RODEO

CONTROL SYSTEM

RODEO 2.2L ENGINE DRIVEABILITY AND EMISSIONS

CONTENTS

SPECIFICATIONS 6E1–6
DIAGRAMS AND SCHEMATICS 6E1–7
PCM PINOUTS 6E1–20
COMPONENT LOCATOR 6E1–26
Undercarriage Component Locator Table . 6E1–28
Fuse And Relay Panel (Underhood Electrical Center) 6E1–29
DIAGNOSIS Strategy–Based Diagnostics .. 6E1–30
Strategy–Based Diagnostics 6E1–30
DTC Stored 6E1–30
No DTC 6E1–30
No Matching Symptom 6E1–30
Intermittents 6E1–30
No Trouble Found 6E1–30
Verifying Vehicle Repair 6E1–30
GENERAL SERVICE INFORMATION 6E1–31
OBD II Serviceability Issues 6E1–31
Emissions Control Information Label 6E1–31
Maintenance Schedule 6E1–32
Visual/Physical Engine Compartment Inspection 6E1–32
Basic Knowledge Of Tools Required 6E1–32
SERIAL DATA COMMUNICATIONS 6E1–32
Class II Serial Data Communications 6E1–32
ON–BOARD DIAGNOSTIC (OBD II) 6E1–32
On–Board Diagnostic Tests 6E1–32
Comprehensive Component Monitor Diagnostic Operation 6E1–32
System Status And Drive Cycle For Satisfying Federal Inspection/Maintenance (I/M 240) Regulations 6E1–33
Common OBD II Terms 6E1–33
The Diagnostic Executive 6E1–34
DTC Types 6E1–35
Decimal/Binary/Hexadecimal Conversions 6E1–36
Verifying Vehicle Repair 6E1–36
Reading Diagnostic Trouble Codes Using A Tech 2 Scan Tool 6E1–36
Tech 2 Features 6E1–38
Getting Started 6E1–38
Operating Procedure (Example) 6E1–39
DTC Modes 6E1–40
DTC Information Mode 6E1–40
Miscellaneous Test 6E1–41
Lamps Test 6E1–41
Relays Test 6E1–42
EVAP Test 6E1–44
Idle Air Control System Test 6E1–45
Fuel System Test 6E1–47
EGR Control Test 6E1–48
Injector Balance Test 6E1–49
Plotting Snapshot Graph 6E1–50
System Check at Tech 2 ..... 6E1–51
General Description 6E1–51
Plotting Graph Flow Chart (Plotting graph after obtaining vehicle information) 6E1–55
Flow Chart for Snapshot Replay (Plotting Graph) 6E1–56
PRIMARY SYSTEM–BASED DIAGNOSTICS 6E1–57
Primary System–Based Diagnostics 6E1–57
Fuel Control Heated Oxygen Sensors ... 6E1–57
HO2S Heater 6E1–57
Catalyst Monitor Heated Oxygen Sensors And Diagnostic Operation 6E1–57
MISFIRE MONITOR DIAGNOSTIC OPERATION 6E1–58
Misfire Monitor Diagnostic Operation 6E1–58
Misfire Counters 6E1–58
FUEL TRIM SYSTEM MONITOR DIAGNOSTIC OPERATION 6E1–59
Fuel Trim System Monitor Diagnostic Operation 6E1–59
Fuel Trim Cell Diagnostic Weights 6E1–59
ON–BOARD DIAGNOSTIC (OBD II) SYSTEM CHECK 6E1–60
A/C CLUTCH CONTROL CIRCUIT DIAGNOSIS 6E1–63
ELECTRONIC IGNITION SYSTEM DIAGNOSIS 6E1–66
EVAP CANISTER PURGE SOLENOID 6E1–66
VISUAL CHECK OF THE EVAPORATIVE EMISSION CANISTER 6E1–66
IDLE AIR CONTROL (IAC) VALVE 6E1–66
FUEL SYSTEM PRESSURE TEST 6E1–66
FUEL METERING SYSTEM CHECK 6E1–67
FUEL INJECTOR COIL TEST PROCEDURE AND FUEL INJECTOR BALANCE TEST PROCEDURE 6E1–67
POWERTRAIN CONTROL MODULE (PCM) DIAGNOSIS 6E1–72
MULTIPLE PCM INFORMATION SENSOR DTCs SET 6E1–73
EXHAUST GAS RECIRCULATION (EGR) DIAGNOSIS 6E1–76

ENGINE Tech 2 DATA DEFINITIONS AND RANGES 6E1–76
TYPICAL SCAN DATA VALUES 6E1–79
NO MALFUNCTION INDICATOR LAMP (MIL) 6E1–83
MALFUNCTION INDICATOR LAMP (MIL) ON STEADY 6E1–86
ENGINE CRANKS BUT WILL NOT RUN ... 6E1–88
FUEL SYSTEM ELECTRICAL TEST 6E1–94
FUEL SYSTEM DIAGNOSIS 6E1–97
IDLE AIR CONTROL (IAC) SYSTEM CHECK 6E1–102
EXHAUST GAS RECIRCULATION (EGR) SYSTEM CHECK 6E1–105
MANIFOLD ABSOLUTE PRESSURE (MAP) OUTPUT CHECK 6E1–107
EVAPORATIVE (EVAP) EMISSIONS CANISTER PURGE VALVE SOLENOID CHECK 6E1–109
Upshift Lamp System Check (Manual Transmission Only) 6E1–112
PCM DIAGNOSTIC TROUBLE CODES 6E1–115
DTC P0106 MANIFOLD ABSOLUTE PRESSURE (MAP) CIRCUIT/RANGE PERFORMANCE PROBLEM 6E1–118
DTC P0107 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT LOW INPUT 6E1–121
DTC P0108 MANIFOLD ABSOLUTE PRESSURE (MAP) CIRCUIT HIGH INPUT 6E1–124
DTC P0112 INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT LOW INPUT 6E1–127
DTC P0113 INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT HIGH INPUT 6E1–130
DTC P0117 ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT LOW INPUT 6E1–133
DTC P0118 ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT HIGH INPUT 6E1–136
DTC P0121 THROTTLE POSITION (TP) SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM 6E1–139
DTC P0122 THROTTLE POSITION (TP) SENSOR CIRCUITLOW INPUT 6E1–142
DTC P0123 THROTTLE POSITION (TP) SENSOR CIRCUIT HIGH INPUT 6E1–145
DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL 6E1–148
DTC P0128 Thermostat Insufficient temperrature for Stable Opreation 6E1–151
DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1) 6E1–153
DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1) 6E1–156
DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1) 6E1–159
DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1) 6E1–162
DTC P0135 O2 SENSOR HEATER CIRCUIT MALFUNCTION (BANK 1 SENSOR 1) 6E1–165
DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2) 6E1–168
DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2) 6E1–171
DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2) 6E1–174
DTC P0141 O2 SENSOR HEATER CIRCUIT MALFUNCTION (BANK 1 SENSOR 2) 6E1–177
DTC P0171 SYSTEM TOO LEAN (BANK 1) 6E1–180
DTC P0172 SYSTEM TOO RICH (BANK 1) 6E1–184
DTC P0201 INJECTOR CIRCUIT MALFUNCTION – CYLINDER 1 ..... 6E1–188
DTC P0202 INJECTOR CIRCUIT MALFUNCTION – CYLINDER 2 ..... 6E1–191
DTC P0203 INJECTOR CIRCUIT MALFUNCTION – CYLINDER 3 ..... 6E1–194
DTC P0204 INJECTOR CIRCUIT MALFUNCTION – CYLINDER 4 ..... 6E1–197
DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED 6E1–200
DTC P0301 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED 6E1–204
DTC P0302 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED 6E1–208
DTC P0303 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED 6E1–212
DTC P0304 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED 6E1–216
DTC P0325 KNOCK SENSOR (KS) CIRCUIT MALFUNCTION 6E1–220
DTC P0327 KNOCK SENSOR (KS) CIRCUIT LOW INPUT 6E1–223
DTC P0336 CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT RANGE/PERFORMANCE 6E1–226
DTC P0337 CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT LOW INPUT 6E1–228
DTC P0341 CAMSHAFT POSITION (CMP) SENSOR CIRCUIT RANGE/PERFORMANCE 6E1–231
DTC P0342 CAMSHAFT POSITION (CMP) SENSOR CIRCUIT LOW INPUT 6E1–234
DTC P0351 IGNITION COIL ”A” PRIMARY/SECONDARY CIRCUIT MALFUNCTION 6E1–237

DTC P0352 IGNITION COIL "B" PRIMARY/SECONDARY CIRCUIT MALFUNCTION 6E1–239
DTC P0401 EXHAUST GAS RECIRCULATION (EGR) FLOW INSUFFICIENT DETECTED . 6E1–241
DTC P0402 EXHAUST GAS RECIRCULATION (EGR) EXCESSIVE FLOW DETECTED . . . 6E1–244
DTC P0404 EXHAUST GAS RECIRCULATION (EGR) CIRCUIT RANGE/PERFORMANCE 6E1–246
DTC P0405 EXHAUST GAS RECIRCULATION (EGR) SENSOR CIRCUIT LOW 6E1–250
DTC P0406 EXHAUST GAS RECIRCULATION (EGR) SENSOR CIRCUIT HIGH 6E1–253
DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD 6E1–257
DTC P0440 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM MALFUNCTION 6E1–260
DTC P0442 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM SMALL LEAK DETECTED 6E1–265
DTC P0456 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM VERY SMALL LEAK DETECTED 6E1–269
DTC P0443 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT MALFUNCTION 6E1–273
DTC P0446 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM VENT CONTROL CIRCUIT MALFUNCTION 6E1–276
DTC P0449 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM VENT VALVE/SOLENOID CIRCUIT MALFUNCTION 6E1–280
DTC P0461 FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE 6E1–283
DTC P0462 FUEL LEVEL SENSOR CIRCUIT LOW INPUT 6E1–285
DTC P0463 FUEL LEVEL SENSOR CIRCUIT HIGH INPUT 6E1–287
DTC P0464 Fuel Level Sensor Noisy Signal 6E1–289
DTC P0480 COOLING FAN 1 CONTROL CIRCUIT MALFUNCTION 6E1–291
DTC P0481 COOLING FAN 2 CONTROL CIRCUIT MALFUNCTION 6E1–294
DTC P0502 VEHICLE SPEED SENSOR (VSS) CIRCUIT LOW INPUT 6E1–297
DTC P0506 IDLE CONTROL SYSTEM RPM LOWER THAN EXPECTED 6E1–299
DTC P0507 IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED 6E1–302
DTC P0532 A/C REFRIGERANT PRESSURE SENSOR CIRCUIT LOW INPUT 6E1–305
DTC P0533 A/C REFRIGERANT PRESSURE SENSOR CIRCUIT HIGH INPUT 6E1–308
DTC P0562 SYSTEM VOLTAGE LOW 6E1–311
DTC P0563 SYSTEM VOLTAGE HIGH 6E1–313
DTC P0601 INTERNAL CONTROL MODULE MEMORY CHECK SUM ERROR 6E1–315
DTC P1106 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE 6E1–317
DTC P1107 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE 6E1–319
DTC P1111 INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE 6E1–321
DTC P1112 INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE 6E1–324
DTC P1114 ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE 6E1–326
DTC P1115 ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE 6E1–328
DTC P1121 THROTTLE POSITION (TP) SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE 6E1–331
DTC P1122 THROTTLE POSITION (TP) SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE 6E1–333
DTC P1133 O2 SENSOR INSUFFICIENT SWITCHING (BANK 1 SENSOR 1) 6E1–335
DTC P1134 O2 SENSOR TRANSITION TIME RATIO (BANK 1 SENSOR 1) 6E1–338
DTC P1171 FUEL SYSTEM LEAN DURING ACCELERATION 6E1–341
DTC P1336 CRANKSHAFT POSITION SENSOR (CKP) SYSTEM VARIATION NOT LEARNED 6E1–344
DTC P1380 ABS ROUGH ROAD SYSTEM FAULT 6E1–347
DTC P1381 ABS ROUGH ROAD CLASS 2 SERIAL DATA FAULT 6E1–349
DTC P1404 EXHAUST GAS RECIRCULATION (EGR) CLOSED VALVE 6E1–352
DTC P1441 EVAPORATIVE EMISSION (EVAP) SYSTEM FLOW DURING NON–PURGE . . . 6E1–355
DTC P1546 A/C COMPRESSOR CLUTCH OUTPUT CIRCUIT MALFUNCTION 6E1–358
DTC P1618 Serial Peripheral Interface (SPI) PCM Interprocessor Communication Error . 6E1–361
DTC P1625 PCM Unexpected Reset 6E1–362
DTC P1627 PCM A/D CONVERSION MALFUNCTION 6E1–364
DTC P1635 5 VOLT REFERENCE VOLTAGE CIRCUIT MALFUNCTION 6E1–366
SYMPTOM DIAGNOSIS 6E1–368
DEFAULT MATRIX TABLE 6E1–391
Camshaft Position (CMP) Sensor 6E1–394
Removal Procedure 6E1–394
Installation Procedure 6E1–394

Crankshaft Position (CKP) Sensor 6E1–395
Removal Procedure 6E1–395
Installation Procedure 6E1–396
EEPROM 6E1–397
EEPROM 6E1–397
EEPROM Programming 6E1–397
Engine Coolant Temperature (ECT) Sensor . 6E1–397
Removal Procedure 6E1–397
Installation Procedure 6E1–398
Heated Oxygen Sensor (HO2S) 6E1–398
Removal Procedure 6E1–398
Inspection Procedure 6E1–398
Installation Procedure 6E1–399
Intake Air Temperature (IAT) Sensor 6E1–399
Removal Procedure 6E1–399
Installation Procedure 6E1–400
Manifold Absolute Pressure (MAP) Sensor . 6E1–400
Removal Procedure 6E1–400
Installation Procedure 6E1–400
Malfunction Indicator Lamp (MIL) 6E1–401
Malfunction Indicator Lamp (MIL) 6E1–401
Powertrain Control Module (PCM) 6E1–401
Electrostatic Discharge (ESD) Damage ... 6E1–401
Removal Procedure 6E1–401
Installation Procedure 6E1–403
Throttle Position (TP) Sensor 6E1–404
Removal Procedure 6E1–404
Function Check 6E1–404
Installation Procedure 6E1–404
Vehicle Speed Sensor (VSS) 6E1–405
Removal Procedure 6E1–405
Inspection Procedure 6E1–405
Installation Procedure 6E1–405
Air Filter 6E1–406
Removal Procedure 6E1–406
Installation Procedure 6E1–406
Idle Air Control (IAC) Valve 6E1–407
Removal Procedure 6E1–407
Cleaning and Inspection Procedure 6E1–407
Measurement Procedure 6E1–408
Installation Procedure 6E1–408
Intake Air Duct 6E1–408
Removal Procedure 6E1–408
Installation Procedure 6E1–409
Knock Sensor 6E1–410
Removal Procedure 6E1–410
Installation Procedure 6E1–410
Oil Pressure Switch 6E1–411
Removal Procedure 6E1–411
Installation Procedure 6E1–411
FUEL METERING SYSTEM Accelerator Cable Assembly 6E1–411
Removal Procedure 6E1–411
Inspection Procedure 6E1–412
Installation Procedure 6E1–412
Accelerator Cable Adjustment 6E1–413
Accelerator Pedal Replacement 6E1–413
Removal Procedure 6E1–413
Installation Procedure 6E1–413
Fuel Filler Cap 6E1–414
Fuel Filler Cap 6E1–414
Inspection Procedure 6E1–414
Fuel Filter 6E1–414
Removal Procedure 6E1–414
Inspection Procedure 6E1–415
Installation Procedure 6E1–415
Fuel Injectors 6E1–416
Removal Procedure 6E1–416
Inspection Procedure 6E1–416
Installation Procedure 6E1–416
Fuel Pressure Regulator 6E1–417
Removal Procedure 6E1–417
Installation Procedure 6E1–418
Fuel Pressure Relief Procedure 6E1–418
Fuel Pump Assembly 6E1–419
Removal Procedure 6E1–419
Inspection Procedure 6E1–420
Installation Procedure 6E1–420
Fuel Pump Relay 6E1–421
Removal Procedure 6E1–421
Installation Procedure 6E1–421
Fuel Rail Assembly 6E1–421
Removal Procedure 6E1–421
Installation Procedure 6E1–422
Fuel Tank 6E1–423
Removal Procedure 6E1–423
Installation Procedure 6E1–423
Throttle body (TB) 6E1–424
Removal Procedure 6E1–424
Inspection Procedure 6E1–424
Installation Procedure 6E1–425
ELECTRONIC IGNITION SYSTEM Ignition Control Module (ICM) 6E1–426
Removal Procedure 6E1–426
Installation Procedure 6E1–426
Ignition Coil 6E1–426
Removal Procedure 6E1–426
Installation Procedure 6E1–426
Spark Plugs 6E1–427
Removal Procedure 6E1–427
Inspection Procedure 6E1–427
Installation Procedure 6E1–428
Spark Plug Cables 6E1–428
Spark Plug Cables 6E1–428
Inspection Procedure 6E1–428
EMISSIONS Catalytic Converter 6E1–429
Catalytic Converter 6E1–429
Air Conditioning Relay 6E1–429

Removal Procedure 6E1–429
Installation Procedure 6E1–429
Ignition Timing Adjustment 6E1–429
Ignition Timing Adjustment 6E1–429
EVAP Canister Hoses 6E1–429
EVAP Canister Hoses 6E1–429
EVAP Canister 6E1–429
Removal Procedure 6E1–429
Inspection Procedure 6E1–429
Installation Procedure 6E1–429
EVAP Canister Vent Solenoid 6E1–430
Removal Procedure 6E1–430
Installation Procedure 6E1–430
EVAP Canister Purge Valve Solenoid 6E1–430
Removal Procedure 6E1–430
Installation Procedure 6E1–431
Linear Exhaust Gas Recirculation (EGR) Valve 6E1–431
Removal Procedure 6E1–431
Inspection Procedure 6E1–431
Installation Procedure 6E1–432
Wiring and Connectors 6E1–433
Wiring Harness Service 6E1–433
PCM Connectors And Terminals 6E1–433
Removal Procedure 6E1–433
Installation Procedure 6E1–433
Connectors And Terminals 6E1–433
Connectors And Terminals 6E1–433
Wire Harness Repair: Twisted Shielded Cable 6E1–433
Removal Procedure 6E1–433
Installation Procedure 6E1–434
Twisted Leads 6E1–434
Removal Procedure 6E1–434
Installation Procedure 6E1–434
Weather–Pack Connector 6E1–435
Tools Required 6E1–435
Removal Procedure 6E1–435
Installation Procedure 6E1–436
Com–Pack III 6E1–436
Com–Pack III 6E1–436
Metri–Pack 6E1–437
Tools Required 6E1–437
Removal Procedure 6E1–437
Installation Procedure 6E1–437
GENERAL DESCRIPTION — PCM AND SENSORS 6E1–437
GENERAL DESCRIPTION — AIR INDUCTION 6E1–445
GENERAL DESCRIPTION — FUEL METERING 6E1–445
GENERAL DESCRIPTION — ELECTRONIC IGNITION SYSTEM 6E1–448
A/C CLUTCH DIAGNOSIS 6E1–452
GENERAL DESCRIPTION — EVAPORATIVE EMISSION (EVAP) SYSTEM 6E1–452
GENERAL DESCRIPTION — EXHAUST GAS RECIRCULATION (EGR) SYSTEM 6E1–454
GENERAL DESCRIPTION — POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM 6E1–455
SPECIAL TOOLS 6E1–456

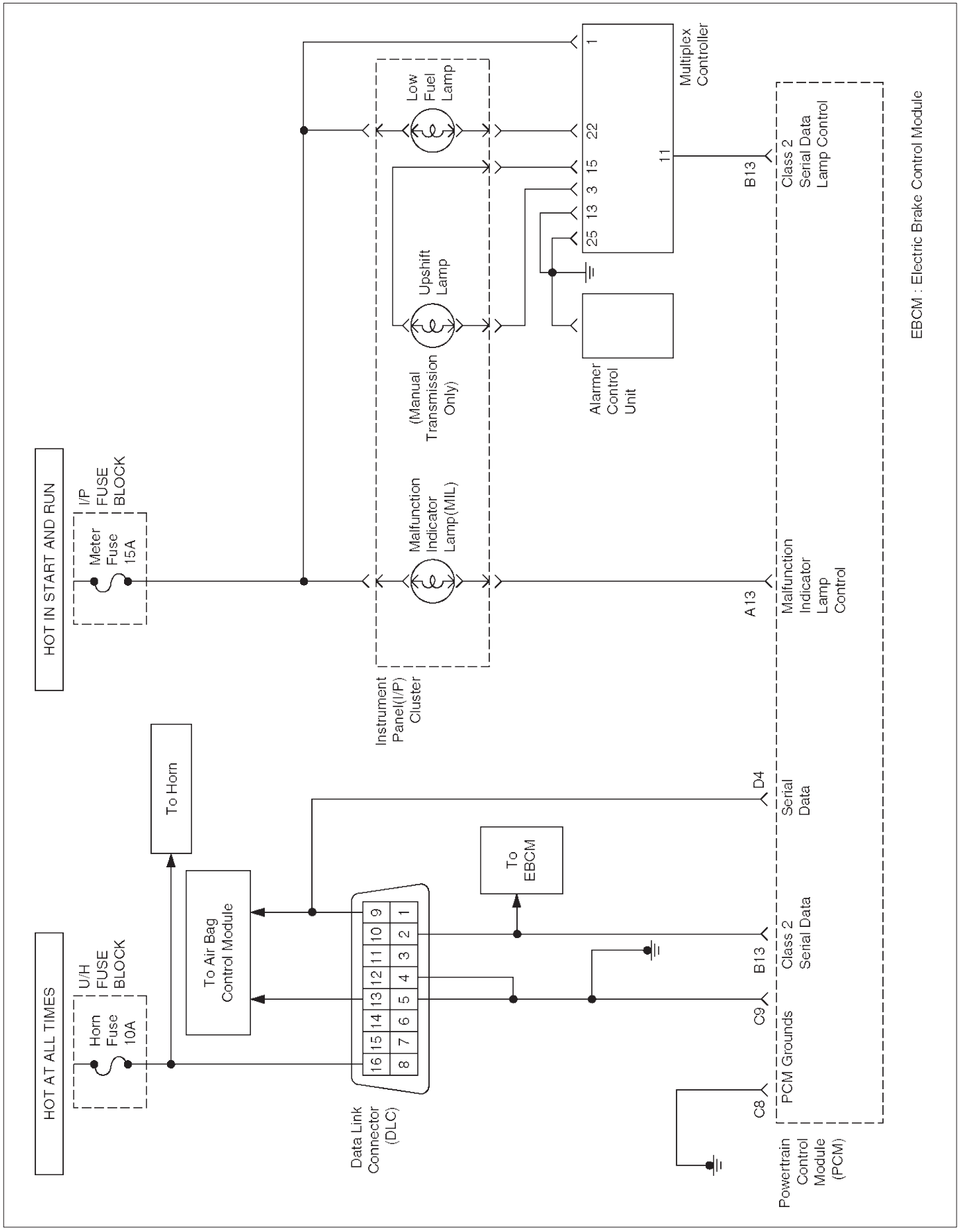
SPECIFICATIONS

TIGHTENING SPECIFICATIONS

Application	N–m	Lb Ft	Lb In
Crankshaft Position Sensor Mounting Bolt	9	—	78
EGR Nut	14	—	130
Engine Coolant Temperature Sensor	30	22	—
Fuel Drain Plug	20	14	—
Fuel Pressure Regulator Attaching Screw	6.5	—	60
Fuel Rail Bolts	7	—	75
Fuel Tank Undercover Retaining Bolts	36	27	—
Heated Oxygen Sensor	5	40	—
Spark Plugs	25	18	—
Throttle Body Mounting Bolts	13	—	120
VSS Retaining Bolt	13	—	120
Crankshaft Pulse Pick–up Sensor Disc to Crankshaft	13	—	115
Spark Plug to Cylinder Head	25	18	—

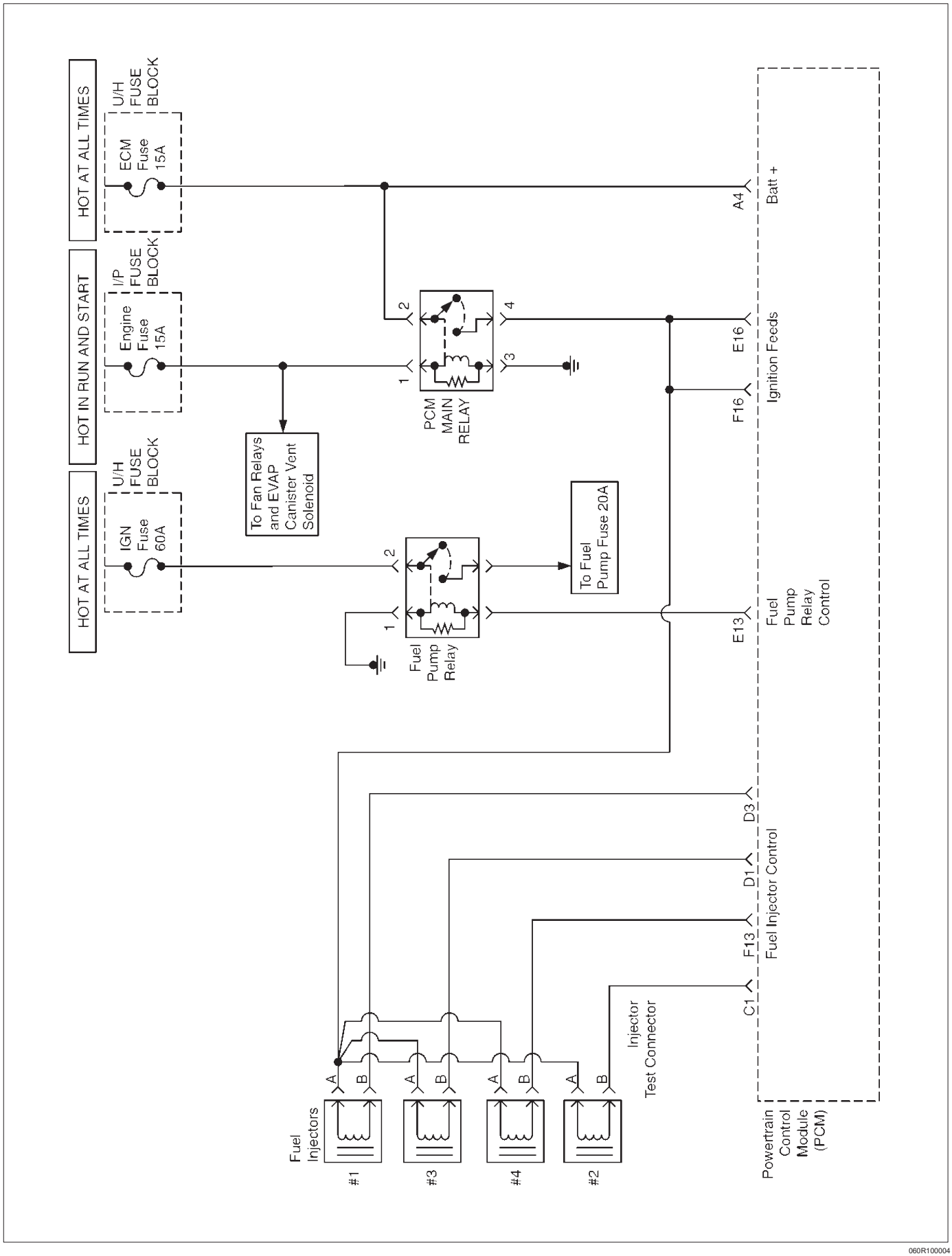
DIAGRAMS AND SCHEMATICS

PCM WIRING DIAGRAM (1 of 13)

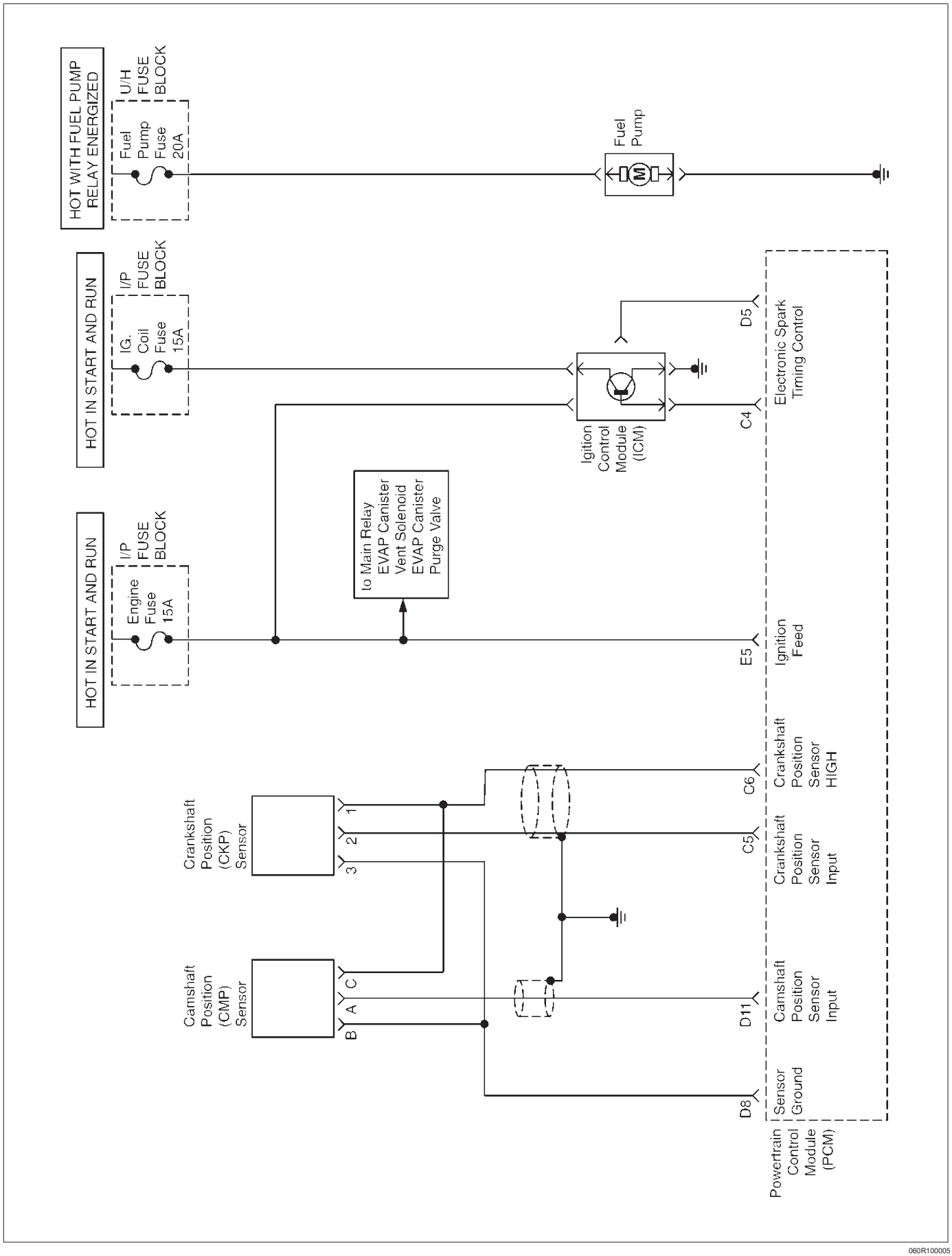


060R100090

PCM WIRING DIAGRAM (2 of 13)

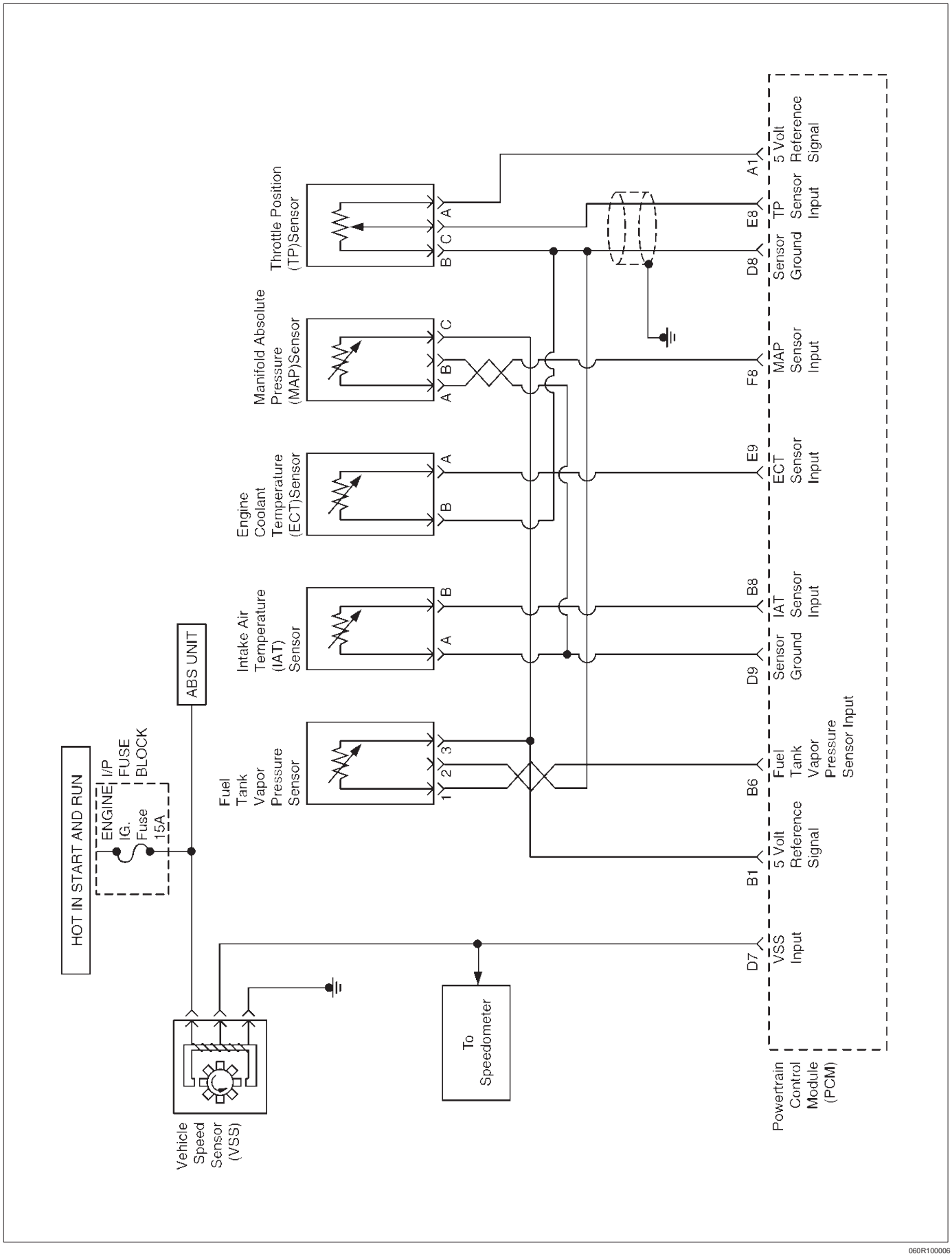


PCM WIRING DIAGRAM (3 of 13)



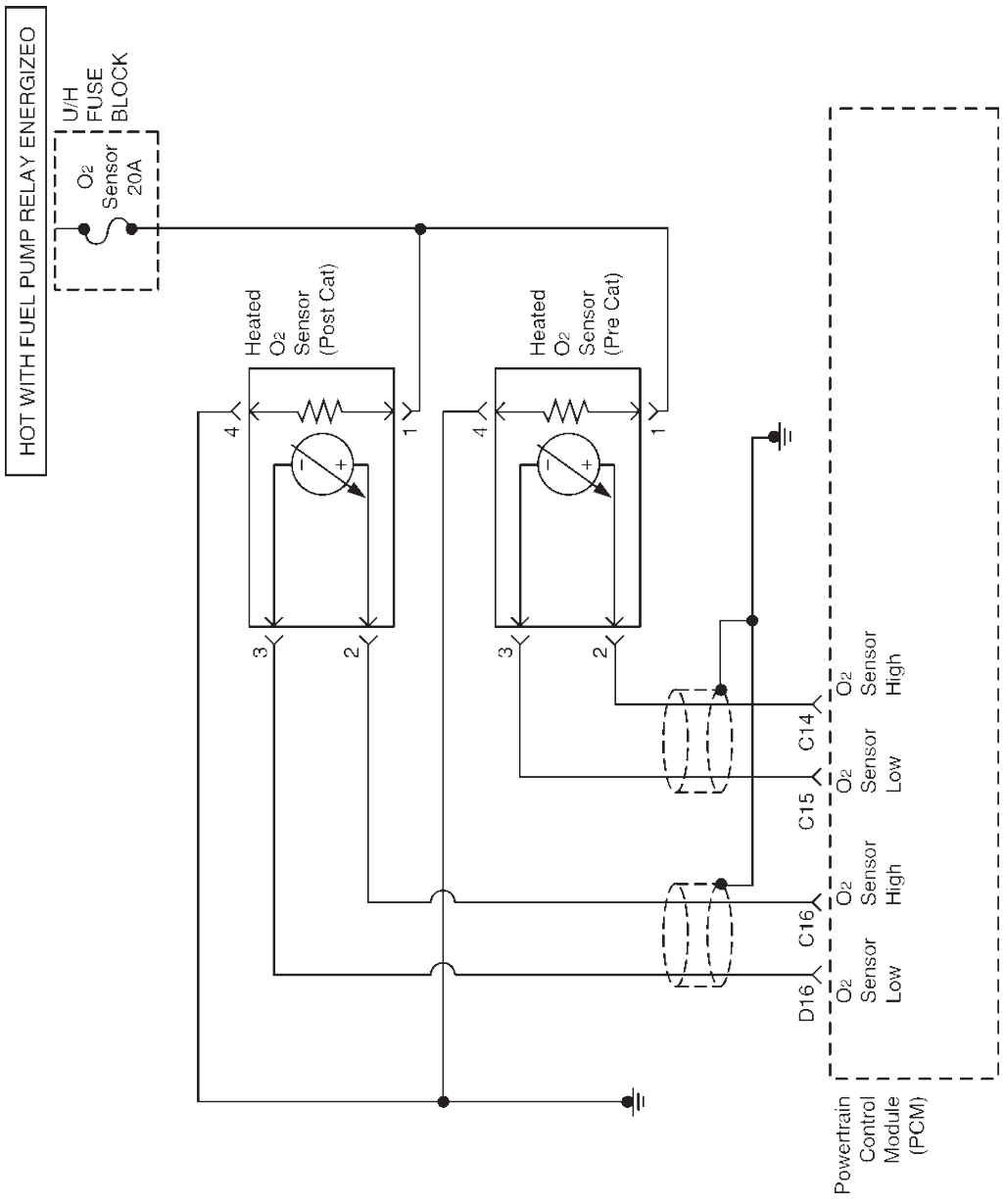
060R100005

PCM WIRING DIAGRAM (4 of 13)



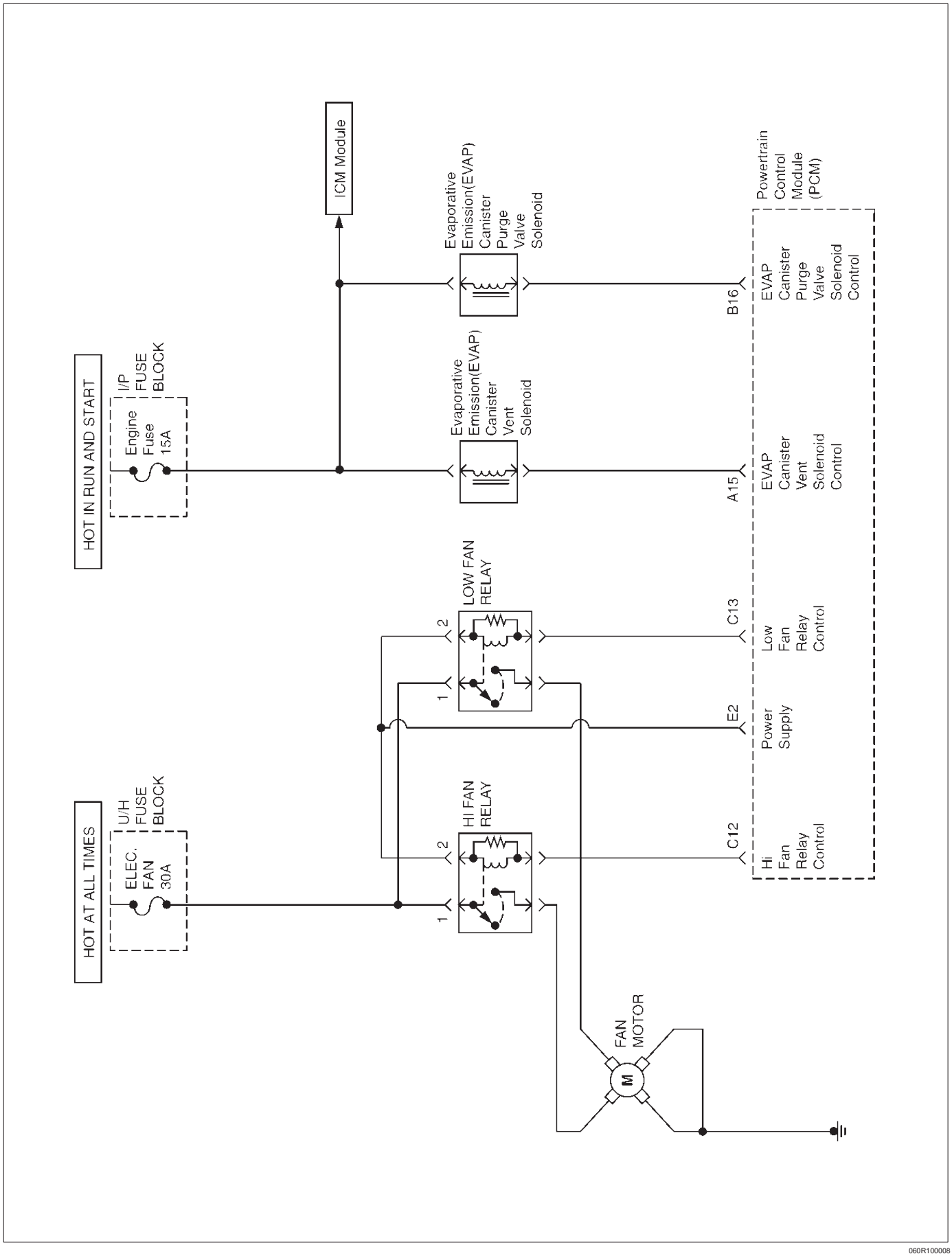
060R100006

PCM WIRING DIAGRAM (5 of 13)



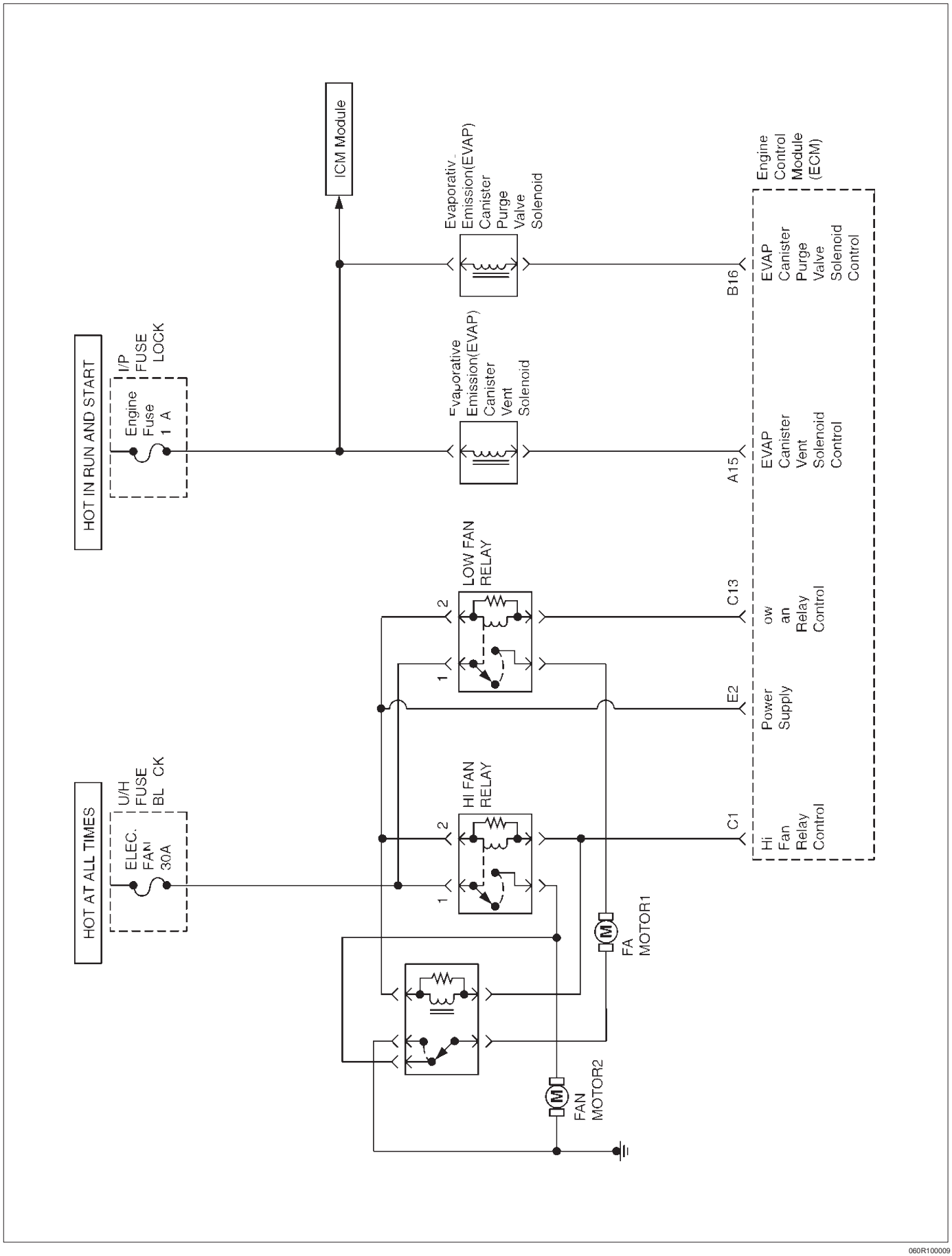
060R100007

PCM WIRING DIAGRAM (6 of 13)

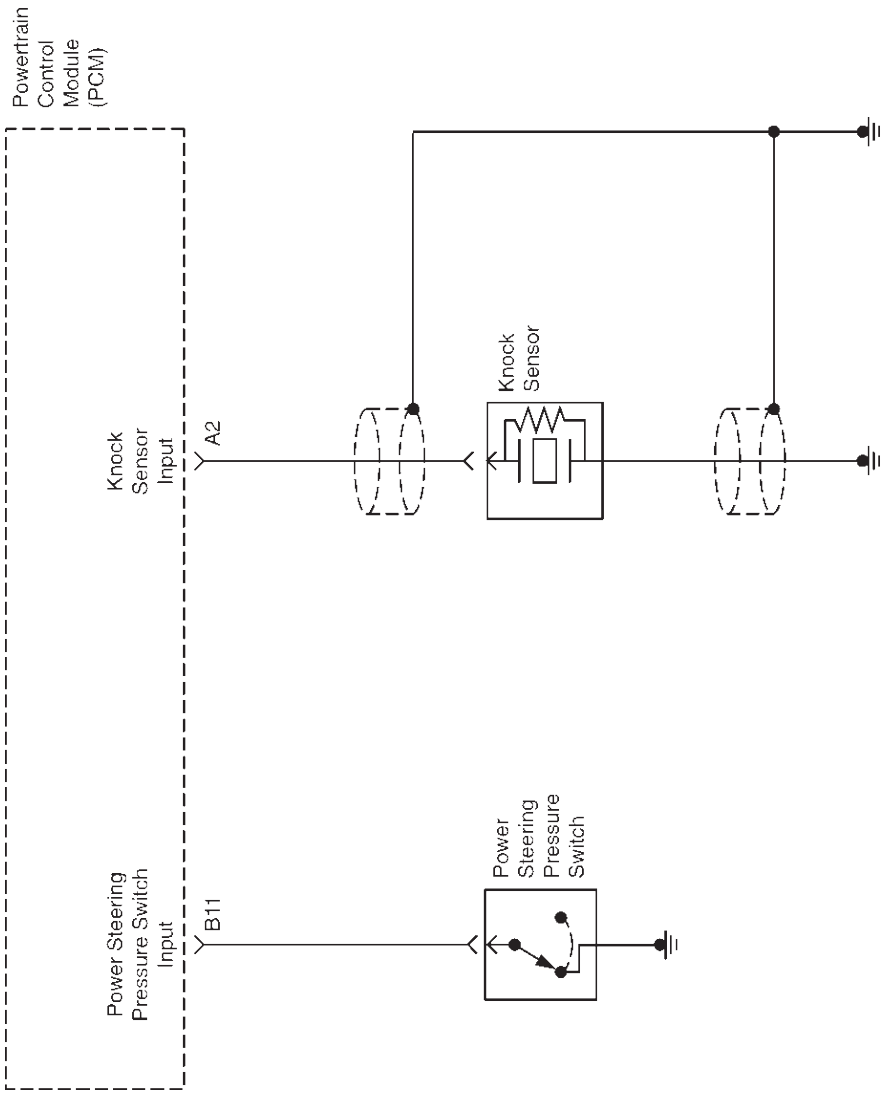


060R100008

PCM WIRING DIAGRAM (7 of 13)

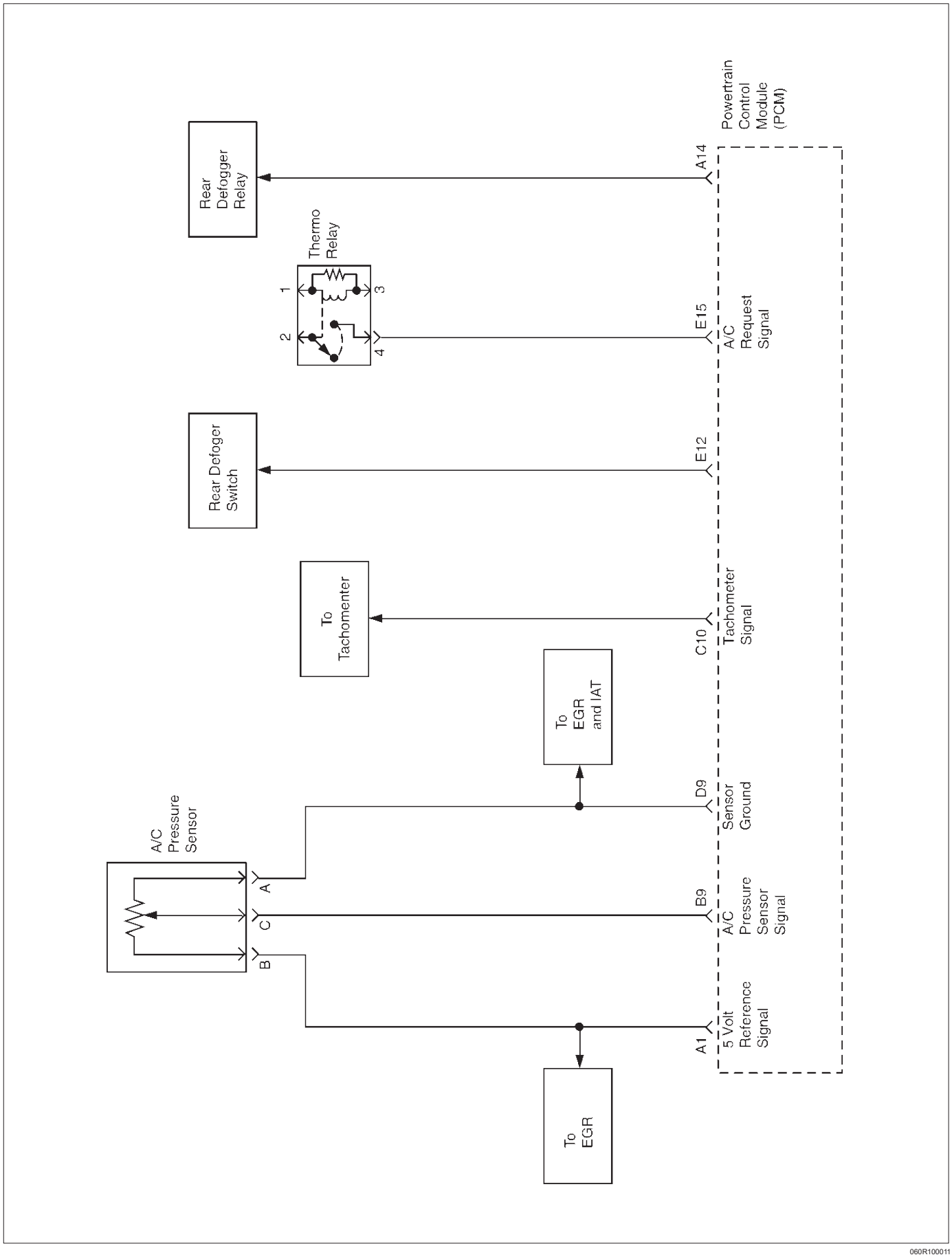


PCM WIRING DIAGRAM (8 of 13)



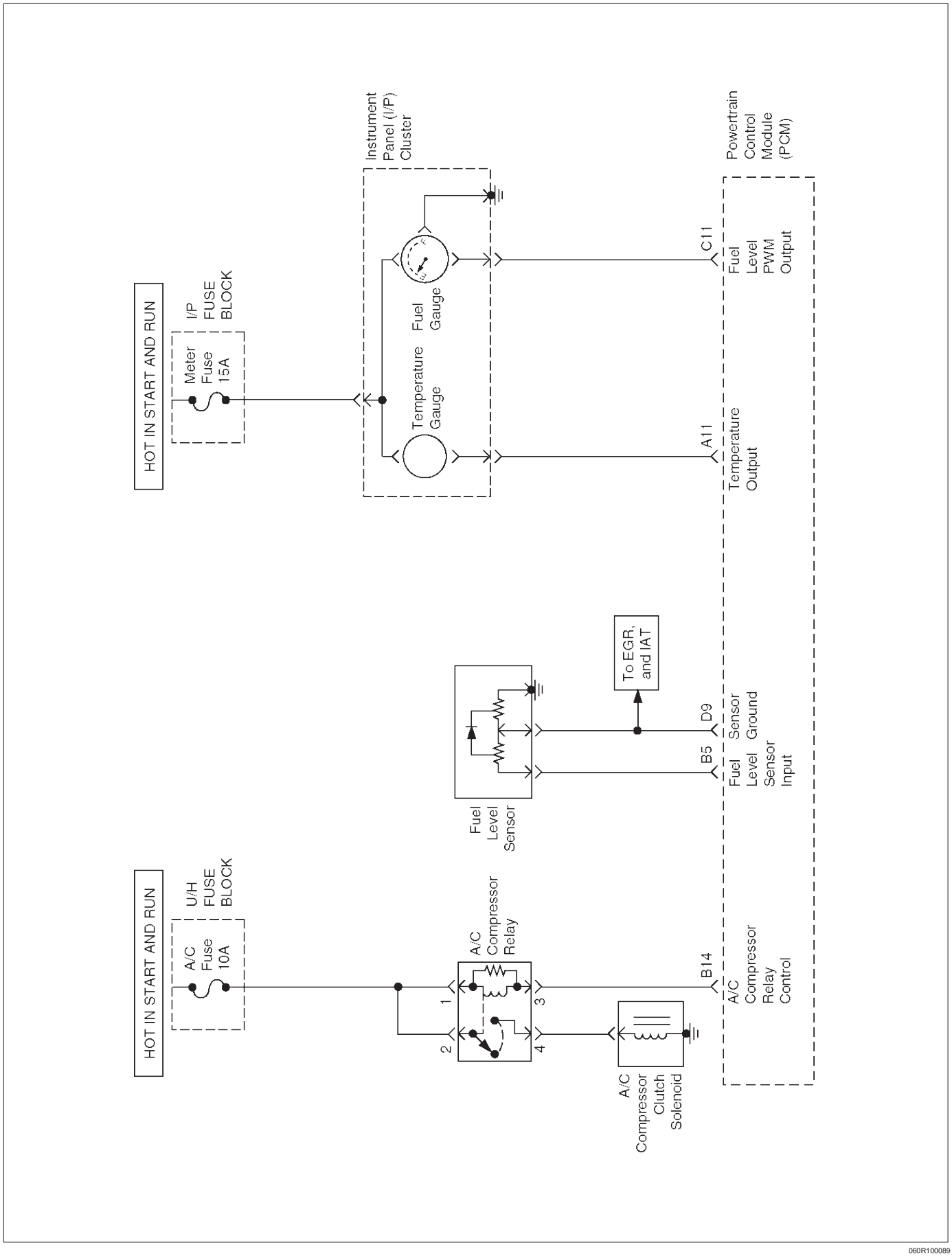
060R100010

PCM WIRING DIAGRAM (9 of 13)



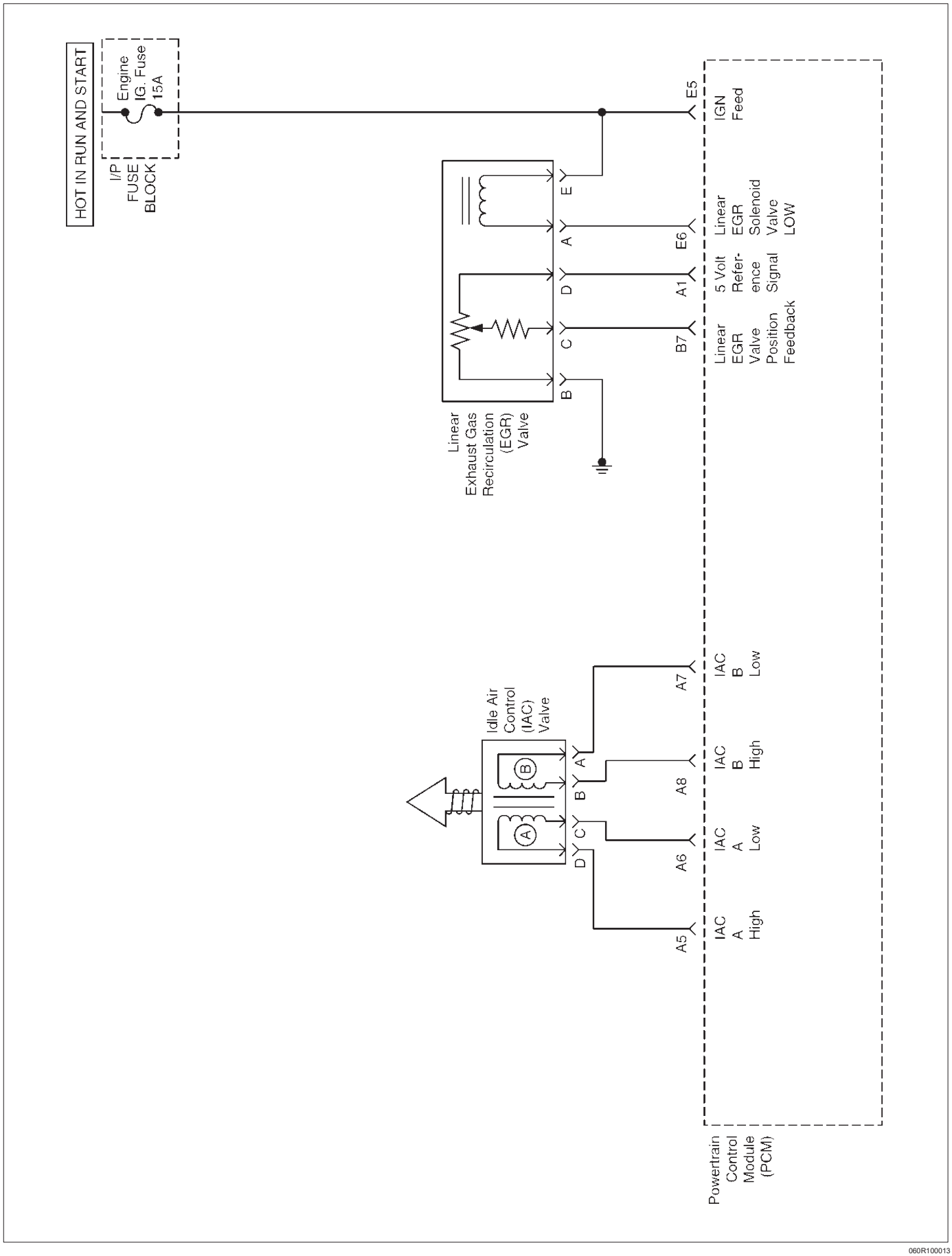
060R100011

PCM WIRING DIAGRAM (10 of 13)



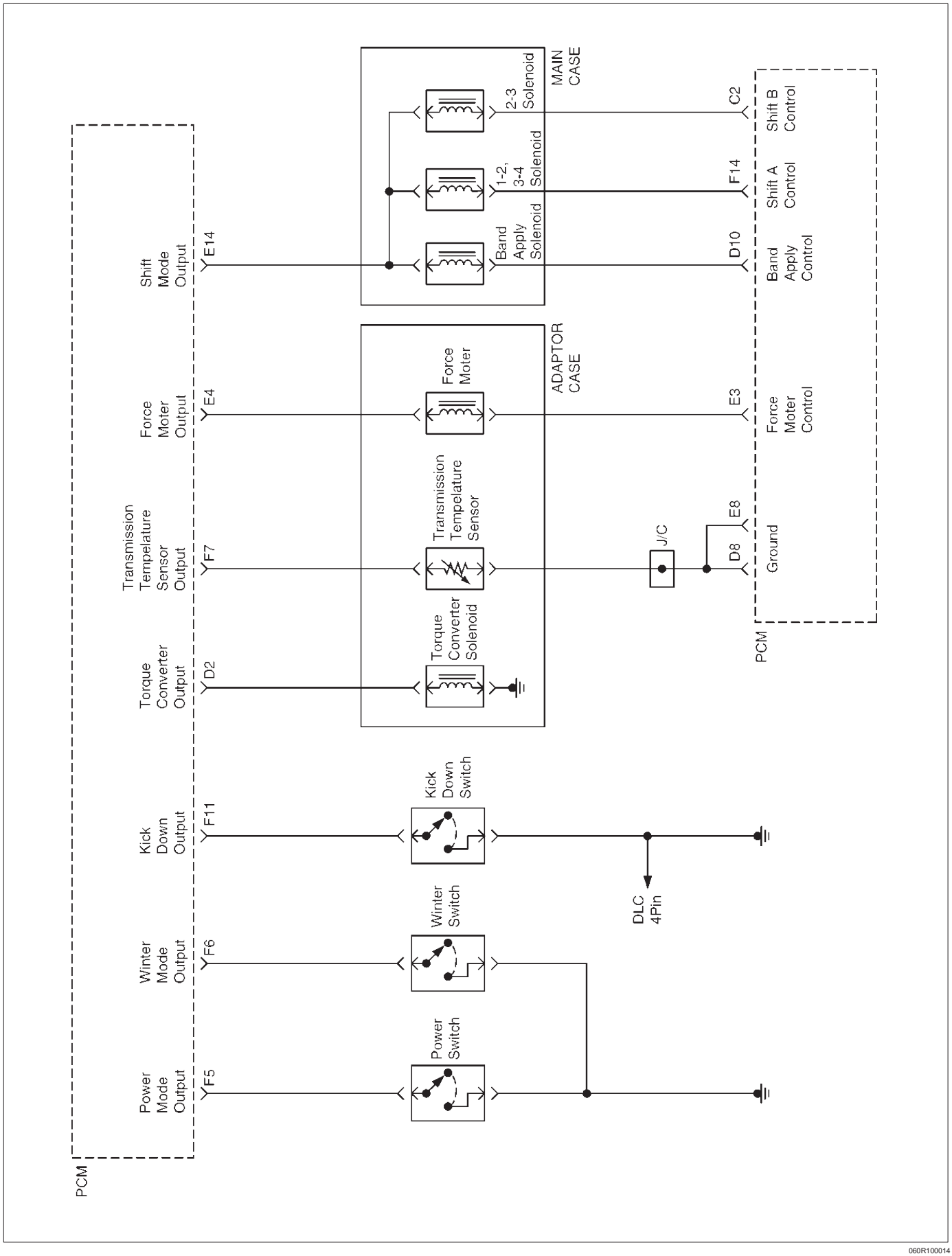
060R100089

PCM WIRING DIAGRAM (11 of 13)



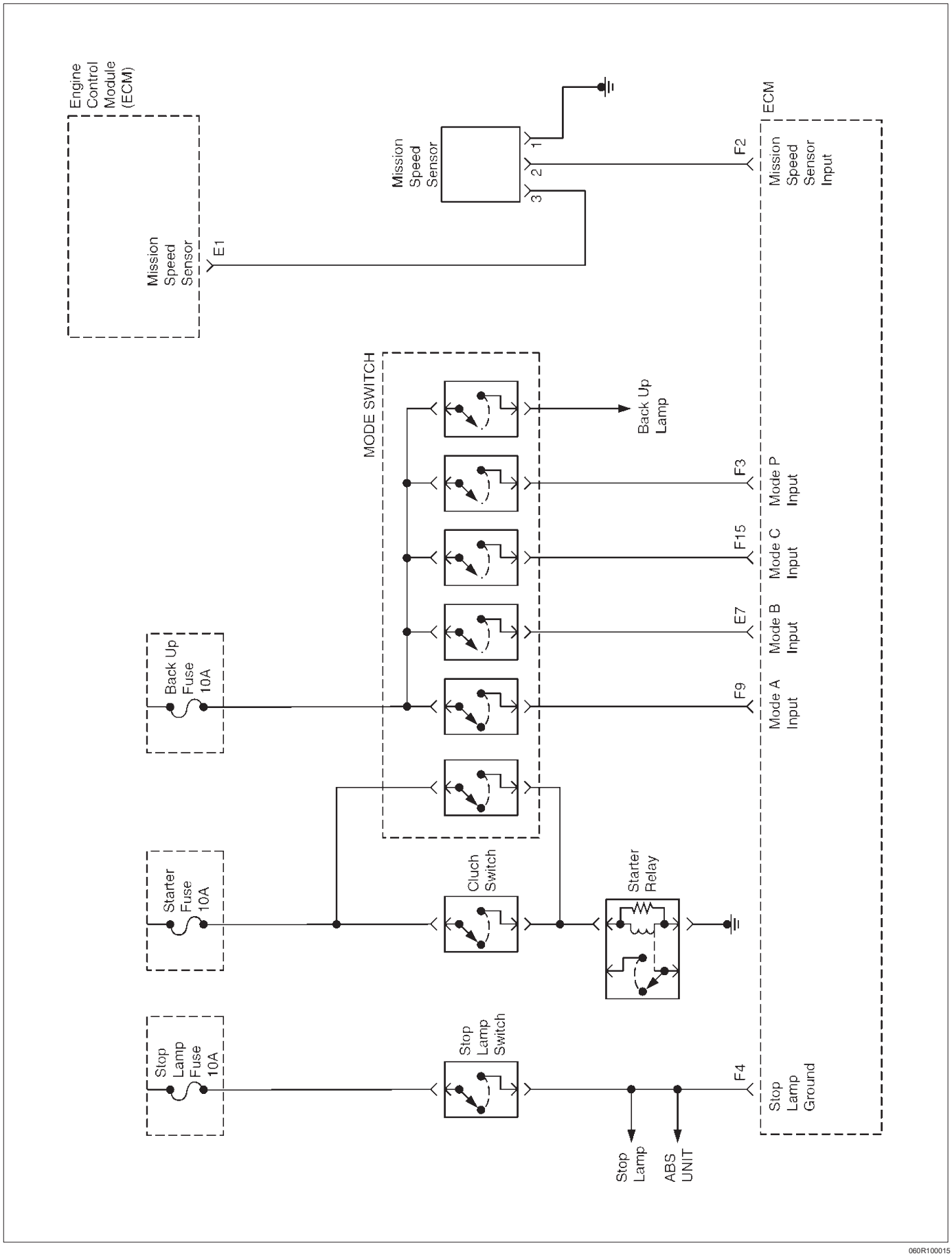
060R100013

PCM WIRING DIAGRAM (12 of 13)



060R100014

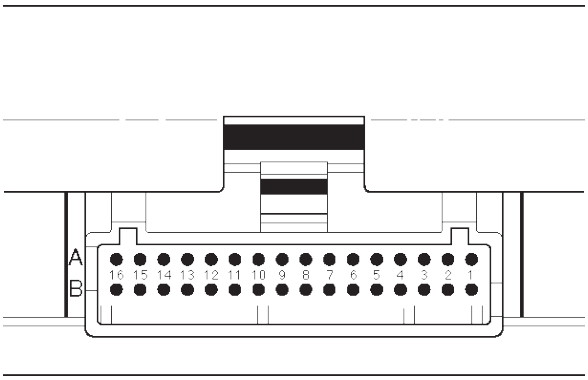
PCM WIRING DIAGRAM (13 of 13)



060R100015

PCM PINOUTS

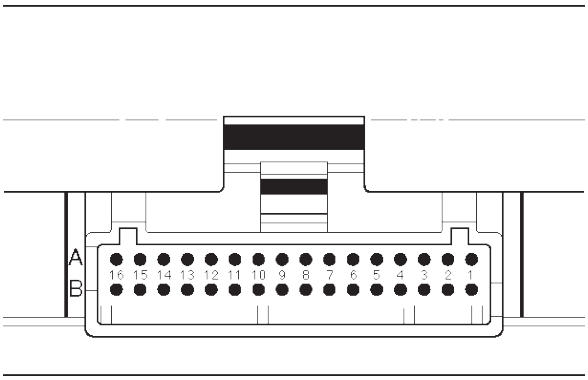
PCM Pinout Table, 32–Pin Red Connector – Row ”A”



TS23344

PIN	PIN Function	IGN ON	ENG RUN	Refer To
A1	5 Volt Reference Signal	5.0 V	5.0 V	Appropriate Sensor
A2	Knock Sensor Input	—	3.0 V (MAX)	General Description and Operation, Knock Sensor
A3	Not Used			
A4	Battery Feed	B+	B+	Chassis Electrical
A5	Idle Air Control (IAC) ”A” High	B+/0.8 V	B+/0.8 V	General Description and Operation, IAC
A6	IAC ”A” Low	B+/0.8 V	B+/0.8 V	General Description and Operation, IAC
A7	IAC ”B” Low	B+/0.8 V	B+/0.8 V	General Description and Operation, IAC
A8	IAC ”B” High	B+/0.8 V	B+/0.8 V	General Description and Operation, IAC
A9	Not Used	—	—	—
A10	Not Used	—	—	—
A11	Temperature Gage	Varies with Temperature	Varies with Temperature	General Description and Operation
A12	Low Fuel Warning Lamp Control	0.4–0.9 V	B+	Chassis Electrical
A13	Malfunction Indicator Lamp (MIL) Control	0.4–0.9 V	B+	Chassis Electrical
A14	Rear Defogger Relay	B+	B+	Classis Electrical
A15	EVAP Canister Vent Solenoid Control	B+	0–5 V (varies)	General Description and Operation, EVAP Emission Control System
A16	Not Used	—	—	—

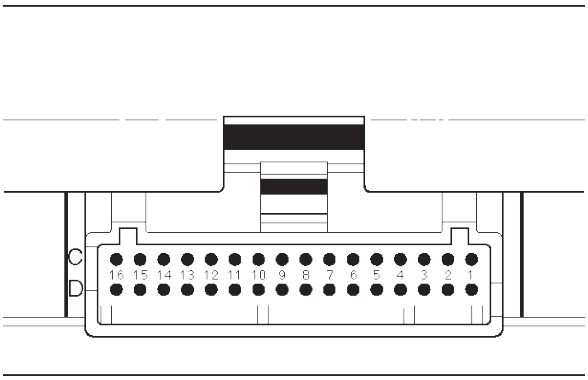
PCM Pinout Table, 32–Pin Red Connector – Row ”B”



TS23344

PIN	PIN Function	IGN ON	ENG RUN	Refer To
B1	5 Volt Reference Signal	5.0 V	5.0 V	Fuel Tank Pressure
B2	Not Used	—	—	—
B3	Not Used	—	—	—
B4	Not Used	—	—	—
B5	Fuel Tank Level Sensor	—	—	General Description and Operation, Fuel Pump
B6	Fuel Tank Pressure Sensor Input	0.2 to 4.9 V (0.5V = +5in H2O)	0.2 to 4.9 V (4.5V = –15 in H2O)	General Description and Operation, Fuel Pump
B7	Exhaust Gas Recirculation (EGR) Position Feedback	0.6 V	0.6 V	General Description and Operation, Linear EGR Control
B8	Intake Air Temperature (IAT) Sensor	~3V (0V = 151˚C {304˚F})	~3 V (5V = –40˚C {–40˚F})	General Description and Operation, IAT
B9	A/C Pressure Sensor Signal	~1 V	~1 V	A/C System
B10	Not Used	—	—	—
B11	Power Steering Pressure (PSP) Switch Input	B+	B+	General Description and Operation, PSP
B12	Not Used	B+	B+	Chassis Electrical
B13	Class 2 Data	0.0 V	0.0 V	Diagnosis, Class 2 Serial Data
B14	A/C Compressor Clutch Relay Control Compressor	0 (A/C OFF)	B+ (A/C ON)	General Description and Operation, A/C Clutch Circuit Operation
B15	Not Used	—	—	—
B16	EVAP Canister Purge Valve Solenoid	—	—	General Description and Operation, EVAP

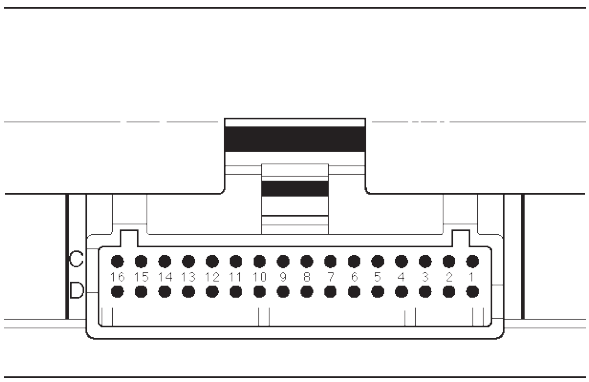
PCM Pinout Table, 32–Pin White Connector – Row ”C”



TS23345

PIN	PIN Function	IGN ON	ENG RUN	Refer To
C1	Injector Cylinder #2	B+ Varies	B+ Varies	General Description and Operation, Fuel Injector
C2	Shift Solenoid B (A/T)	—	—	—
C3	Not Used	—	—	—
C4	Ignition Control Module (ICM) Input	0.0 V	0.1 V	General Description and Operation, Fuel Injector
C5	Crankshaft Position (CKP) Sensor Low	4.98 V	0.76 V (at idle)	General Description and Operation, Crankshaft Position Sensor
C6	Crankshaft Position Sensor (CKP) High	5V	5V	General Description and Operation, Crankshaft Position Sensor
C7	PCM Ground	0.0 V	0.0 V	Chassis Electrical
C8	PCM Ground	0.0 V	0.0 V	Chassis Electrical
C9	PCM Ground	0.0 V	0.0 V	Chassis Electrical
C10	Tachometer Signal	—	—	General Description and Operation
C11	Fuel Gauge PWM Output	Varies with Fuel Level	Varies with Fuel Level	General Description and Operation
C12	High Fan Relay Control	10.5 V	B+	Chassis Electrical
C13	Low Fan Relay Control	—	—	Chassis Electrical
C14	Bank 1 HO2S 1 High	0.3 V	–0.1 to 1.1 V	General Description and Operation, Fuel HO2S 1
C15	Bank 1 HO2S 1 Low	0.0 V	0.1 V	General Description and Operation, Fuel HO2S 1
C16	Bank 1 HO2S 2 High	0.3 V	–0.1 to 1.1 V	General Description and Operation, Catalyst HO2S 2

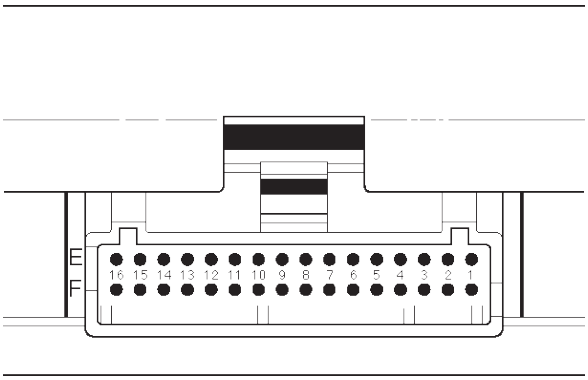
PCM Pinout Table, 32–Pin White Connector – Row ”D”



TS23345

PIN	PIN Function	IGN ON	ENG RUN	Refer To
D1	Injector Cylinder #3	B+	B+	General Description and Operation, Fuel Injector
D2	Torque Converter Solenoid (A/T)	—	—	—
D3	Injector Cylinder #1	B+	B+	General Description and Operation, Fuel Injector
D4	SDATA	—	—	Air Bag Control Module Data
D5	Ignition Control Module (ICM) Input	—	—	General Description and Operation
D6	Not Used	—	—	—
D7	VSS Input	—	—	Chassis Electrical
D8	Sensor Ground 5 V Reference A Return	0.0 V	0.0 V	Vapor Pressure, TPS
D9	Sensor Ground 5 V Reference B Return	0.0 V	0.0 V	MAT, MAP, A/C Pressure Fuel Level
D10	Not Used	—	—	—
D11	Camshaft Position Sensor Input	5.0 V	4.6 V	General Description and Operation, Camshaft Position Sensor
D12	Not Used	—	—	—
D13	Not Used	—	—	—
D14	Not Used	—	—	—
D15	Not Used	—	—	—
D16	Bank 1 HO2S 2 Low	0.0 V	0.1 V	General Description and Operation, Catalyst HO2S 2

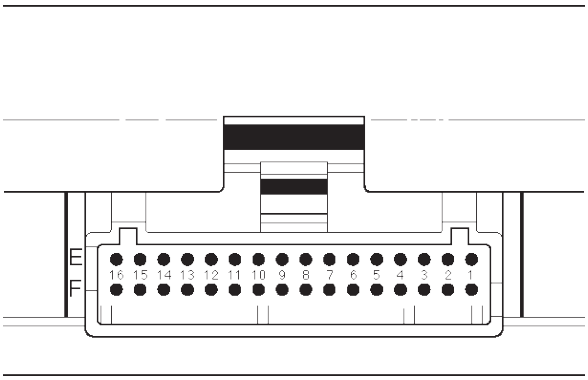
PCM Pinout Table, 32–Pin White Connector – Row ”E”



TS23346

PIN	PIN Function	IGN ON	ENG RUN	Refer To
E1	Transmission Speed Sensor Input (A/T)	—	—	—
E2	Fan Control	0.0V	B+	Chassis Electrical
E3	Force Moter (A/T) High	—	—	—
E4	Force Moter (A/T) Low	—	—	—
E5	Ignition Feed	B+	B+	General Description and Operation
E6	Exhaust Gas Recirculation (EGR) Valve Low	B+ Varies	B+ Varies	General Description and Operation, EGR Control
E7	Shift Mode Switch (A/T)	—	—	—
E8	Throttle Position (TP) Sensor Input and Temperature Retrn	0.25 V (0% = 0.25 V)	0.25 V (at idle) (100% = 4.75 V)	General Description and Operation, Throttle Position Sensor
E9	Engine Coolant Temperature (ECT) Sensor Input	2.3 V (O V = 151˚C {304˚F})	2.1 V (5 V = –40˚C {–40˚F})	General Description and Operation, Engine Coolant Temperature (ECT) Sensor
E10	Not Used	—	—	—
E11	Not Used	—	—	—
E12	Rear Defogger Switch	B+	B+	Chassis Electrical
E13	Fuel Pump (FP) Relay Control	0.0 V	B+	On–Vehicle Service, Fuel Pump Relay
E14	Shift Solenoid High (A/T)	—	—	—
E15	A/C Request (Thermo Relay)	0.0 V	0.0 V	Electric Cooling Fans
E16	Ignition Feed	B+	B+	General Description and Operation

