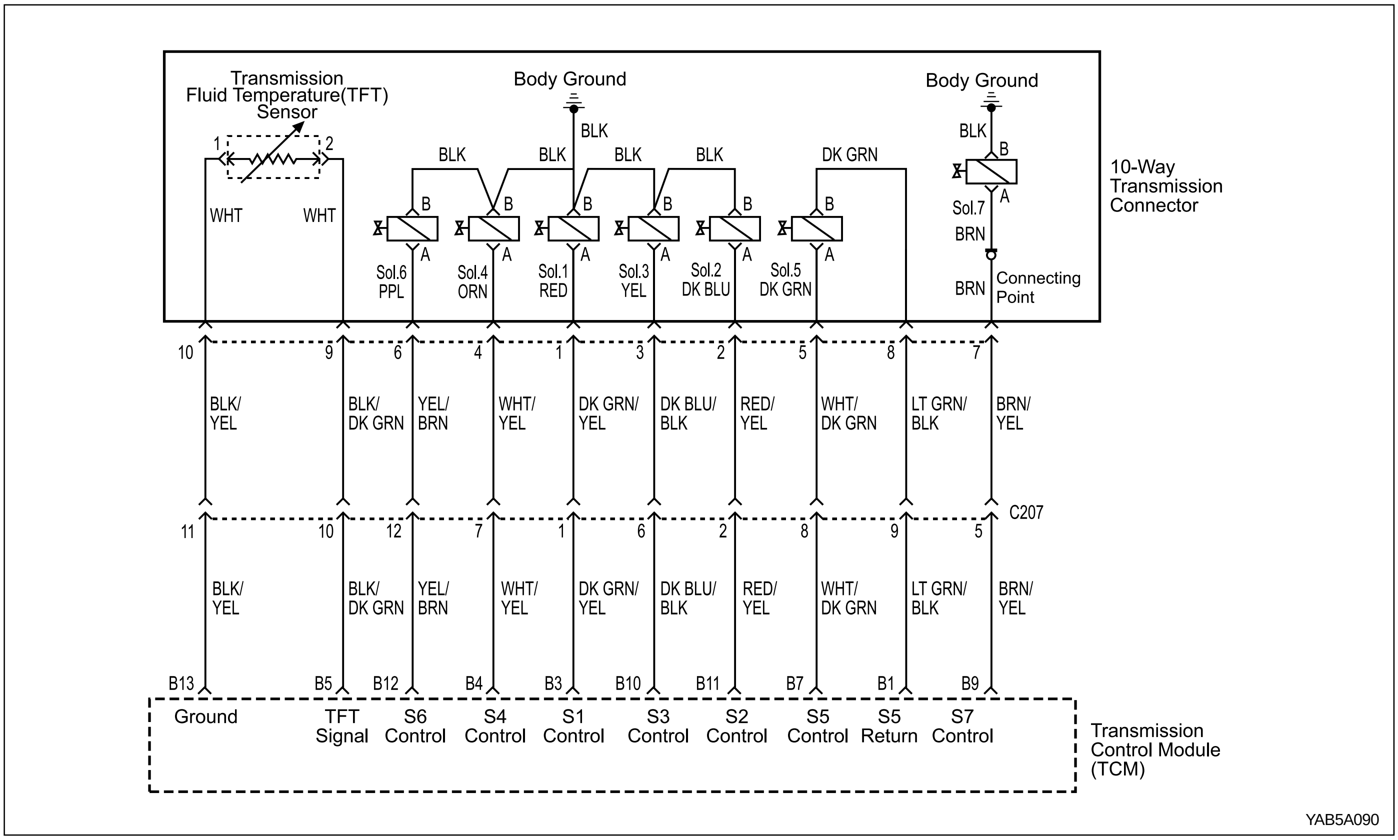

DIAGNOSTIC TROUBLE CODE (DTC) P1737 SOLENOID 5 CIRCUIT OPEN

Circuit Description

The solenoid 5 is a variable force solenoid that ramps the pressure during the gear changes and solenoid switching, to enhance the transmission shift quality. This solenoid provides the signal pressure to the clutch and band regulator, thereby controlling the shift pressure.

The solenoid 5 is attached to the valve body within the transmission. Voltage is supplied directly to the solenoid through the Transmission Control Module (TCM).

The DTC P1737 sets when the solenoid 5 (S5) circuit is open or the switched leg of the solenoid 5 is shorted to battery positive. The solenoid 5's driver Integrated Chip (IC) status indicates a fauty circuit.

Conditions for Setting the DTC

- DTCs P1717 and P1718 are not set.
- The solenoid 5's driver Integrated Chip (IC) status indicates a faulty circuit. This condition must be continuously present for 60 milliseconds.
- The measured S5 current is greater than 100 mA below its expected lower limit.

Action Taken When the DTC Sets

- Solenoid 5 is disabled (always OFF).
- The shift quality is degraded.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred after ignition cycle.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- The current to solenoid 5 was outside acceptable limits.
- This fault results from a mismatch between the current set point for solenoid 5 and the current measured by the feedback within the TCM.
- Typical causes would be an open circuit or short circuit to power in the wiring to, from or within the solenoid.
- It is also possible that there has been a fault in the solenoid output circuit. But if this is the cause, the fault should be continually present.
- Inspect the wiring for poor electrical connections at the TCM and at the 10-way transmission connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.

- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Checks if the S5 circuit in the transmission is malfunctioning.
4. Check cable in the transmission for open / short.
6. Check resistance between S5 terminal A and B. Standard value is 3.6 - 5.5 Ω.
9. Check connections of other connectors

DTC P1737 Solenoid 5 Circuit Open

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1737?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the 10-way transmission connector. (additional DTCs will set) 3. Connect Solenoid/Thermistor Electrical Tester (STET) to the 10-way transmission connector of transmission side. 4. Turn the mode knob of STET to 5 and push the red button. Does the bulb of open circuit on the solenoids side of STET illuminate?	-	Go to Step 4	Go to Step 7
4	1. Remove the valve cover. Refer to the Transmission in this section. 2. Check the wiring harnesses from 10-way trans mission connector to Solenoid 5 (S5) on the valve body for an open or short to positive and repair as necessary. Is a repair complete?	-	Go to Step 11	Go to Step 5
5	Using a Digital Volt Meter (DVM), measure the resistance between S5 terminal A and B. Is the resistance within the specified value?	3.6 - 5.5 Ω	Go to "Diagnostic Aids"	Go to Step 6
6	Replace the S5. Is the action complete?	-	Go to Step 11	-
7	1. Disconnect the TCM connector A. 2. Check the wiring harness from 10-way transmission connector terminal 5 to TCM terminal B7 for an open or short to battery and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 8
8	Check the wiring harness from 10-way transmission connector terminal 8 to TCM terminal B1 for an open and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 9

DTC P1737 Solenoid 5 Circuit Open (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check for a poor connection at the 10-way transmission connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 10
10	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 11	-
11	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 12	Go to Step 2
12	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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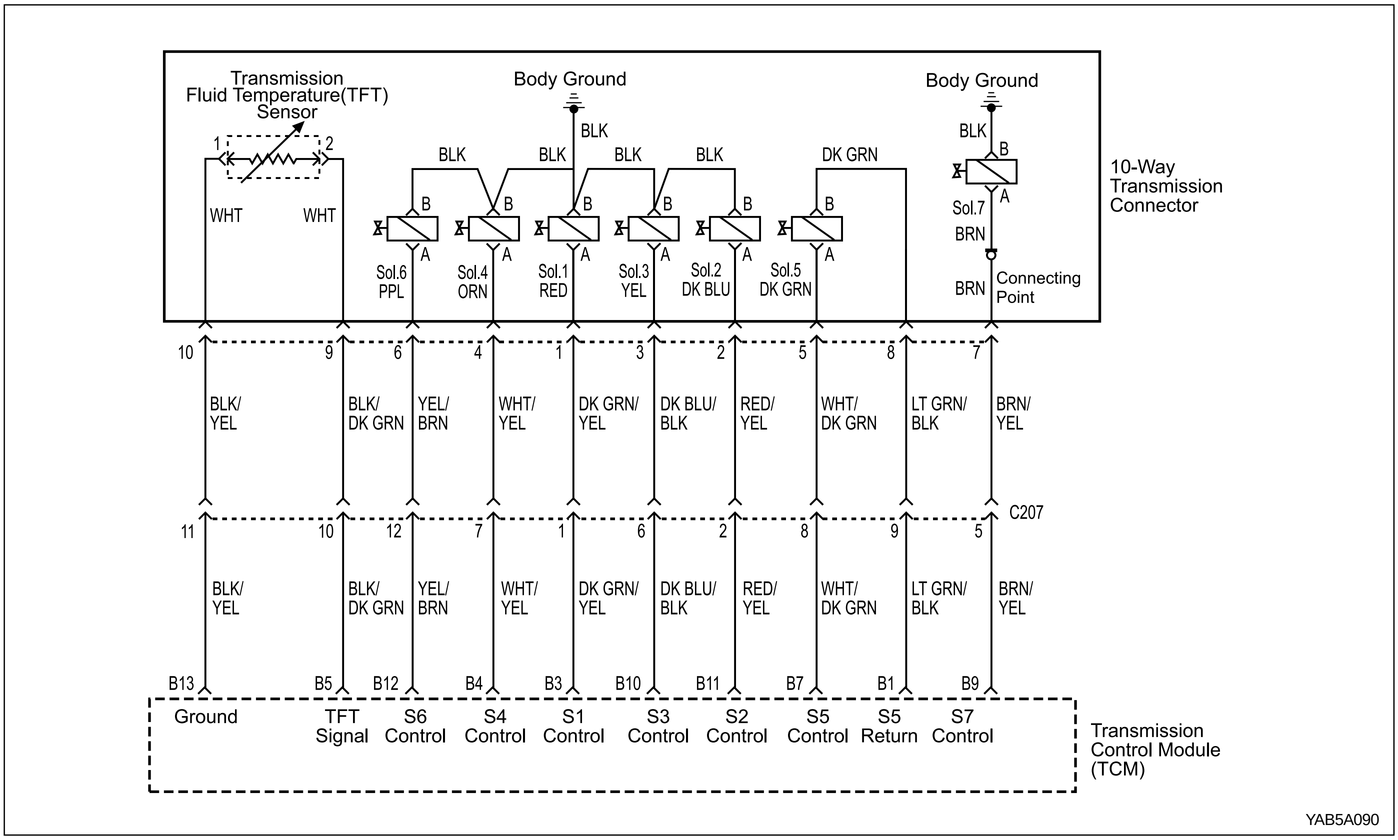

DIAGNOSTIC TROUBLE CODE (DTC) P1738 SOLENOID 6 CIRCUIT OPEN

Circuit Description

The solenoid 6 is a normally open ON/OFF type solenoid that is used to set the high/ low level of line pressure.

The Solenoid 6 (S6) OFF gives high pressure and the S6 is attached to the valve body within the transmission. Voltage is supplied directly to the solenoid through the Transmission Control Module (TCM).

The DTC P1738 sets when the solenoid 6 circuit is open or the switched leg of the solenoid 6 is shorted to battery positive. The solenoid 6's driver Integrated Chip (IC) status indicates a faulty circuit.

Conditions for Setting the DTC

- DTCs P1717 and P1718 are not set.
- S6 is OFF.
- S4 is OFF.
- The solenoid 6's driver Integrated Chip (IC) status indicates a faulty circuit. This condition must be continuously present for 60 milliseconds.

Action Taken When the DTC Sets

- The solenoid 6 is disabled (OFF) resulting in high line pressure being applied continuously.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred after ignition cycle.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- During the TCM's testing, solenoid 6 is turned OFF/ ON by a very small (4 millisecond) pulses. This pulse is too short for the solenoid to react so the transmission operation is not affected.
- The solenoid feedback voltage is measured before the (4 millisecond) pulse and again during the pulse. If the difference is outside the acceptable limits the relevant fault is recorded.
- Typical causes would be an open circuit in the wiring to or within the solenoid, or a short circuit to power in the wiring to or within the solenoid.
- If several faults of solenoids are present, check the wiring or connectors that are common to the selected solenoids, especially the earth connections.

- Inspect the wiring for poor electrical connections at the TCM and at the 10-way transmission connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.
- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Checks if the S6 circuit in the transmission is malfunctioning.
4. Check cable in the transmission for open / short.
6. Check resistance between S6 terminal A and B. Standard value is 22 - 30 Ω.
9. Check connections of other connectors

DTC P1738 Solenoid 6 Circuit Open

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1738?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the 10-way transmission connector. (additional DTCs will set) 3. Connect Solenoid/Thermistor Electrical Tester (STET) to the 10-way transmission connector of transmission side and to the good ground. 4. Turn the mode knob of STET to 6 and push the red button. Does the bulb of open circuit on the solenoids side of STET illuminate?	-	Go to Step 4	Go to Step 8
4	1. Remove the valve cover. Refer to the Transmission in this section. 2. Check the wiring harness from 10-way transmission connector to Solenoid 6 (S6) on the valve body for an open or short to positive and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 5
5	Check the S6 ground circuit for an open and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 6
6	Using a Digital Volt Meter (DVM), measure the resistance between S6 terminal A and B. Is the resistance within the specified value?	22 - 30 Ω	Go to "Diagnostic Aids"	Go to Step 7
7	Replace the S6. Is the action complete?	-	Go to Step 11	-
8	1. Disconnect the TCM connector. 2. Check the wiring harness from 10-way transmission connector terminal 6 to TCM terminal B12 for an open and repair as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 9

DTC P1738 Solenoid 6 Circuit Open (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check for a poor connection at the 10-way transmission connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 10
10	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 11	-
11	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 12	Go to Step 2
12	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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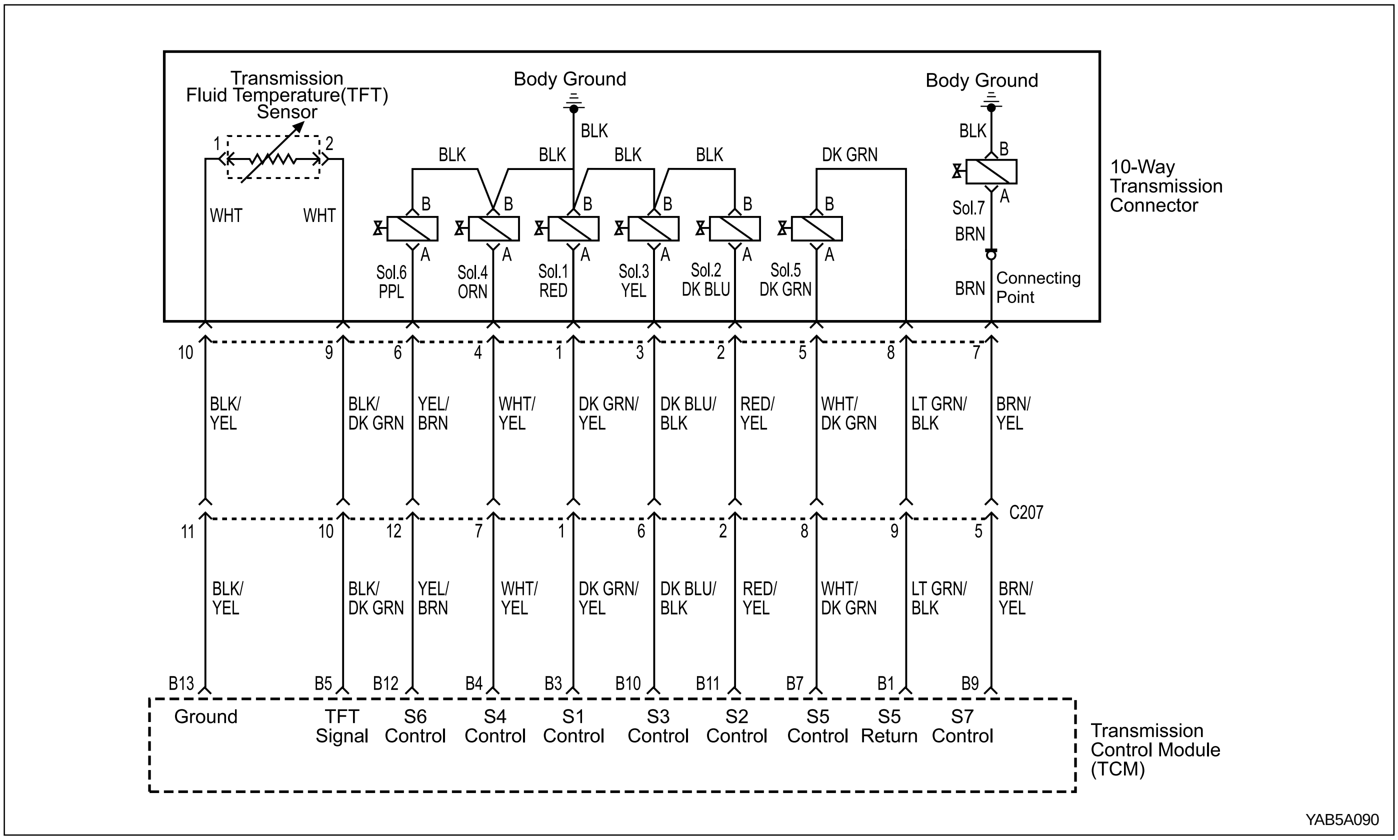

DIAGNOSTIC TROUBLE CODE (DTC) P1739 SOLENOID 7 CIRCUIT OPEN

Circuit Description

The solenoid 7 is a normally open ON/OFF type solenoid that is used to control the application of the Torque Converter Clutch (TCC).

The Solenoid 7 (S7) ON activates the TCC and the S7 is attached to the pump body within the transmission. Voltage is supplied directly to the solenoid through the Transmission Control Module (TCM).

The DTC P1739 sets when the solenoid 7, Torque Converter Clutch Solenoid, circuit is open or the switched leg of the solenoid 7 is shorted to battery positive. The solenoid 7's driver Integrated Chip (IC) status indicates a faulty circuit.

Conditions for Setting the DTC

- DTCs P1717 and P1718 are not set.
- S7 is OFF.
- S3 is OFF.
- The solenoid 7's driver Integrated Chip (IC) status indicates a faulty circuit. This condition must be continuously present for 60 milliseconds.

Action Taken When the DTC Sets

- The solenoid 7 is always disabled (OFF) resulting in the TCC being unlocked always.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred after ignition cycle.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- During the TCM's testing, solenoid 7 is turned OFF/ON by a very small (4 millisecond) pulses. This pulse is too short for the solenoid to react so the transmission operation is not affected.
- The solenoid feedback voltage is measured before the (4 millisecond) pulse and again during the pulse. If the difference is outside the acceptable limits the relevant fault is recorede.
- Typical causes would be an open circuit in the wiring to or within the solenoid, or a short circuit to power in the wiring to or within the solenoid.
- If several faults of solenoids are present, check the wiring or connectors that are common to the selected solenoids, especially the earth connections.
- Inspect the wiring for poor electrical connections at the TCM and at the 10-way transmission connector.

Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.

- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Checks if the S7 circuit in the transmission is malfunctioning.
4. Check cable in the transmission for open / short. If the problem is found in the wiring harness from 10-way transmission connector to contact point attached onto the transmission case, repair it with removing the valve cover. Refer to the Transmission in this section.
7. Check resistance between S7 terminal A and B. Standard value is 22 - 30 Ω.
10. Check connections of other connectors

DTC P1739 Solenoid 7 Circuit Open

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1739?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the 10-way transmission connector. (additional DTCs will set) 3. Connect Solenoid/Thermistor Electrical Tester (STET) to the 10-way transmission connector of transmission side and to the good ground. 4. Turn the mode knob of STET to 7 and push the red button. Does the bulb of open circuit on the solenoids side of STET illuminate?	-	Go to Step 4	Go to Step 9
4	1. Remove the pump assembly. Refer to the Pump in this section. 2. Check the wiring harness from 10-way transmission connector to contact point attached onto the transmission case for an open or short to positive and repair as necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 5
5	Check the wiring harness from contact point attached onto the transmission case to S7 for an open or short to positive and repair as necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 6
6	Check the S4 ground circuit for an open and repair as necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 7
7	Using a Digital Volt Meter (DVM), measure the resistance between S7 terminal A and B. Is the resistance within the specified value?	22 - 30 Ω	Go to "Diagnostic Aids"	Go to Step 8
8	Replace the S7. Is the action complete?	-	Go to Step 12	-

DTC P1739 Solenoid 7 Circuit Open (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Disconnect the TCM connector B. 2. Check the wiring harness from 10-way transmission connector terminal 7 to TCM terminal B9 for an open or short to positive and repair as necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 10
10	Check for a poor connection at the 10-way transmission connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 11
11	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 12	-
12	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 13	Go to Step 2
13	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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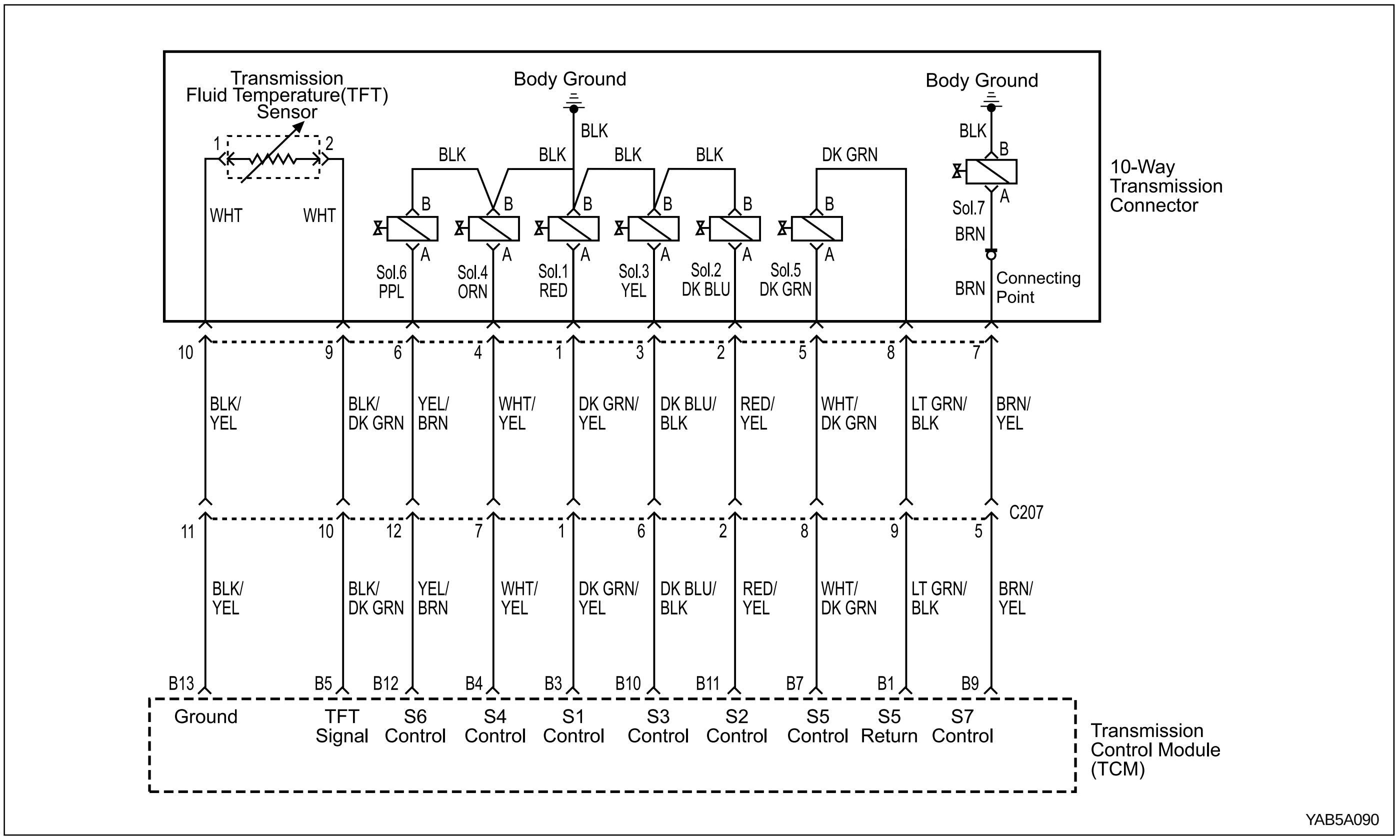

DIAGNOSTIC TROUBLE CODE (DTC) P1741 SOLENOID 1 CIRCUIT SHORT

Circuit Description

The solenoid 1 is used to control fluid flow acting on the 1-2 shift valve. The solenoid 1 is a normally open ON/OFF type solenoid that is used in conjunction with the solenoid 2 to allow four different shifting combinations. Refer to Static Gear Status.

The solenoid is attached to the valve body within the transmission. Voltage is supplied directly to the solenoid through the Transmission Control Module (TCM).

The DTC P1741 sets when the Solenoid 1 (S1) circuit is shorted to ground. The solenoid 1's driver Integrated Chip (IC) status indicates a faulty circuit.

Conditions for Setting the DTC

- DTCs P1717 and P1718 are not set.
- S1 is ON.
- The solenoid 1's driver Integrated Chip (IC) status indicates a faulty circuit. This condition must be continuously present for 60 milliseconds.

Action Taken When the DTC Sets

- The solenoid 1 is always OFF.
- TCM adopts a Limp Home Mode (LHM) operation.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred after ignition cycle.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- During the TCM's testing, solenoid 1 is turned OFF/ON by a very small (4 millisecond) pulses. This pulse is too short for the solenoid to react so the transmission operation is not affected.
- The solenoid feedback voltage is measured before the (4 millisecond) pulse and again during the pulse. If the difference is outside the acceptable limits the relevant fault is recorded.
- Typical causes would be a short circuit to ground in the wiring to or within the solenoid.
- If several faults of solenoids are present, check the wiring or connectors that are common to the selected solenoids, especially the earth connections.
- Inspect the wiring for poor electrical connections at the TCM and at the 10-way transmission connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.

- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.
- Solenoid Logic for Static Gear States

Gear	S1	S2
1 st	ON	ON
2 nd	OFF	ON
3 rd	OFF	OFF
4 th	ON	OFF
Reverse	OFF	OFF
Neutral	OFF	OFF
Park	OFF	OFF

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Checks if the S1 circuit in the transmission is malfunctioning.
4. Check cable in the transmission for short to ground.
6. Check resistance between S1 terminal A and B. Standard value is 22-30 Ω .
9. Check connections of other connectors.

DTC P1741 Solenoid 1 Circuit Short

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) System Check. Is the check performed?	-	Go to Step 2	Go to “TCM Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display	-	Go to Step 3	Go to “Diagnostic Aids”
3	1. Turn the ignition OFF. 2. Disconnect the 10-way transmission connector. (additional DTCs will set) 3. Connect Solenoid/Thermistor Electrical Tester (STET) to the 10-way transmission connector of transmission side and to the good ground. 4. Turn the mode knob of STET to 1 and push the red button. Does the bulb of close circuit on the solenoids side of STET illuminate?	-	Go to Step 4	Go to Step 8
4	1. Remove the valve cover. Refer to the Transmission in this section. 2. With a test light connected to B+, probe the wiring harness from 10-way transmission connector to Solenoid 1 (S1) on the valve body. Does the test light illuminate?	-	Go to Step 5	Go to Step 6
5	Repair the short to ground in the wiring harness. Is the repair complete?	-	Go to Step 11	-
6	Using a Digital Volt Meter (DVM), measure the resistance between S1 terminal A and B. Is the resistance within the specified value?	20 - 30 Ω	Go to “Diagnostic Aids”	Go to Step 7
7	Replace the S1. Is the action complete?	-	Go to Step 11	-

DTC P1741 Solenoid 1 Circuit Short (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Disconnect the TCM connector B. 2. With a test light connected to B+, probe the wiring harness from 10-way transmission connector terminal 1 to TCM terminal B3. Does the test light illuminate?	-	Go to Step 5	Go to Step 9
9	Check for a poor connection at the 10-way transmission connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 10
10	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 11	-
11	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 12	Go to Step 2
12	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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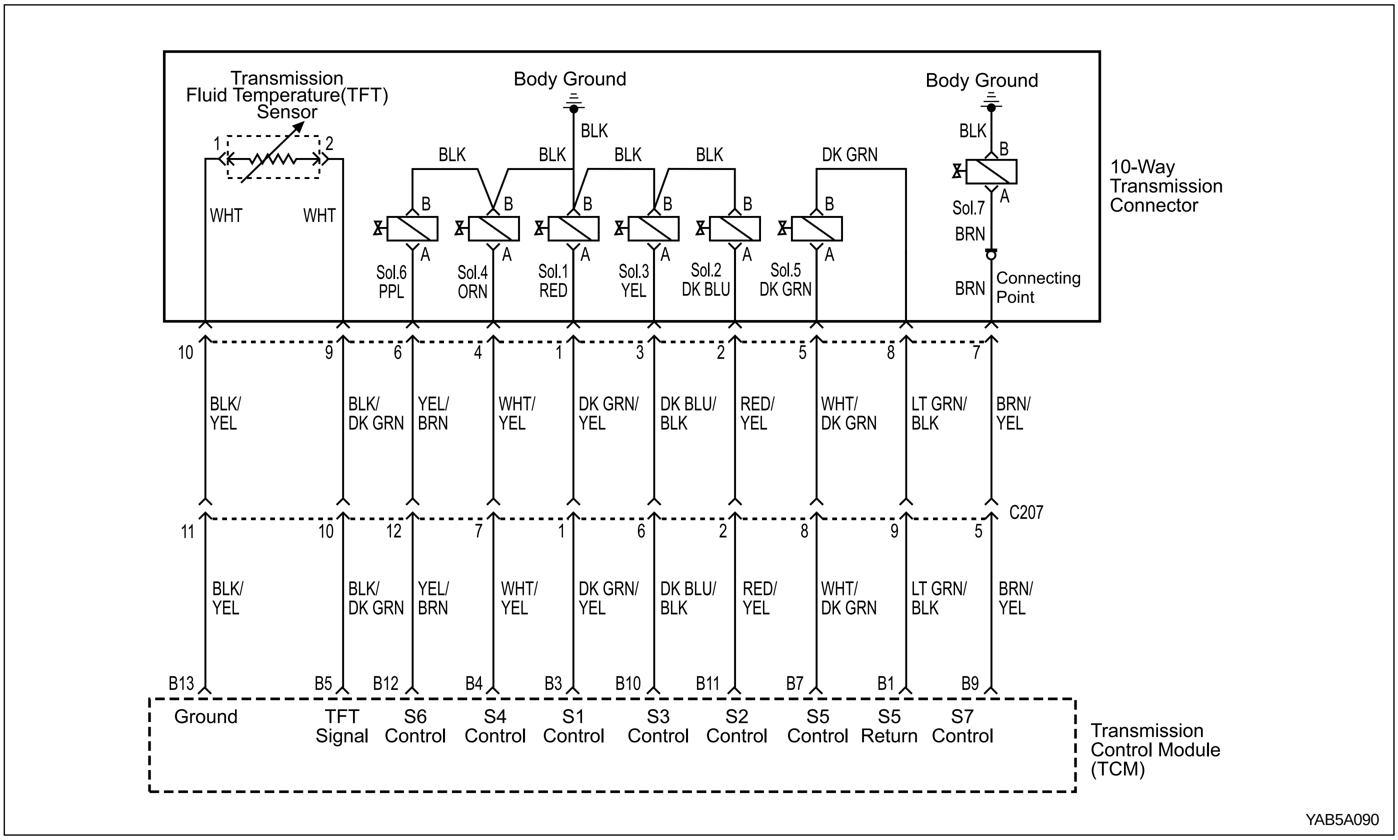

DIAGNOSTIC TROUBLE CODE (DTC) P1742 SOLENOID 2 CIRCUIT SHORT

Circuit Description

The solenoid 2 is used to control fluid flow acting on the 2-3 shift valve. The solenoid 2 is a normally open ON/ OFF type solenoid that is used in conjunction with the solenoid 1 to allow four different shifting combinations. Refer to Static Gear Status.