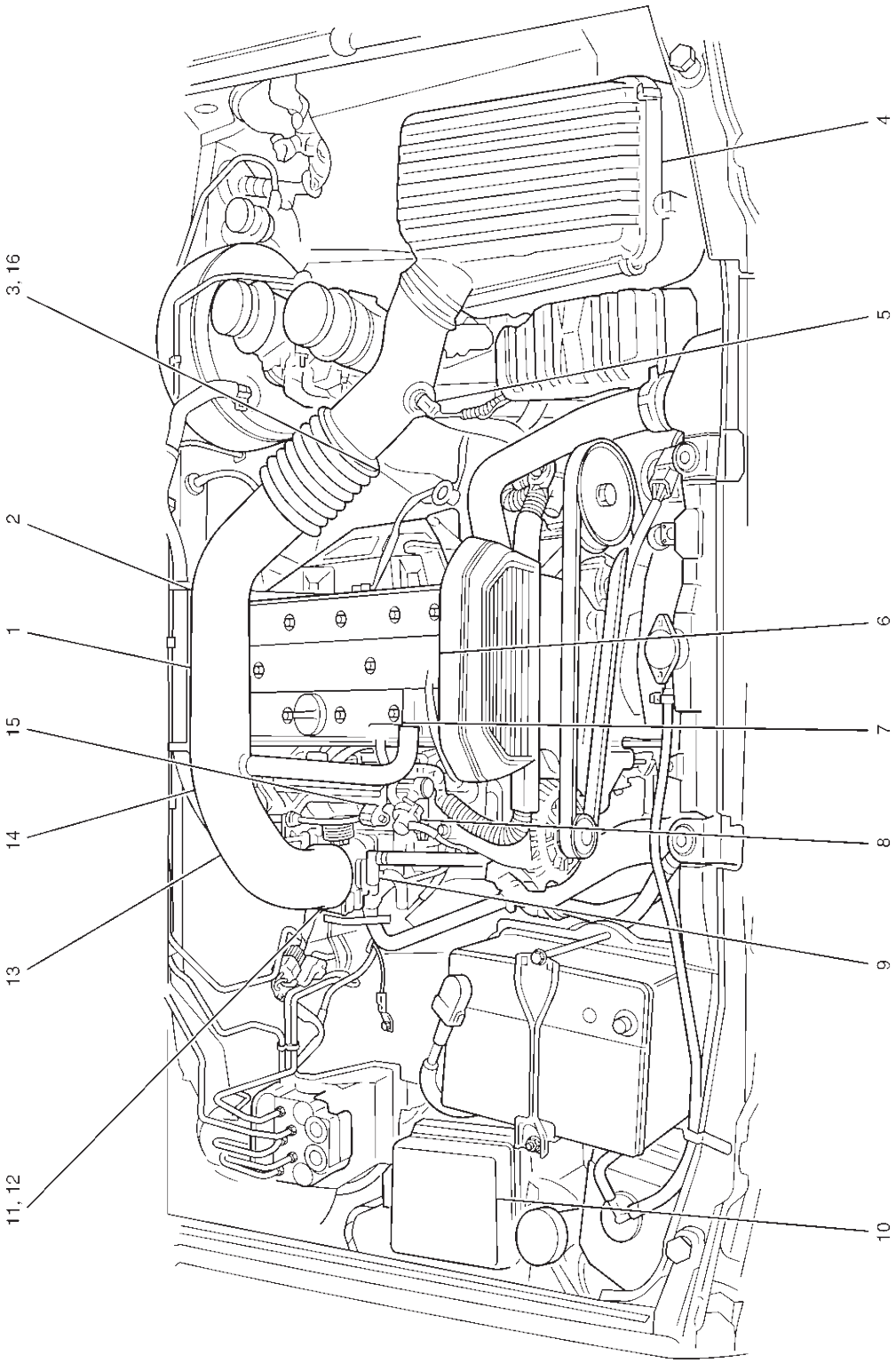
PCM Pinout Table, 32–Pin White Connector – Row ”F”



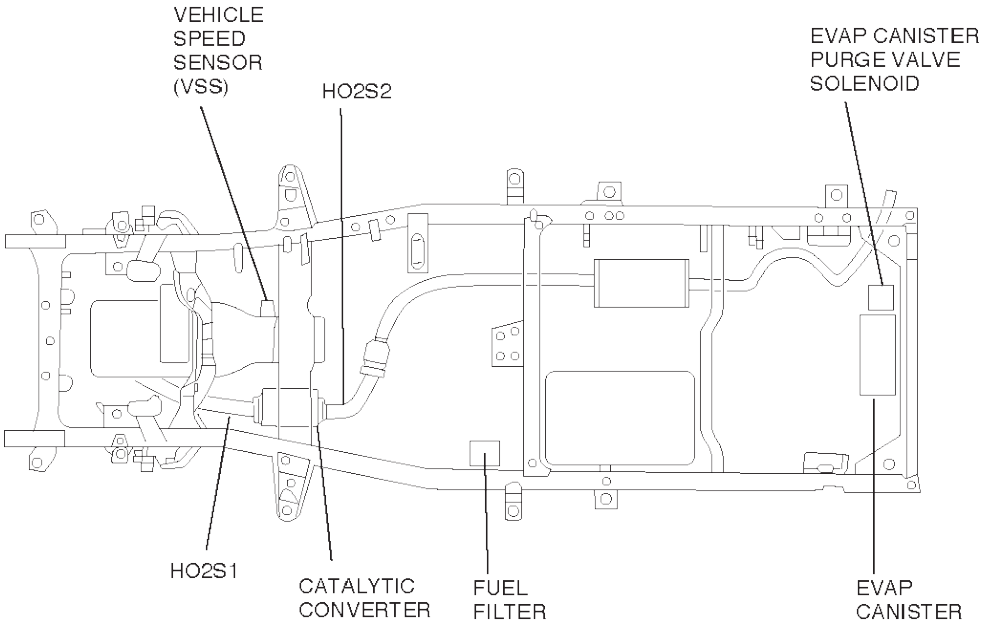
TS23346

PIN	PIN Function	IGN ON	ENG RUN	Refer To
F1	Not Used	—	—	—
F2	Transmission Speed Sensor High (A/T)	—	—	—
F3	Shift Mode Switch (A/T)	—	—	—
F4	Stop Lamp Switch (A/T)	—	—	—
F5	Power Switch (A/T)	—	—	—
F6	Ivineer Switch (A/T)	—	—	—
F7	T/M Oil Temperature Sensor Input (A/T)	—	—	—
F8	Manifold Absolute Pressure (MAP) Sensor Input	~4.7 V (0 V = 10kPa)	~1.1 V (5 V = 104kPa)	General Description and Operation, Manifold Absolute Pressure
F9	Shift Mode Switch (A/T)	—	—	—
F10	Not Used	—	—	—
F11	Kick Down Switch (A/T)	—	—	—
F12	Not Used	—	—	Class 2 Serial Data
F13	Injector ”C” Cylinder #4	B+	B+	General Description and Operation, Fuel Injector
F14	Shift Solenoid (A/T)	—	—	—
F15	Shift Mode Switch (A/T)	—	—	—
F16	Ignition Feed	B+	B+	General Description and Operation

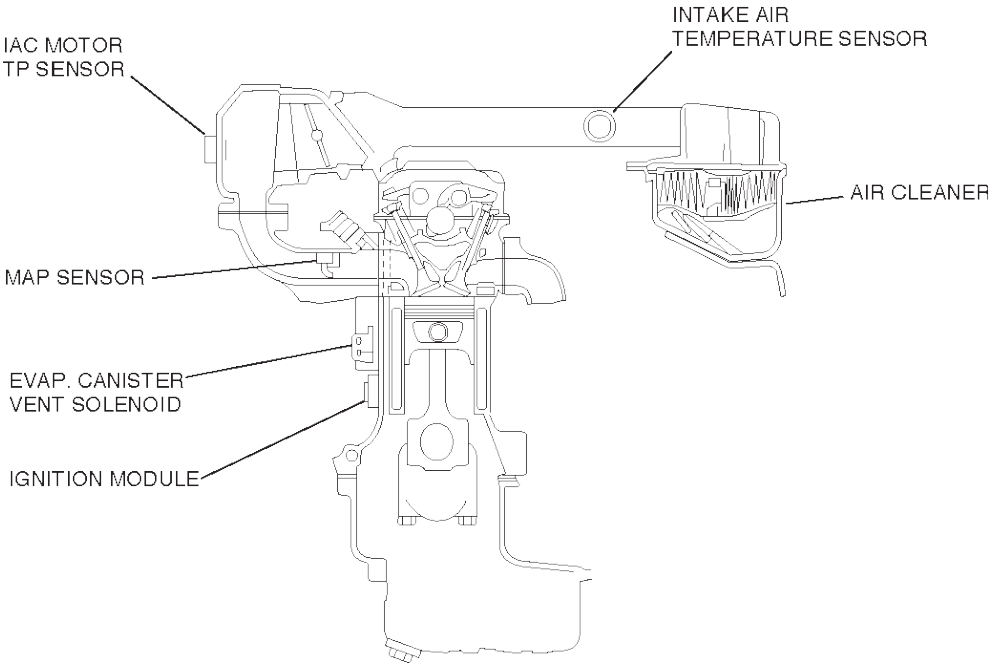
COMPONENT LOCATOR



060R100020



010RX001



028RX001

Engine Component Locator Table

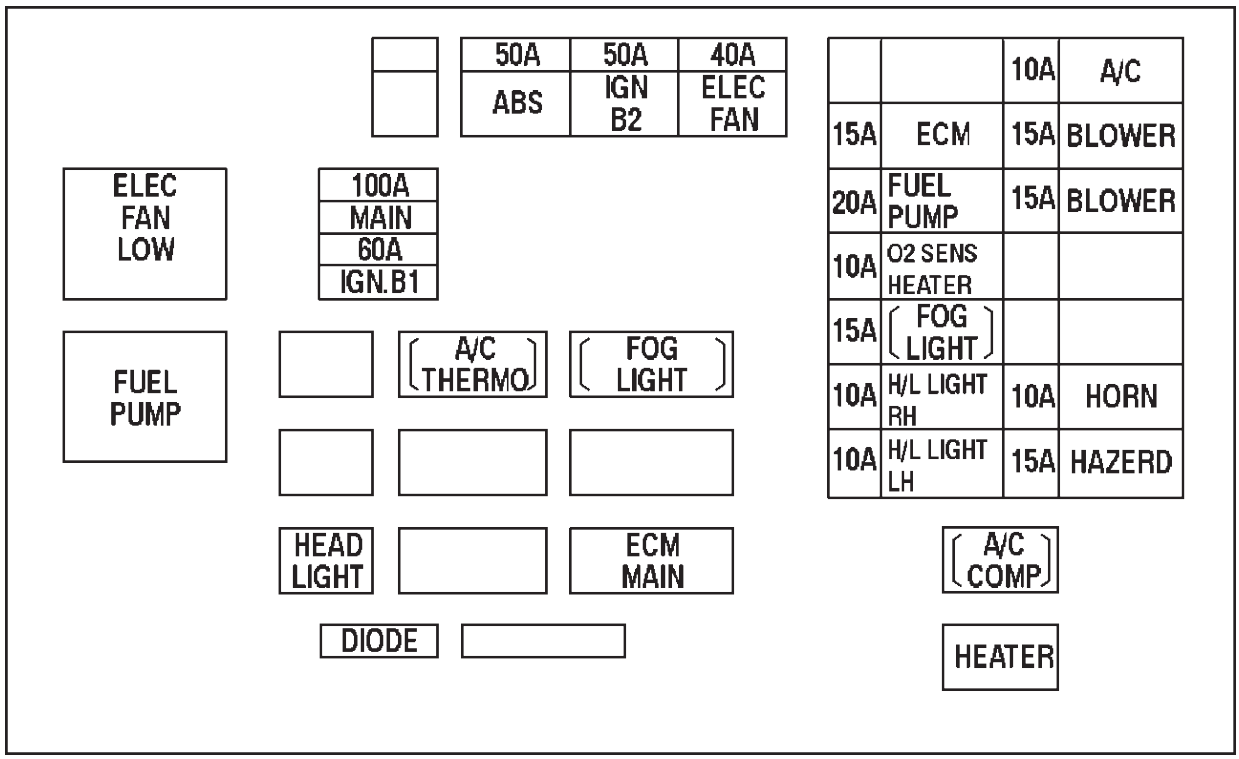
Number	Name	Location
1	Engine Coolant Temperature (ECT) Sensor	Rear of engine, near ignition coils
2	Linear Exhaust Gas Recirculation (EGR) Valve	On the left rear of the engine at the bulkhead
3	Heated Oxygen Sensor (HO2S), Bank 1, Sensor 1	On the exhaust pipe, left side of engine, immediately behind the exhaust manifold
4	Air Cleaner	Left front of the engine bay
5	Intake Air Temperature (IAT) Sensor	On the intake air duct near the air cleaner
6	Camshaft Position (CMP) Sensor	Inside the front cover assembly
7	Positive Crankcase Ventilation (PCV) Port	On the right front corner of the valve cover
8	Fuel Pressure Regulator	On the forward end of the fuel rail, to the right of the PVC port
9	Throttle Body	Between the intake air duct and the intake manifold
10	Fuse/Relay Box	Along the inside of the right fender
11	Throttle Position (TP) Sensor	On the front of the throttle body
12	Idle Air Control (IAC) Valve	On the rear of the throttle body
13	EVAP Canister Vent Solenoid	At the right rear of the engine, behind the Throttle body
14	Ignition Control Module (ICM)	Mounted on a heat sink on the lower right side of the engine block, above the starter motor
15	Manifold Absolute Pressure (MAP) Sensor	Bolted to the front edge of the intake manifold, under the fuel rail
16	Knock Sensor	Left side engine block.

Undercarriage Component Locator Table

Name	Location
Fuel Pump Assembly	Installed in the top of the fuel tank
EVAP Canister	Behind rear axle, near fuel tank filler nozzle
EVAP Canister Purge Valve Solenoid	Behind rear axle, near fuel tank filler nozzle
Heated Oxygen Sensor (HO2S) Bank 1, Sensor 2	Threaded into the exhaust pipe behind the catalytic converter
Vehicle Speed Sensor (VSS)	Protrudes from the right side of the transmission housing, near the output shaft
Crankshaft Position (CKP) Sensor	Lower left hand front of engine, behind power steering pump bracket

Fuse And Relay Panel (Underhood Electrical Center)

Underhood (U/H) Fuse and Relay Panel



060R100016

DIAGNOSIS 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 how to proceed with a diagnosis:

1. Verify the customer complaint.
   - To verify the customer complaint, the technician should know the normal operation of the system.
2. Perform preliminary checks.
   - Conduct a thorough visual inspection.
   - Review the service history.
   - Detect unusual sounds or odors.
   - Gather diagnostic trouble code information to achieve an effective repair.
3. Check bulletins and other service information.
   - This includes videos, newsletters, etc.
4. Refer to service information (manual) system check(s).
   - ”System checks” contain information on a system that may not be supported by one or more DTCs. System checks verify proper operation of the system. This will lead the technician in an organized approach to diagnostics.
5. Refer to service diagnostics.

DTC Stored

Follow the designated DTC chart exactly to make an effective repair.

No DTC

Select the symptom from the symptom tables. Follow the diagnostic paths or suggestions to complete the repair. You may refer to the applicable component/system check in the system checks.

No Matching Symptom

1. Analyze the complaint.
2. Develop a plan for diagnostics.
3. Utilize the wiring diagrams and the theory of operation.

Combine technician knowledge with efficient use of the available service information.

Intermittents

Conditions that are not always present are called intermittents. To resolve intermittents, perform the following steps:

1. Observe history DTCs, DTC modes, and freeze–frame data.
2. Evaluate the symptoms and the conditions described by the customer.
3. Use a check sheet or other method to identify the circuit or electrical system component.
4. Follow the suggestions for intermittent diagnosis found in the service documentation.

Most Scan Tools, such as the Tech 2, have data–capturing capabilities that can assist in detecting intermittents.

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.

1. 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.
2. Repair and verify.
   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 OBD II system diagnostics. Following a repair, the technician should perform the following steps:

IMPORTANT: Follow the steps below when you verify repairs on OBD II systems. Failure to follow these steps could result in unnecessary repairs.

1. 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 MIL (”Check Engine” lamp) has been requested).
2. Clear the DTC(s).
3. Operate the vehicle within conditions noted in the Failure Records and Freeze Frame data.
4. Monitor the DTC status information for the DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

GENERAL SERVICE INFORMATION

OBD II Serviceability Issues

With the introduction of OBD II diagnostics across the entire passenger car and light–duty truck market in 1996, illumination of the MIL (”Check Engine” lamp) 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 (”Check Engine” lamp) with OBD II 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 show up as a Misfire 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 as well.

Using fuel with the wrong octane rating for vehicle may cause driveability problems. Many of the major fuel companies advertise that using ”premium” gasoline will improve the performance of 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

All of the OBD II diagnostics have been calibrated to run with OEM parts. Something as simple as a high–performance exhaust system that affects exhaust system back pressure could potentially interfere with the operation of the EGR valve and thereby turn on the MIL (”Check Engine” lamp). Small leaks in the exhaust system near the post catalyst oxygen sensor can also cause the MIL (”Check Engine” lamp) to turn on.

Aftermarket electronics, such as transceiver, stereos, and anti–theft devices, may radiate EMI into the control system if they are improperly installed. This may cause a false sensor reading and turn on the MIL (”Check Engine” lamp).

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 (”Check Engine” lamp).

Refueling

A new OBD II diagnostic was introduced in 1996 on some vehicles. This diagnostic checks the integrity of the entire evaporative emission system. If the vehicle is restarted after refueling and the fuel cap is not secured correctly, the on–board diagnostic system will sense this as a system faultand turn on the MIL (”Check Engine” lamp) with a DTC P0440.

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 (”Check Engine” lamp) with a P0300 Misfire DTC.

Poor Vehicle Maintenance

The sensitivity of OBD II diagnostics will cause the MIL (”Check Engine” lamp) 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 OBD II. Poor vehicle maintenance can’t be classified as a ”non–vehicle fault”, but with the sensitivity of OBD II diagnostics, 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 a Misfire DTC P0300.

Related System Faults

Many of the OBD II system diagnostics will not run if the PCM detects a fault on a related system or component. One example would be that if the PCM detected a Misfire fault, the diagnostics on the catalytic converter would be suspended until the Misfire fault was repaired. If the Misfire fault was severe enough, the catalytic converter could be damaged due to overheating and would never set a Catalyst DTC until the Misfire fault was repaired and the Catalyst diagnostic was allowed to run to completion. If this happens, the customer may have to make two trips to the dealership in order to repair the vehicle.

Emissions Control Information Label

The engine compartment ”Vehicle Emissions Control Information Label” contains important emission specifications and setting procedures. In the upper left corner is exhaust emission information. This identifies the emission standard (Federal, California, or Canada) of the engine, the displacement of the engine in liters, the class of the vehicle, and the type of fuel metering system. There is also an illustrated emission components and vacuum hose schematic.

This label is located in the engine compartment of every vehicle. If the label has been removed it should be replaced, it can be ordered from Isuzu Dealer ship.

Maintenance Schedule

Refer to the Maintenance Schedule.

Visual/Physical Engine Compartment Inspection

Perform a careful visual and physical engine compartment inspection when performing any diagnostic procedure or diagnosing the cause of an emission test failure. This can often lead to repairing a problem without further steps. Use the following guidelines when performing a visual/physical inspection:

- Inspect all vacuum hoses for pinches, cuts, disconnection, and Droper routing.
- Inspect hoses that are difficult to see behind other components.
- Inspect all wires in the engine compartment for proper connections, burned or chafed spots, pinched wires, contact with sharp edges or contact with hot exhaust manifolds or pipes.

Basic Knowledge Of Tools Required

NOTE: Lack of basic knowledge of this powertrain when performing diagnostic procedures could result in an incorrect diagnosis or damage to powertrain components. Do not attempt to diagnose a powertrain problem without this basic knowledge.

A basic understanding of hand tools is necessary to effectively use this section of the Service Manual.

SERIAL DATA COMMUNICATIONS

Class II Serial Data Communications

Government regulations require that all vehicle manufacturers establish a common communication system. This vehicle utilizes the ”Class II” 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 Class II 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 Tech 2 manufacturers with the capability to access data from any make or model vehicle that is sold.

The data displayed on the other Tech 2 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. For more information on this system of coding, refer to Decimal/Binary/Hexadecimal Conversions. On this vehicle the Tech 2 displays the actual values for vehicle parameters. It will not be necessary to perform any conversions from coded values to actual values.

ON–BOARD DIAGNOSTIC (OBD II)

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 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. The *CARB OBD II Comprehensive Component Monitoring List Of Components Intended To illuminate The MIL* is a list of components, features or functions that could fall under this requirement.

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 MAP voltage). Input components may include, but are not limited to the following sensors:

- Vehicle Speed Sensor (VSS)
- Crankshaft Position (CKP) sensor
- Throttle Position (TP) sensor
- Engine Coolant Temperature (ECT) sensor
- Camshaft Position (CMP) sensor
- 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:

- Idle Air Control (IAC) Motor
- EVAP Canister Purge Valve Solenoid
- A/C relays
- Cooling fan relay(s)
- VSS output
- MIL control
- Cruise control inhibit

Refer to PCM and Sensors in General Descriptions.

Passive and Active Diagnostic Tests

A passive test is a diagnostic test which simply monitors a vehicle system or component. Conversely, an active test, actually takes some sort of action when performing diagnostic functions, often in response to a failed passive test. For example, the EGR diagnostic active test will force the EGR valve open during closed throttle decel and/or force the EGR valve closed during a steady state. Either action should result in a change in manifold pressure.

Intrusive Diagnostic Tests

This is any 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. Refer to Storing And Erasing Freeze Fame Data for more detailed information.

Failure Records

Failure Records data is an enhancement of the OBD II 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.

System Status And Drive Cycle For Satisfying Federal Inspection/Maintenance (I/M 240) Regulations

I/M Ready Status means a signal or flag for each emission system test that had been set in the PCM. I/M Ready Status indicates that the vehicle on–board emissions diagnostics have been run. I/M Ready Status is not concerned whether the emission system passed or failed the test, only that on–board diagnosis is complete. Not all vehicles use all possible I/M flags.

Common OBD II 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
- Oxygen sensor heaters
- EGR
- Catalyst monitoring

Enable Criteria

The term "enable criteria" is engineering language for the conditions necessary for a given diagnostic test to run. Each diagnostic has a specific list of conditions which must be met before the diagnostic will run. "Enable criteria" is another way of saying "conditions required". The enable criteria for each diagnostic is listed on the first page of the DTC description in Section 6E1 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
- ECT
- MAP
- barometric pressure
- IAT
- TP
- high canister purge
- 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 be cruising at a steady highway speed, some run only when the vehicle is at idle; some diagnostics function with the TCC disabled. 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 was operated in such a way as to satisfy the enabling 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.

The Diagnostic Executive

The Diagnostic Executive is a unique segment of software which is designed to coordinate and prioritize the diagnostic procedures as well as define the protocol for recording and displaying their results. The main responsibilities of the Diagnostic Executive are listed as follows:

- Commanding the MIL (”Check Engine” lamp) ON and OFF
- DTC logging and clearing
- Freeze Frame data for the first emission related DTC recorded
- Non–emission related Service Lamp (future)
- Operating conditions Failure Records buffer, (the number of records will vary)
- Current status information on each diagnostic
- System Status (I/M ready)

The Diagnostic Executive records DTCs and turns ON the MIL when emission–related faults occur. It can also turn OFF the MIL if the conditions cease which caused the DTC to set.

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 no 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 diagnostic trouble code is set and the Malfunction Indicator Lamp (MIL) (”Check Engine” lamp) is illuminated.

Malfunction Indicator Lamp (MIL)

The Malfunction Indicator Lamp (MIL) looks the same as the MIL you are already familiar with (”Check Engine” lamp). However, OBD II requires that it illuminate under a strict set of guide lines.

Basically, the MIL is turned ON when the PCM 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.

If the vehicle is experiencing a misfire malfunction which may cause damage to the Three–Way Catalytic Converter (TWC), the MIL will flash once per second. This will continue until the vehicle is outside of speed and load conditions which could cause possible catalyst damage, and the MIL will stop flashing and remain ON steady.

Extinguishing the MIL

When the MIL is ON, the Diagnostic Executive will turn OFF the MIL after *three (3) 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 PCM 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 (10) 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 (”Check Engine” lamp) is on the instrument panel and has the following functions:

- It informs the driver that a fault that affects vehicle emission levels has occurred and that the vehicle should be taken for service as soon as possible.
- As a bulb and 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, a Powertrain On–Board Diagnostic (OBD) System Check must be performed. The procedures for these checks are given in On–Board Diagnostic (OBD II) System Check. These checks will expose faults which may not be detected if other diagnostics are performed first.

DTC Types

Each DTC is directly related to a diagnostic test. The Diagnostic Management System sets DTC based on the failure of the tests during a trip or trips. Certain tests must fail two (2) consecutive trips before the DTC is set. The following are the four (4) types of DTCs and the characteristics of those codes:

- Type A
  - Emissions related
  - Requests illumination of the 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 (1) trip with a fail
  - ”Disarmed” after one (1) 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)
  - Stores a Fail Record when the first test fails (not dependent on *consecutive trip* fails)
  - Updates the Fail Record each time the diagnostic test fails

(Some special conditions apply to misfire and fuel trim DTCs)

- Type C (if the vehicle is so equipped)
  - Non–Emissions related
  - Requests illumination of the Service Lamp or the service message on the Drive Information Center (DIC) on the *first trip* with a fail
  - Stores a History DTC on the *first trip* with a fail
  - *Does not* store a Freeze Frame
  - Stores Fail Record when test fails
  - Updates the Fail Record each time the diagnostic test fails
- Type D. (*Type D* non–emissions related are not utilized on certain vehicle applications).
  - Non–Emissions related
  - Does not request illumination of any lamp
  - Stores a History DTC on the *first trip* with a fail
  - *Does not* store a Freeze Frame
  - Stores Fail Record when test fails
  - Updates the Fail Record each time the diagnostic test fails

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.

Special Cases of Type B Diagnostic Tests

Unique to the misfire diagnostic, the Diagnostic Executive has the capability of alerting the vehicle operator to potentially damaging levels of misfire. If a misfire condition exists that could potentially damage the catalytic converter as a result of high misfire levels, the Diagnostic Executive will command the MIL to “flash” at a rate of once per second during those the time that the catalyst damaging misfire condition is present.

Fuel trim and misfire are special cases of *Type B* diagnostics. Each time a fuel trim or misfire malfunction is detected, engine load, engine speed, and engine coolant temperature are recorded.

When the ignition is turned OFF, the last reported set of conditions remain stored. During subsequent ignition cycles, the stored conditions are used as a reference for similar conditions. If a malfunction occurs during two consecutive trips, the Diagnostic Executive treats the failure as a normal *Type B* diagnostic, and does not use the stored conditions. However, if a malfunction occurs on two non–consecutive trips, the stored conditions are compared with the current conditions. The MIL will then illuminate under the following conditions:

- When the engine load conditions are within 10% of the previous test that failed.
- Engine speed is within 375 rpm, of the previous test that failed.
- Engine coolant temperature is in the same range as the previous test that failed.

Storing and Erasing Freeze Frame Data and Failure Records

Government regulations require that engine operating conditions be captured whenever the MIL is illuminated. The data captured is called Freeze Frame data. The Freeze Frame data is very similar to a single record of operating conditions. Whenever the MIL is illuminated, the corresponding record of operating conditions is recorded to the Freeze Frame buffer.

Freeze Frame data can only be overwritten with data associated with a misfire or fuel trim malfunction. Data from these faults take precedence over data associated with any other fault. The Freeze Frame data will not be erased unless the associated history DTC is cleared.

Each time a diagnostic test reports a failure, the current engine operating conditions are recorded in the *Failure Records* buffer. A subsequent failure will update the recorded operating conditions. The following operating conditions for the diagnostic test which failed *typically* include the following parameters:

- Air Fuel Ratio
- Air Flow Rate

- Fuel Trim
- Engine Speed
- Engine Load
- Engine Coolant Temperature
- Vehicle Speed
- TP Angle
- MAP/BARO
- Injector Base Pulse Width
- Loop Status

Intermittent Malfunction Indicator Lamp

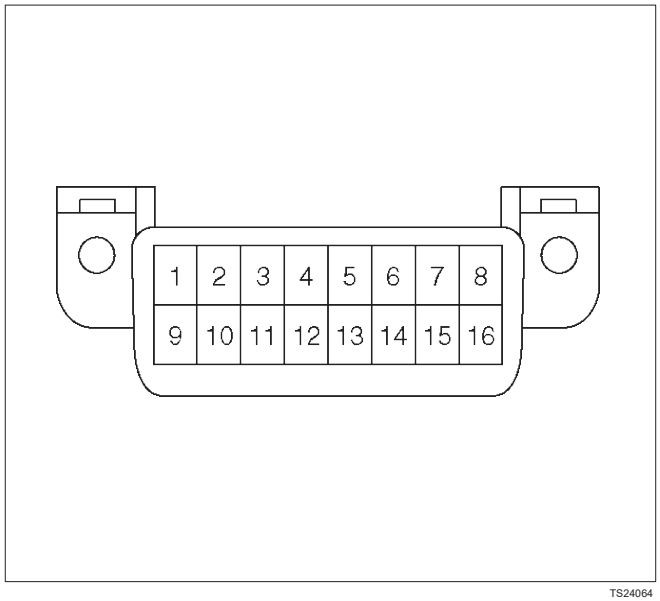
In the case of an ”intermittent” fault, the MIL (”Check Engine” lamp) may illuminate and then (after three trips) go OFF. However, the corresponding diagnostic trouble code will be stored in the memory. When unexpected diagnostic trouble codes appear, check for an intermittent malfunction.

A diagnostic trouble code may reset. Consult the ”Diagnostic Aids” associated with the diagnostic trouble code. A physical inspection of the applicable sub–system most often will resolve the problem.

Data Link Connector (DLC)

The provision for communicating with the control module is the Data Link Connector (DLC). It is located at the lower left of the instrument panel. The DLC is used to connect to the Tech 2 Scan tool. Some common uses of the Tech 2 are listed below:

- Identifying stored Diagnostic Trouble Codes (DTCs)
- Clearing DTCs
- Performing output control tests
- Reading serial data



TS24064

Decimal/Binary/Hexadecimal Conversions

Beginning in 1996, Federal Regulations require that all auto manufacturers selling vehicles in the United States provide Scan tool manufacturers with software information to display vehicle operating parameters. All Scan tool manufacturers will display a variety of vehicle information which will aid in repairing the vehicle. Some Scan Tools will display encoded messages which will aid in determining the nature of the concern. The method of encoding involves the use of a two additional numbering systems: Binary and Hexadecimal.

The binary number system has a base of two numbers. Each digit is either a 0 or a 1. A binary number is an eight digit number and is read from right to left. Each digit has a position number with the farthest right being the 0 position and the farthest left being the 7 position. The 0 position, when displayed by a 1, indicates 1 in decimal. Each position to the left is double the previous position and added to any other position values marked as a 1.

A hexadecimal system is composed of 16 different alpha numeric characters. The alpha numeric characters used are numbers 0 through 9 and letters A through F. The hexadecimal system is the most natural and common approach for Scan Tool manufacturers to display data represented by binary numbers and digital code.

Verifying Vehicle Repair

Verification of vehicle repair will be more comprehensive for vehicles with OBD II system diagnostics. Following a repair, the technician should perform the following steps:

1. Review and record the Fail Records and/or Freeze Frame data for the DTC which has been diagnosed (Freeze Frame data will only be stored for an A or B type diagnostic and only if the MIL has been requested).
2. Clear DTC(s).
3. Operate the vehicle within conditions noted in the Fail Records and/or Freeze Frame data.
4. Monitor the DTC status information for the DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

Following these steps are very important in verifying repairs on OBD II systems. Failure to follow these steps could result in unnecessary repairs.

Reading Diagnostic Trouble Codes Using A Tech 2 Scan Tool

The procedure for reading diagnostic trouble code(s) 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 PCM memory.

To clear Diagnostic Trouble Codes (DTCs), use the diagnostic Scan tool ”clear DTCs” or ”clear information” function. When clearing DTCs follow instructions supplied by the tool manufacturer.

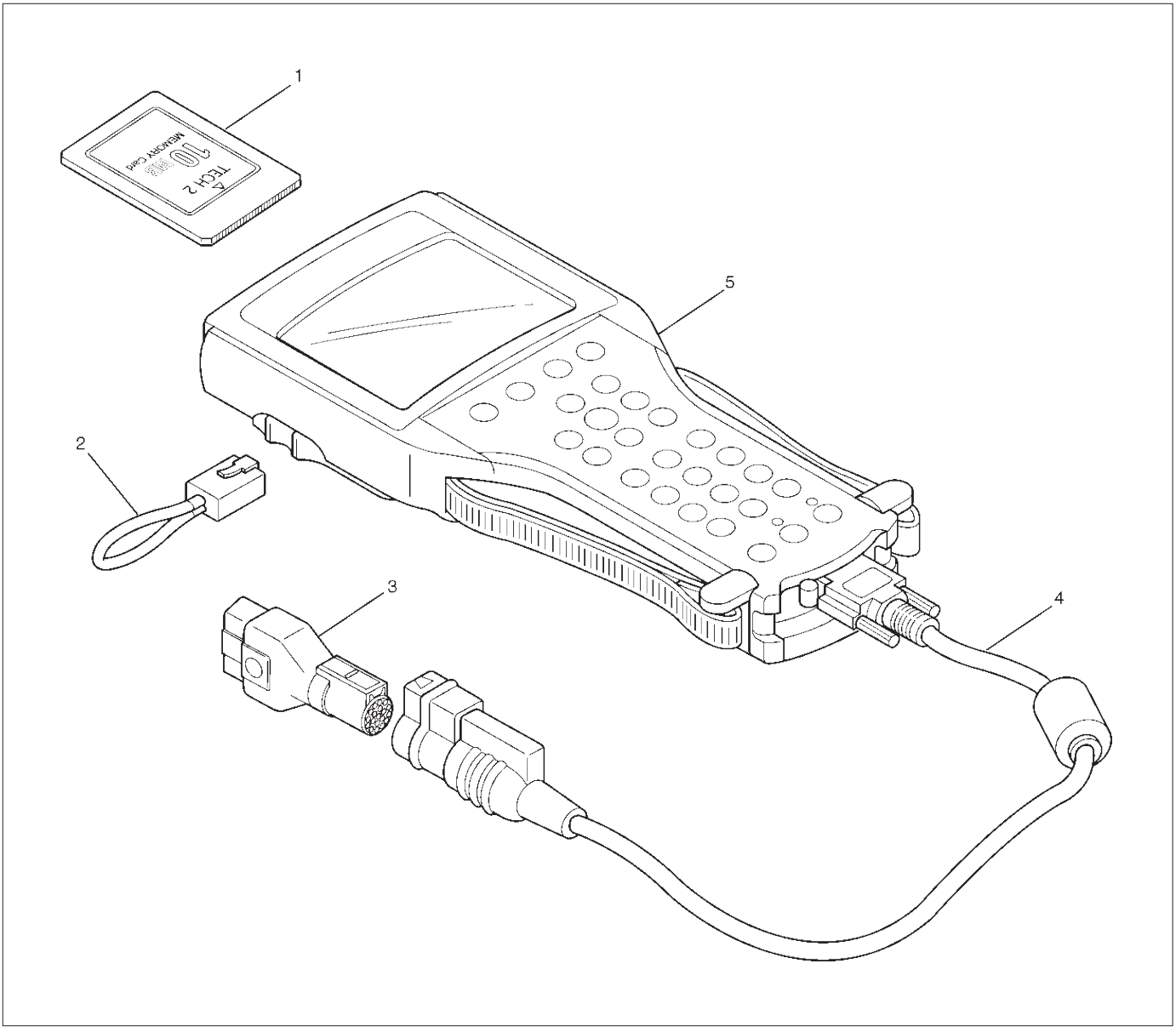
When a Tech 2 is not available, DTCs can also be cleared by disconnecting one of the following sources for at least thirty (30) seconds.

NOTE: 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 PCM 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).

Tech 2

From 98 MY, Isuzu dealer service departments are recommended to use the Tech 2 scan tool. Please refer to the Tech 2 user guide.



901RW180

Legend

(1) PCMCIA Card
(2) R232 Loop Back Connector
(3) SAE 16/19 Adaptor
(4) DLC Cable
(5) Tech 2

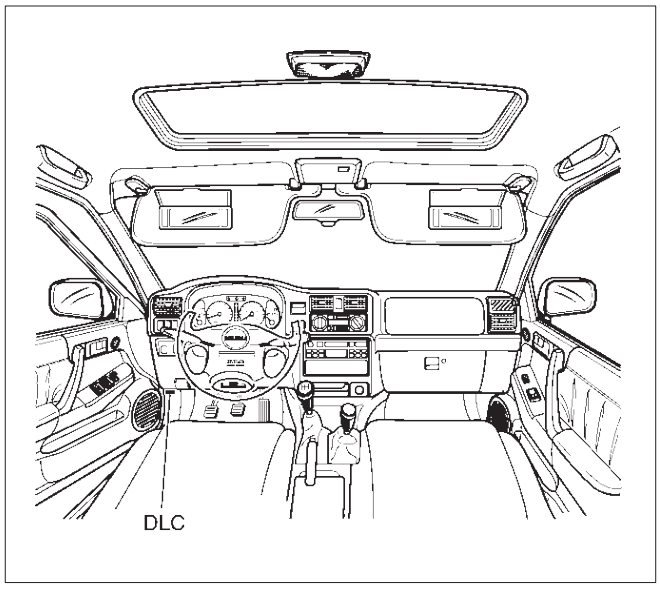
Tech 2 Features

1. Tech 2 is a 12 volt system. Do not apply 24 volt.
2. After connecting and/or installing, the Vehicle Communications Interface (VCI) module, PCMCIA card and DLC connector to the Tech 2, connect the tool to the vehicle DLC.
3. Make sure the Tech 2 is powered OFF when removing or installing the PCMCIA card.
4. The PCMCIA card has a capacity of 10 Megabytes which is 10 times greater than the memory of the Tech 1 Mass Storage Cartridge.
5. The Tech 2 has the capability of two snapshots.
6. The PCMCIA card is sensitive to magnetism and static electricity, so care should be taken in the handling of the card.
7. The Tech 2 can plot a graph when replaying a snapshot.
8. Always return to the Main Menu by pressing the EXIT key several times before shutting down.
9. To clear Diagnostic Trouble Codes (DTCs), open Application Menu and press “F1: Clear DTC Info”.

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. The Isuzu 98 System PCMCIA card (1) inserts into the Tech 2 (5).
2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
3. Connect the DLC cable to the Tech 2 (5)
4. Make sure the vehicle ignition is off.
5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC.



740RW060

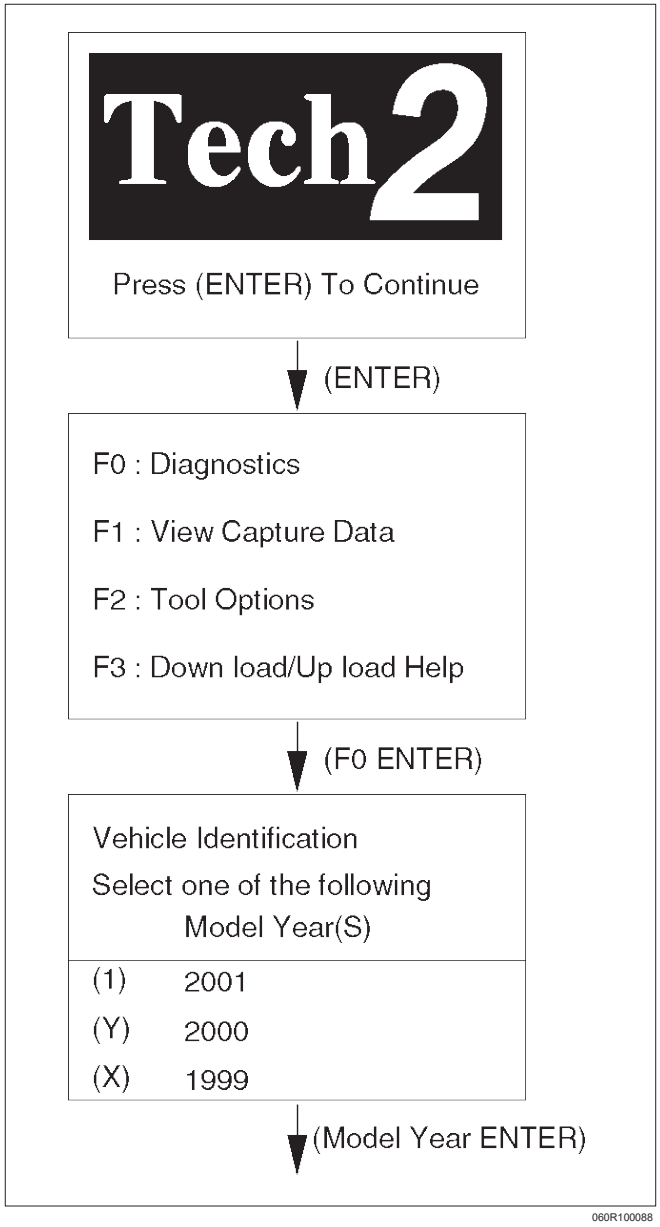
6. Turn on the vehicle ignition.
7. Power the Tech 2 ON and Verify the Tech 2 power up display.

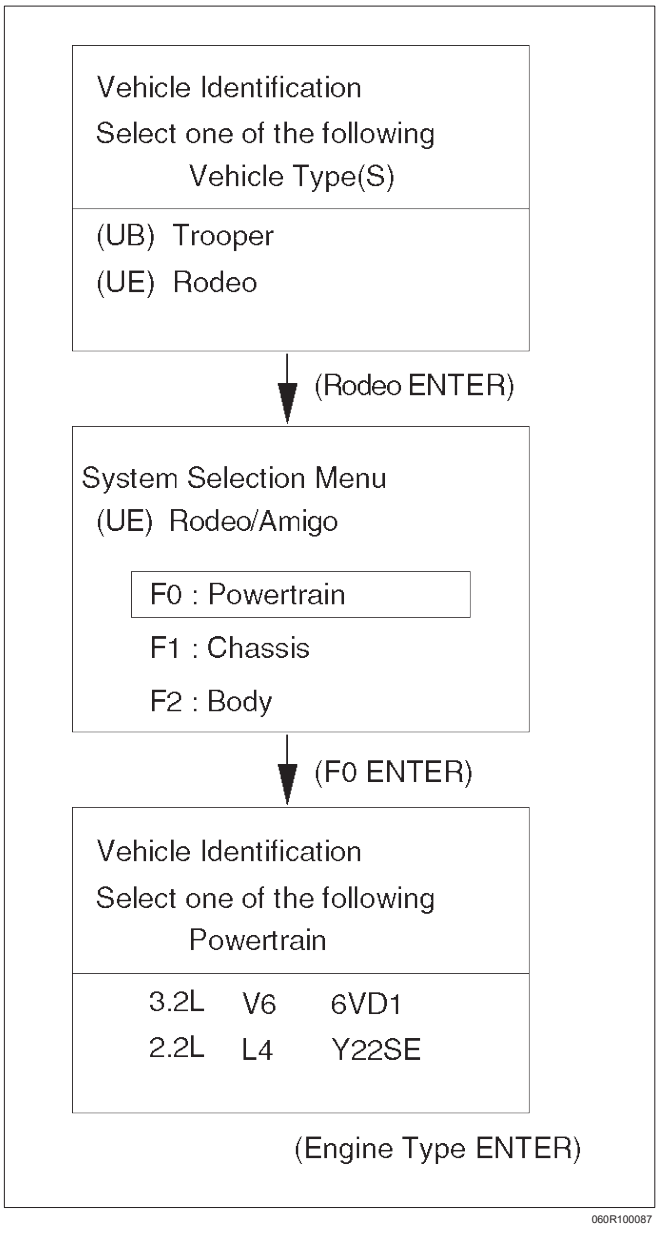
060RW009

NOTE: The RS232 Loop back connector is only to use for diagnosis of Tech 2 and refer to user guide of the Tech 2.

Operating Procedure (Example)

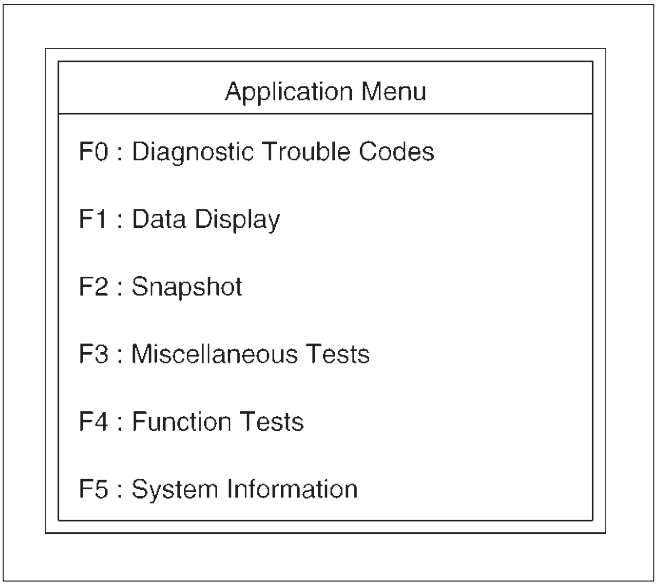
The power up screen is displayed when you power up the tester with the Isuzu system PCMCIA card. Follow the operating procedure below.





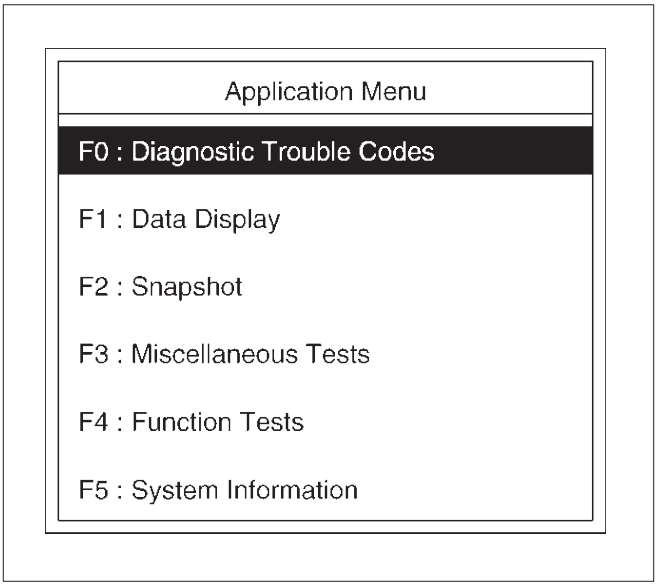
Menu

- The following table shows which functions are used for the available equipment versions.



060R100018

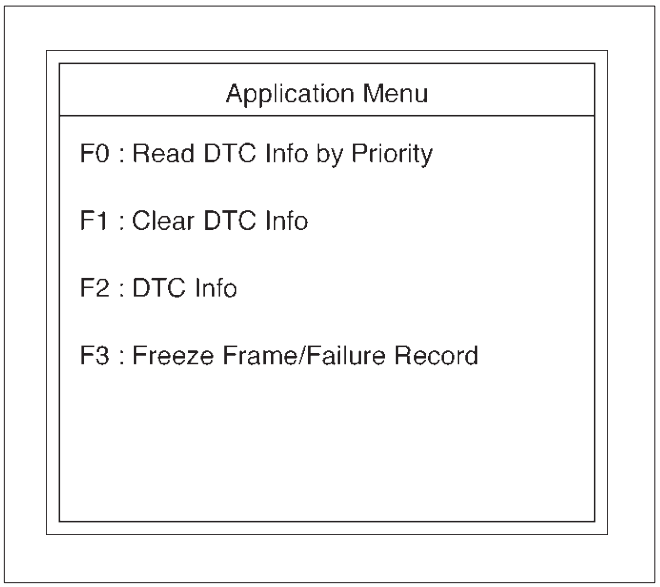
DTC Modes



060R100077

On OBD II vehicles there are five options available in Tech 2 DTC mode to display the enhanced information available. After selecting DTC, the following menu appears:

- DTC Info
- Freeze Frame
- Fail Records (not all applications)
- Clear Info

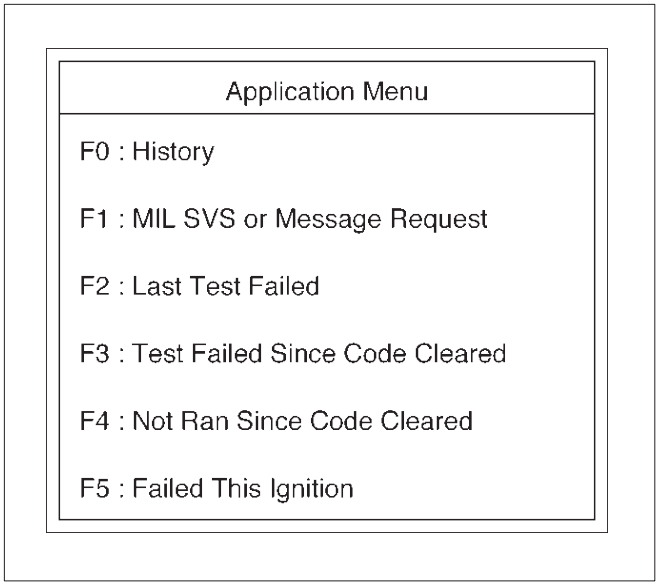


060RW223

The following is a brief description of each of the sub menus in DTC Info and DTC. The order in which they appear here is alphabetical and not necessarily the way they will appear on the Tech 2.

DTC Information Mode

Use the DTC info mode to search for a specific type of stored DTC information. There are six choices. The service manual may instruct the technician to test for DTCs in a certain manner. Always follow published service procedures.



060RW221

DTC Status

This selection will display any DTCs that have not run during the current ignition cycle or have reported a test failure during this ignition up to a maximum of 33 DTCs. DTC tests which run and pass will cause that DTC number to be removed from Tech 2 screen.

Fail This Ignition

This selection will display all DTCs that have failed during the present ignition cycle.

History

This selection will display only DTCs that are stored in the PCM's history memory. It will display all type A and B DTCs that have requested the MIL and have failed within the last 40 warm-up cycles. In addition, it will display all type C and type D DTCs that have failed within the last 40 warm-up cycles.

Last Test Failed

This selection will display only DTCs that have failed the last time the test run. The last test may have run during a previous ignition cycle if a type A or type B DTC is displayed. For type C and type D DTCs, the last failure must have occurred during the current ignition cycle to appear as Last Test Fail.

MILSVC or Message Request

This selection will display only DTCs that are requesting the MIL. Type C and type D DTCs cannot be displayed using this option. This selection will report type B DTCs only after the MIL has been requested.

Not Run Since Code Cleared

This option will display up to 33 DTCs that have not run since the DTCs were last cleared. Since any displayed DTCs have not run, their condition (passing or failing) is unknown.

Test Failed Since Code Cleared

This selection will display all active and history DTCs that have reported a test failure since the last time DTCs were cleared. DTCs that last failed more than 40 warm-up cycles before this option is selected will not be displayed.

Miscellaneous Test

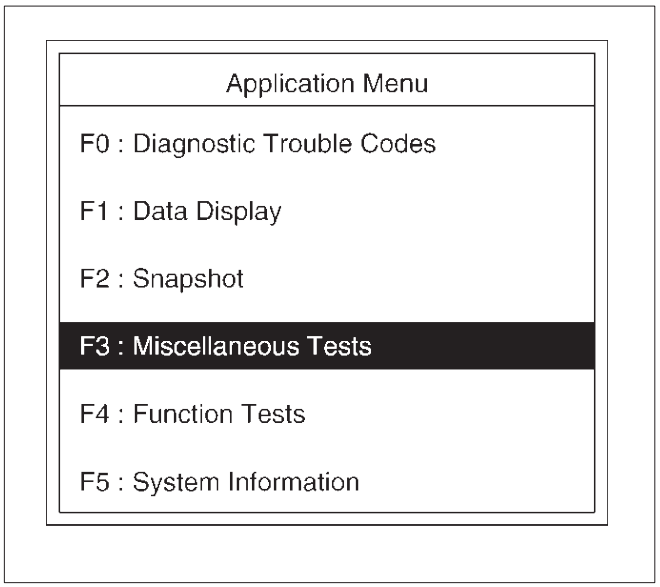
This test consists of eight menus-Lights, Relays, EVAP, IAC System, Fuel System, EGR Control, Variable Intake Manifold Solenoid, and Injector Balance Tests.
In these tests, Tech 2 sends operating signals to the systems to confirm their operations thereby to judge the normality of electric circuits.
To judge intermittent trouble,

1. Confirm DTC freeze frame data, and match the freeze frame data as test conditions with the data list displayed by Miscellaneous Test.
2. Confirm DTC setting conditions, and match the setting conditions as test conditions with the data list displayed by Miscellaneous Test.
3. Refer to the latest Service Bulletin.
   Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.

Lamps Test

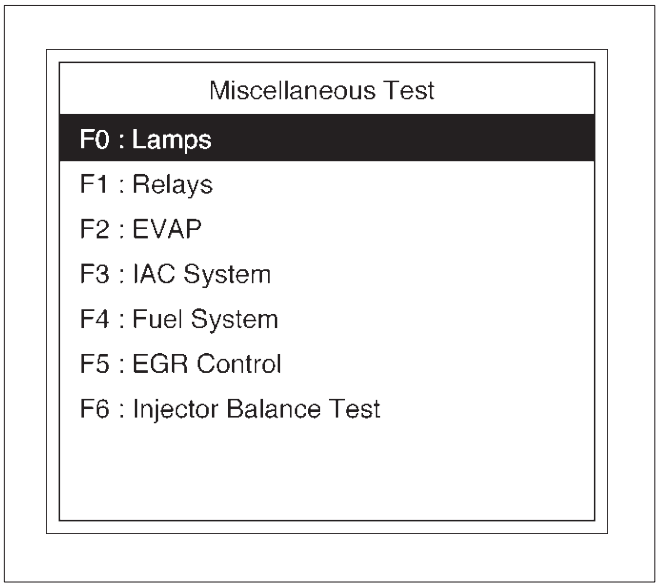
This test is conducted check MIL and Low Fuel Lamp for its working.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.

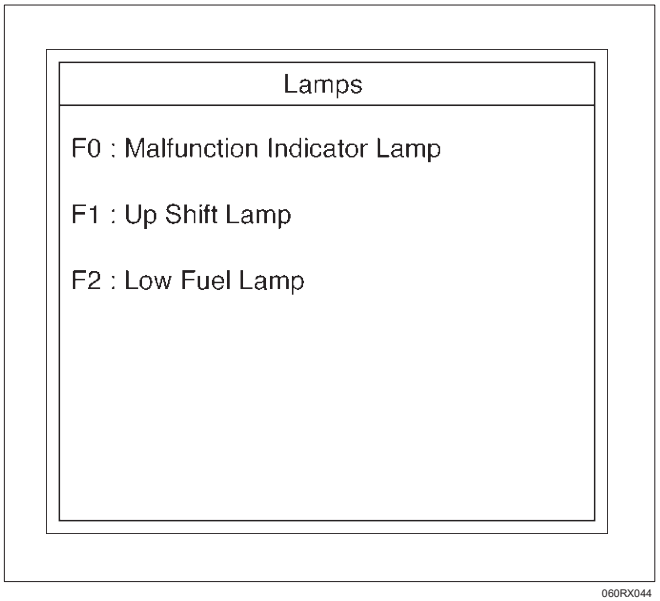


060R100078

4. Select F0:Lamps Test in the Miscellaneous Test.



060RX043



060RX044

5. Select F0:Malfunction Indicator Lamp.

Malfunction Indicator Lamp	
Engine Speed	750 RPM
Desired Idle Speed	750 RPM
Engine Coolant Temperat	75 °C
Start Up ECT(Engine Co	20 °C
Intake Air Temperature	20 °C
Start Up IAT(Intake Ai	20 °C
Manifold Absolute Press	19 KPa
Malfunction Indicator Lamp	Off

Quit	Off	On

060RX019

6. Push “On” soft key.
7. Make sure Lamp illuminates.
8. If lamp illuminates, the Lamp is operating correctly.
9. Select F1:Up Shift Lamp

Up Shift Lamp	
Engine Speed	750 RPM
Desired Idle Speed	750 RPM
Engine Coolant Temperat	75 °C
Start Up ECT(Engine Co	20 °C
Intake Air Tenperature	20 °C
Start Up IAT(Intake Ai	20 °C
Manifold Absolute Press	19 KPa
Up Shift Lamp	Off

Quit	Off	On

060RX045

Select F2:Low Fuel Lamp

Low Fuel Lamp	
Engine Speed	750 RPM
Desired Idle Speed	750 RPM
Engine Coolant Temperat	75 °C
Start Up ECT(Engine Co	20 °C
Intake Air Temperature	20 °C
Start Up IAT(Intake Ai	20 °C
Manifold Absolute Press	19 KPa
Low Fuel Lamp	Off

Quit	Off	On

060RX020

10. Push “On” soft key.
11. Make sure Lamp illuminates.
12. If Lamp illuminates, the Lamp is operaing correctly.

Relays Test

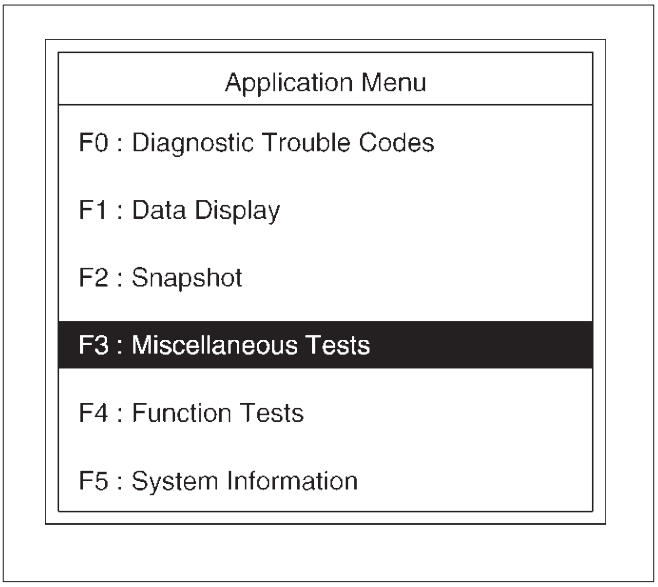
This test is conducted to check Fuel Pump Relay, A/C Clutch Low Fan and High Fan for prepor operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Ignition SW is “On”.
3. Select F3: Miscellaneous Test in the Application Menu.

Application Menu
F0 : Diagnostic Trouble Codes
F1 : Data Display
F2 : Snapshot
F3 : Miscellaneous Tests
F4 : Function Tests
F5 : System Information

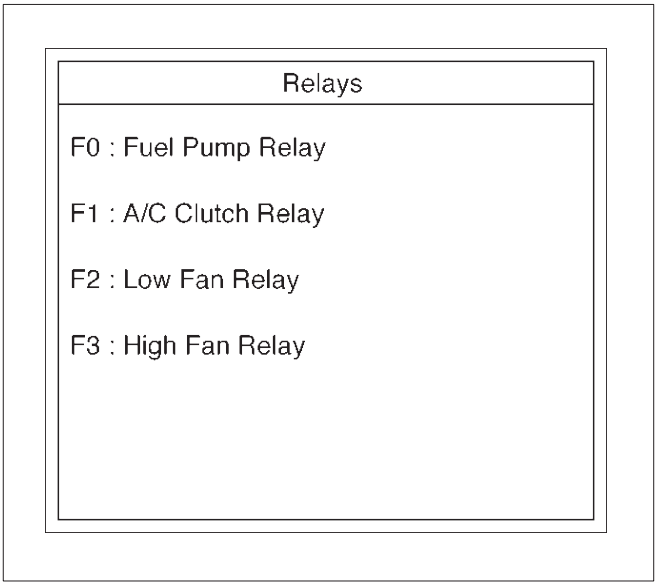
060R100078

4. Select F1:Relay Test in the Miscellaneous Test.



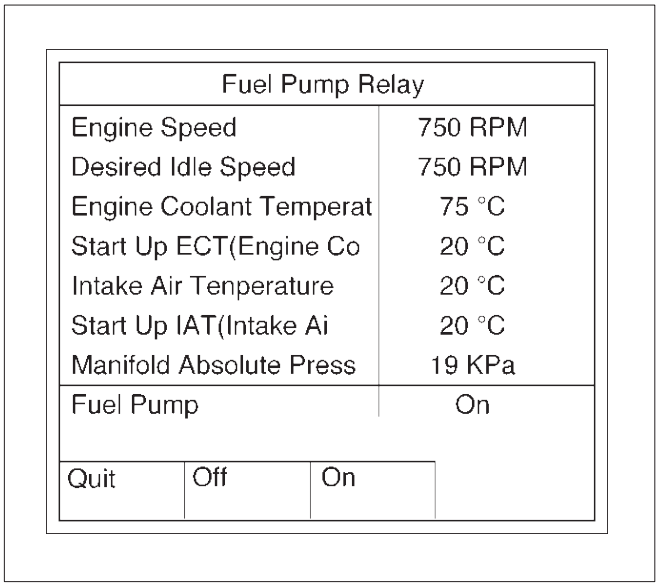
060R100078

5. Select F0:Fuel Pump Relay.



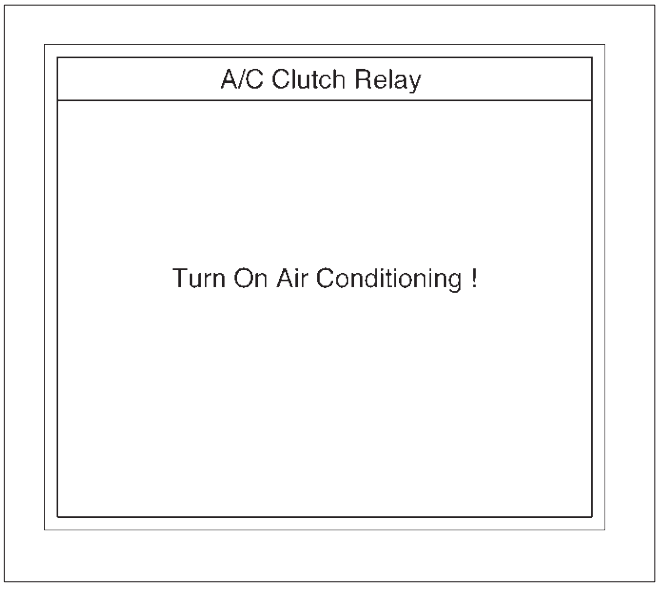
060RX047

6. Push “On” soft key.



060RX022

7. Control Fuel Pump Relay and check a data list.
8. If the data list chenges, the Fuel Pump Relay is normal.
9. Select F1:A/C Clutch Relay.
10. *Run the Engine at idle.
11. Turn on Air Condtioning.



060RX023

12. Push “On” and “Off” of soft key.
13. Control A/C Clutch Relay and check a data list.
14. If the data list changes, the A/C Clutch Relay is normal.

15. Select F2: Low Fan Relay.

Low Fan Relay	
Engine Speed	750 RPM
Desired Idle Speed	750 RPM
Engine Coolant Temperat	75 °C
Start Up ECT(Engine Co	20 °C
Intake Air Tenperature	20 °C
Start Up IAT(Intake Ai	20 °C
Manifold Absolute Press	19 KPa
Low Fan	On

Quit	Off	On

060RX048

16. Push “On” and “Off” of soft key.
17. Control Low Fan Relay and check a data list.
18. If the data list changes, the Low Fan Relay is normal.
19. Run the Fan Motor.
20. Select F3: High Fan Relay.

High Fan Relay	
Engine Speed	750 RPM
Desired Idle Speed	750 RPM
Engine Coolant Temperat	75 °C
Start Up ECT(Engine Co	20 °C
Intake Air Tenperature	20 °C
Start Up IAT(Intake Ai	20 °C
Manifold Absolute Press	19 KPa
High Fan	On

Quit	Off	On

060RX049

21. Push “On” and “Off” of soft key.
22. Control High Fan Relay and check a data list.
    If the data list changes, the High Fan Relay is normal.
23. Run the Fan Motor.

EVAP Test

This test is conducted check EVAP system for its working. Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.

Application Menu
F0 : Diagnostic Trouble Codes
F1 : Data Display
F2 : Snapshot
F3 : Miscellaneous Tests
F4 : Function Tests
F5 : System Information

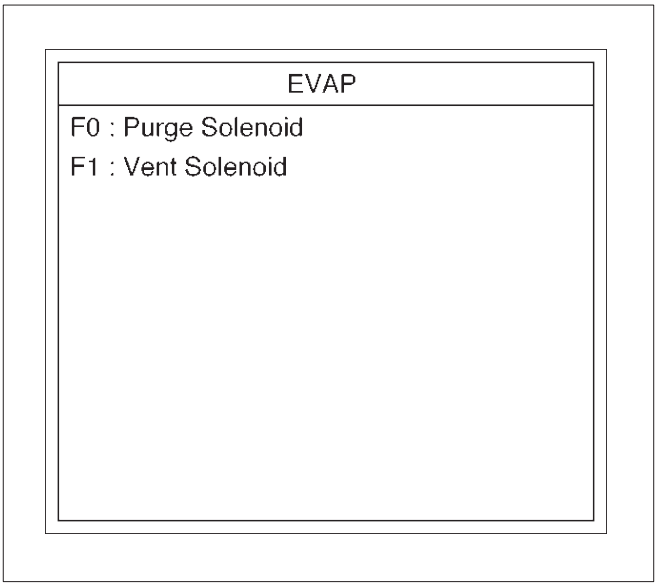
060R100078

4. Select F2:EVAP Test in the Miscellaneous Test.

Miscellaneous Test
F0 : Lamps
F1 : Relays
F2 : EVAP
F3 : IAC System
F4 : Fuel System
F5 : EGR Control
F6 : Injector Balance Test

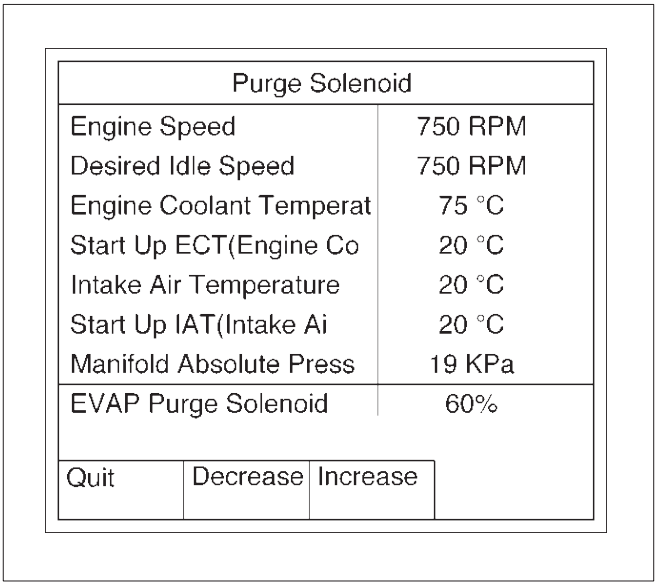
060RX050

5. Select F0: Purge Solenoid.



060RX025

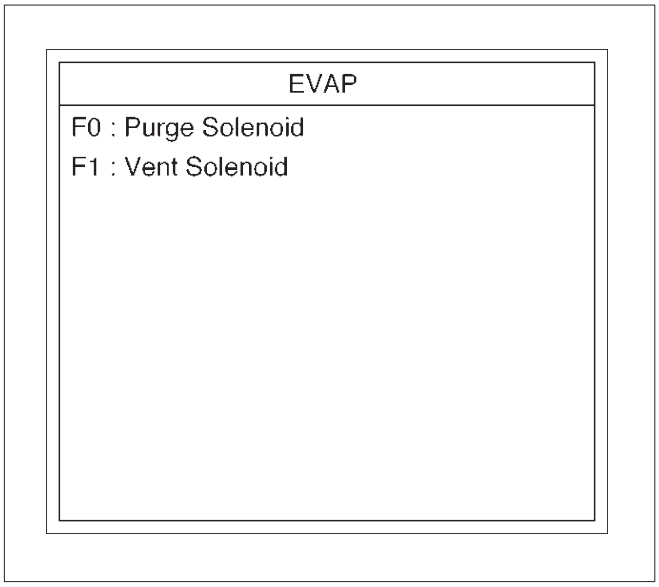
6. Push “Decrease” or “Increase” soft key.



060RX026

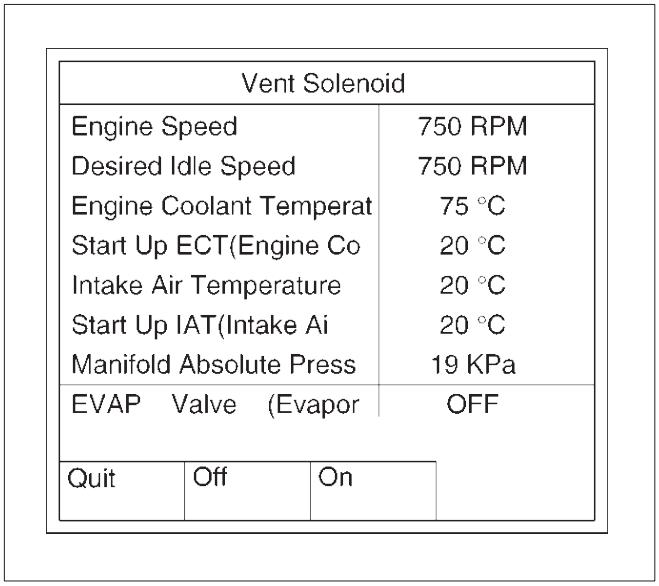
7. Control EVAP Purge Solenoid and check a data list.
8. If the data list changes, the purge Solenoid is normal. Ignition SW is “On”.
9. Turn engine off, turn ignition SW “On”.

10. Select F1:EVAP Vent Solenoid.



060RX025

11. Push “On” or “Off” of soft key.



060R100019

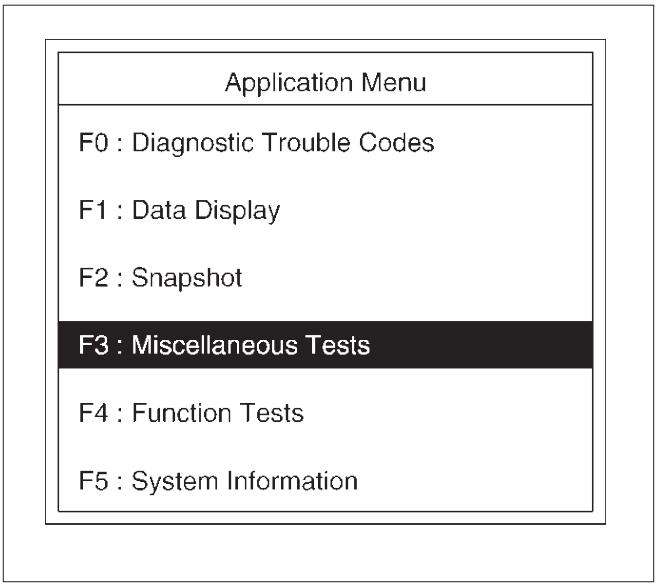
12. Control EVAP Vent Solenoid and check a data list.
13. If the data list changes, the EVAP Vent Solenoid is normal.

Idle Air Control System Test

This test is conducted check to IAC system for proper operation.
Tech 2 must be used for this test.
Test Procedure:

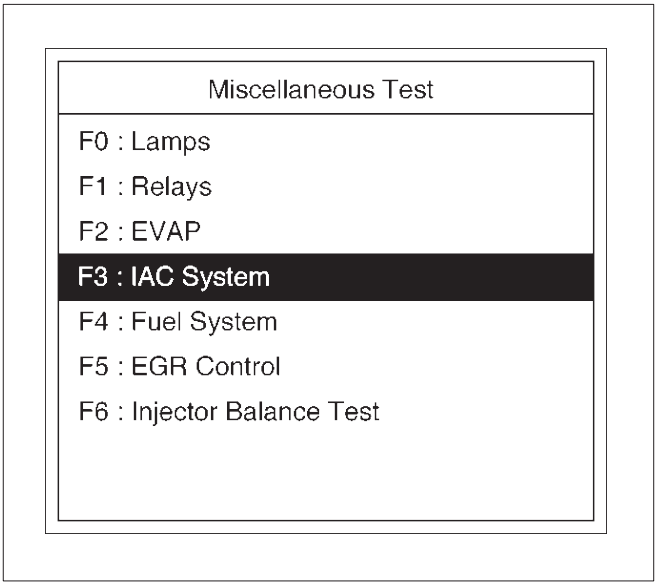
1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.

3. Select F3: Miscellaneous Test in the Application Menu.



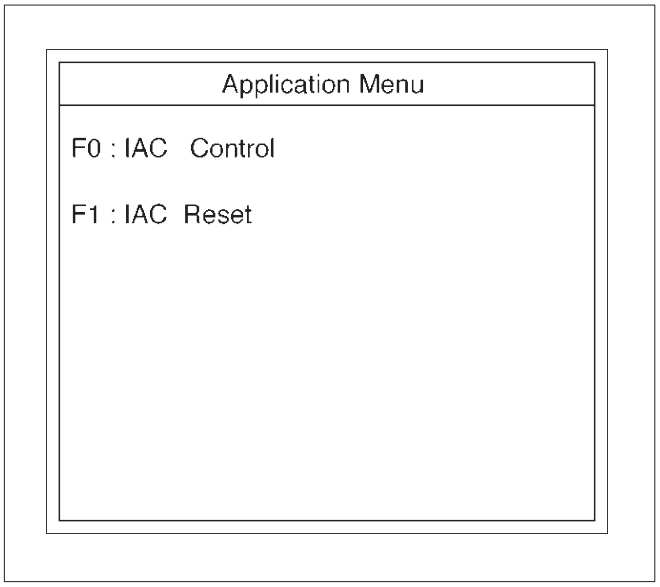
060R100078

4. Select F3: IAC System Test in the Miscellaneous Test.



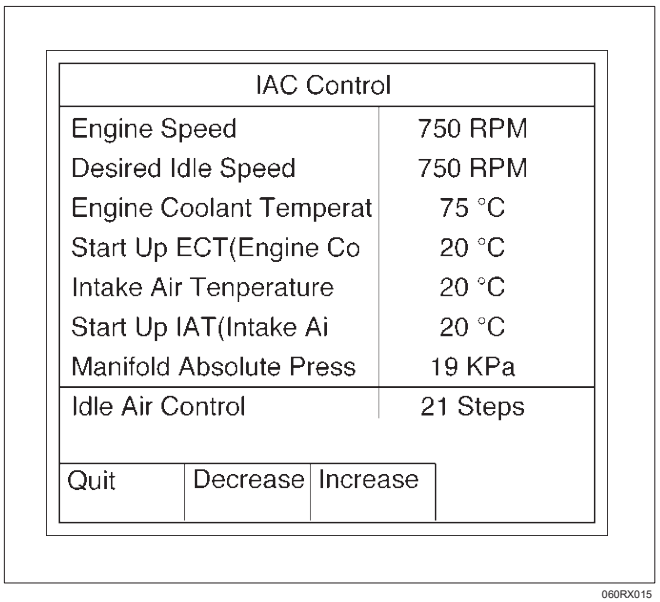
060RX051

5. Select F1: IAC Control Test.



060RX052

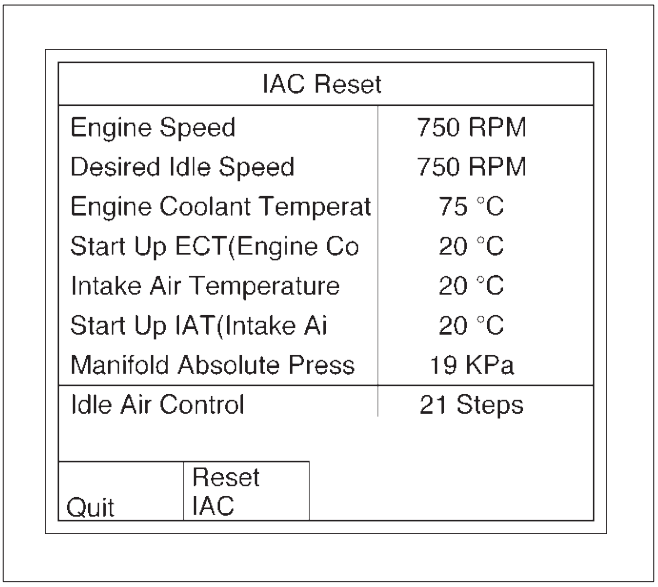
6. Push “Increase” or “Decrease” soft key.
7. Control IAC system and check a data list.
   - F0: IAC Control



060RX015

8. Select F1: IAC Reset.
9. Push “Reset IAC” soft key.
10. Control IAC Reset and check data list.

11. If data list changes, the IAC has been Reset.

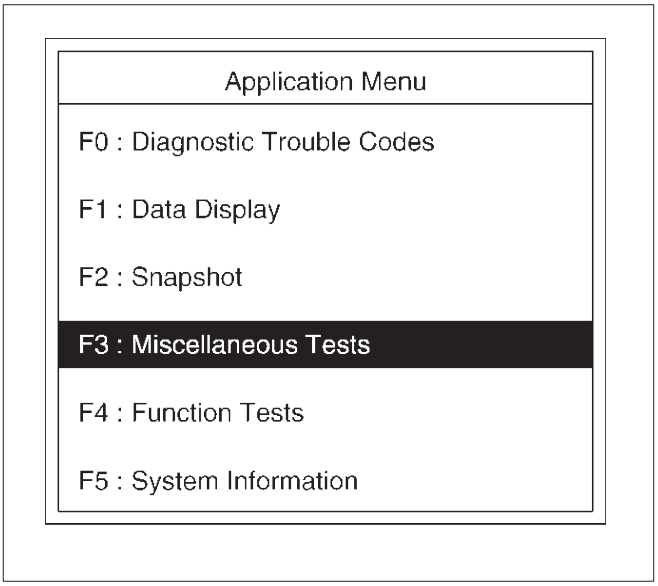


060RW231–1

Fuel System Test

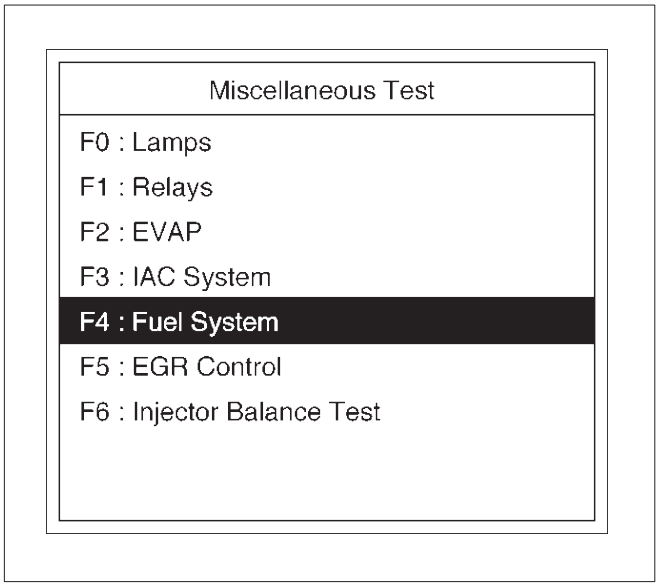
This test is conducted check Fuel Level Gauge for proper operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Ignition SW is “On”.
3. Select F3: Miscellaneous Test in the Application Menu.



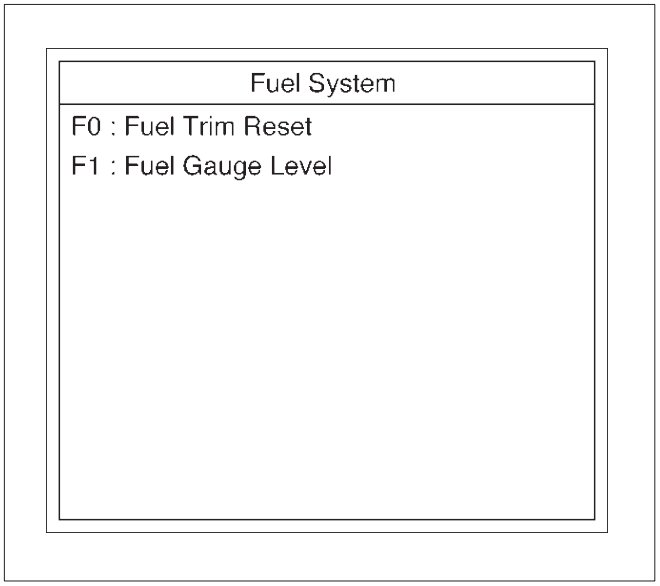
060R100078

4. Select F4: Fuel System in the Miscellaneous Menu.



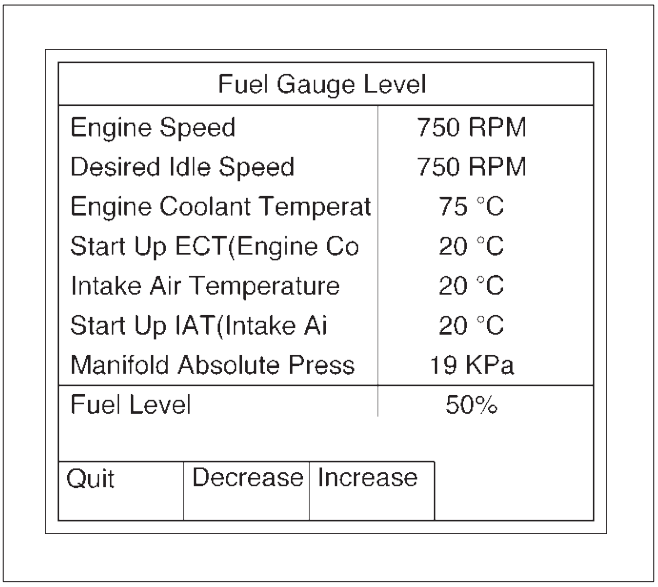
060RX053

5. Select F1: Fuel Gauge Level



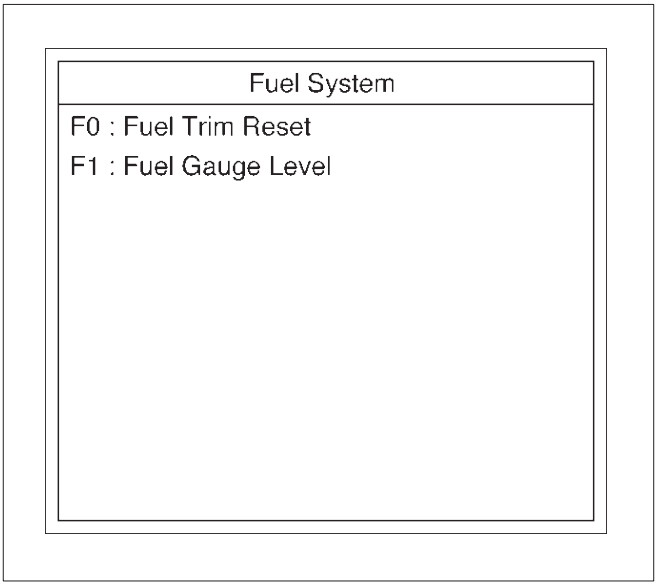
060RX028

6. Push “Decrease” or “Increase” of soft key.



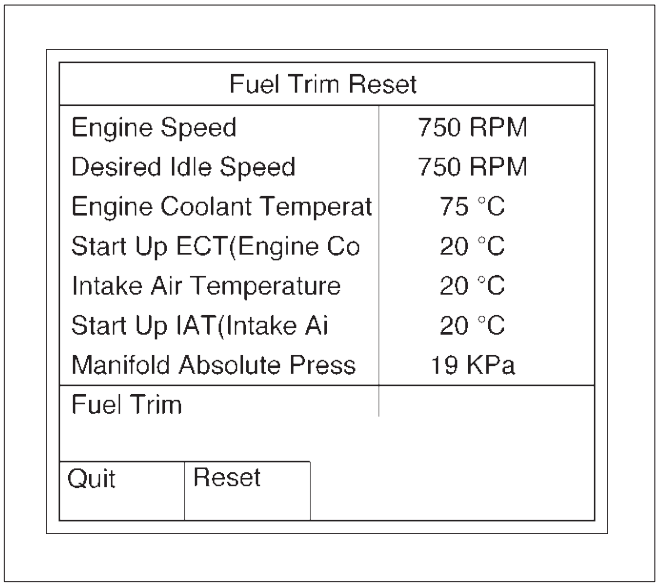
060RX030

7. Control Fuel Level and check data list.
8. If data list changes, the Fuel Gauge Level is normal.
9. Select F0: Fuel Trim Reset.



060RX028

10. Push “Reset” of soft key.

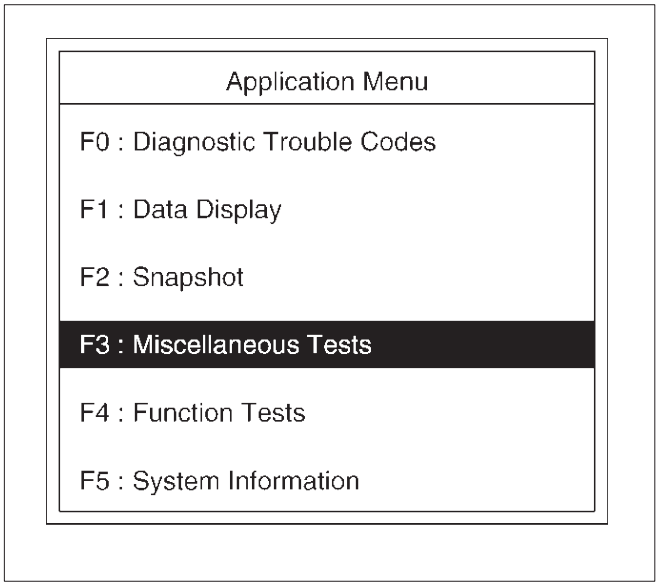


060RX029

EGR Control Test

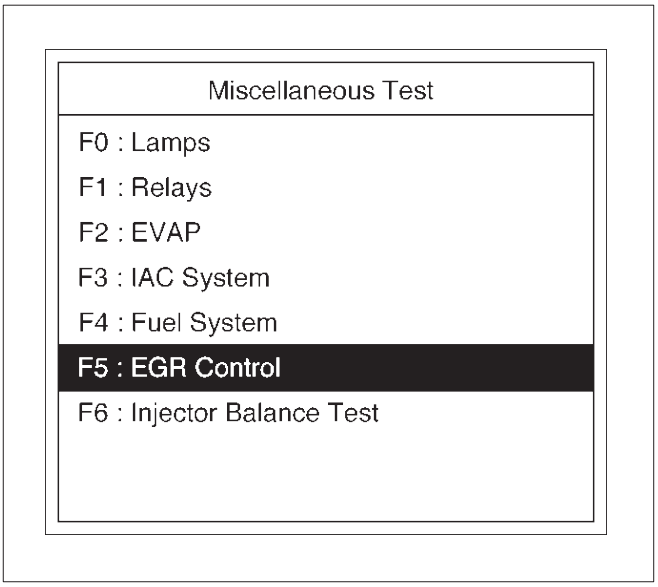
This test is conducted check EGR valve for proper operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



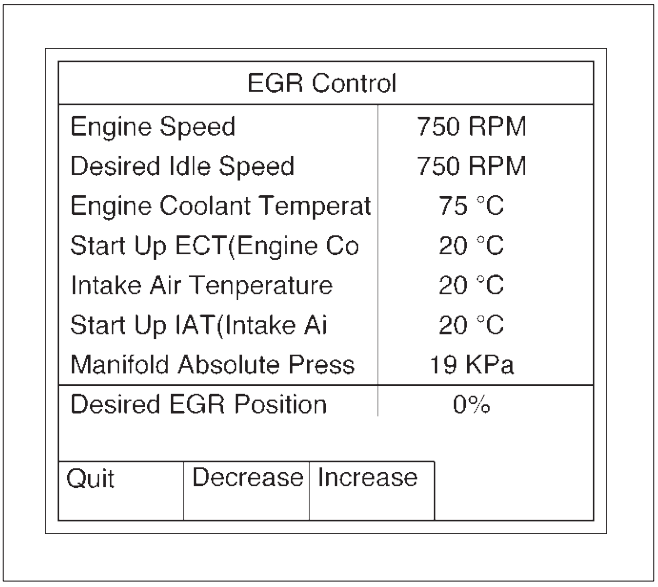
060R100078

4. Select F5: EGR Control Test in the Miscellaneous Test.



060RX054

5. Control EGR Valve and check data list.



060RX017

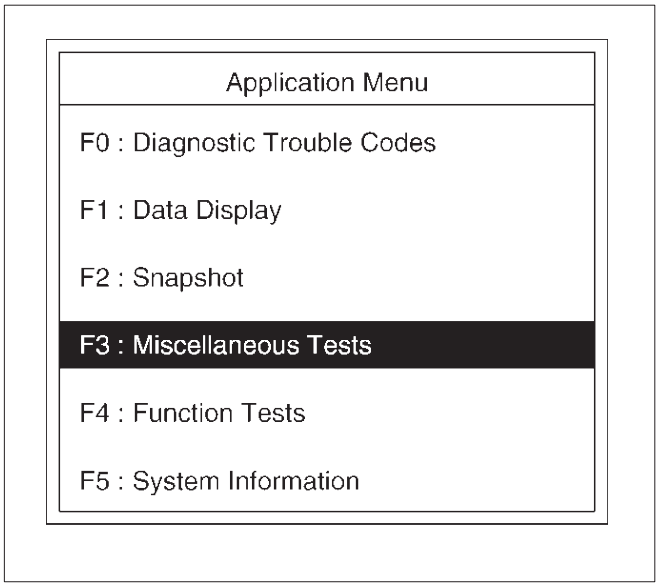
6. If the change, the EGR Control is normal.

Injector Balance Test

This test is conducted to make sure the appropriate electric signals are being sent to injectors Nos. 1–6.
Tech 2 must be used for this test.
Test Procedure:

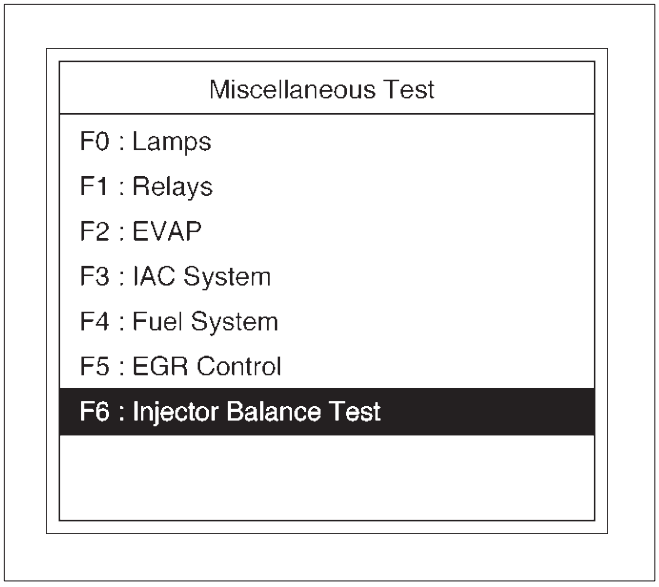
1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.

3. Select F3: Miscellaneous Test in the Application Menu.



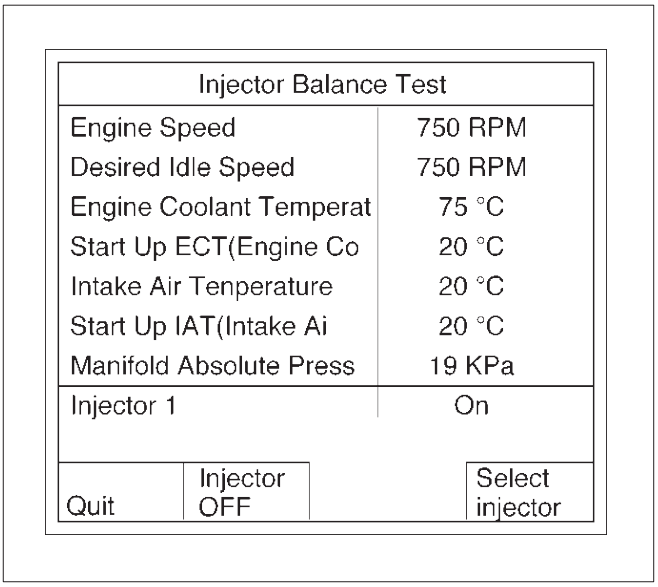
060R100078

4. Select F6: Injector Balance Test in the Miscellaneous Test.



060RX055

5. Select injector number and push “injector off” of soft key.

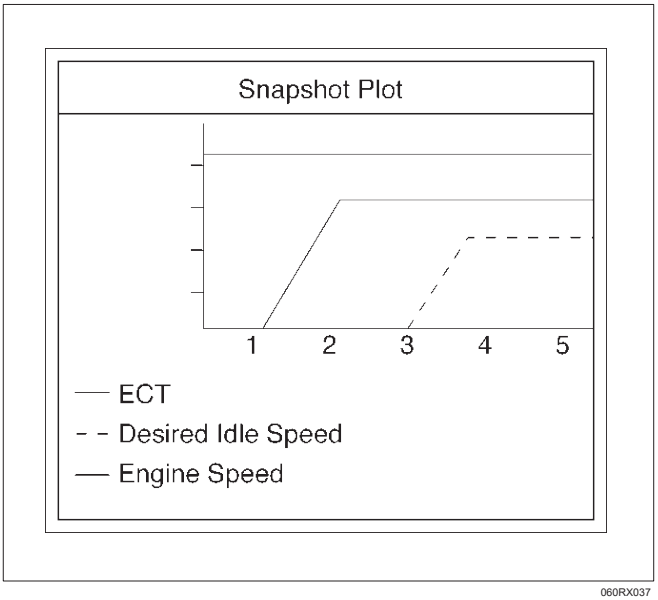


060RW230–1

6. Make sure of engine speed change.
7. If engine speed changes, the injector electric circuit is normal.
   If engine speed does not change, the injector electric circuit or the injector itself is not normal.

Plotting Snapshot Graph

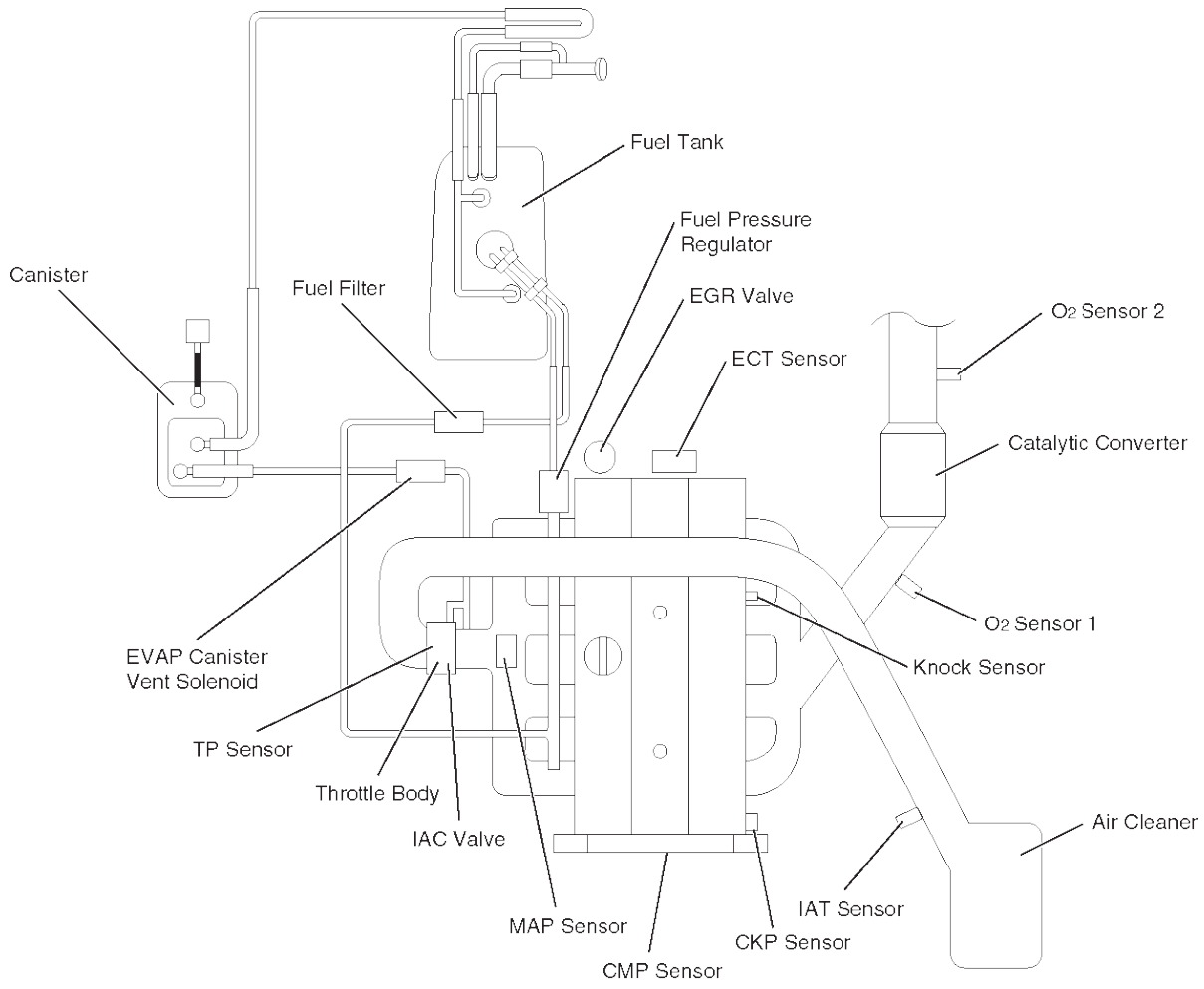
This test selects several necessary items from the data list to plot graphs and makes data comparison on a long term basis. It is an effective test particularly in emission related evaluations.



060RX037

For trouble diagnosis, you can collect graphic data (snap shot) directly from the vehicle. You can replay the snapshot data as needed. There fore, accurate diagnosis is possible, even though the vehicle is not available.

System Check at Tech 2



060R100086

General Description

1. Turn on the ignition and check the check engine lamp. If it is not turned on, execute Miscellaneous Test at Tech 2. (Refer to “Miscellaneous Test”) And if problems are found, repair a blown bulb or a short circuit.
2. Ignition on, engine on. Check flashing check engine lamp. If it keep flashing, Check Diagnosis trouble code (DTC) at Tech 2

CHECK POINT:

- Kind of DTC
- Which is current DTC or history.
- Recording freeze frame data in Tech 2.
- DTC history
- “F1: MIL SVS or Message Request” at Tech 2
- DTC at Current ignition cycle

3. When the lamp don’t turn on, Check a DTC at Tech 2 too.

CHECK POINT:

- Kind of DTC
- Which is current DTC or history.
- Recording freeze frame data in Tech 2.
- DTC history
- “F3: Test Failed Since Code Cleared” at Tech 2.
- DTC at Current ignition cycle

4. Case DTC stored at PCM
   Record the DTC and the freeze frame data and flash it.
   After reappear the trouble from the freeze frame data.
   Check power supply circuits, ground circuits, and signal circuit.

   CHECK POINT:

   - Which is mechanical trouble or electrical trouble.
   - Snapshot the engine data at the Tech 2. And observe variation of the any data, faulty data, fixed data and etc.

5. Case DTC did not store at PCM

   CHECK POINT:

   - Which is mechanical trouble or electrical trouble.
   - Snapshot the engine data at the Tech 2. And observe variation of the any data, faulty data, fixed data and etc.

   CHECK POINT:

   1. A systematic error is caused by a low accuracy of electric items.
   2. A random error is caused by electric trouble. It is disturbance and mechanical trouble.
   3. A fixed error is caused by broken electric item, open circuit, short circuit.

System Check at the Tech 2

Step	Action	Value(s)	Yes	No
1	1. Ignition “On”, engine “Off”. 2. Check the check engine lamp. Did it turm on?	—	Go to *Step 2*	Go to *“No Malfunction Indicator Lamp”*
2	1. Ignition “Off”. 2. Install Tech 2 3. Ignition “On”, engine “Off”. 4. Indicate the engine data at Tech 2 The engine data is illuminate on Tech 2	—	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “Off”. 2. Discconnect the PCM. 3. Check the class2 data circuit for a open, a short to ground or short to voltage. 4. Checke the power supply cirucit at the DLC for a open, a short to ground or short to voltage. If the problelm is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to *Step 4*
4	1. Ignition “On”, engine “On”. Did it run and keep running?	—	Go to *Step 4*	Go to *“Engine Cranke But Will Not Run”*
5	1. Turn on Tech 2 and select Model year and this engine after selected “Powertrain”. 2. Select menu item “F0:Diagnostic Trouble Code” on Tech 2. 3. Select menu item “F0:Read DTC info Priority” on Thch 2. Is Tech2 illuminated any DTCs?	—	Go to *Step 6*	—
6	1. Check DTC type which is current, history or intermittent. Is the DTC current?	—	Go to *Step 8*	Go to *Step 7*

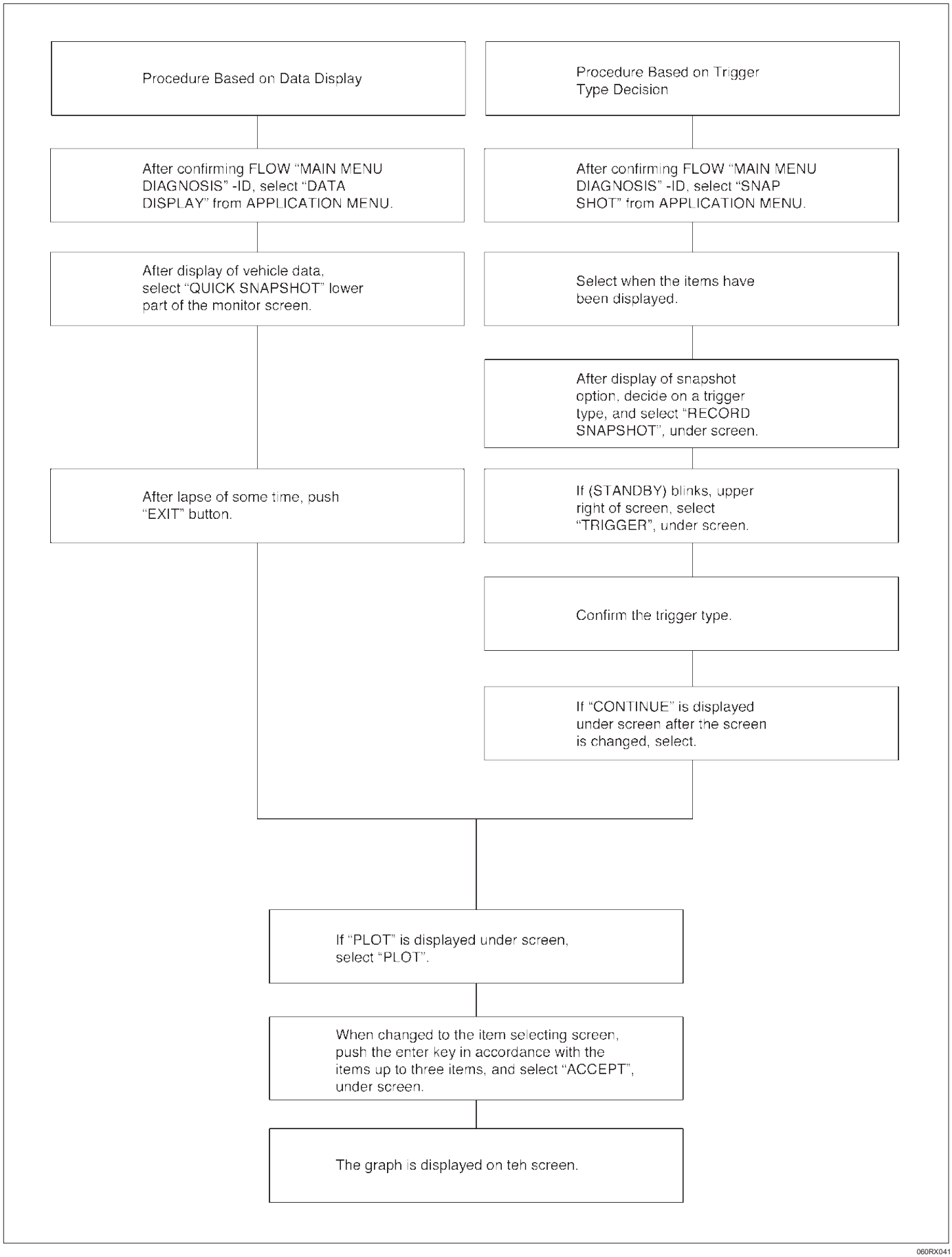
System Check at the Tech 2 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Record the DTC and the freeze frame data. 2. Flash the DTC. 3. Check trouble setteing condition at the freeze frame data. 4. Reappear the trouble from the freeze frame data. 5. Select menu item "F2:DTC Info." On the DTC. 6. Select menu item "F4:Not Run Since Code Cleared" on the DTC. 7. Check DTC id not illuminated on the svreen.(When the action is completed, the PCM checked relevant failure.) 8. Select menu item "F0:Read DTC info by Priority" and check DTC. Was the DTC illuminated on the Tech 2?	—	Go to *Step 8*	Go to *"General decription 5. Case DTC did not store at PCM" in this chapter*
8	1. Turn on Tech 2 and select Model year and this engine after selcted "Powertrain". 2. Select menu item "F0:Diagnostic Trouble Code" on Tech 2. 3. Select menu itme "F2:DTC Information". 4. Select menu itme "F2:Last Test Failed". 5. As obderve the Tech2 screen, vibrate relevant sensor body, connector, harness and actuator. If the screen is shaded, the vibrated point is breaking. Was a problem found?	—	Verify Repair	Go to *Step 9*
9	1. Turn on Tech 2 and select Model year and this engine after selected "Powertrain". 2. Select menu item "F3:Miscellaneous Tests" on Tech 2. 3. Select menu itme relevant sensor, actuator and parts. 4. If a relevant part is not fined on the screen, go to step 10. 5. After a test executed, If a problem is found, repair as necessary. Was problem found?	—	Verify Repair	Go to *Step 10*
10	1. Turn on Tech 2 and selct Model year and this engine after selected "Powertrain". 2. Select menu item "F1:Data Display" on Tech 2. 3. Select menu item "F0:Engine Data" or "F1:O2 sensor Data". 4. Ignition "On", engine "On". And keep idling speed. 5. As observe the Tech 2 screen, Vibrate relevant sensor body. connector, harness and actuator. If the screen is shaded, the vibrated point is braking. Was a problem found?	—	Verify Repair	Go to *step 11*

System Check at the Tech 2 (Cont'd)

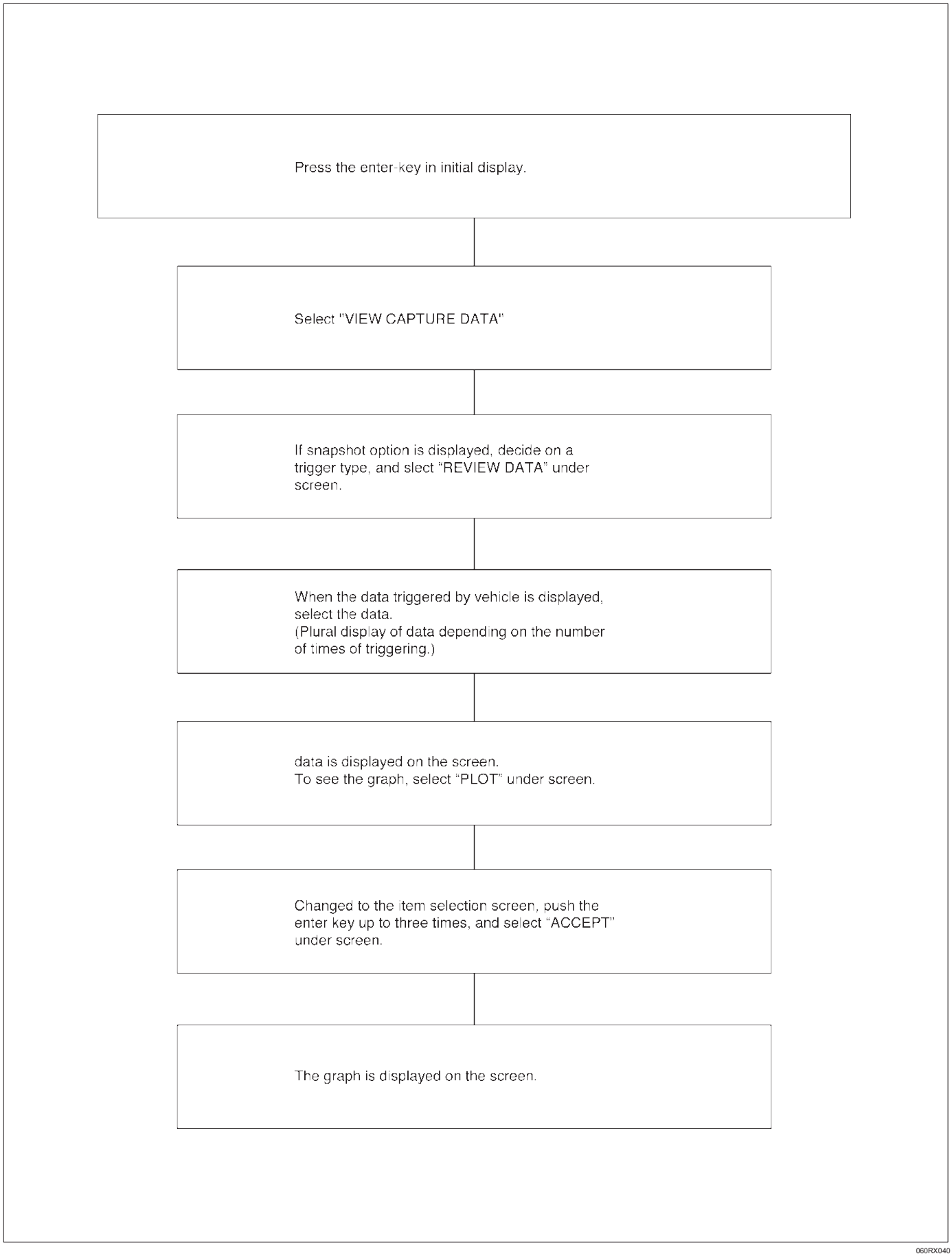
Step	Action	Value(s)	Yes	No
11	1. Turn on Tech 2 and select Model year and this engine agter selected "Powertrain". 2. Select menu item "F1:Date Display" on Tech2. 3. Select menu itne "F0:Engine Data" or "F1:O2 sensor Data". 4. Ignition "On", engine "On". And keep idling speed. (Warm it enough temprature.) 5. Using Tech 2, Start snapshot data. 6. Few minutes later, run up engine unitl 2500rpm for engine data recording. 7. Terminat snapshot, and reappear the engine data. 8. Compare specified value with it, and reappear the engine data. 9. If a problem was found, check the error which is systematic error, random error fixed error. ● A systematic error is caused by a low accuracy of electric items. So a lot of cases will be replaced it. ● A randonm error id caused by electric trouble, it is disturbance and mechanical trouble. In this case, check out applied voltage to electric itme exitence of EMI(electromagnetic interference) parts, elctrical interference, fitting of non genuine parts and mechanical parts. ● A fixed error is caused by broken electric item, open circuit, short circuit. For example when ECT sensor circuit was open ciruit, it is illuminated -40˚C on Tech 2. 10.If a problem was found, repair as neceesaary. Was a problem found?	—	Verify Repair	Go to *Step 12*
12	1. Countercheck mechanical of the engine. Refer to engine work shop manual. 2. If a problem was found, repair as necessary. Was a problem found?	—	Verify Repair	Go to *Step 13*
13	1. Countercheck this check table. 2. When this table is not found a trouble, check following point. ● Physical/Visual check ● Theh 2 data ● Freeze fram data ● Conceivable circuit 3. If a problem was found, repair as necessary. Was a problem found?	—	Verify Repair	—

Plotting Graph Flow Chart (Plotting graph after obtaining vehicle information)



060RX041

Flow Chart for Snapshot Replay (Plotting Graph)



060RX040

PRIMARY SYSTEM–BASED DIAGNOSTICS

Primary System–Based Diagnostics

There are primary system–based diagnostics which evaluate 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 heated oxygen sensor (HO2S 1) is diagnosed for the following conditions:

- Heater performance (time to activity on cold start)
- Slow response
- Response time (time to switch R/L or L/R)
- Inactive signal (output steady at bias voltage – approx. 450 mV)
- Signal fixed high
- Signal fixed low

The catalyst monitor heated oxygen sensor (HO2S 2) is diagnosed for the following conditions:

- 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 deceleration mode (deceleration when a lean mixture should be indicated).
- Inactive sensor (output steady at approx. 438 mV).

If the oxygen sensor pigtail wiring, connector or terminal are damaged, the entire oxygen sensor 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 oxygen sensor wire(s). Any attempt to repair the wires, connector or terminals could result in the obstruction of the reference air and degrade oxygen sensor performance. Refer to On–Vehicle Service, Heated Oxygen Sensors.

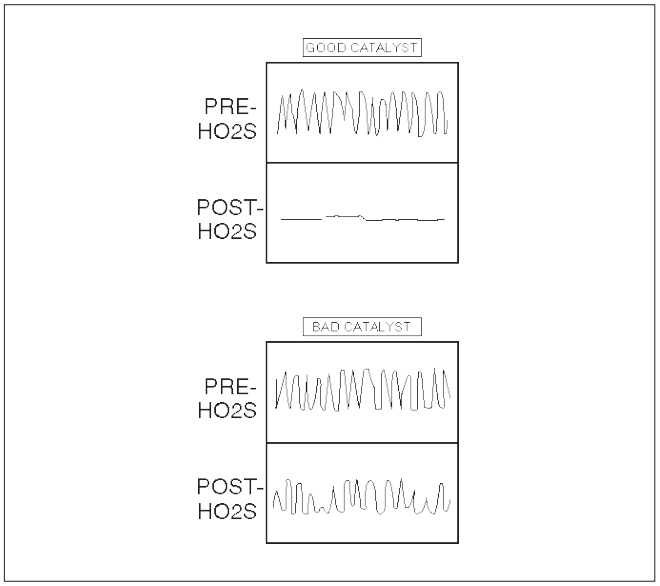
Fuel Control Heated Oxygen Sensors

The main function of the fuel control heated oxygen sensors is to provide the control module with exhaust stream oxygen content information to allow proper fueling and maintain emissions within mandated levels. After it reaches operating temperature, the sensor will generate a voltage, inversely proportional to the amount of oxygen present in the exhaust gases. The control module uses the signal voltage from the fuel control heated oxygen sensors while in ”Closed Loop” to adjust fuel injector pulse width. While in ”Closed Loop”, the PCM can adjust fuel delivery to maintain an air/fuel ratio which allows the best combination of emission control and driveability. The fuel control heated oxygen sensors are also used to determine catalyst efficiency.

HO2S Heater

Heated oxygen sensors are used to minimize the amount of time required for ”Closed Loop” fuel control to begin operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensor (HO2S 1) to become active. Oxygen sensor heaters are required by the catalyst monitor sensor (HO2S 2) to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further away from the engine.

Catalyst Monitor Heated Oxygen Sensors And Diagnostic Operation



TS24067

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three–way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The PCM has the ability to monitor this process using the pre–catalyst and post–catalyst heated oxygen sensors. The pre–catalyst sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three–way catalytic converter. The post–catalyst sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst’s ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the pre–catalyst signal will be far more active than that produced by the post–catalyst sensor.

In addition to catalyst monitoring, the heated oxygen sensors have a limited role in controlling fuel delivery. If the sensor signal indicates a high or low oxygen content for an extended period of time while in ”Closed Loop”, the PCM will adjust the fuel delivery slightly to compensate.

- For the 2.2L engine, the pre–catalyst monitor sensor is designated Bank 1 HO2S 1. The post–catalyst sensor is Bank 1 HO2S 2.

Catalyst Monitor Outputs

The catalyst monitor diagnostic is sensitive to the following conditions:

- Exhaust leaks
- HO2S contamination
- Alternate fuels

Exhaust system leaks may cause the following:

- Preventing a degraded catalyst from failing the diagnostic.
- Causing a false failure for a normally functioning catalyst.
- Preventing the diagnostic from running.

Some of the contaminants that may be encountered are phosphorus, lead, silica, and sulfur. The presence of these contaminants will prevent the TWC diagnostic from functioning properly.

Three–Way Catalyst Oxygen Storage Capacity

The Three–Way catalyst (TWC) must be monitored for efficiency. To accomplish this, the control module monitors the pre–catalyst HO2S and post–catalyst HO2S oxygen sensors. When the TWC is operating properly, the post–catalyst oxygen sensor will have significantly less activity than the pre–catalyst oxygen sensor. The TWC stores and releases oxygen as needed during its normal reduction and oxidation process. The control module will calculate the oxygen storage capacity using the difference between the pre–catalyst and post catalyst oxygen sensor's voltage levels. If the activity of the post–catalyst oxygen sensor approaches that of the pre–catalyst oxygen sensor, the catalyst's efficiency is degraded.

Stepped or staged testing level allow the control module to statistically filter test information. This prevents falsely passing or falsely failing the oxygen storage capacity test. The calculations performed by the on–board diagnostic system are very complex. For this reason, post catalyst oxygen sensor activity should not be used to determine oxygen storage capacity unless directed by the service manual.

Two stages are used to monitor catalyst efficiency. Failure of the first stage will indicate that the catalyst requires further testing to determine catalyst efficiency. The second stage then looks at the inputs from the pre and post catalyst HO2S sensors more closely before determining if the catalyst is indeed degraded. This further statistical processing is done to increase the accuracy of oxygen storage capacity type monitoring. Failing the first (stage 1) test DOES NOT indicate a failed catalyst. The catalyst may be marginal or the fuel sulfur content could be very high.

Aftermarket HO2S characteristics may be different from the original equipment manufacturer sensor. This may lead to a false pass or a false fail of the catalyst monitor diagnostic. Similarly, if an aftermarket catalyst does not contain the same amount of cerium as the original part, the correlation between oxygen storage and conversion efficiency may be altered enough to set a false DTC.

MISFIRE MONITOR DIAGNOSTIC OPERATION

Misfire Monitor Diagnostic Operation

The misfire monitor diagnostic is based on crankshaft rotational velocity (reference period) variations. The PCM determines crankshaft rotational velocity using the crankshaft position sensor and camshaft position sensor. When a cylinder misfires, the crankshaft slows down momentarily. By monitoring the crankshaft and camrhaft position sensor signals, the PCM can calculate when a misfire occurs.

For a non–catalyst damaging misfire, the diagnostic will be required to monitor a misfire present for between 1000–3200 engine revolutions.

For catalyst–damaging misfire, the diagnostic will respond to misfire within 200 engine revolutions.

Rough roads may cause false misfire detection. A rough road will cause torque to be applied to the drive wheels and drive train. This torque can intermittently decrease the crankshaft rotational velocity. This may be falsely detected as a misfire.

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 #1–4) indicate the number of firing events out of the last 200 cylinder firing events which were misfires. The misfire current counter will display real time data without a misfire DTC stored. The misfire history counters (Misfire Hist#1–4) indicate the total number of cylinder firing events which were misfires. The misfire history counters will display 0 until the misfire diagnostic has failed and a DTC P0300 is set. Once the misfire DTC P0300 is set, the misfire history counters will be updated every 200 cylinder firing events. A misfire counter is maintained for each cylinder.

If the misfire diagnostic reports a failure, the diagnostic executive reviews all of the misfire counters before reporting a DTC. This way, the diagnostic executive reports the most current information.

When crankshaft rotation is erratic, a misfire condition will be detected. Because of this erratic condition, the data that is collected by the diagnostic can sometimes incorrectly identify which cylinder is misfiring.

Use diagnostic equipment to monitor misfire counter data on OBD II–compliant vehicles. Knowing which specific cylinder(s) misfired can lead to the root cause, even when dealing with a multiple cylinder misfire. Using the information in the misfire counters, identify which cylinders are misfiring. If the counters indicate cylinders numbers 1 and 4 misfired, look for a circuit or component common to both cylinders number 1 and 4.

Misfire counter information is located in the "Specific Eng." menu, "Misfire Data" sub–menu of the data list.

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

Fuel Trim System Monitor Diagnostic Operation

This system monitors the averages of short–term and long–term fuel trim values. If these fuel trim values stay at their limits for a calibrated period of time, a malfunction is indicated. The fuel trim diagnostic compares the averages of short–term fuel trim values and long–term fuel trim values to rich and lean thresholds. If either value is within the thresholds, a pass is recorded. If both values are outside their thresholds, a rich or lean DTC will be recorded.

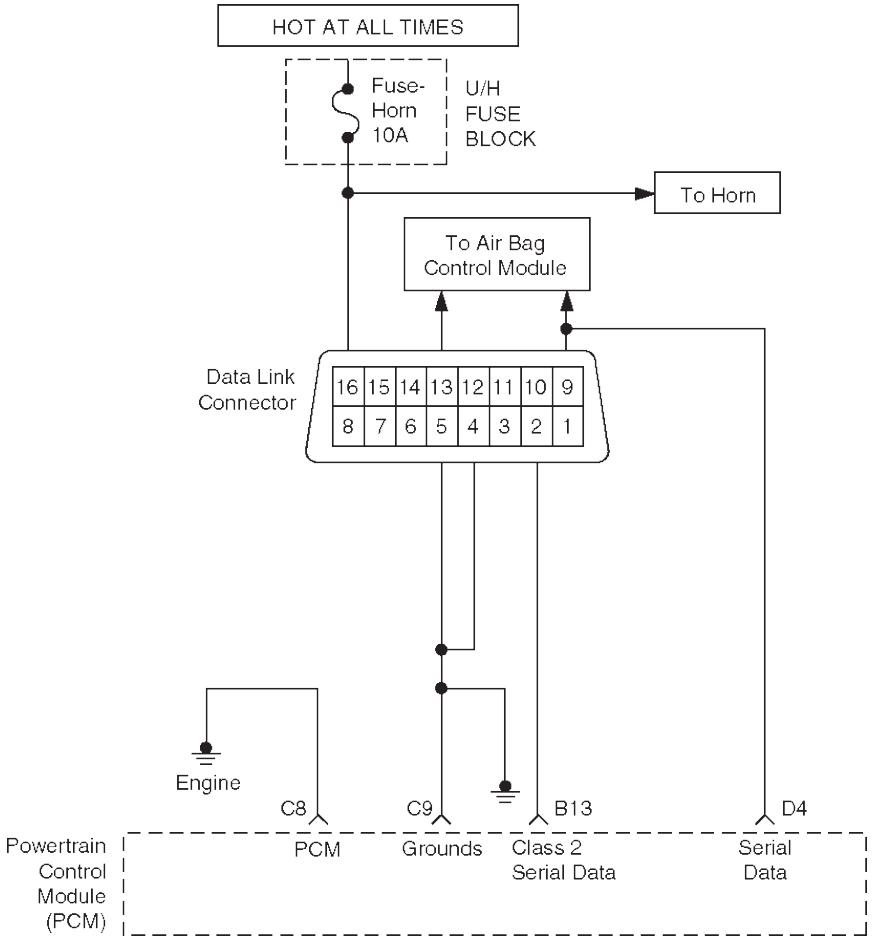
The fuel trim system diagnostic also conducts an intrusive test. This test determines if a rich condition is being caused by excessive fuel vapor from the EVAP canister. In order to meet OBD II requirements, the control module uses weighted fuel trim cells to determine the need to set a fuel trim DTC. A fuel trim DTC can only be set if fuel trim counts in the weighted fuel trim cells exceed specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e., engine idle high due to a small vacuum leak or rough idle due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Use the Tech 2 to observe fuel trim counts while the problem is occurring.

A fuel trim DTC may be triggered by a number of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

Fuel Trim Cell Diagnostic Weights

No fuel trim DTC will set regardless of the fuel trim counts in cell 0 unless the fuel trim counts in the weighted cells are also outside specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e. engine idle high due to a small vacuum leak or rough due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Use the Tech 2 to observe fuel trim counts while the problem is occurring.

ON–BOARD DIAGNOSTIC (OBD II) SYSTEM CHECK



060R100085

Circuit Description

The on–board diagnostic system check is the starting point for any driveability complaint diagnosis. Before using this procedure, perform a careful visual/physical check of the PCM and engine grounds for cleanliness and tightness.

The on–board diagnostic 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 PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal–to–wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The MIL (”Check Engine” lamp) should be ON steady with the ignition ON/engine OFF. If not, isolate the malfunction in the MIL circuit.
2. Checks the Class 2 data circuit and ensures that the PCM is able to transmit serial data.
3. This test ensures that the PCM is capable of controlling the MIL and the MIL driver circuit is not shorted to ground.
4. If the engine will not start, the Cranks But Will Not Run chart should be used to diagnose the condition.

7. A Tech 2 parameter which is not within the typical range may help to isolate the area which is causing the problem.

10. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors.

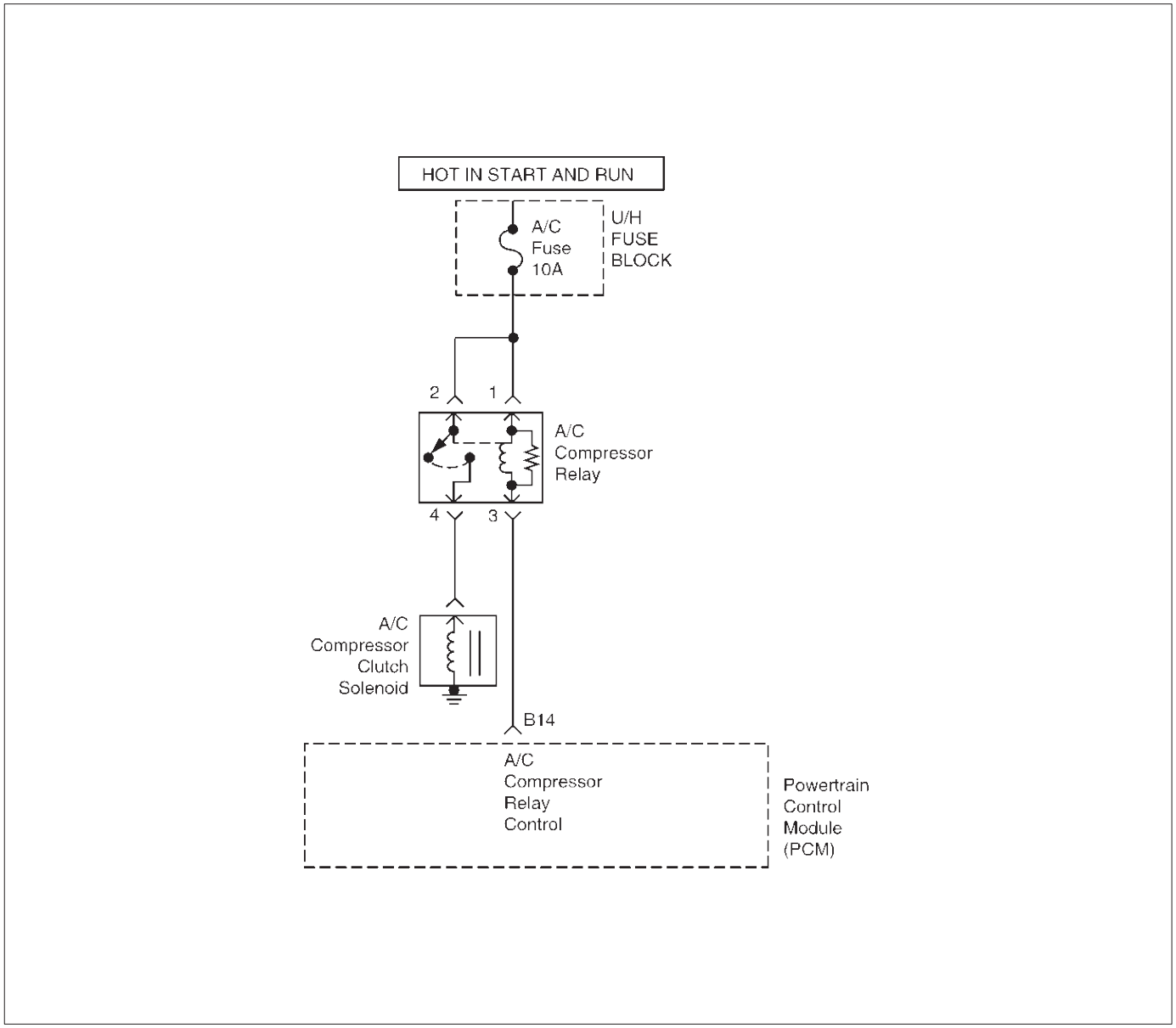
On–Board Diagnostic (OBD II) System Check

Step	Action	Value(s)	Yes	No
1	1. Ignition ON, engine OFF. 2. Observe the malfunction indicator lamp (MIL or ”Check Engine lamp”). Is the MIL (”Check Engine lamp”) ON?	—	Go to *Step 2*	Go to *No MIL*
2	1. Ignition OFF. 2. Install a Tech 2. 3. Ignition ON. 4. Attempt to display PCM engine data with the Tech 2. Does the Tech 2 display PCM data?	—	Go to *Step 3*	Go to *Step 8*
3	1. Using the Tech 2 output tests function, select MIL dash lamp control and command the MIL OFF. 2. Observe the MIL. Did the MIL turn OFF?	—	Go to *Step 4*	Go to MIL *(”Check Engine Lamp”) On Steady*
4	Attempt to start the engine. Did the engine start and continue to run?	—	Go to *Step 5*	Go to *Cranks But Will Not Run*
5	Select ”Display DTCs” with the Tech 2. Are any DTCs stored?	—	Go to *Step 6*	Go to *Step 7*
6	Are two or more of the following DTCs stored? P0107, P0113, P0118, P0122, P0123.	—	Go to *“Multiple PCM Information Sensor DTCs Set”*	Go to *applicable DTC table*
7	Compare PCM data values displayed on the Tech 2 to the typical engine scan data values. Are the displayed values normal or close to the typical values?	—	Go to *“Typial Scan” Data Value*	Go to *indicated Component System Checks*
8	1. Ignition OFF, disconnect the PCM. 2. Ignition ON, engine OFF. 3. Check the Class 2 data circuit 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 circuits for an open. 4. If a problem found, repair as necessary. Was a problem found?	—	Go to *Step 2*	Go to *Step 9*

On–Board Diagnostic (OBD II) System Check (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Attempt to reprogram the PCM. Refer to Powertrain Control Module (PCM) in On–Vehicle Service. 2. Attempt to display PCM data with the Tech 2. Does the Tech 2 display PCM engine data?	—	Go to *Step 2*	Go to *Step 10*
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to Powertrain Control Module (PCM) in On–Vehicle Service. And also refer to latest service bulletin Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

A/C CLUTCH CONTROL CIRCUIT DIAGNOSIS



060R100022

Circuit Description

When air conditioning and blower fan are selected, and if the system has a sufficient refrigerent charge, a 12–volt signal is supplied to the A/C request input of the powertrain control module (PCM). The A/C request signal may be temporarily cancelled during system operation by the electronic thermostat in the evaporator case. The electronic thermostat may intermittently remove the control circuit ground for the A/C thermostat relay to prevent the evaporator from forming ice. When the A/C request signal is received by the PCM, the PCM supplies a ground from the compressor clutch relay if the engine operating conditions are within acceptable ranges. With the A/C compressor relay energized, battery voltage is supplied to the compressor clutch coil.

The PCM will enable the compressor clutch to engage whenever A/C has been selected with the engine running, unless any of the following conditions are present:

- The throttle is greater than 90%.
- The ignition voltage is below 10.5 volts.
- The engine speed is greater than 4500 RPM for 5 seconds or 5400 RPM.
- The engine coolant temperature (ECT) is greater than 125˚C (257˚F)
- The intake air temperature (IAT) is less than 5˚C (41˚F).
- The power steering pressure switch signals a high pressure condition position.

Diagnostic Aids

To diagnose an intermittent fault, check for the following conditions:

- Poor connection at the PCM – Inspect harness connections for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.

- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery voltage, and open circuits. If the harness appears to be OK, observe the A/C clutch while moving connnectors and wiring harnesses related to the A/C. A sudden clutch malfunction will indicate the source of the intermittent.

A/C Clutch Diagnosis

This chart should be used for diagnosing the electrical portion of the A/C compressor clutch circuit. A Tech 2 will be used in diagnosing the system. The Tech 2 has the ability to read the A/C request input to the PCM. The Tech 2 can display when the PCM has commended the A/C clutch ON. The Tech 2 should have the ability to override the A/C request signal and energize the A/C compressor relay.

A/C Clutch Control Circuit Diagnosis

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition ON, engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTCs. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P1546. Does the Tech 2 indicate DTC P1546 ”Ran and Passed”?	—	*Refer to Diagnostic Aids*	Go to *Step 3*
3	1. Ignition OFF. 2. Remove the A/C Compressor Relay from the Underhood Electrical Center. 3. Ignition ON, engine OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the Fused pins of the A/C Compressor Clutch Relat connector. Does the DVM read the following value?	12 Volts	Go to *Step 5*	Go to *Step 4*
4	Check the suspect circuit(s) between the A/C Compressor Clutch Relay connector and the Fuse for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	—
5	1. Ignition OFF. 2. Disconnect the Powertrain Controlm Module (PCM) connectors from the PCM. 3. Check the A/C Compressor Clutch Relay control circuit between the PCM and Underhood Electrical Center for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	Go to *Step 6*

A/C Clutch Control Circuit Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Reinstall the A/C Compressor Clutch Relay. 2. Using a fused jumper, ground the A/C Compressor Clutch Relay control circuit at the PCM connector. 3. Ignition ON, engine OFF. Does the A/C Compressor turn ON?	—	Go to *Step 9*	Go to *Step 7*
7	1. Ignition OFF. 2. Check the A/C Compressor Clutch circuit between the A/C Compressor Clutch Relay and A/C Compressor Clutch for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	Go to *Step 8*
8	Replace the A/C Compressor Clutch Relay. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed.Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest service bulletin Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

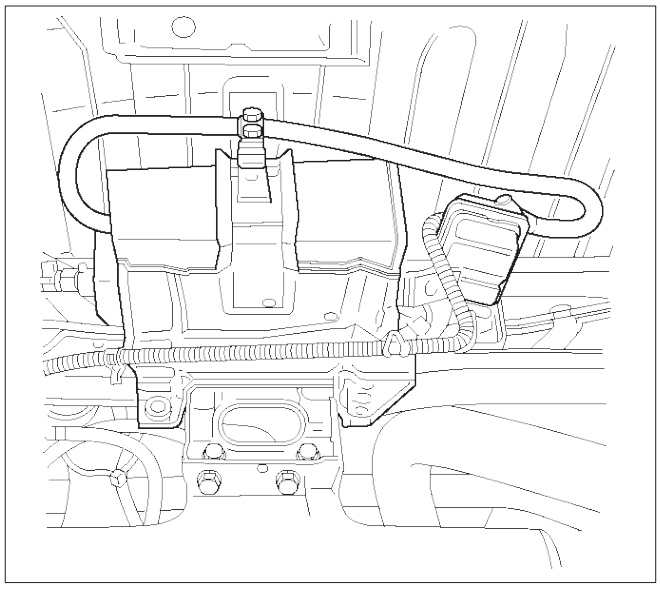
ELECTRONIC IGNITION SYSTEM DIAGNOSIS

If the engine cranks but will not run or immediately stalls, the Engine Cranks But Will Not Start chart must be used to determine if the failure is in the ignition system or the fuel system. If DTC P0300, P0341, P0342, or P0336 is set, the appropriate diagnostic trouble code chart must be used for diagnosis.
If a misfire is being experienced with no DTC set, for diagnosis, refer to the Symptoms section.

EVAP CANISTER PURGE SOLENOID

A continuous purge condition with no purge commanded by the PCM will set a DTC P1441. A fault (small leak) in the EVAP purge vacuum system will set a DTC P0442. Refer to the DTC charts for further information.

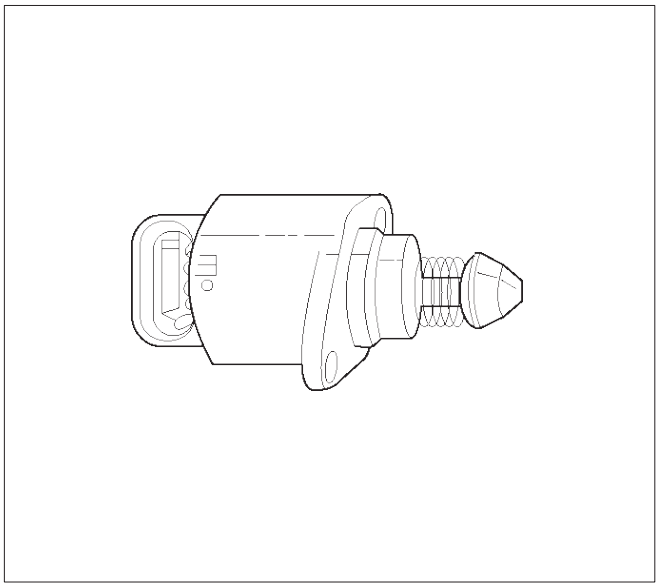
VISUAL CHECK OF THE EVAPORATIVE EMISSION CANISTER



014RX001

- If the canister is cracked or damaged, replace the canister.
- If fuel is leaking from the canister, replace the canister and check hoses and hose routing.

IDLE AIR CONTROL (IAC) VALVE



0006

The Tech 2 displays the IAC pintle position in counts. A count of ”0” indicates the PCM is commanding the IAC pintle to be driven all the way into a fully–seated position. This is usually caused by a vacuum leak.
The higher the number of counts, the more air is being commanded to bypass the throttle blade. In order to diagnose the IAC system, refer to IAC System Check.
For other possible causes of idle problems, refer to Rough, Unstable, or Incorrect Idle, Stalling in Symptoms.

FUEL SYSTEM PRESSURE TEST

A fuel system pressure test is part of several of the diagnostic charts and symptom checks. To perform this test, refer to Fuel System Diagnosis.

FUEL METERING SYSTEM CHECK

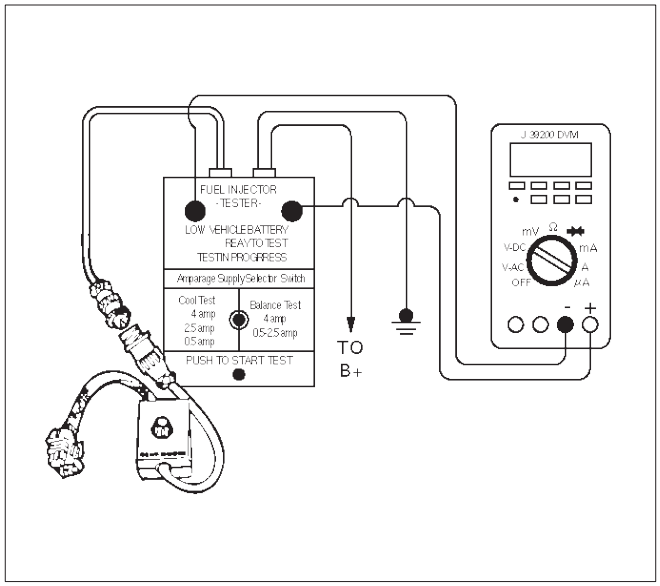
Some failures of the fuel metering system will result in an ”Engine Cranks But Will Not Run” symptom. If this condition exists, refer to the Cranks But Will Not Run chart. This chart will determine if the problem is caused by the ignition system, the PCM, or the fuel pump electrical circuit.

For the fuel system wiring schematic, refer to Fuel System Electrical Test.

If there is a fuel delivery problem, to diagnose the fuel injectors, the fuel pressure regulator, and the fuel pump,refer to Fuel System Diagnosis.

If a malfunction occurs in the fuel metering system, it usually results in either a rich HO2S signal or a lean HO2S signal. This condition is indicated by the HO2S voltage, which causes the PCM to change the fuel calculation (fuel injector pulse width) based on the HO2S reading. Changes made to the fuel calculation will be indicated by a change in the long term fuel trim values which can be monitored with a Tech 2. Ideal long term fuel trim values are around 0%; for a lean HO2S signal, the PCM will add fuel, resulting in a fuel trim value above 0%. Some variations in fuel trim values are normal because all engines are not exactly the same. If the evaporative emission canister purge is ON, the long term fuel trim may be as low as –38%. If the long term fuel trim values are greater than +23%, for items which can cause a lean HO2S signal, refer to DTC P0131, DTC P0171, and DTC 1171.

FUEL INJECTOR COIL TEST PROCEDURE AND FUEL INJECTOR BALANCE TEST PROCEDURE



T32003

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Relieve the fuel pressure by connecting the J 34730–1 Fuel Pressure Gauge to the fuel pressure connection on the fuel rail.

CAUTION: In order to reduce the risk of fire and personal injury, wrap a shop towel around the fuel pressure connection. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.

Place the fuel pressure gauge bleed hose in an approved gasoline container.

With the ignition switch OFF open the valve on the fuel pressure gauge.

3.Record the lowest voltage displayed by the DVM after the first second of the test. (During the first second, voltage displayed by the DVM may be inaccurate due to the initial current surge.)

Injector Specifications:

Resistance Ohms	Voltage Specification at 10˚C–35˚C (50˚F–95˚F)
11.8 – 12.6	5.7 – 6.6

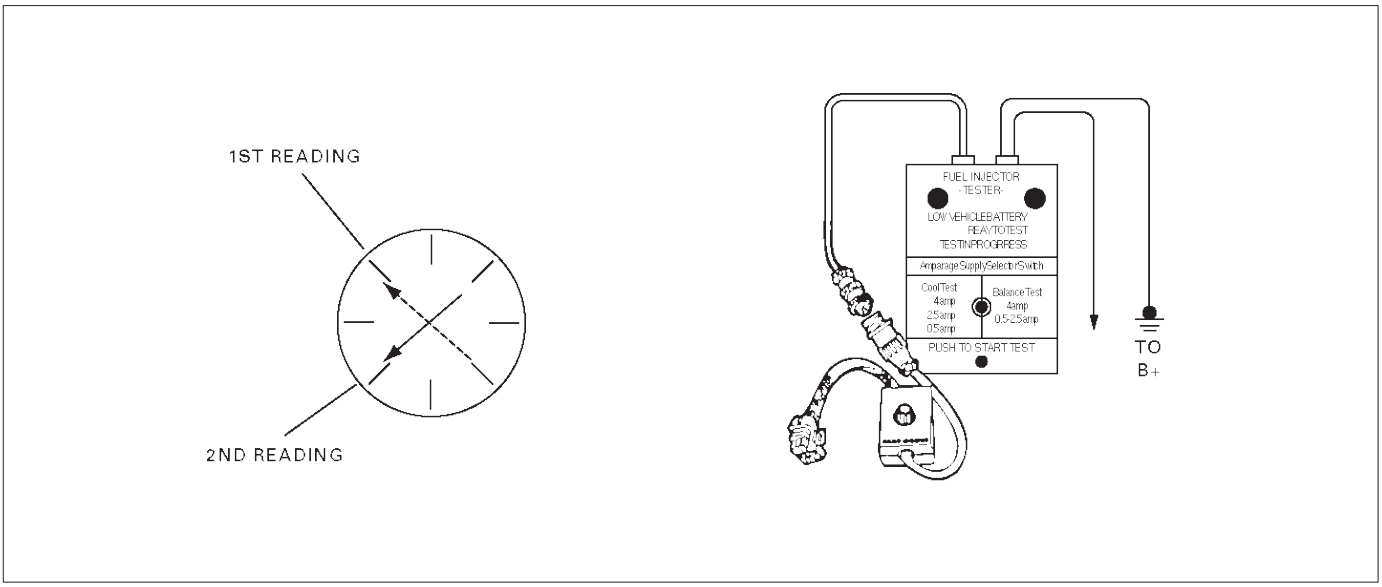
- The voltage displayed by the DVM should be within the specified range.
- The voltage displayed by the DVM may increase throughout the test as the fuel injector windings warm and the resistance of the fuel injector windings changes.
- An erratic voltage reading (large fluctuations in voltage that do not stabilize) indicates an intermittent connection within the fuel injector.

5. Injector Specifications:

Highest Acceptable Voltage Reading Above/Below 35˚C/10˚C (95˚F/50˚F)	Acceptable Subtracted Value
9.5 Volts	0.6 Volt

7. The Fuel Injector Balance Test portion of this chart (Step 7 through Step 11) checks the mechanical (fuel delivery) portion of the fuel injector. An engine cool–down period of 10 minutes is necessary in order to avoid irregular fuel pressure readings due to ”Hot Soak” fuel boiling.

Injector Coil Test Procedure (Steps 1–6) And Injector Balance Test Procedure (Steps 7–11)



R262001

CYLINDER				
	1	2	3	4
1st Reading	296 kPa (43psi)	296 kPa (43psi)	296 kPa (43psi)	296 kPa (43psi)
2nd Reading	131 kPa (19 psi)	117 kPa (17 psi)	124 kPa (18 psi)	145 kPa (21 psi)
Amount of Drop (1st Reading–2nd Reading	165 kPa (24 psi)	179 kPa (26 psi)	172 kPa (25 psi)	151 kPa (22 psi)
Av. drop = 166 kPa/24 psi +/–10 kPa/1.5 psi = 156 – 176 kPa or 22.5 – 25.5 psi	OK	Faulty, Rich (Too Much Fuel Drop)	OK	Faulty, Lean (Too Little Fuel Drop)

NOTE: These figures are examples only.

Injector Coil Test Procedure (Steps 1–6) And Injector Balance Test Procedure (Steps 7–11)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Turn the engine OFF. NOTE: In order to prevent flooding of a single cylinder and possible engine damage, relieve the fuel pressure before performing the fuel injector coil test procedure. 2. Relieve the fuel pressure. Refer to Test Description Number 2. 3. Connect the J 39021–5V Fuel Injector Tester to B+ and ground, and to the J39021–90 Injector Switch Box. 4. Connect the injector switch box to the grey fuel injector harness connector located at the front of the EVAP canister bracket. 5. Set the amperage supply selector switch on the fuel injector tester to the ”Coil Test” 0.5 amp position. 6. Connect the leads from the J 39200 Digital Voltmeter (DVM) to the fuel injector tester. Refer to the illustrations associated with the test description. 7. Set the DVM to the tenths scale (0.0). 8. Observe the engine coolant temperature. Is the engine coolant temperature within the specified values?	10˚C (50˚F) to 35˚C (95˚F)	Go to *Step 3*	Go to *Step 5*
3	1. Set the injector switch box to injector #1. 2. Press the ”Push to Start Test” button on the fuel injector tester. 3. Observe the voltage reading on the DVM. **IMPORTANT:** The voltage reading may rise during the test. 4. Record the lowest voltage observed after the first second of the test. 5. Set the injector switch box to the next injector and repeat steps 2, 3, and 4. Did any fuel injector have an erratic voltage reading (large fluctuations in voltage that did not stabilize) or a voltage reading outside of the specified values?	5.7–6.6 V	Go to *Step 4*	Go to *Step 7*
4	Replace the faulty fuel injector(s). Refer to Fuel Injector. Is the action complete?	—	Go to *Step 7*	—

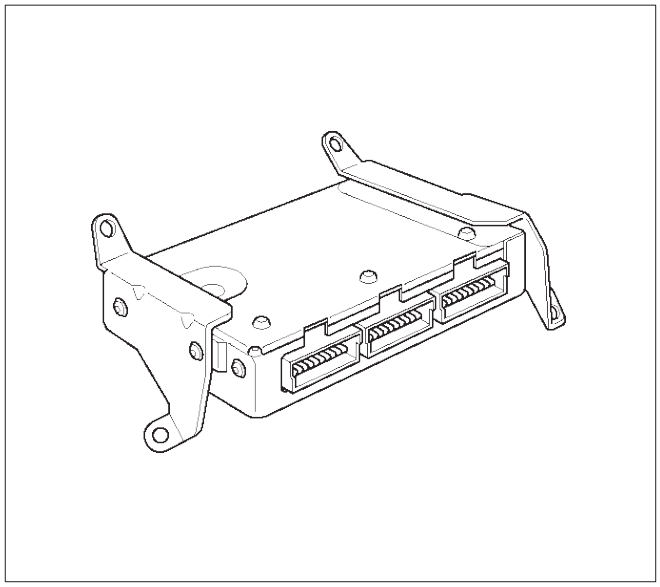
Injector Coil Test Procedure (Steps 1–6) And Injector Balance Test Procedure (Steps 7–11) (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Set the injector switch box to injector #1. 2. Press the "Push to Start Test" button on the fuel injector tester. 3. Observe the voltage reading on the DVM. **IMPORTANT:** The voltage reading may rise during the test. 4. Record the lowest voltage observed after the first second of the test. 5. Set the injector switch box to the next injector and repeat steps 2, 3, and 4. Did any fuel injector have an erratic voltage reading (large fluctuations in voltage that did not stabilize) or a voltage reading above the specified value?	9.5 V	Go to *Step 4*	Go to *Step 6*
6	1. Identify the highest voltage reading recorded (other than those above 9.5 V). 2. Subtract the voltage reading of each injector from the highest voltage selected in step 1. Repeat until you have a subtracted value for each injector. For any injector, is the subtracted value in step 2 greater than the specified value?	0.6 V	Go to *Step 4*	Go to *Step 7*
7	**CAUTION: In order to reduce the risk of fire and personal injury, wrap a shop towel around the fuel pressure connection. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.** 1. Connect the J 34730–1 Fuel Pressure Gauge to the fuel pressure test port. 2. Energize the fuel pump using the Tech 2. 3. Place the bleed hose of the fuel pressure gauge into an approved gasoline container. 4. Bleed the air out of the fuel pressure gauge. 5. With the fuel pump running, observe the reading on the fuel pressure gauge. Is the fuel pressure within the specified values?	296 kPa– 376 kPa (43–55 psi)	Go to *Step 8*	Go to *Fuel System Diagnosis*
8	Turn the fuel pump OFF. Does the fuel pressure remain constant?	—	Go to *Step 9*	Go to *Fuel System Diagnosis*

Injector Coil Test Procedure (Steps 1–6) And Injector Balance Test Procedure (Steps 7–11) (Cont'd)

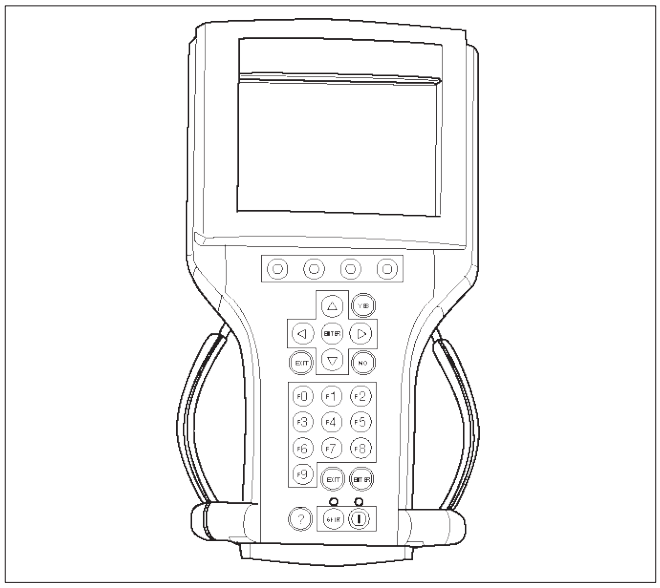
Step	Action	Value(s)	Yes	No
9	1. Connect the J 39021–5V Fuel Injector Tester and J39021–90 Injector Switch Box to the fuel injector harness connector. 2. Set the amperage supply selector switch on the fuel injector tester to the "Balance Test" 0.5–2.5 amp position. 3. Using the Tech 2 turn the fuel pump ON then OFF in order to pressurize the fuel system. 4. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure stabilizes. This is the first pressure reading. 5. Energize the fuel injector by depressing the Push to Start Test button on the fuel injector tester. 6. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure gauge needle has stopped moving. This is the second pressure reading. 7. Repeat steps 1 through 6 for each fuel injector. 8. Subtract the second pressure reading from the first pressure reading for one fuel injector. The result is the pressure drop value. 9. Obtain a pressure drop value for each fuel injector. 10. Add all of the individual pressure drop values. This is the total pressure drop. 11. Divide the total pressure drop by the number of fuel injectors. This is the average pressure drop. Does any fuel injector have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value?	10 kPa (1.5 psi)	Go to *Step 10*	Go to *OBD System Check*
10	Re–test any fuel injector that does not meet the specification. Refer to the procedure in step 11. NOTE: Do not repeat any portion of this test before running the engine in order to prevent the engine from flooding. Does any fuel injector still have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value?	10 kPa (1.5 psi)	Go to *Step 11*	Go to *Symptoms*
11	Replace the faulty fuel injector(s). Refer to Fuel Injector. Is the action complete?	—	Verify repair	—

POWERTRAIN CONTROL MODULE (PCM) DIAGNOSIS



014RX002

To read and clear diagnostic trouble codes, use a Tech 2.



901RX031

IMPORTANT: Use of a Tech 2 is recommended to clear diagnostic trouble codes from the PCM memory. Diagnostic trouble codes can also be cleared by turning the ignition OFF and disconnecting the battery power from the PCM for 30 seconds. Turning off the ignition and disconnecting the battery power from the PCM will cause all diagnostic information in the PCM memory to be cleared. Therefore, all the diagnostic tests will have to be re–run.

Since the PCM can have a failure which may affect only one circuit, following the diagnostic procedures in this section will determine which circuit has a problem and where it is.

If a diagnostic chart indicates that the PCM connections or the PCM is the cause of a problem, and the PCM is replaced, but this does not correct the problem, one of the following may be the reason:

- There is a problem with the PCM terminal connections. The terminals may have to be removed from the connector in order to check them properly.
- EEPROM program is not correct for the application. Incorrect components or reprogramming the PCM with the wrong EEPROM program may cause a malfunction and may or may not set a DTC.
- The problem is intermittent. This means that the problem is not present at the time the system is being checked. In this case, make a careful physical inspection of all components and wiring associated with the affected system and refer to the Symptoms portion of the manual.
- There is a shorted solenoid, relay coil, or harness. Solenoids and relays are turned ON and OFF by the PCM using internal electronic switches called drivers. A shorted solenoid, relay coil, or harness will not damage the PCM but will cause the solenoid or relay to be inoperative.

MULTIPLE PCM INFORMATION SENSOR DTCs SET

Circuit Description

The powertrain control module (PCM) monitors various sensors to determine the engine operating conditions. The PCM controls fuel delivery, spark advance, and emission control device operation based on the sensor inputs.

The PCM provides a sensor ground to all of the sensors. The PCM applies 5 volts through a pull–up resistor, and determines the status of the following sensors by monitoring the voltage present between the 5–volt supply and the resistor:

- The Fuel Tank Vapor Pressure Sensor
- The throttle position (TP) sensor
- The manifold absolute pressure (MAP) sensor

The PCM provides the following sensors with a 5–volt reference and a sensor ground signal:

- The Linear exhaust gas recirculation (EGR) valve
- The A/C Pressure Sensor

The PCM monitors the separate feedback signals from these sensors in order to determine their operating status.

Diagnostic Aids

Be sure to inspect PCM and engine grounds for being secure and clean.

A short to voltage in one of the sensor input circuits may cause one or more of the following DTCs to be set:

- P0108/P1106
- P0113/P1111
- P0118/P1115
- P0123/P1121
- P0463

If a sensor input circuit has been shorted to voltage, ensure that the sensor is not damaged. A damaged sensor will continue to indicate a high or low voltage after the affected circuit has been repaired. If the sensor has been damaged, replace it.

An open in the sensor ground circuit between the PCM and the splice will cause one or more of the following DTCs to be set:

- P0108/P1106
- P0113/P1111
- P0118/P1115
- P0123/P01121
- P0453/P0463

A short to ground in the 5–volt reference A circuit will cause one or more of the following DTCs to be set:

- P0107/P1107
- P0122/P1122
- P0112/P1112
- P0117/P1114
- P0454/P0462
- P0405
- P0532

Check for the following conditions:

- **Poor connection at PCM.** Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and a poor terminal–to–wire connection.
- **Damaged harness.** Inspect the wiring harness for damage. If the harness is not damaged, observe an affected sensor's displayed value on the Tech 2 with the ignition ON and the engine OFF while you move the connectors and the wiring harnesses related to the following sensors:
  - IAT
  - ECT
  - TP
  - MAP
  - EGR
  - Fuel Tank Vapor Pressure Sensor
  - A/C Pressure Sensor

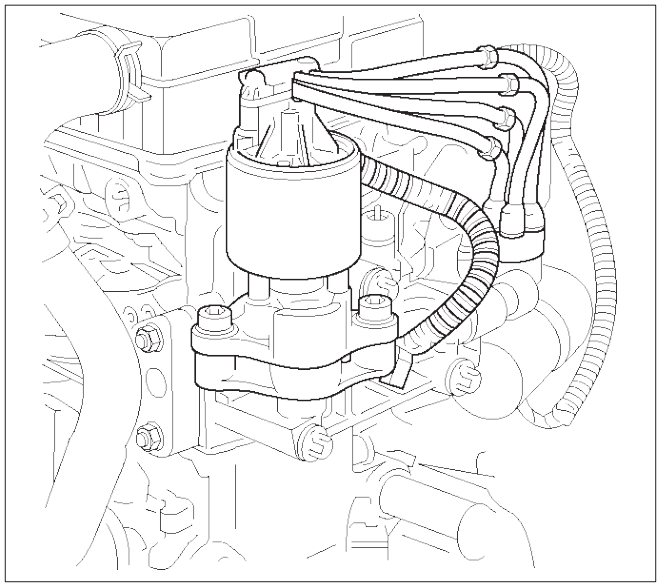
Multiple PCM Information Sensor DTCs Set

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Turn the ignition OFF, disconnect the PCM. 2. Turn the ignition ON, check the 5 volt reference circuits for the following conditions: • A poor connection at the PCM. • An open between the PCM connector and the splice. • A short to ground. • A short to voltage. Is there an open or short?	—	Go to *Step 3*	Go to *Step 4*
3	Repair the open or short. Is the action complete?	—	Verify repair	—
4	Check the sensor ground circuit for the following conditions: • A poor connection at the PCM or the affected sensors. • An open between the PCM connector and the affected sensors. Is there an open or a poor connection?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the open or the poor connection. Is the action complete?	—	Verify repair	—
6	Measure the voltage between the EGR pintle position sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 7*	Go to *Step 13*
7	Measure the voltage between the MAP sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 8*	Go to *Step 14*
8	Measure the voltage between the TP sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 9*	Go to *Step 15*
9	Measure the voltage between the IAT sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 10*	Go to *Step 16*
10	Measure the voltage between the ECT sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 20*	Go to *Step 17*
11	Measure the voltage between the A/C Pressure Sensor circut at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 13*	Go to *Step 19*

Multiple PCM Information Sensor DTCs Set (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Disconnect the EGR valve. 2. Measure the voltage between the EGR pintle position sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 12*	Go to *Step 17*
13	Replace the EGR valve. Is the action complete?	—	Verify repair	—
14	Locate and repair the short to voltage in the MAP sensor signal circuit. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to voltage in the TP sensor signal circuit. Is the action complete?	—	Verify repair	—
16	Locate and repair the short to voltage in the IAT sensor signal circuit. Is the action complete?	—	Verify repair	—
17	Locate and repair the short to voltage in the ECT sensor signal circuit. Is the action complete?	—	Verify repair	—
18	Locate and repair the short to voltage in the A/C Pressure Sensor circuit. Is the action complete?	—	Verify repair	—
19	Locate and repair the short to voltage in the EGR pintle position sensor signal circuit. Is the action complete?	—	Verify repair	—
20	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest service bulletin Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to *OBD System Check*	—

EXHAUST GAS RECIRCULATION (EGR) DIAGNOSIS



057RX001

An EGR flow check diagnosis of the linear EGR system is covered by DTC P0401, P0404, and P0405. If EGR diagnostic trouble code P0401 is encountered, refer to the DTC charts.

ENGINE Tech 2 DATA DEFINITIONS AND RANGES

A/C CLUTCH – Tech 2 Displays ON or OFF
Indicates whether the PCM has commanded the A/C clutch ON. Used in A/C system diagnostics.

A/C REQUEST – Tech 2 Displays YES or NO
Indicates the state of the A/C request input circuit from the HVAC controls. The PCM uses the A/C request signal to determine whether A/C compressor operation is being requested.

AIR/FUEL RATIO – Tech 2 Range 0.0–25.5
Air/fuel ratio indicates the PCM commanded value. In ”Closed Loop”, the air/fuel ratio should normally be displayed around ”14.2–14.7.” A lower air/fuel ratio indicates a richer commanded mixture, which may be seen during power enrichment or TWC protection modes. A higher air/fuel ratio indicates a leaner commanded mixture. This can be seen during deceleration fuel mode.