The solenoid is attached to the valve body within the transmission. Voltage is supplied directly to the solenoid through the Transmission Control Module (TCM).

The DTC P1742 sets when the Solenoid 2 (S2) circuit is shorted to ground. The solenoid 2's driver Integrated Chip (IC) status indicates a faulty circuit.

Conditions for Setting the DTC

- DTCs P1717 and P1718 are not set.
- S2 is ON.
- The solenoid 2's driver Integrated Chip (IC) status indicates a faulty circuit. This condition must be continuously present for 60 milliseconds.

Action Taken When the DTC Sets

- The solenoid 2 is always OFF.
- TCM adopts a Limp Home Mode (LHM) operation.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred after ignition cycle.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- During the TCM's testing, solenoid 2 is turned OFF/ ON by a very small (4 millisecond) pulses. This pulse is too short for the solenoid to react so the transmission operation is not affected.
- The solenoid feedback voltage is measured before the (4 millisecond) pulse and again during the pulse. If the difference is outside the acceptable limits the relevant fault is recorded.
- Typical causes would be a short circuit to ground in the wiring to or within the solenoid.
- If several faults of solenoids are present, check the wiring or connectors that are common to the selected solenoids, especially the earth connections.
- Inspect the wiring for poor electrical connections at the TCM and at the transmission 10-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.

- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.
- Solenoid Logic for Static Gear States

Gear	S1	S2
1 st	ON	ON
2 nd	OFF	ON
3 rd	OFF	OFF
4 th	ON	OFF
Reverse	OFF	OFF
Neutral	OFF	OFF
Park	OFF	OFF

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Checks if the S2 circuit in the transmission is malfunctioning.
4. Check cable in the transmission for short to ground.
6. Check resistance between S2 terminal A and B. Standard value is 22 - 30 Ω.
9. Check connections of other connectors.

DTC P1742 Solenoid 2 Circuit Short

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) System Check. Is the check performed?	-	Go to Step 2	Go to “TCM Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1742?	-	Go to Step 3	Go to “Diagnostic Aids”
3	1. Turn the ignition OFF. 2. Disconnect the 10-way transmission connector. (additional DTCs will set) 3. Connect Solenoid/Thermistor Electrical Tester (STET) to the 10-way transmission connector of transmission side and to the good ground. 4. Turn the mode knob of STET to 2 and push the red button. Does the bulb of close circuit on the solenoids side of STET illuminate?	-	Go to Step 4	Go to Step 8
4	1. Remove the valve cover. Refer to the Transmission in this section. 2. With a test light connected to B+, probe the wiring harness from 10-way transmission connector to Solenoid 2 (S2) on the valve body. Does the test light illuminate?	-	Go to Step 5	Go to Step 6
5	Repair the short to ground in the wiring harness. Is the repair complete?	-	Go to Step 11	-
6	Using a Digital Volt Meter (DVM), measure the resistance between S2 terminal A and B. Is the resistance within the specified value?	20 - 30 Ω	Go to “Diagnostic Aids”	Go to Step 7
7	Replace the S2. Is the action complete?	-	Go to Step 11	-

DTC P1742 Solenoid 2 Circuit Short (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Disconnect the TCM connector B. 2. With a test light connected to B+, probe the wiring harness from 10-way transmission connector terminal 2 to TCM terminal B11. Does the test light illuminate?	-	Go to Step 5	Go to Step 9
9	Check for a poor connection at the 10-way transmission connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 10
10	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 11	-
11	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 12	Go to Step 2
12	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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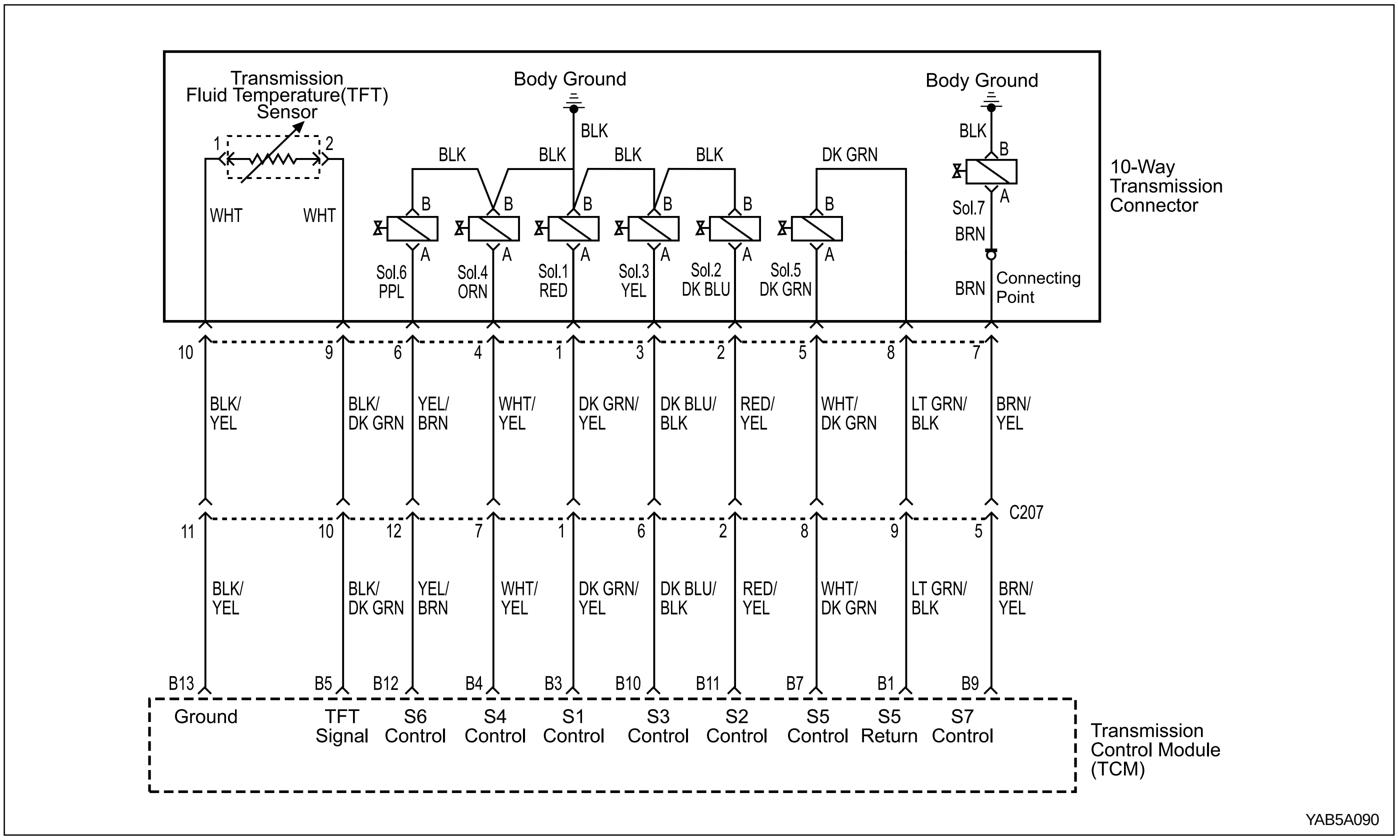

DIAGNOSTIC TROUBLE CODE (DTC) P1743 SOLENOID 3 CIRCUIT SHORT

Circuit Description

The solenoid 3 is a normally open ON/OFF type solenoid that is used in conjunction with the solenoid 4 to control the shift quality and sequencing.

The solenoid 3 switches the clutch regulator valve OFF or ON and is attached to the valve body within the transmission. Voltage is supplied directly to the solenoid through the Transmission Control Module (TCM).

The DTC P1743 sets when the Solenoid 3 (S3) circuit is shorted to ground. The solenoid 3's driver Integrated Chip (IC) status indicates a faulty circuit.

Conditions for Setting the DTC

- DTCs P1717 and P1718 are not set.
- S3 is ON.
- The solenoid 3's driver Integrated Chip (IC) status indicates a faulty circuit. This condition must be continuously present for 60 milliseconds.

Action Taken When the DTC Sets

- The solenoid 3 is always OFF.
- The 1 → 3, 1 → 4, 2 → 3, 2 → 4, 3 → 1, 3 → 2, 4 → 2 and 4   1 shift quality is degraded.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred after ignition cycle.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- During the TCM's testing, solenoid 3 is turned OFF/ ON by a very small (4 millisecond) pulses. This pulse is too short for the solenoid to react so the transmission operation is not affected.
- The solenoid feedback voltage is measured before the (4 millisecond) pulse and again during the pulse. If the difference is outside the acceptable limits the relevant fault is recorded.
- Typical causes would be a short circuit to ground in the wiring to or within the solenoid.
- If several faults of solenoids are present, check the wiring or connectors that are common to the selected solenoids, especially the earth connections.
- Inspect the wiring for poor electrical connections at the TCM and at the 10-way transmission connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.

- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Checks if the S3 circuit in the transmission is malfunctioning.
4. Check cable in the transmission for short to ground.
6. Check resistance between S3 terminal A and B. Standard value is 22 - 30 Ω.
9. Check connections of other connectors.

DTC P1743 Solenoid 3 Circuit Short

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1743?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the 10-way transmission connector. (additional DTCs will set) 3. Connect Solenoid/Thermistor Electrical Tester (STET) to the 10-way transmission connector of transmission side and to the good ground. 4. Turn the mode knob of STET to 3 and push the red button. Does the bulb of close circuit on the solenoids side of STET illuminate?	-	Go to Step 4	Go to Step 8
4	1. Remove the valve cover. Refer to the Transmission in this section. 2. With a test light connected to B+, probe the wiring harness from 10-way transmission connector to Solenoid 3 (S3) on the valve body. Does the test light illuminate?	-	Go to Step 5	Go to Step 6
5	Repair the short to ground in the wiring harness. Is the repair complete?	-	Go to Step 11	-
6	Using a Digital Volt Meter (DVM), measure the resistance between S3 terminal A and B. Is the resistance within the specified value?	20 - 30 Ω	Go to "Diagnostic Aids"	Go to Step 7
7	Replace the S3. Is the action complete?	-	Go to Step 11	-
8	1. Disconnect the TCM connector B. 2. With a test light connected to B+, probe the wiring harness from 10-way transmission connector terminal 3 to TCM terminal B10. Does the test light illuminate?	-	Go to Step 5	Go to Step 9
9	Check for a poor connection at the 10-way transmission connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 10

DTC P1743 Solenoid 3 Circuit Short (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 11	-
11	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 12	Go to Step 2
12	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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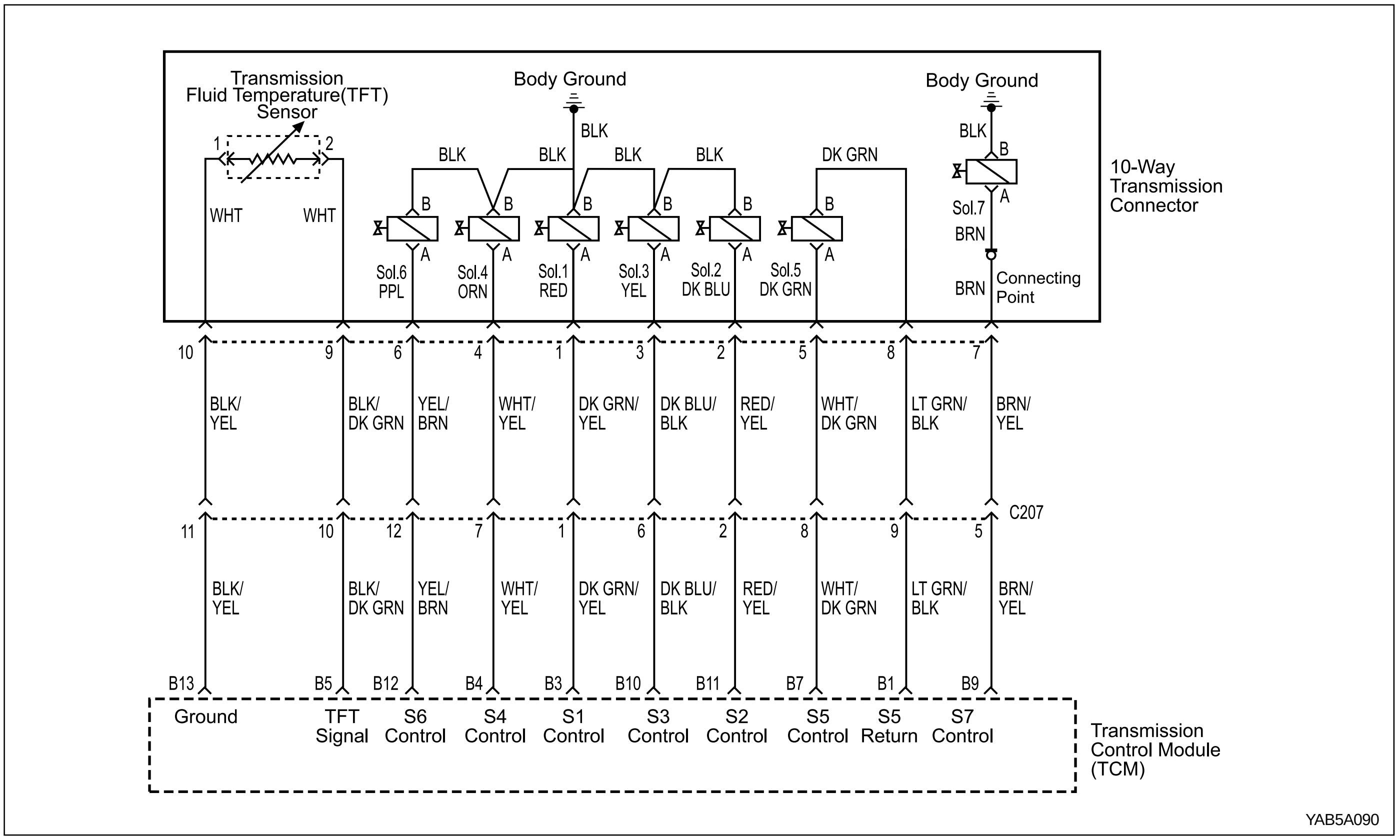

DIAGNOSTIC TROUBLE CODE (DTC) P1744 SOLENOID 4 CIRCUIT SHORT

Circuit Description

The solenoid 4 is a normally open ON/OFF type solenoid that is used in conjunction with the solenoid 3 to control the shift quality and sequencing.

The solenoid 4 switches the band regulator valve OFF or ON and is attached to the valve body within the transmission.

Voltage is supplied directly to the solenoid through the Transmission Control Module (TCM).

The DTC P1744 sets when the Solenoid 4 (S4) circuit is shorted to ground. The solenoid 4's driver Integrated Chip (IC) status indicates a faulty circuit.

Conditions for Setting the DTC

- DTCs P1717 and P1718 are not set.
- S4 is ON.
- The solenoid 4's driver Integrated Chip (IC) status indicates a faulty circuit. This condition must be continuously present for 60 milliseconds.

Action Taken When the DTC Sets

- The solenoid 4 is always OFF.
- The 1 → 2, 1 → 4, 2 → 3, 2 → 4, 3 → 1, 3 → 2 (all including manual), 3 → 4, 4 → 1 and 4 → 3 shift quality is degraded.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred after ignition cycle.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- During the TCM's testing, solenoid 4 is turned OFF/ON by a very small (4 millisecond) pulses. This pulse is too short for the solenoid to react so the transmission operation is not affected.
- The solenoid feedback voltage is measured before the (4 millisecond) pulse and again during the pulse. If the difference is outside the acceptable limits the relevant fault is recorded.
- Typical causes would be a short circuit to ground in the wiring to or within the solenoid.
- If several faults of solenoids are present, check the wiring or connectors that are common to the selected solenoids, especially the earth connections.

- Inspect the wiring for poor electrical connections at the TCM and at the 10-way transmission connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.
- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Checks if the S4 circuit in the transmission is malfunctioning.
4. Check cable in the transmission for short to ground.
6. Check resistance between S4 terminal A and B. Standard value is 22 - 30 Ω.
9. Check connections of other connectors.

DTC P1744 Solenoid 4 Circuit Short

Step	Action	Value(s)	Yes	No
1	Perform Transmission Control Module (TCM) System Check. Is the check performed?	-	Go to Step 2	Go to “TCM Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1744?	-	Go to Step 3	Go to “Diagnostic Aids”
3	1. Turn the ignition OFF. 2. Disconnect the 10-way transmission connector. (additional DTCs will set) 3. Connect Solenoid/Thermistor Electrical Tester (STET) to the 10-way transmission connector of transmission side and to the good ground. 4. Turn the mode knob of STET to 4 and push the red button. Does the bulb of close circuit on the solenoids side of STET illuminate?	-	Go to Step 4	Go to Step 8
4	1. Remove the valve cover. Refer to the Transmission in this section. 2. With a test light connected to B+, probe the wiring harness from 10-way transmission connector to Solenoid 4 (S4) on the valve body. Does the test light illuminate?	-	Go to Step 5	Go to Step 6
5	Repair the short to ground in the wiring harness. Is the repair complete?	-	Go to Step 11	-
6	Using a Digital Volt Meter (DVM), measure the resistance between S4 terminal A and B. Is the resistance within the specified value?	20 - 30 Ω	Go to “Diagnostic Aids”	Go to Step 7
7	Replace the S4. Is the action complete?	-	Go to Step 11	-
8	1. Disconnect the TCM connector B. 2. With a test light connected to B+, probe the wiring harness from 10-way transmission connector terminal 4 to TCM terminal B4. Does the test light illuminate?	-	Go to Step 5	Go to Step 9

DTC P1744 Solenoid 4 Circuit Short (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check for a poor connection at the 10-way transmission connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 10
10	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 11	-
11	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 12	Go to Step 2
12	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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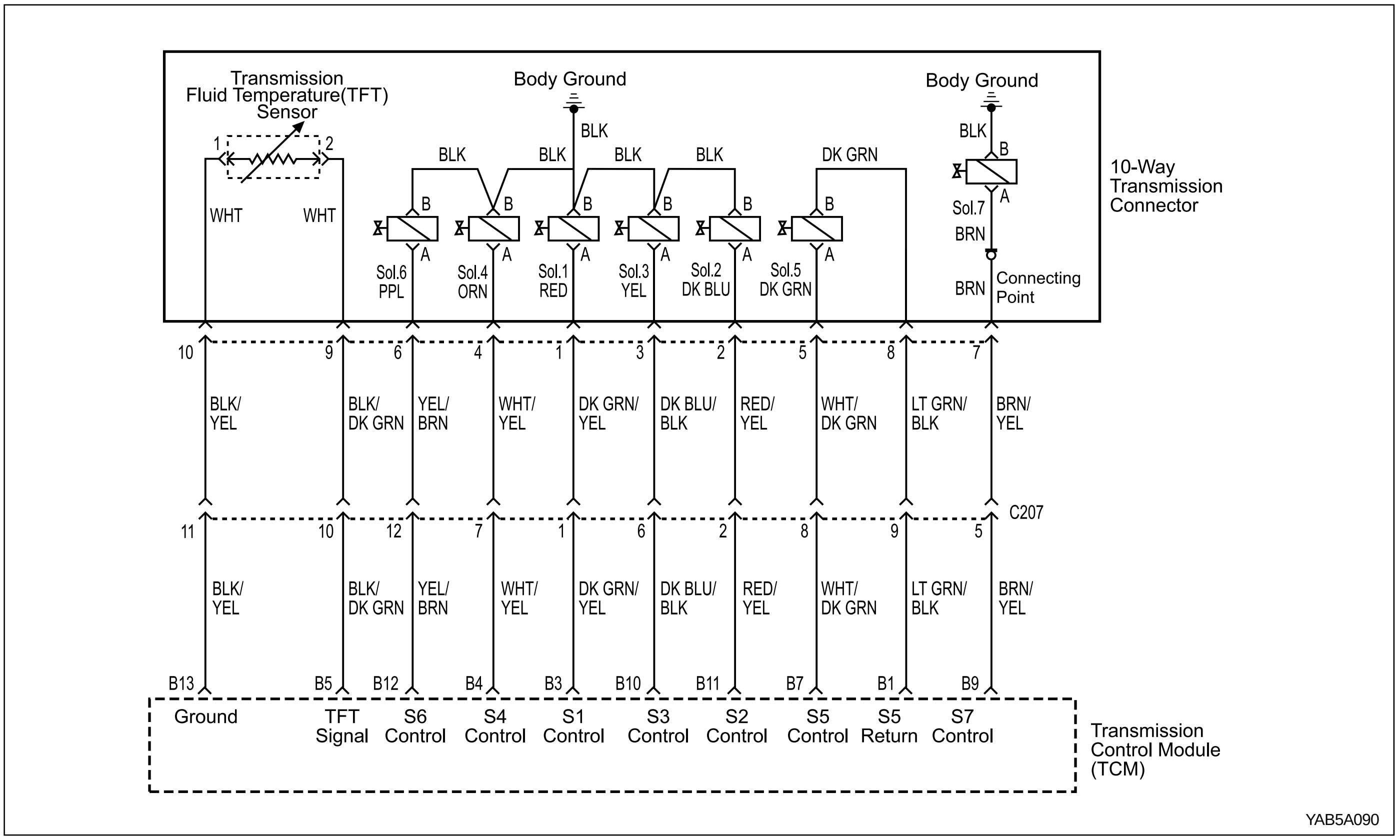

DIAGNOSTIC TROUBLE CODE (DTC) P1745 SOLENOID 5 CIRCUIT SHORT

Circuit Description

The solenoid 5 is a variable force solenoid that ramps the pressure during the gear changes and solenoid switching, to enhance the transmission shift quality. This solenoid provides the signal pressure to the clutch and band regulator, thereby controlling the shift pressure.

The solenoid 5 is attached to the valve body within the transmission. Voltage is supplied directly to the solenoid through the Transmission Control Module (TCM).

The DTC P1745 sets when the Solenoid 5 (S5) circuit is shorted to ground. The solenoid 5's driver Integrated Chip (IC) status indicates a faulty circuit.

Conditions for Setting the DTC

- DTCs P1717 and P1718 are not set.
- S5 is ON.
- The solenoid 5's driver Integrated Chip (IC) status indicates a faulty circuit. This condition must be continuously present for 60 milliseconds.

Action Taken When the DTC Sets

- Solenoid 5 is disabled (always OFF)
- The shift quality is degraded.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred after ignition cycle.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- The current to solenoid 5 was outside acceptable limits.
- This fault results from a mismatch between the current set point for solenoid 5 and the current measured by the feedback within the TCM.
- Typical causes would be a short circuit to ground in the wiring to, from or within the solenoid.
- It is also possible that there has been a fault in the solenoid output circuit. But if this is the cause, the fault should be continually present.
- Inspect the wiring for poor electrical connections at the TCM and at the 10-way transmission connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.
- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Checks if the S5 circuit in the transmission is malfunctioning.
4. Check cable in the transmission for short to ground.
6. Check resistance between S5 terminal A and B. Standard value is 3.6 - 5.5 Ω.
10. Check connections of other connectors.

DTC P1745 Solenoid 5 Circuit Short

Step	Action	Value(s)	Yes	No
1	Perform Transmission Control Module (TCM) System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1745?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the 10-way transmission connector. (additional DTCs will set) 3. Connect Solenoid/Thermistor Electrical Tester (STET) to the 10-way transmission connector of transmission side. 4. Turn the mode knob of STET to 5 and push the red button. Does the bulb of close circuit on the solenoids side of STET illuminate?	-	Go to Step 4	Go to Step 8
4	1. Remove the valve cover. Refer to the Transmission in this section. 2. With a test light connected to B+ probe the wiring harnesses from 10-way transmission connector to Solenoid 5 (S5) on the valve body. Does the test light illuminate?	-	Go to Step 5	Go to Step 6
5	Repair the short to ground in the wiring harness. Is the repair complete?	-	Go to Step 12	-
6	Using a Digital Volt Meter (DVM), measure the resistance between S5 terminal A and B. Is the resistance within the specified value?	3.6 - 5.5 Ω	Go to "Diagnostic Aids"	Go to Step 7
7	Replace the S5. Is the action complete?	-	Go to Step 12	-
8	1. Disconnect the TCM connector B. 2. With a test light connected to B+, probe the wiring harness from 10-way transmission connector terminal 5 to TCM terminal. Does the test light illuminate?	-	Go to Step 5	Go to Step 9
9	Probe the wiring harness from 10-way transmission connector terminal 8 to TCM terminal B1. Does the test light illuminate?	-	Go to Step 5	Go to Step 10
10	Check for a poor connection at the 10-way transmission connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 11

DTC P1745 Solenoid 5 Circuit Short (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 12	-
12	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 13	Go to Step 2
13	Check if any DTCs are set. Are any there DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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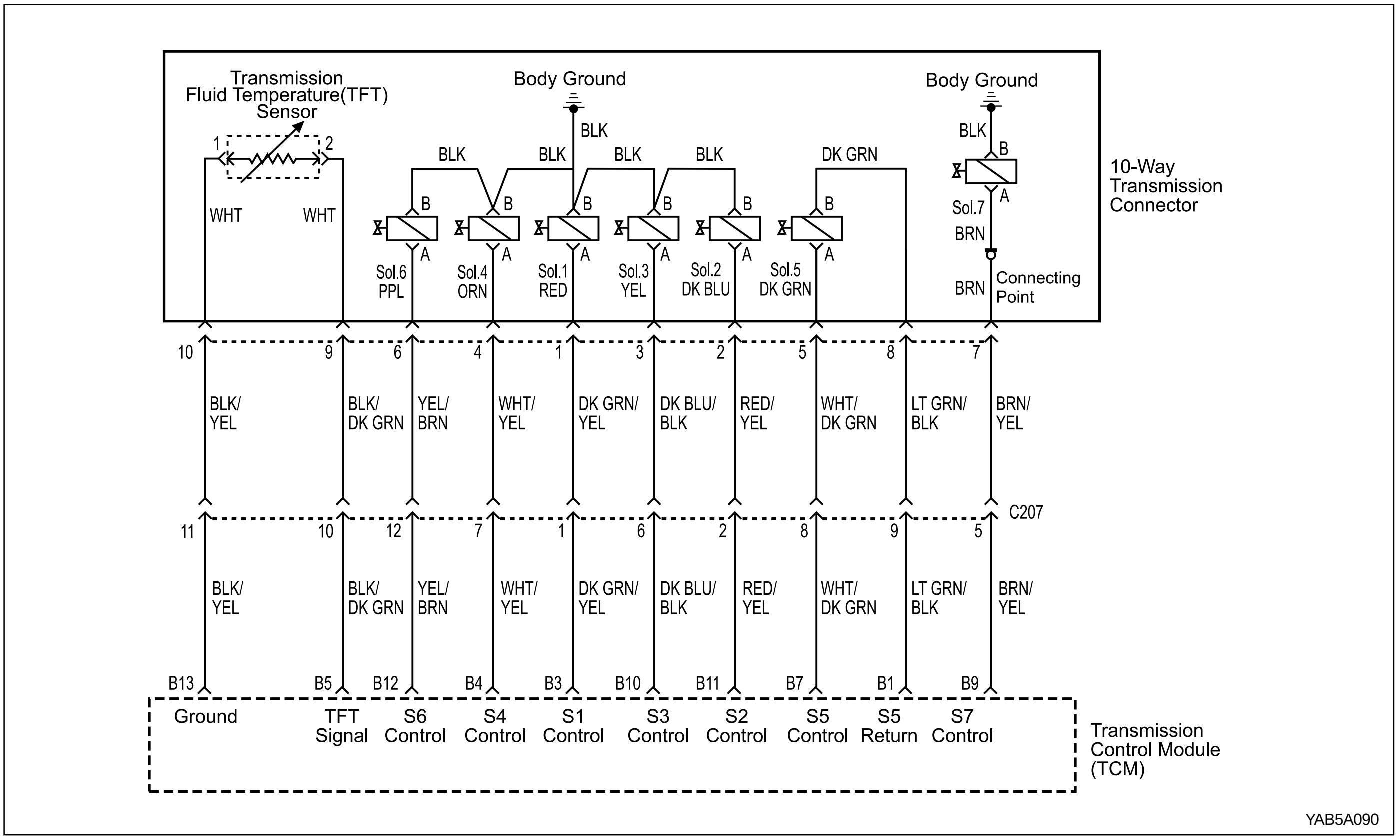

DIAGNOSTIC TROUBLE CODE (DTC) P1746 SOLENOID 6 CIRCUIT SHORT

Circuit Description

The solenoid 6 is a normally open ON/OFF type solenoid that is used to set the high/ low level of line pressure.

The solenoid 6 (S6) OFF gives high pressure and the S6 is attached to the valve body within the transmission. Voltage is supplied directly to the solenoid through the Transmission Control Module (TCM).

The DTC P1746 sets when the Solenoid 6 (S6) circuit is shorted to ground. The solenoid 6's driver Integrated Chip (IC) status indicates a faulty circuit.

Conditions for Setting the DTC

- DTCs P1717 and P1718 are not set.
- S6 is ON.
- The solenoid 6's driver Integrated Chip (IC) status indicates a faulty circuit. This condition must be continuously present for 60 milliseconds.

Action Taken When the DTC Sets

- The solenoid 6 is disabled (OFF) resulting in high line pressure being applied continuously.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred after ignition cycle.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- During the TCM's testing, solenoid 6 is turned OFF/ ON by a very small (4 millisecond) pulses. This pulse is too short for the solenoid to react so the transmission operation is not affected.
- The solenoid feedback voltage is measured before the (4 millisecond) pulse and again during the pulse. If the difference is outside the acceptable limits the relevant fault is recorded.
- Typical causes would be a short circuit to ground in the wiring to or within the solenoid.
- If several faults of solenoids are present, check the wiring or connectors that are common to the selected solenoids, especially the earth connections.
- Inspect the wiring for poor electrical connections at the TCM and at the 10-way transmission connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short to bare metal or other wiring. Inspect for broken wire inside the insulation.

- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Checks if the S6 circuit in the transmission is malfunctioning.
4. Check cable in the transmission for short to ground.
6. Check resistance between S6 terminal A and B. Standard value is 22 - 30 Ω.
9. Check connections of other connectors.