BARO kPa – Tech 2 Range 10–105 kPa/0.00–5.00 Volts
The barometric pressure reading is determined from the MAP sensor signal monitored during key up and wide open throttle (WOT) conditions. The barometric pressure is used to compensate for altitude differences and is normally displayed around ”61–104” depending on altitude and barometric pressure.

CMP ACT. COUNTER – Cam Position Activity

DECEL FUEL MODE – Tech 2 Displays ACTIVE or INACTIVE
”ACTIVE” displayed indicates that the PCM has detected conditions appropriate to operate in deceleration fuel mode. The PCM will command the deceleration fuel mode when it detects a closed throttle position while the vehicle is traveling over 20 mph. While in the deceleration fuel mode, the PCM will decrease the amount of fuel delivered by entering ”Open Loop” and decreasing the injector pulse width.

DESIRED EGR POS. – Tech 2 Range 0%–100%
Represents the EGR pintle position that the PCM is commanding.

DESIRED IDLE – Tech 2 Range 0–3187 RPM
The idle speed that the PCM is commanding. The PCM will compensate for various engine loads based on engine coolant temperature, to keep the engine at the desired speed.

ECT – (Engine Coolant Temperature) Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F)
The engine coolant temperature (ECT) is mounted in the coolant stream and sends engine temperature information to the PCM. The PCM applies 5 volts to the ECT sensor circuit. The sensor is a thermistor which changes internal resistance as the temperature changes. When the sensor is cold (high resistance), the PCM monitors a high signal voltage and interprets that as a cold engine. As the sensor warms (decreasing resistance), the voltage signal will decrease and the PCM will interpret the lower voltage as a warm engine.

EGR DUTY CYCLE – Tech 2 Range 0%–100%
Represents the EGR valve driver PWM signal from the PCM. A duty cycle of 0% indicates that no EGR flow is being commanded; a 100% duty cycle indicates maximum EGR flow commanded.

EGR FEEDBACK – Tech 2 Range 0.00–5.00 Volts
Indicates the EGR pintle position sensor signal voltage being monitored by the PCM. A low voltage indicates a fully extended pintle (closed valve); a voltage near 5 volts indicates a retracted pintle (open valve).

EGR TEST COUNT – Tech 2 Range 0–255
Indicates the number of EGR flow test samples collected during the current ignition cycle. Under normal operation, only one sample is allowed during an ignition cycle. If the PCM battery feed has been disconnected or a DTC P0401 has been cleared, 10 EGR flow test samples will be allowed during the ignition cycle. This is to allow repair verification during a single ignition cycle.

ENGINE LOAD – Tech 2 Range 0%–100%
Engine load is calculated by the PCM from engine speed and MAP sensor readings. Engine load should increase with an increase in RPM or air flow.

ENGINE RUN TIME – Tech 2 Range 00:00:00–99:99:99 Hrs:Min:Sec
Indicates the time elapsed since the engine was started. If the engine is stopped, engine run time will be reset to 00:00:00.

ENGINE SPEED – Range 0–9999 RPM
Engine speed is computed by the PCM from the 58X reference input. It should remain close to desired idle under various engine loads with engine idling.

EVAP PURGE PWM – Tech 2 Range 0%–100%
Represents the PCM commanded PWM duty cycle of the EVAP purge solenoid valve. ”0%” displayed indicates no purge; ”100%” displayed indicates full purge.

EVAP VACUUM SWITCH – Tech 2 Displays PURGE or NO PURGE
The EVAP purge vacuum switch is a normally closed switch positioned in the purge line between the canister and the EVAP purge solenoid. The EVAP purge vacuum switch will open when vacuum increases to greater than 5 inches of water in the purge line. The EVAP purge vacuum switch is used by the PCM to monitor EVAP canister purge solenoid operation and purge system integrity. The EVAP purge vacuum switch should be closed to ground with no vacuum present (0% EVAP purge PWM). With EVAP purge PWM at 25% or greater, the EVAP purge vacuum switch should be open and ”PURGE” should be indicated.

FUEL PUMP – Tech 2 Displays ON or OFF
Indicates the PCM commanded state of the fuel pump relay driver circuit.

FUEL TRIM CELL – Tech 2 Range 0–21
The fuel trim cell is dependent upon engine speed and MAF sensor readings. A plot of RPM vs. MAF is divided into 22 cells. Fuel trim cell indicates which cell is currently active.

FUEL TRIM LEARN – Tech 2 Displays NO or YES
When conditions are appropriate for enabling long term fuel trim corrections, fuel trim learn will display YES. This indicates that the long term fuel trim is responding to the short term fuel trim. If the fuel trim learn displays NO, then long term fuel trim will not respond to changes in short term fuel trim.

GENERATOR CONTROL – Tech 2 Displays ACTIVE or INACTIVE.

HO2S BANK 1, SEN. 1 – Tech 2 Range 0–1000 mV
Represents the fuel control exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 10 mV (lean exhaust) and 1000 mV (rich exhaust) while operating in ”Closed Loop”.

HO2S BANK 1, SEN. 2 – Tech 2 Range 0–1000 mV
Represents the exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 10 mV (lean exhaust) and 1000 mV (rich exhaust) while operating in ”Closed Loop”. This is used along with HO2S Bank 1, Sensor 3 to determine the catalytic converter efficiency in the manual transmission models.

HO2S BANK 1, SEN. 1 – Tech 2 Displays NOT READY or READY
Indicates the status of the exhaust oxygen sensor. The Tech 2 will indicate that the exhaust oxygen sensor is ready when the PCM detects a fluctuating HO2S voltage sufficient to allow ”Closed Loop” operation. This will not occur unless the exhaust sensor is warmed up.

HO2S WARM UP TIME BANK 1, SEN. 1 – Tech 2 Range 00:00:00–99:99:99 HRS:MIN:SEC
Indicates warm–up time for each HO2S. The HO2S warm–up time is used for the HO2S heater test. The PCM will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start–up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start–up. If the PCM determines that too much time was required for the HO2S to become active, a DTC will set. If the engine was warm when started, HO2S warm–up will display ”00:00:00.”

IAC POSITION – Tech 2 Range 0–255 Counts
Displays the commanded position of the idle air control pintle in counts. A larger number of counts means that more air is being commanded through the idle air passage. Idle air control should respond fairly quickly to changes in engine load to maintain desired idle RPM.

IAT (INTAKE AIR TEMPERATURE) – Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F)
The PCM converts the resistance of the intake air temperature sensor to degrees. Intake air temperature (IAT) is used by the PCM to adjust fuel delivery and spark timing according to incoming air density.

IGNITION 1 – Tech 2 Range 0–25.5 Volts
This represents the system voltage measured by the PCM at its ignition feed.

INJ. PULSE BANK 1 – Tech 2 Range 0–1000 msec.
Indicates the amount of time the PCM is commanding each injector ON during each engine cycle. A longer injector pulse width will cause more fuel to be delivered. Injector pulse width should increase with increased engine load.

LONG TERM FUEL TRIM BANK 1
The long term fuel trim is derived from the short term fuel trim values and represents a long term correction of fuel delivery for the bank in question. A value of 0% indicates that the fuel delivery requires no compensation to maintain the PCM commanded air/fuel ratio. A negative value significantly below 0% indicates that the fuel system is rich and fuel delivery is being reduced (decreased injector pulse width). A positive value significantly greater than 0% indicates that a lean condition exists and the PCM is compensating by adding fuel (increased injector pulse width). Because long term fuel trim tends to follow short term fuel trim, a value in the negative range due to canister purge at idle should not be considered unusual. Fuel trim values at maximum authority may indicate an excessively rich or lean system.

LOOP STATUS – Tech 2 Displays OPEN or CLOSED
”CLOSED” indicates that the PCM is controlling fuel delivery according to oxygen sensor voltage. In ”OPEN” the PCM ignores the oxygen sensor voltage and bases the amount of fuel to be delivered on TP sensor, engine coolant, and MAF sensor inputs only.

MAP – Tech 2 Range 10–105 kPa (0.00–4.97 Volts)
The manifold absolute pressure (MAP) sensor measures the change in the intake manifold pressure from engine load, EGR flow, and speed changes. As intake manifold pressure increases, intake vacuum decreases, resulting in a higher MAP sensor voltage and kPa reading. The MAP sensor signal is used to monitor intake manifold pressure changes during the EGR flow test, to update the BARO reading, and as an enabling factor for several of the diagnostics.

MIL – Tech 2 Displays ON or OFF
Indicates the PCM commanded state of the malfunction indicator lamp (”Check Engine Lamp”).

MISFIRE CUR. CYL. #1/#2/#3/#4 – Tech 2 Range 0–255 Counts
The misfire current counters increase at a rate according to the number of possible misfires being detected on each cylinder. The counters may normally display some activity, but the activity should be nearly equal for all the cylinders.

MISFIRE CUR. CYL. #1/#2/#3/#4 – Tech 2 Range 0–65535 Counts
The misfire history counters display the relative level of misfire that has been detected on each cylinder. The misfire history counters will not update or show any activity until a misfire DTC (P0300) has become active.

MISFIRE FAILURES SINCE FIRST FAIL – Tech 2 Range 0–65535 Counts
Indicates the number of 200 crankshaft revolution sample periods during which the level of misfire was sufficiently high to report a fail.

MISFIRE PASSES SINCE FIRST FAIL – Tech 2 Range 0–65535 Counts
Indicates the number of 200 crankshaft revolution sample periods during which the level of misfire was sufficiently low to report a pass.

POWER ENRICHMENT – Tech 2 Displays ACTIVE or INACTIVE
”ACTIVE” displayed indicates that the PCM has detected conditions appropriate to operate in power enrichment mode. The PCM will command power enrichment mode when a large increase in throttle position and load is detected. While in the power enrichment mode, the PCM will increase the amount of fuel delivered by entering ”Open Loop” and increasing the injector pulse width. This is done to prevent a possible sag or hesitation from occurring during acceleration.

RICH/LEAN BANK 1 – Tech 2 Displays RICH or LEAN
Indicates whether oxygen sensor voltage is above a 600 mV threshold voltage (”RICH”) or below a 3000 mV threshold voltage (”LEAN”). Should change constantly while in ”Closed Loop”, indicating that the PCM is controlling the air/fuel mixture properly.

SHORT TERM FT BANK 1
Short term fuel trim to a bank represents a short term correction to the bank fuel delivery by the PCM in response to the amount of time the bank fuel control oxygen sensor voltage spends above or below the 450 mV threshold. If the oxygen sensor voltage has mainly remained less than 450 mV, indicating a lean air/fuel mixture, short term fuel trim will increase into the positive range above 0% and the PCM will pass fuel. If the oxygen sensor voltage stays mainly above the threshold, short term fuel trim will decrease below 0% into the negative range while the PCM reduces fuel delivery to compensate for the indicated rich condition. Under certain conditions such as extended idle and high ambient temperatures, canister purge may cause short term fuel trim to read in the negative range during normal operation. Fuel trim values at maximum authority may indicate an excessively rich or lean system.

SPARK – Tech 2 Range –64˚ to 64˚
Displays the amount of spark advance being commanded by the PCM on the IC circuit.

START–UP ECT – Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F)
Indicates the engine coolant temperature at the time that the vehicle was started. Used by the HO2S diagnostic to determine if the last start–up was a cold start.

START–UP ECT – Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F)
Indicates the intake air temperature at the time that the vehicle was started. Used by the HO2S diagnostic to determine if the last start–up was a cold start.

TOTAL MISFIRE CURRENT COUNT – Tech 2 Range 0–255
Indicates the total number of cylinder firing events that were detected as being misfires during the last 200 crankshaft revolution sample period.

TP ANGLE – Tech 2 Range 0%–100%
TP (throttle position) angle is computed by the PCM from the TP sensor voltage. TP angle should display ”0%” at idle and ”100%” at wide open throttle.

TP SENSOR – Tech 2 Range 0.00–5.00 Volts
The voltage being monitored by the PCM on the TP sensor signal circuit.

UPSHIFT LAMP (MANUAL TRANSMISSION)

VEHICLE SPEED – Tech 2 Range 0–255 km/h (0–155 mph)
The vehicle speed sensor signal is converted into km/h and mph for display.

WEAK CYLINDER – Tech 2 Displays Cylinder Number
This indicates that the PCM has detected crankshaft speed variations that indicate 2% or more cylinder firing events are misfires.

TYPICAL SCAN DATA VALUES

Use the Typical Scan Data Values Table only after the On–Board Diagnostic System Check has been completed, no DTC(s) were noted, and you have determined that the on–board diagnostics are functioning properly. Tech 2 values from a properly–running engine may be used for comparison with the engine you are diagnosing. The typical scan data values represent values that would be seen on a normally–running engine.

NOTE: A Tech 2 that displays faulty data should not be used, and the problem should be reported to the Tech 2 manufacturer. Use of a faulty Tech 2 can result in misdiagnosis and unnecessary replacement of parts.

Only the parameters listed below are referred to in this service manual for use in diagnosis. For further information on using the Tech 2 to diagnose the PCM and related sensors, refer to the applicable reference section listed below. If all values are within the typical range described below, for diagnosis, refer to the Symptoms section.

Test Conditions

Engine running, lower radiator hose hot, transmission in park or neutral, ”Closed Loop”, accessories OFF, brake not applied and air conditioning OFF.

2.2L L–4 Engine

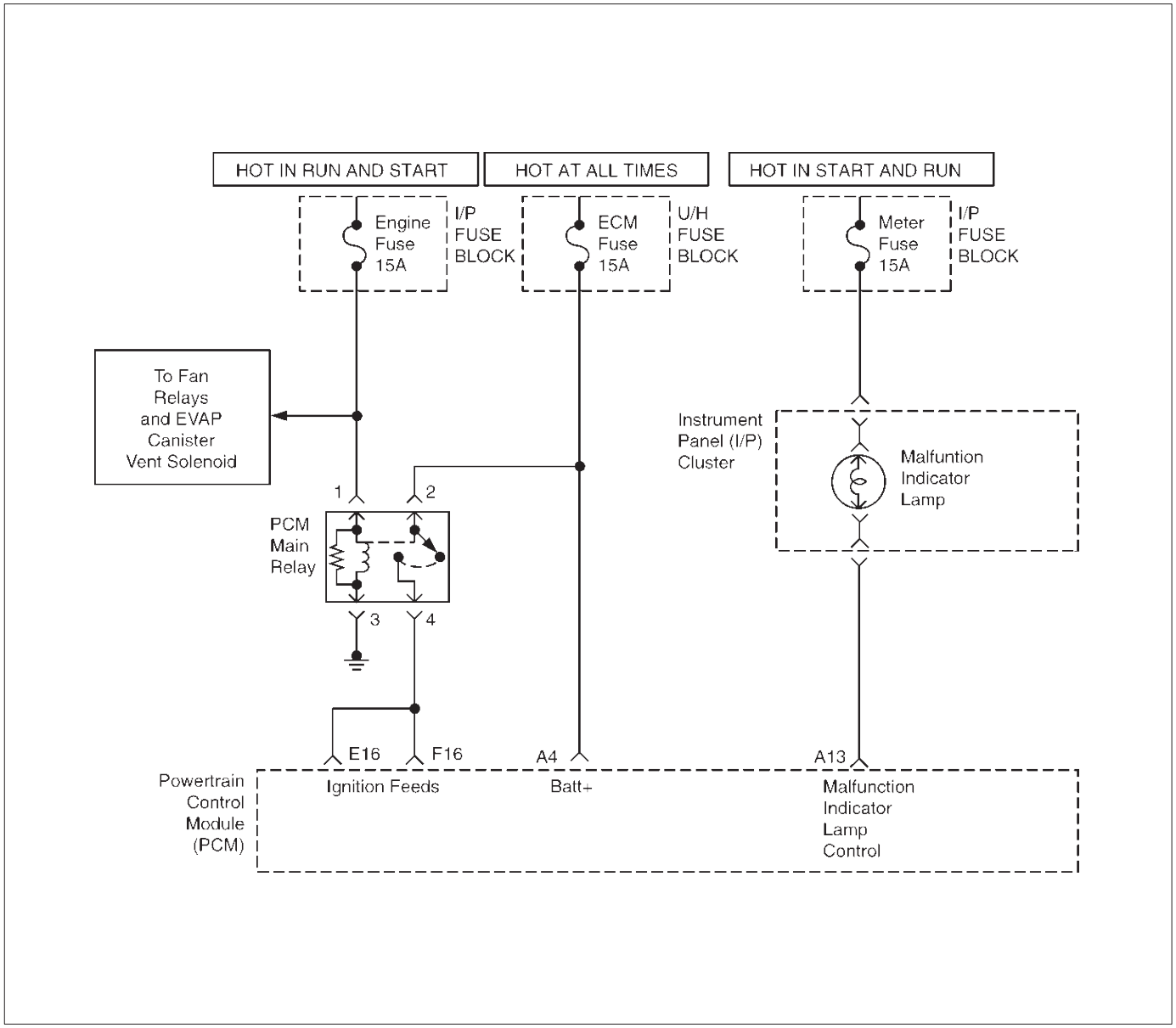
Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
Engine Speed	Engine	RPM	804	2511	General Discription and Operation
Desired Idle Speed	Engine	RPM	800	800	General Discription and and Operation, Idle Air Control
Engine Coolant Temperature	Engine	˚C	88 (190˚F)	86 (187˚F)	General Discription and and Operation, Engin coolant tempereture sensor
Start Up ECT	Engine	˚C	87	87	General Discription and and Operation, Engin coolant tempereture sensor
Intake Air Temperature	Engine	˚C	23	22	General Discription and and Operation, Intake Air tempereture sensor
Start Up IAT	Engine	˚C	23	23	General Discription and and Operation, Intake Air tempereture sensor
Manifold Absolute Pressure	Engine	kPa	35	32	General Discription and Operation, Manifold Absolute Pressure Sensor. DTC P0106,P0107,P0108,P1106, P1107
Manifold Absolute Pressure	Engine	V	1.31	1.15	General Discription and Operation, Manifold Absolute Pressure Sensor. DTC P0106,P0107,P0108,P1106, P1107
Barometric Pressure	Engine	kPa	101	101 (depends on altitude and barometric)	General Discription and Opreration
Throttle Position	Engine	%	0	5	General Discription and Opreration, Throttle Position Sensor. DTC P0121,P0122,P0123,P1121, P1122

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
Throttle Position Sensor	Engine	V	0.33	0.53	General Discription and Opreration, Throttle Position Sensor. DTC P0121,P0122,P0123,P1121, P1122
Calculated Air Flow	Engine	g/s	4.03	12.38	General Discription and and Operation, Manifold Air Flow sensor
Air Fuel Ratio	Engine	Ratio:_to1	13.6	14.6:1	General Discription and Operation, Fuel System Metering Purpose, Fuel Trim
Spark Advance	Engine	˚CA	7	32	General Discription and and Operation, Electronic Ignition System
Engine Load	Engine	%	3	12	–
Fuel system Status	Engine	Closed Loop	Open loop	Closed loop	EVAP System
EGR Duty Cycle	Engine	%	0	0	General Discription and and Operation, Liner EGR Operation and Results of Incorrect Operation
Desired EGR Position	Engine	%	0	0	General Discription and and Operation, EGR Pintle Position Sensor
EGR Normalized	Engine	%	0	0	–
EGR Feed Back	Engine	V	0.7	0.7	–
EGR Closed Pintle Position	Engine	Steps	35	35	General Discription and and Operation, EGR Pintle Position Sensor
Knock Present		Yes/No	No	No	
Knock Counter	Engine	Counts	6	6	DTC P0325,P0327
Knock Retard	Engine	˚CA	0.0	0.0	DTC P0325,P0327
A/C Pressure Sensor	Engine	mV	1	1	DTC P0532,P0533
A/C Clutch Relay	Engine	On/Off	Off	Off	General Discription and and Operation, A/C Culutch Circuit Operation
A/C Request	Engine	Yes/No	No	No	General Discription and and Operation, A/C Request Signal
Low Fan Comanded	Engine	On/Off	Off	Off	General Discription and and Operation, Cooling Fan Control. DTC P0480,P0481
High Fan Comanded	Engine	On/Off	Off	Off	General Discription and and Operation, Cooling Fan Control. DTC P0480,P0481
Camshaft Activity	Engine	Counts	16	231	DTC P0341,P0342

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
EVAP Vent Valve	Engine	On/Off	Off	Off	Diagnosis, EVAP Canister Purge Solenoid And EVAP Vacuum Switch and Visual Check. DTC P1441
EVAP Purge Solenoid	Engine	%	0	6	Diagnosis, EVAP Emission Canister Purge Valve Check
Low Fuel Lamp	Engine	On/Off	On	On	Engine Fuel. DTC P0461,P0462,P0463
Fuel Level Sensor	Engine	V	2.73	2.73	Engine Fuel. DTC P0461,P0462,P0463
Fuel Level	Engine	%	9	9	Engine Fuel. DTC P0461,P0462,P0463
Fuel Pump	Engine	On/Off	On	On	Engine Fuel System
Fuel Tank Pressure Sensor	Engine	V	1.43	1.43	Diagnosis, EVAP Canister Purge Solenoid And EVAP System
Deceleration Fuel Cutoff	Engine	Inactive/Active	Inactive	Inactive	General Discription and and Operation
Idle Air Control	Engine	Steps	31	77	General Discription and and Operation, Intake Air tempereture sensor
Vehicle Speed	Engine	MPH or km/h	0	0	Manual Transmission
Ignition Voltage	Engine	V	14.2	14.3	General Discription and and Operation, Electronic Ignition System
Malfunction Indicator Lamp	Engine	On/Off	Off	Off	On–Board Diagnostic System Check
Up Shift Lamp	Engine	On/Off	On	On	Up–Shift Lamp system Check
Time From Start	Engine	Hrs:Min:Sec	00:00:12	00:00:26	–
Misfire Current Cyl.#1	Engine Misfire	Counts	0	0	DTC P0300,P0301
Misfire Current Cyl.#2	Engine Misfire	Counts	0	0	DTC P0300,P0302
Misfire Current Cyl.#3	Engine Misfire	Counts	0	0	DTC P0300,P0303
Misfire Current Cyl.#4	Engine Misfire	Counts	0	0	DTC P0300,P0304
Misfire History Cyl.#1	Engine Misfire	Counts	0	0	DTC P0300,P0301
Misfire History Cyl.#2	Engine Misfire	Counts	0	0	DTC P0300,P0302
Misfire History Cyl.#3	Engine Misfire	Counts	0	0	DTC P0300,P0303
Misfire History Cyl.#4	Engine Misfire	Counts	0	0	DTC P0300,P0304
Misfire Failure Since First Fail	Engine Misfire	Counts	0	0	DTC P0300

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
Misfire Presses Since First Fail	Engine Misfire	Counts	0	0	DTC P0300
Total Misfire	Engine Misfire	Counts	0	0	DTC P0300
Weak Cylinder	Engine Misfire	Cylinder #	–	–	DTC P0300,P0301,P0302,P0303, P0304
Misfire Delay Counter	Engine Misfire	Counts	0	0	DTC P0300,P0301,P0302,P0303, P0304
ABS Rough Road	Engine Misfire	Value	Okey	Okey	DTC P1380,P1381
ABS Rough Road Counts	Engine Misfire	Counts	0	0	DTC P1380,P1381
B1 O2 Sensor Ready	Engine HO2S	Yes/No	Yes	Yes	General Discription and and Operation, Fuel Control HO2S. DTC P0135
B1S1 Status (Bank1,Sensor1)	Engine HO2S	Rich/Lean	–	–	General Discription and and Operation, Fuel Control HO2S
B1S1 O2 Sensor (Bank1,Sensor1)	Engine HO2S	mV	50 – 950 changing quickly	50 – 950 changing quickly	General Discription and and Operation, Fuel Control HO2S
B1S2 O2 Sensor (Bank1,Sensor2)	Engine HO2S	mV	100 – 700 changing slowly	100 – 700 changing slowly	General Discription and and Operation, Fuel Metering System
B1S2 O2S Warm Up Time	Engine HO2S	sec	0	–	General Discription and and Operation, Catalyst Monitor Heated Oxygen Sensor
Fuel Trim Learned	Engine HO2S	Yes/No	Yes	Yes	Diagnosis, Fuel Trim Monitor
Fuel Trim Cell	Engine HO2S	Cell No.	18	2 or 6	Diagnosis, Fuel Trim Cell Diagnostic Weights
B1 Long Fuel Trim	Engine HO2S	%	–	–	DTC P0171,P0172
B2 Short Fuel Trim	Engine HO2S	%	–	–	DTC P0171,P0172
Power Enrichment	Engine HO2S	Yes/No	No	No	General Discription and and Operation, Acceleration Mode
Braodcast Code	–	2.2 letter	–	–	–

NO MALFUNCTION INDICATOR LAMP (MIL)



060R100023

Circuit Description

The ”Check Engine” lamp (MIL) should always be illuminated and steady with the ignition ON and the engine stopped. Ignition feed voltage is supplied to the MIL bulb through the meter fuse. The powertrain control module (PCM) turns the MIL ON by grounding the MIL driver circuit.

Diagnostic Aids

An intermittent MIL may be caused by a poor connection, rubbed–through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Inspect the PCM harness and connections for improper mating, broken locks, improperly formed or damaged terminals, poor terminal–to–wire connection, and damaged harness.
- If the engine runs OK, check for a faulty light bulb, an open in the MIL driver circuit, or an open in the instrument cluster ignition feed.
- If the engine cranks but will not run, check for an open PCM ignition or battery feed, or a poor PCM to engine ground.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. A ”No MIL” condition accompanied by a no–start condition suggests a faulty PCM ignition feed or battery feed circuit.
9. Using a test light connected to B+, probe each of the PCM ground terminals to ensure that a good ground is present. Refer to PCM Terminal End View for terminal locations of the PCM ground circuits.
12. In this step, temporarily substitute a known good relay for the PCM relay. The horn relay is nearby, and it can be verified as ”good” simply by honking the horn. Replace the horn relay after completing this step.

17. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors.

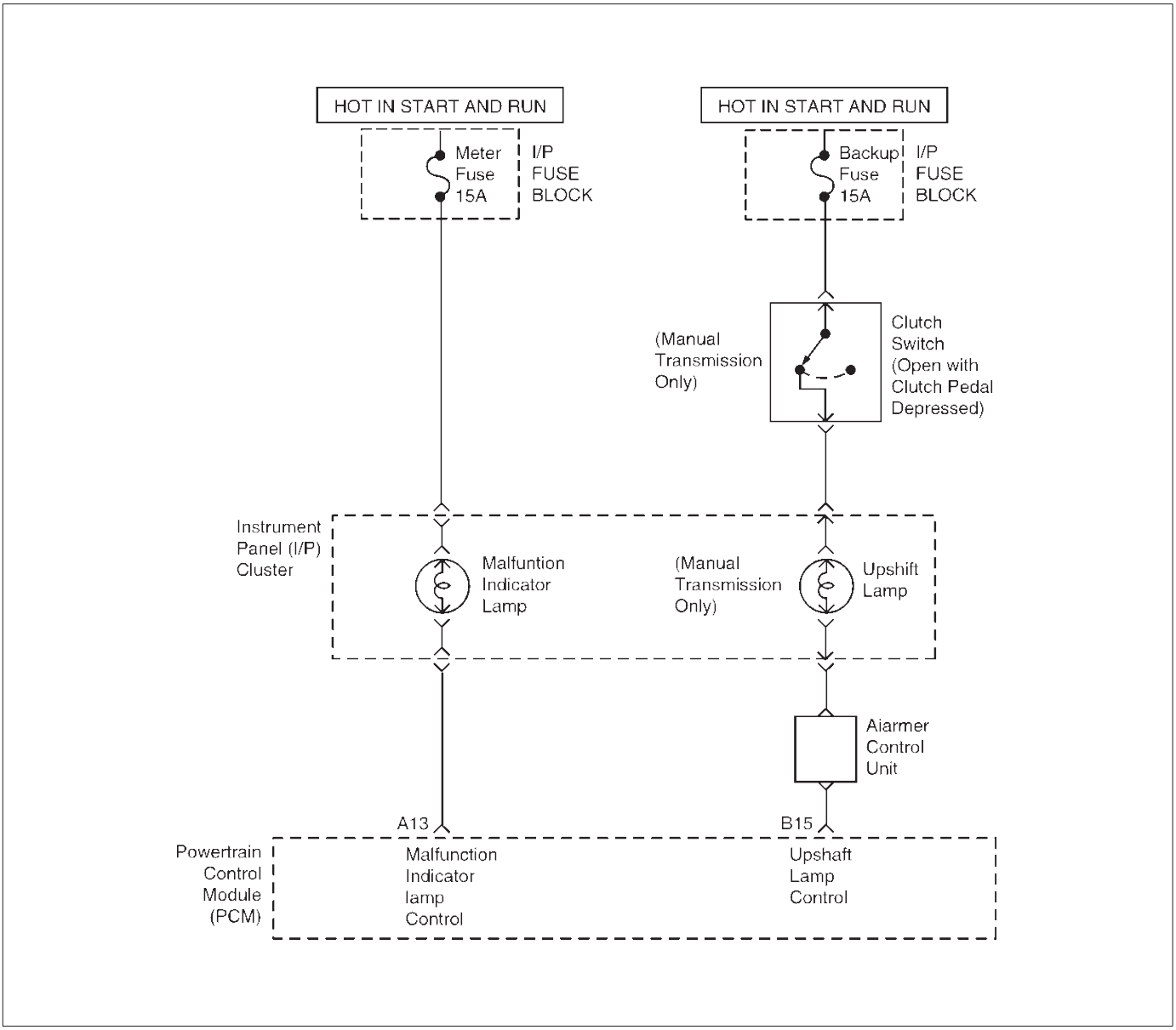
No Malfunction Indicator Lamp (MIL)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Attempt to start the engine. Does the engine start?	—	Go to Step 3	Go to Step 6
3	Check the meter fuse for the instrument cluster ignition feed circuit. Is the fuse OK?	—	Go to Step 4	Go to Step 16
4	1. Ignition ON. 2. Engine OFF. 3. Probe the ignition feed circuit at the cluster connector with a test light to ground. Is the test light ON?	—	Go to Step 5	Go to Step 13
5	1. Ignition OFF. 2. Disconnect the PCM. 3. Jumper the MIL driver circuit at the PCM connector to ground. 4. Ignition ON. Is the MIL ON?	—	Go to Step 10	Go to Step 11
6	Check the PCM ignition feed and battery feed fuses (15A Engine fuse and 15A ECM fuse). Are both fuses OK?	—	Go to Step 7	Go to Step 15
7	1. Ignition OFF. 2. Disconnect the PCM. 3. Ignition ON. 4. Probe the ignition feed circuit at the PCM harness connector with a test light to ground. Is the test light ON?	—	Go to Step 8	Go to Step 12
8	Probe the battery feed circuit at the PCM harness connector with a test light to ground. Is the test light ON?	—	Go to Step 9	Go to Step 14
9	Check for a faulty PCM ground connection. Was a problem found?	—	Verify repair	Go to Step 10
10	Check for damaged terminals at the PCM. Was a problem found?	—	Verify repair	Go to Step 17
11	Check for an open MIL driver circuit between the PCM and the MIL. Was a problem found?	—	Verify repair	Go to Step 18
12	Substitute a known ”good” relay for the PCM main relay. Was the malfunction fixed?	—	Verify repair	Go to Step 13

No Malfunction Indicator Lamp (MIL) (Cont'd)

Step	Action	Value(s)	Yes	No
13	Repair the open in the ignition feed circuit. Is the action complete?	—	Verify repair	—
14	Locate and repair the open PCM battery feed circuit. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to ground in the PCM ignition feed circuit or PCM battery feed circuit. Is the action complete?	—	Verify repair	—
16	Locate and repair the short to ground in the ignition feed circuit to the instrument cluster, and replace the fuse. Is the action complete?	—	Verify repair	—
17	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to PCM in On–Vehicle Service for procedures. and also refer to latest service bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.	—	Verify repair	—
18	Check the MIL driver circuit for a poor connection at the instrument panel connector. Was a problem found?	—	Verify repair	Go to Instrument Panel in Electrical Diagnosis

MALFUNCTION INDICATOR LAMP (MIL) ON STEADY



060R100048

Circuit Description

The malfunction indicator lamp (MIL) should always be illuminated and steady with the ignition ON and the engine stopped. Ignition feed voltage is supplied directly to the MIL indicator. The powertrain control module (PCM) turns the MIL ON by grounding the MIL driver circuit.

The MIL should not remain ON with the engine running and no DTC(s) set. A steady MIL with the engine running and no DTC(s) suggests a short to ground in the MIL driver circuit.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed–through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal–to–wire connection, and damaged harness.

Test Description

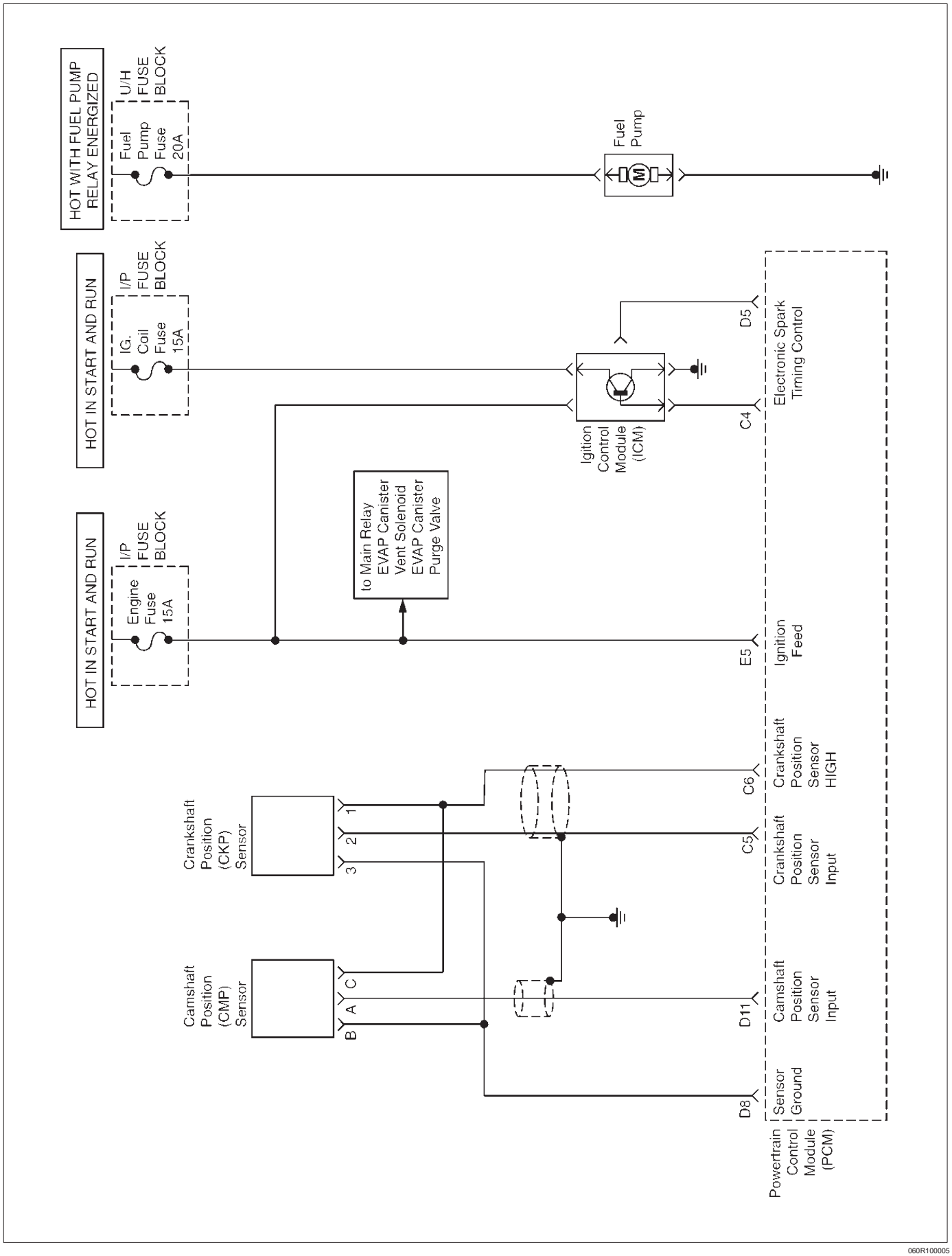
Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. If the MIL does not remain ON when the PCM is disconnected, the MIL driver wiring is not faulty.
3. If the MIL driver circuit is OK, the instrument panel cluster is faulty.
6. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors.

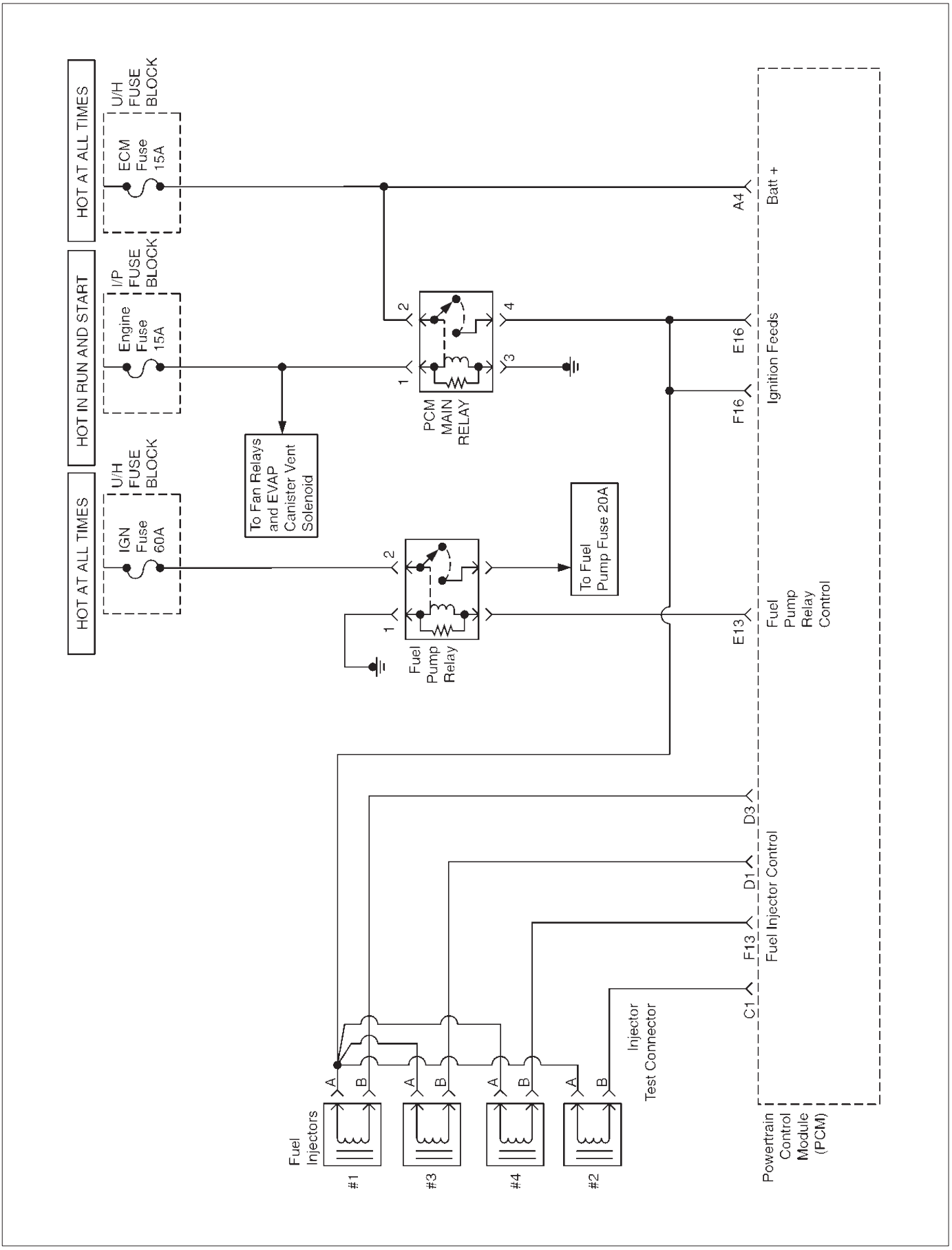
Malfunction Indicator Lamp (MIL) ON Steady

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition OFF, disconnect the PCM. 2. Ignition ON, observe the MIL (Service Engine Soon lamp). Is the MIL ON?	—	Go to Step 3	Go to Step 5
3	1. Ignition OFF, disconnect the instrument panel cluster. 2. Check the MIL driver circuit between the PCM and the instrument panel cluster for a short to ground. 3. If a problem is found, repair as necessary. Was the MIL driver circuit shorted to ground?	—	Go to OBD System Check	Go to Step 4
4	Replace the instrument panel cluster. Is the action complete?	—	Go to OBD System Check	—
5	1. Ignition OFF, reconnect the PCM. 2. Ignition ON, reprogram the PCM. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. 3. Using the Tech 2 output controls function, select MIL dash lamp control and command the MIL OFF. Did the MIL turn OFF?	—	Go to OBD System Check	Go to Step 6
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. and also refer to latest service bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to OBD System Check	—

ENGINE CRANKS BUT WILL NOT RUN



060R100005


HOT AT ALL TIMES
HOT IN RUN AND START
HOT AT ALL TIMES
U/H FUSE BLOCK
I/P FUSE BLOCK
U/H FUSE BLOCK
ECM Fuse 15A
Engine Fuse 15A
IGN Fuse 60A
To Fan Relays and EVAP Canister Vent Solenoid
PCM MAIN RELAY
Fuel Pump Relay
To Fuel Pump Fuse 20A
A4
E16
F16
E13
D3
D1
F13
C1
Batt +
Ignition Feeds
Fuel Pump Relay Control
Fuel Injector Control
Fuel Injectors
#1
#3
#4
#2
Injector Test Connector
Powertrain Control Module (PCM)

060R100004

Circuit Description

The electronic ignition system uses a dual coil method of spark distribution. In this type of ignition system, the powertrain control module (PCM) triggers the correct driver inside the ignition control module (ICM), which then triggers the correct ignition coil based on the 58X signal received from the crankshaft position sensor (CKP). The spark plug connected to the coil fires when the ICM opens the ground circuit for the coil's primary circuit.

During crank, the PCM monitors the CKP 58X signal. The CKP signal is used to determine which cylinder will fire first. After the CKP 58X signal has been processed by the PCM, it will command all four injectors to allow a priming shot of fuel for all the cylinders. After the priming, the injectors are left OFF during the next four 58X reference pulses from the CKP. This allows each cylinder a chance to use the fuel from the priming shot. During this waiting period, a camshaft position (CMP) signal pulse will have been received by the PCM. The CMP signal allows the PCM to operate the injectors sequentially based on camshaft position. If the camshaft position signal is not present at start–up, the PCM will begin sequential fuel delivery with a 1–in–4 chance that fuel delivery is correct. The engine will run without a CMP signal, but will set a DTC code.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal–to–wire connection, and damaged harness.
- Faulty engine coolant temperature sensor – Using a Tech 2, compare engine coolant temperature with intake air temperature on a completely cool engine. Engine coolant temperature should be within 10 °C of intake air temperature. If not, replace the ECT sensor.

Engine Cranks But Will Not Run

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Use the Tech 2 and check for any DTC's. Are any DTC's stored?	—	Go to Applicable DTC Table	Go to Step 3
3	Check the 15A ignition coil fuse, the 15A engine device fuse, and the 15A ECM fuse. Was a fuse blown?	—	Go to Step 4	Go to Step 5
4	Check for a short to ground and replace the fuse. Is the action complete?	—	Verify repair	—
5	1. Ignition ON. 2. Use a grounded test lamp to verify that B+ is available at the ignition coil fuse, the engine device fuse, and the ECM fuse. Was B+ available at the fuses?	—	Go to Step 7	Go to Step 6
6	Repair the open ignition feed circuit.	—	Go to Fuel System Electrical Test	Go to Fuel System Diagnosis
7	1. Disconnect the ignition secondary wire at the No.1. 2. Install a spark tester J 26792 at the end of the disconnected ignition coil. 3. Clip the spark tester J 26792 to a good ground (not near the battery). 4. Observe the spark tester while the engine is cranking. Was a crisp blue spark observed? (Only one or two sparks followed by no result is considered the same as "No Spark.")	—	Go to Step 16	Go to Step 8

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Disconnect the ignition module harness connector. 2. Check for an open or short circuit between the ignition control module and the PCM? Was a problem found?	—	Go to Step 9	Go to Step 10
9	Repair the faulty circuit.	—	Verify repair	—
10	1. Ignition ON. 2. Using a Digital Voltmeter (DVM) check the ignition wire coil at the ignition module harness connector? Was the voltage equal to the specified value?	B+	Go to Step 12	Go to Step 11
11	Repair the open circuit.	—	Verify repair	—
12	1. Ignition OFF. 2. With DVM, check for an open in the ground wire at the ignition module harness connector. Was the ground wire OK?	—	Go to Step 14	Go to Step 13
13	Repair the faulty wire.	—	Verify repair	—
14	Replace the ignition module, verify the repair. Attempt to start the engine. Is there still a problem?	—	Go to Step 15	Verify repair
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. and also refer to latest service bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
16	Use an ohmmeter to check the ignition coil primary winding resistance. Was the primary winding resistance approximately equal to the specified value?	0.8–18 Ω	Go to Step 17	Go to Step 18
17	Use an ohmmeter to check the ignition coil secondary winding resistance. Was the secondary winding resistance equal to the specified value?	9,000–12,000 Ω	Go to Step 19	Go to Step 18
18	Replace the ignition coil.	—	Verify repair	—
19	Test the resistance of the coil–to–spark plug secondary ignition wire. Was the resistance greater than the specified value?	10,000 Ω per foot	Go to Step 20	Go to Step 21

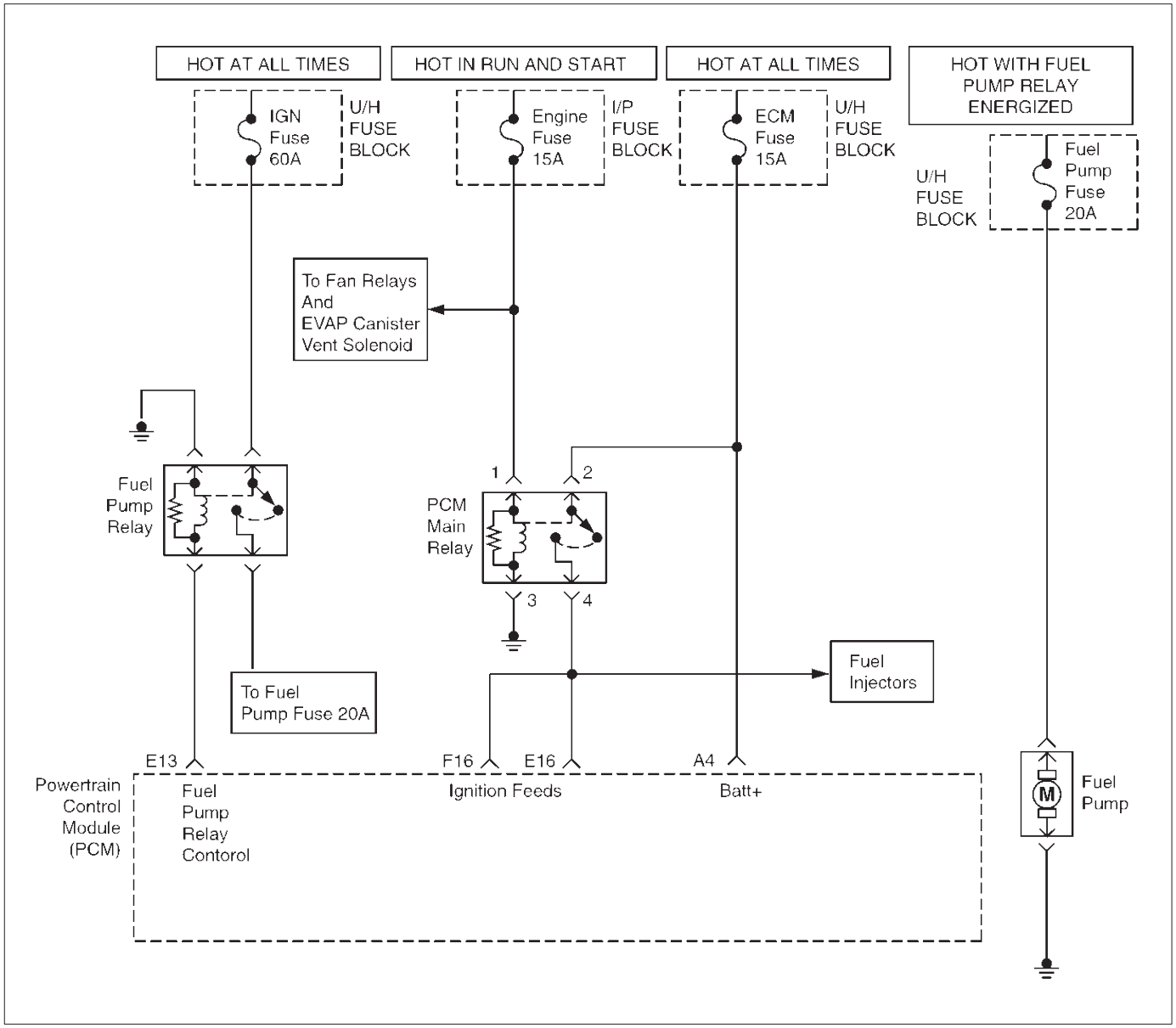
Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
20	Replace the coil–to–spark plug secondary ignition wire and any other secondary wires which exceed the specified value. Is there still a problem?	10,000 Ω per foot	Go to Step 21	Verify repair
21	1. Remove the spark plugs from all cylinders. 2. Visually inspect the spark plug electrodes. 3. Replace any spark plugs with loose or missing electrodes or cracked insulators. Did your inspection reveal any spark plugs exhibiting excessing fouling?	—	Correct the fouling condition	Go to Step 33
22	Verfiy repair. Attempt to start the engine. Is there still a problem?	—	Go to Step 23	Go to Step 22
23	1. Ignition OFF, install a fuel pressure gauge at the test fitting on the fuel supply line in the engine compartment. **CAUTION: Use a shop cloth to absorb any fuel leakage while making the connection.** 2. Check the engine and observe the fuel pressure. Is the fuel pressure within the specified values, and does it hold steady for 2 seconds?	285–375 kPa (43–55 psi)	Go to Step 25	Go to Step 24
24	Is any fuel pressure indicated?	—	Go to Fuel System Electrical Test	Go to Fuel System Diagnosis
25	1. Install switch box J 39021–2 and J 39021–90 at the injector test connector. 2. Activate an injector. Did the fuel pressure drop when the injector was activated?	—	Go to Step 26	Go to Fuel System Diagnosis
26	Pressurize the fuel system using the ignition ON and use the injector switch box to test pressure drop for each injector. Was there a pressure drop when each injector was activated?	—	Go to Step 27	Go to Fuel System Diagnosis
27	1. Remove the switch box and install an injector test light J 39021–45 at the injector test harness connector. 2. Crank the engine. Are any of the lights blinking when the engine is cranked?	—	Go to Step 33	Go to Step 28
28	1. Raise the vehicle and disconnect the CKP sensor harness. 2. Ignition ON. 3. With a test light to ground, probe the CKP ignition feed harness terminal. Did the light illuminate?	—	Go to Step 29	Go to Step 30

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
29	1. Ignition ON. 2. At the CKP harness connector, connect a test lamp between the ignition and ground terminals. Did the lamp illuminate?	—	Go to Step 31	Go to Step 32
30	Check the CKP High circuit between the sensor and the PCM for a short to ground or open circuit. Was a problem found?	—	Verify repair	Go to Step 33
31	Replace the CKP position sensor. Is there still a problem?	—	Go to Step 34	—
32	Check the CKP Low circuit between the sensor and the PCM for: an open circuit, a short to ground, or short to voltage. Was the problem found?	—	Verify repair	Go to Step 33
33	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. and also refer to latest service bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.	—	Verify repair	—
34	1. Test the fuel for contamination. 2. If a problem is found, clean the fuel system and correct the contaminated fuel condition as necessary. Replace the fuel filter and replace any injectors that are not delivering fuel (see Injector Balance Test). Was a problem found?	—	Verify repair	Go to Step 35
35	To diagnose the following conditions, refer to Engine Mechanical: ● Slipped camshaft drive belt. ● Leaking or sticky valves or rings. ● Excessive valve deposits. ● Loose or worn rocker arms. ● Weak valve springs ● Leaking head gasket. Is the action complete?	—	Verify repair	—

FUEL SYSTEM ELECTRICAL TEST



060R100024

Circuit Description

When the ignition switch is first turned ON, the powertrain control module (PCM) energizes the fuel pump relay which applies power to the in–tank fuel pump. The fuel pump relay will remain ON as long as the engine is running or cranking and the PCM is receiving 58X crankshaft position pulses. If no 58X crankshaft position pulses are present, the PCM de–energizes the fuel pump relay within 2 seconds after the ignition is turned ON or the engine is stopped.

The fuel pump delivers fuel to the fuel rail and injectors, then to the fuel pressure regulator. The fuel pressure regulator controls fuel pressure by allowing excess fuel to be returned to the fuel tank. With the engine stopped and ignition ON, the fuel pump can be turned ON by using a command by the Tech 2.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed–through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal–to–wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. If the fuel pump is operating but incorrect pressure is noted, the fuel pump wiring is OK and the ”Fuel System Pressure Test” chart should be used for diagnosis.

CAUTION: To reduce the risk of fire and personal injury:

- **It is necessary to relieve fuel system pressure before connecting a fuel pressure gauge. Refer to Fuel Pressure Relief Procedure, below.**
- **A small amount of fuel may be released when disconnecting the fuel lines. Cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when the procedure is completed.**

Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay center.
3. Start the engine and allow it to stall.
4. Crank the engine for an additional 3 seconds.

Fuel Gauge Installation

1. Remove the shoulder fitting cap.
2. Install fuel gauge J 34730–1 to the fuel feed line located in front of and above the right side valve cover.
3. Reinstall the fuel pump relay.

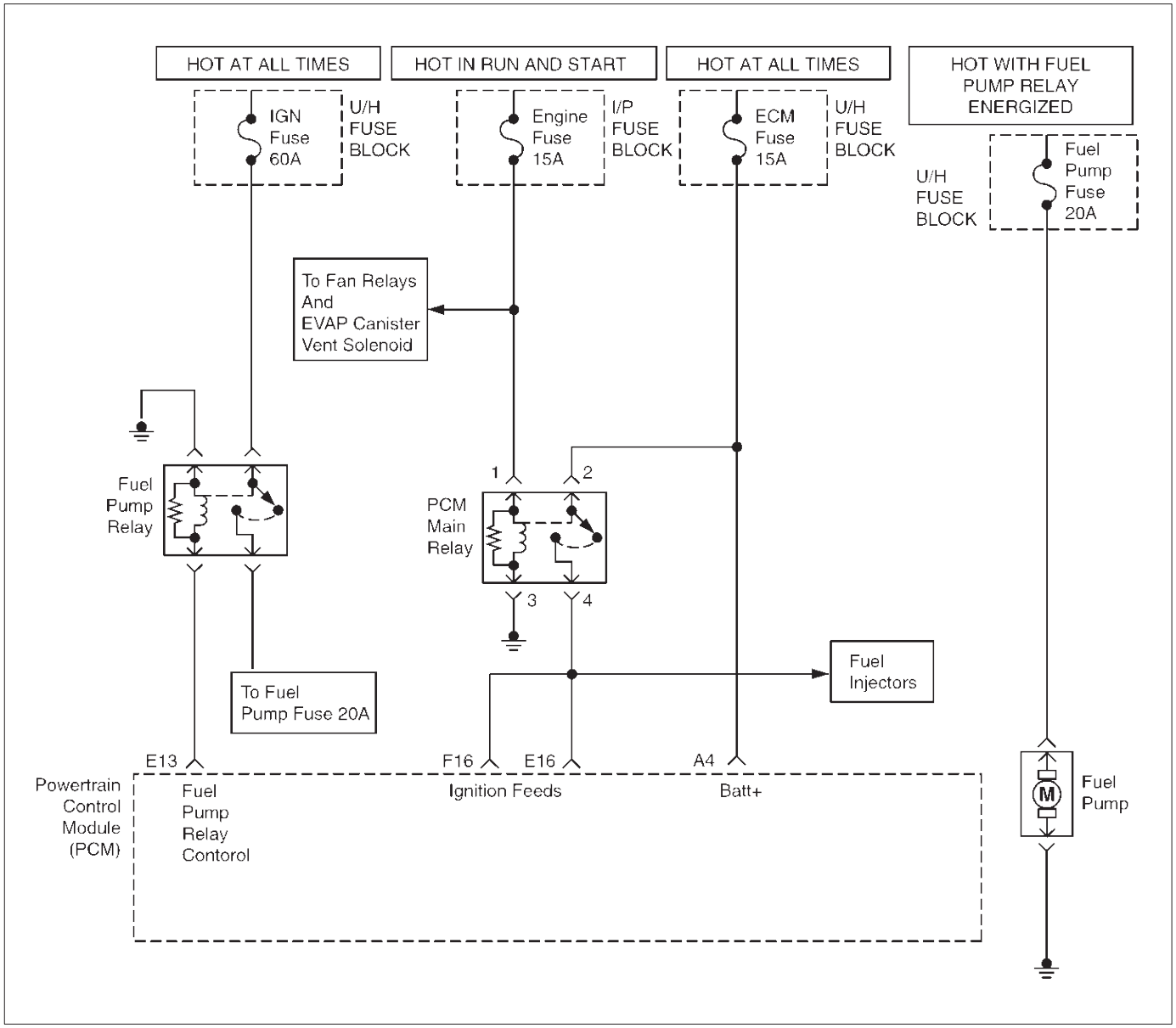
Fuel System Electrical Test

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Read the ”Caution” above. 2. Relieve the fuel system pressure and install the fuel pump pressure gauge to the test fitting. 3. Use a Tech 2 to command the fuel pump ON. Is there an immediate pressure build–up which indicates the pump is running?	—	Go to Step 3	Go to Step 4
3	1. Verify that the pump is not running by removing the fuel filler cap and listening. 2. Command the pump ON with the Tech 2. Did the pump turn OFF after 2 seconds?	—	Test completed	Go to Step 12
4	1. Ignition OFF. 2. Remove the fuel pump relay. 3. Ignition SW “On”, Engin “Off”. 4. Using a test light connected to ground, probe the battery feed to the relay. Did the light illuminate?	—	Go to Step 6	Go to Step 5
5	Repair short or open battery feed to fuel pump relay. Is the action complete?	—	Verify repair	—
6	1. Connect a test light between the two wires that connect to the fuel pump relay pull–in coil. 2. Ignition ON. Did the test light illuminate for 2 seconds and then turn off?	—	Go to Step 12	Go to Step 7
7	1. With a test light connected to battery (–), probe the fuel pump relay connector at the wire which runs from the relay pull–in coil to the PCM. 2. Ignition ON. Did the test light illuminate for 2 seconds and then turn off?	—	Go to Step 8	Go to Step 9
8	Locate and repair open in the fuel pump relay ground circuit. Is the action complete?	—	Verify repair	—

Fuel System Electrical Test (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check for short or open between the PCM and the fuel pump relay. Was a problem found?	——	Verify repair	Go to Step 10
10	1. Check the fuel pump relay circuit for a poor terminal connection at the PCM. 2. If a problem is found, replace terminal as necessary. Was a problem found?	——	Verify repair	Go to Step 11
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. and also refer to latest service bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	——	Verify repair	——
12	1. Reconnect the fuel pump relay. 2. Disconnect the fuel pump electrical connector at the fuel tank. 3. Using a test light connected to ground, probe the fuel pump feed wire (harness side). 4. Command the fuel pump ON with a Tech 2. Did the light illuminate for 2 seconds?	——	Go to Step 15	Go to Step 13
13	1. Honk the horn to verify that the horn relay is functioning. 2. Substitute the horn relay for the fuel pump relay. 3. Leave the test light connected as in step 12. 4. Command the fuel pump ON with the Tech 2. Did the test light illuminate for 2 seconds when the fuel pump was commanded ON?	——	Go to Step 17	Go to Step 14
14	1. Re–connect the horn relay in its proper location. 2. Check for a short circuit, blown fuse or open circuit between the relay and the fuel tank. Is the action complete?	——	Verify repair	——
15	1. With the fuel pump electrical connector at the fuel tank disconnected, connect a test light between the feed wire and the ground wire (harness side). 2. Command the fuel pump ON with a Tech 2. Did the test light illuminate for 2 seconds?	——	Go to Step 18	Go to Step 16
16	Repair the open circuit in the fuel pump ground wire. Is the action complete?	——	Verify repair	——
17	1. Re–connect the horn relay in its proper location. 2. Replace the fuel pump relay. Is the action complete?	——	Verify repair	——
18	Replace the fuel pump. Is the action complete?	——	Verify repair	——

FUEL SYSTEM DIAGNOSIS



060R100024

Circuit Description

When the ignition switch is turned ON, the powertrain control module (PCM) will turn ON the in–tank fuel pump. The in–tank fuel pump will remain ON as long as the engine is cranking or running and the PCM is receiving 58X crankshaft position pulses. If there are no 58X crankshaft position pulses, the PCM will turn the in–tank fuel pump OFF 2 seconds after the ignition switch is turned ON or 2 seconds after the engine stops running. The in–tank fuel pump is an electric pump within an integral reservoir. The in–tank fuel pump supplies fuel through an in–line fuel filter to the fuel rail assembly. The fuel pump is designed to provide fuel at a pressure above the pressure needed by the fuel injectors. A fuel pressure regulator, attached to the fuel rail, keeps the fuel available to the fuel injectors at a regulated pressure. Unused fuel is returned to the fuel tank by a separate fuel return line.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Connect the fuel pressure gauge to the fuel feed line as shown in the fuel system illustration. Wrap a shop towel around the fuel pressure connection in order to absorb any fuel leakage that may occur when installing the fuel pressure gauge. With the ignition switch ON and the fuel pump running, the fuel pressure indicated by the fuel pressure gauge should be 283–376 kPa (41–55 psi). This pressure is controlled by the amount of pressure the spring inside the fuel pressure regulator can provide.
3. A fuel system that cannot maintain a constant fuel pressure has a leak in one or more of the following areas:
   - The fuel pump check valve.
   - The fuel pump flex line.

- The valve or valve seat within the fuel pressure regulator.
- The fuel injector(s)

4. Fuel pressure that drops off during acceleration, cruise, or hard cornering may case a lean condition. A lean condition can cause a loss of power, surging, or misfire. A lean condition can be diagnosed using a Tech 2. If an extremely lean condition occurs, the oxygen sensor(s) will stop toggling. The oxygen sensor output voltage(s) will drop below 500 mV. Also, the fuel injector pulse width will increase.

IMPORTANT: Make sure the fuel system is not operating in the ”Fuel Cut–Off Mode.”

When the engine is at idle, the manifold pressure is low (high vacuum). This low pressure (high vacuum) is applied to the fuel pressure regulator diaphragm. The low pressure (high vacuum) will offset the pressure being applied to the fuel pressure regulator diaphragm by the spring inside the fuel pressure regulator. When this happens, the result is lower fuel pressure. The fuel pressure at idle will vary slightly as the barometric pressure changes, but the fuel pressure at idle should always be less than the fuel pressure noted in step 2 with the engine OFF.

16. Check the spark plug associated with a particular fuel injector for fouling or saturation in order to determine if that particular fuel injector is leaking. If checking the spark plug associated with a particular fuel injector for fouling or saturation does not determine that a particular fuel injector is leaking, use the following procedure:
    - Remove the fuel rail, but leave the fuel lines and injectors connected to the fuel rail. Refer to Fuel Rail Assembly in On–Vehicle Service.
    - Lift the fuel rail just enough to leave the fuel injector nozzles in the fuel injector ports.

CAUTION: In order to reduce the risk of fire and personal injury that may result from fuel spraying on the engine, verify that the fuel rail is positioned over the fuel injector ports and verify that the fuel injector retaining clips are intact.

- **Pressurize the fuel system by connecting a 10 amp fused jumper between B+ and the fuel pump relay connector.**
- **Visually and physically inspect the fuel injector nozzles for leaks.**

17. A rich condition may result from the fuel pressure being above 376 kPa (55 psi). A rich condition may cause a DTC P0132 or a DTC P0172 to set. Driveability conditions associated with rich conditions can include hard starting (followed by black smoke) and a strong sulfur smell in the exhaust.
20. This test determines if the high fuel pressure is due to a restricted fuel return line or if the high fuel pressure is due to a faulty fuel pressure regulator.
21. A lean condition may result from fuel pressure below 333 kPa (48 psi). A lean condition may cause a DTC P0131 or a DTC P0171 to set. Driveability conditions associated with lean conditions can include hard starting (when the engine is cold), hesitation, poor driveability, lack of power, surging, and misfiring.
22. Restricting the fuel return line causes the fuel pressure to rise above the regulated fuel pressure. Command the fuel pump ON with the Tech 2. The fuel pressure should rise above 376 kPa (55 psi) as the fuel return line becomes partially closed.

NOTE: Do not allow the fuel pressure to exceed 414 kPa (60 psi). Fuel pressure in excess of 414 kPa (60 psi) may damage the fuel pressure regulator.

CAUTION: To reduce the risk of fire and personal injury:

- **It is necessary to relieve fuel system pressure before connecting a fuel pressure gauge. Refer to Fuel Pressure Relief Procedure, below.**
- **A small amount of fuel may be released when disconnecting the fuel lines. Cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when the procedure is completed.**

Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay center.
3. Start the engine and allow it to stall.
4. Crank the engine for an additional 3 seconds.

Fuel Gauge Installation

1. Remove the shoulder fitting cap.
2. Install fuel gauge J 34730–1 to the fuel feed line located on the upper right side of the engine near the EGR valve.
3. Reinstall the fuel pump relay.

Fuel System Diagnosis

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Turn the ignition OFF. 2. Turn the air conditioning system OFF. 3. Relieve fuel system pressure and install the fuel pressure gauge. 4. Turn the ignition ON. NOTE: The fuel pump will run for approximately 2 seconds. Use the Tech 2 to command the fuel pump ON. 5. Observe the fuel pressure indicated by the fuel pressure gauge with the fuel pump running. Is the fuel pressure within the specified limits?	283–376 kPa (41–55 psi)	Go to Step 3	Go to Step 17
3	NOTE: The fuel pressure will drop when the fuel pump stops running, then it should stabilize and remain constant. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to Step 4	Go to Step 12
4	1. When the vehicle is at normal operating temperature, turn the ignition ON to build fuel pressure and observe the measurement on the gauge. 2. Start the engine and observe the fuel pressure gauge. Did the reading drop by the amount specified after the engine was started?	21–105 kPa (3–15 psi)	Go to Step 5	Go to Step 9
5	Is fuel pressure dropping off during acceleration, cruise, or hard cornering?	—	Go to Step 6	Check for improper fuel
6	Visually and physically inspect the following items for a restriction: ● The in–pipe fuel filter. ● The fuel feed line. Was a restrication found?	—	Verify repair	Go to Step 7
7	Remove the fuel tank and visually and physically inspect the following items: ● The fuel pump strainer for a restriction. ● The fuel line for a leak. ● Verify that the correct fuel pump is in the vehicle. Was a problem found in any of these areas?	—	Verify repair	Go to Step 8
8	Replace the fuel pump. Is the action complete?	—	Verify repair	—
9	1. Disconnect the vacuum hose from the fuel pressure regulator. 2. With the engine idling, apply 12–14 inches of vacuum to the fuel pressure regulator. Does the fuel pressure indicated by the fuel pressure gauge drop by the amount specified?	21–105 kPa (3–15 psi)	Go to Step 10	Go to Step 11

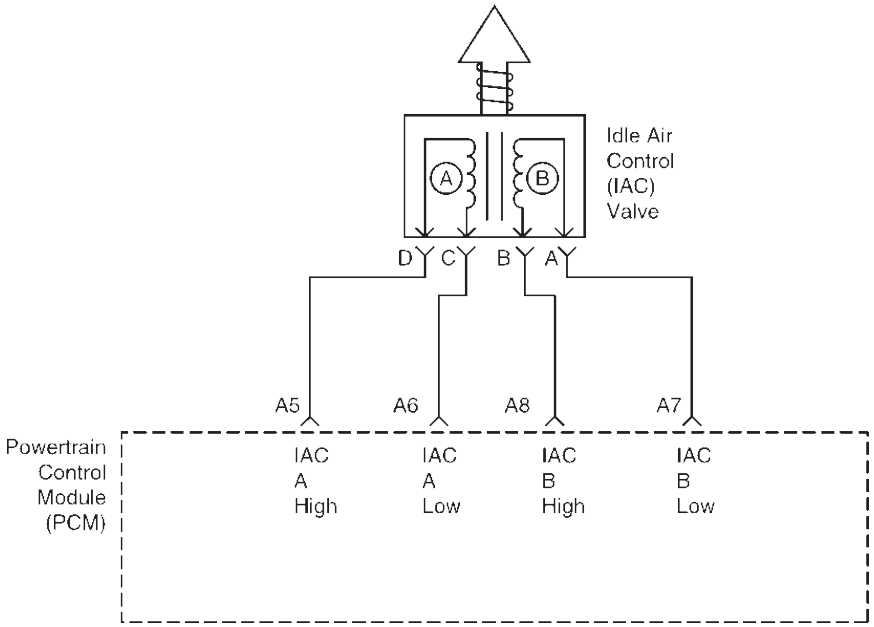
Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
10	Locate and repair the loss of vacuum to the fuel pressure regulator. Is the action complete?	—	Verify repair	—
11	Replace the fuel pressure regulator. Is the action complete?	—	Verify repair	—
12	1. Run the fuel pump with the Tech 2. 2. After pressure has built up, turn off the pump and clamp the supply hose shut with suitable locking pliers which will not damage the hose. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to Step 13	Go to Step 15
13	Visually inspect the fuel supply line and repair any leaks. Was a problem found?	—	Verify repair	Go to Step 14
14	Remove the fuel tank and inspect for leaky hose or in–tank fuel line. Was a problem found?	—	Verify repair	Go to Step 8
15	1. If the pliers are still clamped to the fuel supply hose, remove the locking pliers. 2. With suitable locking pliers which will not damage the hose, clamp the fuel return line to prevent fuel from returning to the fuel tank. 3. Run the fuel pump with the Tech 2. 4. After pressure has built up, remove power to the pump. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to Step 11	Go to Step 16
16	Locate and replace any leaking fuel injector(s). Is the action complete?	—	Verify repair	—
17	Is the fuel pressure indicated by the fuel pressure gauge above the specified limit?	376 kPa (55 psi)	Go to Step 18	Go to Step 21
18	1. Relieve the fuel pressure. Refer to the Fuel Pressure Relief. 2. Disconnect the fuel return line from the fuel rail. 3. Attach a length of flexible hose to the fuel rail return outlet passage. 4. Place the open end of the flexible hose into an approved gasoline container. 5. Run the fuel pump with the Tech 2. 6. Observe the fuel pressure indicated by the fuel pressure gauge with the fuel pump running. Is the fuel pressure within the specified limits?	290–376 kPa (42–55 psi)	Go to Step 19	Go to Step 20
19	Locate and correct the restriction in the fuel return line. Is the action complete?	—	Verify repair	—
20	Visually and physically inspect the fuel rail outlet passages for a restriction. Was a restriction found?	—	Verify repair	Go to Step 11

Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
21	Is the fuel pressure indicated by the fuel pressure gauge above the specified value?	0 kPa (0 psi)	Go to Step 22	Go to Step 23
22	1. Command the fuel pump ON with the Tech 2. 2. Using suitable pliers which will not damage the fuel hose, gradually apply pressure with the pliers to pinch the flexible fuel return hose closed. **CAUTION: Do not let the fuel pressure exceed the second specified value.** Does the fuel pressure indicated by the fuel pressure gauge rise above the first specified value?	414 kPa (60 psi)	Go to Step 11	Go to Step 7
23	1. Command the fuel pump ON with the Tech 2. 2. Remove the fuel filler cap and listen for the sound of the fuel pump running. 3. Turn the pump off. Was the fuel pump running?	—	Go to Step 7	Go to Fuel System Electrical Test Chart

IDLE AIR CONTROL (IAC) SYSTEM CHECK



060R100025

Circuit Description

The powertrain control module (PCM) controls engine idle speed with the idle air control (IAC) valve. To increase idle speed, the PCM retracts the IAC valve pintle away from its seat, allowing more air to bypass the throttle bore. To decrease idle speed, it extends the IAC valve pintle towards its seat, reducing bypass air flow. A Tech 2 will read the PCM commands to the IAC valve in counts. Higher counts indicate more air bypass (higher idle). Lower counts indicate less air is allowed to bypass (lower idle).

Diagnostic Aids

A slow, unstable, or fast idle may be caused by a non–IAC system problem that cannot be overcome by the IAC valve. Out of control range IAC Tech 2 counts will be above 60 if idle is too low, and zero counts if idle is too high. The following checks should be made to repair a non–IAC system problem:

- Vacuum leak (high idle) – If idle is too high, stop the engine. Fully extend (low) IAC with the IAC motor analyzer J 39027–A. Start the engine. If idle speed is above 800 RPM, locate and correct the vacuum leak, including the PCV system. Check for binding of the throttle blade or linkage.
- Lean heated oxygen sensor signal (high air/fuel ratio) – The idle speed may be too high or too low. Engine speed may vary up and down, and disconnecting the IAC valve does not help. Diagnostic trouble codes P0131, P0151, P0171, or P0174 may be set. Tech 2 oxygen (O2) voltage will be less than 100 mV (0.1 V). Check for low regulated fuel pressure, water in fuel, or a restricted injector.

- Rich heated oxygen sensor signal (low air/fuel ratio) – The idle speed will be too low. Tech 2 IAC counts will usually be above 80. The system is obviously rich and may exhibit black smoke in the exhaust.
- Tech 2 O2 voltage will be fixed at about 750 mV (0.75 V). Check for high fuel pressure, or a leaking or sticking injector. A silicon–contaminated heated oxygen sensor will show an O2 voltage slow to respond on the Tech 2.
- Throttle body – Remove the IAC valve and inspect the bore for foreign material.
- IAC valve electrical connections – IAC valve connections should be carefully checked for proper contact.
- PCV valve – An incorrect or faulty PCV valve may result in an incorrect idle speed. Refer to Diagnosis, Rough Idle, Stalling.

  If intermittent poor driveability or idle symptoms are resolved by disconnecting the IAC, carefully recheck the connections and valve terminal resistance, or replace the IAC.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The IAC motor analyzer J 39027–A is used to extend and retract the IAC valve. Valve movement is verified by an engine speed change. If no change in engine speed occurs, the valve can be resettled when removed from the throttle body.
2. This step checks the quality of the IAC movement in step 1. Between 700 revolutions per minute (RPM) and about 1500 RPM, the engine speed should change smoothly with each flash of the tester light in both extend and retract. If the IAC valve is retracted beyond the control range (about 1500 RPM), it may take many flashes to extend the IAC valve before engine speed will begin to drop. This is normal on certain engines. Fully extending the IAC may cause engine stall. This may be normal.
6. Steps 1 and 2 verified the proper IAC valve operation. This step checks the IAC circuits. Each lamp on the noid light should flash red and green while the IAC valve is cycled. While the sequence of color is not important, if either light is OFF or does not flash red and green, check the circuits for faults, beginning with poor terminal contacts.

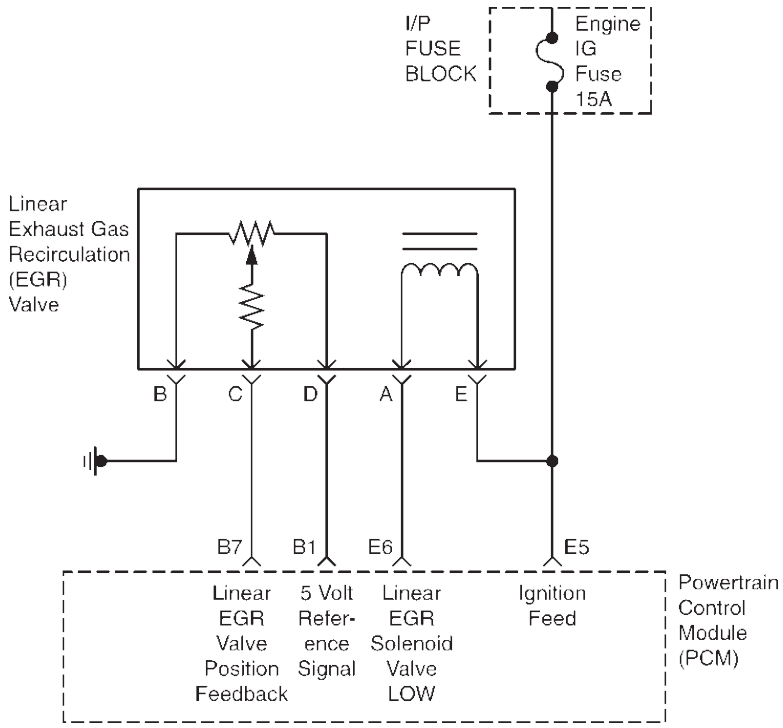
Idle Air Control (IAC) System Check

Step	Action	Value(s)	Yes	No
1	1. Ignition OFF. 2. Connect the IAC motor analyzer J 39027–A to the IAC valve. 3. Set the parking brake. 4. Block the wheels. 5. Turn the air conditioning OFF. 6. Idle the engine in Park (A/T) or Neutral (M/T). 7. Install the Tech 2. Display the RPM. 8. Use the IAC motor analyzer J 39027–A to extend and retract the IAC valve. 9. The engine speed should decrease and increase as the IAC is cycled. Does the RPM change?	—	Go to Step 2	Go to Step 3
2	RPM should change smoothly with each flash of the IAC motor analyzer J 39027–A light. Does the RPM change within the range specified?	700–1500 RPM	Go to Step 6	Go to Step 3
3	Check the IAC passages. Are the IAC passages blocked?	—	Go to Step 4	Go to Step 5
4	Clear any obstruction from the IAC passages. Is the action complete?	—	Verify repair	—
5	Replace the IAC. Refer to On–Vehicle Service, Idle Air Control Valve. Is the action complete?	—	Verify repair	—

Idle Air Control (IAC) System Check (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Install the appropriate IAC noid light from J 39027–A into the powertrain control module harness. 2. Cycle the IAC motor analyzer J 39027–A and observe the noid lights. 3. Both the lights should cycle red and green, but never OFF, as the RPM is changed over its range. Do the noid lights cycle red and green?	—	Go to Step 7	Go to Step 8
7	1. Use the other connector on the IAC motor analyzer J 39027–A pigtail. 2. Check the resistance across the IAC coils. Measure the resistance between terminal A and terminal B. 3. Measure the resistance between terminal C and terminal D. Is the resistance within the specified range?	40–80 Ω	Go to Step 9	Go to Step 10
8	If the circuits did not test green and red, check the following: ● Faulty connector terminal contacts ● Open circuits, including connections ● Circuits shorted to ground or voltage ● Faulty powertrain control module connector(s) or powertrain controlmodule. Are repairs necessary?	—	Go to Step 13	—
9	1. Check the resistance between the IAC terminal B and terminal C. 2. Check the resistance between the IAC terminal A and terminal D. Is the resistance infinite?	—	Go to Step 11	Go to Step 12
10	Replace the IAC. Refer to On–Vehicle Service, Idle Air Control Valve. Is the action complete?	—	Go to Step 7	—
11	Check the IAC valve and circuit. Are the IAC valve and circuit OK?	—	Refer to Diagnostic Aids	Go to Step 12
12	Replace the IAC. Refer to On–Vehicle Service, Idle Air Control Valve. Is the action complete?	—	Go to Step 9	—
13	Repair or replace the faulty component(s). Is the action complete?	—	Go to Step 6	—

EXHAUST GAS RECIRCULATION (EGR) SYSTEM CHECK



060R100039

Circuit Description

A properly operating exhaust gas recirculation (EGR) system will directly affect the air/fuel requirements of the engine. Since the exhaust gas introduced into the air/fuel mixture is an inert gas (contains very little or no oxygen), less fuel is required to maintain a correct air/fuel ratio.