DTC P1746 Solenoid 6 Circuit Short

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) System Check. Is the check performed?	-	Go to Step 2	Go to “TCM Diagnostic System Check”
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1746?	-	Go to Step 3	Go to “Diagnostic Aids”
3	1. Turn the ignition OFF. 2. Disconnect the 10-way transmission connector. (additional DTCs will set) 3. Connect Solenoid/Thermistor Electrical Tester (STET) to the 10-way transmission connector of transmission side and to the good ground. 4. Turn the mode knob of STET to 6 and push the red button. Does the bulb of close circuit on the solenoids side of STET illuminate?	-	Go to Step 4	Go to Step 8
4	1. Remove the valve cover. Refer to the Transmission in this section. 2. With a test light connected to B+, probe the wiring harness from 10-way transmission connector to Solenoid 6 (S6) on the valve body. Does the test light illuminate?	-	Go to Step 5	Go to Step 6
5	Repair the short to ground in the wiring harness. Is the repair complete?	-	Go to Step 11	-
6	Using a Digital Volt Meter (DVM), measure the resistance between S6 terminal A and B. Is the resistance within the specified value?	20 - 30 Ω	Go to “Diagnostic Aids”	Go to Step 7
7	Replace the S6. Is the action complete?	-	Go to Step 11	-
8	1. Disconnect the TCM connector B. 2. With a test light connected to B+, probe the wiring harness from 10-way transmission connector terminal 6 to TCM terminal B12. Does the test light illuminate?	-	Go to Step 5	Go to Step 9
9	Check for a poor connection at the 10-way transmission connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 11	Go to Step 10

DTC P1746 Solenoid 6 Circuit Short (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 11	-
11	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 12	Go to Step 2
12	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

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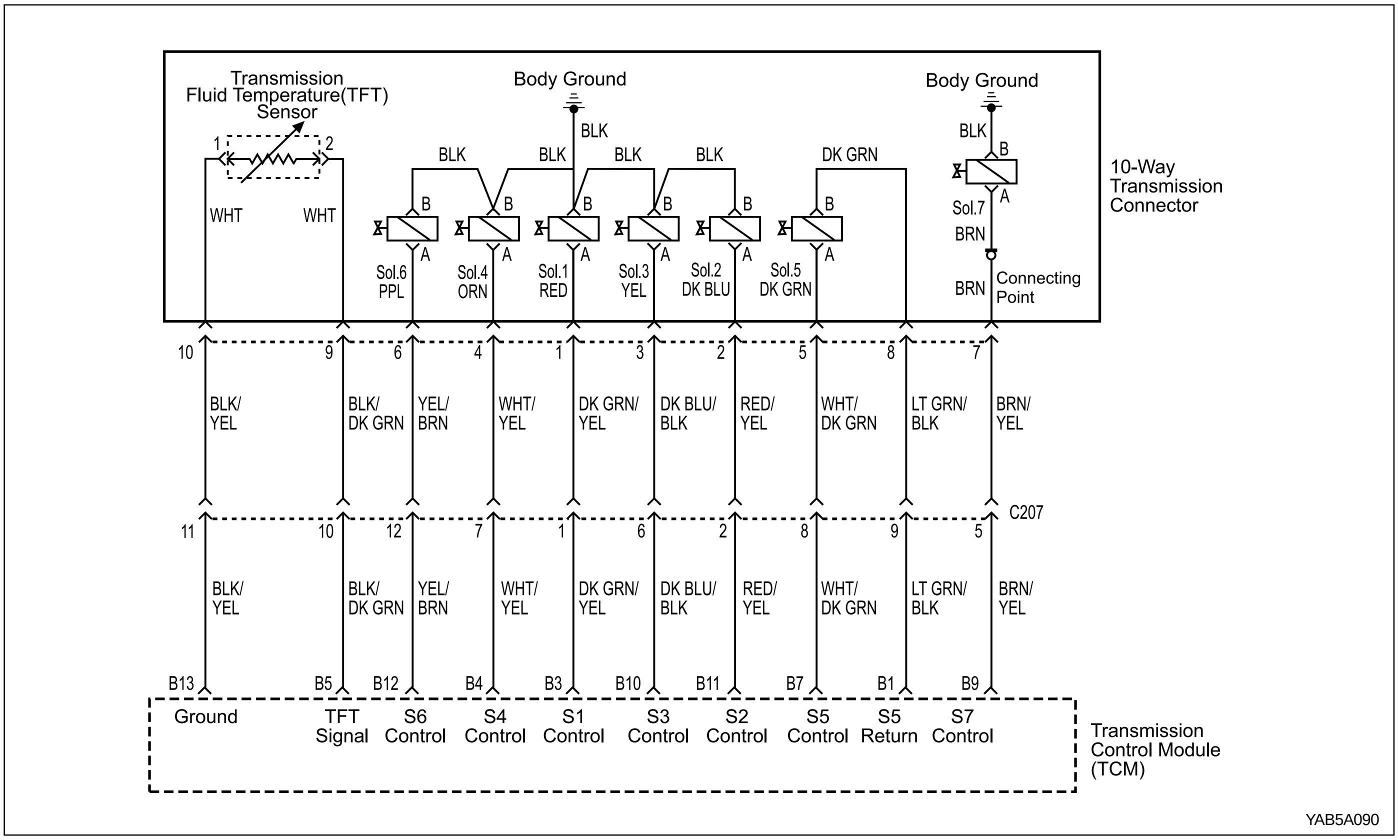


DIAGNOSTIC TROUBLE CODE (DTC) P1747 SOLENOID 7 CIRCUIT SHORT

Circuit Description

The solenoid 7 is a normally open ON/OFF type solenoid that is used to control the application of the Torque Converter Clutch (TCC).

The Solenoid 7 (S7) ON activates the TCC and is attached to the pump body within the transmission. Voltage is supplied directly to the solenoid through the Transmission Control Module (TCM).

The DTC P1747 sets when the solenoid 7, Torque Converter Clutch Solenoid, circuit is shorted to ground. The solenoid 7's driver Integrated Chip (IC) status indicates a faulty circuit.

Conditions for Setting the DTC

- DTCs P1717 and P1718 are not set.
- S7 is ON.
- The solenoid 7's driver Integrated Chip (IC) status indicates a faulty circuit. This condition must be continuously present for 60 milliseconds.

Action Taken When the DTC Sets

- The solenoid 7 is always disabled (OFF) resulting in the TCC being unlocked continuously.

Conditions for Clearing the DTC

- The DTC will clear when the malfunction has not occurred after ignition cycle.
- A history DTC will clear after 40 TCM power-up cycles with a warm transmission (>50 °C) and without a fault.
- History DTCs can be cleared by using a scan tool.

Diagnostic Aids

- During the TCM's testing, solenoid 7 is turned OFF/ ON by a very small (4 millisecond) pulses. This pulse is too short for the solenoid to react so the transmission operation is not affected.
- The solenoid feedback voltage is measured before the (4 millisecond) pulse and again during the pulse. If the difference is outside the acceptable limits the relevant fault is recorded.
- Typical causes would be a short circuit to ground in the wiring to or within the solenoid.
- If several faults of solenoids are present, check the wiring or connectors that are common to the selected solenoids, especially the earth connections.
- Inspect the wiring for poor electrical connections at the TCM and at the 10-way transmission connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for chafed wires that could short tobare metal or other wiring. Inspect for broken wire inside the insulation.

- If diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Table.

3. Checks if the S7 circuit in the transmission is malfunctioning.
4. Check cable in the transmission for short to ground.
7. Check resistance between S7 terminal A and B. Standard value is 22 - 30 Ω.
10. Check connections of other connectors.

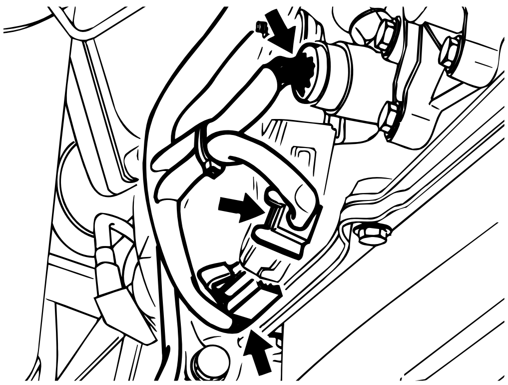
DTC P1747 Solenoid 7 Circuit Short

Step	Action	Value(s)	Yes	No
1	Perform a Transmission Control Module (TCM) System Check. Is the check performed?	-	Go to Step 2	Go to "TCM Diagnostic System Check"
2	1. Install the scan tool. 2. Turn the ignition ON, with the engine OFF. 3. Record and then clear DTCs. 4. Operate the vehicle within the conditions for setting this DTC as specified in the text. Does the scan tool display P1747?	-	Go to Step 3	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF. 2. Disconnect the 10-way transmission connector. (additional DTCs will set) 3. Connect Solenoid/Thermistor Electrical Tester (STET) to the 10-way transmission connector of transmission side and to the good ground. 4. Turn the mode knob of STET to 7 and push the red button. Does the bulb of close circuit on the solenoids side of STET illuminate?	-	Go to Step 4	Go to Step 8
4	1. Remove the pump assembly. Refer to the Pump in this section. 2. With a test light connected to B+, probe the wiring harness from 10-way transmission connector to contact point attached onto the transmission case. Does the test light illuminate?	-	Go to Step 5	Go to Step 6
5	Repair the short to ground in the wiring harness. Is the repair complete?	-	Go to Step 12	-
6	With a test light connected to B+, probe the wiring harness from contact point attached onto the transmission case to S7. Does the test light illuminate?	-	Go to Step 15	Go to Step 7
7	Using a Digital Volt Meter (DVM), measure the resistance between S7 terminal A and B. Is the resistance within the specified value?	20 - 30 Ω	Go to "Diagnostic Aids"	Go to Step 8
8	Replace the S7. Is the action complete?	-	Go to Step 12	-
9	1. Disconnect the TCM connector B. 2. With a test light connected to B+, probe the wiring harness from 10-way transmission connector terminal 7 to TCM terminal B9. Does the test light illuminate?	-	Go to Step 5	Go to Step 10

DTC P1747 Solenoid 7 Circuit Short (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check for a poor connection at the 10-way transmission connector and TCM connector and repair the malfunctioning terminals as necessary. Is a repair necessary?	-	Go to Step 12	Go to Step 11
11	1. Turn the ignition OFF. 2. Replace the TCM. Is the action complete?	-	Go to Step 12	-
12	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 13	Go to Step 2
13	Check if any DTCs are set. Are there any DTCs displayed or previously recorded at Step 2 that have not been diagnosed?	-	Go to applicable DTC table	System OK, Check Complete

REPAIR INSTRUCTIONS



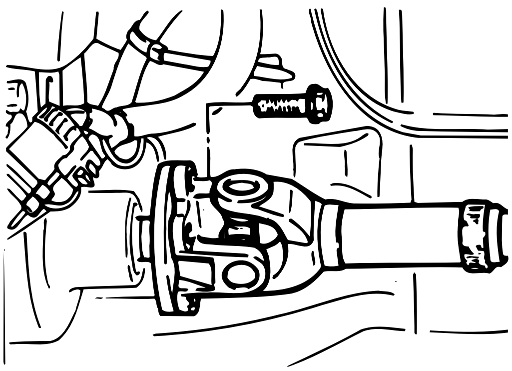
KAA5A2H0

ON-VEHICLE SERVICE

TRANSMISSION

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Disconnect the connectors from transfer case.
3. Disconnect the speedometer connector from transfer case.
4. Disconnect the inhibitor connector, gear position sensor connector and transmission case connector.

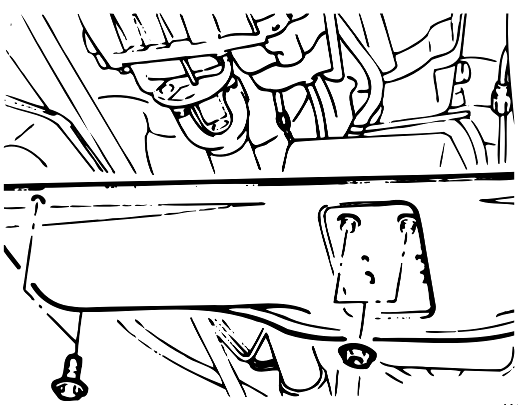


KAA5A2I0

5. Remove the rear propeller shaft bolts.

Installation Notice

Tightening Torque	70-80 N•m (52-59 lb-ft)

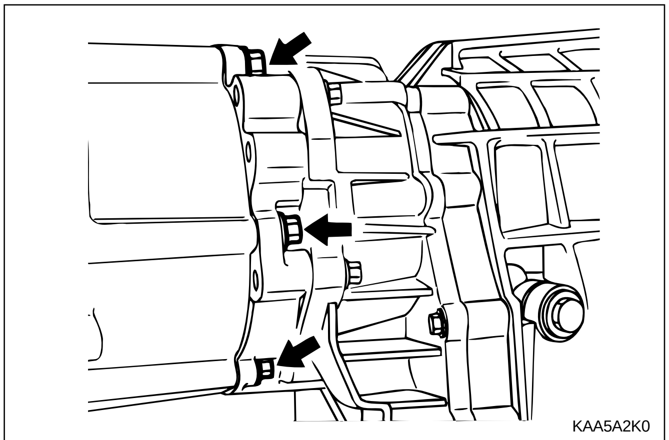


KAA5A2J0

6. Remove the cross member bolts and nuts.
7. Remove the front propeller shaft bolts.

Installation Notice

Tightening Torque	70-80 N•m (52-59 lb-ft)



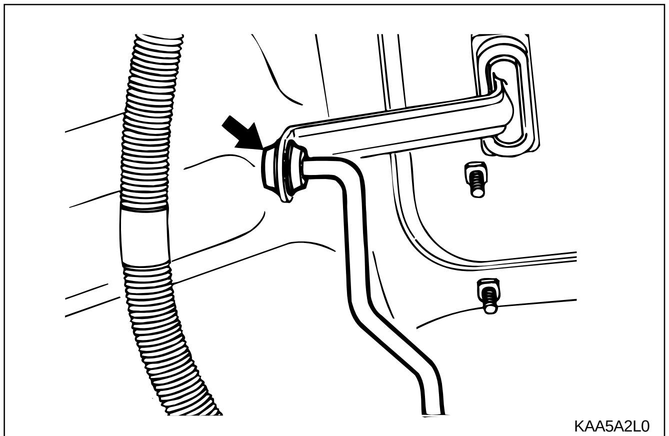
KAA5A2K0

8. Remove the transfer case-to-transmission housing bolts and remove the transfer case.

Installation Notice

Tightening Torque	35-60 N•m (28-44 lb-ft)

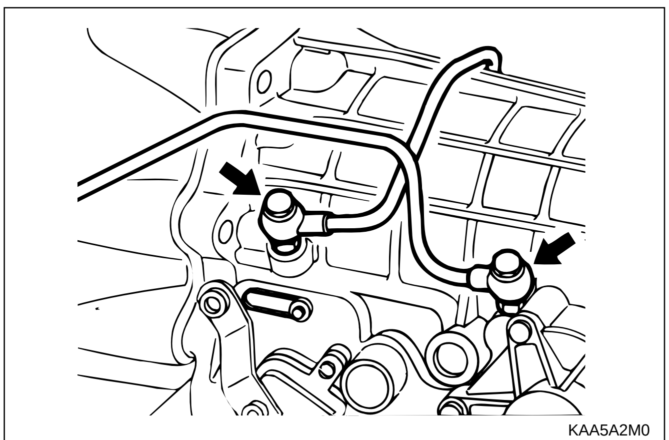
9. Disconnect the 10-Pins Plug connector from transmission.



KAA5A2L0

10. Separate the locking clip on shift lever and remove the shift rod.

Notice: Removal and installation performed when the shift procedure should be lever is in 'D' range.

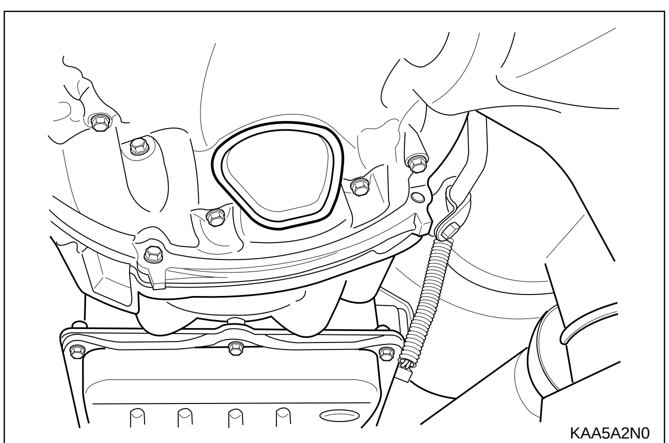


KAA5A2M0

11. Remove the oil cooler pipes.

Installation Notice

Tightening Torque	40-45 N•m (29-33 lb-ft)



KAA5A2N0

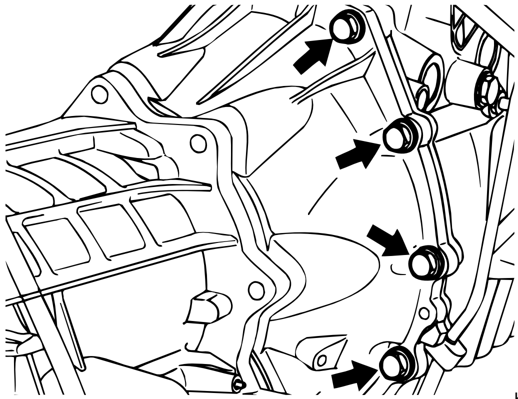
12. Remove the service hole cover in the engine block.
13. Put the alignment mark for installation, and remove the six mounting bolts for torque converter from drive plate through the service hole by rotating the engine and remove the torque converter.

Installation Notice

Tightening Torque	42 N•m (31 lb-ft)

- Screw the six bolts mounting the torque converter through the service hole by using a mirror and rotating the engine.

14. Remover the starter. Refer to Section *1E, Engine* Electrical.


KAA5A2O0

15. Remove the extension housing to case bolts and remove the transmission assembly.

Installation Notice

Tightening Torque	54-68 N•m (40-50 lb-ft)

- Be careful not to drop the torque converter while removing the transmission.

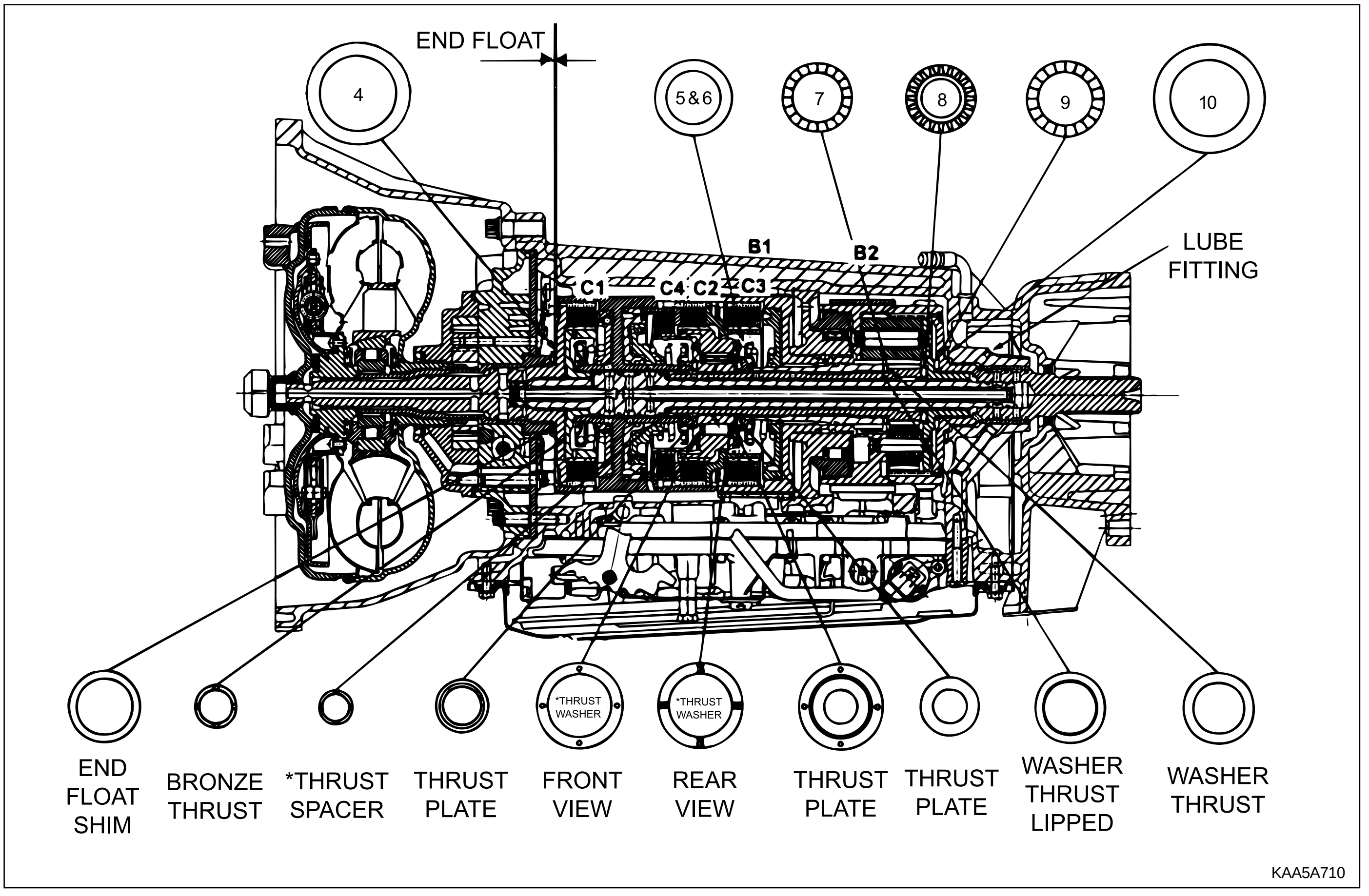
16. Installation should follow the removal procedure in the reverse order.

UNIT REPAIR

REBUILD WARNINGS

Prior to rebuilding a transmission system, the following warnings are to be noted.

- Ensure that, before replacing a transmission the cooler lines are flushed out to remove any debris. This can be done by applying compressed air to the rear cooler line forcing oil and any contaminants out of the front cooler line.
- The cooler flow should be checked after the transmission has been fitted. With the front cooler line connected and the rear line run into a suitable container, measure the flow over 15 seconds with the vehicle idling in park.
- The flow rate should exceed 1 liter in 15 seconds.
- Be wary of any situation where water enters the transmission. This may result in fluid foaming and leaking through the breather.
- Ensure that both earth straps (one at the battery terminal and one on the vehicle body) are connected in the vehicle before connecting the positive side of the battery.
- Follow the throttle position calibration procedure in this manual if the engine control module/ transmission control module (ECM/TCM) is swapped.



DISASSEMBLY PROCEDURE

Transmission

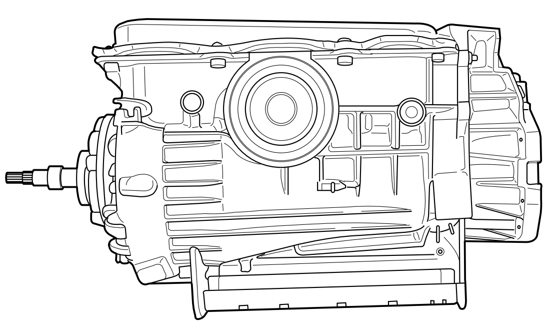
Tools Required

0555-336256 Transmission Bench Cradle

0555-336257 Pump Puller

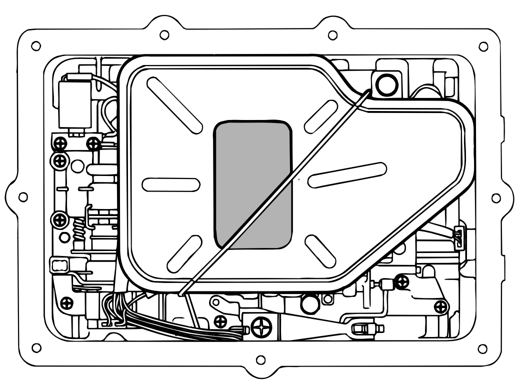
Notice:

- Remove the inhibitor switch before washing the transmission in solvent or hot wash.
- It is assumed that the transmission fluid has been drained when the transmission was removed from the vehicle and that the 'special tools' quoted are available
- The transmission is dismantled in a modular fashion, and the details of disassembly for each module are given under the appropriate subject. Refer to Special Tools Table in this chapter for details of all special tools required when performing disassembly procedures.
- Technicians overhauling these transmissions will also require a selection of good quality Torx bit sockets, in particular numbers 30, 40 and 50, and an 8mm, 10mm and 12 mm double hex socket.



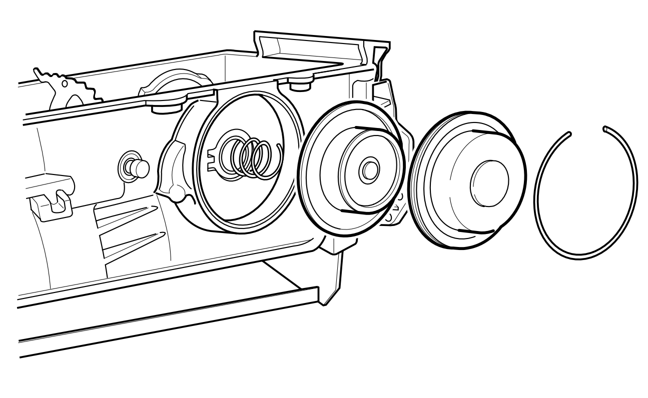
KAA5A500

1. Remove the converter and the converter housing.
2. Mount the transmission on the transmission bench cradle 0555-336256.
3. Remove the oil pan and the oil pan seal.



KAA5A510

4. Remove each end of the filter retaining clip from the valve body and remove the filter.
5. Disconnect the wires from each solenoid and ground and lay the wiring to one side.
6. Remove the valve body securing screws and remove the valve body from the case.

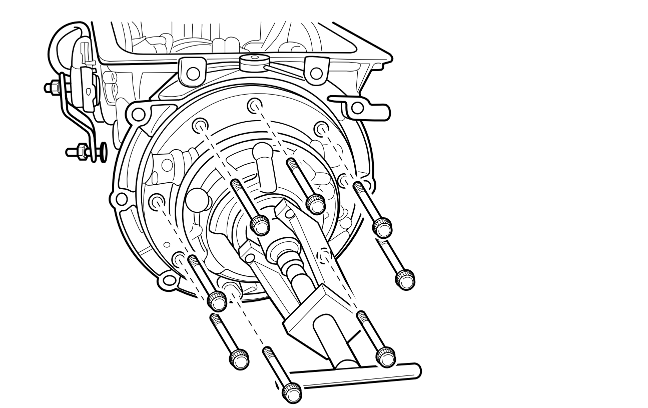


KAA5A520

7. Remove the front servo cover circlip.
8. Remove the front servo cover, piston and spring.

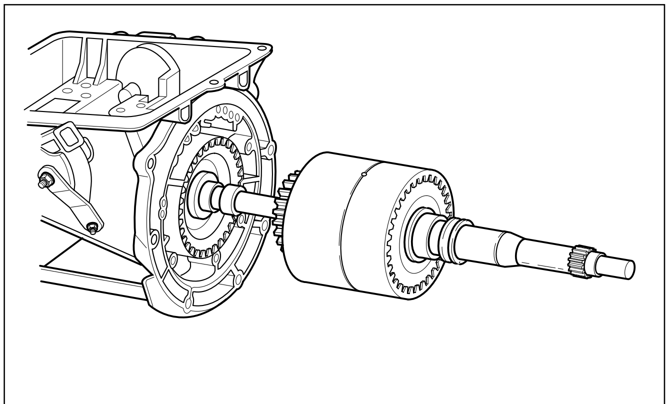
Notice: The plastic servo block is retained by the piston return spring only.

9. Remove the adaptor housing bolts and adaptor housing.



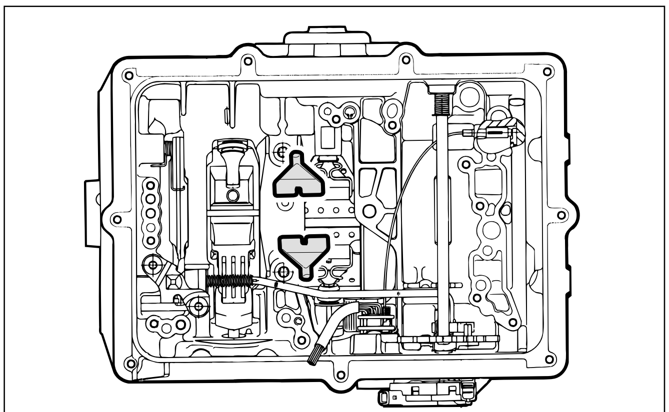
KAA5A530

10. Remove the pump to case bolts using a multi-hex 8 mm spanner.
11. Using the pump puller 0555-336257, remove the pump and pump cover.



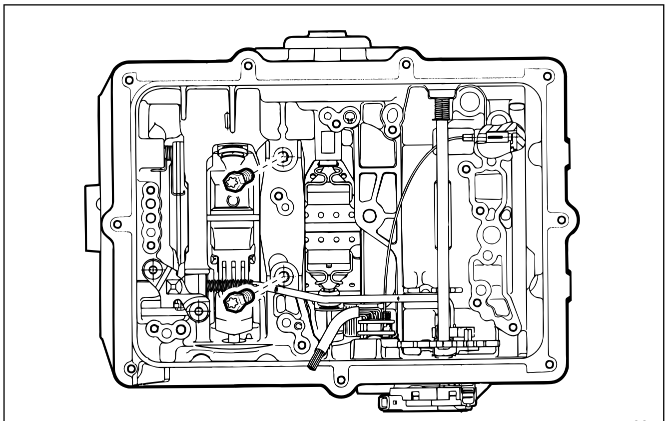
KAA5A540

12. Remove the input shaft, forward clutch cylinder, and the overdrive shaft as an assembly, withdrawing them through the front of the case.
13. Remove the C3 clutch cylinder and sun gears.



KAA5A550

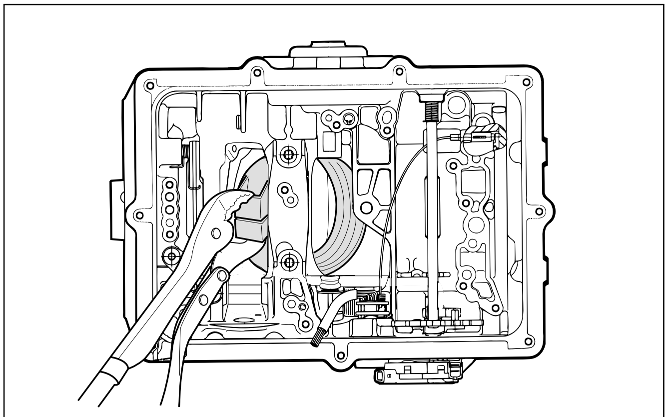
14. Remove the front band struts. Remove the front band.


KAA5A560

15. Remove the two centre support retaining bolts using a T50 Torx bit.
16. Remove the centre support retaining circlip.

Notice: Do not hammer the output shaft to remove the centre support as this will cause permanent damage to the thrust bearing surfaces.

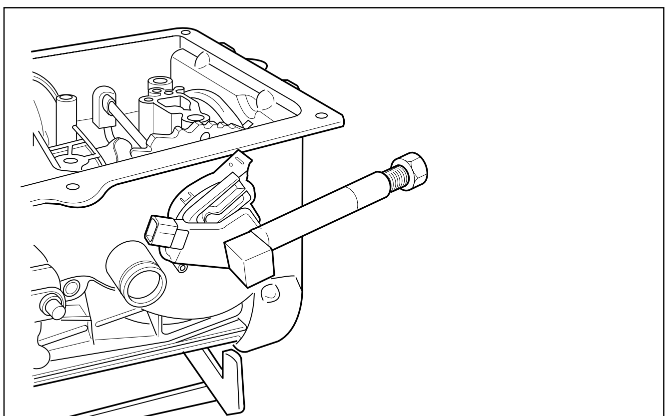
17. Remove the centre support, 1-2 one way clutch, and planetary gear set as an assembly.
18. Remove the parking rod cam plate using a T40 Torx bit.