Introducing exhaust gas into the combustion chamber lowers combustion temperatures and reduces the formation of oxides of nitrogen (NOx) in the exhaust gas. Lower combustion temperatures also prevent detonation. If the EGR pintle were to stay closed, the inert exhaust gas would be replaced with air and the air/fuel mixture would be leaner. The powertrain control module (PCM) would compensate for the lean condition by adding fuel, resulting in higher long term fuel trim values.

Diagnostic Aids

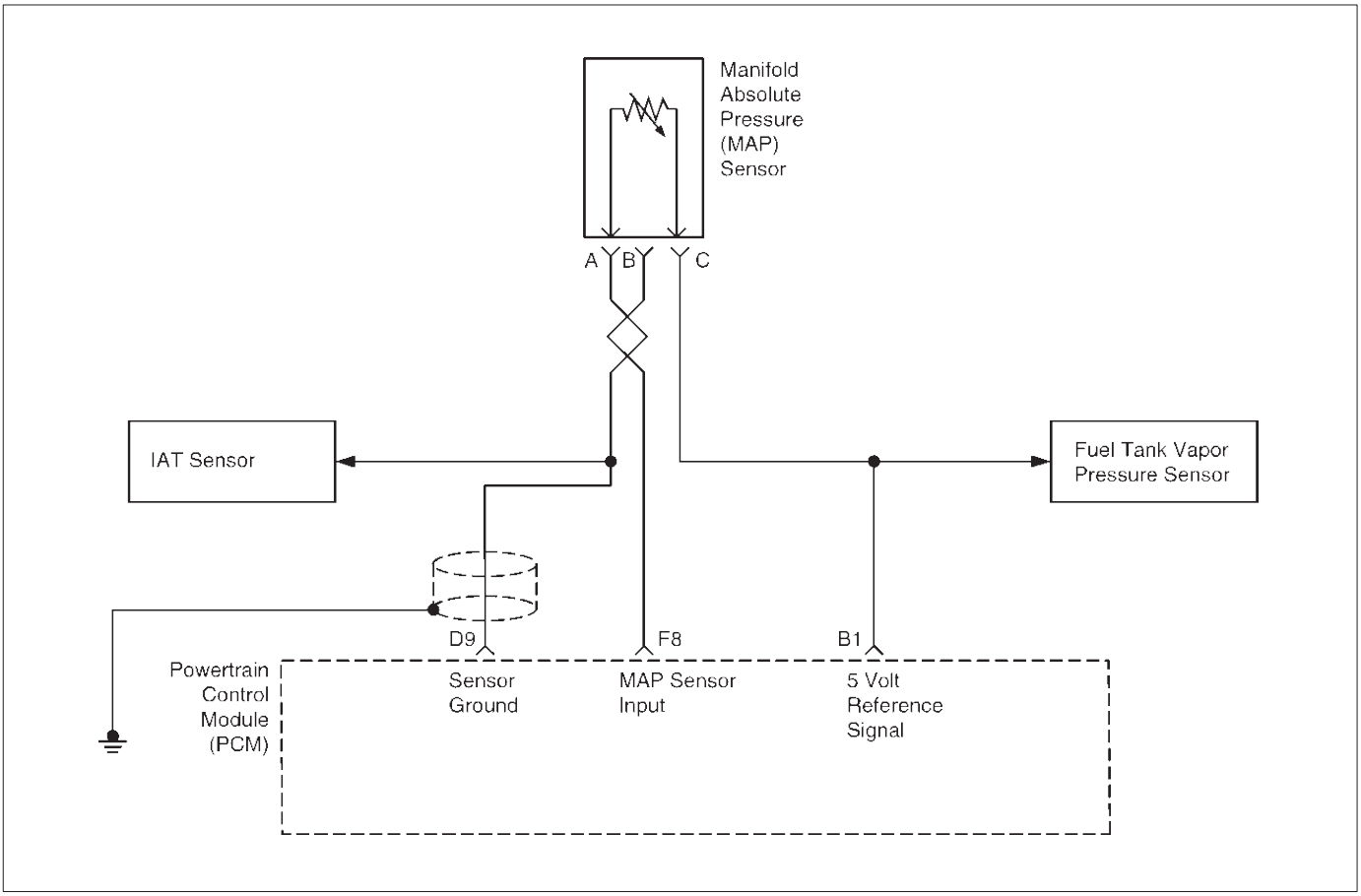
The EGR valve chart is a check of the EGR system. An EGR pintle constantly in the closed position could cause detonation and high emissions of NOx. It could also result in high long term fuel trim values in the open throttle cell, but not in the closed throttle cell. An EGR pintle constantly in the open position would cause rough idle. Also, an EGR valve mounted incorrectly (rotated 180˚) could cause a rough idle without setting an EGR DTC. Check for the following items:

- EGR passages – Check for restricted or blocked EGR passages.
- Manifold absolute pressure sensor – A manifold absolute pressure sensor may shift in calibration enough to affect fuel delivery. Refer to Manifold Absolute Pressure Output Check.

Exhaust Gas Recirculation (EGR) System Check

Step	Action	Value(s)	Yes	No
1	Check the EGR valve for looseness. Is the EGR valve loose?	—	Go to Step 2	Go to Step 3
2	Tighten the EGR valve. Is the action complete?	—	Verify repair	—
3	1. Place the transmission selector in Park or Neutral. 2. Start the engine and idle until warm (”Closed Loop”). 3. Using a Tech 2, command EGR ”50% ON.” Does the engine idle rough and lose RPMs?	—	EGR system working properly. No problem found.	Go to Step 4
4	1. Engine OFF. 2. Ignition ON. 3. Using a test light to ground, check the EGR harness between the ignition feed and ground. Does the test light illuminate?	—	Go to Step 6	Go to Step 5
5	Repair the EGR harness ignition feed. Was the problem corrected?	—	Verify repair	Go to Step 6
6	1. Remove the EGR valve. 2. Visually and physically inspect the EGR valve pintle, valve passages and adapter for excessive deposits, obstructions or any restrictions. Does the EGR valve have excessive deposits, obstructions or any restrictions?	—	Go to Step 7	Go to Step 8
7	Clean or replace EGR system components as necessary. Was the problem corrected?	—	Verify repair	Go to Step 8
8	1. Ground the EGR valve metal case to battery (–). 2. Using a Tech 2, command EGR ON and observe the EGR valve pintle for movement. Does the EGR valve pintle move according to command?	—	Go to Step 9	Go to DTC P0404 chart
9	1. Remove the EGR inlet and outlet pipes from the intake and exhaust manifolds. 2. Visually and physically inspect manifold EGR ports and EGR inlet and outlet pipes for blockage or restriction caused by excessive deposits or other damage. Do the manifold EGR ports or inlet and outlet pipes have excessive deposits, obstructions, or any restrictions?	—	Go to Step 10	EGR system working properly. No problem found.
10	Clean or replace EGR system components as necessary. Is the action complete?	—	Verify repair	—

MANIFOLD ABSOLUTE PRESSURE (MAP) OUTPUT CHECK



060R100026

Circuit Description

The manifold absolute pressure (MAP) sensor measures the changes in the intake MAP which result from engine load (intake manifold vacuum) and engine speed changes; and converts these into a voltage output. The powertrain control module (PCM) sends a 5–volt reference voltage to the MAP sensor. As the MAP changes, the output voltage of the sensor also changes. By monitoring the sensor output voltage, the PCM knows the MAP. A lower pressure (low voltage) output voltage will be about 1–2 volts at idle. Higher pressure (high voltage) output voltage will be about 4–4.8 volts at wide open throttle. The MAP sensor is also used, under certain conditions, to measure barometric pressure, allowing the PCM to make adjustments for different altitudes. The PCM uses the MAP sensor to diagnose proper operation of the EGR system, in addition to other functions.

Test Description

IMPORTANT: Be sure to use the same diagnostic test equipment for all measurements.

The number(s) below refer to the step number(s) on the Diagnostic Chart:

1. When you compare the Tech 2 readings to a known good vehicle, it is important to compare vehicles that use MAP sensors that have the same part number.
2. Applying 34 kPa (10 inch Hg) vacuum to the MAP sensor should cause the voltage to be 1.5–2.1 volts less than the voltage at step 1. Upon applying vacuum to the sensor, the change in voltage should be instantaneous. A slow voltage change indicates a faulty sensor.
3. Check the vacuum hose to the sensor for leaking or restriction. Be sure that no other vacuum devices are connected to the MAP hose.

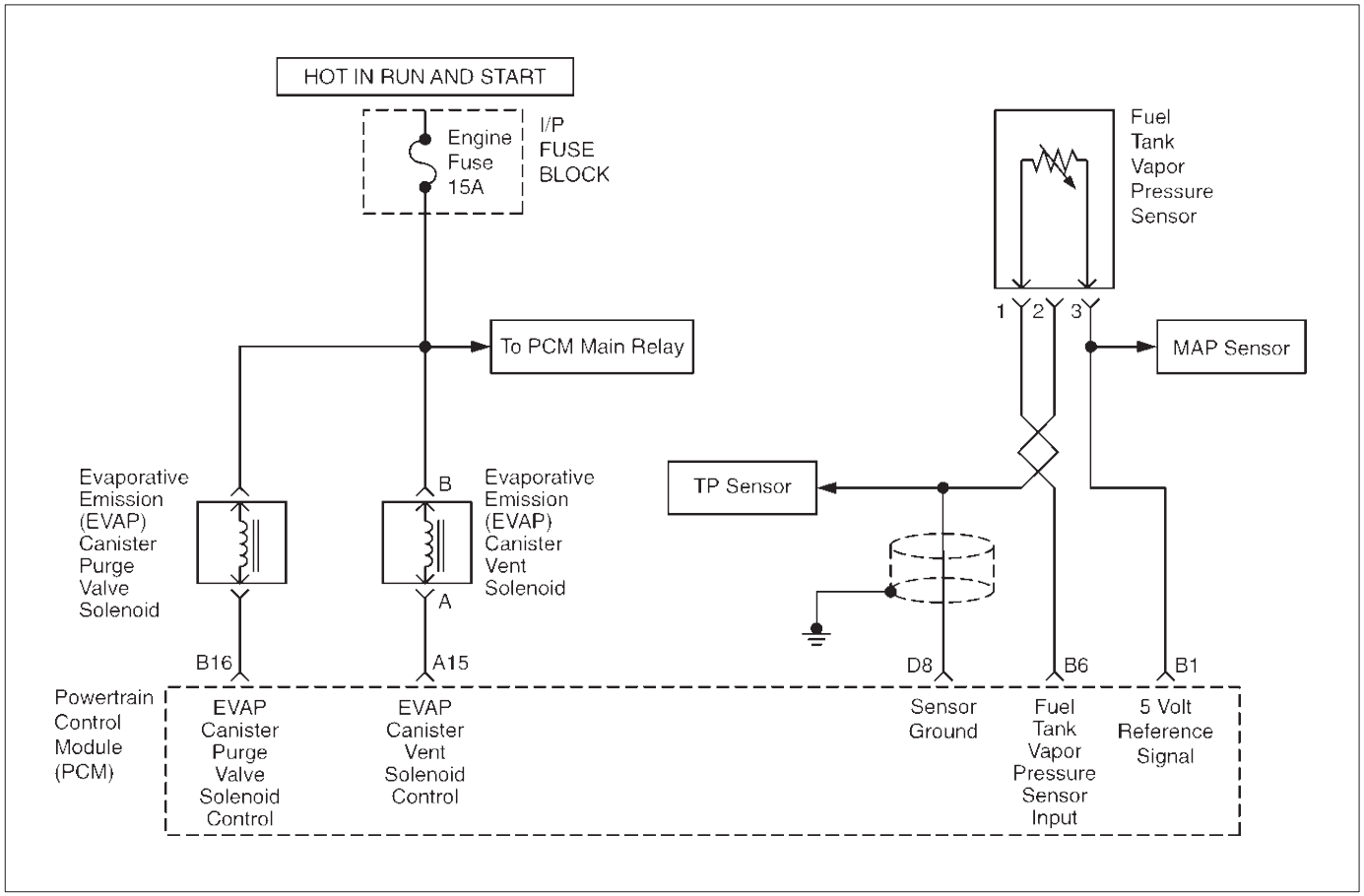
IMPORTANT: Make sure the electrical connector remains securely fastened.

4. Disconnect the sensor from the bracket. Twist the sensor with your hand to check for an intermittent connection. Output changes greater than 0.10 volt indicate a bad sensor.

Manifold Absolute Pressure (MAP) Output Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF and leave it OFF for 15 seconds. 2. Ignition ON. Do not crank engine. 3. The Tech 2 should indicate a manifold absolute pressure (MAP) sensor voltage. 4. Compare this scan reading to the scan reading of a known good vehicle obtained using the exact same procedure as in Steps 1–4. Is the voltage reading the same +/– 0.40 volt?	—	Go to Step 2	Go to Step 5
2	1. Disconnect the vacuum hose at the MAP sensor and plug the hose. 2. Connect a hand vacuum pump to the MAP sensor. 3. Start the engine. 4. Apply 34 kPa (10 inch Hg) of vacuum and note the voltage change. Is the voltage change 1.5–2.1 volts less than step 1?	—	Go to Step 3	Go to Step 4
3	Check the sensor hose for leakage or restriction. Does the hose supply vacuum to the MAP sensor only?	—	Go to Step 5	Go to Step 4
4	Repair the hose to ensure the hose supplies vacuum to the MAP sensor only. Is the action complete?	—	Verify repair	—
5	Check the sensor connection. Is the sensor connection good?	—	Go to Step 6	Go to Step 7
6	Refer to On–Vehicle Service, MAP Sensor. Is the action complete?	—	Verify repair	—
7	Repair the poor connection. Is the action complete?	—	Verify repair	—

EVAPORATIVE (EVAP) EMISSIONS CANISTER PURGE VALVE SOLENOID CHECK



060R100040

Circuit Description

Canister purge is controlled by a solenoid valve that allows manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge ON). The EVAP purge solenoid control is turned ON time is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the purge solenoid is enabled when the appropriate conditions have been met:

- The engine run time after start is more than 60 seconds.
- The engine coolant temperature is above 30°C (86°F).
- The fuel control system is operating in the Closed–Loop mode.

Diagnostic Aids

- Make a visual check of vacuum hoses.
- Check the throttle body for possible cracked.
- Check the malfunction indicator lamp for a possible mechanical problem.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart:

1. Check to see if the solenoid is open or closed. The solenoid is normally de–energized in this step, so it should be closed.
2. This step checks to determine if the solenoid was open due to an electrical circuit problem or a defective solenoid.
3. This should normally energize the solenoid, opening the valve and allowing the vacuum to drop (purge ON).

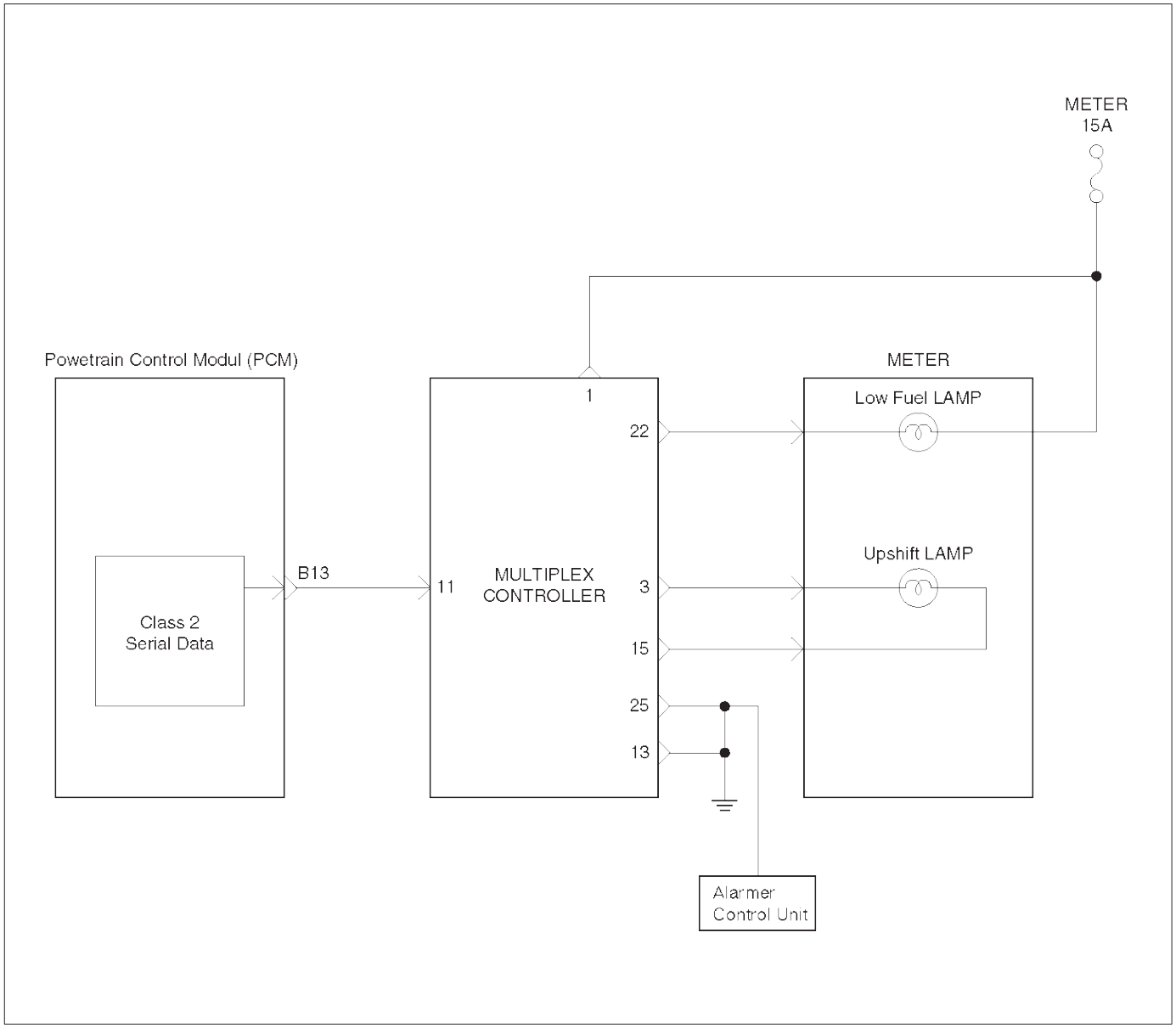
Evaporative (EVAP) Emissions Canister Purge Valve Solenoid Check

Step	Action	Value(s)	Yes	No
1	1. Ignition OFF. 2. Ignition ON, engine OFF. 3. At the throttle body, disconnect the hose that goes to the pump solenoid. 4. Using a hand vacuum pump with an attached vacuum gauge J 23738–A, apply vacuum (10 inch Hg or 34 kPa) to the solenoid. Does the solenoid hold vacuum?	—	Go to Step 3	Go to Step 2
2	1. Disconnect the solenoid electrical connector. 2. As in Step 1, apply vacuum (10” Hg or 34 kPa) to the solenoid. Does the solenoid hold vacuum?	—	Go to Step 4	Go to Step 7
3	1. At the throttle body, put a cap over the vacuum port where the hose was disconnected for testing. This is to prevent a vacuum leak when the engine is started. 2. Ignition OFF. 3. Install the Tech 2. 4. Apply vacuum to the purge solenoid with the hand vacuum pump. 5. Start the engine, run at 2500 RPM. 6. Using the Tech 2 command the purge solenoid ON. Did the vacuum drop when the purge was turned on?	—	Go to Step 8	Go to Step 9
4	Check for a short to ground or open in the wire between the solenoid and the PCM. Is there a problem?	—	Go to Step 5	Go to Step 6
5	Repair the faulty wire. Is the action complete?	—	Verify repair	—
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. and also refer to latest service bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
7	Replace the faulty purge solenoid. Refer to On–Vehicle Service, EVAP Canister Purge Solenoid. Is the action complete?	—	Verify repair	—

Evaporative (EVAP) Emissions Canister Purge Valve Solenoid Check (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition OFF. 2. At the throttle body, install a vacuum gauge where the hose from the purge solenoid was disconnected for testing. 3. Start the engine. 4. Stabilize the engine speed at about 2500 RPM. 5. Momentarily snap the throttle open and let it return to idle. Is there approximately 10 inch Hg (34 kPa) of vacuum available at the EVAP emission canister purge solenoid?	—	No problem found in the EVAP emission canister purge valve check.	Refer to Diagnostic Aids
9	1. Turn the Ignition OFF. 2. Disconnect the solenoid's electrical connector. 3. Connect a test lamp between the harness terminals. 4. Turn the Ignition ON. Does the test lamp light?	—	Go to Step 7	Go to Step 10
10	Probe each terminal of the solenoid valve electrical connector with a test lamp to ground. Does the test lamp light on both terminals?	—	Go to Step 11	Go to Step 12
11	Repair the short to voltage in the wire between the solenoid and the PCM. Is the action complete?	—	Verify repair	—
12	Does the ignition feed terminals light the test lamp?	—	Go to Step 13	Go to Step 14
13	Check for an open in the wire between the purge solenoid and the PCM. Was there an open circuit?	—	Go to Step 15	Go to Step 6
14	Repair the open in the ignition feed wire. Is the action complete?	—	Verify repair	—
15	Repair the open wire. Is the action complete?	—	Verify repair	—

Upshift Lamp System Check (Manual Transmission Only)



060R100084

Circuit Description

The shift lamp indicates the best transmission shift point for maximum fuel economy.
The lamp is controlled by the Power Train Control Module (PCM) and the Multiplex Controller, it is turned “ON” by grounding in the Multiplex Controller.
The PCM is used information from the following inputs to control the upshift lamp.

- Engine Coolant Temperature (ECT) Sensor
- Throttle Position Sensor
- Vehicle Speed Sensor
- Engine Speed

The PCM uses the measured RPM and the vehicle speed to calculate what gear the vehicle is in.
It’s this calculation that determines when the upshift lamp should be turned “ON”.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation. Check for poor connections or a damaged harness.
Inspect the PCM harness and connector for proper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.

Up-Shift Lamp System Check

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Verify the customer complaints in accordance with mentioned below: Go to the adequate Step Chart first. ● At the 1st gear position, the lamp doesn’t illuminate: Go to Step Chart ● At the 3rd gear position, the lamp doesn’t illuminate: Go to Step Chart ● Upshift Lamp doesn’t illuminate always. 2. Ignition “ON”, engine “OFF”. 3. Using the Tech 2, check to see if the upshift lamp turn “ON” or “OFF”. Does the upshift lamp stay “OFF”?	—	Go to *Step 2*	Go to *Step 10*
3	1. Ignition “OFF”. 2. Disconnect the cluster meter connector. 3. Disconnect the Multiplex Control Unit connector. 4. Check the circuit (Voltage feed circuit and Lamp driver circuit) between cluster meter connector and Multiplex Control Unit. Was a problem found?	—	Go to *Step 4*	Go to *Step 5*
4	Locate and repair the between cluster meter and Multiplex Control Unit open circuit. Is the action complete?	—	Verify repair	—
5	1. Reconnect the cluster meter connector. 2. Check the circuit resistance between voltage feed circuit and lamp driver circuit at Multiplex Control Unit connector. Was a problem found?	—	Go to *Instrument Panel in Electrical Diagnosis*	Go to *Step 6*
6	1. Ignition “OFF”. 2. Disconnect the Alarmer Control Unit. 3. Ignition “ON”, Probe the ignition feed circuit at the Alarmer Control Unit connector with a test light to ground. Is the test light “ON”?	—	Go to *Step 8*	Go to *Step 7*
7	Locator and repair the Alarmer Control Unit battery feed open circuit. Is the action complete ?	—	Verify repair	—
8	Check the Alarmer Control Unit ground connection and circuit. Was a problem found?	—	Go to *Step 9*	Go to *Step 10*
9	Locator and repair the ground connector for Alarmer Control Unit Circuit. Is the action complete?	—	Verify repair	—

Up-Shift Lamp System Check (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Disconnect the Multiplex Control Unlit. 2. Check the circuit between Alarmer control Unlit and Multiplex Control Unit. Was a problem found?	—	Go to *Step 11*	Go to *Step 12*
11	Locate and repair the between Multiplex Control Unit and PCM open circuit. Is the action complete?	—	Verify repair	—
12	Check for damaged terminals at the Multiplex Control Unit. Was a problem found?	—	Go to *Step 13*	Go to *Step 14*
13	Replace the Multiplex Control Unit. Is the action complete?	—	Go to *Step 16*	—
14	1. Ignition "OFF". 2. Reconnect the all connector. 3. Install the Tech 2. 4. Ignition "ON". 5. Using the Tech 2 output control function, select Upshift lamp control and command the Upshift lamp "ON" and "OFF". (Refer to the Miscellaneous test) Is the action complete?	—	Verify repair	Go to *Step 15*
15	Replace the Multiplex Control Unit. Is the action complete?	—	Go to *Step 16*	—
16	1. Verify the customer complaints in accordance with mentioned below: Go to the adequate Step Chart first. ● At the 1st gear position, the lamp does not illuminate: Go to Step Chart ● At the 3rd gear position, the lamp does not illuminate: Go to Step Chart ● Upshift Lamp does not illuminate always. 2. Ignition "ON", or "OFF". 3. Using the Tech 2, check to see if the upshift lamp turn "ON" or "OFF". Is the action complete?	—	Verify repair	Go to *Step 17*
17	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed refer to *ON-Vehicle Service in PowerTrain Control Module and Sensor* for procedure. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

PCM DIAGNOSTIC TROUBLE CODES

The following table lists the diagnostic trouble codes supported by this vehicle application. If any DTCs not listed here are displayed by a Scan Tool, the Tech 2 data may be faulty; notify the Tech 2 manufacturer of any DTCs displayed that are not included in the following table.

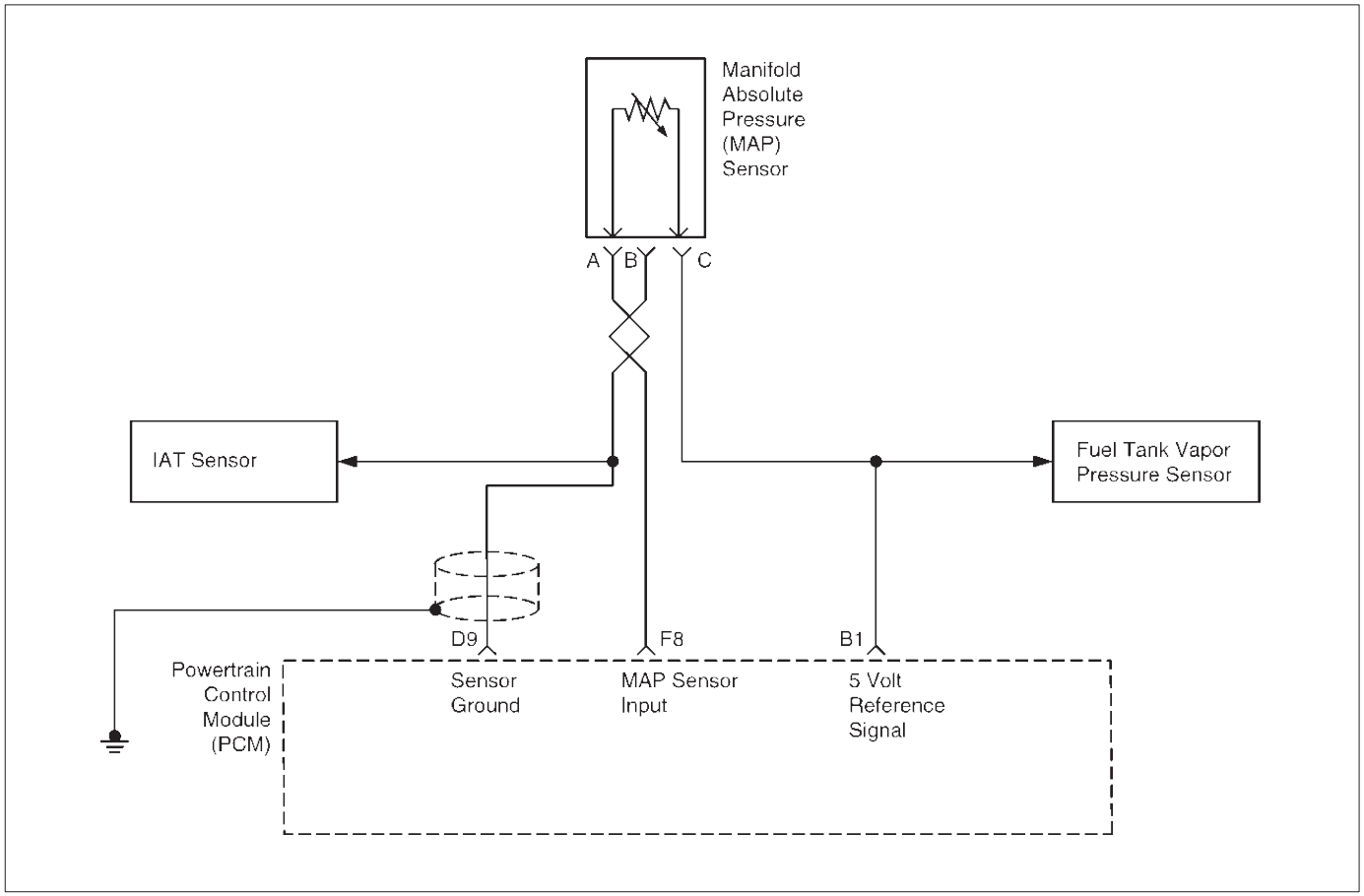
PCM Diagnostic Trouble Codes

DTC	Description	Type	Illuminate MIL
P0106	MAP Circuit/Range Performance Problem	B	Yes
P0107	MAP Sensor Circuit Low Input	A	Yes
P0108	MAP Sensor Circuit High Input	A	Yes
P0112	IAT Sensor Circuit Low Input	A	Yes
P0113	IAT Sensor Circuit High Input	A	Yes
P0117	ECT Sensor Circuit Low Input	A	Yes
P0118	ECT Sensor Circuit High Input	A	Yes
P0121	TP Sensor Circuit Range/Performance Problem	B	Yes
P0122	TP Sensor Circuit Low Input	A	Yes
P0123	TP Sensor Circuit High Input	A	Yes
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	B	Yes
P0128	Thermostat In Sufficient Temperature for Stable Operation	B	Yes
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	A	Yes
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	A	Yes
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	B	Yes
P0134	O2 Sensor Circuit No Activity Detected (Bank Sensor 1)	A	Yes
P0135	O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)	B	Yes
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	A	Yes
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	A	Yes
P0140	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)	A	Yes
P0141	O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)	B	Yes
P0171	Fuel Trim System Too Lean (Bank 1)	B	Yes
P0172	Fuel Trim System Too Rich (Bank 1)	B	Yes
P0201	Injector Circuit Malfunction – Cylinder 1	A	Yes
P0202	Injector Circuit Malfunction – Cylinder 2	A	Yes
P0203	Injector Circuit Malfunction – Cylinder 3	A	Yes
P0204	Injector Circuit Malfunction – Cylinder 4	A	Yes
P0300	Random/Multiple Cylinder Misfire Detected	B	Yes
P0301	Cylinder Misfire Detected (#1)	B	Yes
P0302	Cylinder Misfire Detected (#2)	B	Yes
P0303	Cylinder Misfire Detected (#3)	B	Yes
P0304	Cylinder Misfire Detected (#4)	B	Yes
P0325	Knock Sensor Circuit Malfunction	B	Yes
P0327	Knock Sensor Circuit Low Input	B	Yes
P0336	CKP Sensor Circuit Range/Performance	B	Yes
P0337	CKP Sensor Circuit Low Input	B	Yes
P0341	CMP Sensor Circuit Range/Performance	B	Yes
P0342	CMP Sensor Circuit Low Input	B	Yes

DTC	Description	Type	Illuminate MIL
P0351	Ignition Coil ”A” Primary/Secondary	A	Yes
P0352	Ignition Coil ”B” Primary/Secondary	A	Yes
P0401	EGR Flow Insufficient Detected	A	Yes
P0402	EGR Excessive Flow Detected	B	Yes
P0404	EGR Circuit Range/Performance	B	Yes
P0405	EGR Sensor Circuit Low	A	Yes
P0406	EGR Sensor Circuit High	A	Yes
P0420	Catalyst System Efficiency Below Threshold	A	Yes
P0440	EVAP Control System Malfunction	A	Yes
P0442	EVAP Control System Small Leak Detected	A	Yes
P0443	EVAP Control System Purge Control Valve Circuit Malfunction	A	Yes
P0446	EVAP Control System Vent Control Circuit Malfunction	B	Yes
P0449	EVAP Control System Vent Valve/Solenoid Circuit Malfunction	A	Yes
P0456	EVAP Control System Very Small Leak Detected	A	Yes
P0461	Fuel Level Sensor Circuit Range/Performance	B	Yes
P0462	Fuel Level Sensor Circuit Low Input	B	Yes
P0463	Fuel Level Sensor Circuit High Input	B	Yes
P0464	Fuel Level Sensor Noisy Signal	D	No
P0480	Cooling Fan 1 Control Circuit Malfunction	D	No
P0481	Cooling Fan 2 Control Circuit Malfunction	D	No
P0502	VSS Circuit Low Input	B	Yes
P0506	Idle Control System RPM Lower than expected	B	Yes
P0507	Idle Control System RPM Higher than expected	B	Yes
P0532	A/C Refrigerent Pressure Sensor Circuit Low	D	No
P0533	A/C Refrigerent Pressure Sensor Circuit High	D	No
P0562	System Voltage Low	D	No
P0563	System Voltage High	A	Yes
P0601	Internal Control Module Memory Check Sum Error	A	Yes
P1106	MAP Sensor Circuit Intermittent High Voltage	D	No
P1107	MAP Sensor Circuit Intermittent Low Voltage	D	No
P1111	IAT Sensor Circuit Intermittent High Voltage	D	No
P1112	IAT Sensor Circuit Intermittent Low Voltage	D	No
P1114	ECT Sensor Circuit Intermittent Low Voltage	D	No
P1115	ECT Sensor Circuit Intermittent High Voltage	D	No
P1121	TP Sensor Circuit Intermittent High Voltage	D	No
P1122	TP Sensor Circuit Intermittent Low Voltage	D	No
P1133	O2 Sensor Insufficient Switching (Bank 1 Sensor 1)	B	Yes
P1134	O2 Sensor Transition Time Ratio (Bank 1 Sensor1)	B	Yes
P1171	Fuel System Lean During Acceleration	A	Yes
P1336	CKP System Variation Not Learned	A	Yes
P1380	ABS Rough Road System Fault	D	No
P1381	ABS Rough Road Class 2 Serial Data Fault	D	No
P1404	EGR Closed Valve	B	Yes

DTC	Description	Type	Illuminate MIL
P1441	EVAP System Flow During Non–Purge	B	Yes
P1546	A/C Compressor Clutch Output Circuit Malfunction	D	No
P1618	SPI PCM Interprocessor Communication Error	A	Yes
P1625	PCM Unexpected Reset	D	Yes
P1627	PCM A/D Conversion Malfunction	A	Yes
P1635	5 Volt Reference Voltage Circuit Malfunction	A	Yes

DIAGNOSTIC TROUBLE CODE (DTC) P0106 MANIFOLD ABSOLUTE PRESSURE (MAP) CIRCUIT/RANGE PERFORMANCE PROBLEM



060R100026

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure. The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (low manifold pressure) to above 4 volts with the ignition ON engine not running or at wide–open throttle (high manifold pressure).

A ”speed density” method of determining engine load is used on the 2.2L engine. This is calculated using inputs from the MAP sensor, RPM, CKP Sensor, and the Intake Air Temperature (IAT) sensor. The MAP sensor is the main sensor used in this calculation, and measuring engine load is its main function. The MAP sensor is also used to determine manifold pressure changes while the exhaust gas recirculation (EGR) flow test diagnostic is being run, to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). Refer to DTC P0401.

The PCM monitors the MAP signals for voltages outside the normal range (10–104 kpa) of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively low, Diagnostic Trouble Code P0106 will be set. Diagnostic Trouble Code P0106 is a Type B Code.

Conditions for Setting the DTC

- No ECT, CKP, EGR, EVAP, MAP, Injector, Misfire, A/D Multiplexer or TP sensor DTC’s present.
- Engine speed is steady, changing less than 20 RPM.
- Throttle position is steady, throttle angle changes less than 5%.
- EGR flow rate is steady, changing less than 2%.
- IAC valve counts are steady, changing less than 3 counts.
- Engine speed is between 1000 RPM and 4000 RPM.
- ECT is above –10˚C (14˚F).
- No change in brake switch, A/C clutch, power steering pressure switch status.

The above conditions are met for 80 test failures within a 160 test sample (125 msec/test)

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0106 will clear after 40 consecutive warm–up cycles have occurred without a fault.

- Diagnostic Trouble Code P0106 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- The MAP sensor shares a 5 Volt Reference with the TP sensor and Fuel Pressure sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor shares a ground with the TP sensor and Fuel Pressure sensor.
- Damaged harness – Inspect the wiring harness for damage; an open circuit, a short to ground, or a short to voltage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If Diagnostic Trouble Code P0106 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the Diagnostic Trouble Code was last set. If it is determined that the Diagnostic Trouble Code occurs intermittently, performing the Diagnostic Trouble Code P1106 or P1107 Diagnostic Chart may isolate the cause of the fault.

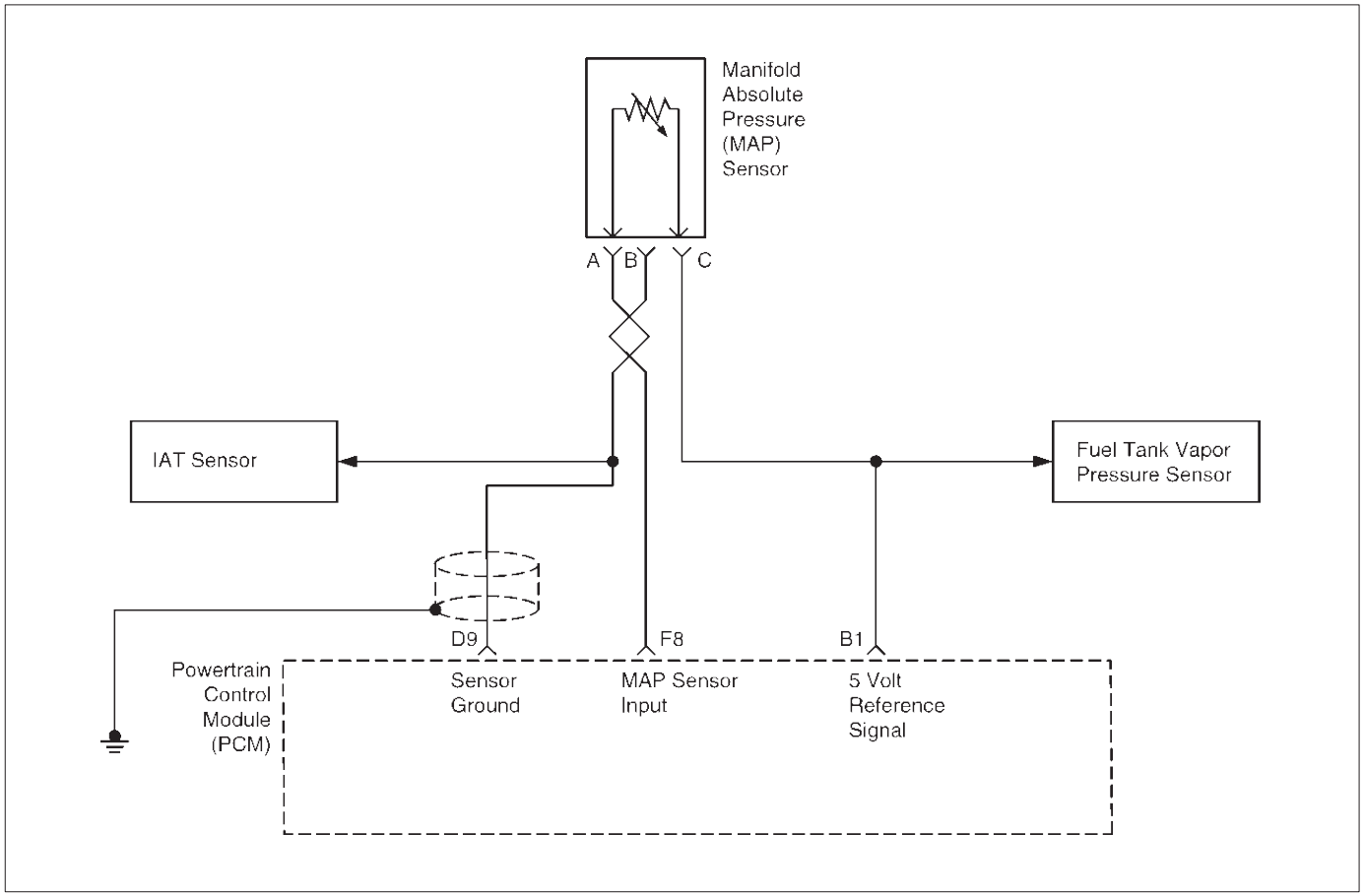
DTC P0106 MAP Circuit/Range Performance Problem

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, engine OFF 2. Review and record Tech 2 Failure Records data, then clear the DTC's. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for Diagnostic Trouble Code P0106. Does the Tech 2 indicate that DTC P0106 ran and passed?	—	Go to Step 3	Go to Step 4
3	1. Check for the following condition: • Vacuum hoses disconnected, damaged, or incorrectly routed? • Intake manifold vacuum leaks; • Vacuum leaks at throttle body; • Vacuum leaks at EGR valve flange and pipes; 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to Diagnostic Aids
4	1. Disconnect the Manifold Absolute Pressure (MAP) sensor electrical connector. 2. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	0 V 10.3 kPa	Go to Step 6	Go to Step 5
5	Check the MAP sensor signal circuit; between the MAP sensor and the Powertrain Control Module (PCM), for a short to voltage?	—	Verify repair	Go to Step 12
6	Check the MAP sensor circuit, between the MAP sensor and the PCM, the following conditions: • A short to ground • An open circuit Was the problem found?	—	Verify repair	Go to Step 7

DTC P0106 MAP Circuit/Range Performance Problem (Cont'd)

Step	Action	Value(s)	Yes	No
7	Check the 5 volt signal circuit, between the MAP sensor and the PCM, for the following conditions: ● An open circuit ● A short to ground ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 8
8	1. Ignition OFF. 2. Place a fused jumper between the MAP sensor circuit and the 5 volt signal circuit, both at the wiring harness' MAP sensor connector. 3. Ignition ON, engine OFF. 4. Observe the MAP value displayed on the Tech 2? Does the Tech 2 read the following value? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	5 volts 104 kPa	Go to Step 9	Go to Step 12
9	Check the MAP sensor ground circuit, between the MAP sensor and the PCM, for the following conditions: ● An open circuit ● A short to ground ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 10
10	1. Ignition OFF. 2. Place a Digital Multimeter (DVM), set to measure voltage, between the ground circuit and the 5 volt signal circuit, both at the wiring harness' MAP sensor connector. 3. Ignition ON, engine OFF. 5 volts Does the DVM read the following value?	—	Go to Step 11	Go to Step 12
11	Replace the MAP sensor. Verify repair.	—	—	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P0107 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT LOW INPUT



060R100026

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure. The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (low manifold pressure) to above 4 volts with the ignition ON, engine not running or at wide–open throttle (high manifold pressure).

A ”speed density” method of determining engine load is used on the 2.2L engine. This is calculated using inputs from the MAP sensor, the CKP Sensor, and the Intake Air Temperature (IAT) sensor. The MAP sensor is the main sensor used in this calculation, and measuring engine load is its main function. The MAP sensor is also used to determine manifold pressure changes while the exhaust gas recirculation (EGR) flow test diagnostic is being run, to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). Refer to DTC P0401.

The PCM monitors the MAP signals for voltages outside the normal range (10–104 kpa) of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively low, Diagnostic Trouble Code P0107 will be set. DTC P0107 is a Type A Code.

Conditions for Setting the DTC

- No TP sensor Diagnostic Trouble Codes present.
- Engine is running.
- Throttle angle is above 0% if engine speed is less than or equal to 1300 RPM.
- Throttle angle is above 5% if engine speed is above 1300 RPM.
- The MAP sensor indicates manifold absolute pressure below 11 kPa.

The above conditions are met for 128 test failures within a 256 test sample (7.81 msec/test).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will use a MAP value based on speed density calculation.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0107 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0107 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- The MAP sensor shares a 5 Volt Reference with the TP sensor and Fuel Pressure sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor shares a ground with the TP sensor and Fuel Pressure sensor.
- Damaged harness – Inspect the wiring harness for damage, shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.
- A faulty 5 volt reference circuit could also set a TP Sensor Diagnostic Trouble Code because the two sensors share the same 5 volt reference pin at the PCM.

If Diagnostic Trouble Code P0107 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the Diagnostic Trouble Code was last set. If it is determined that the Diagnostic Trouble Code occurs intermittently, performing the Diagnostic Trouble Code P0107 Diagnostic Chart may isolate the cause of the fault.

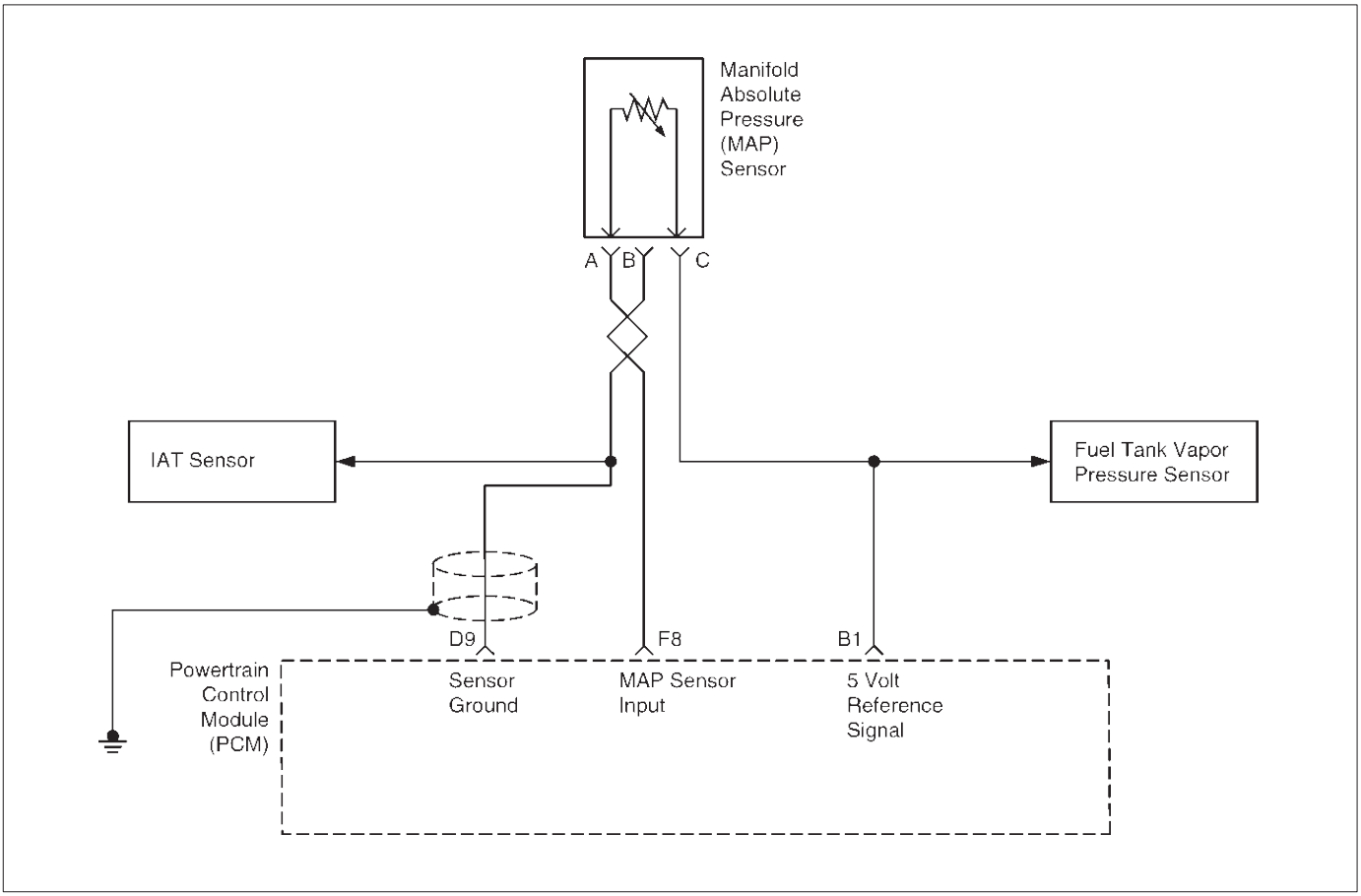
DTC P0107 – MAP Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, engine OFF. 2. With the throttle closed, observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	0V 10.3 kPa at sea level	Go to Step 4	Go to Step 3
3	1. Ignition ON, engine OFF. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor «Diagnostic Trouble Code” info for Diagnostic Trouble Code P0107. Does the Tech 2 indicate Diagnostic Trouble Code P0107 failed?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Ignition OFF. 2. Disconnect the MAP sensor electrical connector. 3. Jumper the 5 volt reference circuit and the MAP signal together at the MAP sensor harness connector. 4. Ignition ON. 5. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	5 V 104 kPa	Go to Step 10	Go to Step 5
5	1. Disconnect the jumper. 2. Connect a fused jumper between the 5 Volt signal circuit and the MAP sensor signal circuit at the MAP sensor harness connector. 3. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	5 V 104 kPa	Go to Step 6	Go to Step 8

DTC P0107 – MAP Sensor Circuit Low Input (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Ignition OFF. 2. Disconnect the PCM and check the 5 volt reference circuit for an open or short to ground. 3. If the 5 volt reference circuit is open or shorted to ground, repair it as necessary. Was the 5 volt reference circuit open or shorted to ground?	—	Verify repair	Go to Step 7
7	Check the 5 volt reference circuit for a poor connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 11
8	1. Ignition OFF. 2. Disconnect the PCM, and check the MAP signal circuit for an open, short to ground, or short to the sensor ground circuit. 3. If the MAP sensor signal circuit is open or shorted to ground, repair it as necessary. Was the MAP signal circuit open or shorted to ground?	—	Verify repair	Go to Step 9
9	Check the MAP sensor signal circuit for a poor connection at the PCM and the MAP sensor; replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 11
10	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC)
P0108 MANIFOLD ABSOLUTE PRESSURE (MAP) CIRCUIT HIGH INPUT



060R100026

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure. The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (low manifold pressure) to above 4 volts with the ignition ON, engine not running or at wide–open throttle (high manifold pressure).

A ”speed density” method of determining engine load is used on the 2.2L engine. This is calculated using inputs from the MAP sensor, RPM, CKP Sensor, and the Intake Air Temperature (IAT) sensor. The MAP sensor is the main sensor used in this calculation, and measuring engine load is its main function. The MAP sensor is also used to determine manifold pressure changes while the exhaust gas recirculation (EGR) flow test diagnostic is being run, to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). Refer to DTC P0401.

The PCM monitors the MAP signals for voltages outside the normal range (10–104 kpa) of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively low, Diagnostic Trouble Code P0108 will be set. DTC P0108 is a Type A Code.

Conditions for Setting the DTC

- No TP sensor Diagnostic Trouble Codes present.
- Engine is running.
- Throttle position is below 2.7% if engine speed is below 1000 RPM.
- Throttle position is below 10% if engine speed is above 1000 RPM.
- The MAP sensor indicates manifold absolute pressure above 90 kPa.

The above conditions are met for 128 test failures within a 256 test sample (7.81 msec/test).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0108 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0108 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- The MAP sensor shares a 5 Volt Reference with the TP sensor and Fuel Pressure sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor share a ground with the TP sensor and Fuel Pressure sensor.
- Damaged harness – Inspect the wiring harness for damage; an open circuit, a short to ground, or a short to voltage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If Diagnostic Trouble Code P0108 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the Diagnostic Trouble Code was last set.

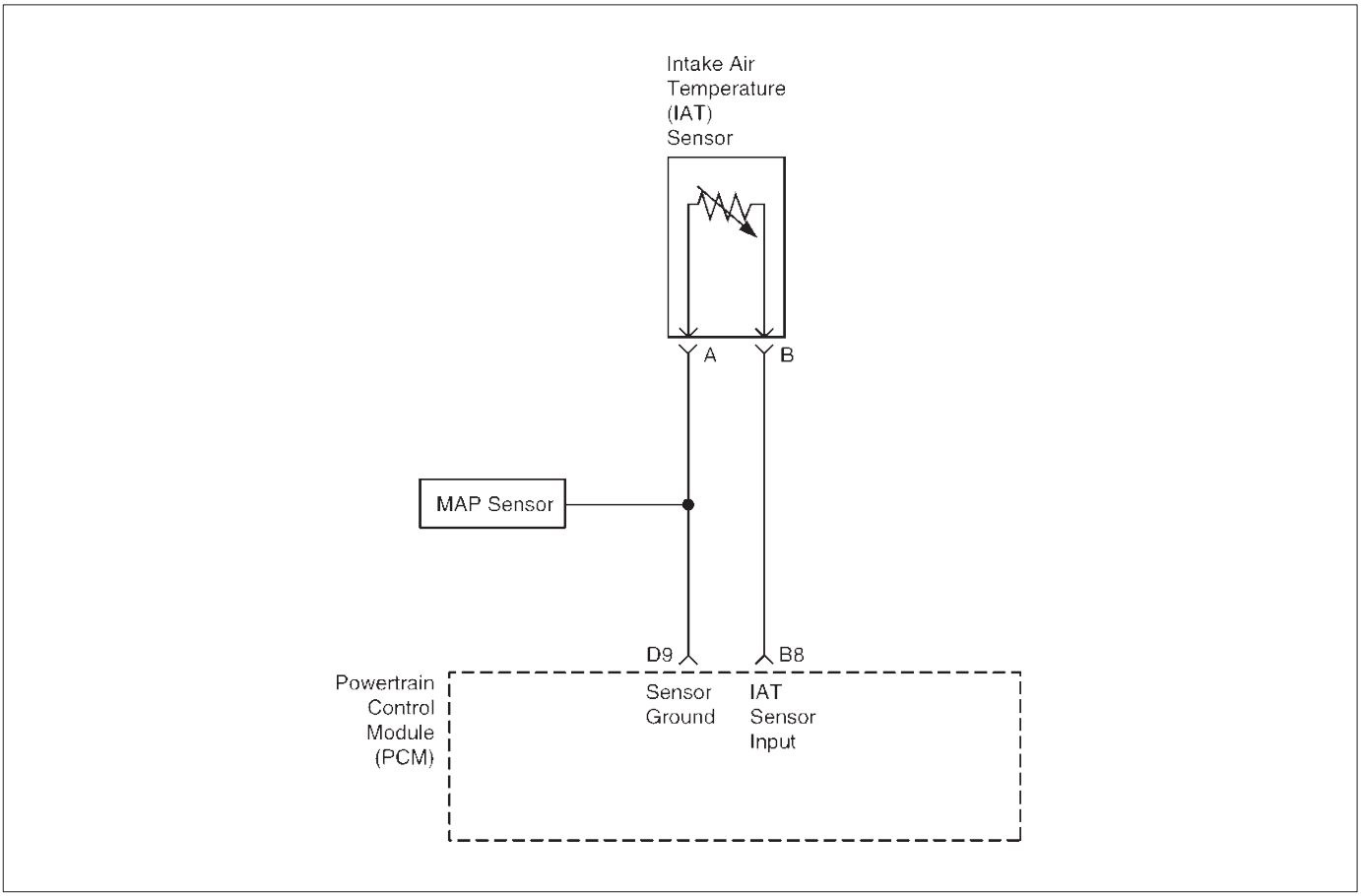
DTC P0108 MAP Sensor Circuit High Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. If the engine idle is rough, unstable or incorrect, repair the idle problem before using this chart. Refer to Symptoms section. 2. With the engine idling, note the MAP value on the Tech 2. Is the MAP reading above the specified value?	About 4V 90 kPa	Go to Step 4	Go to Step 3
3	1. Ignition ON engine OFF 2. Review and record Tech 2 Failure Records data, then clear the DTC’s. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for Diagnostic Trouble Code P0108. Does the Tech 2 indicate that DTC P0108 failed this ignition?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Ignition OFF. 2. Disconnect the MAP sensor electrical connector. 3. Ignition ON. 4. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	0 V 10.3 kPa	Go to Step 5	Go to Step 6
5	Check the MAP sensor signal circuit; between the MAP sensor and the Powertrain Control Module (PCM), for a short to voltage. Was the problem found?	—	Verify repair	Go to Step 12
6	Check the MAP sensor circuit, between the MAP sensor and the PCM, the following conditions: • A short to ground • An open circuit Was the problem found?	—	Verify repair	Go to Step 7

DTC P0108 MAP Sensor Circuit High Input (Cont'd)

Step	Action	Value(s)	Yes	No
7	Check the 5 volt signal circuit, between the MAP sensor and the PCM for the following conditions: ● An open circuit ● A short to ground ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 8
8	1. Ignition OFF. 2. Place a fused jumper between the MAP sensor circuit and the 5 volt signal circuit, both at the wiring harness' MAP sensor connector. 3. Ignition ON, Engine OFF. 4. Observe the MAP value displayed on the Tech 2? Does the Tech 2 read the following value?	5 volts 104 kPa	Go to Step 9	Go to Step 12
9	Check the MAP sensor ground circuit, between the MAP sensor and the PCM, for the following conditions: ● An open circuit ● A short to ground ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 10
10	1. Ignition OFF. 2. Place a Digital Multimeter (DVM), set to measure voltage, between the ground circuit and the 5 volt signal circuit, both at the wiring harness' MAP sensor connector. 3. Ignition ON, Engine OFF. Does the DVM read the following value?	5 Volts	Go to Step 11	Go to Step 12
11	Replace the MAP sensor. Verify repair.	—	—	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC)
P0112 INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT LOW INPUT



060R100027

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull–up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower, causing the PCM to monitor a lower voltage. Diagnostic Trouble Code P0112 will set when the PCM detects an excessively low signal voltage (short to ground) on the intake air temperature sensor signal circuit. DTC P0112 is a Type A Code.

Conditions for Setting the DTC

- Vehicle speed is greater than 48 km/h (30 mph).
- The engine has been running for over 120 seconds.
- IAT signal voltage less than 0.10 volts for a total of 12.5 seconds over a 25–second period of time.

The above conditions are met for 100 test failures within a 200 test sample (125 msec/test).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will use a default IAT valve based on PCM inputs and engine run time.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0112 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P0112 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage, shorts to ground, shorts to battery and open circuits. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

If Diagnostic Trouble Code P0112 cannot be duplicated, the information included in the Failure Records data can

be useful in determining vehicle mileage since the Diagnostic Trouble Code was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is present.
3. If Diagnostic Trouble Code P0112 can be repeated only by duplicating the Failure Records condition, refer to the Temperature vs. Resistance Value table.

   The table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a ”shifted” sensor that may be stored above or below a certain temperature. If this is the case, replace the IAT sensor. If the IAT sensor appears to be OK, the fault is intermittent; refer to Diagnostic Aids.

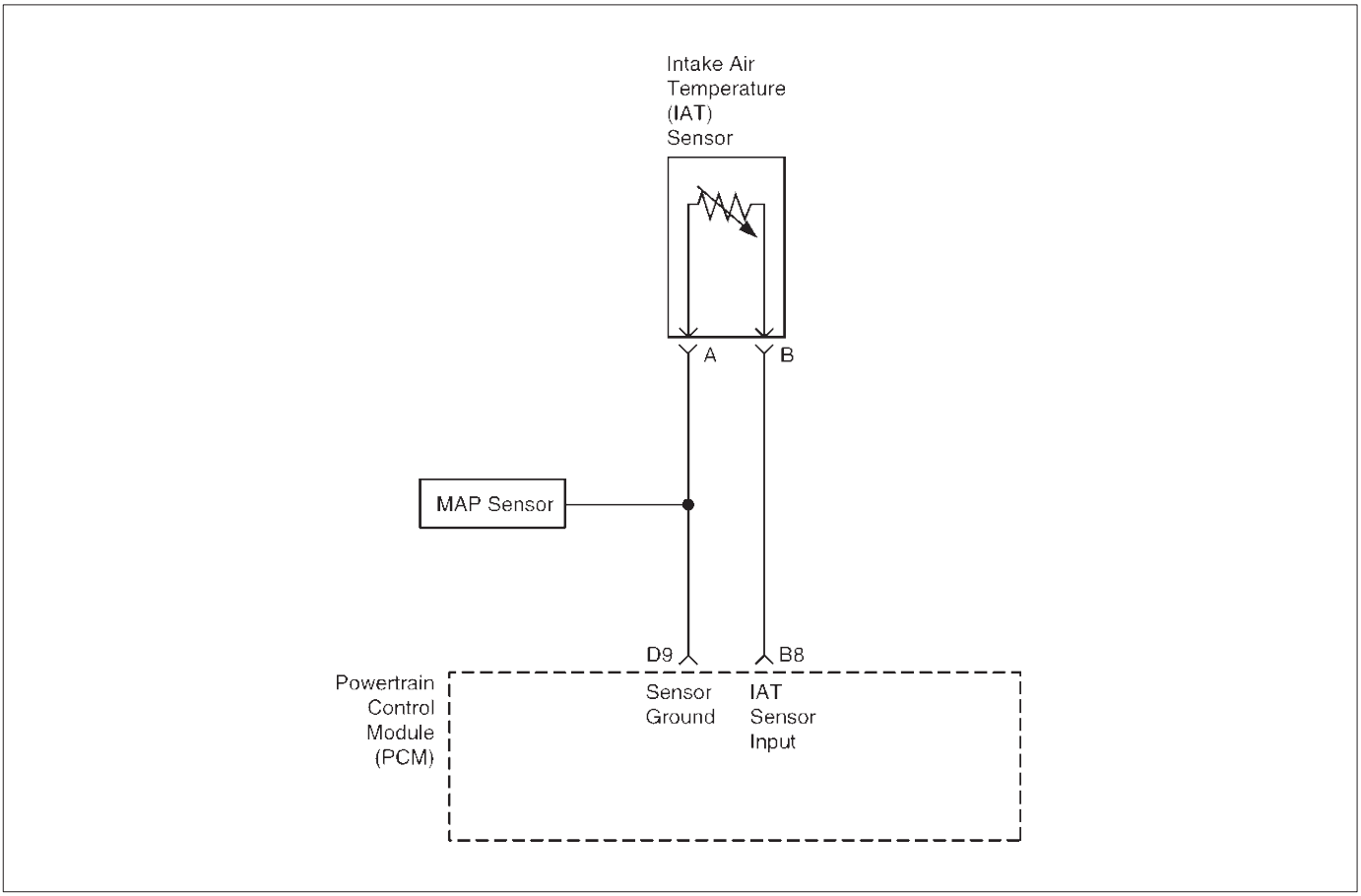
Intake Air Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P0112 Intake Air Temperature (IAT) Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, engine OFF. 2. Using a Tech 2, monitor the intake air temperature (IAT). Is the intake air temperature greater than the specified value?	148˚C (283˚F)	Go to Step 4	Go to Step 3
3	1. Ignition ON, engine OFF. Review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor the ”DTC” info for Diagnostic Trouble Code P0112. Does the Tech 2 indicate DTC P0112 failed this ignition?	—	Refer to Test Description	Refer to Diagnostic Aids
4	1. Ignition OFF. 2. Disconnect the IAT sensor electrical connector. 3. Ignition ON. 4. Observe the intake air temperature on the Tech 2. Is the intake air temperature below the specified value?	–38˚C (–36˚F)	Go to Step 6	Go to Step 5
5	1. Ignition OFF. 2. Disconnect the PCM electrical connectors. 3. Check the IAT sensor signal circuit for a short to ground. Is the IAT sensor signal circuit shorted to ground?	—	Verify Repair	Go to Step 7
6	Replace the IAT sensor. Is the action complete?	—	Verify Repair	—
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify Repair	—

DIAGNOSTIC TROUBLE CODE (DTC)
P0113 INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT HIGH INPUT



060R100027

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull–up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the PCM to monitor a lower voltage. Diagnostic Trouble Code P0113 will set when the PCM detects an excessively high signal voltage on the intake air temperature sensor signal circuit. DTC P0113 is a Type A Code.

Conditions for Setting the DTC

- The engine has been running for over 240 seconds.
- Vehicle speed is less than 32 km/h (20 mph).
- ECT signal temperature is above 60°C (140°F).
- Mass air flow is less than 20g/second.
- IAT signal voltage almost 5 volts which indicates an intake air temperature less than –39°C (–38°F) for a total of 12.5 seconds over a 25–second period.

The above condition are met for 100 test failures within a 200 test sample (125 msec/test)

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will use a default IAT valve based on PCM inputs and engine run time.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0113 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0113 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage, shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

If Diagnostic Trouble Code P0113 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the Diagnostic Trouble Code was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2.Verifies that the fault is present.

3.If Diagnostic Trouble Code P0113 can be repeated only by duplicating the Failure Records conditions, refer to the ”Temperature vs. Resistance Values” table.

The table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a ”shifted” sensor that may be open above or below a certain temperature. If this is the case, replace the IAT sensor. If the IAT sensor appears to be OK, the fault is intermittent; refer to Diagnostic Aids.

Intake Air Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

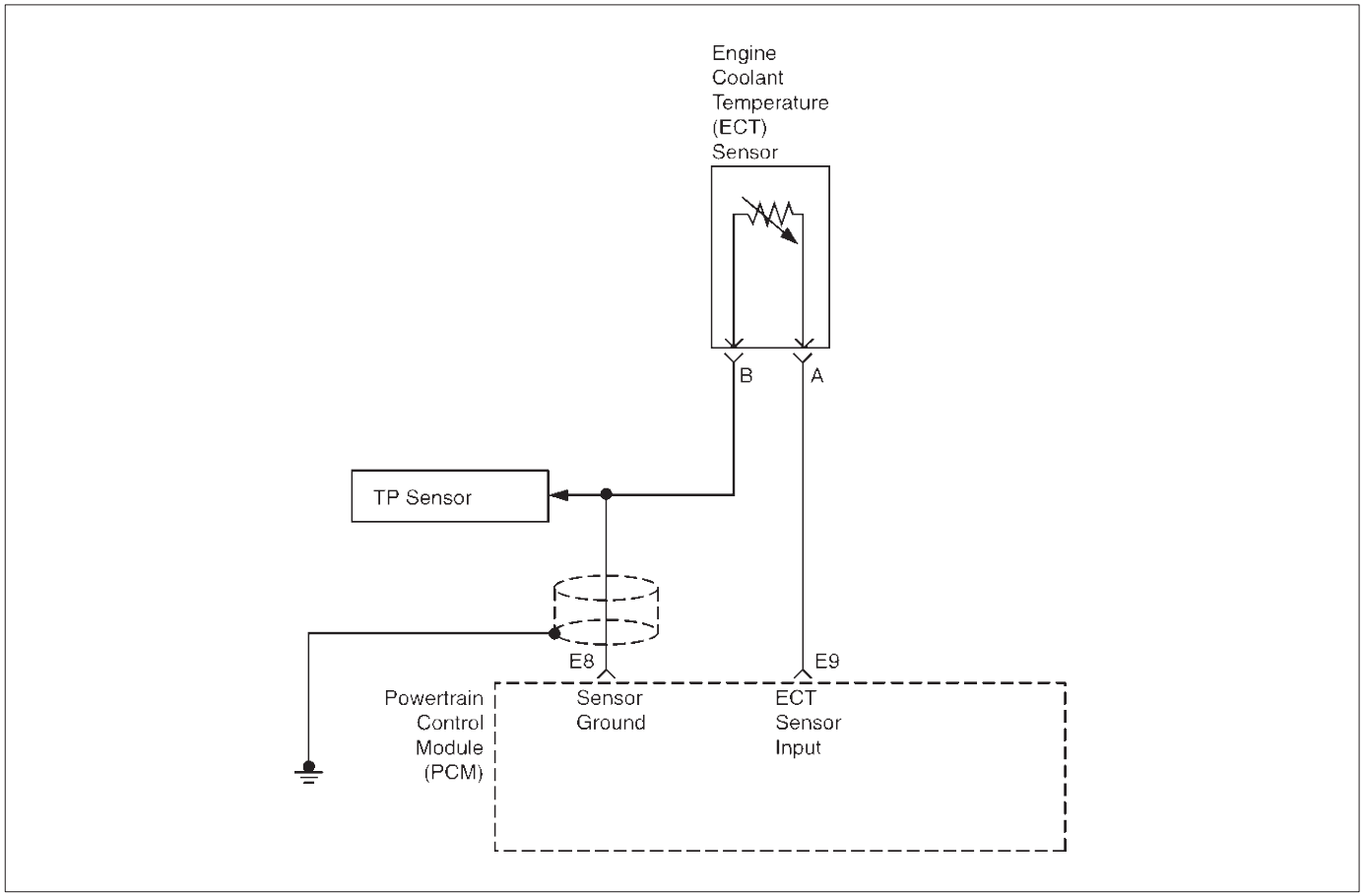
DTC P0113 Intake Air Temperature (IAT) Sensor Circuit High Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Ignition ON, engine OFF. Observe the ”Intake Air Temp” display on the Tech 2. Is the ”Intake Air Temp” below the specified value?	5V –38˚C (–36˚F)	Go to Step 4	Go to Step 3
3	1. Ignition ON, engine OFF. 2. Review and record Tech 2 Failure Records data parameters. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0113. Does the Tech 2 indicate Diagnostic Trouble Code P0113 failed?	—	Refer to Test Description	Refer to Diagnostic Aids
4	1. Ignition OFF. 2. Disconnect the IAT sensor electrical connector. 3. Jumper the IAT signal circuit and the sensor ground circuit together at the IAT sensor harness connector. 4. Ignition ON. 5. Observe the ”Intake Air Temp” display on the Tech 2. Is the ”Intake Air Temp” at the specified value?	0V 140˚C (284˚F)	Go to Step 6	Go to Step 5

DTC P0113 Intake Air Temperature (IAT) Sensor Circuit High Input (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Jumper the IAT signal circuit at the IAT sensor harness connector to chassis ground. 2. Observe the "Intake Air Temp" display on the Tech 2. Is the "Intake Air Temp" at the specified value?	0V 140°C (284°F)	Go to Step 7	Go to Step 8
6	Check for poor connections at the IAT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify Repair	Go to Step 10
7	1. Ignition OFF. 2. Disconnect the PCM, and check the IAT sensor ground circuit for an open. 3. If the IAT sensor ground circuit is open, repair it as necessary. Was the IAT sensor ground circuit open?	—	Verify repair	Go to Step 9
8	1. Ignition OFF. 2. Disconnect the PCM, and check the IAT signal circuit for an open. 3. If the IAT sensor signal circuit is open, repair it as necessary. Was the IAT signal circuit open?	—	Verify repair	Go to Step 9
9	Check for a poor sensor ground or IAT signal circuit terminal connection at the PCM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Verify repair	Go to Step 11
10	Replace the IAT sensor Is the action complete?	—	Verify repair	—
11	Replace the PCM **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0117 ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT LOW INPUT



060R100028

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The powertrain control module (PCM) applies a voltage (about 5 volts) through a pull–up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes lower, and the ECT signal voltage measured at the PCM drops. With a fully warmed–up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. DTC P0117 is a Type A Code.

Conditions for Setting the DTC

- Engine running time is longer than 120 seconds.
- The ECT sensor signal indicates an engine coolant temperature greaterthan 150˚C (302˚F) (about 0.14 V) for a total of 12.5 seconds overa 25–second period.

The above condition are met for 100 test failures within a 200 test sample (125 msec/test)

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will substitute the ECT reading with a default engine coolant temperature value. The default value is based on start–up intake air temperature and running time.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0117 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0117 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage, shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If Diagnostic Trouble Code P0117 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the

Diagnostic Trouble Code was last set. If it is determined that the Diagnostic Trouble Code occurs intermittently, performing the Diagnostic Trouble Code P1114 Diagnostic Chart may isolate the cause of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2.Verifies that the fault is present.

3.If Diagnostic Trouble Code P0117 can be repeated only by duplicating the Failure Records conditions, refer to the ”Temperature vs. Resistance Values” table.

The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a ”shifted” sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to Diagnostic Aids.

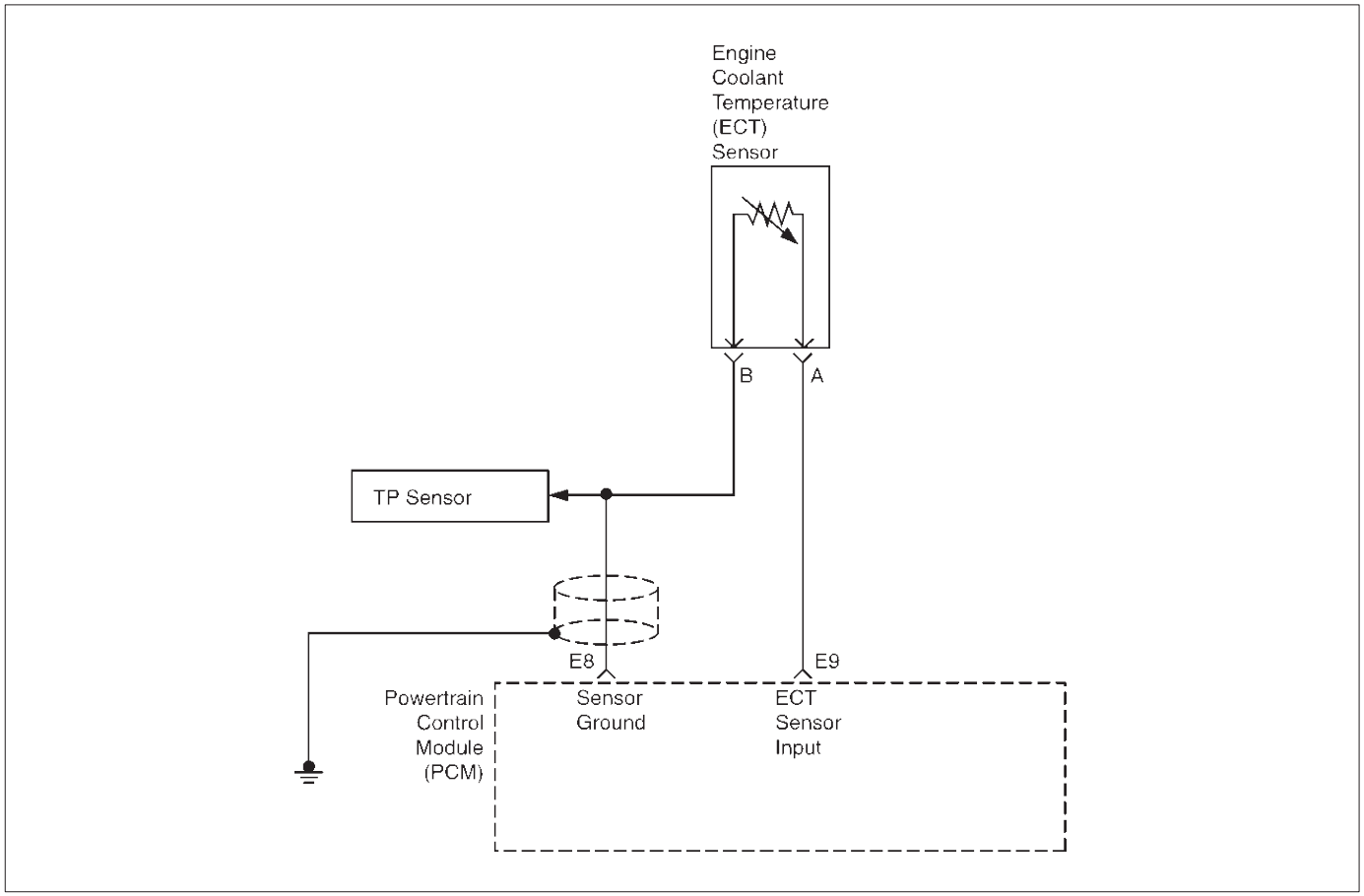
Intake Air Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P0117 – Engine Coolant Temperature (ECT) Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON engine OFF. 2. Observe the ”Eng Cool Temp” display on the Tech 2. Is the ”Eng Cool Temp” below the specified value?	139°C (282°F)	Go to Step 4	Go to Step 3
3	1. Ignition ON engine OFF. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor ”DTC” info for DTC P0117. Does the Tech 2 indicate DTC P0117 failed this ignition?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Disconnect the ECT sensor electrical connector. 2. Observe the ”Eng Cool Temp” display on the Tech 2. Is the ”Eng Cool Temp” at or below the specified value?	–39°C (–38°F)	Go to Step 6	Go to Step 5
5	1. Ignition OFF. 2. Disconnect the PCM and check the ECT signal circuit for a short to ground or a short to the sensor ground circuit. 3. If the ECT signal circuit is shorted, repair it as necessary. Was the ECT signal circuit shorted to ground?	—	Verify repair	Go to Step 7
6	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0118 ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT HIGH INPUT



060R100028

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The powertrain control module (PCM) applies a voltage (about 5 volts) through a pull–up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the PCM detect a continuous open in the ECT sensor or circuit, then a code P0118 will set. DTC P0118 is a type A code.

Conditions for Setting the DTC

- Engine running time is longer than 180 seconds.
- The ECT sensor signal indicates an engine coolant temperature of –39˚C (–38˚F) or less (about 5 volts) for a total of 12.5 seconds over a 25–second period.

The above conditions are met for 100 test failures within a 200 test sample(125 msec/test)

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will substitute the ECT reading with a default engine coolant temperature value. The default value is based on start–up intake air temperature and running time.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0118 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0118 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage, shorts to ground, shorts to battery positive, and open circuit. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If Diagnostic Trouble Code P0118 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the Diagnostic Trouble Code was last set. If it is determined that the Diagnostic Trouble Code occurs intermittently, performing the DTC P1115 Diagnostic Chart may isolate the cause of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2.Verifies that the fault is present.

3.If Diagnostic Trouble Code P0118 can be repeated only by duplicating the Failure Records condition, refer to the ”Temperature vs. Resistance Value” table.

The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a ”shifted” sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to Diagnostic Aids.