KAA5A570

19. Remove the rear band struts and remove the band.

Notice: Vise the both end of rear band using the plier and lean forward about 15 degrees

20. Remove the output shaft assembly.

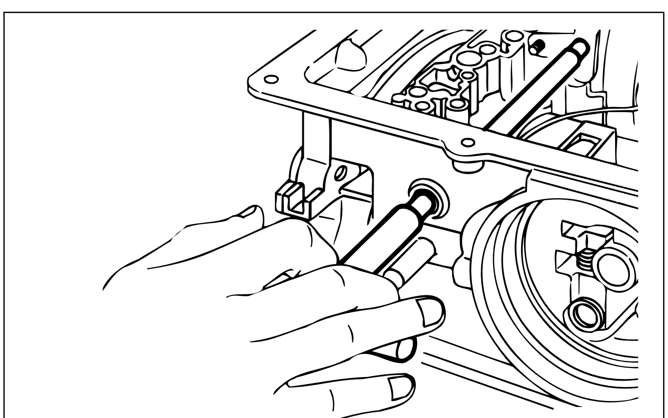

KAA5A580

Transmission Case

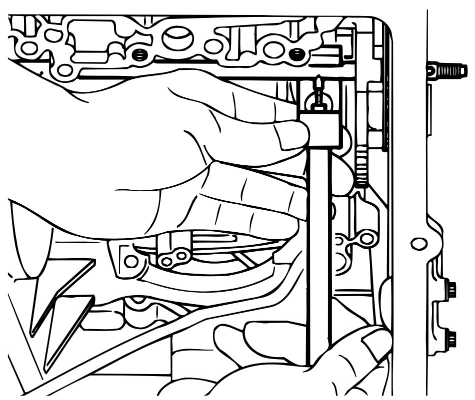
Tools Required

0555-336258	Cross Shaft Pin Remover/Installer (Detent Lever)
0555-336261	Cross Shaft Seal Remover
0555-336265	Cross Shaft Pin Remover/Installer (Inhibitor Switch)

1. Remove the pin from the side of cross shaft inhibitor switch using cross shaft pin remover/installer (inhibitor switch) 0555-336265.
2. Remove the inhibitor switch bolts and inhibitor switch from the case.

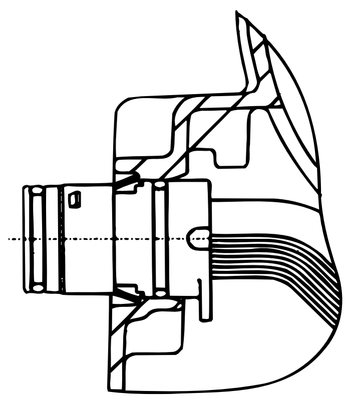

KAA5A590

3. Remove the cross shaft seals with cross shaft seal remover 0555-336261.
4. Remove the circlip from the cross shaft. Pull the shaft to release the drive pin from the selector quadrant.



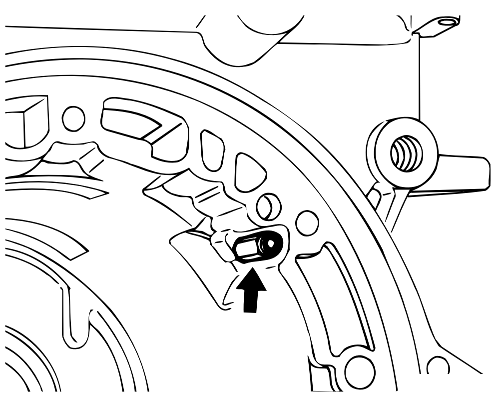
KAA5A600

5. Using cross shaft pin remover/installer (detent lever) 0555-336258, press the pin from the cross shaft and withdraw the shaft from the case.
6. Remove the cross shaft pin and spring.
7. Remove the manual valve lever and the park rod.



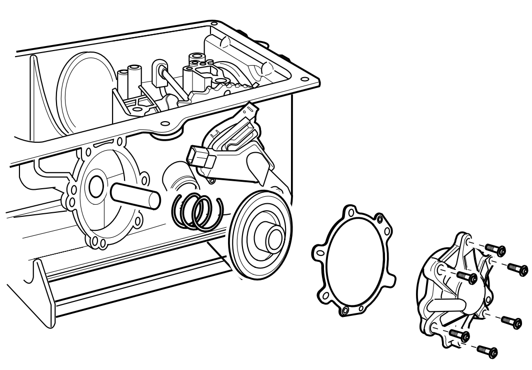
KAA5A610

8. Depress the tangs and withdraw the 10 pin connector into the case. Remove the wiring loom assembly.



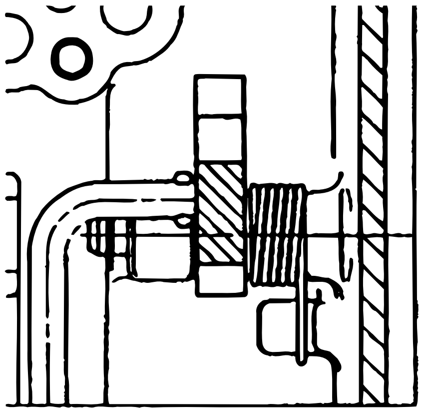
KAA5A620

9. Detach the No.7 solenoid wire from the front of the case.
10. Remove the parking pawl pivot pin and the pawl and spring from the case.
11. Remove the shaft and the rear servo lever.



KAA5A630

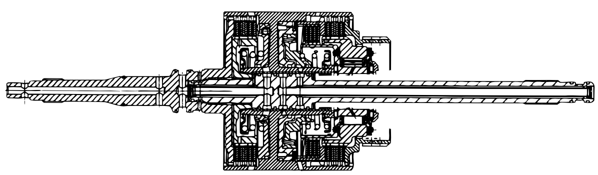
12. Remove the rear servo cover and piston assembly.
13. Remove the B1R circlip, valve and spring.
14. Remove both band adjustment shims.
15. Inspect the output shaft bushing in the case and replace if necessary.
16. Inspect cooler line fittings and replace as necessary.
17. Inspect the case for damage.



KAA5A640

18. To remove the park rod lever: Remove the circlip from the inner end of the pivot shaft and tap the outer end of the shaft until it moves free from the case, then using a wide shallow tapered drift as a wedge, drive the pin out from the inside of the case and remove the lever and spring.

Notice: Do not remove the park rod lever unless absolutely necessary.



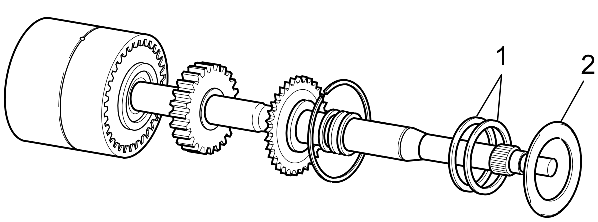
KAA5A650

Forward Clutch Cylinder

Tools Required

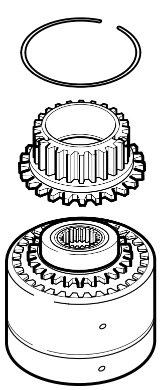
0555-336259 Clutch Spring Compressor

1. Place the assembly in a horizontal position.



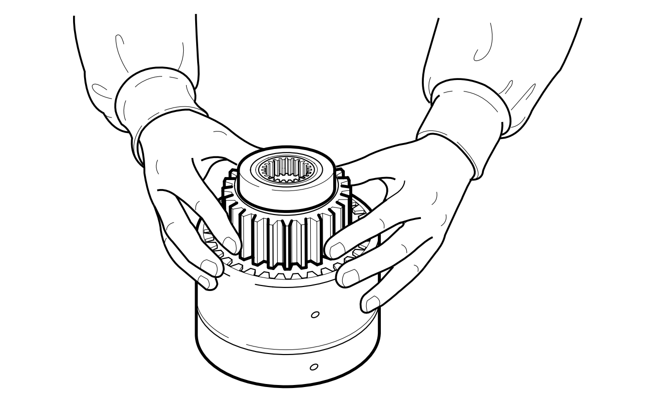
KAA5A660

2. Remove the No. 4 needle bearing (2) and adjustment shims (1) from the input shaft.
3. Remove the circlip from the front of the clutch cylinder and remove the input shaft.
4. Remove the overdrive shaft and the C1 clutch hub assembly from the clutch cylinder.
5. Remove the C1 clutch plates from the cylinder.



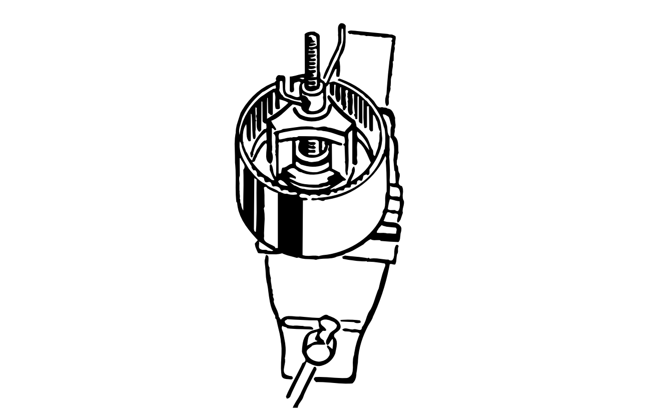
KAA5A670

6. Remove the circlip retaining the C3 clutch hub in the rear of the clutch cylinder and remove the hub.
7. Remove the C2/C4 clutch hub assembly and remove the No. 5 needle bearing from the C4 hub.
8. Removethe C2 clutch plates.



KAA5A680

9. Invert the clutch cylinder and remove the C4 clutch sleeve, clutch plates and the two wave washers. The 3-4 one way clutch is located between the C2 and C4 clutch hubs, and the hubs may be separated by rotating one hub clockwise and withdrawing it from the other.
10. Remove the thrust block from the C4 clutch cylinder hub.

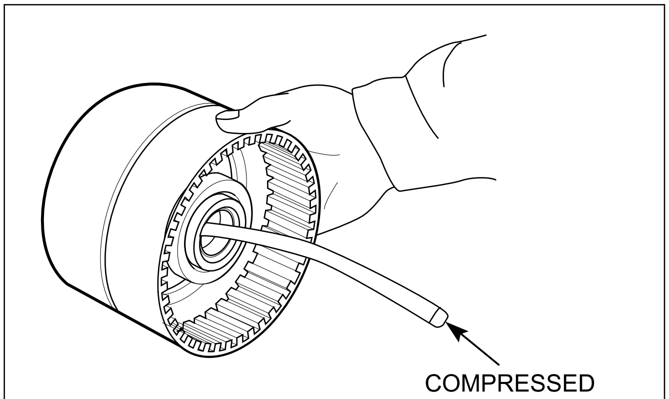


KAA5A690

11. Mount the clutch cylinder on clutch spring compressor 0555-336259 with the C2/C4 end uppermost and compress the piston return spring. Remove the spring retaining circlip. Release the tool and remove the circlip, keeper and spring.

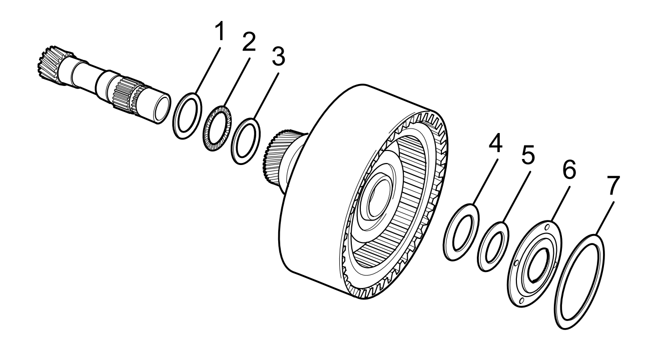
Notice: Make sure that the spring keeper is not caught in the circlip groove, and that all the spring pressure is released, before removing the tool.

12. Invert the clutch cylinder on the compressor tool and removethe C1 clutch piston return spring in asimilar manner.



KAA5A700

13. To remove the clutch pistons from the clutch cylinder, apply air pressure to the apply ports in the bore of the cylinder.



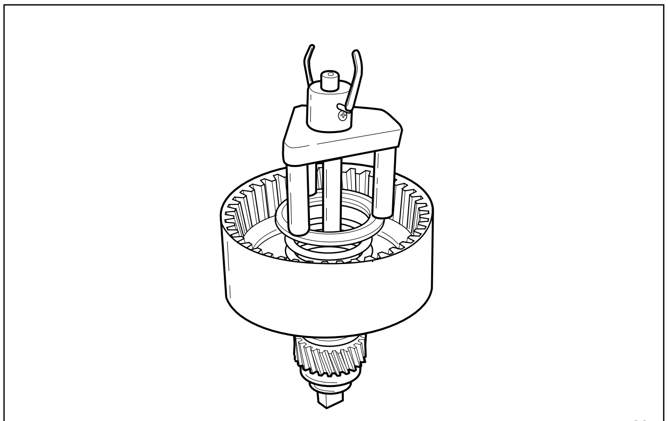
KAA5A720

C3 Clutch Cylinder

Tools Required

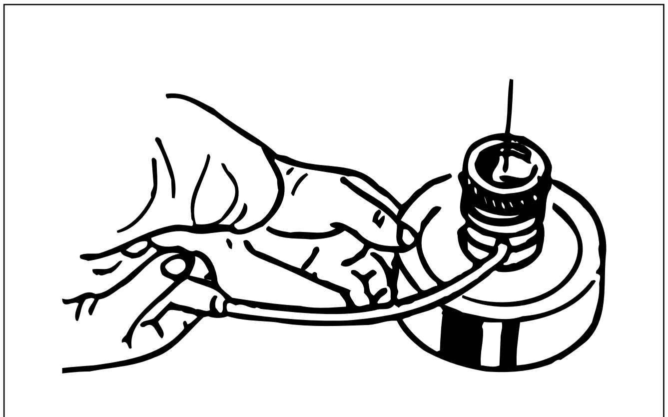
0555-336259 Clutch Spring Compressor

1. Remove the forward sun gear, No.7 needle bearing (2) thrust washer (1) and lipped thrust washer (3) from the C3 clutch cylinder.
2. Remove the thrust plate (4), No.6 needle bearing (5), thrust plate (6) and nylon thrust plate (7) from the clutch cylinder hub.
3. Remove the clutch plate retaining circlip and re-move the clutch plates.

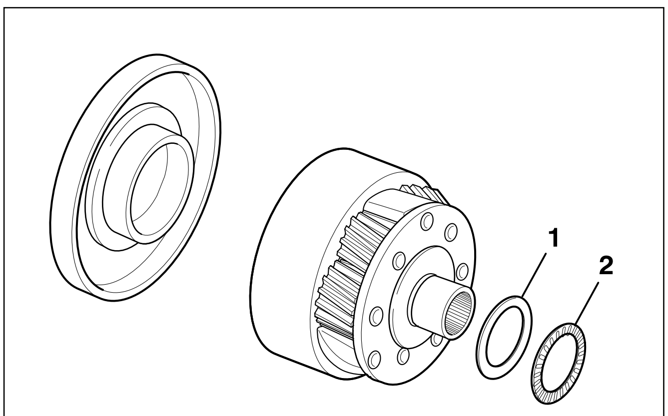

KAA5A730

4. Mount the clutch assembly on clutch spring compressor 0555-336259 and compress the piston return spring.
5. Remove the circlip and release the spring.
6. Remove the tool, circlip, keeper and spring.

Notice: Make sure that the spring keeper has not been caught in the circlip groove, and that all spring pressure has been released, before removing the tool.


KAA5A740

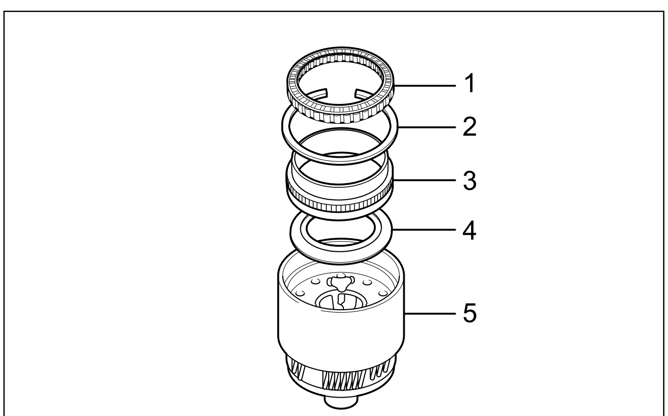
7. Remove the sealing rings from the C3 clutch cylinder.
8. To remove the clutch piston from the clutch cylinder, apply air pressure to the port between the iron sealing rings on the bearing journals of the cylinder.
9. Remove the reverse sun gear and C3 washer from the cylinder.



KAA5A750

Planet Carrier Assembly and Centre Support

1. Remove the No. 9 (2) needle bearing and washer (1) from the output shaft and the planet carrier.
2. Separate the centre support from the planet carrier by rotating it anti-clockwise.



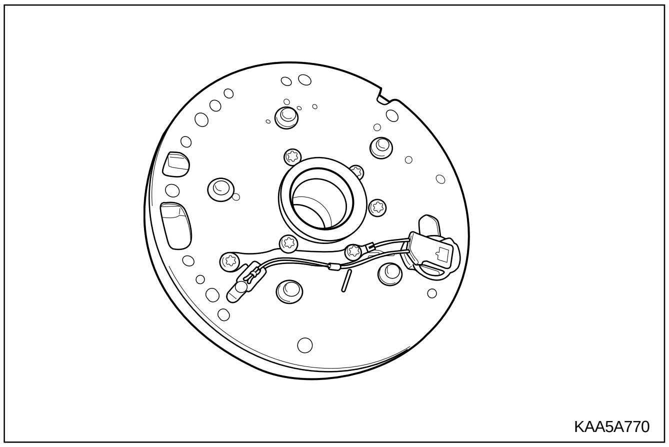
KAA5A760

3. Lift the one way clutch (1) from the planet carrier (5).
4. Remove the circlip (2) retaining the one way clutch outer race (3) in the planet carrier and remove the race.
5. Remove the one way clutch retainer (4) from the planet carrier.

Pump

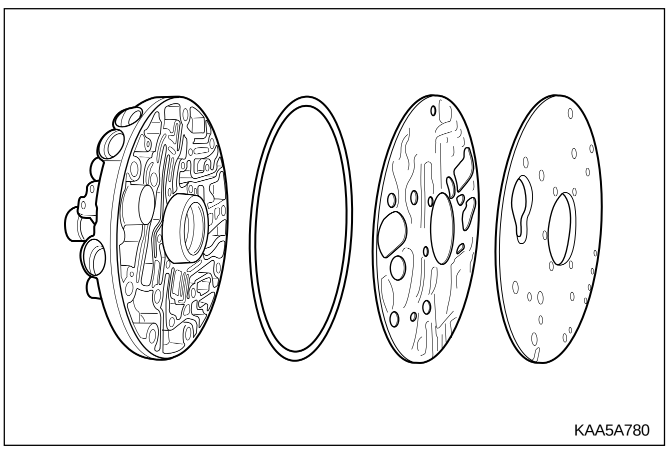
Notice: The following valves are housed in the pump cover:

- Solenoid 7
- Converter clutch control valve
- Converter clutch regulator valve
- Primary regulator valve

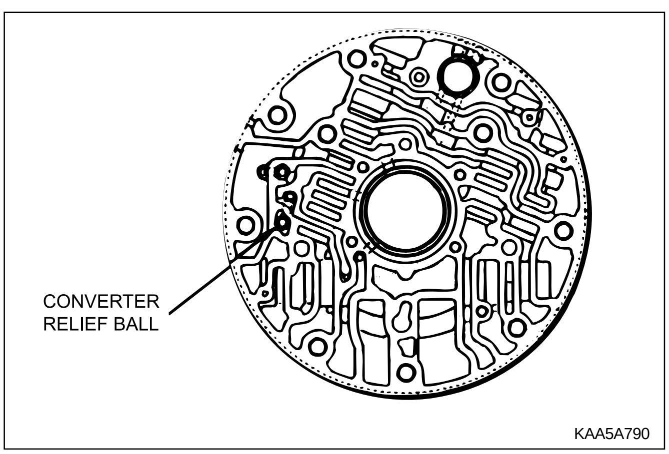


1. Remove the wiring loom retainer plate and remove solenoid 7 with a T30 Torx bit.
2. Remove the five washer head bolts from the cover plate using a multi-point 8 mm socket.
3. Remove the five Torx head screws from the cover plate with T30 Torx bit. Note that the long screw holds the pump body to the pump body cover.

Notice: Do not strike the converter support tube to loosen the pump body.



4. Separate the pump body from the pump cover.
5. Remove the cover plate, gasket and seal from the cover.



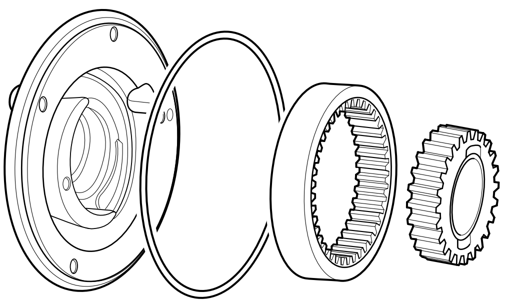
6. Remove the ball check valve and one spring from the pump cover.

KAA5A800

7. Depress the plug inward and remove the retaining pin for each of the three valves.

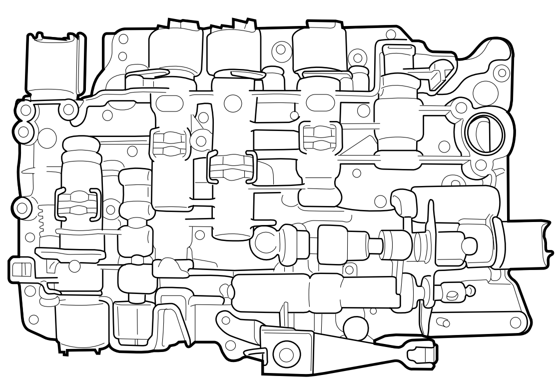
Notice: Some of the valves and plugs are preloaded by springs and may unexpectedly fall out of the cover when the pins are removed.

8. Remove the four valves, plugs and springs.



KAA5A810

9. Remove the pump gears from the pump body.
10. Remove the lip seal from the front of the pump body.



KAA5A820

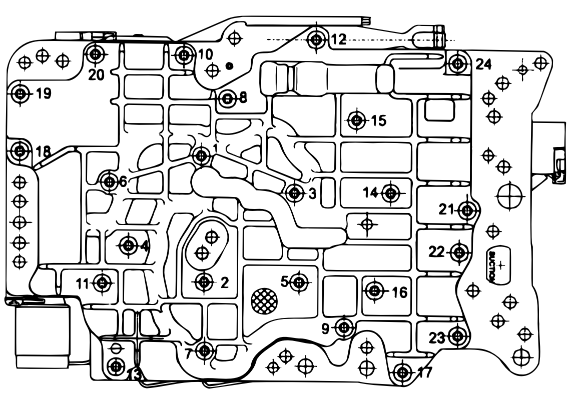
Valve Body

1. Remove the manual valve detent spring and retainer plate using a T40 Torx bit.
2. Slide the manual valve out of the lower valve body.

Notice: Be aware that the manual valve will fall out of the valve body.

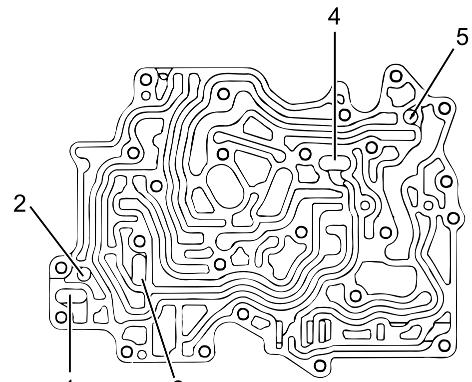
3. Take note of the angular relationship of the solenoid terminals to the valve body and remove the solenoids 1, 2, 3, 4, 5, 6 and valve assemblies.

Notice: Take care that the bracket is not separated from the solenoid.



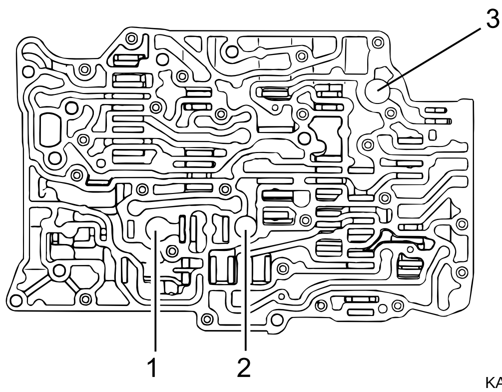
KAA5A830

4. Place the valve body assembly on the bench with the upper body uppermost.
5. Remove the 24 clamping screws with a No. 30 Torx bit. Separate the upper and lower valve bodies by lifting the upper body and the separator plate together.
6. Turn the upper body over and place it on the bench with the separator plate uppermost.



KAA5A840

7. Lift the separator plate and gaskets from the upper valve body.
8. Remove the five nylon check balls exposed in the valve body.
9. Remove the retaining plate, plug, spring and re-verse lockout valve.

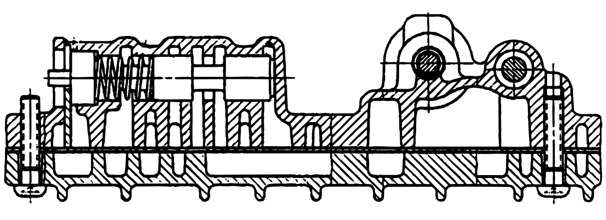


KAA5A850

10. Remove the two filters (1, 3) and the large nylon check ball (2) from the lower valve body.
11. Remove the retaining plates and pins from the 1-2, 2-3, 3-4, BAR and CAR valves. The pins can be removed with a magnet.

Notice: Once the pins are removed, the plates are loose in the valve body and will drop out when the valve body is turned over.

12. Remove the 1-2, 2-3 and 3-4 shift valves.

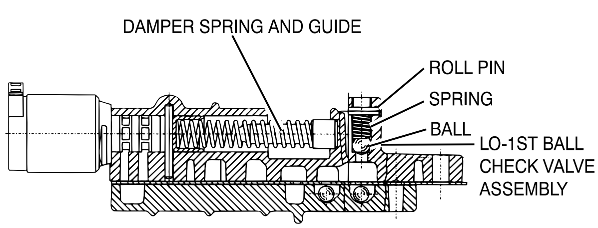


KAA5A860

13. Depress the 4-3 sequence valve plug and remove the retaining plate.

Notice: The plug is preloaded by the spring and may un-expectedly fall out of the valve body.

14. Remove the plug, spring and valve



KAA5A870

15. Depress the solenoid 5 valve. Remove the retaining in and remove the valve, damper guide and spring.

Notice: The valve is preloaded by the spring and may unexpectedly fall out of the valve body.

16. Depress the line pressure release valve, remove the retaining pin, disc (if fitted), spring and valve.
17. Drive out the retaining pin and remove the spring and ball check valve adjacent to the BAR valve.

ASSEMBLY PROCEDURE

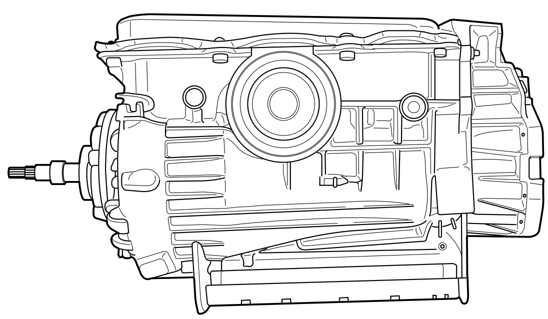
Transmission

Tools Required

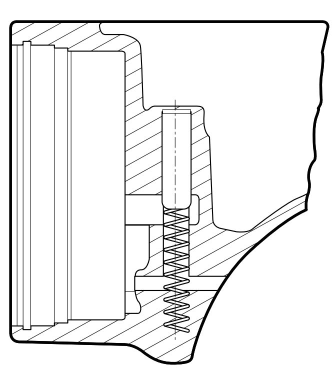
0555-336256	Transmission Bench Cradle
0555-336258	Cross Shaft Pin Remover/Installer (Detent Lever)
0555-336262	Cross Shaft Seal Installer
0555-336263	Cross Shaft bullet
0555-336265	Cross Shaft Pin Remover/Installer (Inhibitor Switch)

Notice:

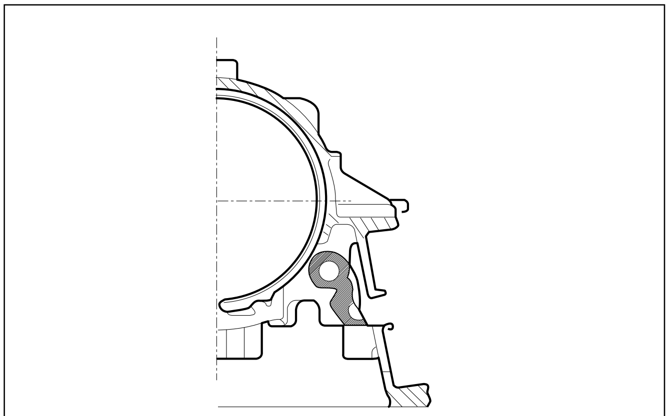
- The transmission is assembled in modular fashion and details of assembly for each module are given under the appropriate subject.
- Technicians overhauling these transmissions will also require a selection of good quality Torx bit sockets, in particular numbers 30, 40 and 50, and an 8 mm, 10 mm and 12 mm double hex socket.
- Ensure that the B1R circlip is fitted to the case. (If this is not fitted, the valve will peen its way into and through the separator plate)
- Ensure that the ’E’clip is fitted to the cross shaft.
- Ensure that all aspects of the parking mechanism are working.


KAA5A500

1. Turn the transmission case upside down on the bench and mount it to the transmission bench cradle 0555-336256.
2. Install all fittings, plugs and the breather, applying a sealant where applicable, Tighten the fittings to specifi-cations. Ensurethatthebreatheris clear, andcheckthat the lube fitting in the rear of the case is fittedand clear of obstruction.


KAA5A880

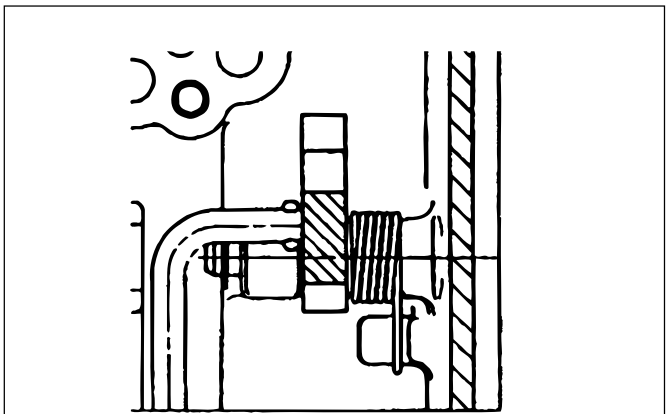
3. Assemble the B1R valve and spring, and secure with the circlip. Ensure that the circlip is completely seated in its groove.



KAA5A890

4. Install the rear servo lever and pivot pin.

Notice: The lever must pivot freely on its pin.



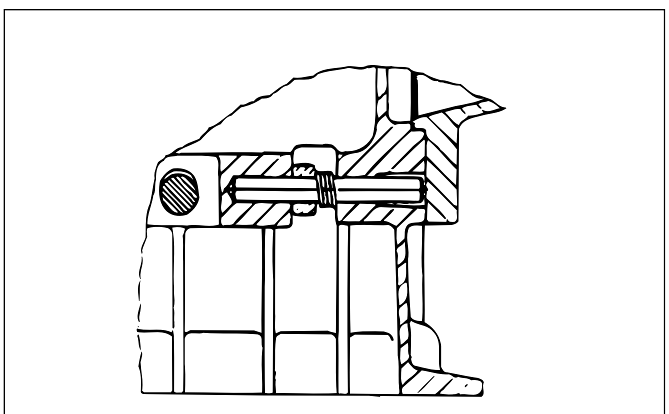
KAA5A640

5. Assemble the park rod lever, complete with the return spring and pivot pin, applying a small amount of sealant to the outer end of the pivot pin.

Notice: Care must be taken when applying sealant to ensure that it is not applied between the pin and the lever.

6. Secure the pivot pin with the circlip.

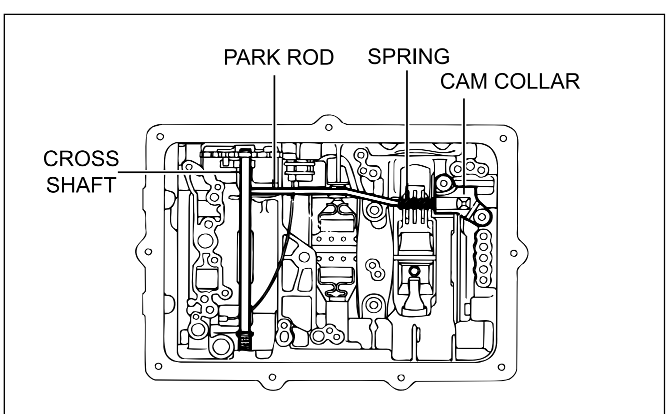
Notice: The lever must pivot freely on its pin and the spring must return the park rod lever to its correct location.



KAA5A900

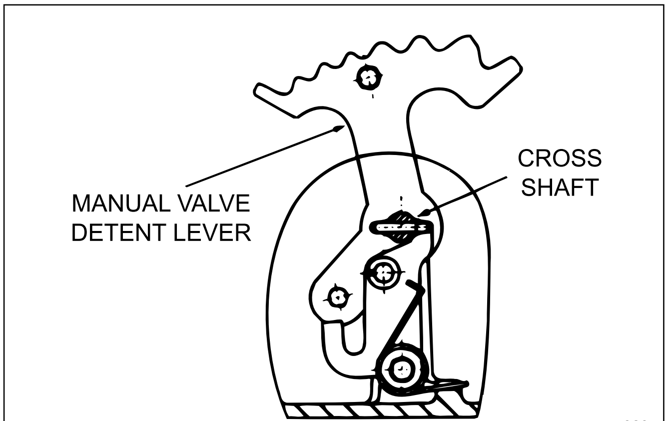
7. Install the parking pawl pivot pin and spring.

Notice: The pawl must pivot freely on its pin.



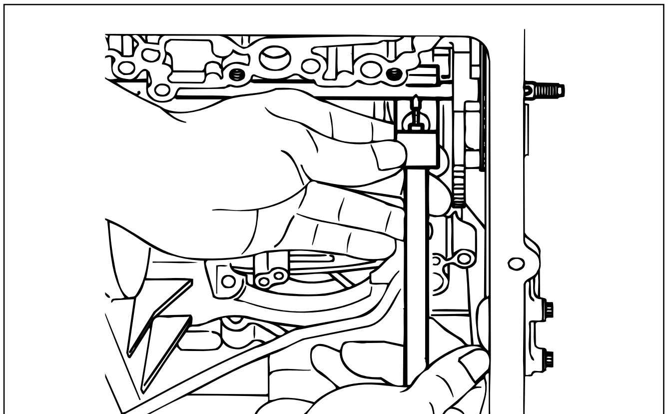
KAA5A910

8. Connect the park rod to the manual valve detent lever. Ensure the spring and cam collar is firmly installed on the rod.
9. Check that the cam collar slides freely on the rod.
10. Insert the cross shaft into the case, from the side opposite to the inhibitor switch, then install the antirattle spring on the shaft.

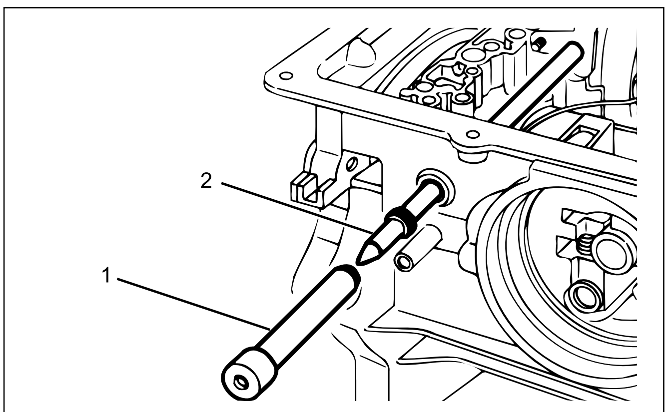


KAA5A920

11. Poition the manual valve detent lever, aligning it with the cross-shaft bore in the case.
12. Push the shaft through the detent lever until it starts in the detent lever side of the case.

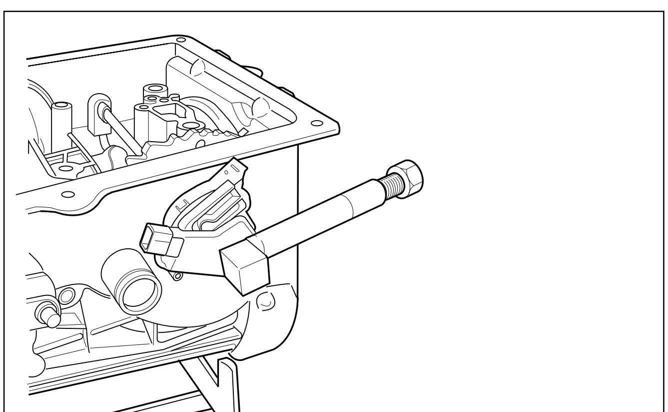

KAA5A600

13. Install the detent lever drive pin in the shaft using cross shaft pin remover/installer (detent lever) 0555-336258 with the adaptor over the pin.
14. Press the pin into the shaft until the tool bottoms.
15. Remove the tool and fit the spring retaining circlip to the shaft.



KAA5A930

16. Install the new cross shaft seals using cross shaft seal installer 0555-336262 (1) and cross shaft bullet 0555-336263 (2).

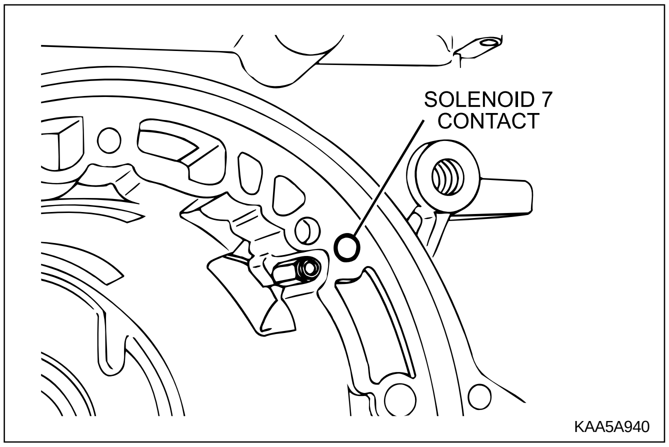

KAA5A580

17. Install the inhibitor switch on the case. Torque the bolts as per specifications. Press the pin into the shaft until the tool bottoms using cross shaft pin installer/ remover (inhibitor switch) 0555-336265.

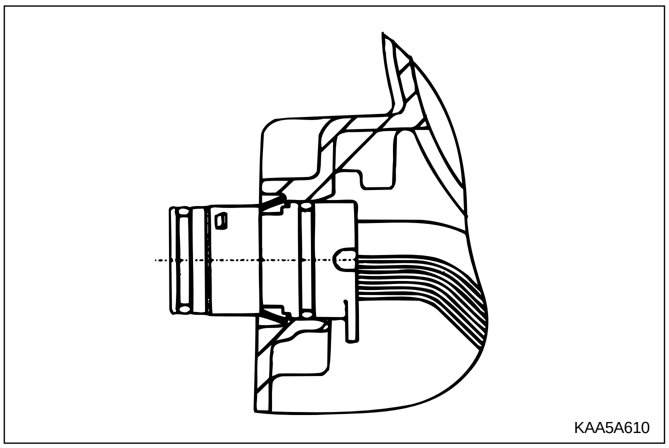
Installation Notice

Tightening Torque	4-6 N•m (35-53 lb-in)

18. Thoroughly check the terminal wiring loom for condition and continuity.

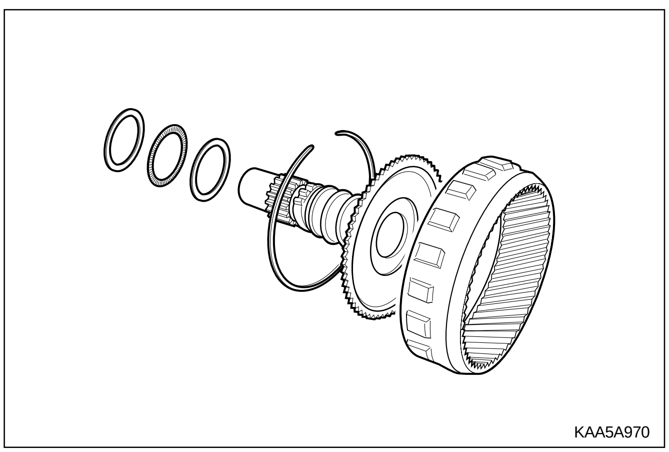


19. Position the wiring loom and locate the solenoid 7 contact and terminal in the pump mounting flange at the front of the case. The solenoid 7 wire is routed under the park rod and cross shaft in the case.

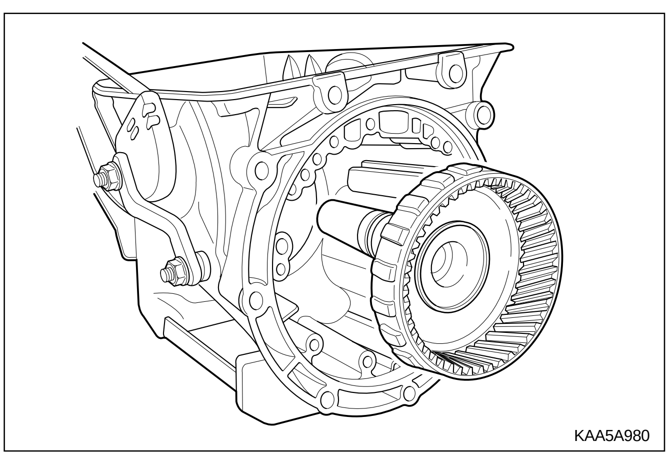


20. Install the 10 pin connector in the case engaging the tangs on the connector in the notches in case.

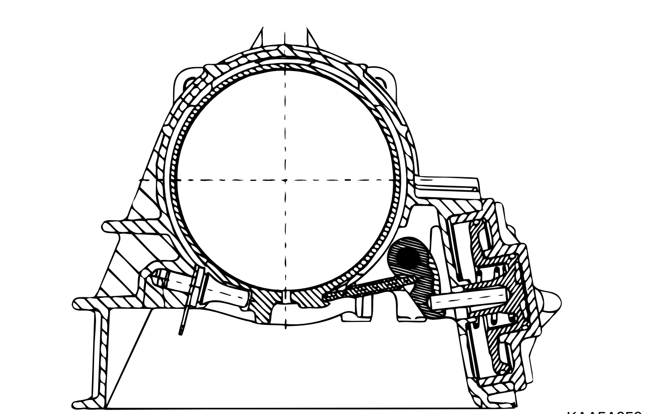
Output Shaft and Gear Assembly



1. Check that the output shaft bush is not worn or damaged. Replace if necessary.
2. Check for damage to parking pawl teeth on the ring gear. Replace if necessary.
3. Check that the sealing ring grooves have not been damaged.
4. Lubricate the sealing rings with automatic transmission fluid.
5. Assemble the sealing rings to the output shaft with the scarf cut uppermost.



6. If previously dismantled, assemble the ring gear to the output shaft and secure with circlip. Ensure that the circlip is firmly seated in its groove.
7. Install the No. 10 needle bearing assembly onto the output shaft using petroleum jelly.
8. Carefully install the output shaft assembly in the case to prevent damage to the sealing rings.

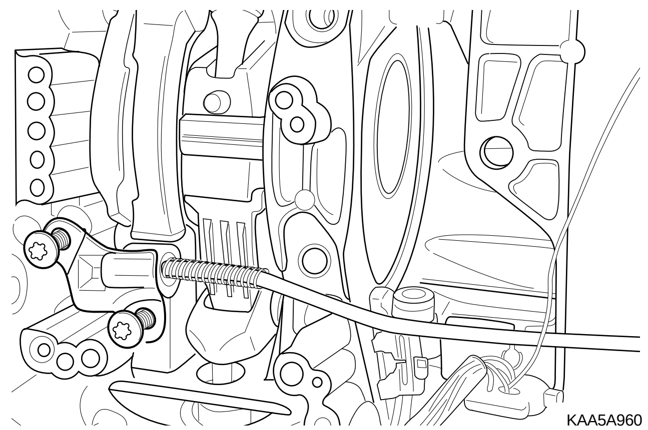


KAA5A950

Rear Band Assembly

1. Check the rear band for any cracks or damage along the lining and metal backing.
2. Install the reaction anchor strut into the main case, without shims.
3. Carefully install the rear band into the transmission case and ensure that it is properly fitted in the case.

Notice: If fitting a new band, soak the new band in automatic transmission fluid for a minimum of five minutes prior to assembly.

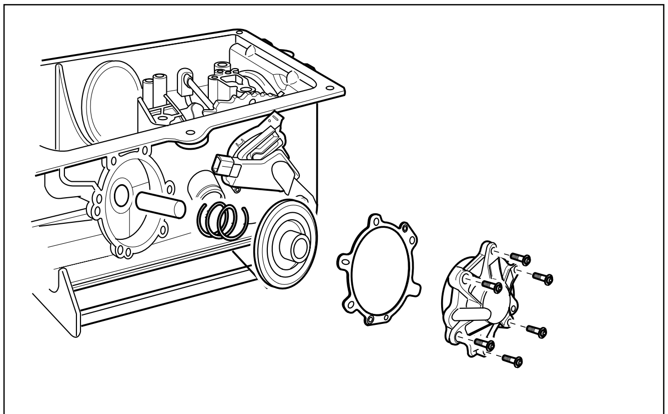


KAA5A960

4. Position the apply strut on the rear band then engage the apply strut in the servo lever.
5. Install the cam plate and tighten the screws to specification.

Installation Notice

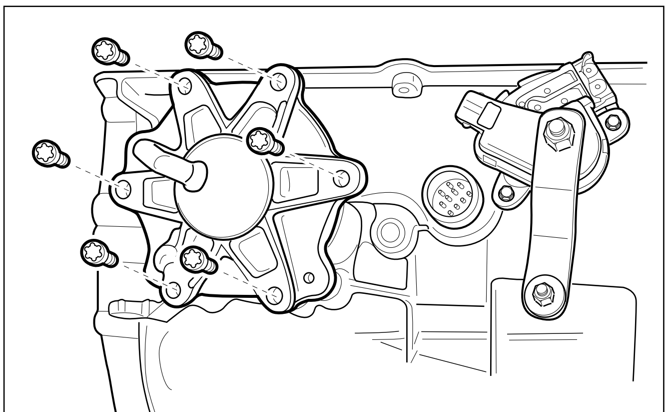
Tightening Torque	16-22 N•m (12-16 lb-ft)



KAA5A630

Rear Servo Assembly

1. Check the servo piston ‘O’ rings and gasket for any damage.
2. Lubricate the servo piston ‘O’ rings with automatic transmission fluid, and fit the ‘O’ rings to the piston grooves.
3. Assemble the piston to the cover, ensuring that ‘O’ ring compression is adequate but not excessive.
4. Align the spring on the piston spigot, then position the rear servo rod into the spigot.



KAA5A990

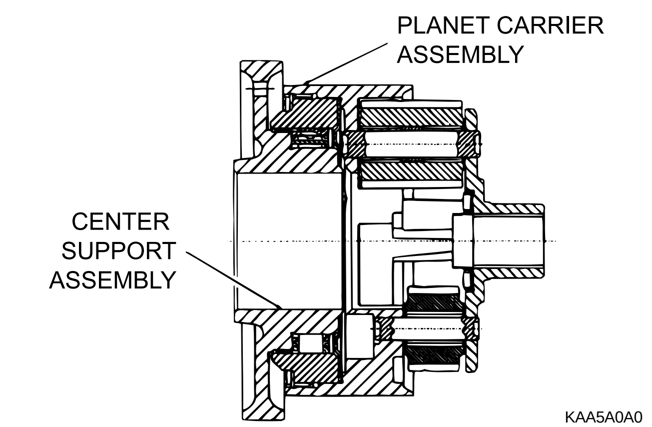
5. Assemble the gasket to the cover and fit the assembly to the case.

Notice: Do not use petroleum jelly on the gasket.

6. Apply additional Loctite 202 or equivalent as required to the rear servo to case bolts. Install the bolts and tighten to specification.

Installation Notice

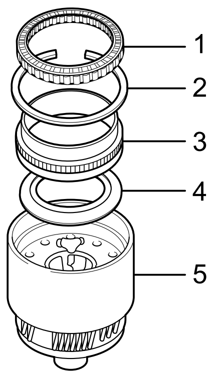
Tightening Torque	30-35 N•m (22-26 lb-ft)



KAA5A0A0

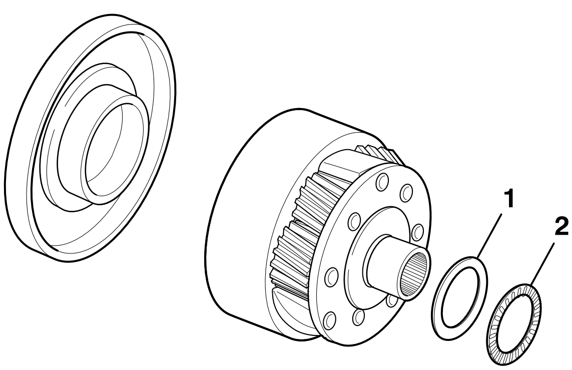
Planet Carrier Assembly and Centre Support

1. Check the carrier and planet assembly for any damage or irregularity and ensure that all pinions rotate freely and that the pinion end float is within 0.10mm - 0.50 mm.



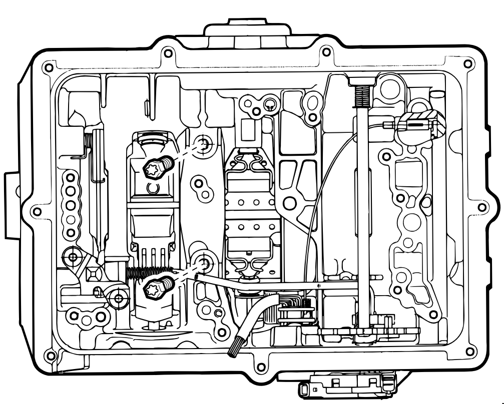
KAA5A760

2. Install the One Way Clutch (OWC) retainer (1) to the planet carrier with the inner edge pointing downwards. Inspect the OWC race and the sprag assemblies for wear or damage. Replace if necessary.
3. Install the outer (3) race in the drum. Press the race to the bottom of the drum and install the retaining circlip (2). Ensure the circlip is firmly seated in its groove.
4. Install the OWC (1) into the outer race with the lip edge uppermost. Lubricate the sprags with automatic transmission fluid.



KAA5A750

5. Check that the plugs are fitted to the centre support, then assemble the centre support into the OWC, ensuring that the support will rotate in an anti-clockwise direction only.
6. Lubricate the No. 9 needle bearing and washer with petroleum jelly and fit them to the rear face of the planet carrier.

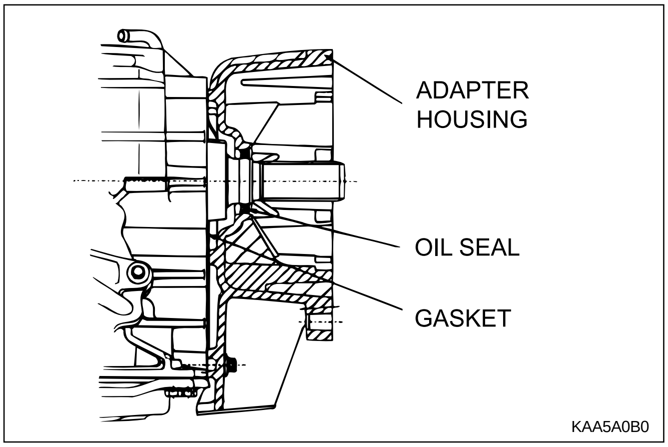


KAA5A560

7. Install the planet assembly and the centre support into the case, and align the centre support mounting bolt holes.
8. Install the centre support bolts finger tight.
9. Install the circlip retainer ensuring that the circlip is completely seated in the groove of the case.
10. Remove the centre support bolts and apply Loctite 222 or equivalent to the threads. Install the bolts and torque to specifications.

Installation Notice

Tightening Torque	20-27 N•m (15-20 lb-ft)



Adaptor Housing Assembly

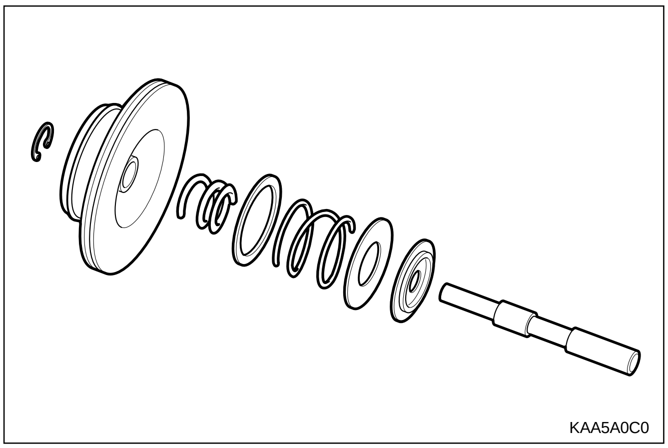
1. Install a new seal to the adaptor housing.
2. Position a new gasket onto the adaptor housing.

Notice: Do not use petroleum jelly to hold the gasket in position.

3. Apply additional Loctite 202 or equivalent as required to the adapter housing bolts. Install the adaptor housing and torque the bolts to specification.

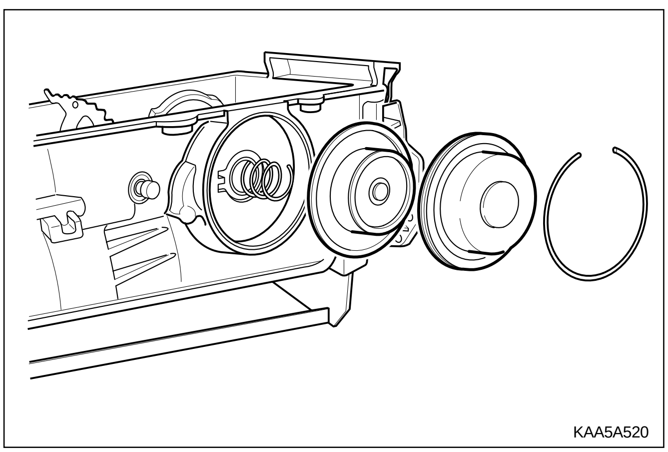
Installation Notice

Tightening Torque	30-35 N•m (22-26 lb-ft)

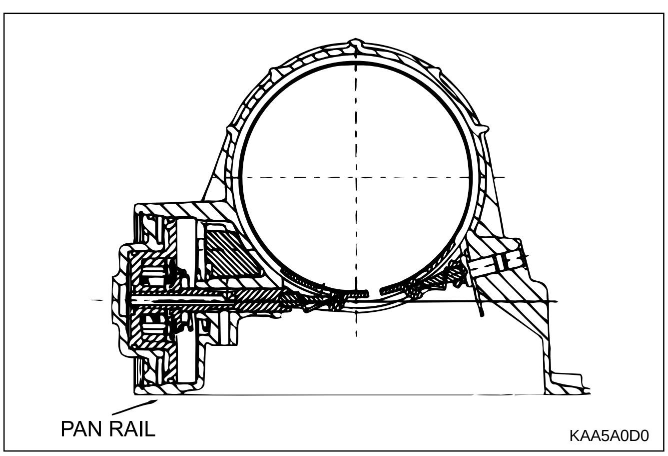


Front Servo Assembly

1. Lubricate the cover ‘O’ ring with automatic transmission fluid and fit to the cover.
2. Lubricatethepiston‘O’ rings with automatic transmission fluid and fit to the piston.
3. Assemble the piston, push rod, spring, belleville washer, seat and retaining ring.
4. Fit the piston push rod assembly into the front servo cover.

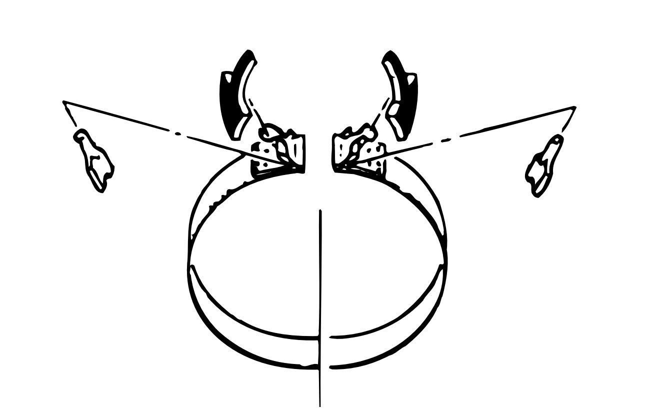


5. Install the front servo block and spring into the case.
6. Install the front servo assembly into the case.



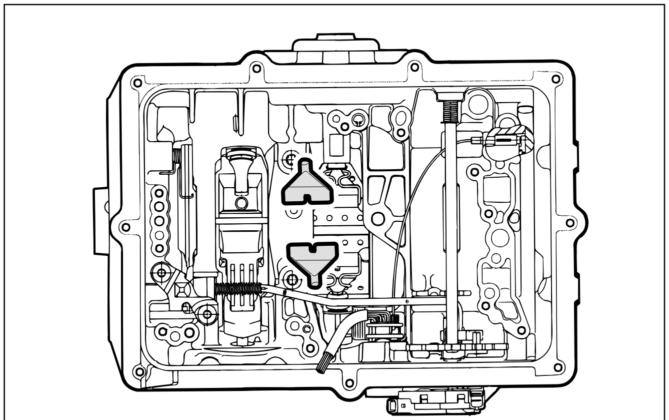
7. Compress the servo cover and fit the servo cover retaining circlip, aligning the gap with the pan rail, and ensuring that it is completely seated in its groove.

Notice: Ensure that the front servo snap ring is installed correctly. Orient the circlip with the gap at the bottom, near the pan rail.


KAA5A0E0

Front Band Assembly

1. Install the reaction anchor strut to the case.
2. Check the band for all cracks or damage along its lining and metal backing.
3. Position the strut retainers on the band.


KAA5A550

4. Install the front band into the transmission case, ensuring that it is properly seated in place.

Notice: If fitting a new band, soak the band in automatic transmission fluid for a minimum of 5 minutes prior to assembly.

5. Position the reaction strut in its retaining clip and engage it with the band and anchor strut.
6. Position the apply strut in its retaining clip and engage it with the band and the servo piston rod.

C2/C4 Clutch Assembly

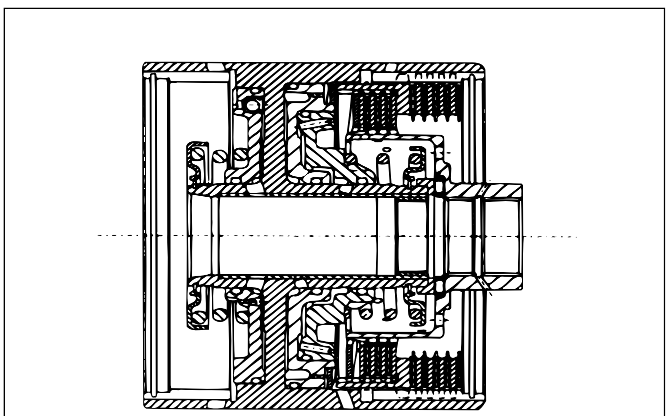
Tools Required

0555-336259 Clutch Spring Compressor

0555-336260 Clutch Pack Clearance Kit

Notice:

- Check pistons for cracks.
- Do not mix the clutch piston return springs.
- Ensure that the snap rings are fitted correctly.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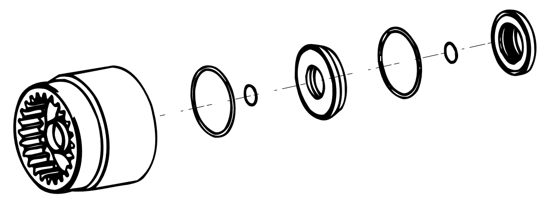
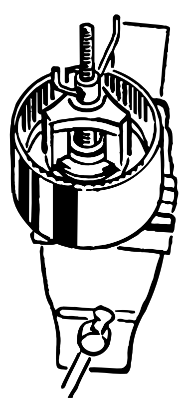
1. Check the feed orifices in the cylinder bore are clear of obstructions.
2. Check the C2 piston bleed orifices are clear of obstructions.
3. Lubricate the ‘O’ rings with Automatic Transmission Fluid (ATF)
4. Fit the small ‘O’ ring onto the inner groove, and the large ‘O’ ring onto the outer groove of the piston.

Notice: ‘O’ rings must not be twisted in the grooves.


KAA5A0G0

5. Check the C4 piston bleed orifices are clear of obstructions.
6. Lubricate the ‘O’ rings with ATF.
7. Fit the small ‘O’ rings onto the inner groove and the large ‘O’ rings onto the outer groove of the piston.
8. Position the clutch cylinder with the C2/C4 cavity facing upwards.
9. Fit the C4 piston into the C2 piston with the bleed orifices in alignment.
10. Install the C2/C4 piston assembly into the cylinder, with the piston bleed orifices aligned with the holes on the outside of the cylinder, until the outer diameter of the C2 piston enters the inner diameter of the cylinder.

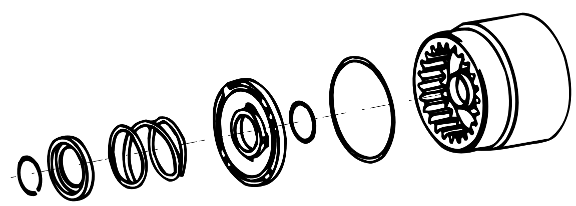

KAA5A690

11. Assemble the piston return spring to the piston, and fit the spring retainer over the spring.
12. Using 0555-336259 clutch spring compressor, compress the spring sufficiently to enable the installation of the retaining circlip ensuring that the circlip is firmly seated in its groove, then remove the tool.

Notice: The wire diameter of this spring is 4.3 mm.

13. Check the C1 piston check valves are not damaged and are free to move, and that the cylinder feed orifices are clear of obstructions.
14. Lubricate the ‘O’ rings with ATF and fit them to their respective grooves.

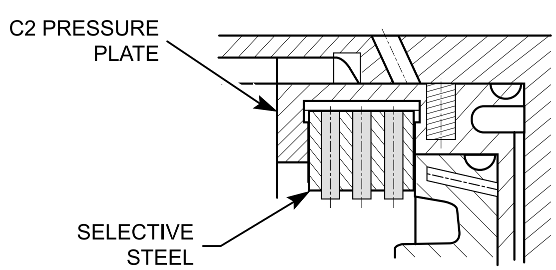
Notice: ‘O’ rings must not be twisted in the grooves.