Intake Air Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

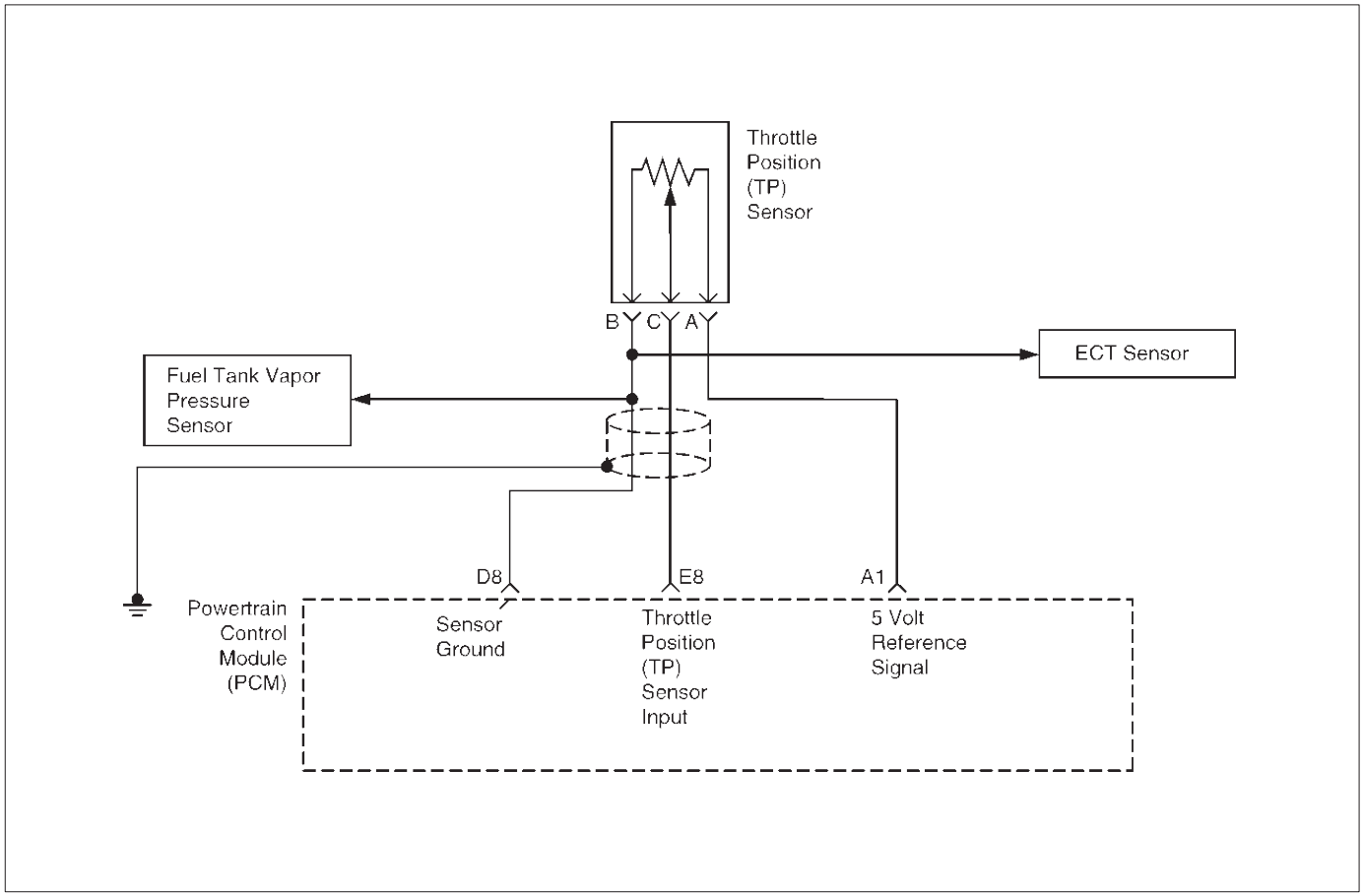
DTC P0118 – ECT Sensor Circuit High Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON engine OFF. 2. Observe the ”Eng Cool Temp” display on the Tech 2. Is the ”Eng Cool Temp” below the specified value?	–39˚C (–38˚F)	Go to Step 4	Go to Step 3
3	1. Ignition ON engine OFF. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the ”DTC” info for Diagnostic Trouble Code P0118. Does the Tech 2 indicate Diagnostic Trouble Code P0118 failed?	—	Refer to Test Description	Refer to Diagnostic Aids
4	1. Disconnect the ECT sensor electrical connector. 2. Jumper the ECT signal circuit and the sensor ground circuit together at the ECT sensor harness connector. 3. Observe the ”Eng Cool Temp” display on the Tech 2. Is the ”Eng Cool Temp” at or above the specified value?	140˚C (284˚F)	Go to Step 6	Go to Step 5
5	1. Jumper the ECT signal circuit at the ECT sensor harness connector to chassis ground. 2. Observe the ”Eng Cool Temp” display on the Tech 2. Is the ”Eng Cool Temp” at or above the specified value?	140˚C (284˚F)	Go to Step 7	Go to Step 8
6	Check for poor connections at the ECT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 10

DTC P0118 – ECT Sensor Circuit High Input (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition OFF. 2. Disconnect the PCM, and check the ECT sensor ground circuit for an open. 3. If the ECT sensor ground circuit is open, repair it as necessary. Was the ECT sensor ground circuit open?	—	Verify repair	Go to Step 9
8	1. Ignition OFF. 2. Disconnect the PCM, and check the ECT signal circuit for an open. 3. If the ECT sensor signal circuit is open, repair it as necessary. Was the ECT signal circuit open?	—	Verify repair	Go to Step 9
9	Check for a poor sensor ground or ECT signal circuit terminal connection at the PCM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Verify repair	Go to Step 11
10	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0121 THROTTLE POSITION (TP) SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM



060R100029

Circuit Description

The throttle position (Throttle Position) sensor circuit provides a voltage signal that changes relative to throttle blade angle. The signal voltage will vary from about 0.25 volts at closed throttle to about 4.75 volts at wide open throttle (WOT).

The Throttle Position (TP) signal is used by the powertrain control module (PCM) for fuel control and most of the PCM–controlled outputs. The PCM monitors throttle position and compares actual throttle positions from the TP sensor to a predicted TP value calculated from engine speed. If the PCM detects an out–of–range condition, then a DTC code P0121 will set. DTC P0121 is type A code.

Conditions for Setting the DTC

- The Engine is running.
- No MAP, ECT, TP, CKP, EGR, EVAP, No Injector, No Misfire or DTC's are set.
- IAC is between 10 and 160 counts.
- ECT is above –10°C (14°F).
- The MAP value changes by less than 2 kPa.

The above conditions are met for 100 test failures within a 200 test sample (125 msec/test)

Stuck High–

- MAP value is below 55 kPa.
- Actual TP value is greater than the PCM's estimated TP value (Estimated TP value is based on MAP and RPM).

Stuck Low–

- MAP value is below 50 kPa.
- Actual TP value is less than the PCM's estimated TP value (Estimated TP value is based on MAP and RPM).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.
- The PCM will use a default throttle position based on MAP and RPM.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0121 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P0121 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Skewed MAP signal or faulty MAP sensor – An incorrect MAP signal may cause the PCM to incorrectly calculate the predicted TP sensor value during high engine load situations. Check for an unusually low MAP reading. This condition can cause DTC P0121 to be set.
- The TP sensor shares a 5 Volt reference with the MAP sensor and Fuel Pressure sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The TP sensor shares a ground with the MAP sensor and the Fuel Pressure sensor.
- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; an open circuit, a short to ground, or a short to voltage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0121 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1122 or P1121 Diagnostic Chart may isolate the cause of the fault.

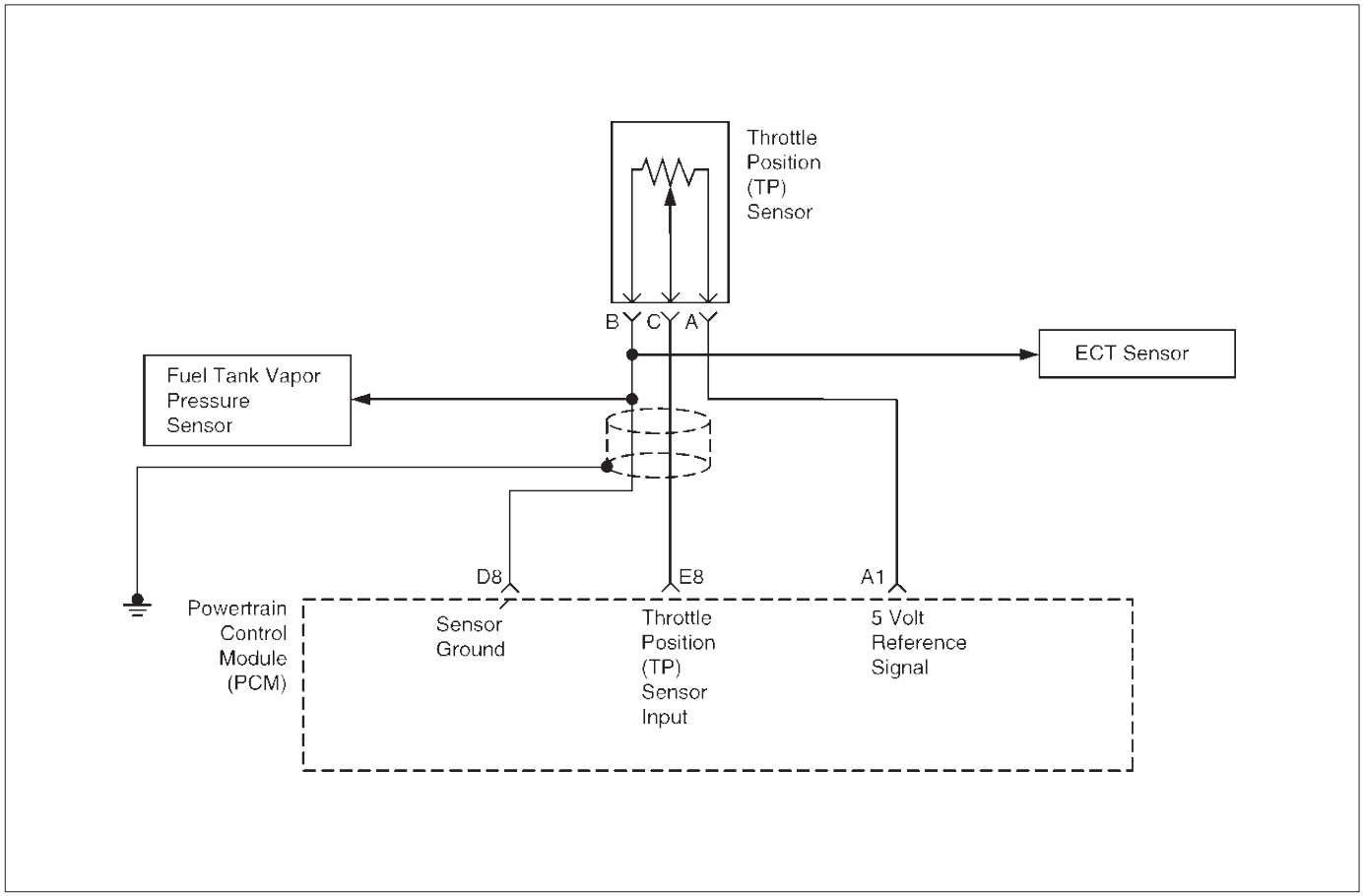
DTC P0121 TP Sensor/Range Performance Problem

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON engine OFF 2. Review and record Tech 2 Failure Records data, then clear the DTC’s. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor ”DTC” info for DTC P0121. Does the Tech 2 indicate that DTC P0121 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition ON, engine OFF. 2. Monitor the TP value on the Tech 2 while moving the throttle between 0% and 100%. Does the TP value on the Tech 2 move smoothly from 0% (0.25 volts) to 100% (4.75 volts)? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to Step 4	Go to Step 11
4	1. Ignition OFF. 2. Disconnect the Throttle Position (TP) Sensor electrical connector, located on the RH side of the Throttle body. 3. Start the vehicle, and monitor the TP value with the Tech 2. Does the TP value on the Tech 2 hold steadily within the given range?	0–0.25 volts 0%	Go to Step 6	Go to Step 5
5	Check the TP sensor signal circuit; between the TP sensor and the Powertrain Control Module (PCM), for a short to voltage. Was the problem found?	—	Verify repair	Go to Step 12
6	Check the TP sensor circuit, between the TP sensor and the PCM, the following conditions: • A short to ground • An open circuit Was the problem found?	—	Verify repair	Go to Step 7

DTC P0121 TP Sensor/Range Performance Problem (Cont'd)

Step	Action	Value(s)	Yes	No
7	Check the 5 volt signal circuit, between the TP sensor and the PCM, for the following conditions: • An open circuit • A short to ground • A short to voltage Was the problem found?	—	Verify repair	Go to Step 8
8	1. Ignition OFF. 2. Place a fused jumper between the TP sensor circuit and the 5 volt signal circuit both at the wiring harness' TP sensor connector. 3. Ignition ON, Engine OFF. 4. Observe the TP value displayed on the Tech 2? Does the Tech 2 read the following value?	about 5 volts 100%	Go to Step 9	Go to Step 12
9	Check the TP sensor ground circuit, between the TP sensor and the PCM, for the following conditions: • An open circuit • A short to ground • A short to voltage Was the problem found?	—	Verify repair	Go to Step 10
10	1. Ignition OFF. 2. Place a Digital Multimeter (DVM), set to measure voltage, between the ground circuit and the 5 volt signal circuit, both at the wiring harness' TP sensor connector. 3. Ignition ON, Engine OFF. Does the DVM read the following value?	about 5 volts	Go to Step 11	Go to Step 12
11	Replace the TP sensor. Verify repair.	—	—	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC)
P0122 THROTTLE POSITION (TP) SENSOR CIRCUITLOW INPUT



060R100029

Circuit Description

The throttle position (TP) sensor circuit provides a voltage signal that changes relative to throttle blade angle. The signal voltage will vary from below 1 volt at closed throttle to about 4 volts at wide open throttle(WOT).
The TP signal is used by the powertrain control module (PCM) for fuel control and most of the PCM–controlled outputs. If the PCM detect a continuous short to ground in the TP sensor or circuit, then a code P0122 will set. Diagnostic Trouble Code P0122 is type A code.

Conditions for Setting the DTC

- The ignition is ON.
- Throttle Position sensor signal voltage is less than 0.235 volt for a total of 0.78 second over a 1.5–second period.

The above conditions are met for 100 test failures within a 200 test samples (7.81 msec/test).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.
- The PCM will use a default throttle position based on MAP and RPM.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0122 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0122 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- The TP sensor shares a 5 Volt reference with the MAP sensor and Fuel Pressure sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The TP sensor share a ground with the MAP and the Fuel Pressure sensor.
- Damaged harness – Inspect the wiring harness for damage, shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the throttle position display on the Tech 2 while moving connectors and wiring harnesses related to the TP sensor. A change in the display will indicate the location of the fault.

If Diagnostic Trouble Code P0122 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the Diagnostic Trouble Code was last set. If it is determined that the Diagnostic Trouble Code occurs intermittently, performing the Diagnostic Trouble Code P1122 Diagnostic Chart may isolate the cause of the fault.

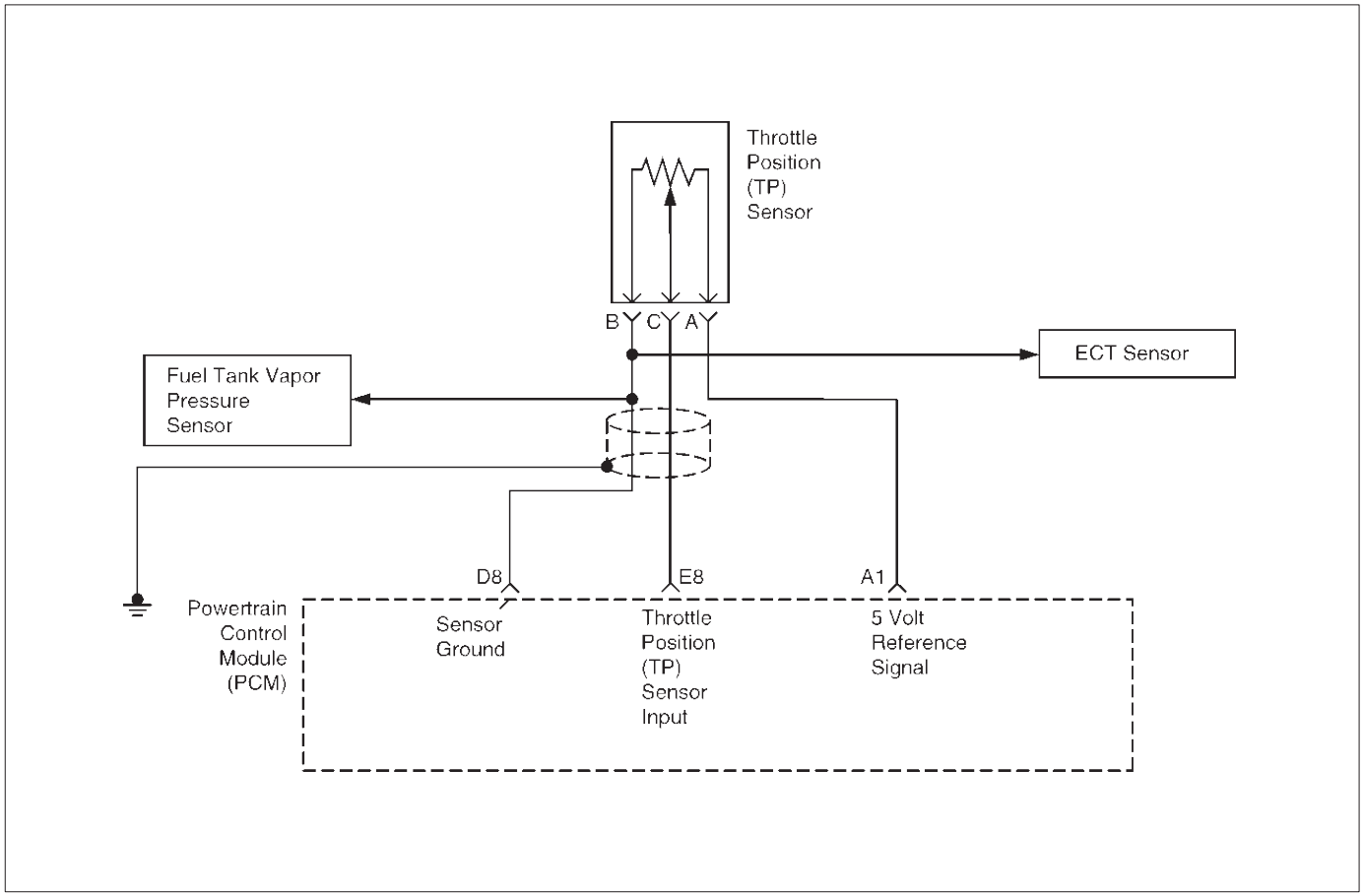
DTC P0122 – TP Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON engine OFF. 2. With the throttle closed, observe the ”Throttle Position Sensor” display on the Tech 2. Is the ”Throttle Position Sensor” below the specified value?	0.235 V	Go to Step 4	Go to Step 3
3	1. Ignition ON engine OFF. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0122. Does the Tech 2 indicate DTC P0122 failed?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Ignition OFF. 2. Disconnect the TP sensor electrical connector. 3. Jumper the 5 volt reference circuit and the Throttle Position signal together at the Throttle Position sensor harness connector. 4. Ignition ON. Observe the ”Throtle Position Sensor” display on the Tech 2. Is the ”Throttle Position Sensor” at the specified value?	5 V	Go to Step 10	Go to Step 5
5	1. Disconnect jumper. 2. Connect a test light between B+ and the Throttle Position sensor signal circuit at the Throttle Position sensor harness connector. Observe the ”Throttle Position Sensor” display on the Tech 2. Is the ”Throttle Position Sensor” at the specified value? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	5 V	Go to Step 6	Go to Step 8
6	1. Ignition OFF. 2. Disconnect the PCM and check the 5 volt reference circuit for an open or short to ground. 3. If the 5 volt reference circuit is open or shorted to ground, repair it as necessary. Was the 5 volt reference circuit open or shorted to ground?	—	Verify repair	Go to Step 7
7	Check the 5 volt reference circuit for a poor connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 12

DTC P0122 – TP Sensor Circuit Low Input (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition OFF. 2. Disconnect the PCM, and check the TP signal circuit for an open, short to ground, or short to the sensor ground circuit. 3. If the TP sensor signal circuit is open or shorted to ground, repair it as necessary. Was the TP signal circuit open or shorted to ground?	—	Verify repair	Go to Step 9
9	Check the TP sensor signal circuit for a poor connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 12
10	Check the TP sensor signal circuit for a poor connection at the TP sensor and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 11
11	Replace the TP sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC)
P0123 THROTTLE POSITION (TP) SENSOR CIRCUIT HIGH INPUT



060R100029

Circuit Description

The throttle position (TP) sensor circuit provides a voltage signal that changes relative to throttle blade angle. The signal voltage will vary from below 1 volt at closed throttle to about 4 volts at wide open throttle (WOT).
The TP signal is used by the powertrain control module (PCM) for fuel control and most of the PCM–controlled outputs. If the PCM detect a continuous open in the TP sensor or circuit, then a code P0123 will set. DTC P0123 is a type A code.

Conditions for Setting the DTC

- The ignition is ON.
- Throttle Position sensor signal voltage is greater than 4.78 volts for a total of 0.78 second over a 1.5–second period.

The above conditions met for 100 test failures within a 200 test samples (7.81 msec/test).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- The PCM will use a default throttle position based on MAP and RPM.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0123 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0123 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- The TP sensor shares a 5 Volt reference with the MAP sensor and Fuel Pressure sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The TP sensor share a ground with the MAP and the Fuel Pressure sensor.
- Damaged harness – Inspect the wiring harness for damage, shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, observe the Throttle Position sensor display on the Tech 2 while moving connectors and wiring harnesses

related to the TP sensor. A change in the display will indicate the location of the fault.

- Faulty Throttle Position sensor – With the ignition key ON engine OFF observe the TP sensor display on the Tech 2 while slowly depressing the accelerator to wide open throttle. If a voltage over 4.88 volts is seen at any point in normal accelerator travel, replace the TP sensor.

If Diagnostic Trouble Code P0123 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the Diagnostic Trouble Code was last set. If it is determined that the Diagnostic Trouble Code occurs intermittently, performing theDiagnostic Trouble Code P1121 Diagnostic Chart may isolate the cause of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

7. Components that share the TP sensor 5 volt reference circuit include the following devices:
   - EGR valve
   - Fuel Tank Pressure sensor
   - MAP sensor

   Disconnect the component while observing the Throttle Position sensor display on the Tech 2. If the reading changes drastically when this component is disconnected, replace the component that affected the reading.

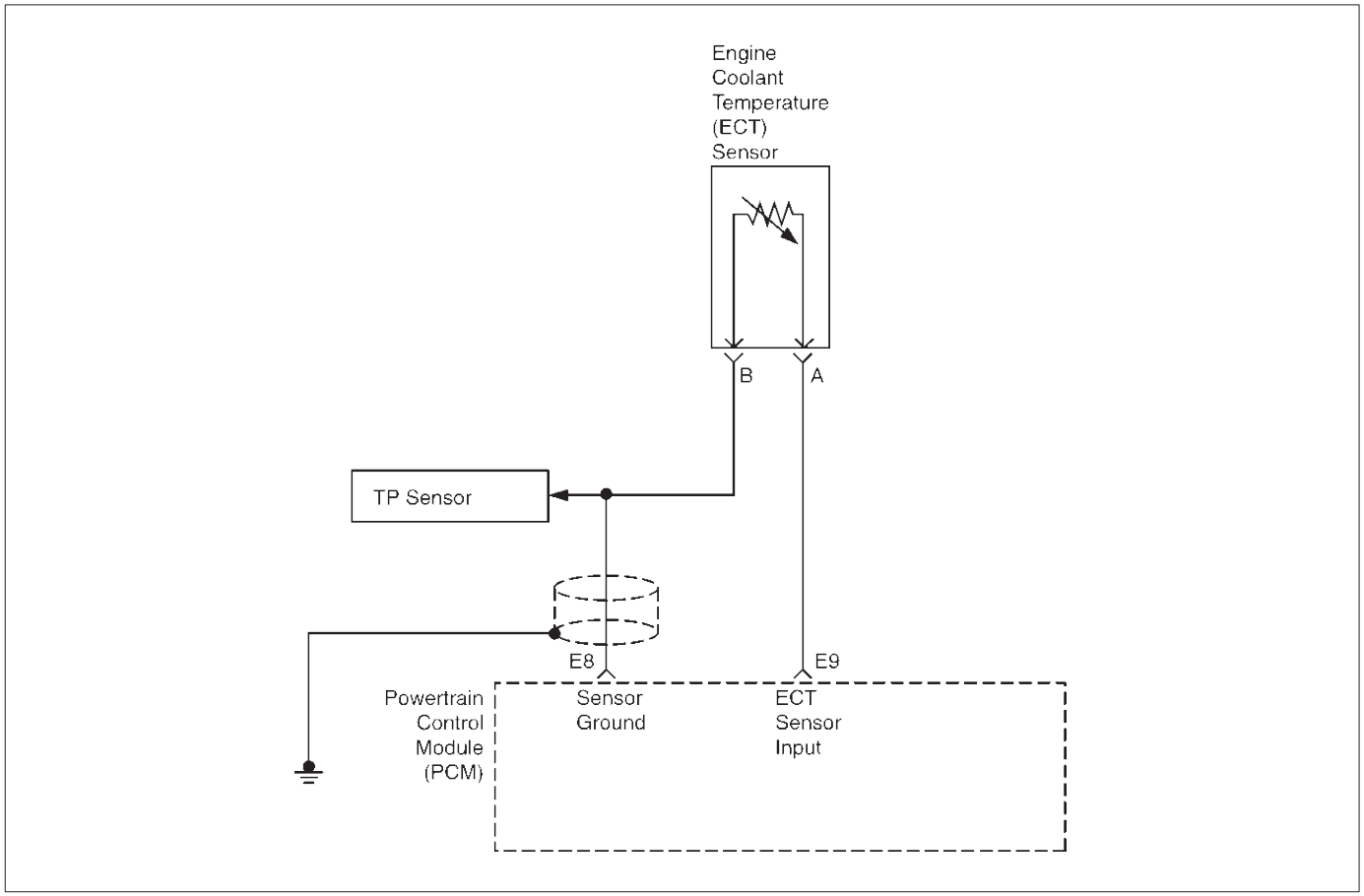
DTC P0123 – TP Sensor Circuit High Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, engine OFF. 2. With the throttle closed, observe the ”Throttle Position Sensor” display on the Tech 2. Is the ”Throttle Position Sensor” above the specified value?	4.78 V	Go to Step 4	Go to Step 3
3	1. Ignition ON, engine OFF. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0123. Does the Tech 2 indicate Diagnostic Trouble Code P0123 failed.	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Disconnect the Throttle Position sensor electrical connector. 2. Observe the ”Throttle Position Sensor” display on the Tech 2. Is the ”Throttle Position Sensor” near the specified value? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	0 V	Go to Step 5	Go to Step 6
5	Probe the sensor ground circuit at the Throttle Position sensor harness connector with a test light connected to B+. Is the test light ON?	—	Go to Step 7	Go to Step 10
6	1. Ignition OFF disconnect the PCM. 2. Ignition ON engine OFF. 3. Check for a short to voltage on the TP sensor signal circuit. 4. If the TP sensor signal circuit is shorted, repair it as necessary. Was the TP sensor signal circuit shorted?	—	Verify repair	Go to Step 12

DTC P0123 – TP Sensor Circuit High Input (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition ON. 2. Monitor the "Throttle Position Sensor" Tech 2 display while disconnecting each of the components that share the 5 volt reference circuit (one at a time). 3. If the "Throttle Position Sensor" Tech 2 display changes, service the component(s) that caused the display to change when disconnected. Does disconnecting any of these components cause the "Throttle Position Sensor" display to change?	—	Verify repair	Go to Step 8
8	1. Ignition OFF disconnect the PCM. 2. Ignition ON, engine OFF. 3. Check for a short to B+ on the 5 volt reference circuit. 4. If the 5 volt reference circuit is shorted, repair it as necessary. Was the 5 volt reference circuit shorted?	—	Verify repair	Go to Step 9
9	Check for poor electrical connections at the Throttle Position sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 11
10	1. Ignition OFF. 2. Disconnect the PCM, and check for an open sensor ground circuit to the Throttle Position sensor. 3. If a problem is found, repair it as necessary. Was the sensor ground circuit to the Throttle Position sensor open?	—	Verify repair	Go to Step 12
11	Replace the Throttle Position sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL



060R100028

Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a "Closed Loop" air/fuel metering system is used. When the vehicle is first started, the powertrain control module (PCM) controls fuel delivery in "Open Loop" ignoring the heated oxygen sensor (HO2S) signals and calculating air/fuel ratio based on inputs from the engine coolant temperature, throttle position sensors.

If the PCM detects that the ECT sensor has not reached a sufficient reading to achieve "Closed Loop" within a specified amount of time, DTC P0125 will set. DTC P0125 is a type B code.

Conditions for Setting the DTC

- No MAP, IAT, ECT, TP, Misfire, Injector, or VSS DTC codes set.

Test failed if 3 consective failures detected (500 msec/test).

Warm Case Test

- Start–up ECT value is less than 29˚C (84˚F).
- IAT is greater than 10˚C (50˚F).
- Accumulated airflow is greater than 1500 grams.
- Engine run time is greater than 90 seconds.
- Time for coolant to reach stabilized "Closed Loop" value is less than 120 seconds.

Cold Case Test

- IAT is between –7˚C (20˚F) and 10˚C (50˚F)
- Accumulated airflow is greater than 2000 grams.
- Engine run time is less than 225 seconds.
- Time for coolant to reach stabilized "Closed Loop" value is less than 300 seconds.

Other Case Test

- IAT is between –30˚C (–22˚F) and –7˚C (20˚F).
- Accumulated airflow is greater than 3600 grams.
- Engine run time is less than 450 seconds.
- Time for coolant to reach stabilized "Closed Loop" value is less than 600 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history Diagnostic Trouble Code P0125 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0125 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

DTC P0125 set indicates a faulty ECT sensor. Comparing the engine coolant temperature displayed on a Tech 2 with actual coolant temperature measured with a thermometer may isolate this condition. If the displayed engine coolant temperature is not close to the actual coolant temperature, replace the ECT sensor.
Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for back–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged Harness – Inspect the wiring harness for damage; open circuits, shorts to ground, or shorts to voltage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0125 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Comparing the engine coolant temperature displayed on a Tech 2 with actual coolant temperature measured with a thermometer may isolate this condition. If the displayed engine coolant temperature is not close to the actual coolant temperature, replace the ECT sensor. If the temperatures are closed, the fault is intermittent; refer to Diagnostic Aids.
7. Engine Coolant Temperature

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

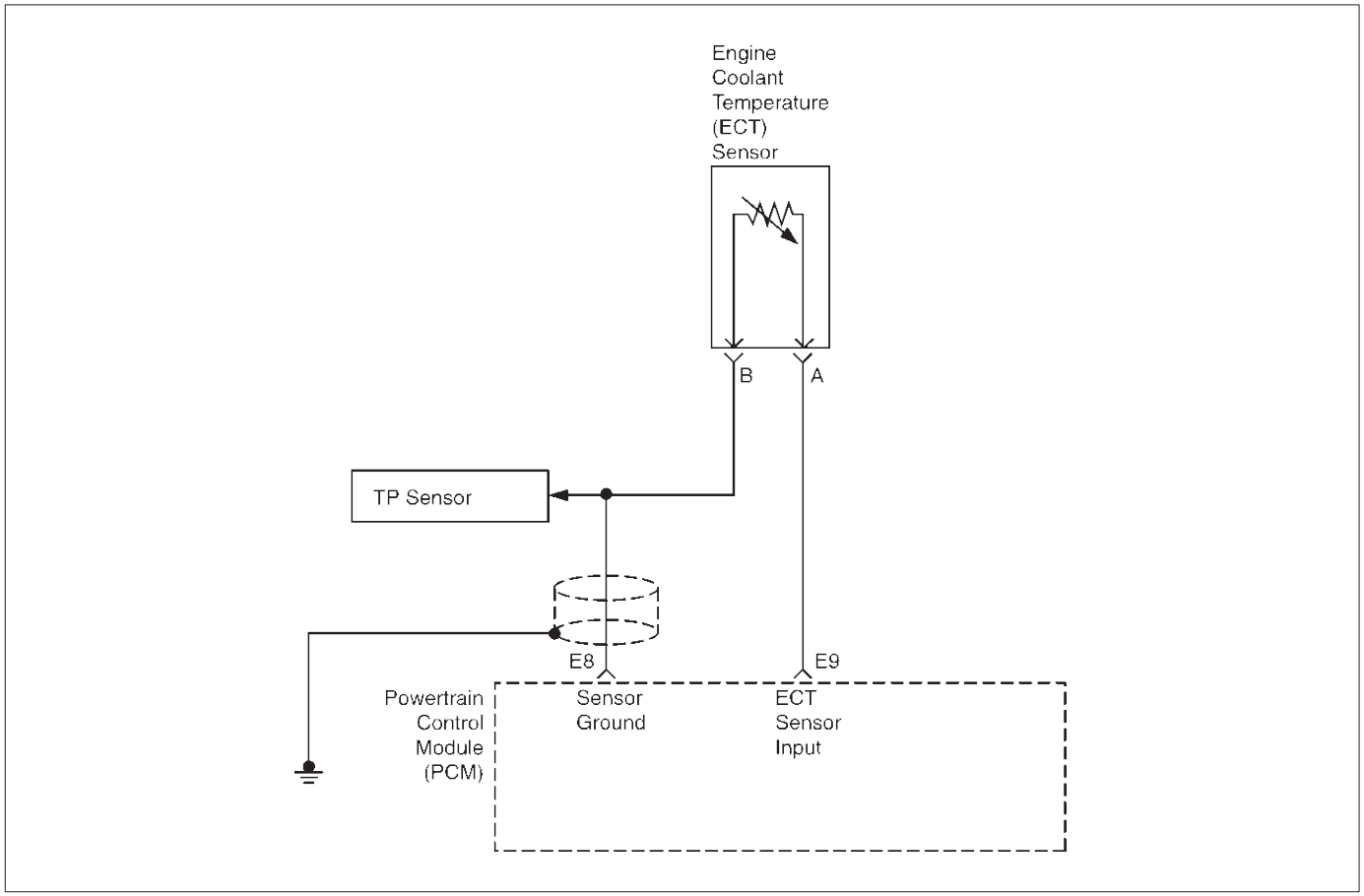
DTC P0125 Insufficient Coolant Temperature for Closed Loop Fuel Control

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Are any ECT sensor DTC's set?	—	Go to applicable ECT sensor DTC chart	Go to Step 3
3	1. Allow the engine to cool completely. 2. Check the cooling system coolant level (refer to Cooling and Radiator). Is the coolant level OK?	—	Go to Step 4	Go to Step 9
4	1. Start the engine. 2. With the engine idling, monitor "ENG COOL TEMP" display on the Tech 2. Does "ENG COOL TEMP" increase to above the specified value within 2 minutes?	21˚C (70˚F)	Refer to Diagnsotic Aids	Go to Step 5
5	Check for proper operation of the thermostat (refer to Cooling and Radiator). Is the thermostat operating correctly?	—	Go to Step 6	Go to Step 9

DTC P0125 Insufficient Coolant Temperature for Closed Loop Fuel Control (Cont'd)

Step	Action	Value(s)	Yes	No
6	Compare engine coolant temperature displayed on the Tech 2 to the actual coolant temperature measured with a thermometer. (Observe normal precautions when opening the cooling system.) Is the Tech 2 engine coolant temperature indication close to the measured temperature?	—	Go to Step 9	Go to Step 7
7	1. Ignition OFF. 2. Disconnect the PCM. 3. Using a DVM, measure the resistance of the ECT at the PCM connector. 4. Compare the DVM reading with the chart in "Test Description." Is the chart value approximately equal to the thermometer reading?	—	Go to Step 12	Go to Step 8
8	Check for the following conditions in the wiring between the ECT and the PCM: • An open circuit • A short to ground • A short to voltage	—	Go to Step 10	Go to Step 11
9	Refer to Cooling and Radiator for cooling system diagnosis and repair condition as necessary. Is the action complete?	—	Verify Repair	—
10	Replace the faulty terminal(s) or repair faulty wiring as necessary. Is the action complete?	—	Verify Repair	—
11	Replace the ECT sensor. Is the action complete?	—	Verify Repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify Repair	—

Diagnostic Trouble Code(DTC) P0128 Thermostat Insufficient temperrature for Stable Opreation



Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system used. When the vehicle is first started, the power train control module (PCM) controls fuel delivery in “open loop” ignoring the heated oxygen sensor (HO2S) signals and caculating air/fuel ratio based on inputs from the engine coolant temperature and throttle position sensors.

This DTC will detect an open thermostat that causes the engine coolant temperature not reaching the warm-up temperature within the specified value. It is Type B code.

Conditions for setting the DTC

Cold Case:

- Engine starting temperature more than –7˚C (20˚F) and less than 10˚C (50˚F).
- The accumulated airflow more than 10000 g.
- The accumulated idle time less than 450 seconds.
- Time for coolant temperature must be 74˚C after 800 seconds.

Warm Case:

- The accumulated idle time is less than 255 seconds.
- The starting temperature is between –7˚C (19˚F) and 37˚C (99˚F).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp(MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P0128 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P0128 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

  Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM–Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness–Inspect the wiring harness for damage.

  If the harness appears to be OK, observe the ECT display on the Tech2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault.

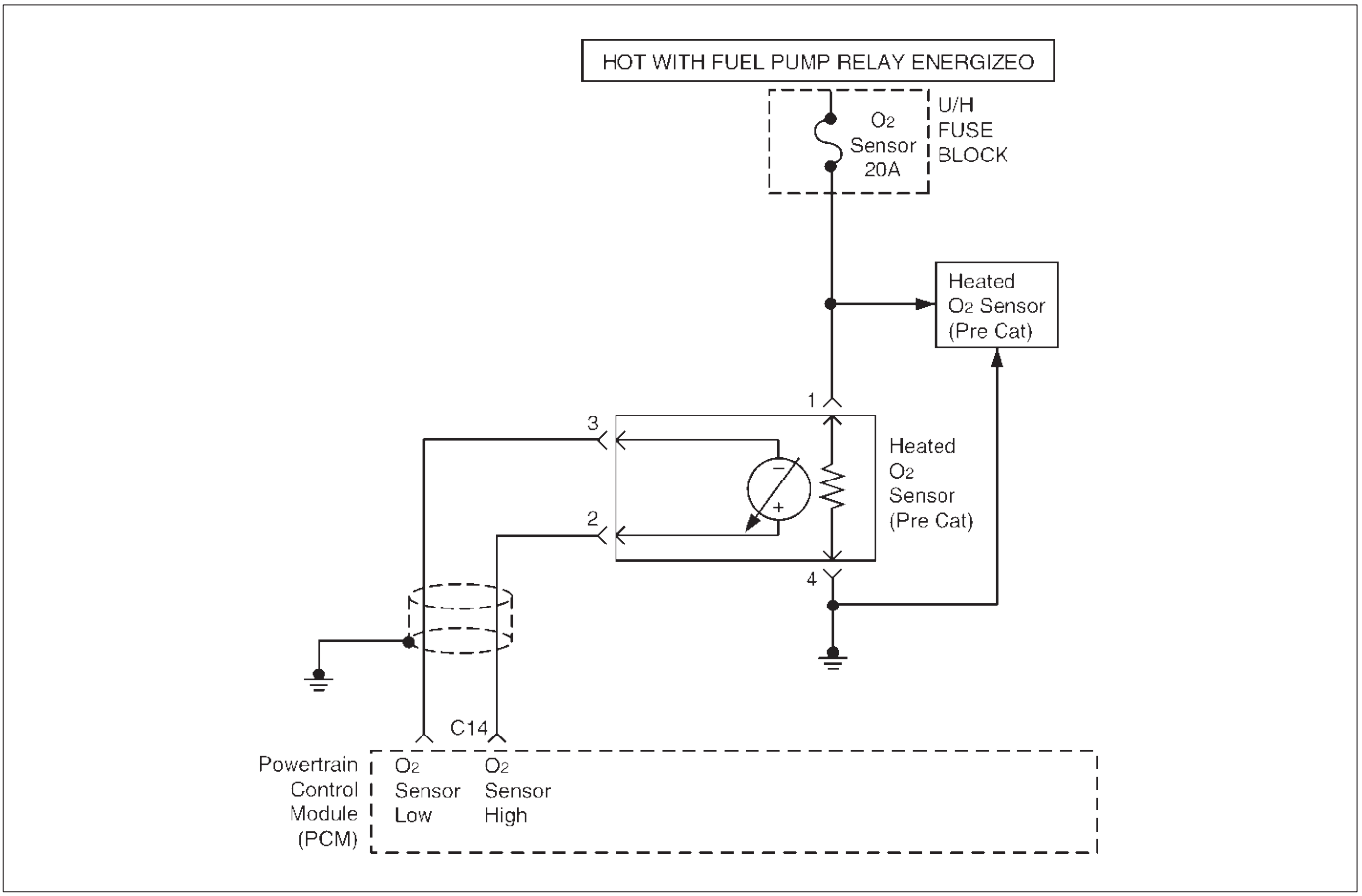
If DTC P0128 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P0128 Diagnostic Chart may isolate the cause of the fault.

Diagnostic Trouble Code (DTC)
P0128 Thermostat Insufficient temperrature for stable opreation

Step	Action	Value(s)	Yes	No
1	Was the “On-Board(OBD)System Check”performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Visually/physically check water pipe for splits, kinks,and proper conections and routing. 2. If a problem is found,repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 3*
3	1. Remove and check the Thermostat for stable opreation. Refer to *6B section.* 2. Replace the thermostat if necessary. Was a problem found?	—	Verify repair	Go to *Step 4*
4	1. Ignition “ON”, engine “OFF”. 2. Review and record Tech 2 Failure Records. 3. Opreate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0128. Does the Tech 2 indicate DTC P0128 failed this ignition?	—	Go to *Step 5*	Refer to *Diagnostic Aids*
5	1. Ignition “ON”, engine “OFF”. 2. Observe the “Eng Cool Temp” display on the Tech2. Is the “Eng Cool Temp” below the specified value?	139˚C (282˚F)	Verify repair	Go to *Step 6*
6	1. Ignition “OFF”. 2. Disconnect the PCM and check the ECT signal circuit for a short to ground or a short to the sensor ground circuit. 3. If the ECT signal circuit is shorted, repair it as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

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



Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal and low circuits. When measured with a 10 megaΩ digital voltmeter, this may display as low as 350 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during ”Closed Loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains excessively low for an extended period of time, Diagnostic Trouble Code P0131 will be set. DTC P0131 is a type A code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Vehicle is operating in ”Closed Loop”.
- Engine coolant temperature is above 60˚C (140˚F)
- ”Closed Loop” commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 5.9% and 50%.

All above conditions met for 0.3 seconds and the following condition is met for 190 test failures in 220 test samples (125 msec/test).

- Bank 1 HO2S 1 signal voltage remains below 22 mV during normal ”Closed Loop” operation.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- ”Open Loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0131 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0131 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be routed incorrectly and/or contacting the exhaust system. Also, check for shorts to ground, shorts to battery positive and open circuits.
- Poor PCM to engine block grounds.

- Fuel pressure – The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, a Diagnostic Trouble Code P0131 may be set. Refer to Fuel System Diagnosis.
- Lean injector(s) – Perform ”Injector Balance Test.”
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the system to appear lean. Check for exhaust leaks that may cause a false lean condition to be indicated.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. For the procedure to check for fuel contamination, Refer to Fuel System Diagnosis.

If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3. Diagnostic Trouble Code P0131 failing during operation may indicate a condition described in the ”Diagnostic Aids” above. If the Diagnostic Trouble Code P0131 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

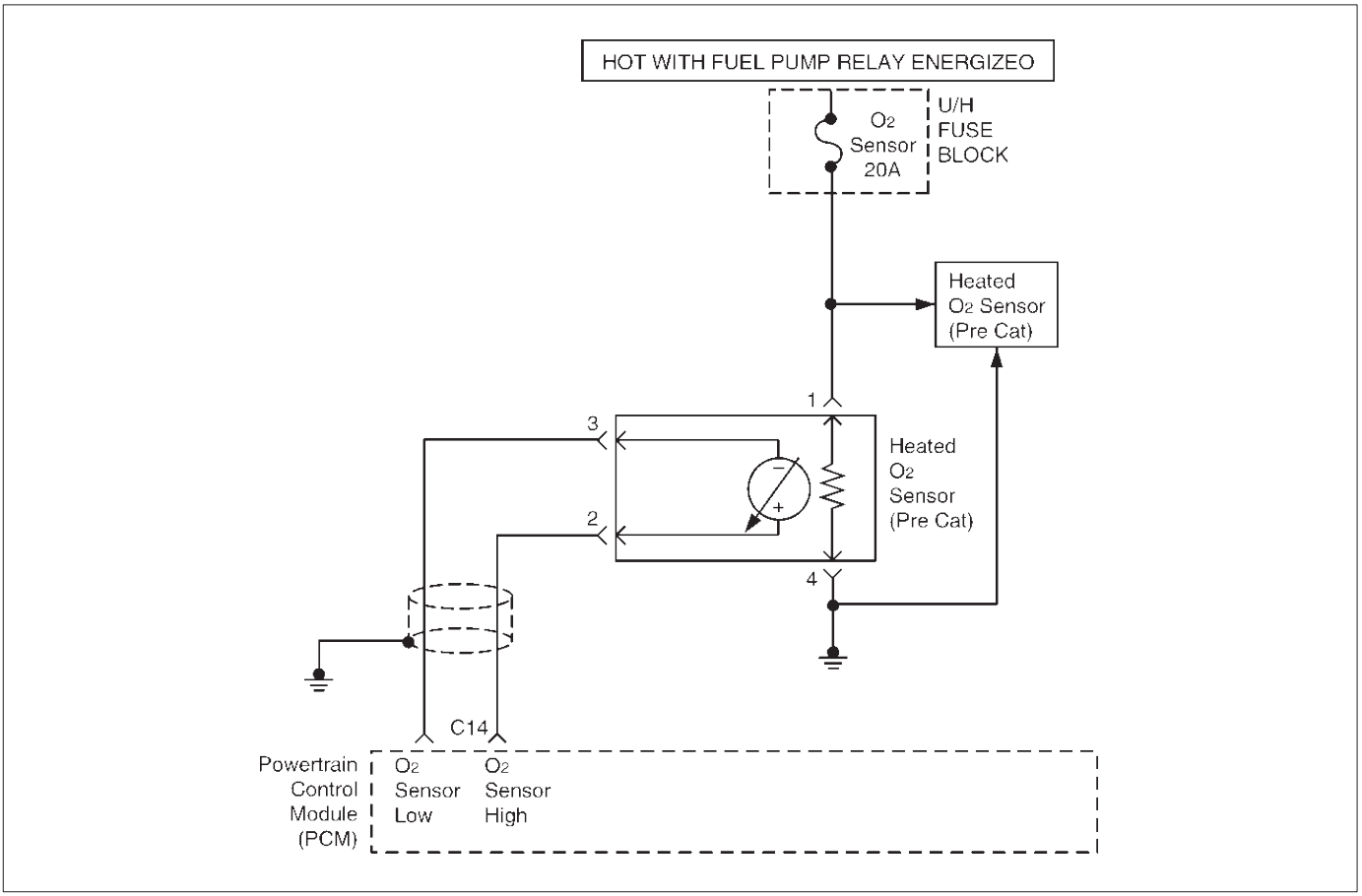
DTC P0131 – O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under ”Conditions for Setting the Diagnostic Trouble Code” criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Does the Bank 1 HO2S 1 voltage remain below the specified value?	300 mV	Go to Step 4	Go to Step 3
3	1. Ignition ON engine OFF review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0131 until the Diagnostic Trouble Code P0131 test runs. Note test result. Does Tech 2 indicate DTC P0131 failed this ignition?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Turn the ignition OFF. 2. Disconnect the PCM. 3. Check the Bank 1 HO2S 1 high and low circuits for a short to ground or a short to the heater ground circuit. Are the Bank 1 HO2S 1 signal circuits shorted to ground?	—	Go to Step 5	Go to Step 6
5	Repair the Bank 1 HO2S 1 signal circuit. Is the action complete?	—	Verify repair	—

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

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF HO2S 1 and PCM disconnected. 2. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to Step 7	Go to Step 8
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—
8	1. Ignition OFF. 2. Reconnect the PCM, leave the sensor disconnected. 3. Ignition ON. Does the Tech 2 indicate Bank 1 HO2S 1 voltage near the specified value?	430–450 mV	Refer to Diagnostic Aids	Go to Step 9
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

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



Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal and low circuits. When measured with a 10 megaΩ digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during ”Closed Loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains excessively high for an extended period of time, Diagnostic Trouble Code P0132 will be set. DTC P0132 is a type A code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Engine coolant temperature is above 60˚C (140˚F).
- ”Closed Loop” commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 5.9% and 50%.

All above conditions met for 0.3 seconds or vehicle in Decelleration Fuel Cut–Off (DFCO) mode for 3 seconds, and one of the following two conditions met for 190 test failures in 220 test samples or 40 failures in 40 samples in DFCO mode (125 msec/test).

- Bank 1 HO2S 1 signal voltage remains above 952 mV during normal ”Closed Loop” operation for a total of 76.5 seconds over a 90–second period.

OR

- Bank 1 HO2S 1 signal voltage remains above 500 mV during ”deceleration fuel cutoff mode” (DFCO) operation for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- ”Open Loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0132 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0132 can be cleared by using the Scan Tool’s ”Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check the following items:

- Fuel pressure – The system will go rich if pressure is too high. The PCM can compensate for some increase. However, if fuel pressure is too high, a Diagnostic Trouble Code P0132 may be set. Refer to Fuel System Diagnosis.
- Perform ”Injector Balance Test” – Refer to Fuel System Diagnosis.
- Check the EVAP canister for fuel saturation – If full of fuel, check canister control and hoses. Refer to Evaporative (EVAP) Emission Control System.
- Check for a leak in the fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel.
- An intermittent TP sensor output will cause the system to go rich due to a false indication of the engine accelerating.
- Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery white deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Operate the vehicle while monitoring the HO2S voltage with a Tech 2. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S high and low circuit wiring and associated terminal connections. If the wiring and connections are OK, replace the HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3. Diagnostic Trouble Code P0132 failing during ”deceleration fuel cutoff mode” operation may indicate a condition described in the ”Diagnostic Aids” above. If the Diagnostic Trouble Code P0132 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated. Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

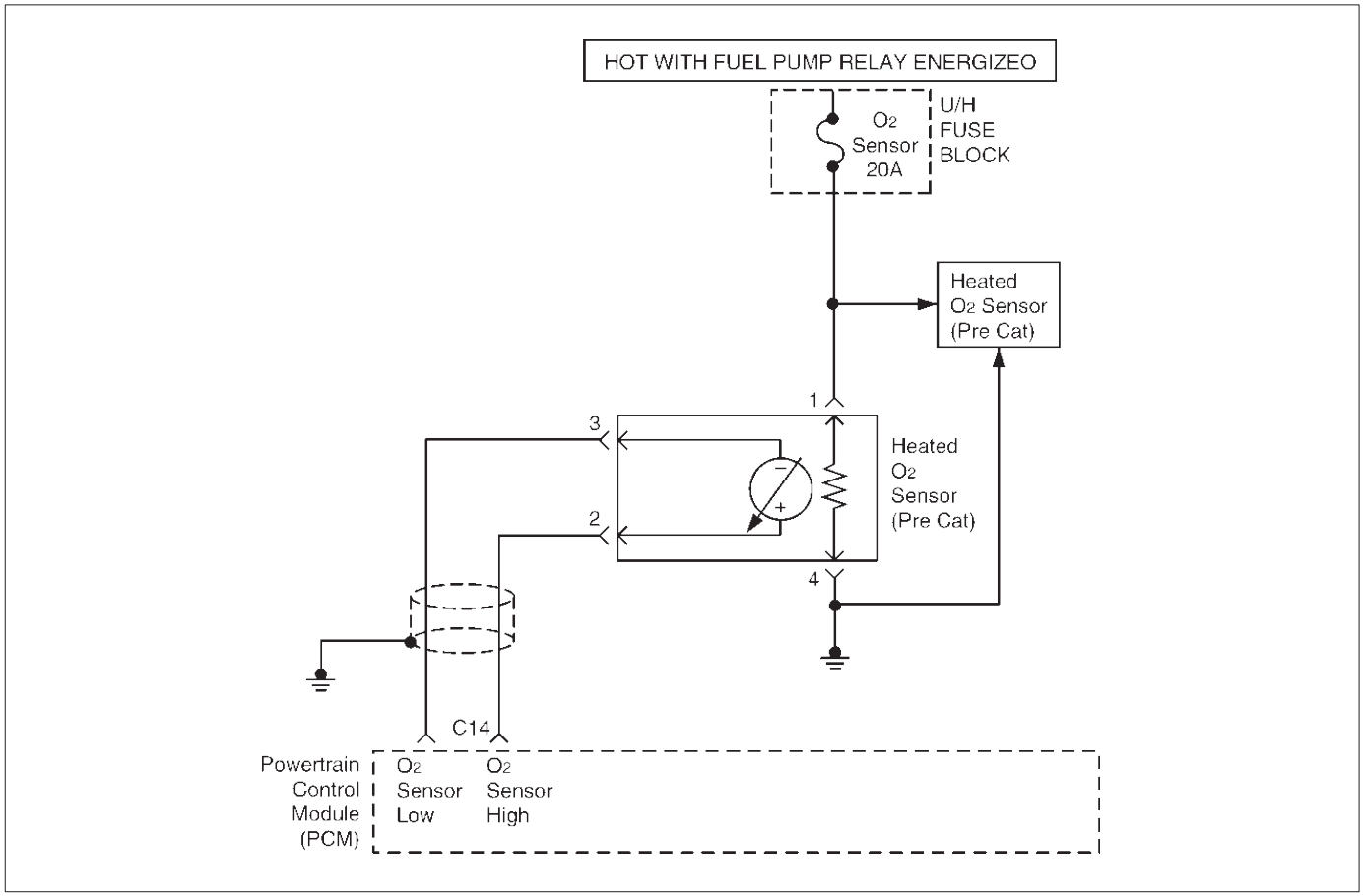
DTC P0132 – O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within parameters specified under ”Conditions for Setting the DTC” included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Does the Bank 1 HO2S 1 voltage remain above the specified value?	952 mV (500 mV in deceleration fuel cutoff mode)	Go to Step 4	Go to Step 3
3	1. Ignition ON review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0132 until the Diagnostic Trouble Code P0132 test runs. 4. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0132 failed this ignition?	—	Refer to Diagnostic Aids	Go to Step 4
4	1. Ignition OFF. 2. Disconnect Bank 1 HO2S 1. 3. Ignition ON. 4. At HO2S 1 connector (PCM side) use a Digital Voltmeter (DVM) to measure voltages at the high and low signal terminals. Are the voltages in the specified range?	5–14 V	Go to Step 5	Go to Step 6
5	Repair short to voltage in signal circuit.	—	Verify repair	—

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

Step	Action	Value(s)	Yes	No
6	1. Ignition OFF. 2. Disconnect the PCM connector. 3. Check for damage to the PCM pins and terminals. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Ignition ON, engine OFF. 2. Disconnect Bank 1 HO2S 1 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 1 voltage below the specified value?	10 mV	Go to Step 8	Go to Step 9
8	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

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



060R100030

Circuit Description

The powertrain control module (PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after ”Closed Loop” has been enabled. During the monitoring period the PCM counts the number of times that a rich–to–lean and lean–to–rich response is indicated and adds the amount of time it took to complete all transitions. With this information, an average time for each transition can be determined. If the average response time is too slow, a Diagnostic Trouble Code P0133 will be set. A DTC P0133 is a type B code.

A lean–to–rich transition is indicated when the HO2S voltage changes from less than 300 mV to greater than 600 mV. A rich–to–lean transition is indicated when the HO2S voltage changes from more than 600 mV to less than 300 mV. An HO2S that responds too slowly is likely to be faulty and should be replaced.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Engine coolant temperature is greater than 60°C (140°F).
- Engine is operating in ”Closed Loop”.
- Engine speed is between 1500 RPM and 3500 RPM.
- Canister purge solenoid duty cycle is greater than 2%.
- Calculated air flow is between 17 and 32 g/second.

All above conditions are met for 1 second and the following condition is met for 90 seconds after closed loop and operation enabled once per key cycle.

- 90 seconds after ”Closed Loop” has been enabled, Bank 1 HO2S 1 average transition time between 300 mV and 600 mV is too slow. The lean–to–rich average transition response time was longer than 100 milliseconds or rich–to–lean average transition response time was longer than 105 milliseconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator Lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.
- ”Open Loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0133 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0133 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If Diagnostic Trouble Code P0133 cannot be duplicated, reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is currently present.
3. HO2S transition time, ratio mean volts and switching Diagnostic Trouble Codes set for multiple sensors indicate probable contamination. Before replacing the sensors, isolate and correct the source of the contamination to avoid damaging the replacement sensors.

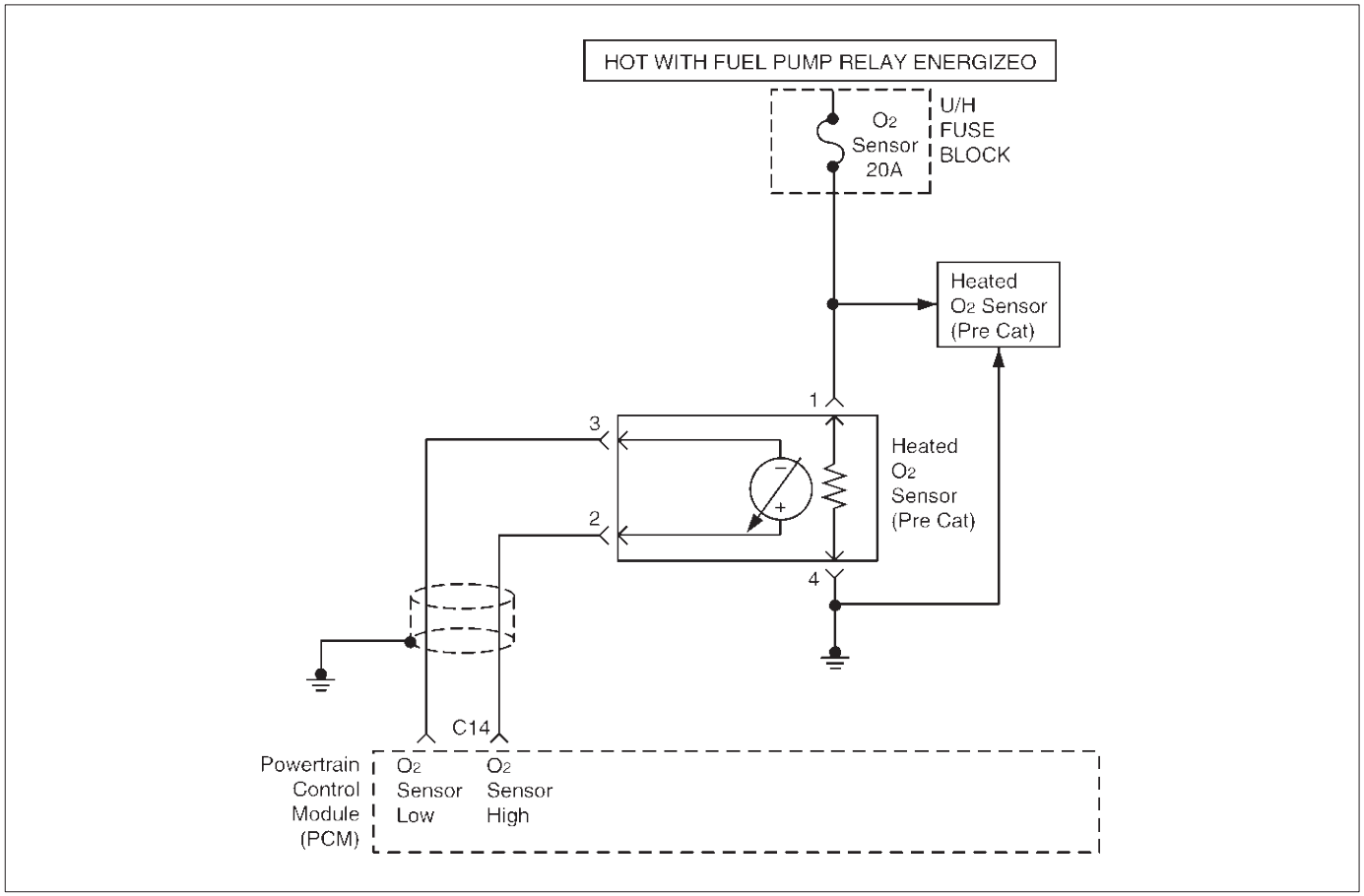
DTC P0133 – O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	NOTE: If any DTCs are set (except P1133 and/or P1134), refer to those DTCs before proceeding with this diagnostic chart. 1. Install the Tech 2. 2. Idle the engine at operating temperature. 3. Operate the vehicle within parameters specified under ”Conditions for Setting the Diagnostic Trouble Code” included in Diagnostic Support. 4. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0133 until the Diagnostic Trouble Code P0133 test runs. 5. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0133 failed this ignition?	—	Go to Step 3	Refer to Diagnostic Aids
3	Did the Tech 2 also indicate Diagnostic Trouble Code P1133 and/or P1134 failed this ignition?	—	Go to Step 8	Go to Step 4
4	1. Perform ”Exhaust System Leak Test” (refer to Exhaust System). After ”Exhaust System Leak Test” has been performed, return to this diagnostic 2. If an exhaust leak is found, repair as necessary. Was an exhaust leak isolated?	—	Go to Step 2	Go to Step 5
5	Visually/physically inspect the following items: ● Ensure that the Bank 1 HO2S 1 is securely installed. ● Check for corrosion on terminals. ● Check terminal tension (at Bank 1 HO2S 1 and at the PCM). ● Check for damaged wiring. Was a problem found in any of the above areas?	—	Go to Step 9	Go to Step 6

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

Step	Action	Value(s)	Yes	No
6	1. Disconnect Bank 1 HO2S 1. 2. Ignition ON. 3. Using a Digital Voltmeter (DVM) at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground. Also measure the voltage between the low signal circuit and ground. Are both voltages in the specified range?	3–4 V	Go to Step 7	Go to Step 10
7	1. With Bank 1 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition ON. 3. Using a Tech 2, monitor the Bank 1 HO2S 1 voltage. Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to Step 12	Go to Step 13
8	Replace the affected heated oxygen sensors. NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected. • Fuel contamination. • Use of improper RTV sealant. • Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
9	Repair condition as necessary. Is the action complete?	—	Verify repair	—
10	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to Step 11
11	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	—
12	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

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



060R100030

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) high and low circuits. When measured with a 10 MΩ digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during ”Closed Loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains at or near the 450 mV bias for an extended period of time, Diagnostic Trouble Code P0134 will be set, indicating an open sensor signal or sensor low circuit. DTC P0134 is a type B code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Engine run time is longer than 120 seconds.
- Engine Coolant Temperature (ECT) is above 60˚C (140˚F).
- Oxygen sensor heater has been determined to be functioning properly, and the oxygen sensor has warmed to operating temperature.

All the above conditions are met and the following condition is met for 612 test failures in 720 test samples (125 msec/test).

- Bank 1 HO2S 1 signal voltage remains between 400 mV and 500 mV.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the second time the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.
- ”Open Loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0134 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0134 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal–to–wire connection, and damaged harness.
- Faulty HO2S heater or heater circuit – With the ignition ON engine OFF after a cooldown period, the HO2S 1

voltage displayed on the Tech 2 is normally 455–460 mV. A reading over 1000 mV indicates a signal line shorted to voltage. A reading under 5 mV indicates a signal line shorted to ground or signal lines shorted together. Disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light for 2 seconds when the ignition is turned on, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.

- Intermittent test – With the ignition ON monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

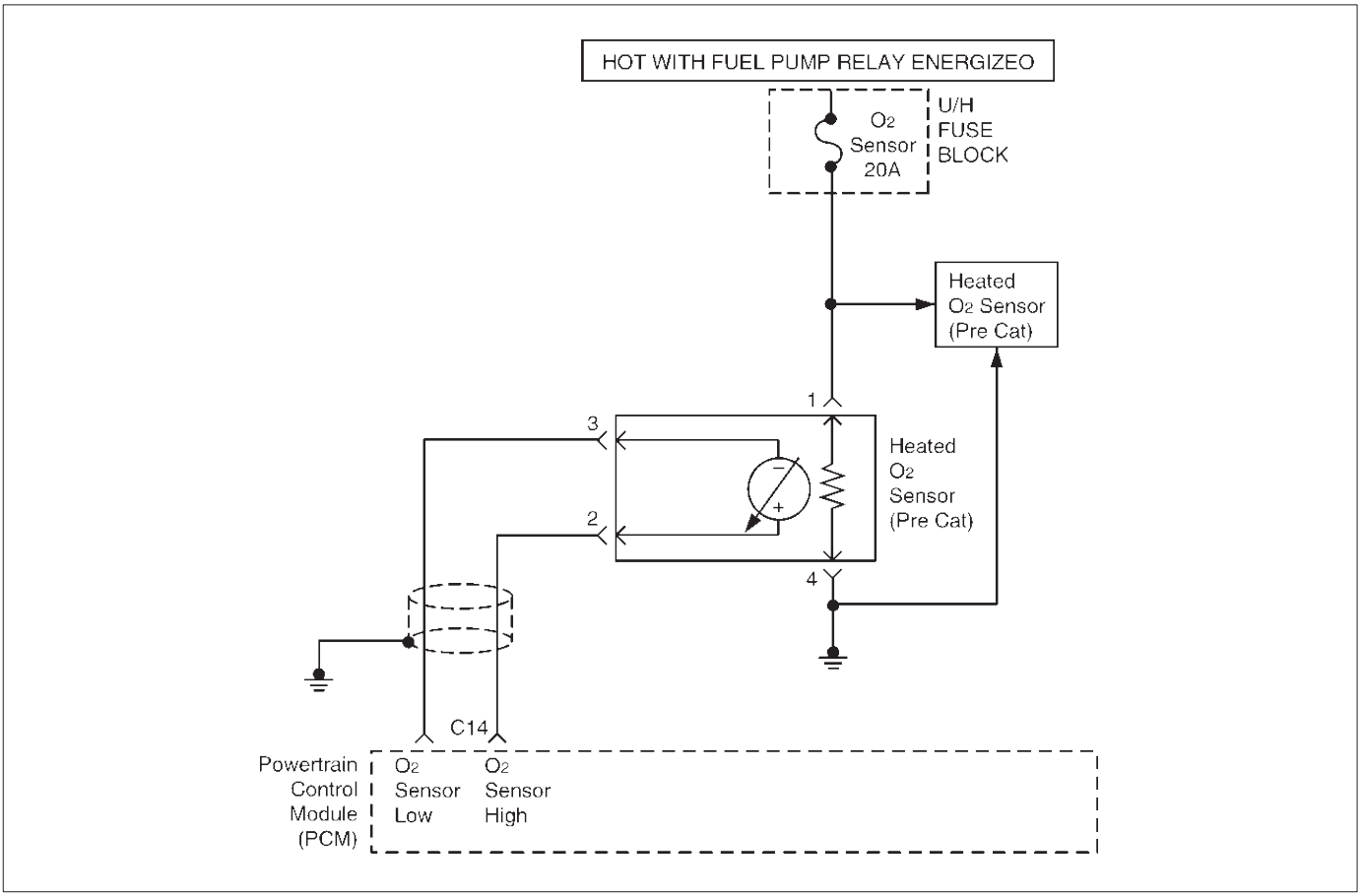
DTC P0134 – O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for three minutes. Does the Tech 2 indicate Bank 1 HO2S 1 voltage varying outside the specified values?	400–500 mV	Go to Step 3	Go to Step 4
3	1. Ignition ON, engine OFF review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0134 until the Diagnostic Trouble Code P0134 test runs. 4. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0134 failed this ignition?	—	Go to Step 4	Refer to Diagnostic Aids
4	Check for a damaged harness. Was a problem found?	—	Verify repair	Go to Step 5
5	Check for poor Bank 1 HO2S 1 high and low circuit terminal connections at the Bank 1 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 6
6	Check for poor Bank 1 HO2S 1 high and low circuit terminal connections at the PCM and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 7
7	1. Ignition OFF. 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 1 high circuit. 3. If the Bank 1 HO2S 1 high circuit measures over 0.5 Ω, repair open or poor connection as necessary. Was a Bank 1 HO2S 1 high circuit problem found and corrected?	—	Verify repair	Go to Step 8

DTC P0134 – O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1) (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition OFF. 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 1 low circuit. 3. If the Bank 1 HO2S 1 low circuit measures over 5 Ω, repair open or poor connection as necessary. Was a Bank 1 HO2S 1 low circuit problem found and corrected?	—	Verify repair	Go to Step 9
9	1. Ignition ON, engine OFF. 2. Disconnect Bank 1 HO2S 1 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 1 voltage approximately equal to the specified value?	10 mV	Go to Step 10	Go to Step 11
10	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC)
P0135 O2 SENSOR HEATER CIRCUIT MALFUNCTION (BANK 1 SENSOR 1)



060R100030

Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for ”Closed Loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by catalyst monitor sensors Bank 1 HO2S 2 and Bank 2 HO2S 2 to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine.

The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start–up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start–up. If the PCM determines that too much time was required for the Bank 1 HO2S 1 to become active, a Diagnostic Trouble Code P0135 will set. DTC P0135 is a type B code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Intake air temperature (IAT) is less than 32˚C (90˚F) at start–up.
- Engine coolant temperature (ECT) is less than 32˚C (90˚F) at start–up.
- IAT and ECT are within 6.75˚C (44˚F) of each other at start–up.
- Ignition voltage is between 11 and 16.6 V.
- Average calculated air flow is less than 25 g/second during sample period.
- Throttle angle is less than 40%.
- Bank 1 HO2S 1 voltage does not change more than 148 mV from the bias voltage (between 400 mV and 500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 240 seconds. This warm–up time depends on the engine coolant temperature at start–up and intake air temperature at start–up.

From cold start to a maximum time of 176 seconds determined by table value. It is once per key cycle.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0135 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0135 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display 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 Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. Ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2s heater ground circuit is faulty.
5. Checks the HO2S heater ground circuit.
6. Checks for an open or shorted HO2S heater element.
10. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

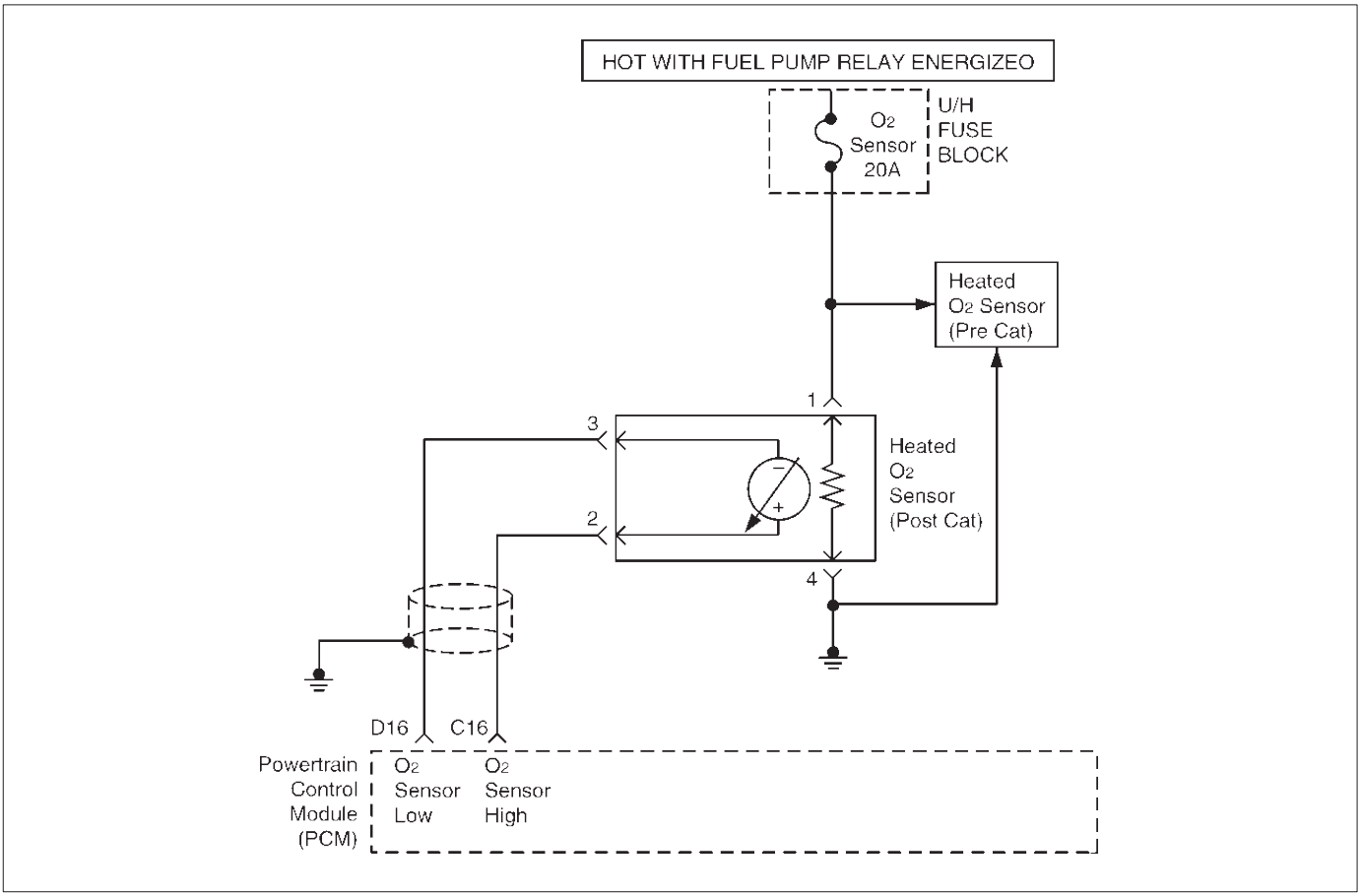
DTC P0135 – O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	NOTE: If the engine has just been operating, allow engine to cool for about one half hour before proceeding. 1. Ignition OFF, engine OFF. 2. Install a Tech 2. 3. Ignition ON engine OFF monitor the Bank 1 HO2S 1 voltage. Does the HO2S voltage go from bias voltage to above and below the specified values?	Above 650 mV or below 250 mV	Refer to Diagnostic Aids	Go to Step 3
3	Inspect the fuse for the Bank 1 HO2S 1 ignition feed. Is the fuse open?	—	Go to Step 15	Go to Step 4
4	1. Ignition OFF. 2. Raise the vehicle. 3. Disconnect the Bank 1 HO2S 1 electrical connector. 4. Using a test light connected to a good ground (do not use Bank 1 HO2S 1 heater ground or Bank 1 HO2S 1 low), probe the ignition feed circuit at the Bank 1 HO2S 1 electrical connector (PCM harness side). Does the test light illuminate?	—	Go to Step 5	Go to Step 7
5	Connect the test light between the Bank 1 HO2S 1 ignition feed and the Bank 1 HO2S 1 heater ground. Does the test light illuminate?	—	Go to Step 6	Go to Step 8

DTC P0135 – O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 1) (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Allow the HO2S to cool for at least 10 minutes. 2. Using a Digital Voltmeter (DVM), measure the resistance between the Bank 1 HO2S 1 ignition feed and the Bank 1 HO2S 1 heater ground at the Bank 1 HO2S 1 pigtail. Is the HO2S heater resistance within the specified values?	3–6 ohms	Go to Step 9	Go to Step 10
7	Repair the open Bank 1 HO2S 1 ignition feed circuit to Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
8	Repair the open Bank 1 HO2S 1 heater ground circuit to Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
9	1. Check for a poor connection at the Bank 1 HO2S 1 harness terminals. 2. If a poor connection is found, replace terminals. Was a poor connection found?	—	Verify repair	Go to Step 10
10	Check for a poor Bank 1 HO2S 1 high or low circuit terminal connection at the Bank 1 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 11
11	1. Ignition OFF. 2. Disconnect the PCM and check the continuity of the Bank 1 HO2S 1 signal circuit and the Bank 1 HO2S 1 low circuit. 3. If the Bank 1 HO2S 1 high circuit or HO2S low circuit measures over 5 Ω, repair open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to Step 12
12	Check for a poor Bank 1 HO2S 1 low circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 13
13	Check for a poor Bank 1 HO2S 1 high circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 14
14	Replace the Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to ground in Bank 1 HO2S 1 ignition feed circuit and replace the fault fuse. Is the action complete?	—	Verify repair	—

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



Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three–way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 1 HO2S 1 and the Bank 1 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three–way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be far more active than that produced by the Bank 1 HO2S 2 sensor. If the Bank 1 HO2S 2 signal voltage remains excessively low for an extended period of time, Diagnostic Trouble Code P0137 will be set. DTC P0137 is a type A code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Engine is operating in "Closed Loop".
- Engine coolant temperature is above 60°C (140°F).
- "Closed Loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 5.9% and 50%.

  All above conditions met for 0.3 seconds or for 3.0 seconds, if in "Decelleration Fuel Cut–Off" (DFCO) mode, and the following two conditions are met:
- Bank 1 HO2S 2 signal voltage remains below 22 mV during normal "Closed Loop" operation for a total of 106.25 seconds over a 125–second period of time.

OR

- Bank 1 HO2S 2 signal voltage remains below 426 mV during power enrichment (P.E.) mode fuel control operation for 5 seconds.

The above conditions are met for 190 test failures in 220 test samples or 40 failures in 40 samples in P.E. mode (125 msec/test).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0137 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0137 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be mispositioned and/or contacting the exhaust system.
- Poor PCM to engine grounds.
- Fuel pressure – A condition which causes a lean exhaust can cause Diagnostic Trouble Code P0137 to set. The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, a Diagnostic Trouble Code P0137 may be set. Refer to Fuel System Diagnosis.
- Lean injector(s) – Perform "Injector Balance Test."
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the Diagnostic Trouble Code P0137 to set. Check for exhaust leaks near the Bank 1 HO2S 2 sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. For procedure to check for fuel contamination, refer to Fuel System Diagnosis.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3. Diagnostic Trouble Code P0137 being set in power enrichment mode conditions may indicate a condition described in the "Diagnostic Aids" above. If the Diagnostic Trouble Code P0137 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated. Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

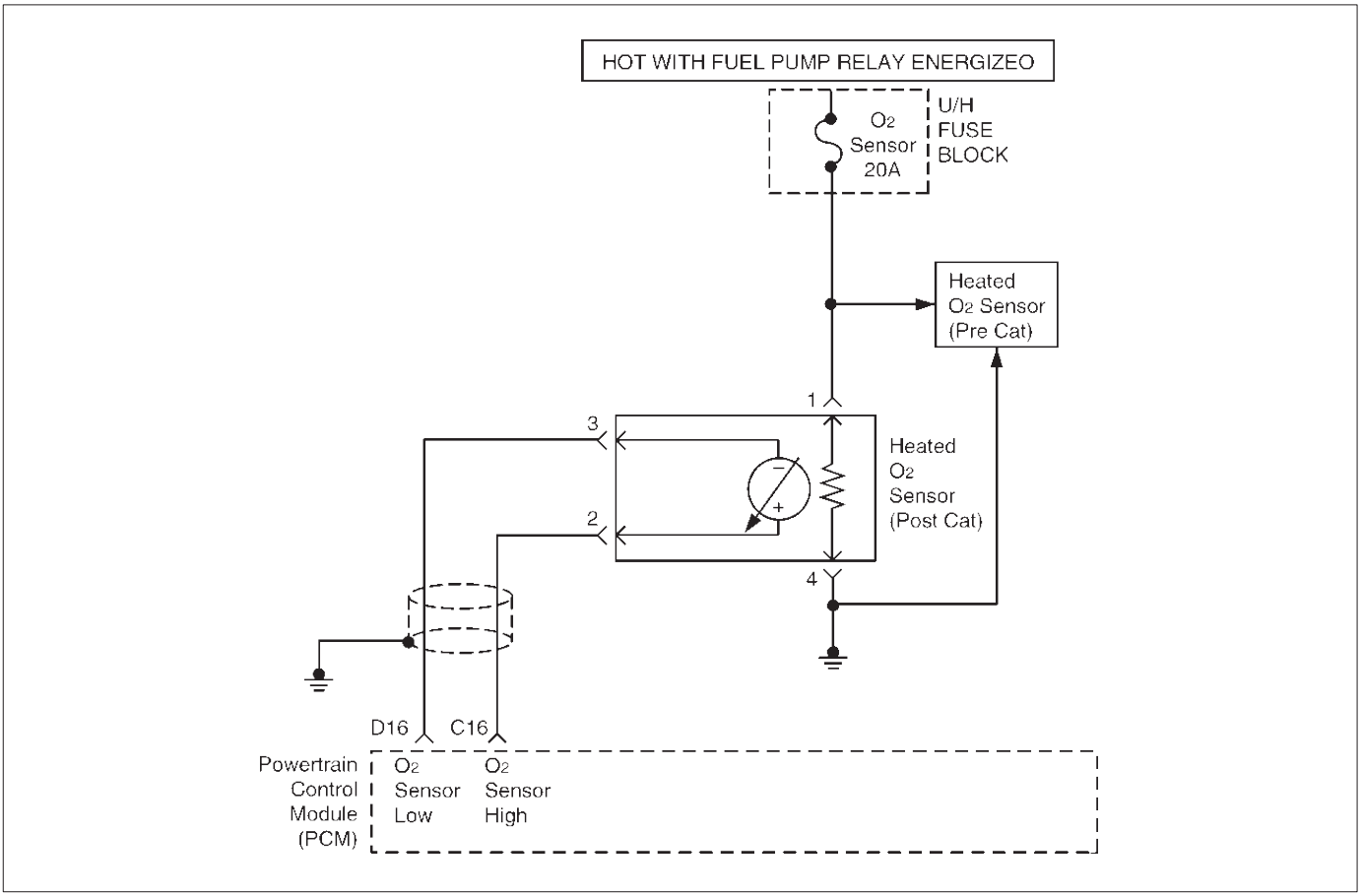
DTC P0137 – O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under "Conditions for Setting the Diagnostic Trouble Code" criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 2 voltage. Does the Bank 1 HO2S 2 voltage remain below the specified value?	26 mV	Go to Step 4	Go to Step 3
3	1. Ignition ON, engine OFF review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "Diagnostic Trouble Code" info for Diagnostic Trouble Code P0137 until the Diagnostic Trouble Code P0137 test runs. 4. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0137 failed this ignition?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Turn ignition OFF. 2. Disconnect the PCM. 3. Check the Bank 1 HO2S 2 high and low signal circuits for a short to ground or a short to the heater ground circuit. Were Bank 1 HO2S 2 signal circuits shorted?	—	Go to Step 5	Go to Step 6

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

Step	Action	Value(s)	Yes	No
5	Repair the Bank 1 HO2S 2 signal circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition OFF. 2. Leave the PCM and HO2S 2 disconnected. 3. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to Step 7	Go to Step 8
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—
8	1. Ignition OFF. 2. Reconnect the PCM, leave HO2S 2 disconnected. 3. Ignition ON. Does the Tech 2 indicate Bank 1 HO2S 2 voltage near the specified value?	430–450 mV	Refer to Diagnostic Aids	Go to Step 9
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

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



Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three–way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 1 HO2S 1 and the Bank 1 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three–way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be far more active than that produced by the Bank 1 HO2S 2 sensor. If the Bank 1 HO2S 2 signal voltage remains excessively high for an extended period of time, Diagnostic Trouble Code P0138 will be set. DTC P0138 is a type A code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Engine is operating in "Closed Loop".
- "Closed Loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Engine coolant temperature is above 60°C (140°F).
- Throttle angle is between 5.9% and 50%.