KAA5A0H0

15. Position the cylinder with the C1 cavity upwards. Install the piston into the cylinder until the outer diameter of the piston enters the inner diameter of the cylinder.
16. Install the spring and spring retainer onto the piston.
17. Using 0555-336259 clutch spring compressor, compress the spring sufficiently to enable the installation of the retaining circlip ensuring that the circlip is firmly seated in its groove, then remove the tool.

Notice: The wire diameter of this spring is 5.26 mm.

18. Install the C2 wave washer into the cylinder with the crest of one wave covering one of the bleed orifices inthe C2 piston.



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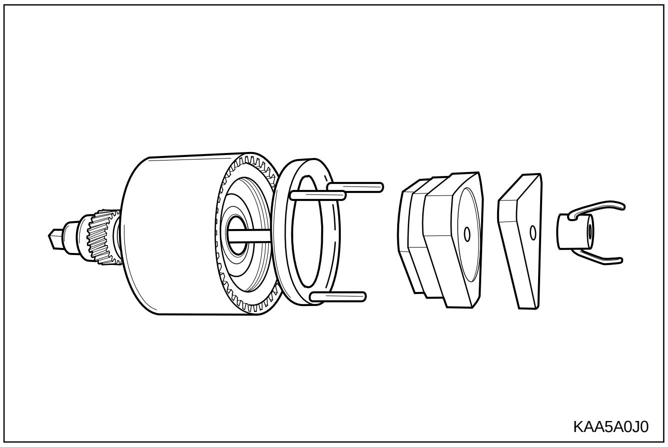
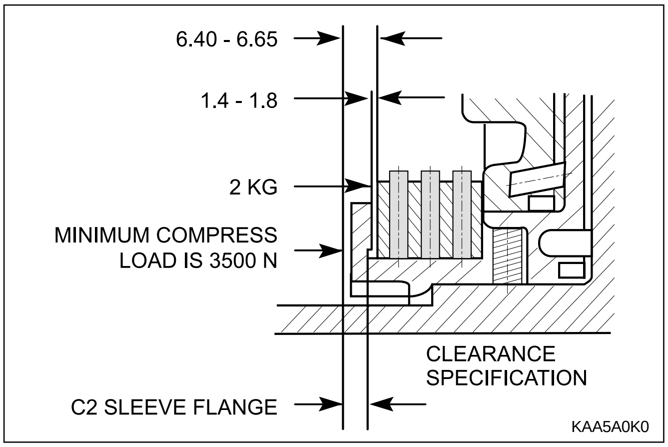
19. Measure and record the thickness of the flange of the C2 sleeve.
20. Install the C4 clutch plates and wave washer into the C2 actuating sleeve, with the rounded edge of the steel plates down, in the following sequence:
    - Steel plate (selective)
    - Friction disc
    - Steel plate
    - Friction disc
    - Steel plate
    - Friction disc
    - Steel plate
    - Wave washer



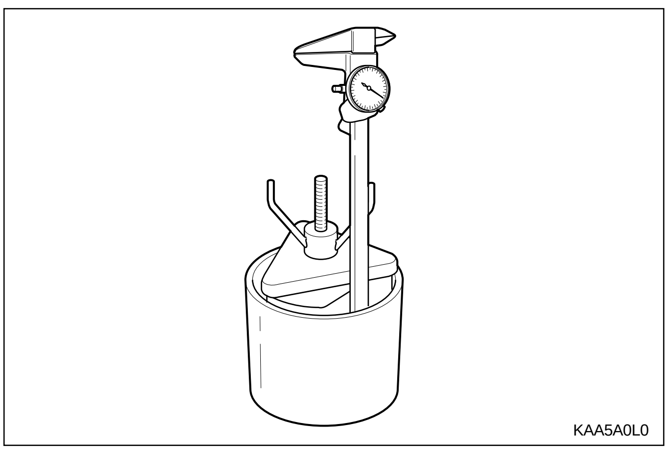
21. Holding the cylinder horizontal, install the sleeve and clutch plate assembly into the cylinder, with the crest of one wave of the washer in line with one of the holes in the outside of the cylinder, until the sleeve contacts the C2 wave washer.
22. Check the C4 clutch pack clearance using 0555-336260 clutch pack clearance kit.



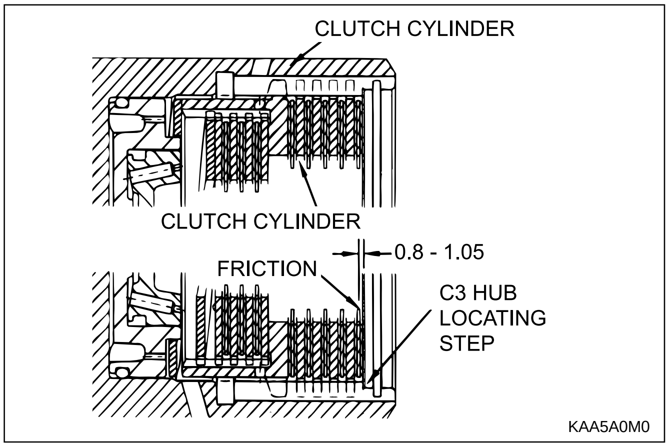
Notice: With the C2 wave spring compressed, and the clutch Pack supporting a 2 kg weight, the dimension from the underside of the C2 pressure plate to the selective steel is to be between 1.4 - 1.8 mm. If the clutch is to be gauged from the top of the pressure plate, then the dimension is to be the actual thickness of the pressure plate plus 1.4 - 1.8 mm.

23. Use selective plates to achieve the correct specification. If new friction plates are being fitted, remove the clutch pack and soak the friction plates in ATF for a minimum of 5 minutes prior to reassembly.

Notice: The clutch pack clearance must be taken before the elements are soaked in ATF.



24. Reassemble the sleeve and clutch pack into the cylinder. Observe the alignment of the wave washer to the hole in the cylinder.
25. Install the C2 clutch plates in the cylinder in the following sequence:
    - Friction disc
    - Steel plate
    - Friction disc
    - Steel plate
    - Steel plate (0574-000013, `014, `015, `016, `019, `022), or Friction disc (0574-000012 & `017)
    - Steel plate (selective)
    - Friction disc
    - Steel plate (selective)
    - Friction disc



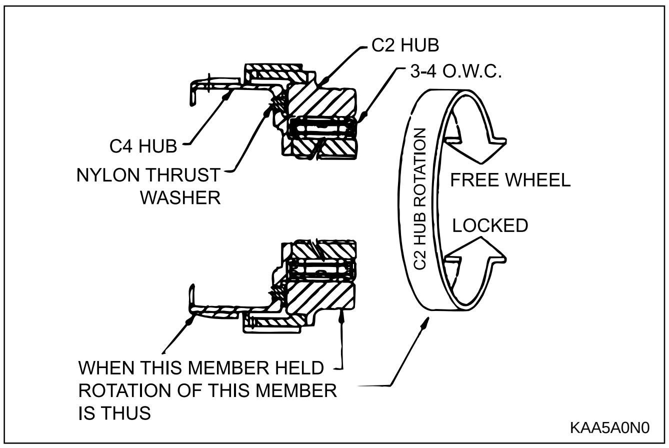
26. Check the clutch pack clearance using only the weight from 0555-336260 clutch pack clearance kit.

Notice: With the clutch pack supporting a 2 kgweight, the dimension from the C3 clutch hub locating step to the friction plate is to be between 0.80 - 1.05 mm.

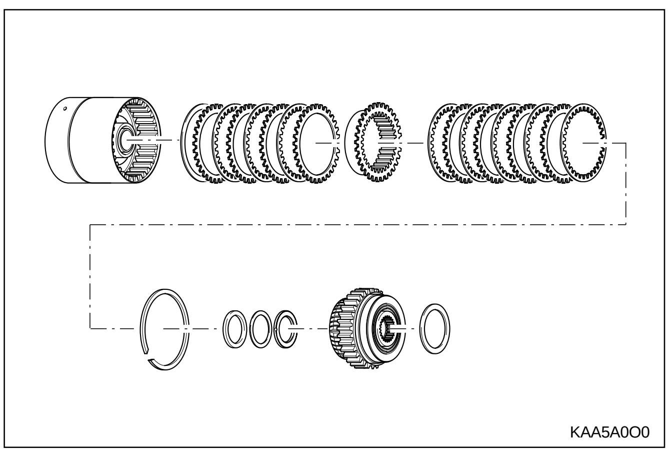
27. Use selective plates to achieve the correct specification. If new friction plates are being fitted, remove the clutch pack and soak the friction plates in ATF for a minimum of 5 minutes prior to reassembly.

Notice: The clutch pack clearance must be taken before the elements are soaked in ATF.

28. Lubricate and fit the 3-4 OWC and end caps to the C2 hub.



29. Align the tangs and fit the nylon thrust washer onto the C4 hub.
30. Align and fit the C4 hub to the C2 clutch and the OWC assembly.
31. Check the rotation of the C2 hub. While holding the C4 hub, the C2 hub should rotate in the clockwise direction and lockup in the anti-clockwise direction when viewed from the C2 hub.



32. Apply petroleum jelly to the No. 5 needle bearing and fit it to the C4 hub.
33. Remove the C2 clutch plates from the clutch cylinder.
34. Fit the thrust plate over the cylinder inner hub.
35. Engage the C2/C4 clutch hub assembly in the C4 clutch plates.
36. Install the C2 clutch plates.
37. Install the C3 hub and secure it with the circlip, ensuring that the circlip is firmly seated in its groove.

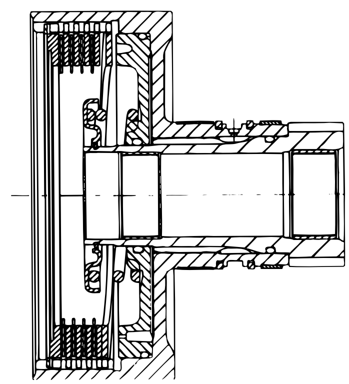
C3 Clutch and Reverse Sun Gear Assembly

Tools Required

0555-336259 Clutch Spring Compressor

0555-336260 Clutch Pack Clearance Kit

1. Check the orifices in the cylinder are clear of obstructions.
2. Check the C3 cylinder bush outside diameter and the centre support inside diameter are in good condition and not damaged. Coat the sealing rings with automatic transmission fluid and fit into the C3 cylinder grooves.



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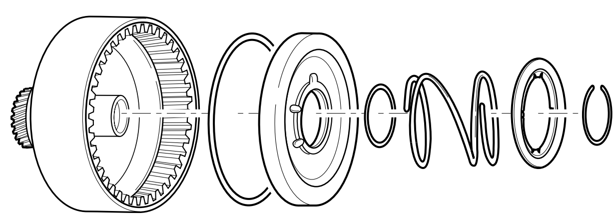
3. Check the reverse sun gear splines, grooves and thrust face for condition. Coat the ‘O’ ring with automatic transmission fluid and fit it to the groove of the reverse sun gear.
4. Lubricate the C3 washer with petroleum jelly and fit to the inner face of the reverse sun gear.
5. Install the reverse sun gear in the C3 cylinder, ensuring that the ‘O’ ring compression is adequate but not excessive.

Notice: ‘O’ rings must not be twisted in the grooves.



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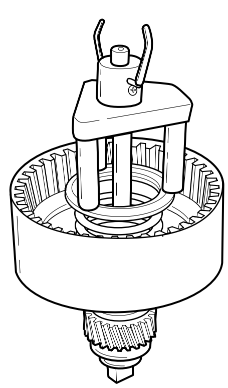
6. Coat the C3 piston ‘O’ rings with automatic transmission fluid and fit the small ‘O’ ring onto the inner ring and the large ‘O’ ring onto the outer ring of the C3 piston.
7. Check that the bleed orifices of the piston are clean and clear of obstructions.
8. Install the C3 piston in the cylinder until the outside diameter of the piston enters the inside diameter of the cylinder.

Notice: Take care not to cut the ‘O’ ring.



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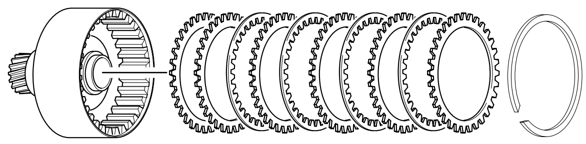
9. Assemble the spring and spring retainer on the piston. Using 0555-336259 clutch spring compressor compress the spring sufficiently to enable the installation of the retaining circlip, ensuring that the circlip is firmly seated in the groove, and remove the tool.
10. Fit the C3 wave plate to the C3 piston face, ensuring that one crest of the wave plate of the C3 piston face is aligned over one of the piston orifices.



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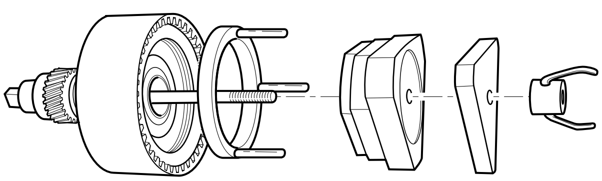
11. Assemble the clutch plates and discs into the cylinder in the following sequence :
    - Steel plate
    - Friction disc
    - Steel plate
    - Steel plate (0574-000013, `014, `015, `016, `019, `022), or Friction disc (0574-000012, `017)
    - Steel plate (selective)
    - Friction disc
    - Steel plate (selective)
    - Friction disc
12. Align and fit the pressure plate with the counterbore facing away from the clutch plates.



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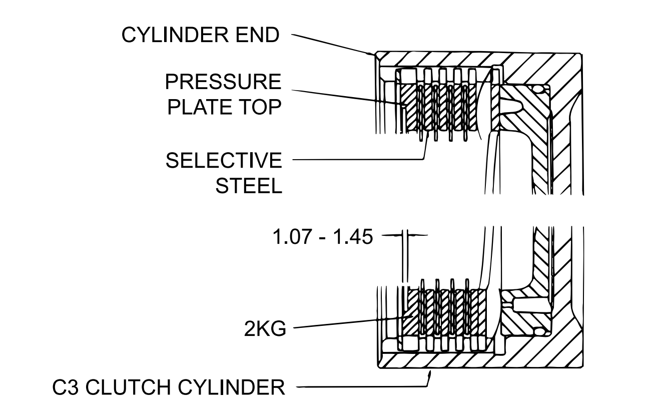
13. Install the circlip.
14. Check the C3 clutch clearance using 0555-336260 clutch pack clearance kit in the following manner (weight only)
    a. Place the weight on the pressure plate and measure the distance from the end of the cylinder to the top of the pressure plate.
    b. Record this figure.
    c. Remove the weight.
    d. Lift the pressure plate up against the circlip and measure the distance from the end of the cylinder to the top of the pressure plate.
    e. Record this figure.
    f. Subtract the second reading from the first reading to obtain the clutch pack clearance.



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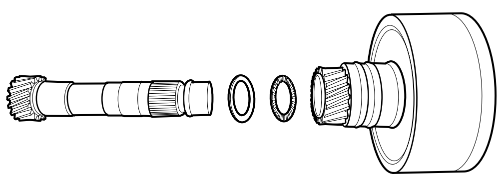
Notice: With the clutch pack supporting a weight of 2kg, the clearance between the snap ring and the top of the pressure plate is to be between 1.07 - 1.45 mm.

15. If new friction plates are being fitted, remove the clutch pack and soak the friction elements in automatic transmission fluid for a minimum of five minutes prior to reassembly.

Notice: The clutch pack clearance must be taken before the elements are soaked in automatic transmission fluid.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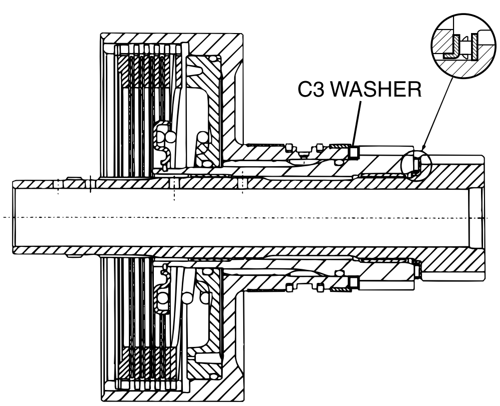
Forward Sun Gear and C3 Clutch Pack Assembly

1. Fit the No.7 needle bearing assembly over the forward sun gear, ensuring that the thrust washer is between the bearing and the sun gear.
2. Lubricate the lipped thrust plate with petroleum jelly and fit the thrust plate onto the reverse sun gear.



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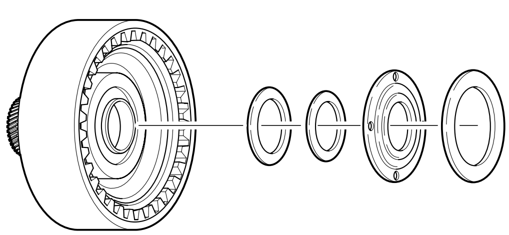
3. Align and fit the C3 clutch assembly over the forward sun gear.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4. Lubricate the No.6 needle bearing with petroleum jelly and fit it to the thrust plate. Ensure the lugs on the outside diameter of the bearing fit in the thrust plate counterbore.
5. Align and fit the plastic thrust washer to the thrust plate with petroleum jelly.
6. Install the assembly over the forward sun gear shaft against the No. 6 needle bearing.
7. Place the assembly to one side.

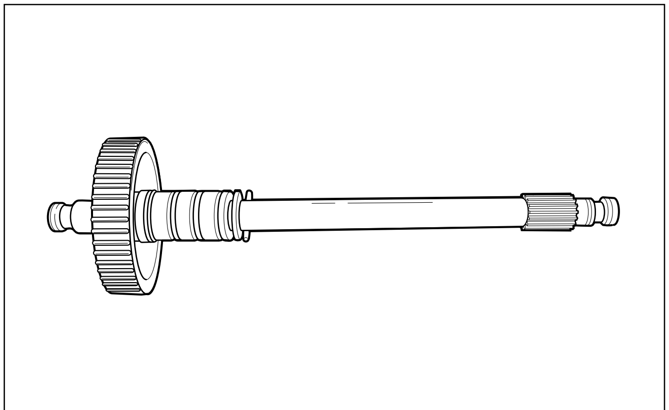
C1 Clutch Overdrive Shaft and Input Shaft Assembly

Tools Required

0555-336260 Clutch Pack Clearance Kit

Notice:

- Ensure that the snap rings are fitted correctly.
- Check pistons for cracks, especially the C1 piston.
- Do not mix clutch piston return springs.
- If the C1/C2 clutch packs separate from the C3 clutch pack, make sure the No. 6 bearing doesn't drop out of the bearing retainer.



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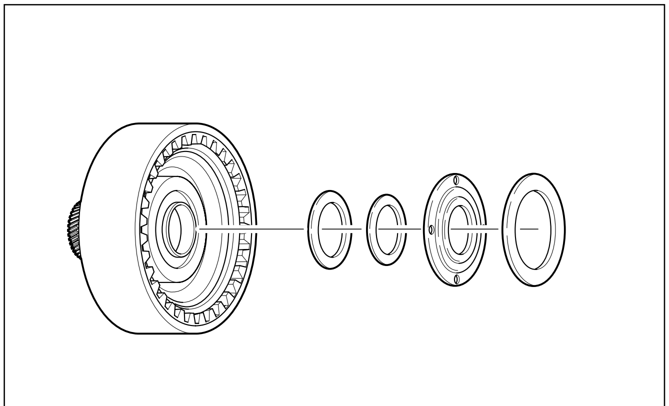
1. Check the overdrive shaft grooves for any defect.
2. Coat the sealing rings, large and small, with petroleum jelly and fit them to the overdrive shaft. The sealing rings may be held in place with a small amount of petroleum jelly.



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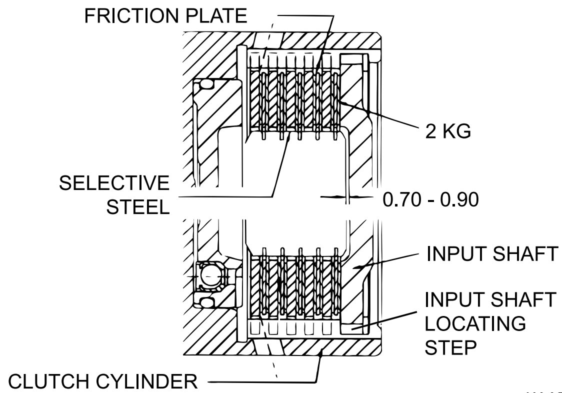
3. Assemble the clutch plate and disc into the cylinder in the following sequence:
   - steel plate
   - friction disc
   - steel plate
   - friction disc
   - steel plate
   - steel plate (0574-000013, `014, `015, `016, `019, `022), or friction disc (0574-000012 & `017)
   - steel plate (selective)
   - friction disc
   - steel plate (selective)
   - friction disc



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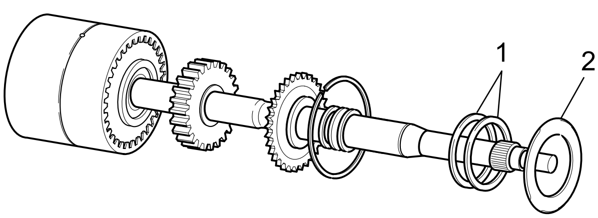
4. Check the clutch pack clearance using 0555-336260 clutch pack clearance kit.
5. Use selective plates to achieve the correct specification.

Notice: With the clutch pack supporting a 2 kg weight, the dimension from the input shaft locating stop to the friction disc must be 0.70 - 0.90 mm.

6. If new friction plates are being fitted, remove the clutch pack and soak the friction elements in automatic transmission fluid for a minimum of five minutes prior to assembly.

Notice: The clutch pack clearance must be taken before elements are soaked in automatic transmission fluid.



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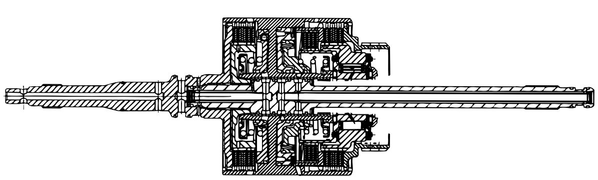
7. Check the fit of the C1 clutch hub on the overdrive shaft. If it is loose, the hub and shaft assembly must be replaced.
8. Coat the small nylon thrust spacer with petroleum jelly and install it over the overdrive shaft.
9. Carefully fit the overdrive shaft into the C1 cylinder so as not to damage the sealing ring.
10. Fit the small bronze C1 hub thrust washer in place with petroleum jelly.
11. Check the input shaft for any defect. Fit the input shaft into the cylinder and secure it with the circlip, ensuring that the circlip is completely seated in the groove.



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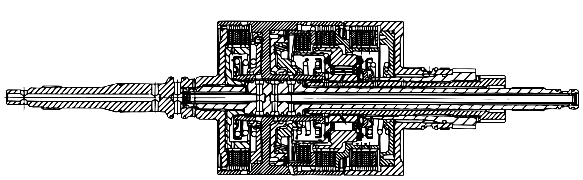
12. Coat the sealing rings with petroleum jelly and fit onto the input shaft.



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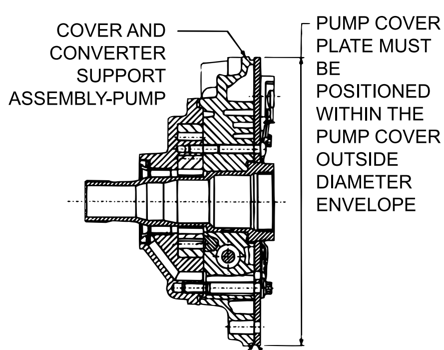
13. Assemble the C1/C2/C4 clutch assembly to the C3 clutch and sun gear assembly.
14. Install this assembly in the transmission case.

Pump Cover and Converter Support

Notice:

- Do not wash the nose of solenoids in solvent.
- Ensure that the correct ‘O’ ring is fitted for the application.
- Be careful not to damage the needle bearings on the assembly. Avoid any axial impact loads during assembly.
- Check the transmission end float. This will help to detect any missing parts or incorrect assembly.



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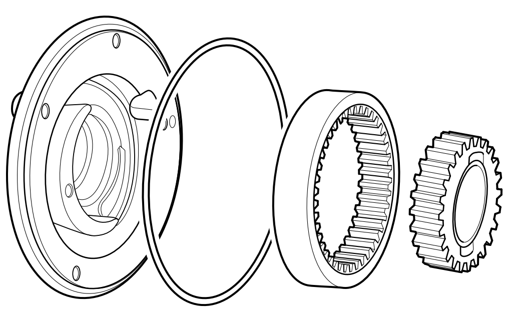
1. Check the pump body for any damage, chips or irregularity. Check that the bush is firmly staked in the drive gear.
2. Install the seal flush with the front face of the pump body.
3. Lubricate the pump bush, and the drive and driven gears, with automatic transmission fluid.



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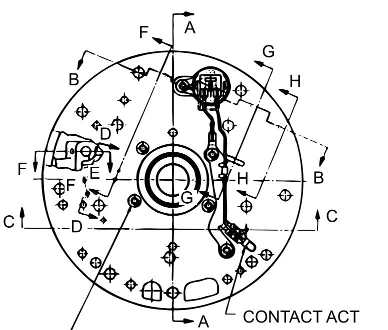
4. Install the pump driven gear and the pump drive gear into the pump body.
5. Using a straight edge and thickness gauge, check that the clearance between pump face and gears is 0.04 - 0.018 mm.
6. Lubricate the pump body ‘O’ ring with automatic transmission fluid and fit it to the pump body. Put the pump body to one side.



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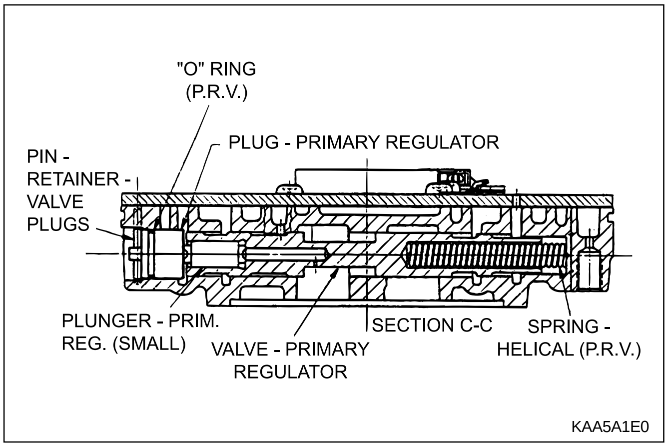
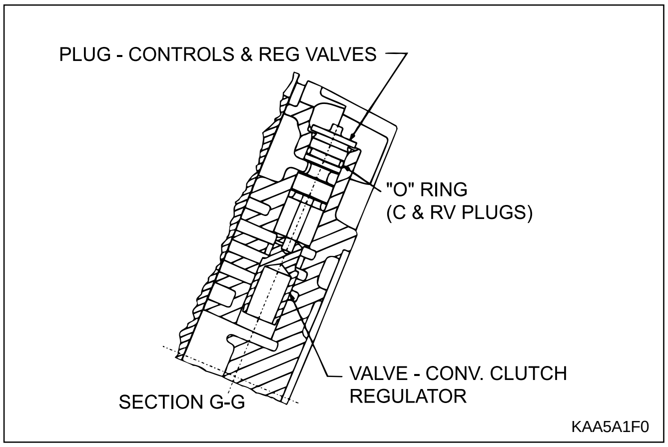
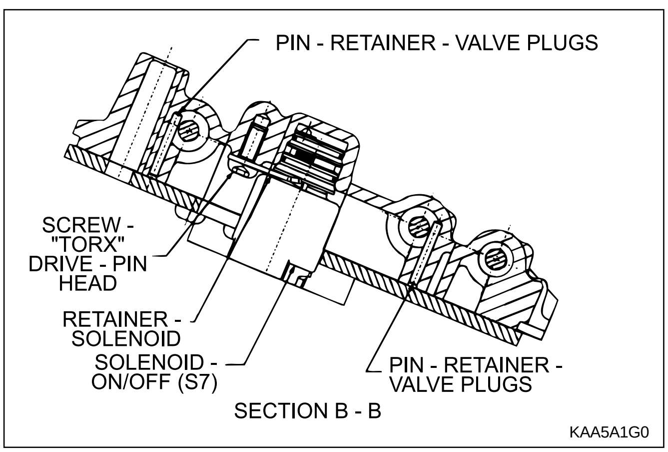
7. Ensure that the pump cover cavities, ports and holes are clean and free of any obstruction.
8. Lubricate all loose parts with automatic transmission fluid prior to assembly.



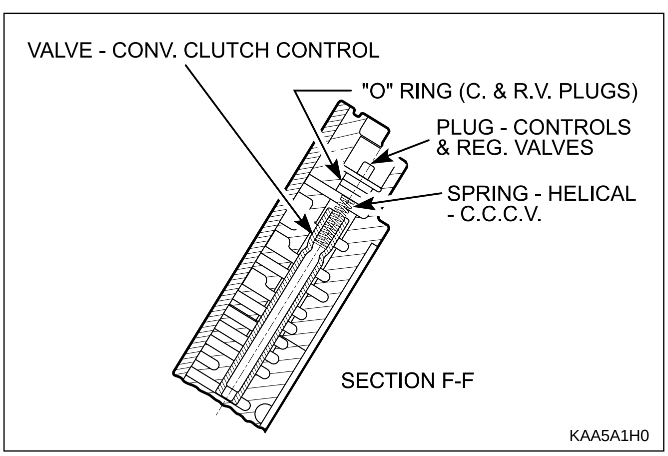
9. Assemble the primary regulator valve, spring and plunger to the pump cover, ensuring that the regulator valve slides freely, then fit the regulator valve plug and ‘O’ ring.
10. Install the retaining pin.



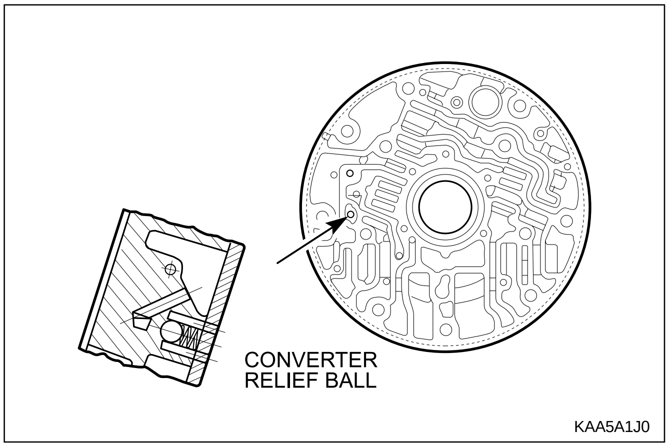
11. Install the converter clutch regulator valve, plug, spring and ‘O’ ring.



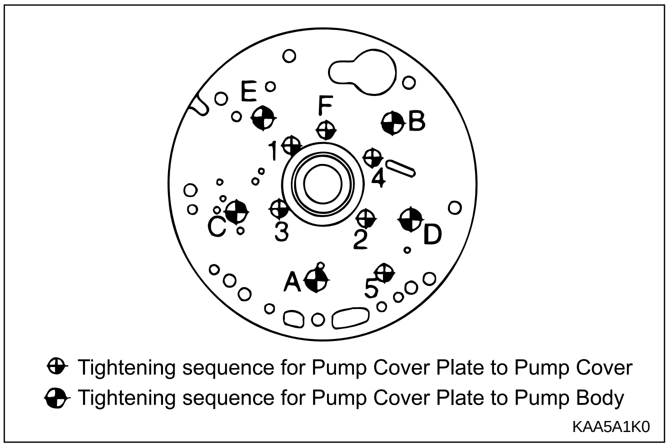
12. Install the retaining pin.