  All above conditions met for 3.0 seconds or in "Deceleration Fuel Cutoff" DFCO mode, and one of the following two conditions are met:
- Bank 1 HO2S 2 signal voltage remains above 952 mV during normal "Closed Loop" operation.

OR

- Bank 1 HO2S 2 signal voltage remains above 474 mV during deceleration fuel cutoff mode operation.

The above conditions are met for 190 test failures in 220 test samples or 40 fails in 40 samples in DFCO mode (125 msec/test).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history Diagnostic Trouble Code P0138 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0138 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check the following items:

- Fuel pressure – An excessively rich fuel mixture can cause a Diagnostic Trouble Code P0138 to be set. Refer to Fuel System Diagnosis.
- Rich injector(s) – Perform "Injector Balance Test."
- Leaking injector – Refer to Fuel System Diagnosis.
- Evaporative emissions (EVAP) canister purge – Check for fuel saturation. If full of fuel, check the canister control and hoses. Refer to Evaporative Emission (EVAP) Control System.
- Check for a leaking fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel.
- TP sensor – An intermittent TP sensor output will cause the system to go rich, due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S) – If the HO2S is internally shorted the HO2S voltage displayed on the Tech 2 will be over 1 volt. Silicon contamination of the HO2S can also cause a high HO2S voltage. This condition is indicated by a powdery white deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is evident, replace the affected HO2S.
- Open HO2S Signal, Low Circuit or Faulty HO2S – A poor connection or open in the HO2S signal or low circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle while monitoring the HO2S voltage with a Tech 2. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S signal and low circuit wiring and associated terminal connections. If the wiring and connections are OK, replace the HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3. Diagnostic Trouble Code P0138 being set during deceleration fuel mode operation may indicate a condition described in the "Diagnostic Aids" above. If the Diagnostic Trouble Code P0138 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated. Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

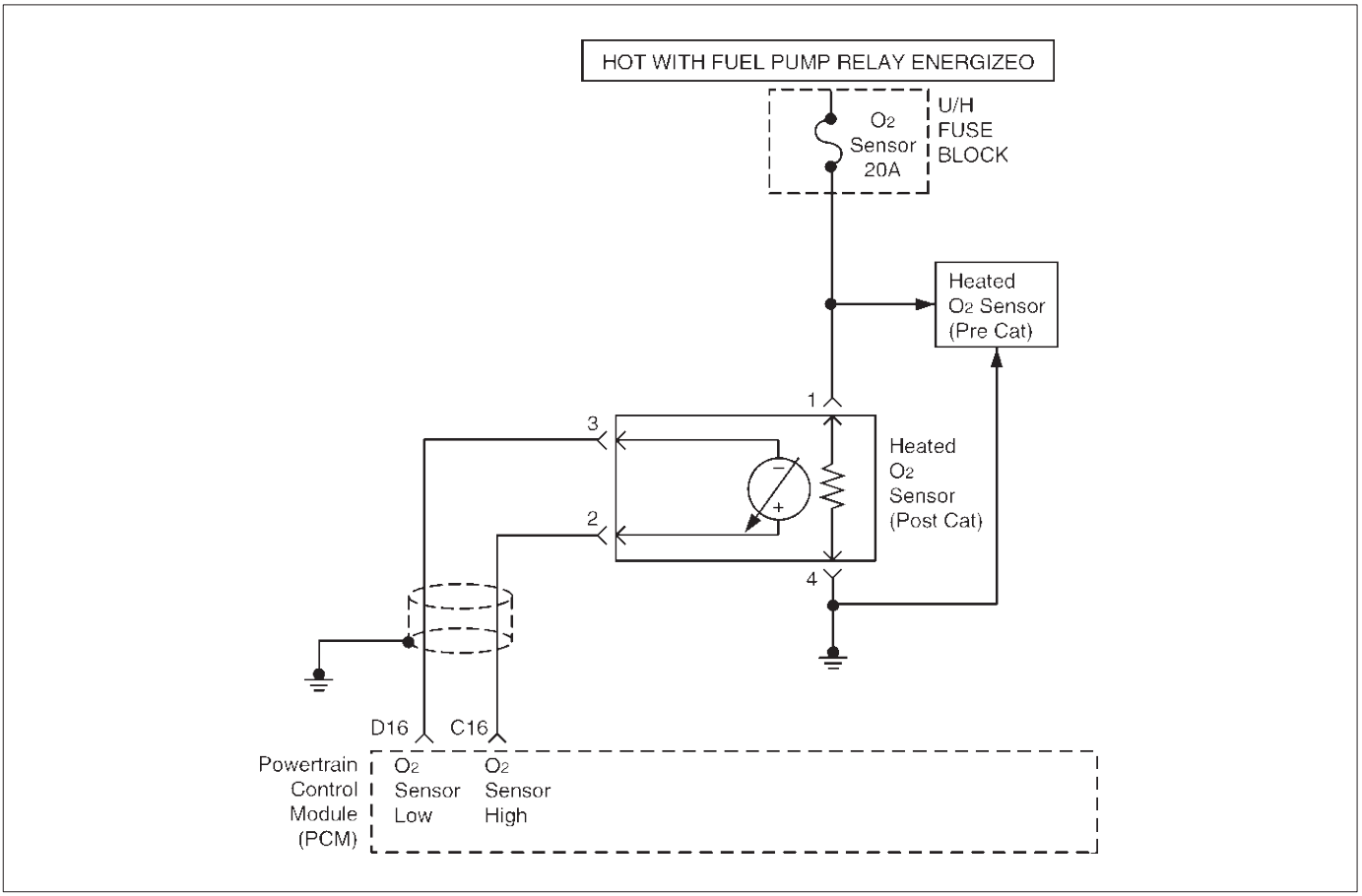
DTC P0138 – O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within parameters specified under "Conditions for Setting the Diagnostic Trouble Code" included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Does the Bank 1 HO2S 2 voltage remain above the specified value?	952 mV	Go to Step 4	Go to Step 3
3	1. Ignition ON review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "Diagnostic Trouble Code" info for Diagnostic Trouble Code P0138 until the Diagnostic Trouble Code P0138 test runs. 4. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0138 failed this ignition?	—	Go to Step 4	Refer to Diagnostic Aids

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

Step	Action	Value(s)	Yes	No
4	1. Ignition OFF. 2. Disconnect Bank 1 HO2S 2. 3. Ignition ON. 4. At HO2S 2 connector (PCM side) use a DVM to measure voltages at the high and low signal terminals. Are the voltages in the specified range?	5–14 V	Go to Step 5	Go to Step 6
5	Repair short to voltage in signal circuit.	—	Verify repair	—
6	1. Ignition OFF. 2. Disconnect the PCM connector. 3. Check for damage to the PCM pins and terminals. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Ignition ON, engine OFF. 2. Disconnect Bank 1 HO2S 2 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 2 voltage below the specified value?	10 mV	Go to Step 8	Go to Step 9
8	Replace Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2)



Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three–way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 1 HO2S 1 and the Bank 1 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 2 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three–way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be far more active than that produced by the Bank 1 HO2S 2 sensor. If the Bank 1 HO2S 2 signal voltage remains between 400 mV and 500 mV for an extended period of time, Diagnostic Trouble Code P0140 will be set. DTC P0140 is a type A code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Engine run time is longer than 120 seconds.
- Oxygen sensor heater is functioning properly, and the oxygen sensor has reached operating temperature.
- Engine is operating in "Closed Loop".
- Bank 1 HO2S 2 signal voltage remains between 426 mV and 474 mV.

The above conditions are met for 850 test failures in 1000 test samples (125 msec/test).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0140 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0140 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the harness connectors for backed–out terminals,

improper mating, broken locks, improperly formed or damaged terminals, poor terminal–to–wire connection, shorts to ground, shorts to battery positive and open circuits.

- Faulty HO2S heater or heater circuit – With the ignition ON engine OFF the HO2S voltage displayed on a Tech 2 should gradually drop to below 250 mV. If not, disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.
- Intermittent test – With the ignition ON monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage 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 Chart:

3. If the Diagnostic Trouble Code P0140 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated. Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

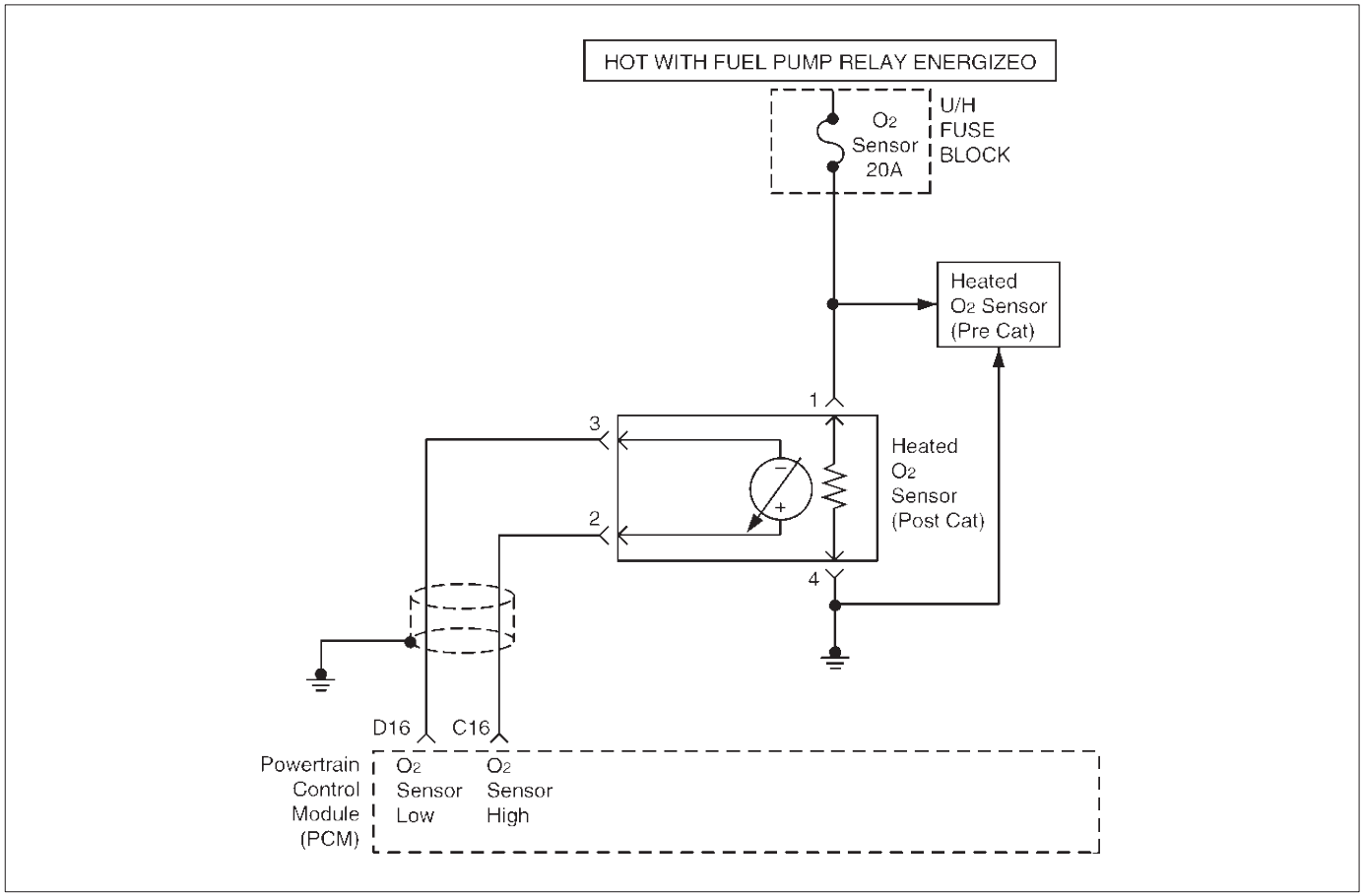
DTC P0140 – O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for two minutes. Does the Tech 2 indicate Bank 1 HO2S 2 voltage vary outside the specified value?	425–475 mV	Go to Step 3	Go to Step 4
3	1. Ignition ON engine OFF review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0140 until the Diagnostic Trouble Code P0140 test runs. 4. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0140 failed this ignition?	—	Go to Step 4	Refer to Diagnostic Aids
4	Check for a poor Bank 1 HO2S 2 high or low signal circuit terminal connection at the Bank 1 HO2S 2 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 5
5	1. Ignition OFF. 2. Disconnect the PCM. 3. Check for poor Bank 1 HO2S 2 high or low signal circuit terminal connection at the PCM and replace the terminal if necessary. Did either terminal require replacement?	—	Verify repair	Go to Step 6
6	Check continuity of the Bank 1 HO2S 2 signal circuits. If either Bank 1 HO2S 2 signal circuit measures over 5 Ω, repair open or poor connection as necessary. Was a Bank 1 HO2S 2 signal circuit problem found and corrected?	—	Verify repair	Go to Step 7

DTC P0140 – O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2) (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Reconnect the PCM harness. 2. Ignition ON. 3. With the Bank 1 HO2S 2 sensor harness disconnected, use a Digital Voltmeter (DVM) to measure the voltage between the HO2S heater ground wire and each signal circuit wire. Does each signal circuit measure in the specified range?	3–4 V	Go to Step 9	Go to Step 8
8	Check for a short to ground or voltage in both signal circuits. Was a problem found?	—	Verify repair	Go to Step 11
9	1. Jumper the high and low signal wires to the heater ground wire. 2. Ignition ON. Using a Tech 2, is the Bank 1 HO2S 2 voltage in the specified range?	0–10 mV	Go to Step 10	Go to Step 11
10	Replace Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0141 O2 SENSOR HEATER CIRCUIT MALFUNCTION (BANK 1 SENSOR 2)



Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for ”Closed Loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by catalyst monitor sensors Bank 1 HO2S 2 and Bank 2 HO2S 2 to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine.

The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start–up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the Bank HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start–up. If the PCM determines that too much time was required for the Bank 1 HO2S 2 to become active, a Diagnostic Trouble Code P0141 will set. DTC P0141 is a type B code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Intake air temperature (IAT) is less than 32˚C (90˚F) at start–up.
- Engine coolant temperature (ECT) is less than 32˚C (90˚F) at start–up.
- IAT and ECT are within 6.75˚C (44˚F) of each other at start–up.
- Ignition voltage is between 11 volts and 16.6 volts.
- Throttle angle is less than 40%.
- Average calculated airflow is less than 26 g/second during the sample period.
- Bank 1 HO2S 2 voltage does not change more than 148 mV from the bias voltage (between 400 mV–500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 375 seconds. This warm–up time depends on the engine coolant temperature at start–up and intake air temperature at start–up.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle duringwhich the diagnostic has been run and the fault condition is no longer present.

- A history Diagnostic Trouble Code P0141 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0141 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display 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

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. This ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. This checks the HO2S heater ground circuit.
6. This checks for an open or shorted HO2S heater element.
11. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

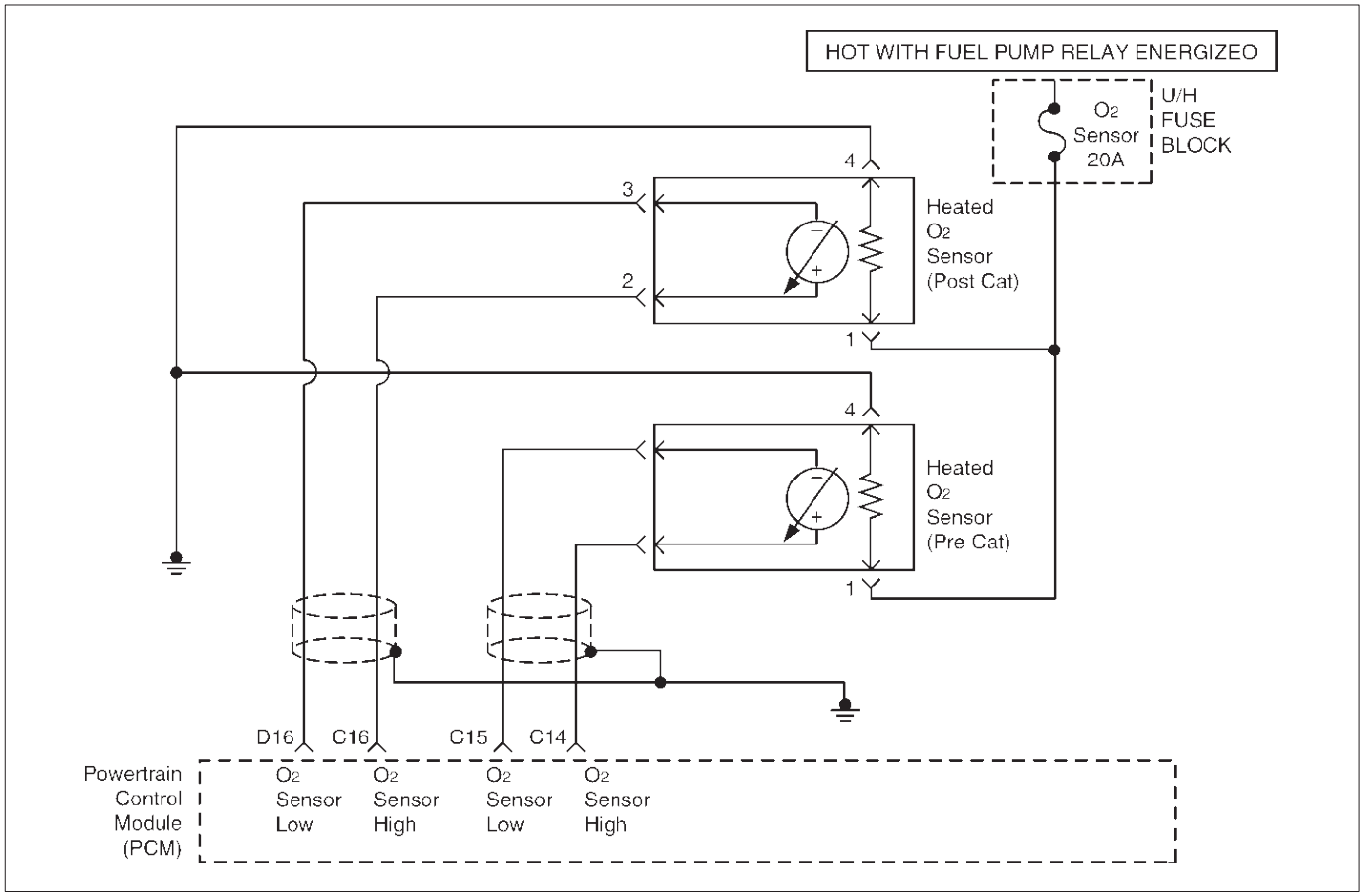
DTC P0141 – O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	NOTE: If the engine has just been operating, allow the engine to cool for about one half hour before proceeding. 1. Ignition OFF, engine OFF. 2. Install the Tech 2. 3. Ignition ON, engine OFF monitor the Bank 1 HO2S 2 voltage. Does the HO2S voltage go from bias voltage to above or below the specified values?	Above 650 mV or below 250 mV	Refer to Diagnostic Aids	Go to Step 3
3	Inspect the fuse for Bank 1 HO2S 2 ignition feed. Is the fuse open?	—	Go to Step 15	Go to Step 4
4	1. Ignition OFF. 2. Raise the vehicle. 3. Disconnect the Bank 1 HO2S 2 electrical connector. 4. Using a test light connected to a good ground (do not use Bank 1 HO2S 2 heater ground or Bank 1 HO2S 2 low), probe the ignition feed circuit at the Bank 1 HO2S 2 electrical connector (PCM harness side). Does the test light illuminate?	—	Go to Step 5	Go to Step 7
5	Connect the test light between the Bank 1 HO2S 2 ignition feed and the Bank 1 HO2S 2 heater ground. Does the test light illuminate?	—	Go to Step 6	Go to Step 8

DTC P0141 – O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 2) (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Allow the HO2S to cool for at least 10 minutes. 2. Using a Digital Voltmeter (DVM), measure the resistance between the Bank 1 HO2S 2 ignition feed and the Bank 1 HO2S 2 heater ground at the Bank 1 HO2S 2 pigtail. Is the HO2S resistance within the specified values?	3–6 Ω	Go to Step 9	Go to Step 10
7	Repair the open Bank 1 HO2S 2 ignition feed circuit to Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
8	Repair the open Bank 1 HO2S 2 heater ground circuit. Is the action complete?	—	Verify repair	—
9	1. Check for a poor connection at the Bank 1 HO2S 2 harness terminals. 2. If a poor connection is found, replace the terminals. Was a poor connection found?	—	Verify repair	Go to Step 10
10	1. Ignition OFF. 2. Disconnect the PCM and check the continuity of the Bank 1 HO2S 2 signal circuit and the Bank 1 HO2S 2 low circuit. 3. If the Bank 1 HO2S 2 signal circuit or the HO2S low circuit measures over 5 Ω, repair the open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to Step 11
11	Check for a poor Bank 1 HO2S 2 high or low circuit terminal connection at the Bank 1 HO2S 2 harness connector and replace the terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 12
12	Check for a poor Bank 1 HO2S 2 low circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 13
13	Check for a poor Bank 1 HO2S 2 high circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 14
14	Replace Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to ground in Bank 1 HO2S 2 ignition feed circuit and replace the faulty fuse. Is the action complete?	—	Verify repair	—

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



060R100032

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 powertrain control module (PCM) monitors the Bank 1 HO2S 1 signal and adjusts fuel delivery based upon the HO2S 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 a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signal indicates a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively lean condition is detected on Bank 1, the PCM will set Diagnostic Trouble Code P0171. DTC P0171 is a type B code.

The PCM’s maximum authority to control long term fuel trim allows a range between –14% and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of the following: EGR Diagnostic Trouble Codes, HO2S Diagnostic Trouble Codes, (response, transition, open, low volts, no activity), TP sensor Diagnostic Trouble Codes, MAP Diagnostic Trouble Codes, IAT Diagnostic Trouble Codes, canister purge Diagnostic Trouble Codes, EVAP Diagnostic Trouble Codes, injector circuit Diagnostic Trouble Codes, or misfire Diagnostic Trouble Codes.
- Engine coolant temperature is between 65˚C (149˚F) and 104˚C (219˚F).
- Intake air temperature is between –40˚C (–40˚F) and 120˚C (248˚F).
- Manifold absolute pressure is between 23.75 kPa and 99 kPa.
- Engine speed is between 400 and 6000 RPM.
- Barometric pressure is greater than 72.3 kPa.
- System voltage is greater than 9.5v.
- Engine is operating in ”Closed Loop”.
- The average of the short term fuel trim samples is greater than 1.012 and the average of adaptive index multiplier samples is greater than 1.266.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0171 will clear after 40 consecutivewarm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0171 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display 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 Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2.Diagnostic Trouble Codes other than P0171 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other Diagnostic Trouble Code will most likely correct the Diagnostic Trouble Code P0171.

4.If the Diagnostic Trouble Code P0171 test passes while the Failure Records conditions are being duplicated, the lean condition is intermittent. Refer to Diagnostic Aids or Symptoms for additional information on diagnosing intermittent problems.

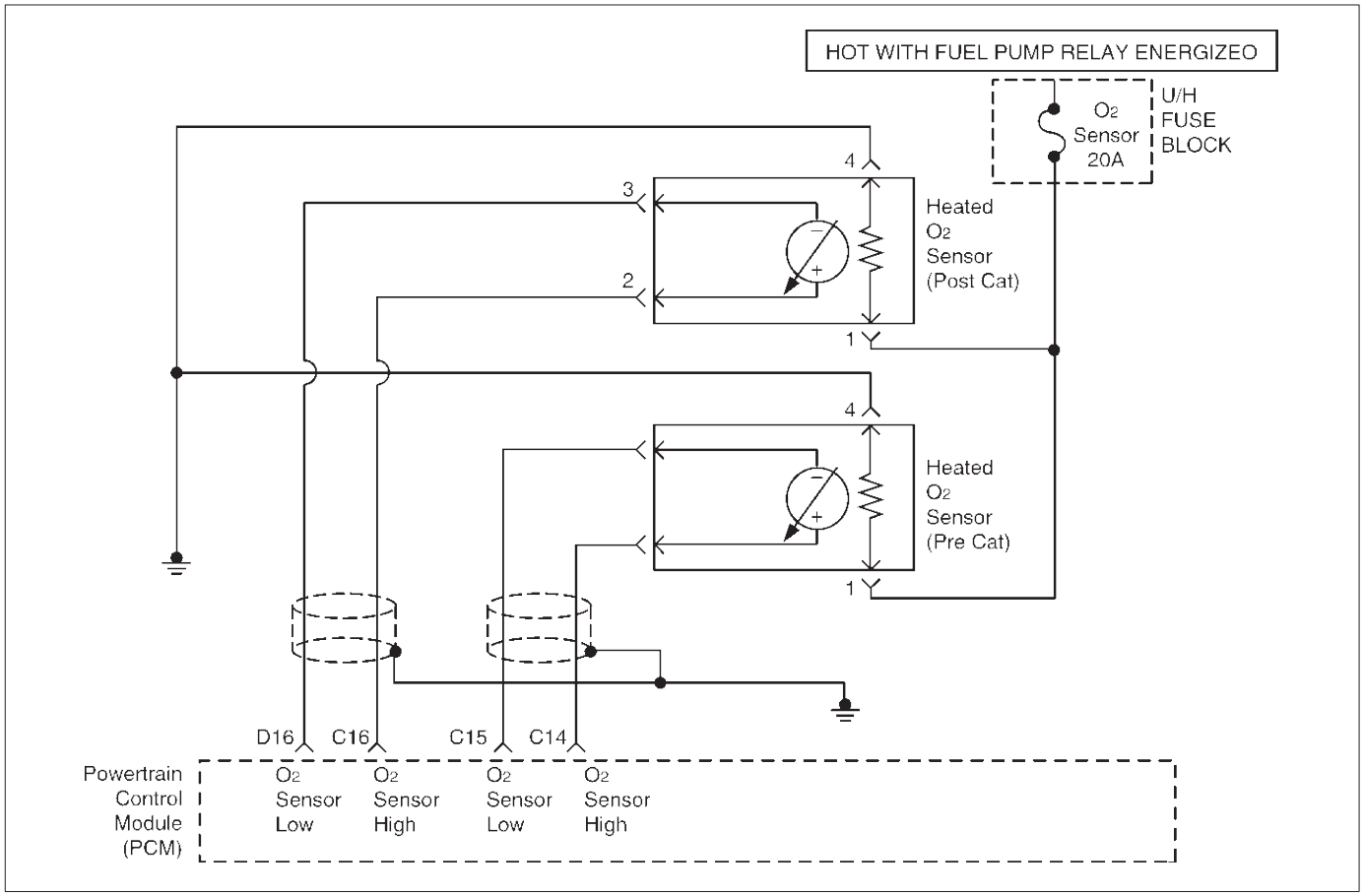
DTC P0171 – System Too Lean (Bank 1)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Are any DTCs set other than P0171?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart.	Go to Step 3
3	1. Start the engine and operate the vehicle in ”Closed Loop”. 2. Observe the ”BANK 1 L.T. FUEL TRIM” and display on the Tech 2. Are the displayed values greater than the specified values?	L.T. Fuel Trim: 20%	Go to Step 5	Go to Step 4
4	1. Review and record the Tech 2 Failure Records data. 2. Clear the Diagnostic Trouble Code P0171 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0171 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the Diagnostic Trouble Code P0171 test runs and note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0171 failed this ignition?	—	Go to Step 5	The lean condition is not present. If a driveability symptom still exists, refer to Symptoms section.
5	Visually and physically inspect the vacuum hoses for disconnects, splits, kinks, improper routing and improper connections and repair any problem found. Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to Step 6
6	Visually and physically inspect the crankcase ventilation valve for proper installation and repair any problem found (refer to Crankcase Ventilation System). Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to Step 7
7	Start the engine and note the idle quality. Is a high or unsteady idle being experienced?	—	Go to Step 8	Go to Step 10
8	With the engine idling, observe the ”IDLE AIR CONTROL” display on the Tech 2. Is the displayed value above the specified value?	Above 5 counts	Go to Step 10	Go to Step 9
9	1. Visually and physically inspect the throttle body, intake manifold, EGR valve and the EGR feed pipe for vacuum leaks. 2. Repair any vacuum leaks as necessary. Did your inspection reveal a vacuum leak?	—	Verify repair	Go to Step 10

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

Step	Action	Value(s)	Yes	No
10	Perform the "Idle Air Control (IAC) Valve Check" and correct any IAC problem as necessary. Did this test isolate a problem requiring repair?	—	Verify repair	Go to Step 11
11	Check the fuel for excessive water, alcohol, or other contaminants (see Diagnosis in Engine Fuel for the procedure) and correct the contaminated fuel condition if present (see Engine Fuel). Was the fuel contaminated?	—	Verify repair	Go to Step 12
12	1. Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight, and in their proper locations. 2. If a faulty ground condition is present, correct it as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to Step 13
13	Perform the procedure in "Fuel System Pressure Test" and repair fuel system problem if necessary. Did the test isolate a condition requiring repair?	—	Verify repair	Go to Step 14
14	Perform the "Evaporative Emissions Control (EVAP) Canister Purge Valve Check" and repair EVAP system problem if necessary. Did the test isolate a problem?	—	Verify repair	Go to Step 15
15	1. Visually and physically inspect the intake manifold, injector O–rings, EGR adapter, EGR valve and the EGR feed pipes for vacuum leaks. 2. Repair any problem that is found. Did your inspection reveal a problem?	—	Verify repair	Go to Step 16
16	Visually and physically inspect the Bank 1 exhaust manifold for leaks and loose or missing hardware and correct any problem found. Did your inspection reveal a problem?	—	Verify repair	Go to Step 17
17	Perform the "Injector Balance Test," and correct any problem found (refer to Fuel Metering System). Did the test isolate a problem?	—	Verify repair	Go to Step 18
18	1. Visually and physically inspect the Bank 1 HO2S 1 to ensure that it is installed securely and that the Bank 1 HO2S 1 pigtail and wiring harness are not contacting the exhaust or otherwise damaged. 2. If a problem is found, correct it as necessary. Did your inspection reveal a problem?	—	Verify repair	Refer to Diagnostic Aids

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



060R100032

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 powertrain control module (PCM) monitors the Bank 1 heated oxygen sensor (HO2S) 1 and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively rich condition is detected on Bank 1, the PCM will set Diagnostic Trouble Code P0172. DTC P0172 is a type B code.

The PCM’s maximum authority to control long term fuel trim allows a range between –14% and +20%. The PCM’s maximum authority to control short term fuel trim allows a range between –11% and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- Engine run time more than 500 sec.
- None of the following was set: EGR Diagnostic Trouble Codes, HO2S Diagnostic Trouble Codes, (response, transition, open, low volts, no activity), TPS Diagnostic Trouble Codes, MAP Diagnostic Trouble Codes, IAT Diagnostic Trouble Codes, canister purge Diagnostic Trouble Codes, EVAP Diagnostic Trouble Codes, injector circuit Diagnostic Trouble Codes, CKP Diagnostic Trouble Code, ECT Diagnostic Trouble Code, VSS Diagnostic Trouble Code, Idle Diagnostic Trouble Code or misfire Diagnostic Trouble Codes.
- Engine coolant temperature is between 65˚C (149˚F) and 104˚C (219˚F).
- Intake air temperature is between –40˚C (–40˚F) and 120˚C(248˚F).
- Manifold absolute pressure is between 23.75 kPa and 99 kPa.
- System voltage is greater than 9.5 volts.
- Engine speed is between 400 and 6000 RPM.
- Barometric pressure is greater than 72.3 kPa.
- Engine is operating in ”Closed Loop”.
- The average of the short term full trim samples is less than 0.988 and the average of the adaptive index multiplier samples is less 0.914.

Rich counter is more than 10 during 2.5 sec.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0172 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0172 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display 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

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Diagnostic Trouble Codes other than P0172 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0172.
4. If the Diagnostic Trouble Code P0172 test passes while the Failure Records conditions are being duplicated, the rich condition is intermittent. Refer to Diagnostic Aids or Symptoms for additional information on diagnosing intermittent problems.

—

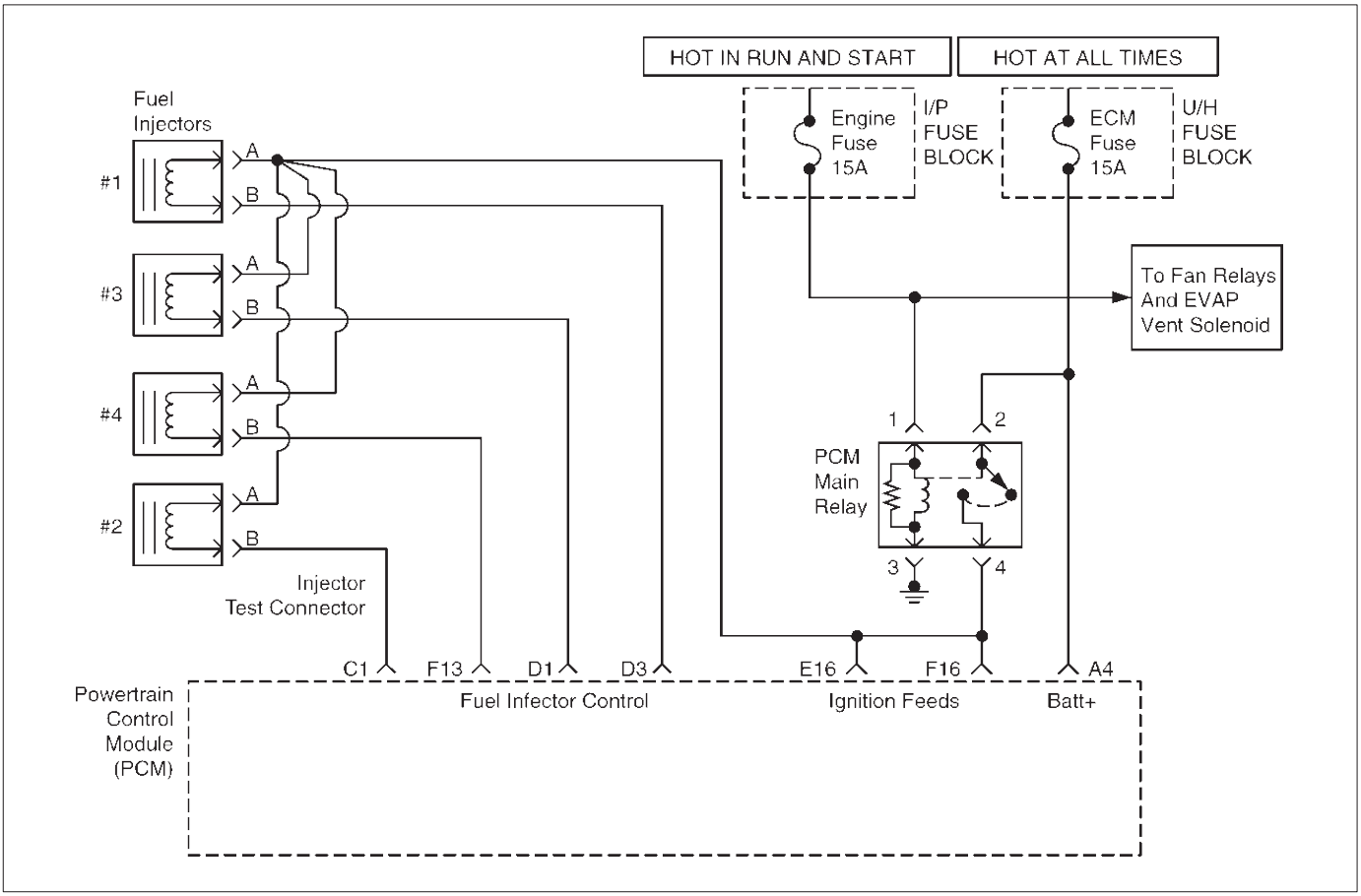
DTC P0172 – System Too Rich (Bank 1)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Are any Diagnostic Trouble Codes set other than P0172?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart.	Go to Step 3
3	1. Start the engine and operate the vehicle in ”Closed Loop”. 2. Observe ”BANK 1 L.T. FUEL TRIM” display on the Tech 2. Are the displayed values more negative than the specified values?	L.T. Fuel Trim: –14%	Go to Step 5	Go to Step 4
4	1. Review and record the Tech 2 Failure Records data. 2. Clear the Diagnostic Trouble Code P0172 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0172 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the Diagnostic Trouble Code P0172 test runs and note test result. Does the Tech 2 indicate Diagnostic Trouble Code P0172 failed this ignition?	—	Go to Step 5	The rich condition is not present. If a driveability symptom still exists, refer to Symptoms.
5	Visually and physically inspect the air filter element and replace it if necessary. Did the air filter require replacement?	—	Verify repair	Go to Step 6
6	Visually and physically inspect the air intake duct for collapse or restriction and repair if necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to Step 7
7	Start the engine and note the idle quality. Is a low or unsteady idle being experienced?	—	Go to Step 8	Go to Step 10
8	With the engine idling, observe the ”IDLE AIR CONTROL” display on the Tech 2. Is the ”IDLE AIR CONTROL” value below the specified value?	Below 100 counts	Go to Step 10	Go to Step 9
9	1. Ignition OFF. 2. Physically inspect the throttle body bore, throttle plate, and IAC passages for coking and foreign objects. 3. If a problem was found, repair as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to Step 10

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

Step	Action	Value(s)	Yes	No
10	1. Perform the "Idle Air Control (IAC) Valve Check." 2. If a problem is found, repair as necessary. Did the test isolate a problem requiring repair?	—	Verify repair	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 (refer to Fuel Metering System). Did the fuel pressure regulator require replacement?	—	Verify repair	Go to Step 12
12	Ignition ON engine OFF monitor the TP Angle display on the Tech 2 while slowly depressing the accelerator pedal. Does the TP Angle display increase steadily and evenly from minimum value at closed throttle to maximum value at wide–open throttle?	Minimum 0% Maximum 100%	Go to Step 13	Go to Step 17
13	1. Perform the "Fuel System Pressure Test." 2. If the test isolates a problem, repair as necessary (refer to Engine Fuel or Fuel Metering System). Did the test isolate a problem requiring repair?	—	Verify repair	Go to Step 14
14	1. Perform the "Evaporative Emissions Control (EVAP) Canister Purge Valve Check." 2. If the test isolates a problem, repair as necessary. Did the test isolate a problem requiring repair?	—	Verify repair	Go to Step 15
15	1. Perform the "Injector Balance Test." 2. If the test isolates a problem, repair as necessary (refer to Fuel Metering System). Did the test isolate a problem requiring repair?	—	Verify repair	Go to Step 16
16	1. Remove and visually/physically inspect the Bank 1 HO2S 1 for silicon contamination. This will be indicated by a powdery white deposit on the portion of the HO2S that is exposed to the exhaust stream. 2. If contamination is evident on the Bank 1 HO2S 1, replace the contaminated sensors. Did the sensor require replacement?	—	Verify repair	Refer to Diagnostic Aids
17	1. Check the TP sensor mounting screws and tighten or replace them as necessary if they are loose or missing. 2. If the screws are OK, replace the TP sensor. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0201 INJECTOR CIRCUIT MALFUNCTION – CYLINDER 1



060R100033

Circuit Description

The powertrain control module (PCM) has four individual injector driver circuits. Each controls an injector. When a driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The PCM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a Diagnostic Trouble Code is set. This Diagnostic Trouble Code is also set if an injector driver is shorted to voltage. DTC P0201 is a type A code.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- Engine is running.
- Fuel pump is ON.
- The injector voltage does not equal the ignition voltage when the injector is commanded OFF or the injector voltage does not equal 0 volts when the injector is commanded ON.

The above conditions are met for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history Diagnostic Trouble Code P0201 will clear after 40 consecutive warm–up cycles occur without a fault.
- Diagnostic Trouble Code P0201 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a Diagnostic Trouble Code P0201 to set. It will also cause a misfire due to an inoperative injector. A misfire Diagnostic Trouble Code will also be set indicating which cylinder is inoperative.
Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3.This step determines if Diagnostic Trouble Code P0201 is the result of a hard failure or an intermittent condition.

5. This step tests the harness wiring and PCM control of the injectors using a test light.

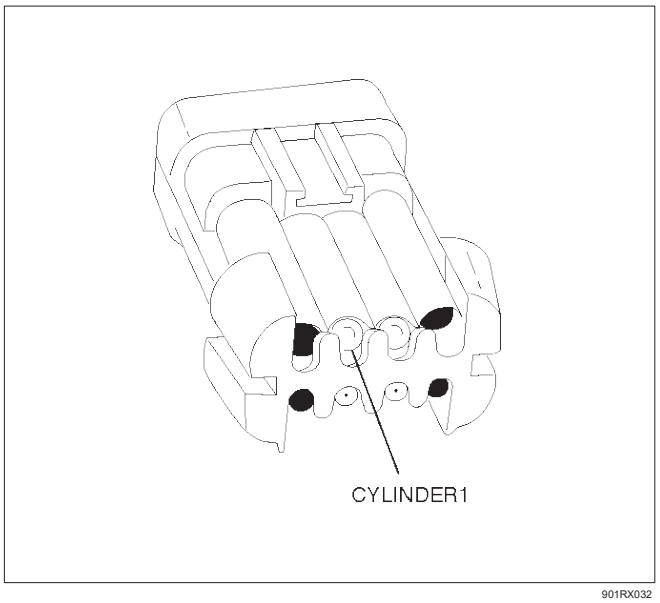
The fuel injector test connector is a gray 5 pin connector at the right rear of the valve cover. It can be identified by a blue connector lock which is tethered to the harness.

J 39021–45 is a test light with one light for each cylinder. The test light fits on the injector test connector.

If the test light is ON steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to voltage.

If the test light blinks, the PCM and the wiring to the injectors are OK. Fuel Injector Coil Test Procedure will check if the injectors are faulty.

7. Because the test light was ON steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.



901RX032

13. Normal injector resistance is slightly more than if tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5 Ω.

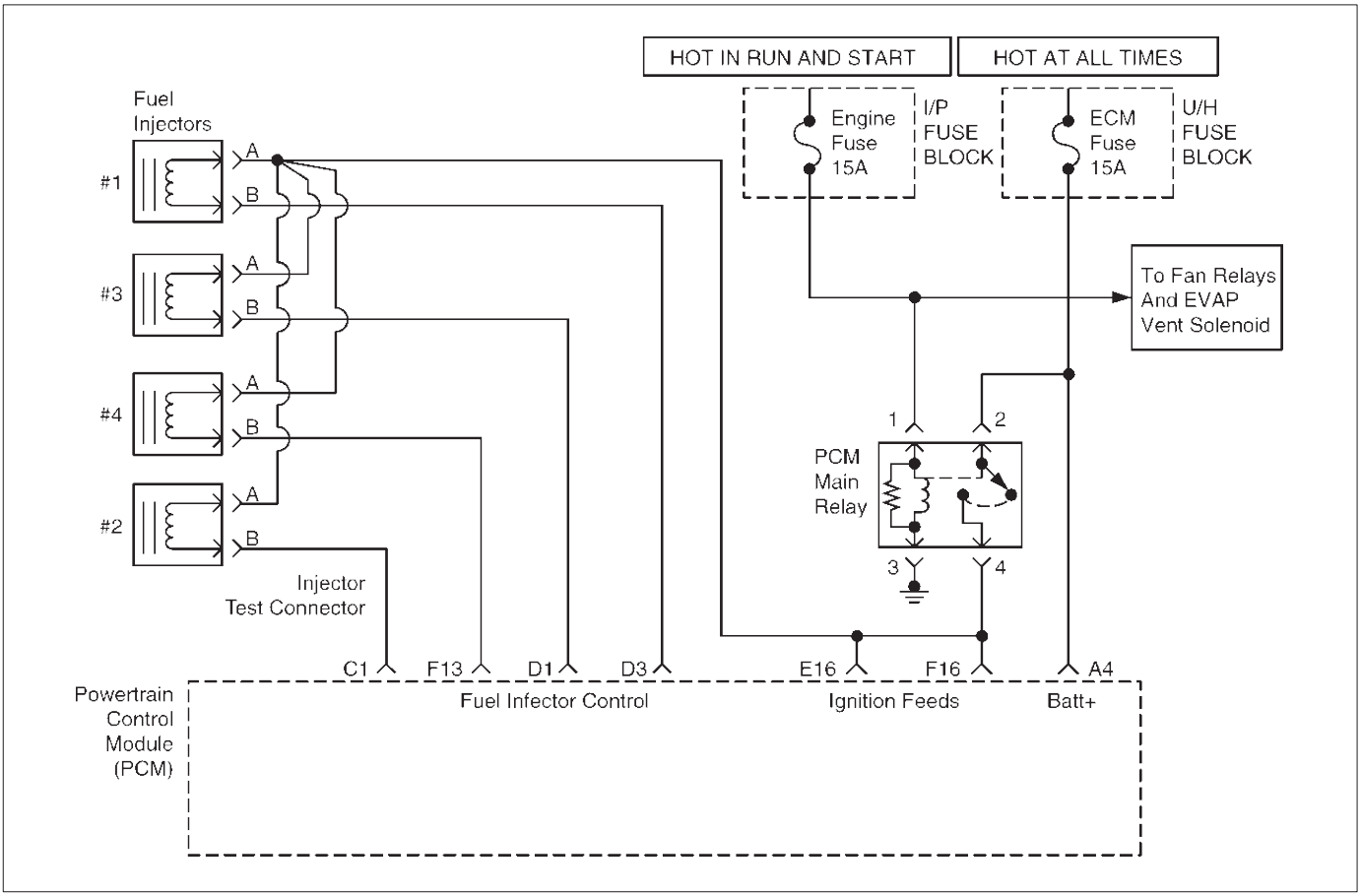
DTC P0201 – Injector Circuit Malfunction – Cylinder 1

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Will the engine start?	—	Go to Step 3	Go to Engine Cranks But Will Not Run Chart
3	1. Install the Tech 2. Clear the Diagnostic Trouble Code. 2. Idle the engine for one minute. Does Diagnostic Trouble Code P0201 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0201 reset?	—	Go to Step 5	Go to Diagnostic Aids
5	1. Ignition OFF. 2. Disconnect the injector test connector. 3. Install the injector test light J 39021–45 on the injector test connector. 4. Crank the engine while observing the light for cylinder 1. Does the injector test light blink?	—	Go to Fuel Injector Coil Test Procedure	Go to Step 6
6	Note whether the injector test light was OFF or ON steady in step 5. Was the test light ON steady while cranking the engine?	—	Go to Step 7	Go to Step 10

DTC P0201 – Injector Circuit Malfunction – Cylinder 1 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to Step 8	Go to Step 9
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to OBD System Check	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to OBD System Check	—
10	1. Disconnect the injector test connector. 2. Ignition ON. 3. Use a test light connected to ground to probe each terminal on the PCM side of the injector test connector. Only the Ign+ terminal should illuminate the test light. Besides the Ign+, did any other terminal illuminate the test light?	—	Go to Step 11	Go to Step 12
11	Repair the short to voltage in the injector driver circuit.	—	Verify repair	—
12	1. Disconnect the injector test connector. 2. Ignition ON. 3. Use a test light connected to ground to probe each pin on the injector side of the connector. Did any terminal illuminate the test light?	—	Go to Step 11	Go to Step 13
13	1. Disconnect the injector test connector. 2. Ignition OFF. 3. Clip one lead of an ohmmeter to the ignition pin on the injector side of the test connector. 4. Touch the other lead to each of the other four pins in the test connector, one pin at a time. Instead of normal injector resistance, did the ohmmeter indicate an open in one of the injector circuits?	—	Go to Step 14	Go to Step 15
14	Repair the open circuit or open injector.	—	Verify repair	—
15	Check for an open circuit between the injector test connector and the PCM connector for the Injector 1 control circuit. Was there an open circuit?	—	Go to Step 16	Go to Step 9
16	Repair the open circuit.	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0202 INJECTOR CIRCUIT MALFUNCTION – CYLINDER 2



060R100033

Circuit Description

The powertrain control module (PCM) has four individual injector driver circuits. Each controls an injector. When a driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The PCM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a Diagnostic Trouble Code is set. This Diagnostic Trouble Code is also set if an injector driver is shorted to voltage. DTC P0202 is a type A code.

Conditions for Setting the DTC

- The battery voltage is greater than 9 volts.
- Engine is running.
- Fuel pump is ON.
- The injector voltage does not equal the ignition voltage when the injector is commanded OFF or the injector voltage does not equal 0 volts when the injector is commanded ON.

The above conditions are met for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history Diagnostic Trouble Code P0202 will clear after 40 consecutive warm–up cycles occur without a fault.
- Diagnostic Trouble Code P0202 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a Diagnostic Trouble Code P0202 to set. It will also cause a misfire due to an inoperative injector. A misfire Diagnostic Trouble Code will also be set indicating which cylinder is inoperative.
Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3.This step determines if Diagnostic Trouble Code P0202 is the result of a hard failure or an intermittent condition.

5.This step tests the harness wiring and PCM control of the injectors using a test light.

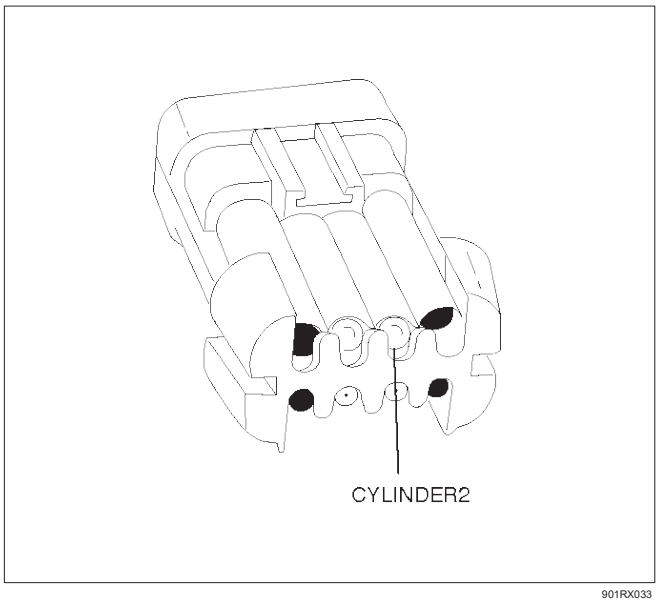
The fuel injector test connector is a gray 5 pin connector at the right rear of the valve cover. It can be identified by a blue connector lock which is tethered to the harness.

J 39021–45 is a test light with one light for each cylinder. The test light fits on the injector test connector.

If the test light is ON steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to voltage.

If the test light blinks, the PCM and the wiring to the injectors are OK. Fuel Injector Coil Test Procedure will check if the injectors are faulty.

7.Because the test light was ON steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.



901RX033

13. Normal injector resistance is slightly more than if tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5 Ω.

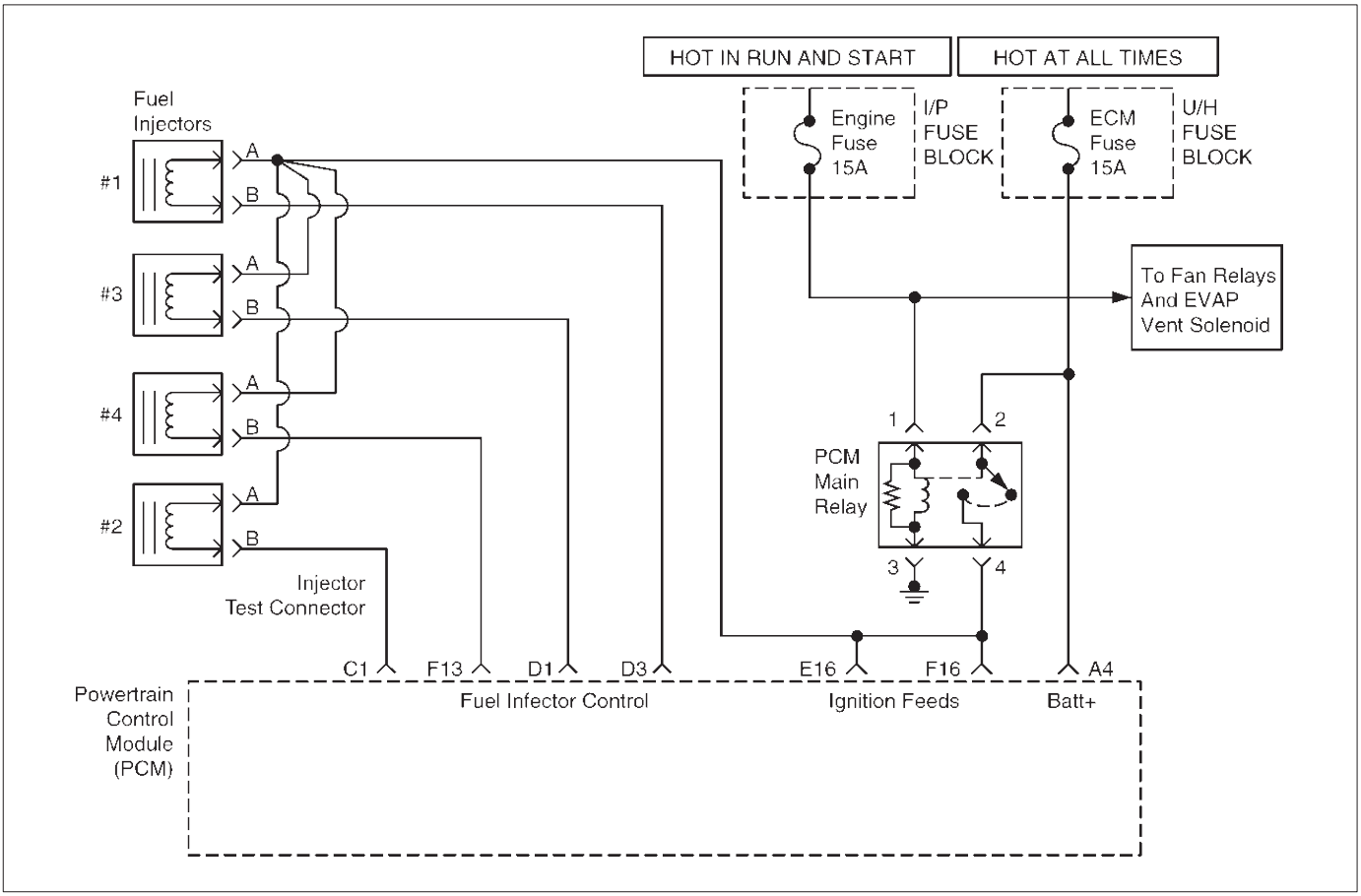
DTC P0202 – Injector Circuit Malfunction – Cylinder 2

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Will the engine start?	—	Go to Step 3	Go to Engine Cranks But Will Not Run Chart
3	1. Install the Tech 2. Clear the Diagnostic Trouble Code. 2. Idle the engine for one minute. Does Diagnostic Trouble Code P0202 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0202 reset?	—	Go to Step 5	Go to Diagnostic Aids
5	1. Ignition OFF. 2. Disconnect the injector test connector. 3. Install the injector test light J 39021–45 on the injector connector. 4. Crank the engine while observing the light for cylinder 2. Does the injector test light blink?	—	Go to Fuel Injector Coil Test Procedure	Go to Step 6
6	Note whether the injector test light was OFF or ON steady in step 5. Was the test light ON steady while cranking the engine?	—	Go to Step 7	Go to Step 10

DTC P0202 – Injector Circuit Malfunction – Cylinder 2 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to Step 8	Go to Step 9
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to OBD System Check	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to OBD System Check	—
10	1. Disconnect the injector test connector. 2. Ignition ON. 3. Use a test light connected to ground to probe each terminal on the PCM side of the injector test connector. Only the Ign+ terminal should illuminate the test light. Besides the Ign+, did any other terminal illuminate the test light?	—	Go to Step 11	Go to Step 12
11	Repair the short to voltage in the injector driver circuit.	—	Verify repair	—
12	1. Disconnect the injector test connector. 2. Ignition ON. 3. Use a test light connected to ground to probe each pin on the injector side of the connector. Did any terminal illuminate the test light?	—	Go to Step 11	Go to Step 13
13	1. Disconnect the injector test connector. 2. Ignition OFF. 3. Clip one lead of an ohmmeter to the ignition pin on the injector side of the test connector. 4. Touch the other lead to each of the other four pins in the test connector, one pin at a time. Instead of normal injector resistance, did the ohmmeter indicate an open in one of the injector circuits?	—	Go to Step 14	Go to Step 15
14	Repair the open circuit or open injector.	—	Verify repair	—
15	Check for an open circuit between the injector test connector and the PCM connector for the Injector 2 control circuit. Was there an open circuit?	—	Go to Step 16	Go to Step 9
16	Repair the open circuit.	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0203 INJECTOR CIRCUIT MALFUNCTION – CYLINDER 3



060R100033

Circuit Description

The powertrain control module (PCM) has four individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The PCM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a Diagnostic Trouble Code is set. This Diagnostic Trouble Code is also set if an injector driver is shorted to voltage. DTC P0203 is a type A code.

Conditions for Setting the DTC

- The battery voltage is greater than 9 volts.
- Engine is running.
- Fuel pump is ON.
- The injector voltage does not equal the ignition voltage when the injector is commanded OFF or the injector voltage does not equal 0 volts when the injector is commanded ON.

The above conditions are met for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was setas Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history Diagnostic Trouble Code P0203 will clear after 40 consecutive warm–up cycles occur without a fault.
- Diagnostic Trouble Code P0203 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a Diagnostic Trouble Code P0203 to set. It will also cause a misfire due to an inoperative injector. A misfire Diagnostic Trouble Code will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3. This step determines if Diagnostic Trouble Code P0203 is the result of a hard failure or an intermittent condition.

5. This step tests the harness wiring and PCM control of the injectors using a test light.

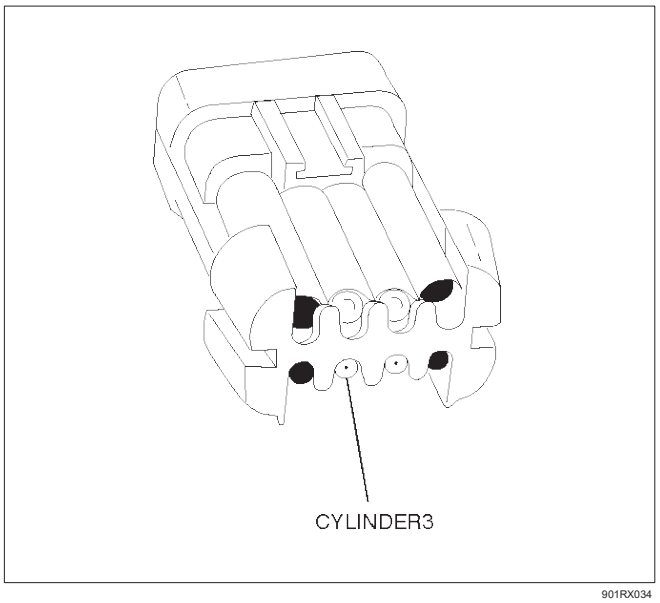
   The fuel injector test connector is a gray 5 pin connector at the right rear of the valve cover. It can be identified by a blue connector lock which is tethered to the harness.

   J 39021–45 is a test light with one light for each cylinder. The test light fits on the injector test connector.

   If the test light is ON steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to voltage.

   If the test light blinks, the PCM and the wiring to the injectors are OK. Fuel Injector Coil Test Procedure will check if the injectors are faulty.

7. Because the test light was ON steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.



901RX034

13. Normal injector resistance is slightly more than if tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5 Ω.

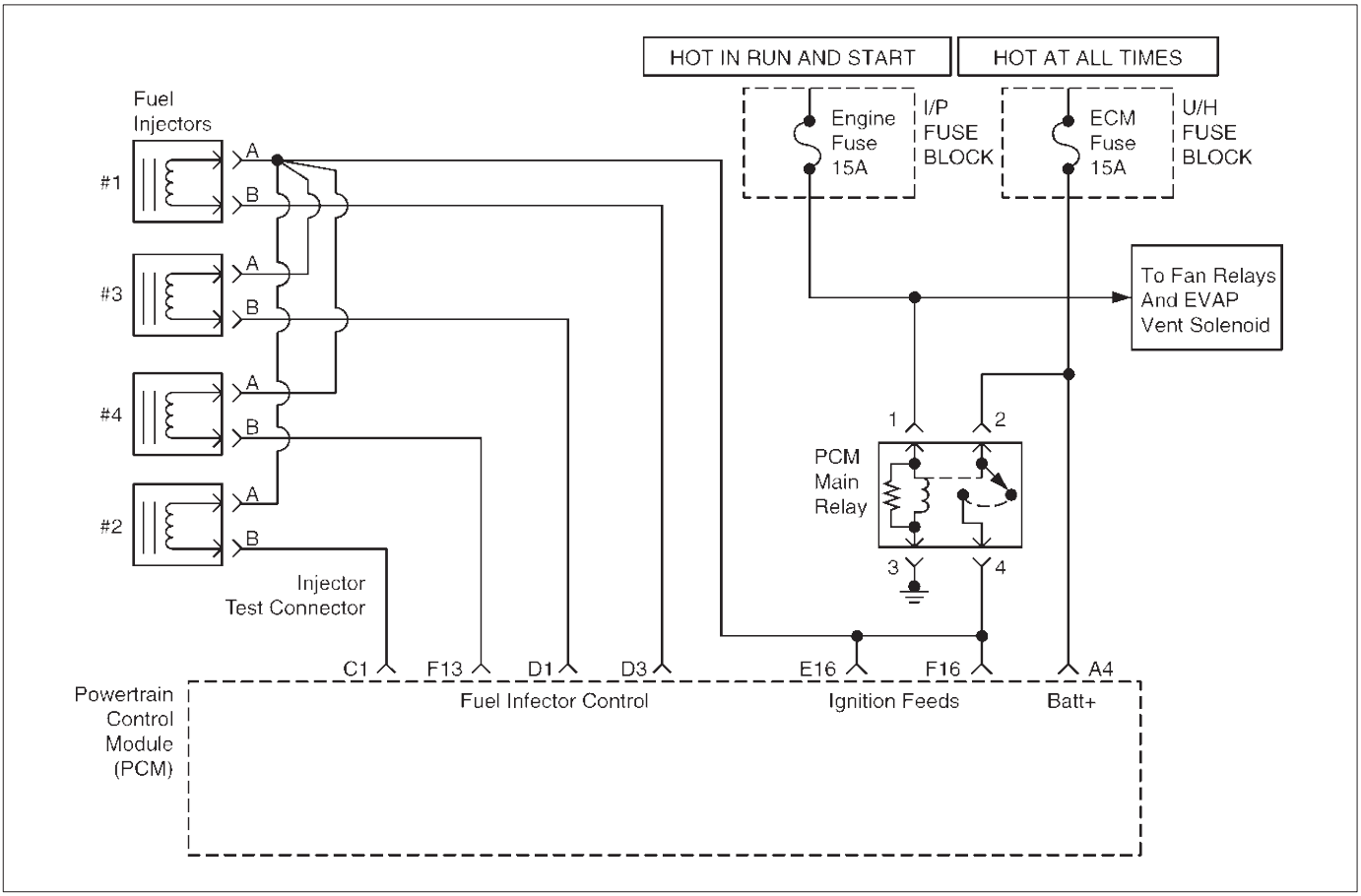
DTC P0203 – Injector Circuit Malfunction – Cylinder 3

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Will the engine start?	—	Go to Step 3	Go to Engine Cranks But Will Not Run Chart
3	1. Install the Tech 2. Clear the Diagnostic Trouble Code. 2. Idle the engine for one minute. Does Diagnostic Trouble Code P0203 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0203 reset?	—	Go to Step 5	Go to Diagnostic Aids
5	1. Ignition OFF. 2. Disconnect the injector test connector. 3. Install the injector test light J 39021–45 on the injector connector. 4. Crank the engine while observing the light for cylinder 3. Does the injector test light blink?	—	Go to Fuel Injector Coil Test Procedure	Go to Step 6
6	Note whether the injector test light was OFF or ON steady in step 5. Was the test light ON steady while cranking the engine?	—	Go to Step 7	Go to Step 10

DTC P0203 – Injector Circuit Malfunction – Cylinder 3 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to Step 8	Go to Step 9
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to OBD System Check	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to OBD System Check	—
10	1. Disconnect the injector test connector. 2. Ignition ON. 3. Use a test light connected to ground to probe each terminal on the PCM side of the injector test connector. Only the Ign+ terminal should illuminate the test light. Besides the Ign+, did any other terminal illuminate the test light?	—	Go to Step 11	Go to Step 12
11	Repair the short to voltage in the injector driver circuit.	—	Verify repair	—
12	1. Disconnect the injector test connector. 2. Ignition ON. 3. Use a test light connected to ground to probe each pin on the injector side of the connector. Did any terminal illuminate the test light?	—	Go to Step 11	Go to Step 13
13	1. Disconnect the injector test connector. 2. Ignition OFF. 3. Clip one lead of an ohmmeter to the ignition pin on the injector side of the test connector. 4. Touch the other lead to each of the other four pins in the test connector, one pin at a time. Instead of normal injector resistance, did the ohmmeter indicate an open in one of the injector circuits?	—	Go to Step 14	Go to Step 15
14	Repair the open circuit or open injector.	—	Verify repair	—
15	Check for an open circuit between the injector test connector and the PCM connector for the Injector 3 control circuit. Was there an open circuit?	—	Go to Step 16	Go to Step 9
16	Repair the open circuit.	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0204 INJECTOR CIRCUIT MALFUNCTION – CYLINDER 4



Circuit Description

The powertrain control module (PCM) has four individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The PCM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a Diagnostic Trouble Code is set. This Diagnostic Trouble Code is also set if an injector driver is shorted to voltage. DTC P0204 is a type A code.

Conditions for Setting the DTC

- The battery voltage is greater than 9 volts.
- Engine is running.
- Fuel pump is ON.
- The injector voltage does not equal the ignition voltage when the injector is commanded OFF or the injector voltage does not equal 0 volts when the injector is commanded ON.

The above conditions are met for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history Diagnostic Trouble Code P0204 will clear after 40 consecutive warm–up cycles occur without a fault.
- Diagnostic Trouble Code P0204 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a Diagnostic Trouble Code P0204 to set. It will also cause a misfire due to an inoperative injector. A misfire Diagnostic Trouble Code will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

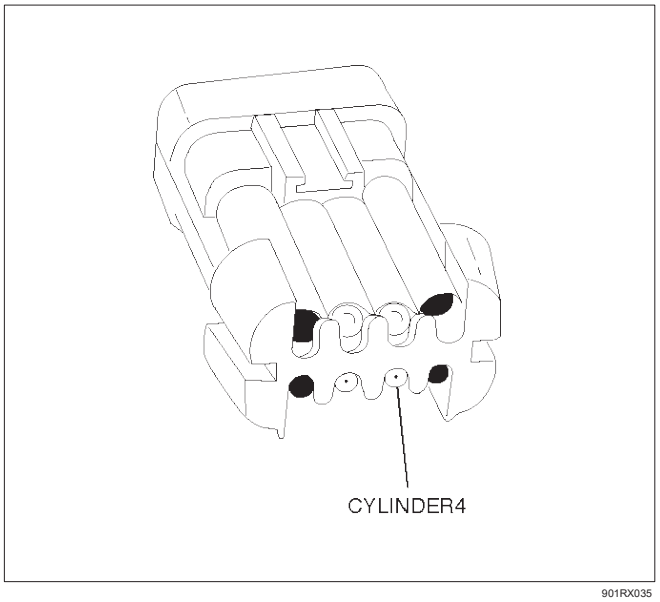
3. This step determines if Diagnostic Trouble Code P0204 is the result of a hard failure or an intermittent condition.
5. This step tests the harness wiring and PCM control of the injectors using a test light.

   The fuel injector test connector is a gray 5 pin connector at the right rear of the valve cover. It can be identified by a blue connector lock which is tethered to the harness.

   J 39021–45 is a test light with one light for each cylinder. The test light fits on the injector test connector.

   If the test light is ON steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to voltage.

   If the test light blinks, the PCM and the wiring to the injectors are OK. Fuel Injector Coil Test Procedure will check if the injectors are faulty.
7. Because the test light was ON steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.



901RX035

13. Normal injector resistance is slightly more than if tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5 Ω.

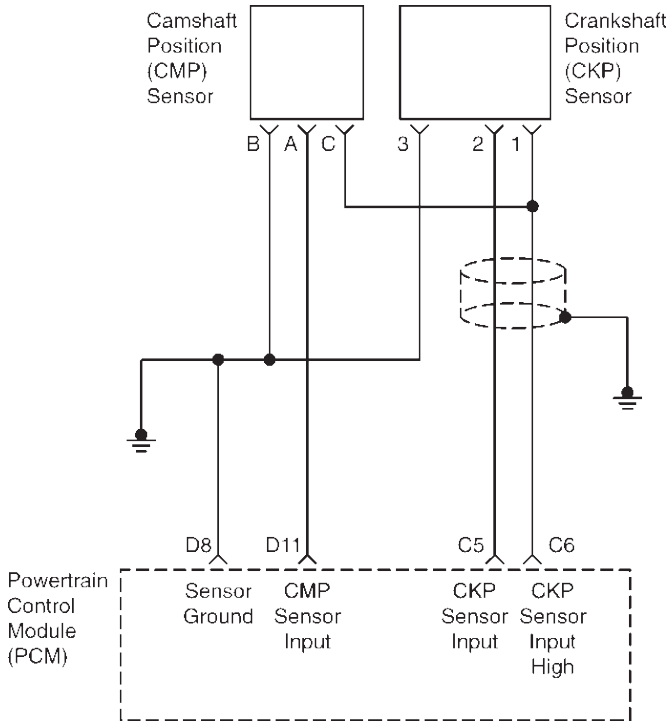
DTC P0204 – Injector Circuit Malfunction – Cylinder 4

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Will the engine start?	—	Go to Step 3	Go to Engine Cranks But Will Not Run Chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0204 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0204 reset?	—	Go to Step 5	Go to Diagnostic Aids
5	1. Ignition OFF. 2. Disconnect the injector test connector. 3. Install the injector test light J 39021–45 on the injector connector. 4. Crank the engine while observing the light for cylinder 4. Does the injector test light blink?	—	Go to Fuel Injector Coil Test Procedure	Go to Step 6
6	Note whether the injector test light was OFF or ON steady in step 5. Was the test light ON steady while cranking the engine?	—	Go to Step 7	Go to Step 10

DTC P0204 – Injector Circuit Malfunction – Cylinder 4 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to Step 8	Go to Step 9
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to OBD System Check	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to OBD System Check	—
10	1. Disconnect the injector test connector. 2. Ignition ON. 3. Use a test light connected to ground to probe each terminal on the PCM side of the injector test connector. Only the Ign+ terminal should illuminate the test light. Besides the Ign+, did any other terminal illuminate the test light?	—	Go to Step 11	Go to Step 12
11	Repair the short to voltage in the injector driver circuit.	—	Verify repair	—
12	1. Disconnect the injector test connector. 2. Ignition ON. 3. Use a test light connected to ground to probe each pin on the injector side of the connector. Did any terminal illuminate the test light?	—	Go to Step 11	Go to Step 13
13	1. Disconnect the injector test connector. 2. Ignition OFF. 3. Clip one lead of an ohmmeter to the ignition pin on the injector side of the test connector. 4. Touch the other lead to each of the other four pins in the test connector, one pin at a time. Instead of normal injector resistance, did the ohmmeter indicate an open in one of the injector circuits?	—	Go to Step 14	Go to Step 15
14	Repair the open circuit or open injector.	—	Verify repair	—
15	Check for an open circuit between the injector test connector and the PCM connector for the Injector 3 control circuit. Was there an open circuit?	—	Go to Step 16	Go to Step 9
16	Repair the open circuit.	—	—	Verify repair

DIAGNOSTIC TROUBLE CODE (DTC)
P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED



060R100034

Circuit Description

If the PCM determines that the engine is misfiring and cannot determine the actual cylinder that is misfiring then it will log the trouble code P0300. This is normally the case shere the misfire is caused by the ignition coil(s) which would then cause a misfire to happen in more than one cylinder.

Conditions for Setting the DTC

- None of the following Diagnostic Trouble Codes are present: TP sensor, MAP sensor, CMP sensor, VSS, ECT, CKP sensor.
- The engine speed is between 687 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The engine coolant temperature sensor (ECT) indicates an engine temperature between –6.75˚C (20˚F) and 120˚C (248˚F).
- Throttle angle is steady and throttle angle changes less than 2.73% per 100 milliseconds.
- The PCM detects a crankshaft RPM variation indicating a misfire that is sufficient to cause catalytic converter damage or emissions levels to exceed the mandated standard.
- TP sensor reads less than 3.125%.
- Vehicle speed is greater than 19km/h (12mph).
- Fuel level is more than 14.8%.
- ECT is less than –7.0˚C (19.4˚F) at startup engine.
- ECT is less than 20.75˚C (69.35˚F) and 120˚C (248˚F).
- Rough road table based on rough road valve from ABS vs vehicle speed.
- Decelation index versus engine speed versus load and crank position.
- Emission damage misfire ratio more than 2.00%.
- Catalyst damage misfire ratio 11–25%.

Emission level is 5 failed 200 revolution blocks out of 16. Catalyst Damage level is 4 of 16 failed 200 engine cycle blocks.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history Diagnostic Trouble Code P0300 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0300 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

The Tech 2 displays "Misfire Cur. # 1 through #4" can be useful to determine whether the misfire is isolated to a single cylinder.

- Damaged or faulty ignition coils – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If misfire follows the coil, replace the ignition coil.

If the misfire is random, check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Air induction system – Check for disconnected or damaged vacuum hoses, incorrectly installed or faulty PCV valve, or for vacuum leaks at the throttle body, EGR valve, and intake manifold mounting surfaces.
- Fuel pressure – Perform a fuel system pressure test. A faulty fuel pump, plugged filter, or faulty fuel system pressure regulator will contribute to a lean condition.
- Excessive engine vibration – This may falsely set a P0300. Refer to Engine Mechanical Diagnosis to check for a falsely Mechanical condition or component.
- Injector(s) – Perform an injector coil/balance test to locate faulty injector(s) contributing to a lean or flooding condition. In addition to the above test, check the condition of the injector O–rings.
- EGR – Check for a leaking valve, adapter, or feed pipes which will contribute to a lean condition or excessive EGR flow.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

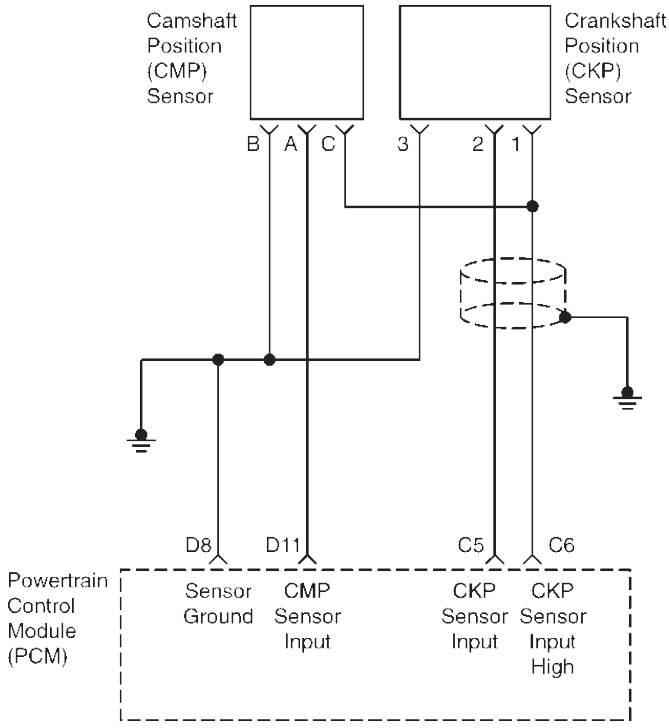
DTC P0300 – Random/Multiple Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Start and idle the engine. 2. Review and record the Tech 2 Freeze Frame data. 3. Operate the vehicle to duplicate the conditions present when the Diagnostic Trouble Code was set (as defined by the Freeze Frame data). 4. Monitor the Tech 2 ”Misfire Cur. #” display for each cylinder. Is ”Misfire Cur. #” display increasing for any cylinder (indicating a misfire currently occurring)?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. 2. If a problem is found, repair or replace the vacuum hoses as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 4
4	1. Visually and physically inspect the following areas for vacuum leaks: ● Intake manifold ● Injector O–rings ● EGR valve ● EGR feed pipes Did your inspection reveal a vacuum leak?	—	Verify repair	Go to Step 5
5	Inspect the crankcase ventilation valve for proper installation or a cracked hose. Did your inspection reveal a problem?	—	Verify repair	Go to Step 6
6	1. Remove and visually/physically inspect the ignition coils. Ensure that the coils are free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coils. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Remove the EGR valve and visually/physically inspect the pintle to ensure that it is not sticking partially open. Also, inspect the EGR valve pintle and seat for carbon deposits or burrs that may interfere with the pintle closing completely. 2. If a problem is found, clean the EGR valve pintle and seat or replace the EGR valve as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 8
8	1. Install a spark tester at the spark plug end of the ignition wire for the cylinder that is indicated by the ”Misfire Cur. Counters” or ”Misfire Hist. Counters” as having the most severe misfire (largest number of counts). 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to Step 13	Go to Step 9

DTC P0300 – Random/Multiple Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Remove the spark plugs from the cylinders that were indicated as misfiring. 2. Visually inspect the spark plug electrodes. Does your inspection reveal any spark plugs exhibiting excessive fouling?	—	Go to Engine Mechanical Diagnosis	Go to Step 10
10	1. Visually inspect the spark plug insulators for cracks, carbon tracking, or other damage. 2. If a problem is found, replace the faulty spark plug(s) as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 11
11	Replace the ignition control module.	—	Verify repair	—
12	1. Inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight and in their proper locations. 2. If a problem is found, correct the faulty ground condition as necessary. Did your inspection reveal a poor ground?	—	Verify repair	Go to Step 13
13	1. Perform the "Fuel System Pressure Test" procedure. 2. If a problem is found, repair as necessary (refer to Engine Fuel or Fuel Metering System). Was a fuel system problem found?	—	Verify repair	Go to Step 14
14	1. Check the fuel for excessive water, alcohol, or other contaminants (refer to Diagnosis in Engine Fuel for procedure). Was the fuel contaminated?	—	Verify repair	Go to Step 15
15	1. Perform the "Injector Coil/Balance Test." 2. If a problem is found, replace the faulty injector(s) as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to Step 16
16	Check for an engine mechanical problem. Refer to Engine Mechanical Diagnosis to diagnose the following conditions: ● A faulty or incorrect camshaft ● Leaking or sticky valves or piston rings ● Excessive valve deposits ● Loose or worn rocker arms ● Weak valve springs ● Incorrect valve timing ● A leaking head gasket ● A loose or broken motor mount	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0301 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED



060R100034

Circuit Description

If the PCM determines that the engine is misfiring and can determine the actual cylinder that is misfiring then it will log the individual trouble code for that cylinder P0301. This is normally the situation in the case of a failed fuel injector, spark plug or ignition lead.