13. Install the converter clutch control valve, spring, plug, and ‘O’ ring.
14. Install the retaining pin.



15. Install the converter release check ball and spring.
16. Install the gasket on the pump cover.



17. Install the cover plate, solenoid 7 with the retainer and the solenoid wiring retainer to the pump cover, ensuring that the periphery of the cover plate is flush with the periphery of the pump cover.
18. Tighten the screws to specification in the order. (1-5)

Installation Notice

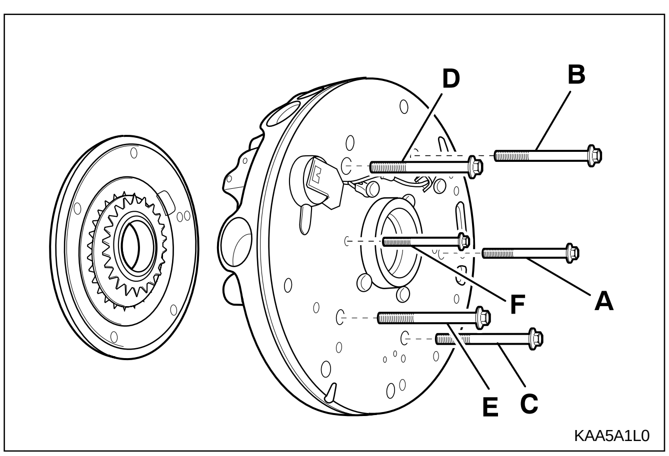
Tightening Torque	13-16 N•m (10-12 lb-ft)

19. Tighten the solenoid 7 screw.

Installation Notice

Tightening Torque	13-16 N•m (10-12 lb-ft)

- Check that neither the wiring nor the connector protrudes excessively, in order that at assembly neither the wiring and the connector contacts or rubs on the input shaft or the C1/C2 clutch cylinder.

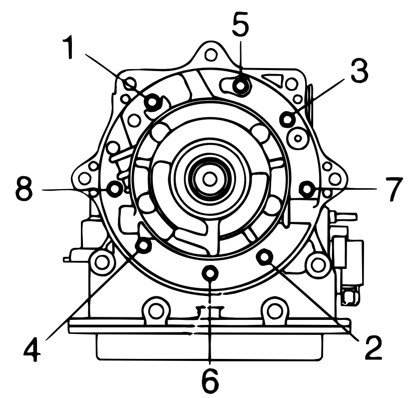


20. Assemble the pump to the pump cover.
21. Tighten all bolts and the crescent screw finger tight, ensuring that the pump is flush against the pump cover. Tighten the bolts and the screw to specification in the order. (A-F)

Installation Notice

Tightening Torque	Bolt (A-E) : 24-27 N•m (18-20 lb-ft)
	Screw (F) : 13-16 N•m (10-12 lb-ft)

22. Install the pump to transmission case gasket onto the case.
23. Fit the ‘O’ ring to the pump cover outer diameter.



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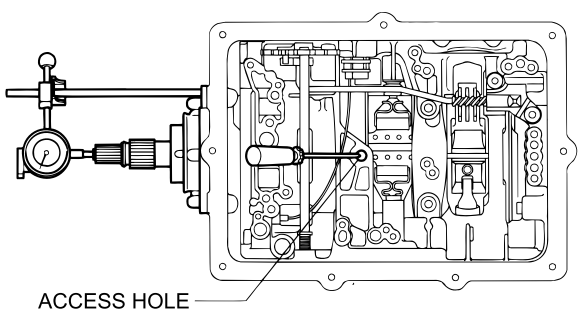
24. Install the pump and cover assembly over the input shaft being careful not to damage the sealing rings. Apply additional Loctite 202 or equivalent as required to the pump cover to case bolts. Install and tighten bolts to specification.

Installation Notice

Tightening Torque	24-34 N•m (18-25 lb-ft)



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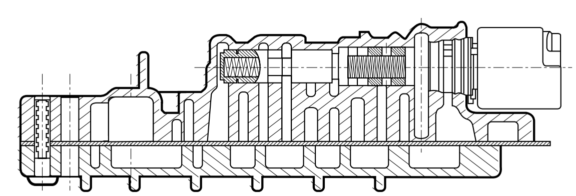
25. Check that the transmission end float is 0.50 - 0.65 mm. If the unshimmed end float clearance is greater than specification, shims are to be placed between the No. 4 bearing and the input shaft bearing surface. If the end float clearance is less than 0.5 mm then the transmission has been assembled incorrectly or the parts are out of specification.
26. Perform the following steps to check the end float :
    a. Attach a dial indicator to the front of the transmission case with the stylus resting on the end of the input shaft.
    b. Apply a force of approximately 250 N or 25 kg to the input shaft.
    c. Zero the dial indicator.
    d. Place a small lever behind the forward clutch cylinder and lever the cylinder forward.
    e. The measurement recorded on the dial indicator is the transmission end float or clearance between the No.4 bearing and the converter support tube.
27. On completion of this procedure, adjust the front and rear bands to specifications. Refer to “Front and Rear Band Adjustment” in this section.

Valve Body

Notice:

- Do not wash the nose of solenoids in solvent.
- Be aware of ball positions in the upper valve body.
- Be aware of 1-2 and 3-4 shift valve positions, they can be swapped.
- Check the 4-3 sequence valve and spring orientation.
- Check that the 12 mm ball is in the lower body.
- Check the line pressure relief valve for swarf, and be aware of replacing the shims.
- When servicing the transmission, ensure that the solenoid 5 damper spring is not broken.
- Locate the detent spring central to the detent lever.
- Wash the upper and lower valve bodies thoroughly with cleansing solvent and blow dry.
- Check the valve body cavities, ports and holes for damage or obstructions.
- The orifices in the valve body are for stability and safeguard. Do not drill them larger.
- Thoroughly wash all loose components.
- Check that all valves slide freely in their location.



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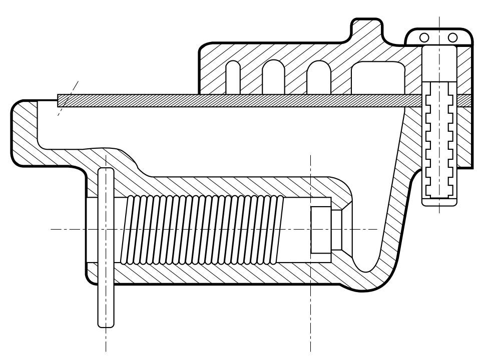
1. Install the detent lever locating pin
2. Install the Band Apply Regulator (BAR) valve, springs, plunger and retaining pin.



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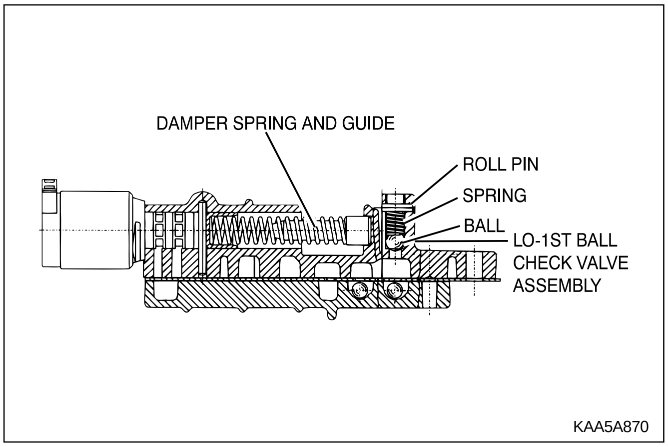
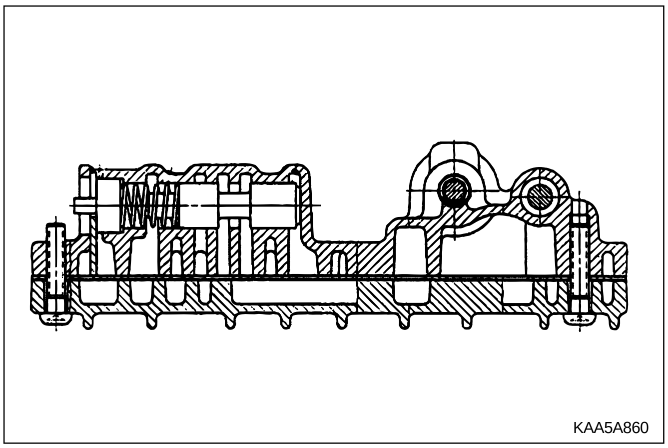
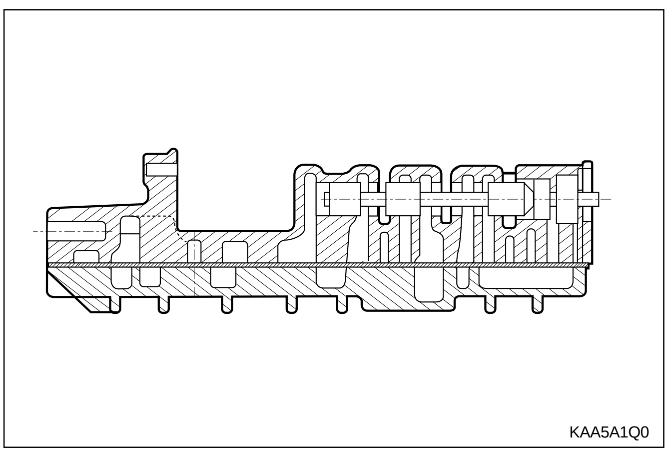
3. Install the line pressure relief valve, tapered end first, spring and disc. Secure with the retaining pin.



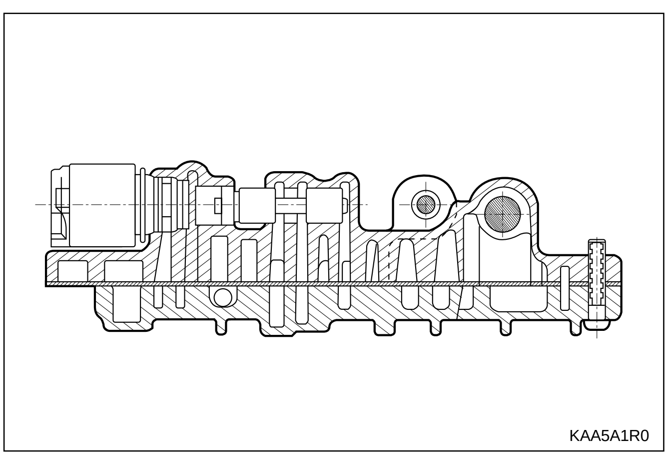
4. Install the solenoid 5 damper guide and spring, piston and retaining pin.



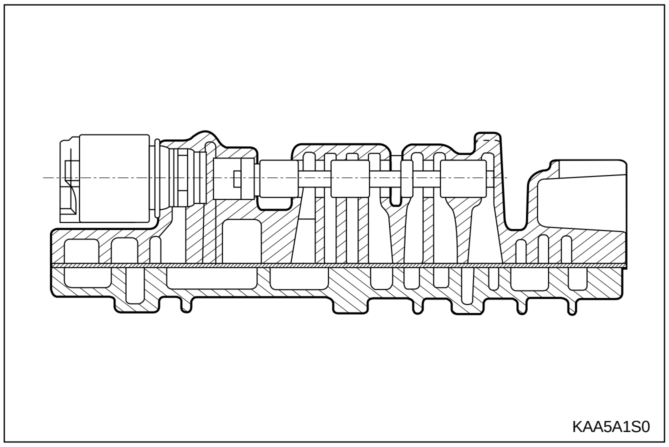
5. Install the 4-3 sequence valve, spring, plug and retaining plate.



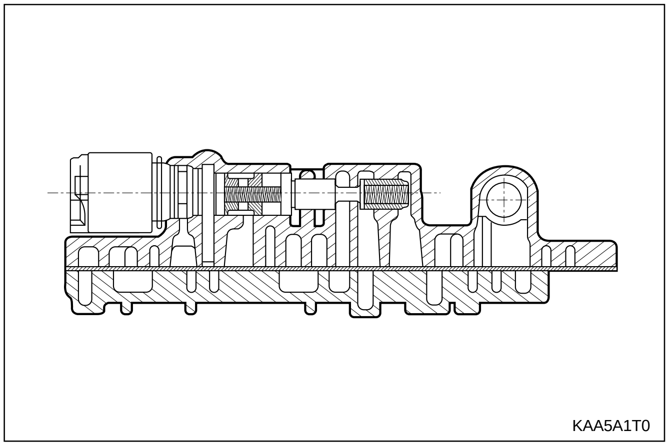
6. Install the 1-2 shift valve, plug and retaining pin.



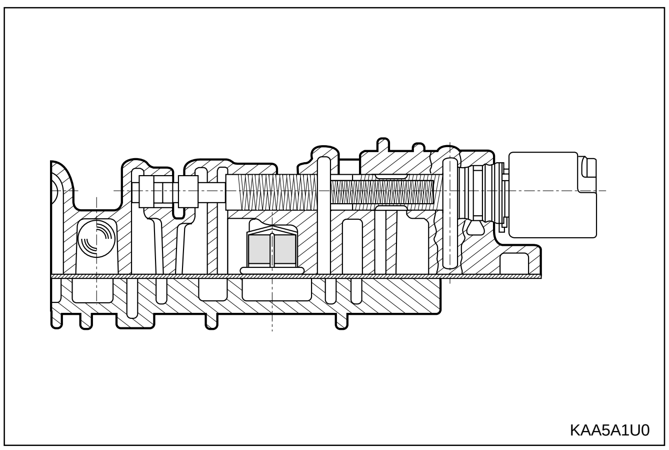
7. Install the 2-3 shift valve and retaining pin.



8. Install the 3-4 shift valve and retaining pin.



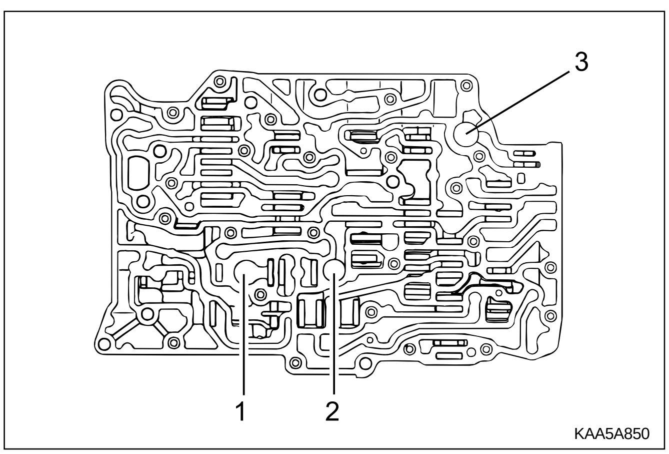
9. Install the Clutch Apply Regulator (CAR) valve, springs, plunger and retaining pin.



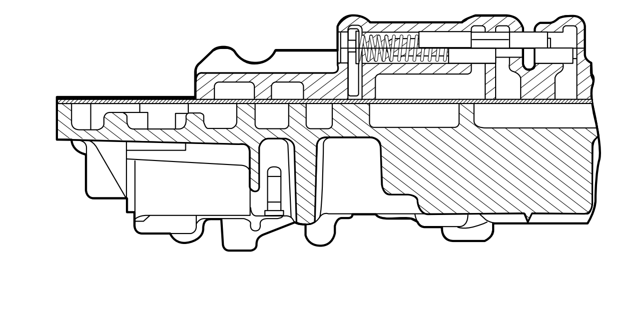
10. Install the solenoid supply valve, spring and retaining plate.

Notice: This aluminum valve is easily damaged.

11. Install solenoid 6 plunger, spring and retaining pin.

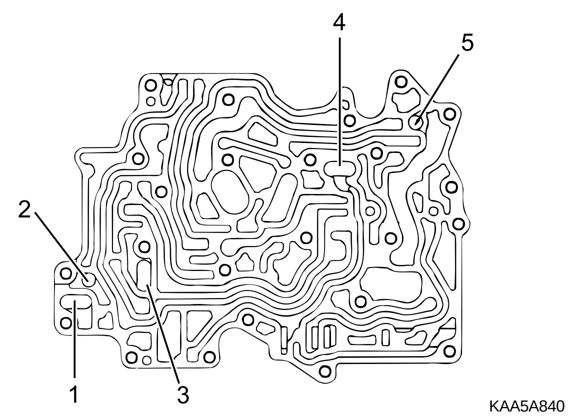


12. Position the third feed ball (large nylon) in the valve body and install the solenoid 6 filter.
13. Check the separator plate for burrs and damage. Repair or replace the separator plate as necessary.
14. Check the upper and lower valve body gaskets for damage. Replace the gaskets as necessary.
15. Install the lower valve body gasket on the lower valve body.



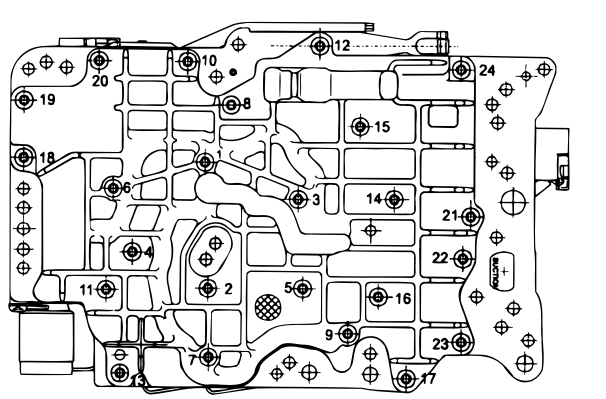
KAA5A1V0

16. Install the reverse lockout valve, spring, plug and retaining plate. Ensure that the valve is correctly oriented.



KAA5A840

17. Position the five nylon ball checks in the upper valve body.
18. Fit the upper valve body gasket. Install the separator plate over the upper valve body.



KAA5A830

19. Holding the separator plate to the upper valve body to prevent the check balls from falling out, install the upper valve body on the lower valve body. Install all screws finger tight then tighten the screws to specification in the prescribed sequence.

Installation Notice

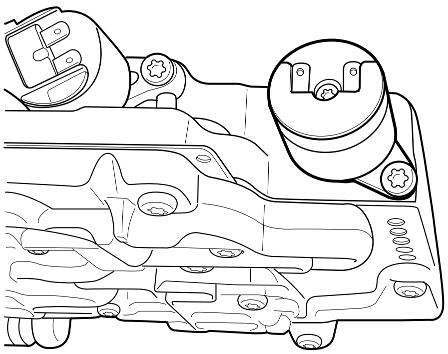
Tightening Torque	11-16 N•m (8-12 lb-ft)

20. Install solenoids 1, 2, 3, 4 and 6. Ensure the solenoid is firmly secured by the retainer and that the screw is tightened to specification.

Installation Notice

Tightening Torque	8-12 N•m (71-106 lb-in)

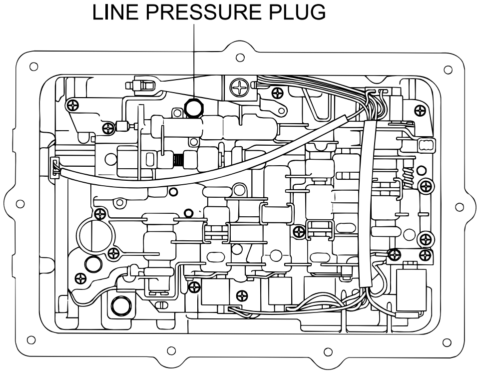
- The wiring loom ground wire eyelet terminal is secured beneath the solenoid 1 retainer.


KAA5A1W0

21. Install solenoid 5. Ensure that the solenoid is pushed firmly into the valve body by the retainer and that the screw is tightened to specification.

Installation Notice

Tightening Torque	8-12 N•m (71-106 lb-in)

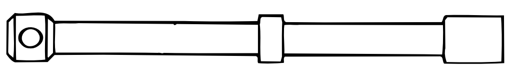


KAA5A1X0

22. Install the detent spring assembly (spring, support plate and screw), ensuring that the screw is tightened to specification. Check the spring for wear or damage.

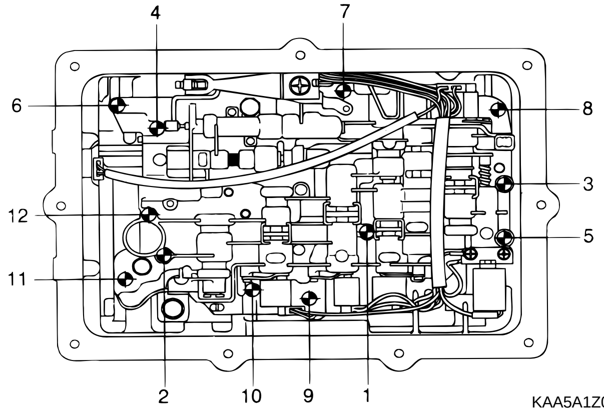
Installation Notice

Tightening Torque	20-22 N•m (15-16 lb-ft)


KAA5A1Y0

23. Install the manual shift valve.

Notice: Be aware that the manual valve will fall out of the valve body.

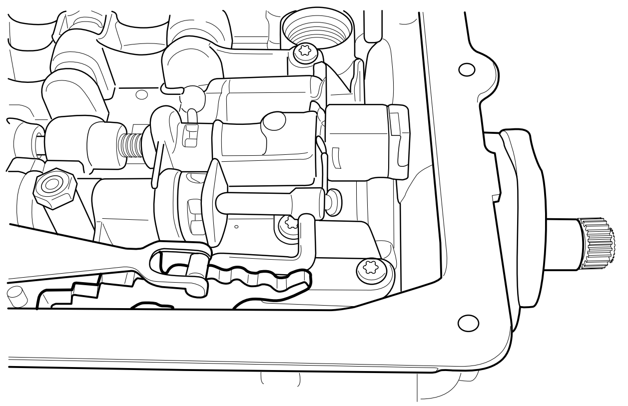


KAA5A1Z0

24. Align the valve body assembly on the transmission case and install the manual valve lever to manual valve link. Fit the long end of the link to the manual valve first. Install the securing bolts and tighten to specification in the specified sequence.

Installation Notice

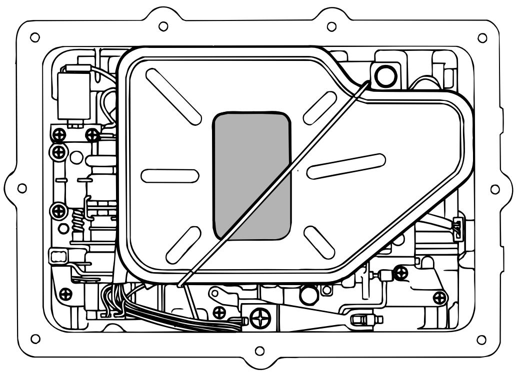
Tightening Torque	8-13 N•m (71-115 lb-in)



KAA5A2A0

25. Check the alignment of the detent roller and the manual lever quadrant.
26. Connect the solenoid wiring as detailed below:
    Solenoid 1 - red
    Solenoid 2 - blue
    Solenoid 3 - yellow
    Solenoid 4 - orange
    Solenoid 5 - green
    Solenoid 6 - violet

Notice: All hardware must be correctly installed and torqued to specification.



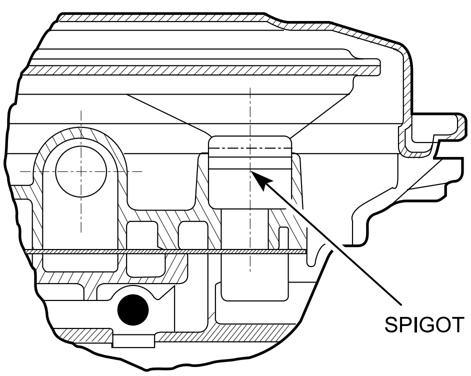
KAA5A510

Oil Filter and Pan Assembly

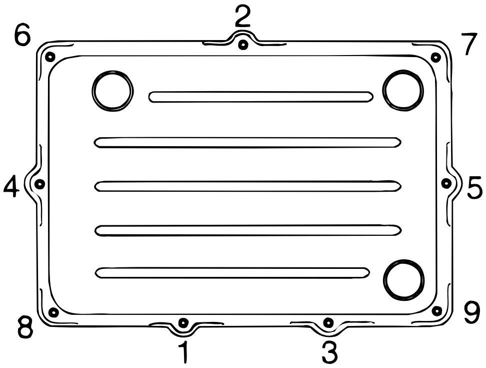
Notice:

- Replace the filter whenever rebuilding a transmission where a significant amount of mechanical damage has occurred.
- To aid the assembly of the pan gasket, use a small amount of Vaseline at the pan/gasket interface. This ensures that the gasket remains on the pan ridge. Do not over torque pan bolts as this may distort the pan and cause leaks.
- Ensure that the internal line pressure plus in the valve body is fitted.

1. Lubricate the oil filter sealing ring with automatic transmission fluid.
2. Carefully assemble the oil filter to the valve body. The spigot must not lean on one side while being fitted.
3. Secure the oil filter assembly with the retainer.
4. Check that the magnet is located in the dimple in the corner of the oil pan.
5. Assemble the gasket on the pan lip. The gasket must be free of any distortion when installed.



KAA5A2B0

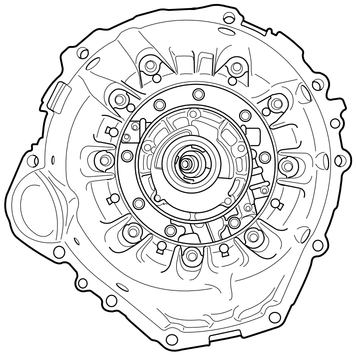


KAA5A2C0

6. Fit the oil pan assembly to the transmission case and tighten the securing bolts to specification and sequence Do not over torque.

Installation Notice

Tightening Torque	4-6 N•m (35-53 lb-in)


KAA5A2D0

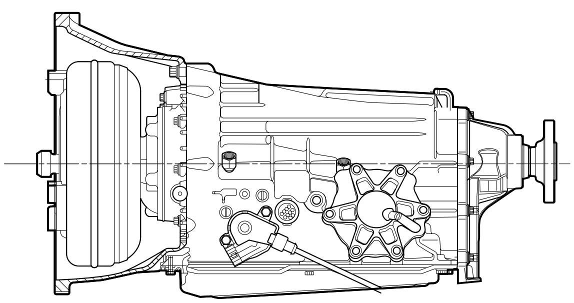
Torque Converter and Housing Assembly

1. Locate the torque converter housing on the transmission main case.
2. Apply additional Loctite 202 or equivalent as required to the converter housing to case bolts. Install and tighten bolts to specification.

   Installation Notice

Tightening Torque	54-68 N•m (40-50 lb-ft)

   - All the hardware must be correctly installed and torqued to specification.
3. Fit the converter ensuring that the tangs are engaged in the pump gear. Ensure that the tangs do not contact the pump seal.


KAC5A040

Output Flange Assembly (2WD Mode)

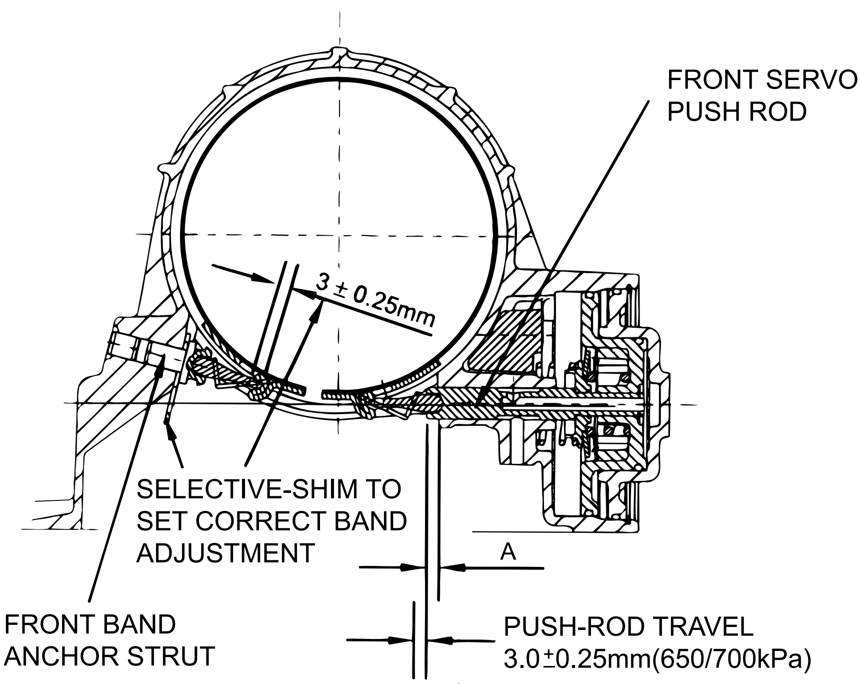
1. Position the transmission detent lever into the park position and lock the output shaft.
2. Clear the threads on the output shaft and apply Loctite 243 or equivalent as required to threads.
3. Install the flange, ‘O’ ring and torque the nut to specification.

   Installation Notice

Tightening Torque	35 N•m (26 lb-ft)

FRONT AND REAR BAND ADJUSTMENT

Front Band Setting Procedure



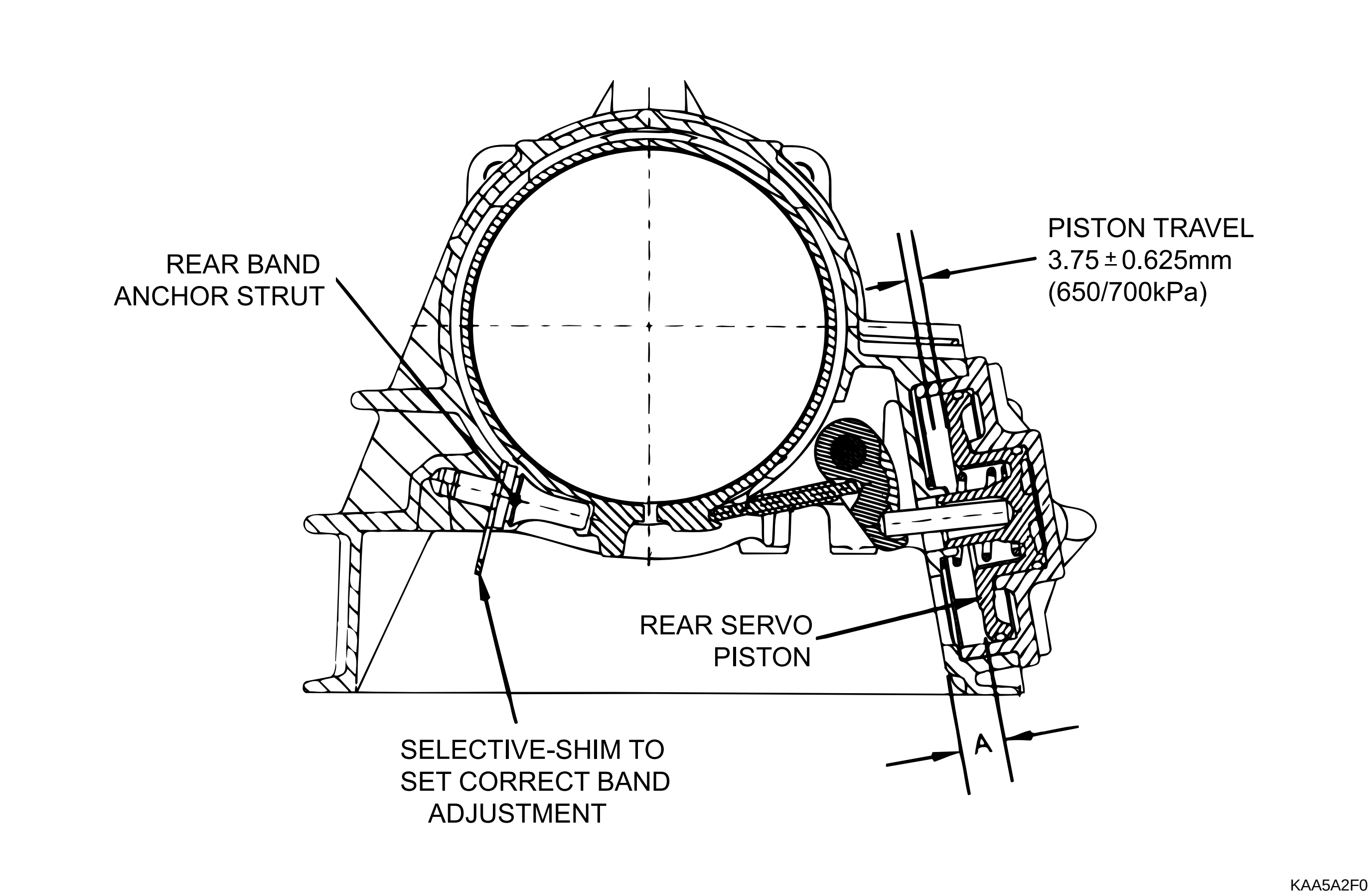
1. Measure the projection of the front servo push rod from the transmission case dimension 'A' .
   a. Apply air at 650/700 kPa to the front servo apply area (B1 outer)
   b. Measure the travel of the push rod and subtract 3 mm to find the shim size required.
   c. Release the air.

Notice: A minimum of one shim is required at all times - minimum shim size is 1 mm. The thickness of available shims are listed in the table below.

Thickness(mm)	Part Number
0.95/1.05	0574-037017
1.15/1.25	0574-037018
1.44/1.56	0574-037019
1.73/1.87	0574-037020
1.93/2.07	0574-037021
2.12/2.28	0574-037022
2.42/2.58	0574-037023
2.61/2.79	0574-037024

2. Fit the selected shim(s) to the shank of the anchor strut as follows:
   a. Inspect the shim(s) for damage, wear or corrosion. Replace as necessary.
   b. The shim(s) are to be installed between the case abutment face and the anchor strut flange.
   c. The shim(s) are to be fitted by hand and under no circumstances to be hammered or forced.
   d. Shim(s) are to be pressed on by hand until an audible click is heard. The click indicates that the shim is clipped home correctly.
3. Re-check that the push rod travel. (3mm ±0.25mm)

Rear Band Setting Procedure

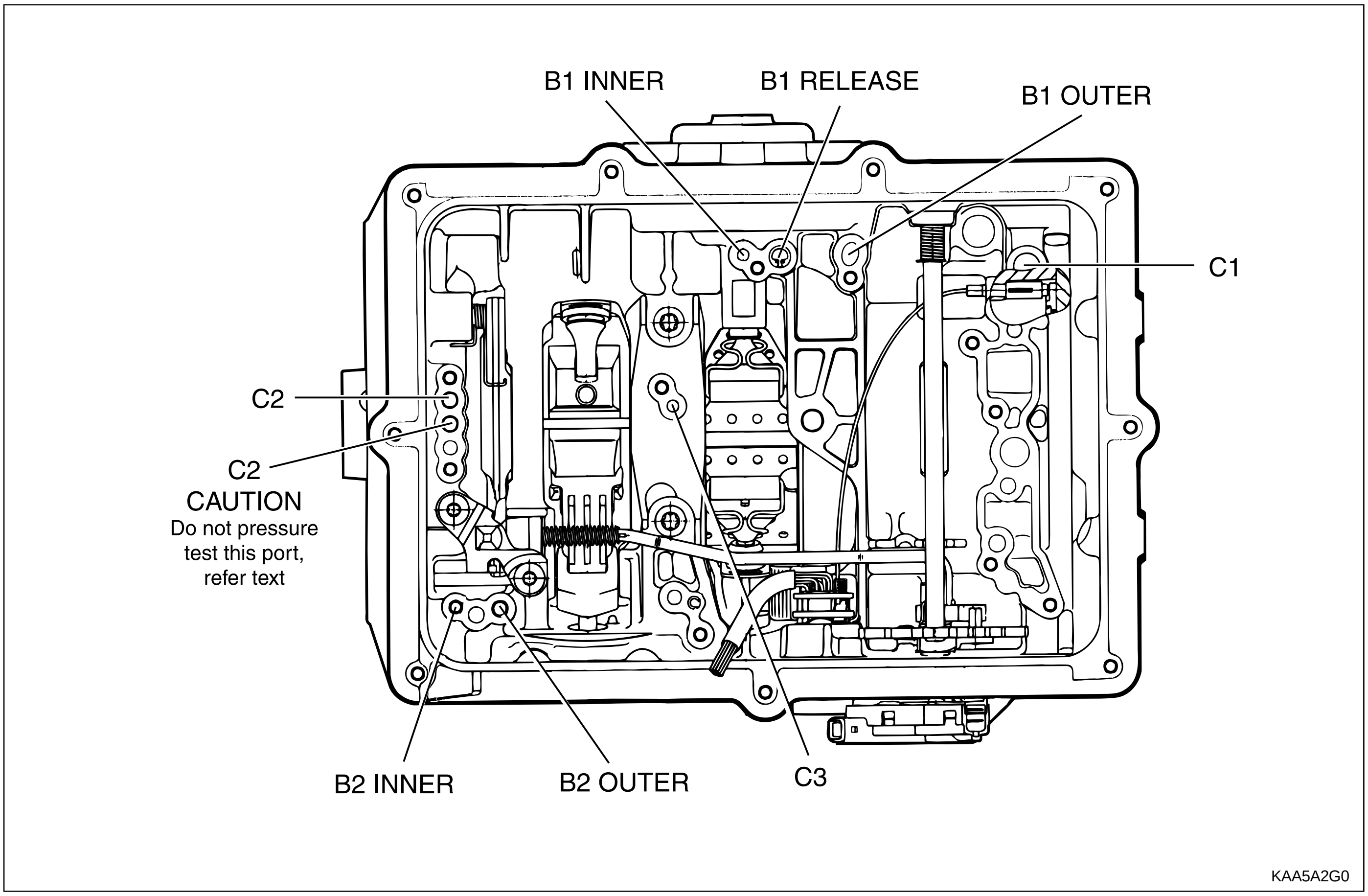


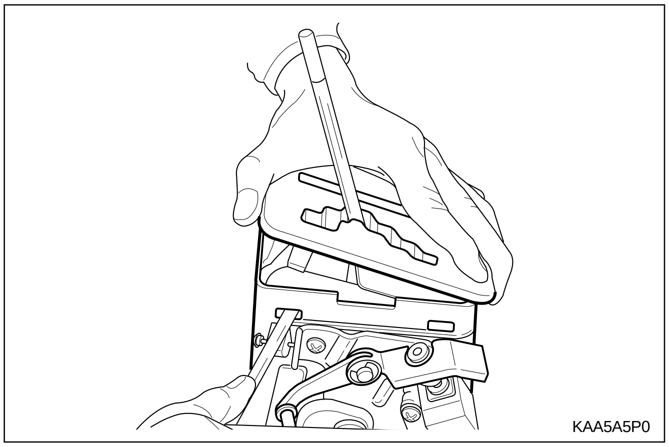
1. Measure distance‘A’ from the rear servo piston to the inner face of the transmission case using vernier calipers.
   a. Apply air at 650/700 kPa to the rear servo apply area (B2 outer)
   b. Measure the travel of the piston, subtract 3.75 mm and divide the remainder by 2.5 to find shim size.
   c. Release the air.

Notice: A minimum of one shim is required at all times - minimum shim size is 1 mm. The thickness of available shims are listed in the table below.

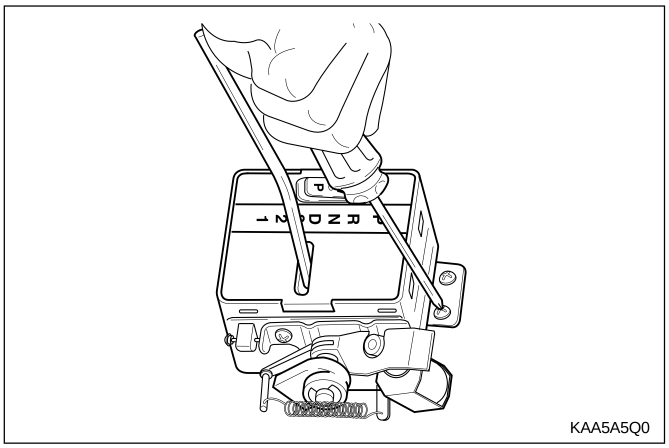
Thickness(mm)	Part Number
0.0.95/1.05	0574-037017
1.15/1.25	0574-037018
1.44/1.56	0574-037019
1.73/1.87	0574-037020
1.93/2.07	0574-037021
2.12/2.28	0574-037022
2.42/2.58	0574-037023
2.61/2.79	0574-037024

2. Fit the selected shim(s) to the shank of the anchor strut as follows.
   a. Inspect the shim(s) for damage, wear or corrosion and replace as necessary. The shim(s) are to be installed between the case abutment face and the anchor strut flange.
   b. The shim(s) are to be fitted by hand and under no circumstances to be hammered or forced
   c. The shim(s) are to be pressed on by hand until an audible click is heard. The click indicates that the shim is clipped home correctly.
3. Re-check that the piston travel. (3.75 mm ± 0.625 mm)


B1 INNER
B1 RELEASE
B1 OUTER
C1
C2
C2
CAUTION
Do not pressure
test this port,
refer text
B2 INNER
B2 OUTER
C3
KAA5A2G0



KAA5A5P0



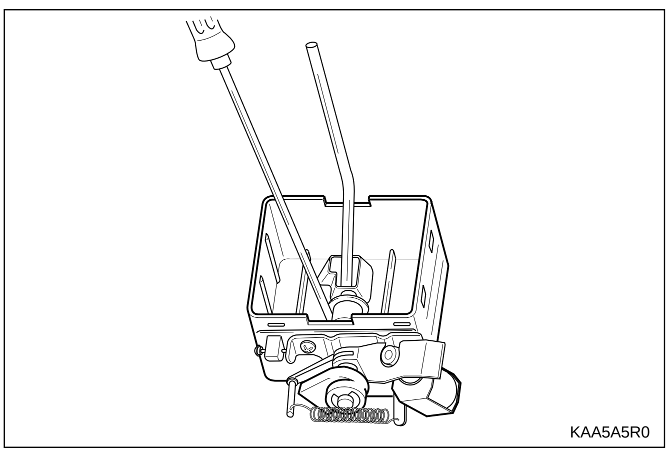
KAA5A5Q0

GEAR SHIFT CONTROL LEVER

Disassembly and Assembly Procedure

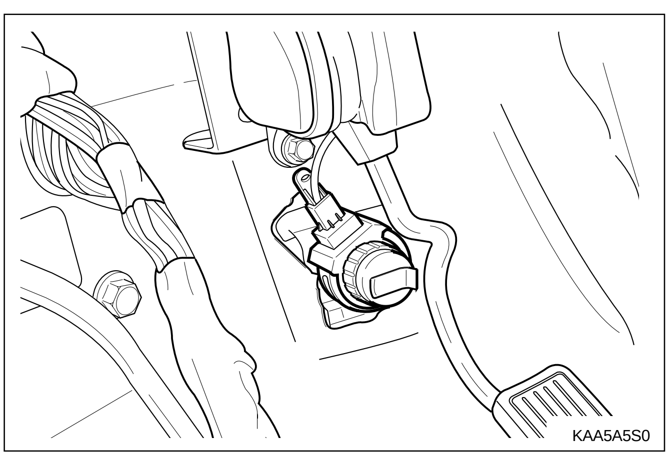
1. Disconnect the negative battery cable.
2. Remove the gear shift control lever assembly. Refer to *Section 9G, interior Trim.*
3. Remove the gear shift control lever knob.
4. Separate the upper and middle housing from the gear shift control lever assembly by unlocking the lock.
5. Remove the upper housing.
6. Disconnect the P position lamp by turning it from the middle housing.
7. Remove the P position switches assembly bolts.
8. Remove the middle housing with the mode selector switch wiring harness from the gear shift control lever assembly.
9. Separate the P position switches assembly with the P position lamp wiring harness from the gear shift control lever assembly.

Notice: Adjust the brake transmission shift interlock ease the operation well.



KAA5A5R0

10. Remove the clips supporting the springs and bushes from the pin of the pin of the gear shift control lever.
11. Remover the spring and bushes from the pin of the gear shift control lever.
12. Remove the gear shift control lever by pushing the pin.
13. Installation should follow the removal procedure in the reverse order.



KAA5A5S0

KICKDOWN SWITCH

1. Separate the Kickdown Switch from the Kickdown Switch bracket by pushing the lock.
2. Disconnect the Kickdown Switch connector.
3. Installation should follow the removal procedure in the reverse order.

SPECIFICATIONS

GENERAL SPECIFICATION

Model Part Numbers And Applications

SYMC P/NO	Transmission	Engine Version	Torque Converter
36100-05442	0574-000017	E23	179K
36100-05432	0574-000012	E32	150K

Model Specifications

Application	Descriprtion
Torque Converter	
Mean Diameter of Fluid Circuit Description	260 mm (10.2 in.)
Maximum Torque Multiplication	2.0 : 1
Gear Ratios	
First	2.741 : 1
Second	1.508 : 1
Third	1.000 : 1
Fourth	0.708 : 1
Reverse	2.429 : 1
Lubricant	
Type	Castrol TQ95
Capacity	
Dry System	9.0 Liters (approx.)
Service Refill	4.5 Liters (approx.)
Gear Train End Float	0.50 - 0.65 mm (0.020 - 0.026 in.)
Gear Set Pinion End Float	0.10 - 0.50 mm (0.004 - 0.020 in.)

Clutch Pack Details

	0574-000012 (17)
C1	
Composition	5
Steel	5
C2	
Composition	5
Steel	4
C3	
Composition	4
Steel	4
C4	
Composition	3
Steel	4

Typical Shift Patterns

NORMAL MODE						POWER MODE					
Throttle Opening	SHIFT (km/h)					Throttle Opening	SHIFT (km/h)				
	1/2	2/3	3L	3/4	4L		1/2	2/3	3L	3/4	4L
0 %	12	20	-	39	72	0 %	12	24	-	41	82
45 %	24	50	70	93	93	45 %	32	66	-	105	117
100 % (WOT)	53	104	111	157	157	100 % (WOT)	53	104	-	158	158
Kickdown	53	105	114	163	163	Kickdown	53	105	114	163	163

Typical Manual Downshift Maximum Speeds

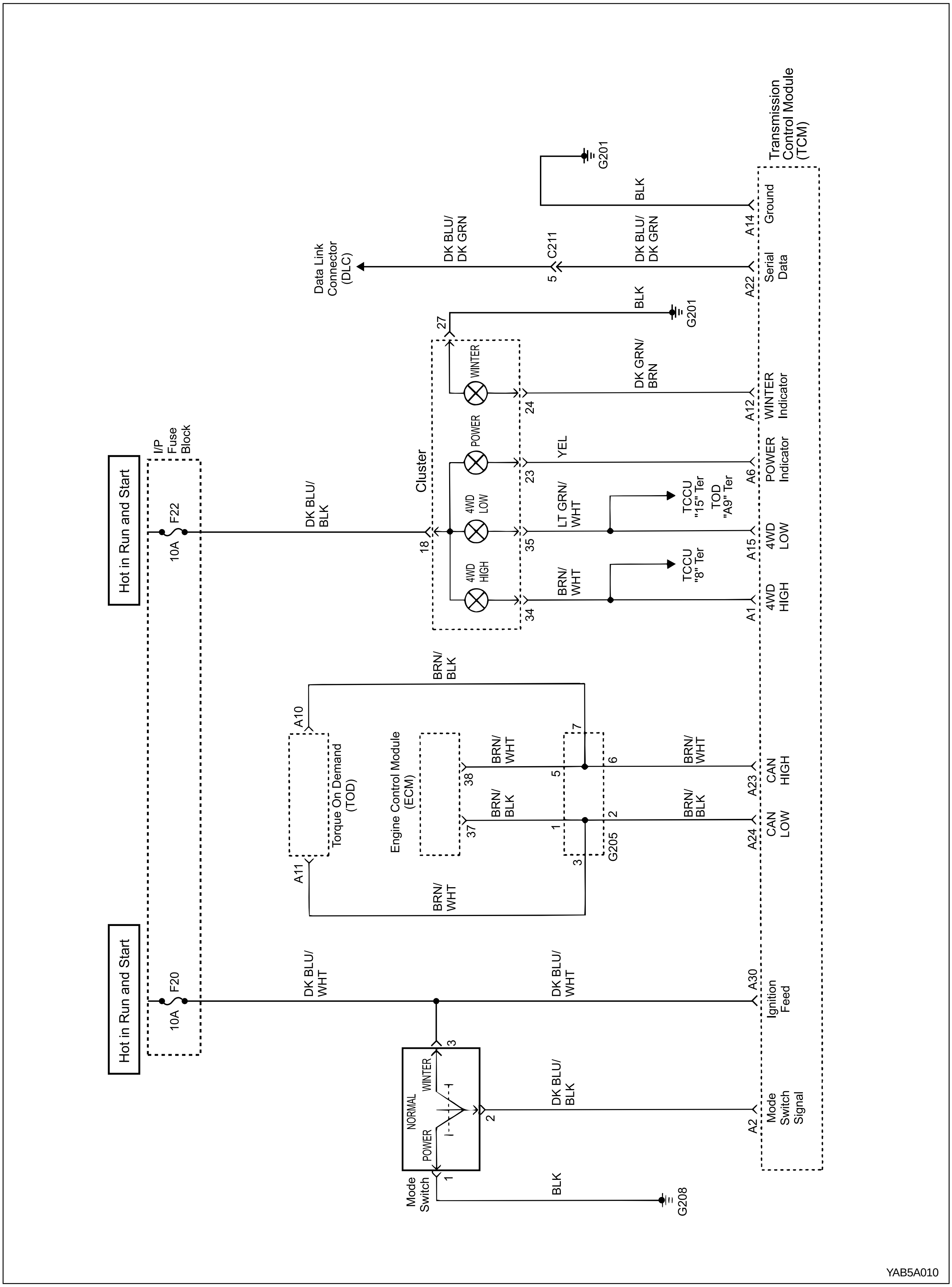
Downshift Type Max.	Speed Limitations inhibiting Downshift
Manual 2-1	61 kph (37.9 mph)
Manual 3-2	117 kph (72.7 mph)
Manual 4-3	149 kph (92.5 mph)
Manual 4-2 (4-2 direct)	64 kph (39.8 mph)
Manual 4-2 (4-3-2 sequence)	117 kph (72.7 mph)

FASTENER TIGHTENING SPECIFICATIONS

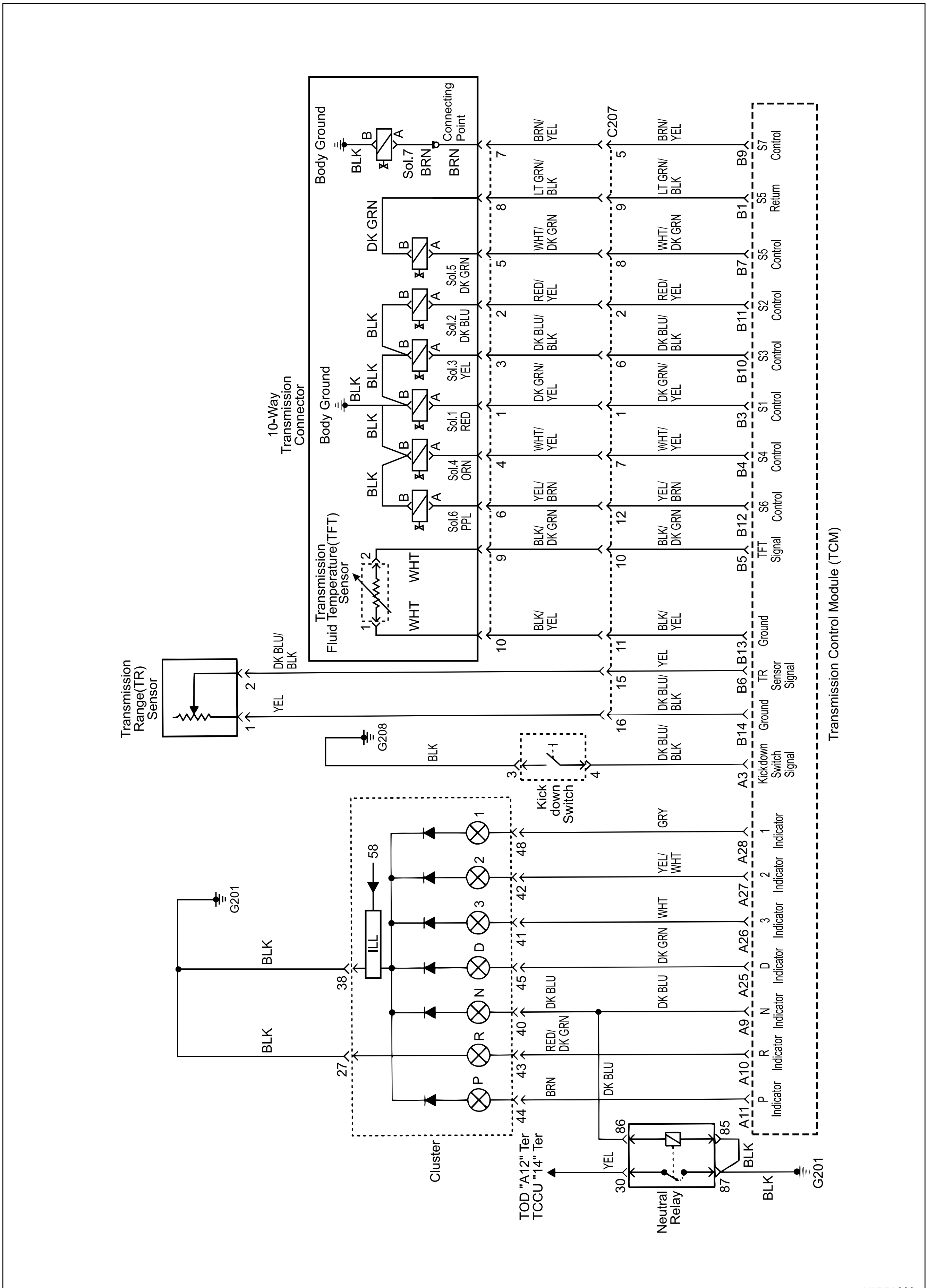
Application	N•m	Lb-Ft	Lb-In
Adaptor Housing to Case Bolts	30 - 35	22 - 26	-
Cam Plate to Case (Parking Pawl) Screws	16 - 22	12 - 16	-
Centre Support to Case Bolts	20 - 27	15 - 20	-
Detent Spring Screw	20 - 22	15 - 16	-
Front Propeller Shaft Bolts	70 - 80	52 - 59	-
Inhibitor Switch to Case Bolts	4 - 6	-	35 - 53
Oil Cooler Pipes	40 - 45	29 - 33	-
Oil Pan to Case Bolts	4 - 6	-	35 - 53
On/Off Solenoid Retainer Screws	8 - 12	-	71 - 106
Output Flange Nuts	35	26	-
Pump Cover Plate to Crescent Screw	13 - 16	10 - 12	-
Pump Cover Plate to Pump Cover Screws	13 - 16	10 - 12	-
Pump Cover to Case Bolts	24 - 34	18 - 25	-
Pump to Pump Cover Bolts	24 - 27	18 - 20	-
Rear Propeller Shaft Bolts	70 - 80	52 - 59	-
Rear Servo Cover to Case Bolts	30 - 35	22 - 26	-
Torque Converter Housing to Case Bolts	54 - 68	40 - 50	-
Torque Converter Mounting Bolts	42	31	-
Transfer Case to Transmission Housing Bolts	35 - 60	26 - 44	-
Transmission Filler Plug	30 - 35	22 - 26	-
Extension Housing to Case Bolts	54 - 68	40 - 50	-
Upper Valve Body to Lower Valve Body Screws	11 - 16	8 - 12	-
Valve Body To Case Bolts	8 - 13	-	71 - 115
Variable Pressure Solenoid (S5) Retainer Screw	8 - 12	-	71 - 106

SCHEMATIC AND ROUTING DIAGRAMS

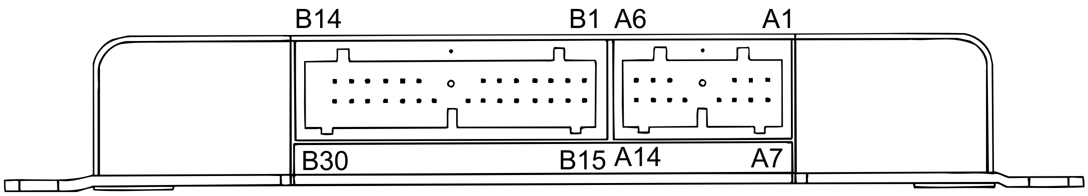
TCM WIRING DIAGRAM (1 OF 2)



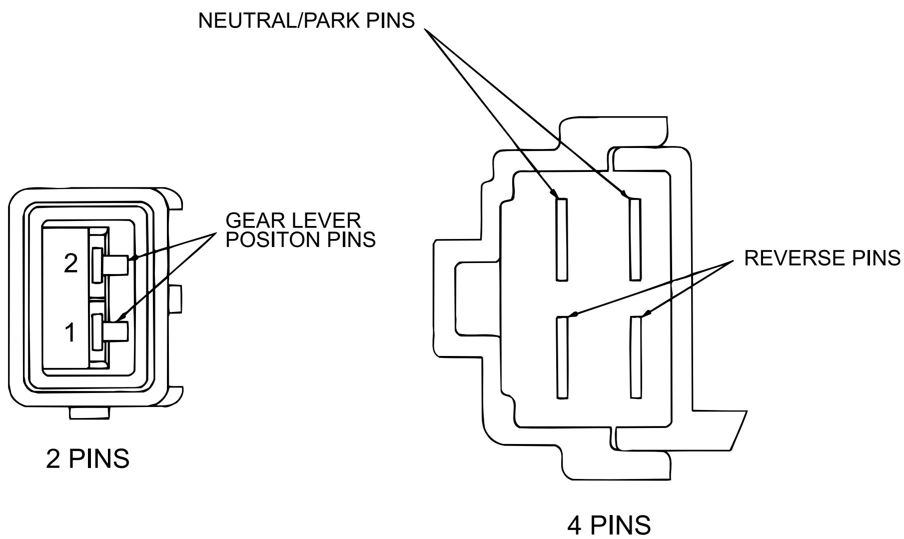
TCM WIRING DIAGRAM (2 OF 2)



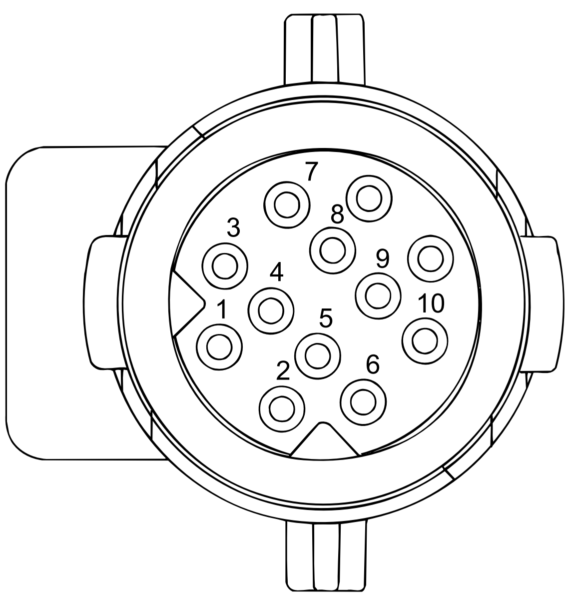
CONNECTOR END VIEW



Transmission Control Module (TCM) Pin Numbers



Inhibitor Switch Pins

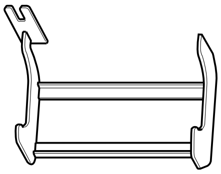
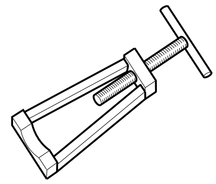
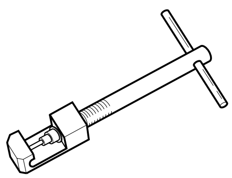
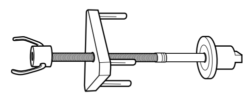
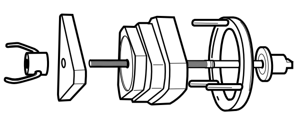
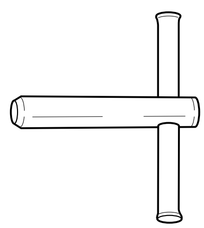
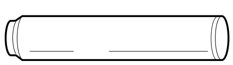
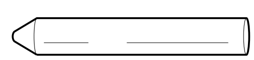


10-Way Transmission Connector

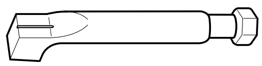
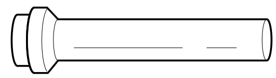
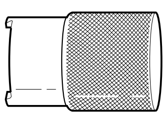
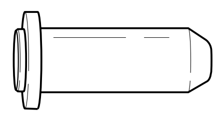
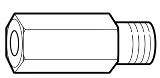
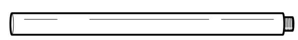
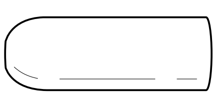
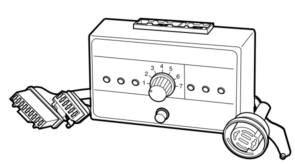
KAA5A5O0

SPECIAL TOOLS AND EQUIPMENT

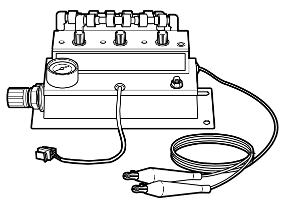
SPECIAL TOOLS TABLE

 KAA5A2P0	**0555 - 336256 Transmission Bench Cradle**	 KAA5A2Q0	**0555 - 336257 Pump Puller**
 KAA5A2R0	**0555 - 336258 Cross Shaft Pin Remover / Installer (Detent Lever)**	 KAA5A2S0	**0555 - 336259 Clutch Spring Compressor**
 KAA5A2T0	**0555 - 336260 Clutch Pack Clearance Kit**	 KAA5A2U0	**0555 - 336261 Cross Shaft Seal Remover**
 KAA5A2V0	**0555 - 336262 Cross Shaft Seal Installer**	 KAA5A2W0	**0555 - 336263 Cross Shaft Bullet**

SPECIAL TOOLS TABLE (Cont'd)

 KAA5A2X0	**0555 - 336265 Cross Shaft Pin Remover / Installer (Inhibitor Switch)**	 KAA5A2Y0	**0555 - 336266 Adaptor Housing Seal Installer**
 KAA5A2Z0	**0555 - 336267 Pump Alignment Tool**	 KAA5A3A0	**0555 - 336268 Pump Seal Installer**
 KAA5A3B0	**0555 - 336269 End Float Measuring Adaptor**	 KAA5A3C0	**0555 - 336270 End Float Measuring Shaft**
 KAA5A3D0	**0555 - 336302 Output Shaft Bullet**	 KAC5A050	**0555 - 336045 Solenoid Bench Tester**

SPECIAL TOOLS TABLE (Cont'd)

 KAC5A060	**0555 - 332083 Solenoid /Thermistor Electronic Tester**

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