Conditions for Setting the DTC

- None of the following Diagnostic Trouble Codes are present: TP sensor, MAP sensor, CMP sensor, VSS, ECT, CKP sensor.
- The engine speed is between 687 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The engine coolant temperature sensor (ECT) indicates an engine temperature between –6.75˚C (20˚F) and 120˚C (248˚F).
- Throttle angle is steady and throttle angle changes less than 2.73% per 100 milliseconds.
- The PCM detects a crankshaft RPM variation indicating a misfire that is sufficient to cause catalytic converter damage or emissions levels to exceed the mandated standard.
- TP sensor reads less than 3.125%.
- Vehicle speed is greater than 19km/h (12mph).
- Engine under load.
- Fuel level is more than 14.8%.
- ECT is less than –7.0˚C (19.4˚F) at startup engine.
- ECT is less than 20.75˚C (69.35˚F) and 120˚C (248˚F).
- Rough road table based on rough road valve from ABS vs vehicle speed.
- Decelation index versus engine speed versus load and crank position.
- Emission damage misfire ratio more than 2.00%.
- Catalyst damage misfire ratio 11–25%.

Emission level is 5 failed 200 revolution blocks out of 16. Catalyst Damage level is 4 of 16 failed 200 engine cycle blocks.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history Diagnostic Trouble Code P0301 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0301 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

The Tech 2 displays "Misfire Cur. # 1 through #4" can be useful to determine whether the misfire is isolated to a single cylinder.

- Damaged or faulty ignition coils – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If misfire follows the coil, replace the ignition coil.

If the misfire is random, check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Air induction system – Check for disconnected or damaged vacuum hoses, incorrectly installed or faulty PCV valve, or for vacuum leaks at the throttle body, EGR valve, and intake manifold mounting surfaces.
- Fuel pressure – Perform a fuel system pressure test. A faulty fuel pump, plugged filter, or faulty fuel system pressure regulator will contribute to a lean condition.
- Excessive engine vibration – This may falsely set a P0301. Refer to Engine Mechanical Diagnosis to check for a falsely Mechanical condition or component.
- Injector(s) – Perform an injector coil/balance test to locate faulty injector(s) contributing to a lean or flooding condition. In addition to the above test, check the condition of the injector O–rings.
- EGR – Check for a leaking valve, adapter, or feed pipes which will contribute to a lean condition or excessive EGR flow.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

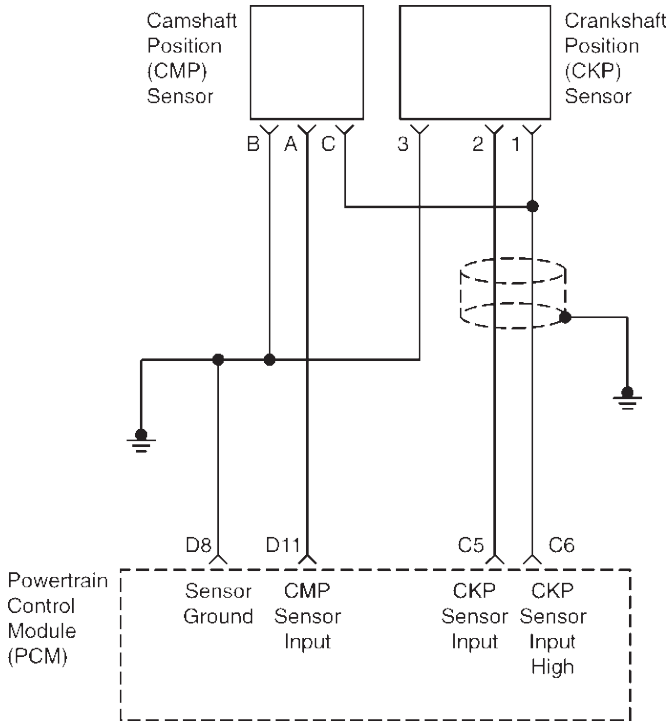
DTC P0301 – Random/Multiple Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Start and idle the engine. 2. Review and record the Tech 2 Freeze Frame data. 3. Operate the vehicle to duplicate the conditions present when the Diagnostic Trouble Code was set (as defined by the Freeze Frame data). 4. Monitor the Tech 2 ”Misfire Cur. #” display for each cylinder. Is ”Misfire Cur. #” display increasing for any cylinder (indicating a misfire currently occurring)?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. 2. If a problem is found, repair or replace the vacuum hoses as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 4
4	1. Visually and physically inspect the following areas for vacuum leaks: ● Intake manifold ● Injector O–rings ● EGR valve ● EGR feed pipes Did your inspection reveal a vacuum leak?	—	Verify repair	Go to Step 5
5	Inspect the crankcase ventilation valve for proper installation or a cracked hose. Did your inspection reveal a problem?	—	Verify repair	Go to Step 6
6	1. Remove and visually/physically inspect the ignition coils. Ensure that the coils are free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coils. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Install a spark tester at the spark plug end of the ignition wire for the cylinder that is indicated by the ”Misfire Cur. Counters” or ”Misfire Hist. Counters” as having the most severe misfire (largest number of counts). 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to Step 12	Go to Step 8
8	1. Remove the spark plugs from the cylinders that were indicated as misfiring. 2. Visually inspect the spark plug electrodes. Does your inspection reveal any spark plugs exhibiting excessive fouling?	—	Go to Engine Mechanical Diagnosis	Go to Step 9

DTC P0301 – Random/Multiple Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Visually inspect the spark plug insulators for cracks, carbon tracking, or other damage. 2. If a problem is found, replace the faulty spark plug(s) as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 10
10	Replace the ignition control module.	—	Verify repair	—
11	1. Inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight and in their proper locations. 2. If a problem is found, correct the faulty ground condition as necessary. Did your inspection reveal a poor ground?	—	Verify repair	Go to Step 12
12	1. Perform the "Fuel System Pressure Test" procedure. 2. If a problem is found, repair as necessary (refer to Engine Fuel or Fuel Metering System). Was a fuel system problem found?	—	Verify repair	Go to Step 13
13	1. Check the fuel for excessive water, alcohol, or other contaminants (refer to Diagnosis in Engine Fuel for procedure). Was the fuel contaminated?	—	Verify repair	Go to Step 14
14	1. Perform the "Injector Coil/Balance Test." 2. If a problem is found, replace the faulty injector(s) as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to Step 15
15	Check for an engine mechanical problem. Refer to Engine Mechanical Diagnosis to diagnose the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or piston rings • Excessive valve deposits • Loose or worn rocker arms • Weak valve springs • Incorrect valve timing • A leaking head gasket • A loose or broken motor mount	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0302 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED



060R100034

Circuit Description

If the PCM determines that the engine is misfiring and can determine the actual cylinder that is misfiring then it will log the individual trouble code for that cylinder P0302. This is normally the situation in the case of a failed fuel injector, spark plug or ignition lead.

Conditions for Setting the DTC

- None of the following Diagnostic Trouble Codes are present: TP sensor, MAP sensor, CMP sensor, VSS, ECT, CKP sensor.
- The engine speed is between 687 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The engine coolant temperature sensor (ECT) indicates an engine temperature between –6.75˚C (20˚F) and 120˚C (248˚F).
- Throttle angle is steady and throttle angle changes less than 2.73% per 100 milliseconds.
- The PCM detects a crankshaft RPM variation indicating a misfire that is sufficient to cause catalytic converter damage or emissions levels to exceed the mandated standard.
- TP sensor reads less than 3.125%.
- Vehicle speed is greater than 19km/h (12mph).
- Fuel level is more than 14.8%.
- ECT is less than –7.0˚C (19.4˚F) at startup engine.
- ECT is less than 20.75˚C (69.35˚F) and 120˚C (248˚F).
- Rough road table based on rough road valve from ABS vs vehicle speed.
- Decelation index versus engine speed versus load and crank position.
- Emission damage misfire ratio more than 2.00%.
- Catalyst damage misfire ratio 11–25%.

Emission level is 5 failed 200 revolution blocks out of 16. Catalyst Damage level is 4 of 16 failed 200 engine cycle blocks.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DiagnosticTrouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0302 will clear after 40 consecutive warm–up cycles have occurred without a fault.

- Diagnostic Trouble Code P0302 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

The Tech 2 displays "Misfire Cur. # 1 through #4" can be useful to determine whether the misfire is isolated to a single cylinder.

- Damaged or faulty ignition coils – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If misfire follows the coil, replace the ignition coil.

If the misfire is random, check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Air induction system – Check for disconnected or damaged vacuum hoses, incorrectly installed or faulty PCV valve, or for vacuum leaks at the throttle body, EGR valve, and intake manifold mounting surfaces.
- Fuel pressure – Perform a fuel system pressure test. A faulty fuel pump, plugged filter, or faulty fuel system pressure regulator will contribute to a lean condition.
- Excessive engine vibration – This may falsely set a P0302. Refer to Engine Mechanical Diagnosis to check for a falsely Mechanical condition or component.
- Injector(s) – Perform an injector coil/balance test to locate faulty injector(s) contributing to a lean or flooding condition. In addition to the above test, check the condition of the injector O–rings.
- EGR – Check for a leaking valve, adapter, or feed pipes which will contribute to a lean condition or excessive EGR flow.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

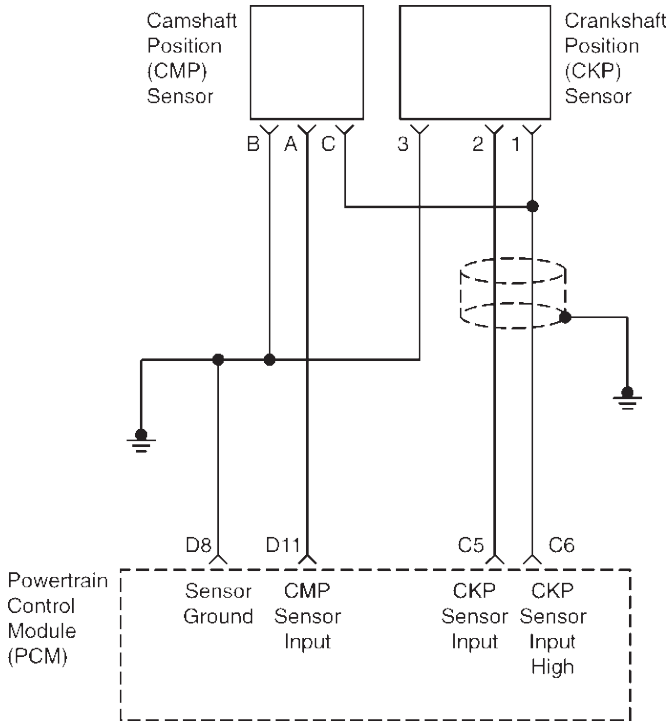
DTC P0302 – Random/Multiple Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Start and idle the engine. 2. Review and record the Tech 2 Freeze Frame data. 3. Operate the vehicle to duplicate the conditions present when the Diagnostic Trouble Code was set (as defined by the Freeze Frame data). 4. Monitor the Tech 2 ”Misfire Cur. #” display for each cylinder. Is ”Misfire Cur. #” display increasing for any cylinder (indicating a misfire currently occurring)?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. 2. If a problem is found, repair or replace the vacuum hoses as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 4
4	1. Visually and physically inspect the following areas for vacuum leaks: ● Intake manifold ● Injector O–rings ● EGR valve ● EGR feed pipes Did your inspection reveal a vacuum leak?	—	Verify repair	Go to Step 5
5	Inspect the crankcase ventilation valve for proper installation or a cracked hose. Did your inspection reveal a problem?	—	Verify repair	Go to Step 6
6	1. Remove and visually/physically inspect the ignition coils. Ensure that the coils are free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coils. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Install a spark tester at the spark plug end of the ignition wire for the cylinder that is indicated by the ”Misfire Cur. Counters” or ”Misfire Hist. Counters” as having the most severe misfire (largest number of counts). 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to Step 12	Go to Step 8
8	1. Remove the spark plugs from the cylinders that were indicated as misfiring. 2. Visually inspect the spark plug electrodes. Does your inspection reveal any spark plugs exhibiting excessive fouling?	—	Go to Engine Mechanical Diagnosis	Go to Step 9

DTC P0302 – Random/Multiple Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Visually inspect the spark plug insulators for cracks, carbon tracking, or other damage. 2. If a problem is found, replace the faulty spark plug(s) as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 10
10	Replace the ignition control module.	—	Verify repair	—
11	1. Inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight and in their proper locations. 2. If a problem is found, correct the faulty ground condition as necessary. Did your inspection reveal a poor ground?	—	Verify repair	Go to Step 12
12	1. Perform the "Fuel System Pressure Test" procedure. 2. If a problem is found, repair as necessary (refer to Engine Fuel or Fuel Metering System). Was a fuel system problem found?	—	Verify repair	Go to Step 13
13	1. Check the fuel for excessive water, alcohol, or other contaminants (refer to Diagnosis in Engine Fuel for procedure). Was the fuel contaminated?	—	Verify repair	Go to Step 14
14	1. Perform the "Injector Coil/Balance Test." 2. If a problem is found, replace the faulty injector(s) as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to Step 15
15	Check for an engine mechanical problem. Refer to Engine Mechanical Diagnosis to diagnose the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or piston rings • Excessive valve deposits • Loose or worn rocker arms • Weak valve springs • Incorrect valve timing • A leaking head gasket • A loose or broken motor mount	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0303 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED



060R100034

Circuit Description

If the PCM determines that the engine is misfiring and can determine the actual cylinder that is misfiring then it will log the individual trouble code for that cylinder P0303. This is normally the situation in the case of a failed fuel injector, spark plug or ignition lead.

Conditions for Setting the DTC

- None of the following Diagnostic Trouble Codes are present: TP sensor, MAP sensor, CMP sensor, VSS, ECT, CKP sensor.
- The engine speed is between 687 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The engine coolant temperature sensor (ECT) indicates an engine temperature between –6.75˚C (20˚F) and 120˚C (248˚F).
- Throttle angle is steady and throttle angle changes less than 2.73% per 100 milliseconds.
- The PCM detects a crankshaft RPM variation indicating a misfire that is sufficient to cause catalytic converter damage or emissions levels to exceed the mandated standard.
- TP sensor reads less than 3.125%.
- Vehicle speed is greater than 19km/h (12mph).
- Fuel level is more than 14.8%.
- ECT is less than –7.0˚C (19.4˚F) at startup engine.
- ECT is less than 20.75˚C (69.35˚F) and 120˚C (248˚F).
- Rough road table based on rough road valve from ABS vs vehicle speed.
- Decelation index versus engine speed versus load and crank position.
- Emission damage misfire ratio more than 2.00%.
- Catalyst damage misfire ratio 11–25%.

Emission level is 5 failed 200 revolution blocks out of 16. Catalyst Damage level is 4 of 16 failed 200 engine cycle blocks.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0303 will clear after 40 consecutive warm–up cycles have occurred without a fault.

- Diagnostic Trouble Code P0303 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

The Tech 2 displays "Misfire Cur. # 1 through #4" can be useful to determine whether the misfire is isolated to a single cylinder.

- Damaged or faulty ignition coils – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If misfire follows the coil, replace the ignition coil.

If the misfire is random, check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Air induction system – Check for disconnected or damaged vacuum hoses, incorrectly installed or faulty PCV valve, or for vacuum leaks at the throttle body, EGR valve, and intake manifold mounting surfaces.
- Fuel pressure – Perform a fuel system pressure test. A faulty fuel pump, plugged filter, or faulty fuel system pressure regulator will contribute to a lean condition.
- Excessive engine vibration – This may falsely set a P0303. Refer to Engine Mechanical Diagnosis to check for a falsely Mechanical condition or component.
- Injector(s) – Perform an injector coil/balance test to locate faulty injector(s) contributing to a lean or flooding condition. In addition to the above test, check the condition of the injector O–rings.
- EGR – Check for a leaking valve, adapter, or feed pipes which will contribute to a lean condition or excessive EGR flow.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

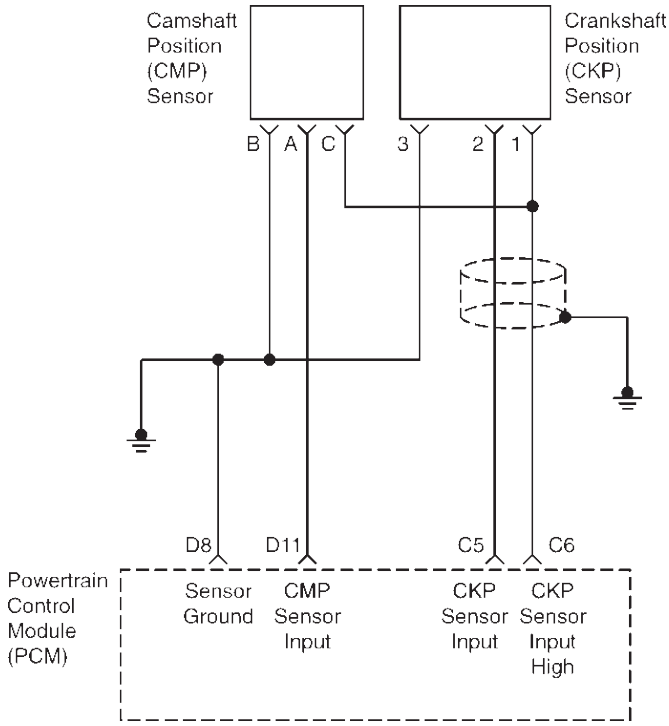
DTC P0303 – Random/Multiple Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Start and idle the engine. 2. Review and record the Tech 2 Freeze Frame data. 3. Operate the vehicle to duplicate the conditions present when the Diagnostic Trouble Code was set (as defined by the Freeze Frame data). 4. Monitor the Tech 2 ”Misfire Cur. #” display for each cylinder. Is ”Misfire Cur. #” display increasing for any cylinder (indicating a misfire currently occurring)?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. 2. If a problem is found, repair or replace the vacuum hoses as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 4
4	1. Visually and physically inspect the following areas for vacuum leaks: ● Intake manifold ● Injector O–rings ● EGR valve ● EGR feed pipes Did your inspection reveal a vacuum leak?	—	Verify repair	Go to Step 5
5	Inspect the crankcase ventilation valve for proper installation or a cracked hose. Did your inspection reveal a problem?	—	Verify repair	Go to Step 6
6	1. Remove and visually/physically inspect the ignition coils. Ensure that the coils are free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coils. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Install a spark tester at the spark plug end of the ignition wire for the cylinder that is indicated by the ”Misfire Cur. Counters” or ”Misfire Hist. Counters” as having the most severe misfire (largest number of counts). 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to Step 12	Go to Step 8
8	1. Remove the spark plugs from the cylinders that were indicated as misfiring. 2. Visually inspect the spark plug electrodes. Does your inspection reveal any spark plugs exhibiting excessive fouling?	—	Go to Engine Mechanical Diagnosis	Go to Step 9

DTC P0303 – Random/Multiple Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Visually inspect the spark plug insulators for cracks, carbon tracking, or other damage. 2. If a problem is found, replace the faulty spark plug(s) as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 10
10	Replace the ignition control module.	—	Verify repair	—
11	1. Inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight and in their proper locations. 2. If a problem is found, correct the faulty ground condition as necessary. Did your inspection reveal a poor ground?	—	Verify repair	Go to Step 12
12	1. Perform the "Fuel System Pressure Test" procedure. 2. If a problem is found, repair as necessary (refer to Engine Fuel or Fuel Metering System). Was a fuel system problem found?	—	Verify repair	Go to Step 13
13	1. Check the fuel for excessive water, alcohol, or other contaminants (refer to Diagnosis in Engine Fuel for procedure). Was the fuel contaminated?	—	Verify repair	Go to Step 14
14	1. Perform the "Injector Coil/Balance Test." 2. If a problem is found, replace the faulty injector(s) as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to Step 15
15	Check for an engine mechanical problem. Refer to Engine Mechanical Diagnosis to diagnose the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or piston rings • Excessive valve deposits • Loose or worn rocker arms • Weak valve springs • Incorrect valve timing • A leaking head gasket • A loose or broken motor mount	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0304 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED



060R100034

Circuit Description

If the PCM determines that the engine is misfiring and can determine the actual cylinder that is misfiring then it will log the individual trouble code for that cylinder P0304. This is normally the situation in the case of a failed fuel injector, spark plug or ignition lead.

Conditions for Setting the DTC

- None of the following Diagnostic Trouble Codes are present: TP sensor, MAP sensor, CMP sensor, VSS, ECT, CKP sensor.
- The engine speed is between 687 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The engine coolant temperature sensor (ECT) indicates an engine temperature between –6.75˚C (20˚F) and 120˚C (248˚F).
- Throttle angle is steady and throttle angle changes less than 2.73% per 100 milliseconds.
- The PCM detects a crankshaft RPM variation indicating a misfire that is sufficient to cause catalytic converter damage or emissions levels to exceed the mandated standard.
- TP sensor reads less than 3.125%.
- Vehicle speed is greater than 19km/h (12mph).
- Engine under load.
- Fuel level is more than 14.8%.
- ECT is less than –7.0˚C (19.4˚F) at startup engine.
- ECT is less than 20.75˚C (69.35˚F) and 120˚C (248˚F).
- Rough road table based on rough road valve from ABS vs vehicle speed.
- Decelation index versus engine speed versus load and crank position.
- Emission damage misfire ratio more than 2.00%.
- Catalyst damage misfire ratio 11–25%.

Emission level is 5 failed 200 revolution blocks out of 16. Catalyst Damage level is 4 of 16 failed 200 engine cycle blocks.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history Diagnostic Trouble Code P0304 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0304 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

The Tech 2 displays "Misfire Cur. # 1 through #4" can be useful to determine whether the misfire is isolated to a single cylinder.

- Damaged or faulty ignition coils – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If misfire follows the coil, replace the ignition coil.

If the misfire is random, check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Air induction system – Check for disconnected or damaged vacuum hoses, incorrectly installed or faulty PCV valve, or for vacuum leaks at the throttle body, EGR valve, and intake manifold mounting surfaces.
- Fuel pressure – Perform a fuel system pressure test. A faulty fuel pump, plugged filter, or faulty fuel system pressure regulator will contribute to a lean condition.
- Excessive engine vibration – This may falsely set a P0304. Refer to Engine Mechanical Diagnosis to check for a falsely Mechanical condition or component.
- Injector(s) – Perform an injector coil/balance test to locate faulty injector(s) contributing to a lean or flooding condition. In addition to the above test, check the condition of the injector O–rings.
- EGR – Check for a leaking valve, adapter, or feed pipes which will contribute to a lean condition or excessive EGR flow.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

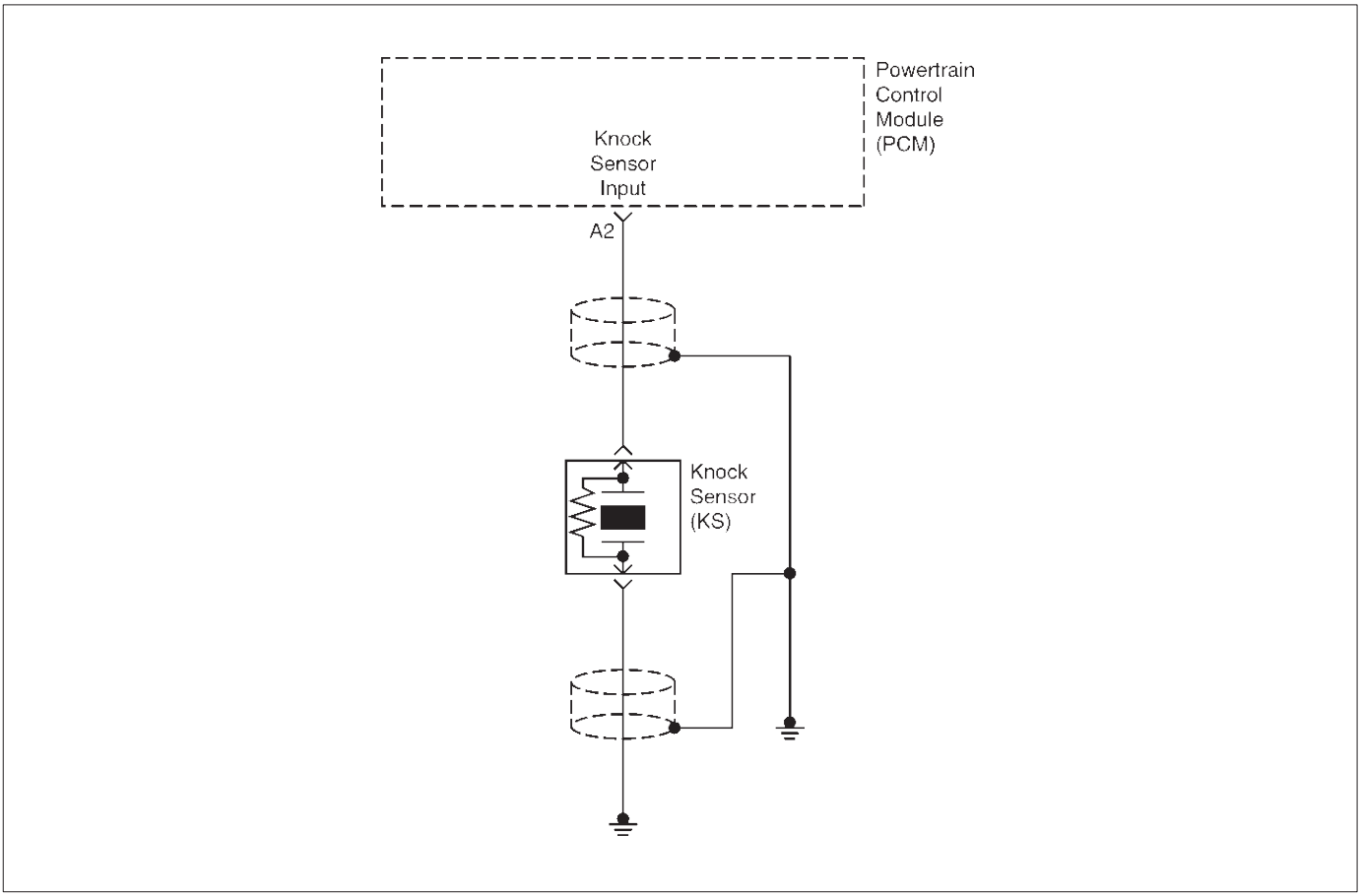
DTC P0304 – Random/Multiple Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Start and idle the engine. 2. Review and record the Tech 2 Freeze Frame data. 3. Operate the vehicle to duplicate the conditions present when the Diagnostic Trouble Code was set (as defined by the Freeze Frame data). 4. Monitor the Tech 2 ”Misfire Cur. #” display for each cylinder. Is ”Misfire Cur. #” display increasing for any cylinder (indicating a misfire currently occurring)?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. 2. If a problem is found, repair or replace the vacuum hoses as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 4
4	1. Visually and physically inspect the following areas for vacuum leaks: ● Intake manifold ● Injector O–rings ● EGR valve ● EGR feed pipes Did your inspection reveal a vacuum leak?	—	Verify repair	Go to Step 5
5	Inspect the crankcase ventilation valve for proper installation or a cracked hose. Did your inspection reveal a problem?	—	Verify repair	Go to Step 6
6	1. Remove and visually/physically inspect the ignition coils. Ensure that the coils are free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coils. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Install a spark tester at the spark plug end of the ignition wire for the cylinder that is indicated by the ”Misfire Cur. Counters” or ”Misfire Hist. Counters” as having the most severe misfire (largest number of counts). 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to Step 12	Go to Step 8
8	1. Remove the spark plugs from the cylinders that were indicated as misfiring. 2. Visually inspect the spark plug electrodes. Does your inspection reveal any spark plugs exhibiting excessive fouling?	—	Go to Engine Mechanical Diagnosis	Go to Step 9

DTC P0304 – Random/Multiple Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Visually inspect the spark plug insulators for cracks, carbon tracking, or other damage. 2. If a problem is found, replace the faulty spark plug(s) as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 10
10	Replace the ignition control module.	—	Verify repair	—
11	1. Inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight and in their proper locations. 2. If a problem is found, correct the faulty ground condition as necessary. Did your inspection reveal a poor ground?	—	Verify repair	Go to Step 12
12	1. Perform the "Fuel System Pressure Test" procedure. 2. If a problem is found, repair as necessary (refer to Engine Fuel or Fuel Metering System). Was a fuel system problem found?	—	Verify repair	Go to Step 13
13	1. Check the fuel for excessive water, alcohol, or other contaminants (refer to Diagnosis in Engine Fuel for procedure). Was the fuel contaminated?	—	Verify repair	Go to Step 14
14	1. Perform the "Injector Coil/Balance Test." 2. If a problem is found, replace the faulty injector(s) as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to Step 15
15	Check for an engine mechanical problem. Refer to Engine Mechanical Diagnosis to diagnose the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or piston rings • Excessive valve deposits • Loose or worn rocker arms • Weak valve springs • Incorrect valve timing • A leaking head gasket • A loose or broken motor mount	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC)
P0325 KNOCK SENSOR (KS) CIRCUIT MALFUNCTION



060R100035

Circuit Description

The knock sensor (KS) system is used to detect engine detonation. The knock sensor produced an AC voltage signal. The knock sensor sends this signal to the PCM. The amplitude and the frequency of the AC voltage signal depends upon the knock level being detected. The PCM will then retard the spark timing based on the signals from the Knock Sensor. DTC P0325 is a type B code.

Conditions for Setting the DTC

- No P0327 Diagnostic Trouble Code set.
- Engine speed is above 2500 rpm.

All the above mentioned conditions are met, and the following conditions are met for 8.75 seconds within a 10 second monitoring period:

- Any of the four A/D voltages exceeds 1.5625 Volts.
- Instantaneous A/D delta Voltage falls below 0.019531 Volts.
- ECT is more than 60˚C.
- Vacuum is lower than 35kPa.

The above condition are met 40 test failures within 80 test sample during 125 msec.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate the second time the fault is detected.
- The PCM will record operating conditions at the time the diagnostic fails.
- A history Diagnostic Trouble Code is stored.
- The PCM will use a calculated spark retard value in order to minimize the knock during the conditions when the knock is likely to occur. The calculated value will vary based on the engine speed and load.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after 3 consecutive ignition cycles in which the diagnostic runs without a fault.
- A history Diagnostic Trouble Code will clear after 40 consecutive warm up cycles without a fault.
- A Tech 2 can clear the Diagnostic Trouble Codes.

Diagnostic Aids

Correct any abnormal engine noise before using the diagnostic table.
Check for an open ignition feed circuit.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame data and failure records data on the Tech 2 if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the Tech 2 for later reference.
2. If the conditions for the test as described above are met, a Diagnostic Trouble Code P0325 will set and 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 knock sensor may be responding to the noise.
6. The Tech 2 displays knock sensor activity in counts, approximately 20–50 at idle. The counts should increase when engine speed is increased and the counts should decrease when engine speed is decreased.
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.
8. If the KS module was previously replaced and the Diagnostic Trouble Code resets, a malfunctioning PCM is indicated.

NOTE: Replacement PCMs must be reprogrammed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures.

9. Checking the internal resistance of the knock sensor verifies if the knock sensor or the wiring to the knock sensor is OK.

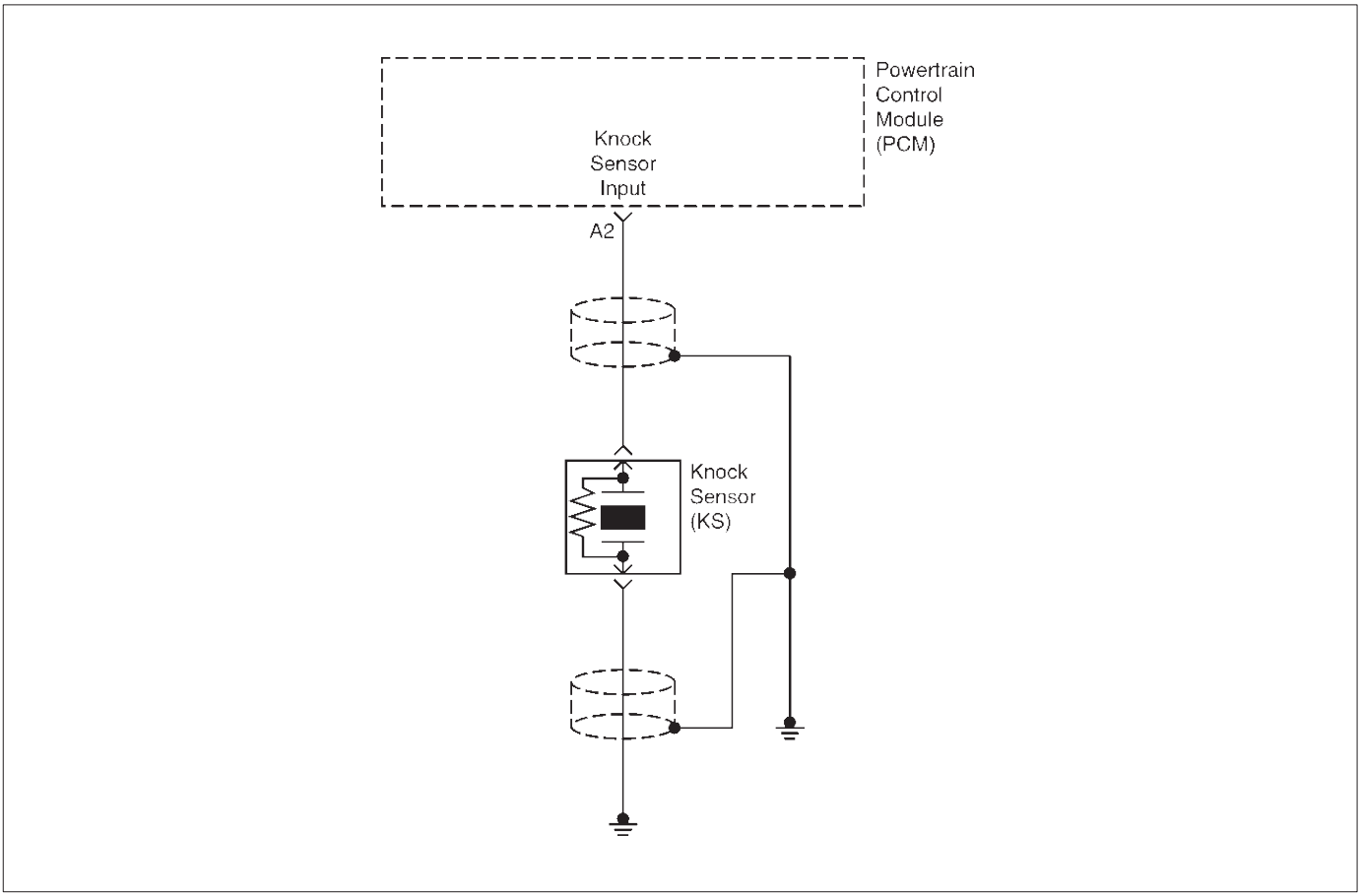
DTC P0325 KS Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the Powertrain ”On–Board Diagnostic (OBD) System Check” performed? —	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Start the engine. 2. Install a Tech 2. 3. Clear the Diagnostic Trouble Codes. 4. Run the engine at slightly more than 10% throttle angle. Does the Malfunction Indicator Lamp (MIL) illuminate?	—	Go to Step 4	Go to Step 3
3	1. Turn the ignition switch ON, with engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Conditions and Conditions for Setting the DTC as noted. Does the Malfunction Indicator Lamp (MIL) illuminate?	—	Go to Step 4	Go to Step 13
4	Listen to the engine while raising and lowering the engine speed. Is a knock or audible noise present?	—	Go to Step 5	Go to Step 6
5	Repair the mechanical engine problem or a loose bracket or component. Is the action complete?	—	Go to Step 13	—
6	Slowly increase the engine speed to the specified value. Does the KS Activity increase with the engine speed?	2500 RPM	Go to Step 7	Go to Step 11
7	Check for a poor connection at the PCM connector, Knock sensor signal circuit and repair as necessary. Was a repair necessary?	—	Go to Step 13	Go to Step 8

DTC P0325 KS Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to Step 13	—
9	1. Turn the ignition switch OFF. 2. Disconnect the PCM connectors at the PCM. 3. With a Digital Voltmeter (DVM) connected to ground, measure the resistance of the knock sensor through the knock sensor signal circuit. Is the measured value within the specified value?	90K – 110K Ω	Go to Step 7	Go to Step 10
10	Check the knock sensor electrical connector for a poor connection and repair as necessary. Was a repair necessary?	—	Go to Step 13	Go to Step 11
11	Check the knock sensor signal circuit for an open or a short to ground or to voltage and repair as necessary. Was a repair necessary?	—	Go to Step 13	Go to Step 12
12	Replace the Knock Sensor (KS). Is the action complete?	—	Go to Step 13	—
13	1. Using the Tech 2, clear the Diagnostic Trouble Codes. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this Diagnostic Trouble Code as specified in the supporting text. Does the Tech 2 indicate that this diagnostic has ran and passed?	—	Go to Step 14	Go to Step 2
14	Check is any additional Diagnostic Trouble Codes are set. Are any Diagnostic Trouble Codes displayed that have not been diagnosed?	—	Go to applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC)
P0327 KNOCK SENSOR (KS) CIRCUIT LOW INPUT



060R100035

Circuit Description

The PCM uses the Knock Sensor (KS) in order to detect engine detonation. This allows the PCM to retard the Ignition Control (IC) spark timing based on the KS signal the PCM receives. The circuitry within the knock sensor pulls down the PCM–supplied 5 volt signal, so that under a no knock condition the signal on the KS circuit measures about 1.3 volts. The knock sensors produce an AC signal that rides on the 1.3 volts DC. The signal's amplitude and frequency are dependent upon the amount of the knock being experienced.

The PCM determines whether the knock is occurring by comparing the signal level on the KS circuit with a voltage level on the noise channel. The noise channel allows the CM to reject any false knock signal by indicating the amount of normal engine mechanical noise present. The normal engine noise varies depending on the engine speed and load. Then the ECM determines that an abnormally high noise channel voltage level is being experienced, a Diagnostic Trouble Code P0327 sets. This DTC is a type B DTC.

Conditions for Setting the DTC

A/D Test

- Engine speed is equal to or greater than 2500 RPM.
- A/D Voltage is less than or equal to 0.0781 Volts.
- ECT is more than 60˚C.
- Vacuum is lower than 35kPa.
- Engine speed is more than 2500 rpm or equal to 2500 rpm.

The above condition are met for 40 test failures within 80 test sample during 125 msec.

Gain Test

- Engine speed is greater than 2500 RPM.
- Gain is equal to or greater than 23.875 dB.

Action Taken When the DTC Sets

- The PCM will illuminate the MIL the second time the fault is detected.
- The PCM will store the conditions which were present then the Diagnostic Trouble Code set.
- The PCM will use a calculated spark retard value in order to minimize the knock during the conditions when the knock is likely to occur. The calculated value will vary based on the engine speed and load.

Conditions for Clearing the MIL/DTC

- A history Diagnostic Trouble Code will clear after 40 consecutive warm–up cycles have occurred without a fault.
- The Tech 2 "Clear Info" will clear the Diagnostic Trouble Code.

Diagnostic Aids

Check for the following conditions:
A poor connection at the PCM. Inspect the knock sensor and the PCM connectors for: , broken locks, improperly formed or damaged terminals.

- Backed out terminals
- Broken locks
- Improperly formed or damaged terminals

Also, check the wiring harness for: shorts to ground, shorts to battery positive, and open circuits.

- A misrouted harness. Inspect the knock sensor harness in order to ensure that it is not routed too close to high voltage wires such as spark plug leads.
- Improper Knock Sensor torque specification. Torque the Knock Sensor to 19N·m (14 lbs·ft). Refer to Fastener Notice.

Review the Fail Records vehicle mileage since the diagnostic test last failed in order to help determine how often the conditions that caused the DTC to set occur. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Ensures that the fault is present.
6. Ensures that the knock sensor is capable of detecting detonation.

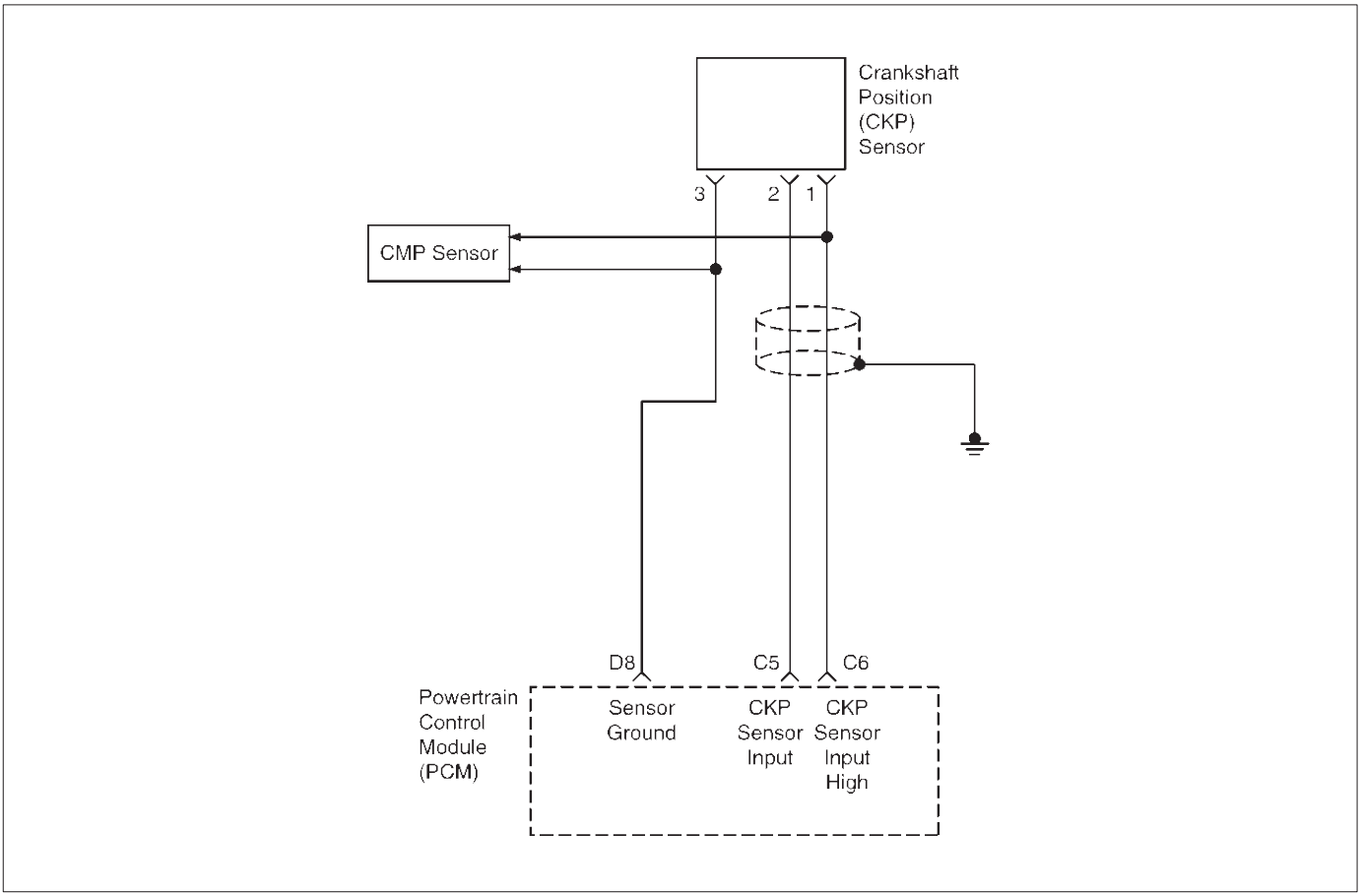
DTC P0327 KS Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the Powertrain ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Operate the engine within the conditions specified in the diagnostic support Conditions for Setting the DTC. 2. Using a Tech 2, monitor theDiagnostic Trouble Code information for Diagnostic Trouble Code P0327 until the Diagnostic Trouble Code P0327 test runs. 3. Observe the test results. Does the Tech 2 indicate the DTC P0327 failed this ignition?	—	Go to Step 4	Go to Step 3
3	1. Turn ON the Ignition leaving the engine OFF. 2. Review the Tech 2 Fail Records data. 3. **IMPORTANT:** Before clearing the DTCs, use the Tech 2 to record the Freeze Frame and the Failure Records for reference. This data will be lost when the Clear Info function is used. 4. Record the Tech 2 Fail Records data. 5. Operate the vehicle within the Fail Records conditions. 6. Using a Tech 2, monitor the DTC info for the DTC P0327 until the DTC P0327 test runs. 7. Observe the test results. Does the Tech 2 indicate the DTC P0327 Failed This Ignition?	—	Go to Step 4	Go to Diagnostic Aids
4	1. Disconnect the KS Sensor electrical connector. 2. Using a Digital Voltmeter (DVM), measure the voltage between the KS signal circuit at the knock sensor harness connectors and ground. Is the voltage at the specified value?	Approx. 5.0 V	Go to Step 5	Go to Step 8

DTC P0327 KS Circuit Low Input (Cont'd)

Step	Action	Value(s)	Yes	No
5	Measure the resistance of the KS sensor by connecting the between the KS sensor terminal and the engine block. Is the resistance of the KS sensor near the specified value?	100K Ω	Go to Step 6	Go to Step 9
6	1. Check the KS signal circuit for a poor terminal connection at the knock sensor. 2. If a problem is found, repair as necessary. Refer to Wiring Repairs in Engine Electrical. Was a problem found?	—	Go to Step 7	Go to Step 9
7	1. Re–Connect the KS Sensor in order to monitor the voltage between the KS sensor terminal and the engine ground. 2. Tap on the engine lift bracket, near the KS Sensor, while observing the signal indicated on the Tech 2. Is any signal indicated on the while tapping on the engine lift bracket?	—	Go to Step 11	Go to Step 8
8	1. Turn OFF the ignition. 2. Disconnect the PCM. 3. Turn ON the ignition. 4. Check the KS signal circuit between the PCM and the KS sensor connector for an open, a short to voltage, or a short to ground. 5. If a wiring problem is found, repair as necessary. Was a problem found?	—	Go to Step 11	Go to Step 10
9	Replace the KS Sensor. Refer to Knock Sensor. Is the action complete?	—	Go to Step 11	—
10	Replace the PCM. **IMPORTANT:** If the PCM is faulty, reprogram the PCM. Refer to PCM Replacement/Programming. Is the action complete?	—	Go to Step 11	—
11	1. Using the Tech 2, select the DTC and the Clear Info. 2. Start the engine. 3. Idle at the normal operating temperature. 4. Select the DTC and the Specific. 5. Enter the DTC number which was set. 6. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Tech 2 indicate that this diagnostic ran and passed?	—	Go to Step 12	Go to Step 2
12	Using the Tech 2, select the Capture Info and the Review Info. Are any DTCs displayed that have not been diagnosed?	—	Go to applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P0336 CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT RANGE/PERFORMANCE



060R100036

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 powertrain control module (PCM) uses the 58X reference signal to calculate engine RPM and crankshaft position. The PCM 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 PCM receives an incorrect number of pulses on the 58X reference circuit, Diagnostic Trouble Code P0336 will set. Diagnostic Trouble Code P0336 is a type B code.

Conditions for Setting the DTC

- Engine is running.
- Extra or missing pulse is detected between consecutive 58X reference pulses.
- Above condition is detected in 10 of 100 crankshaft rotations.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0336 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0336 can be cleared by using the Scan Tool's "Clear Info" function.

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 PCM 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; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the 58X reference circuit at the PCM harness connector while moving connectors and wiring harnesses related to the PCM. A change in voltage will indicate the location of the fault.

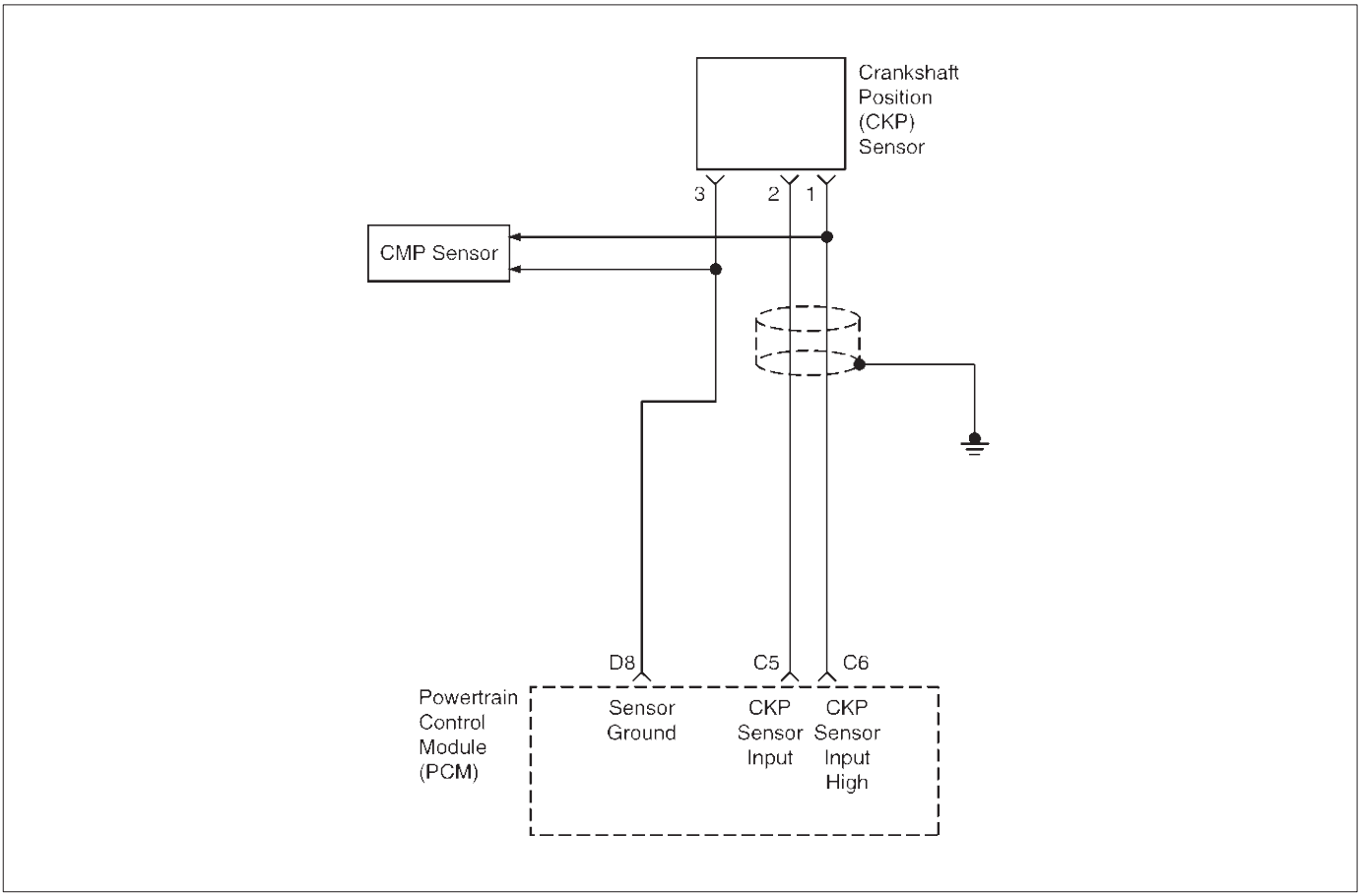
Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to

be set occurs. This may assist in diagnosing the condition.

DTC P0336 – CKP Sensor Circuit Range/Performance

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Attempt to start the engine. Does the engine start?	—	Go to Step 3	Refer to Engine Cranks But Will Not Run chart
3	1. Review and record Failure Records information. 2. Clear Diagnostic Trouble Code P0336. 3. Start the engine and idle for 1 minute. 4. Observe Diagnostic Trouble Codes. Is Diagnostic Trouble Code P0336 set?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Disconnect the PCM and CKP sensor. 2. Check for an open or a short to ground in the 58X reference circuit between the CKP sensor connector and the PCM harness connector. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Reconnect the PCM and CKP sensor. 2. Connect a Digital Voltmeter (DVM) to measure voltage on the 58X reference circuit at the PCM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to Step 8	Go to Step 6
6	Check the connections at the CKP sensor and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 7
7	Replace the CKP sensor. **IMPORTANT:** The PCM must go through the Scan Tool’s Tooth Error Correction (TEC) procedure after CKP Sensor replacement. Refer to the Tooth Error Correction procedure. Is the action complete?	—	Verify repair	—
8	Check connections at the PCM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 9
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0337 CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT LOW INPUT



060R100036

Circuit Description

The 58X reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, 58 crankshaft reference pulses will be produced. The powertrain control module (PCM) uses the 58X reference signal to calculate engine RPM and crankshaft position. The PCM 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 PCM does not receive pulses on the 58X reference circuit, Diagnostic Trouble Code P0337 will set. Diagnostic Trouble Code P0337 is a type B code.

Conditions for Setting the DTC

- No camshaft position (CMP) sensor DTCs are set.
- Engine cranking.
- CKP reference pulse is not detected within 8 CMP pulses.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0337 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0337 can be cleared by using the Scan Tool's "Clear Info" function.

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 PCM 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; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the 58X reference circuit at the PCM harness connector while moving connectors and wiring harnesses related to the PCM. 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 Diagnostic Trouble Code to

be set occurs. This may assist in diagnosing the condition.

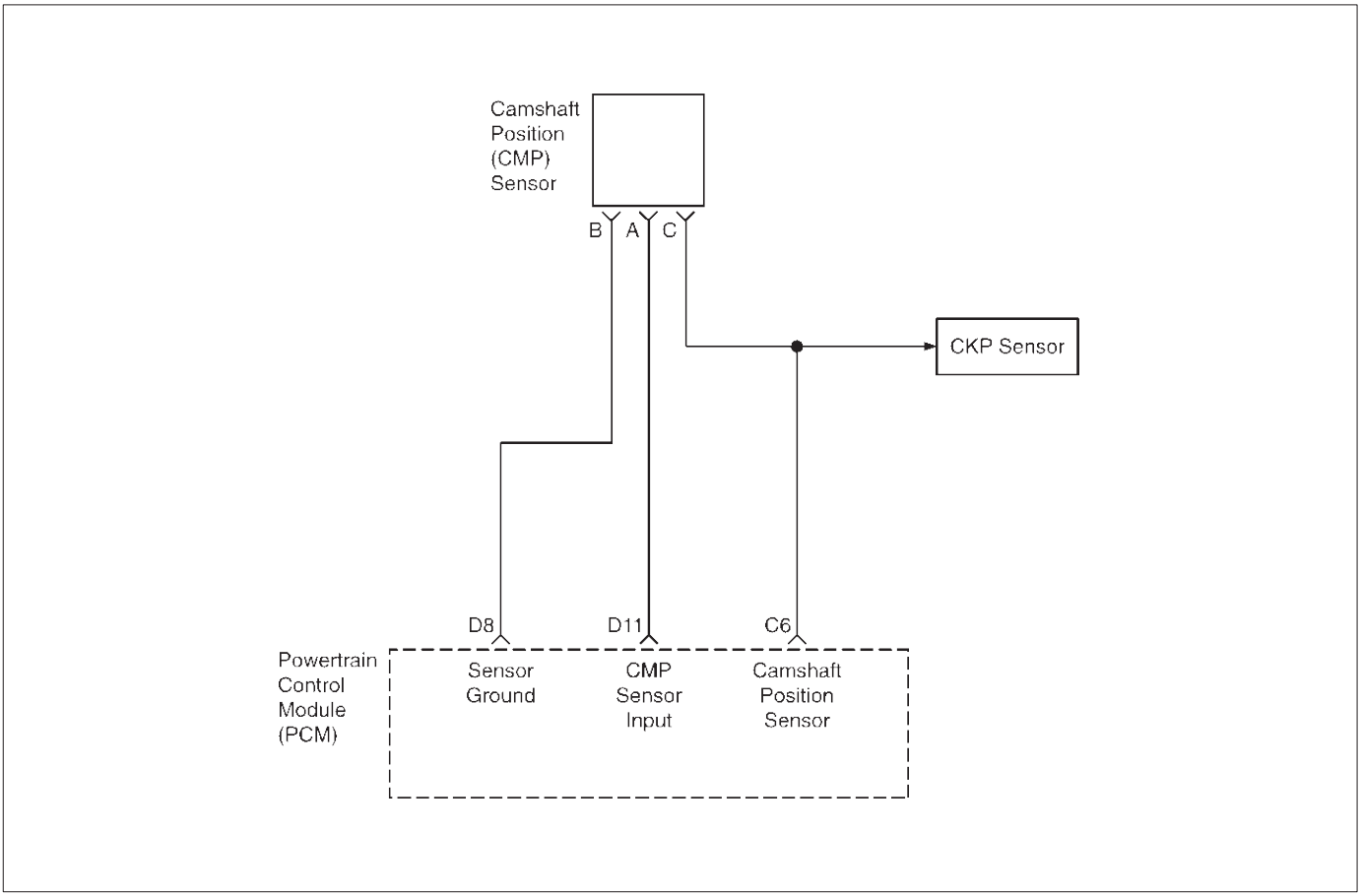
DTC P0337 – CKP Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Disconnect the CKP sensor. 2. Ignition ON. 3. Using a Digital Voltmeter (DVM), verify that 5 V reference and ground are being supplied at the sensor connector (PCM side). Are 5 V and ground being supplied to the sensor?	—	Go to Step 5	Go to Step 3
3	1. Ignition ON. 2. With a DVM, backprobe the PCM connector 5 V reference and ground connections. Are 5 V reference and ground available at the PCM?	—	Go to Step 4	Go to Step 9
4	Check 5 V reference or ground between the CKP sensor and PCM and repair the open circuit, short to ground or short to voltage. Is the action complete?	—	Verify repair	—
5	1. Ignition OFF. 2. Disconnect the PCM and CKP sensor. 3. Check for an open or a short to ground in the 58X reference circuit between the CKP sensor connector and the PCM harness connector. 4. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 6
6	1. Reconnect the PCM and CKP sensor. 2. Connect a DVM to measure voltage on the 58X reference circuit at the PCM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to Step 9	Go to Step 7
7	Check the connections at the CKP sensor and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 8
8	Replace the CKP sensor. **IMPORTANT:** The PCM must go through the Scan Tool’s Tooth Error Correction (TEC) procedure after a CKP Sensor replacement. Refer to Tooth Error Correction (TEC) procedure. Is the action complete?	—	Verify repair	—

DTC P0337 – CKP Sensor Circuit Low Input (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the connections at the PCM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 10
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0341 CAMSHAFT POSITION (CMP) SENSOR CIRCUIT RANGE/PERFORMANCE



060R100037

Circuit Description

The camshaft position (CMP) sensor signal is produced by the CMP sensor pulses when the engine is running and crankshaft position (CKP) sync pulses are also being received. The powertrain control module (PCM) uses the CMP signal pulses to initiate sequential fuel injection. The PCM constantly monitors the number of pulses on the CMP signal circuit and compares the number of CMP pulses to the number of 58X reference pulses received. If the PCM receives an incorrect number of pulses on the CMP reference circuit, Diagnostic Trouble Code P0341 will set and the PCM will initiate injector sequence without the CMP signal with a one in four chance that injector sequence is correct. The engine will continue to start and run normally, although the misfire diagnostic will be affected if a misfiring condition occurs. DTC P0341 is a type B code.

Conditions for Setting the DTC

- The engine is running (CMP reference pulses are being received).
- Above condition fails for 10 occurrences within 100 test samples (15.6 m/s).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will initiate injector sequence without the CMP signal with a one in four chance that injector sequence is correct.
- The PCM will store conditions which were present when the Diagnostic Trouble Code (DTC) was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code (DTC) P0341 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code (DTC) P0341 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

- If a CKP Diagnostic Trouble Code (DTC) is also indicated, there may be a problem with the ground circuit because the CMP ground is spliced to the CKP ground wire.
- If a fuel injector Diagnostic Trouble Code (DTC) is also indicated, there may be a problem with the power supply to the CMP. The wire supplying CMP power is spliced to the wire supplying power to the fuel injectors.

An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for the following conditions:

- Poor connection – Inspect the PCM 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; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, disconnect the PCM, turn the ignition ON and observe a voltmeter connected to the CMP signal circuit at the PCM harness connector while moving connectors and wiring harnesses related to the CMP sensor. 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 Diagnostic Trouble Code (DTC) to be set occurs. This may assist in diagnosing the condition.

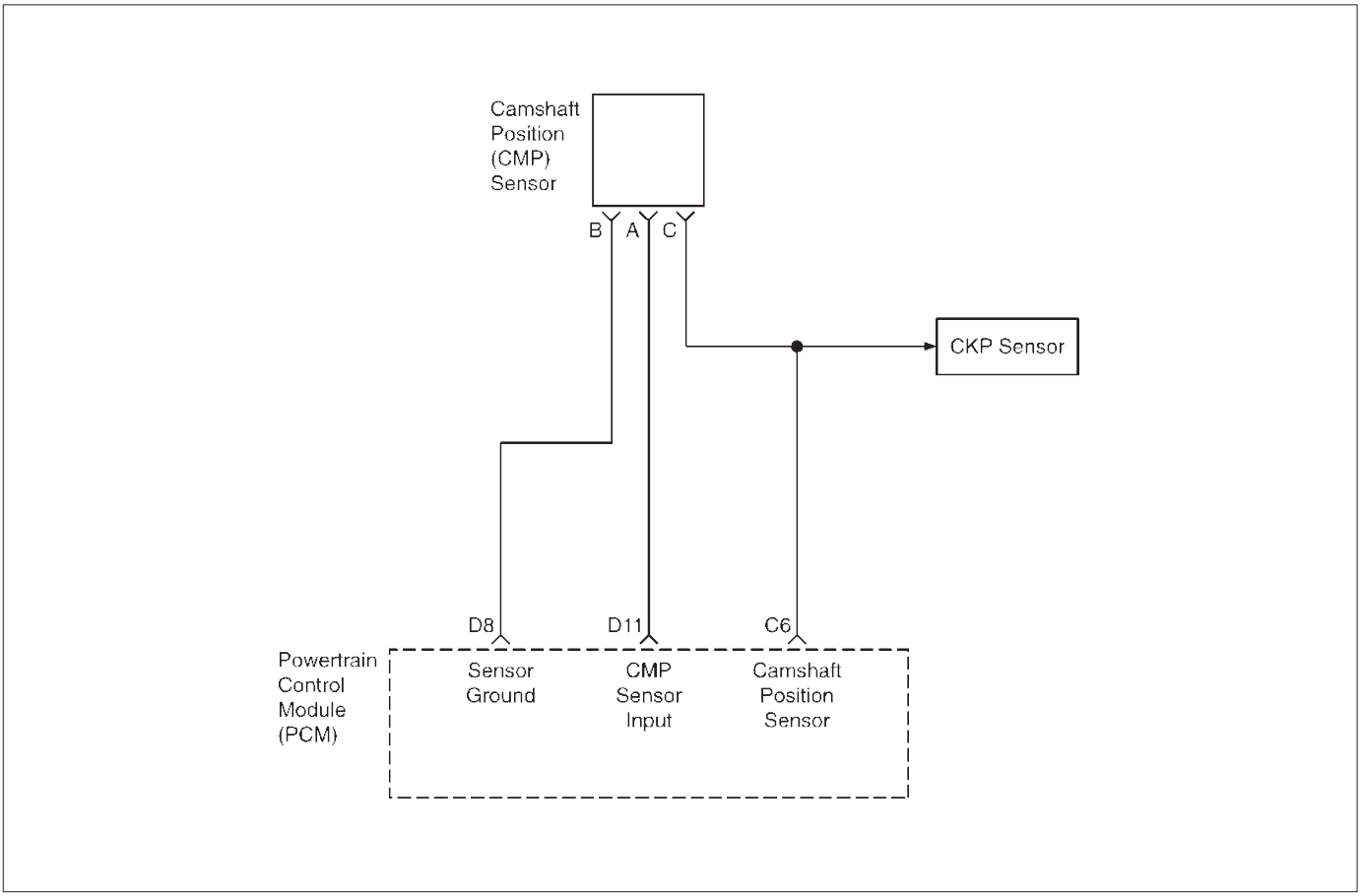
DTC P0341 – CMP Sensor Circuit Range/Performance

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using a Tech 2, monitor ”DTC” information for DTC P0341 until the DTC P0341 test runs. Does the Tech 2 indicate DTC P0341 failed this ignition cycle?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Monitor voltage on the CMP signal circuit while cranking the engine. Does the voltage toggle between the specified values?	0–4 V	Go to Step 4	Go to Step 7
4	Check for a poor connection of the CMP signal wire at the PCM terminal. Was a poor connection found?	—	Go to Step 5	Go to Step 6
5	Repair the damaged pin or terminal at the PCM.	—	Verify repair	—
6	Replace the PCM **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the repair complete?	—	—	Verify repair
7	1. Disconnect the CMP connector from the CMP Sensor. 2. Ignition ON. 3. At the CMP connector, use a Digital Voltmeter (DVM) to check the voltage between the voltage signal wire and sensor ground. Does the DVM indicate the specified value?	B+	Go to Step 12	Go to Step 8
8	1. Ignition ON. 2. Use a DVM to measure between the ground and the CMP positive connector. Does the DVM indicate the specified value?	B+	Go to Step 10	Go to Step 9

DTC P0341 – CMP Sensor Circuit Range/Performance (Cont'd)

Step	Action	Value(s)	Yes	No
9	Repair the open circuit. Is the repair complete?	—	Verify repair	—
10	1. Ignition ON. 2. Use a DVM to measure at the CMP connector between the battery + and the CMP ground wire. Does the DVM indicate the specified value?	B+	Go to Step 12	Go to Step 11
11	Repair the open ground wire. Is the repair complete?	—	Verify repair	—
12	Use an ohmmeter to check continuity of the signal wire between the CMP and the PCM. Was there an open circuit?	—	Go to Step 13	Go to Step 14
13	Repair the open signal wire. Is the action complete?	—	Verify repair	—
14	1. Ignition ON. 2. Check the signal wire for a short to ground or a short to voltage. Was a problem found?	—	Go to Step 15	Go to Step 16
15	Repair the signal circuit problem. Is the action complete?	—	Verify repair	—
16	Replace the CMP Sensor. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0342 CAMSHAFT POSITION (CMP) SENSOR CIRCUIT LOW INPUT



060R100037

Circuit Description

The camshaft position (CMP) sensor signal is produced by the CMP sensor pulses when the engine is running and crankshaft position (CKP) sync pulses are also being received. The PCM uses the CMP signal pulses to initiate sequential fuel injection. The PCM constantly monitors the number of pulses on the CMP signal circuit and compares the number of CMP pulses to the number of 58X reference pulses received. If the PCM does not receive pulses on the CMP reference circuit, Diagnostic Trouble Code (DTC) P0342 will set and the PCM will initiate injector sequence without the CMP signal with a one in four chance that injector sequence is correct. The engine will continue to start and run normally, although the misfire diagnostic will be affected if a misfiring condition occurs. Diagnostic Trouble Code (DTC) P0342 is a type B code.

Conditions for Setting the DTC

- The engine is running.
- The CMP sensor signal is not received by the PCM once every 4 cylinders.
- The above condition occurs for 10 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will initiate injector sequence without the CMP signal with a one in four chance that injector sequence is correct.
- The PCM will store conditions which were present when the Diagnostic Trouble Code (DTC) was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code (DTC) P0342 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code (DTC) P0342 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

- If a CKP Diagnostic Trouble Code (DTC) is also indicated, there may be a problem with the ground circuit because the CMP ground is spliced to the CKP ground wire.
- If a fuel injector Diagnostic Trouble Code (DTC) is also indicated, there may be a problem with the power supply to the CMP. The wire supplying CMP power is spliced to the wire supplying power to the fuel injectors.

An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for the following:

- Poor connection – Inspect the PCM 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; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, disconnect the PCM, turn the ignition ON and observe a voltmeter connected to the CMP signal circuit at the PCM harness connector while moving connectors and wiring harnesses related to the CMP sensor. A change in voltage will indicate the location of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Ensures that the fault is present.

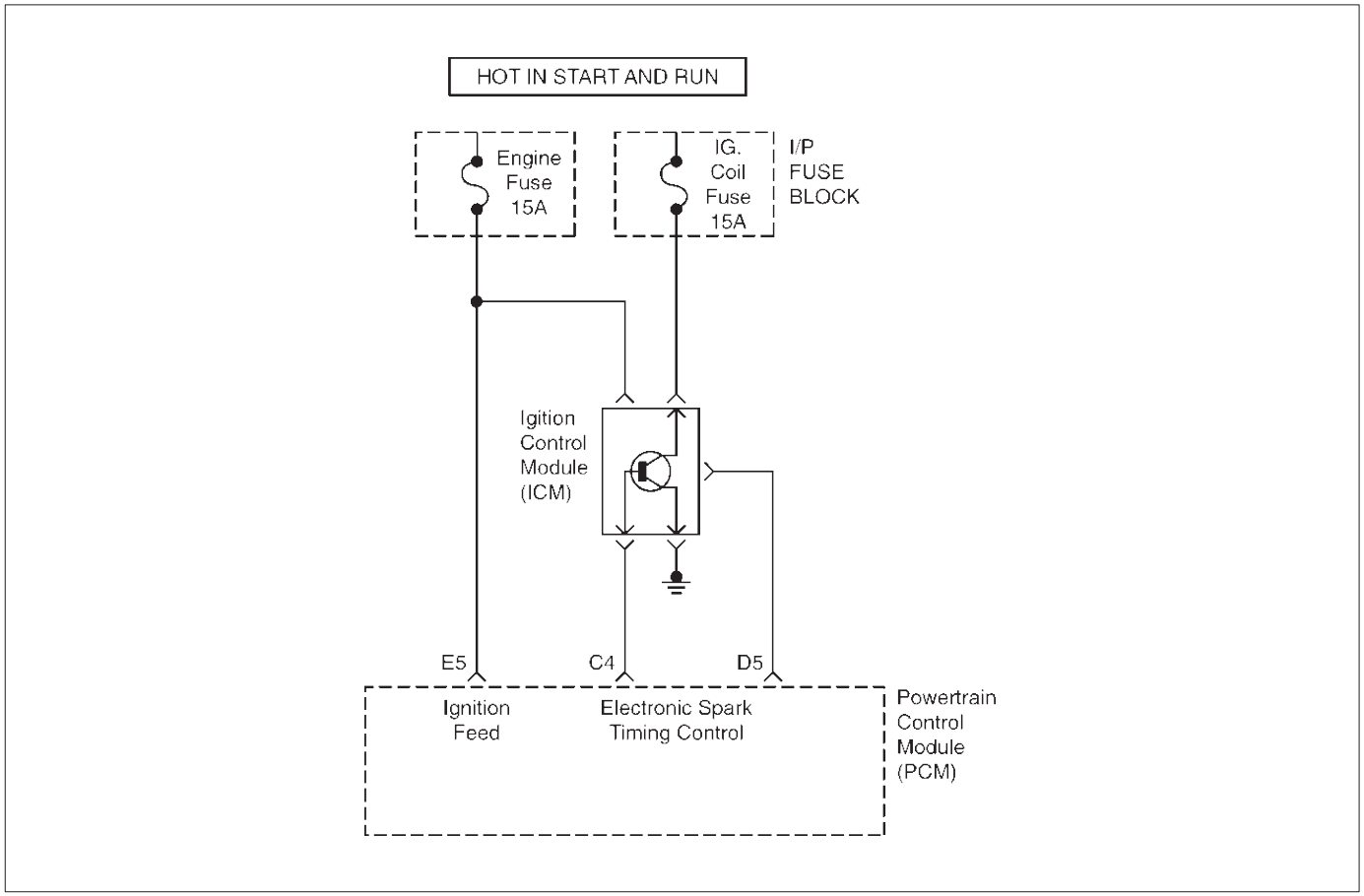
DTC P0342 – Camshaft Position Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor ”DTC” information for DTC P0342 until the DTC P0342 test runs. Did the Tech 2 indicate DTC P0342 failed this ignition cycle?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Use a Digital Voltmeter (DVM) to monitor voltage on the CMP signal circuit while cranking the engine. Does the voltage toggle between the specified values?	0–4 V	Go to Step 4	Go to Step 7
4	Check for a poor connection of the CMP signal wire at the PCM terminal. Was a poor connection found?	—	Go to Step 5	Go to Step 6
5	Repair the damaged pin or terminal at the PCM.	—	Verify repair	—
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the repair complete?	—	Verify repair	—
7	1. Disconnect the CMP connector from the CMP Sensor. 2. Ignition ON. 3. At the CMP connector, check the voltage between the voltage signal wire and sensor ground. Does the DVM indicate the specified value?	B+	Go to Step 12	Go to Step 8
8	1. Ignition ON. 2. Use a DVM to measure between the ground and the CMP positive connector. Does the DVM indicate the specified value?	B+	Go to Step 10	Go to Step 9
9	Repair the open circuit. Is the repair complete?	—	Verify repair	—

DTC P0342 – Camshaft Position Sensor Circuit Low Input (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Ignition ON. 2. Use a DVM to measure at the CMP connector between the battery + and the CMP ground wire. Does the DVM indicate the specified value?	B+	Go to Step 12	Go to Step 11
11	Repair the open ground wire. Is the repair complete?	—	Verify repair	—
12	Use an ohmmeter to check continuity of the signal wire between the CMP and the PCM. Was there an open circuit?	—	Go to Step 13	Go to Step 14
13	Repair the open signal wire. Is the action complete?	—	Verify repair	—
14	1. Ignition ON. 2. Check the signal wire for a short to ground or a short to voltage. Was a problem found?	—	Go to Step 15	Go to Step 16
15	Repair the signal circuit problem. Is the action complete?	—	Verify repair	—
16	Replace the CMP Sensor. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0351 IGNITION COIL ”A” PRIMARY/ SECONDARY CIRCUIT MALFUNCTION



060R100038

Circuit Description

The ignition control circuit provides a zero volt or a 5 volt signal to the ignition control module. The normal circuit voltage is zero volts. When the module receives the 5 volt signal from the powertrain control module (PCM), it provides a ground path for the B+ voltage supplied to the ignition primary coil. When the PCM turns off the 5 volts to the module, the module will remove the ground path of the ignition primary coils; causing the magnetic field produces a voltage in the secondary coils which fires the spark plug.

The circuit between the PCM and the ignition control module is monitored for an open circuit, short to voltage, and short to ground. When the PCM detects a problem in the ignition control circuit, it will set DTC P0351. DTC P0351 is a type A code.

Conditions for Setting the DTC

- Ignition ON.
- The engine running.
- Output voltage is not equal to 5 volts when output is ON.
- Output voltage is not equal to 0 volt when output is OFF.
- Twenty test failures within 40 samples of continuous circuit monitoring.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0351 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P0351 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

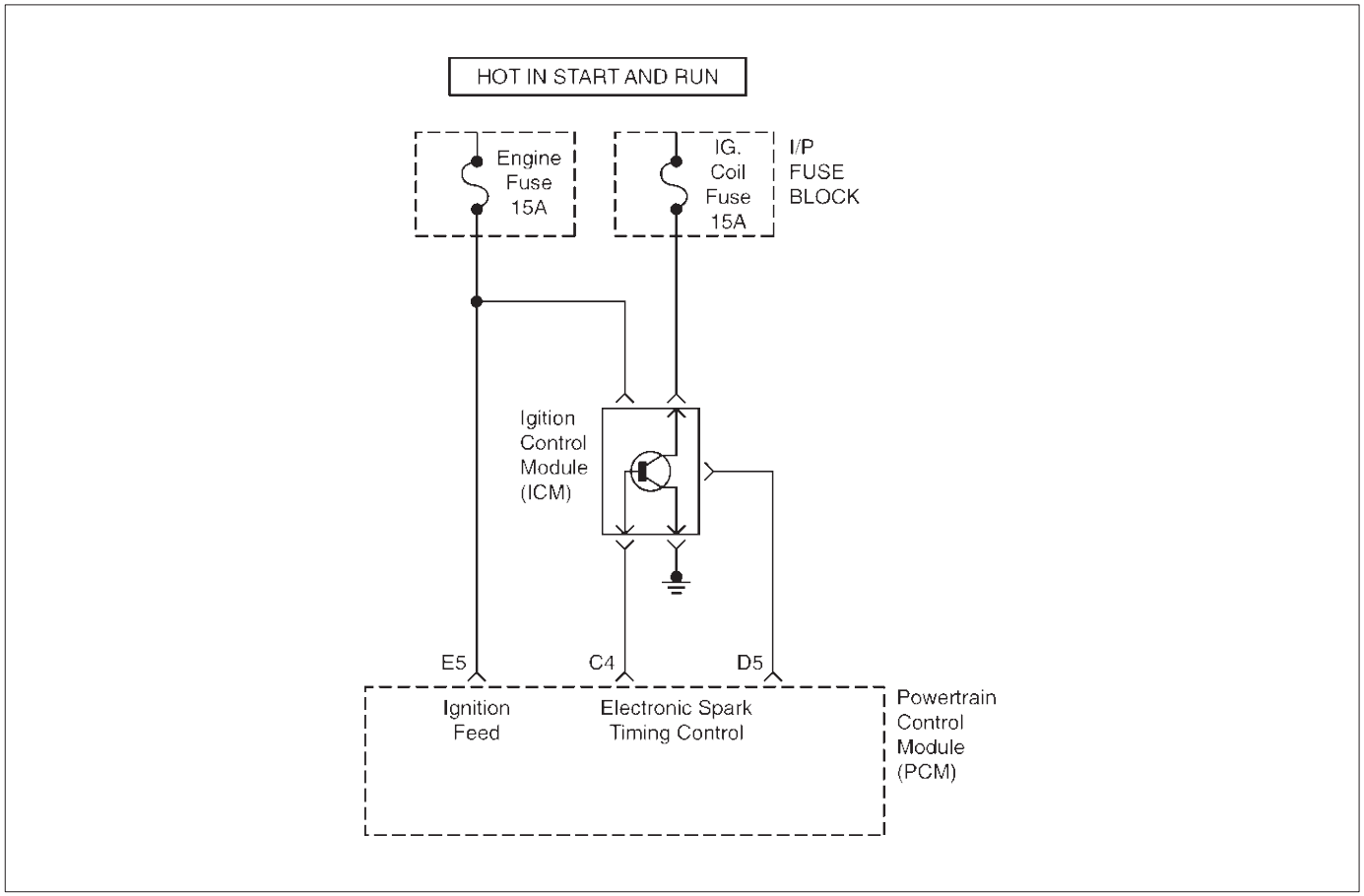
- Poor connection at the PCM – Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connections.
- Damaged harness – Inspect the wiring harness for damage; Open circuits, shorts to ground, or shorts to Voltage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0351 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0351 Ignition Coil ”A” Primary/Secondary Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Check for a faulty connection or damaged terminals at the ignition control module. Was a problem found?	—	Verify Repair	Go to Step 3
3	Check for a faulty connection or damaged terminals at the PCM connector. Was a problem found?	—	Verify Repair	Go to Step 4
4	1. Ignition OFF. 2. Disconnect the PCM and the ignition control module. 3. Check the ignition control circuit for a short to voltage. Was a problem found?	—	Verify Repair	Go to Step 5
5	Check the ignition control circuit for a short to voltage. Was a problem found?	—	Verify Repair	Go to Step 6
6	Check for an open in the ignition control circuit. Was a problem found?	—	Verify Repair	Go to Step 7
7	Replace the ignition control module. Verify repair. Is there still a problem?	—	Go to Step 8	—
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the repair complete?	—	Verify Repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0352 IGNITION COIL "B" PRIMARY/ SECONDARY CIRCUIT MALFUNCTION



060R100038

Circuit Description

The ignition control circuit provides a zero volt or a 5 volt signal to the ignition control module. The normal circuit voltage is zero volts. When the module receives the 5 volt signal from the powertrain control module (PCM), it provides a ground path for the B+ voltage supplied to the ignition primary coil. When the PCM turns off the 5 volts to the module, the module will remove the ground path of the ignition primary coils; causing the magnetic field produces a voltage in the secondary coils which fires the spark plug.

The circuit between the PCM and the ignition control module is monitored for an open circuit, short to voltage, and short to ground. When the PCM detects a problem in the ignition control circuit, it will set DTC P0352. DTC P0352 is a type A code.

Conditions for Setting the DTC

- Ignition ON.
- The engine running.
- Output voltage is not equal to 5 volts when output is ON.
- Output voltage is not equal to 0 volt when output is OFF.
- Twenty test failures within 40 samples of continuous circuit monitoring.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0352 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P0352 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

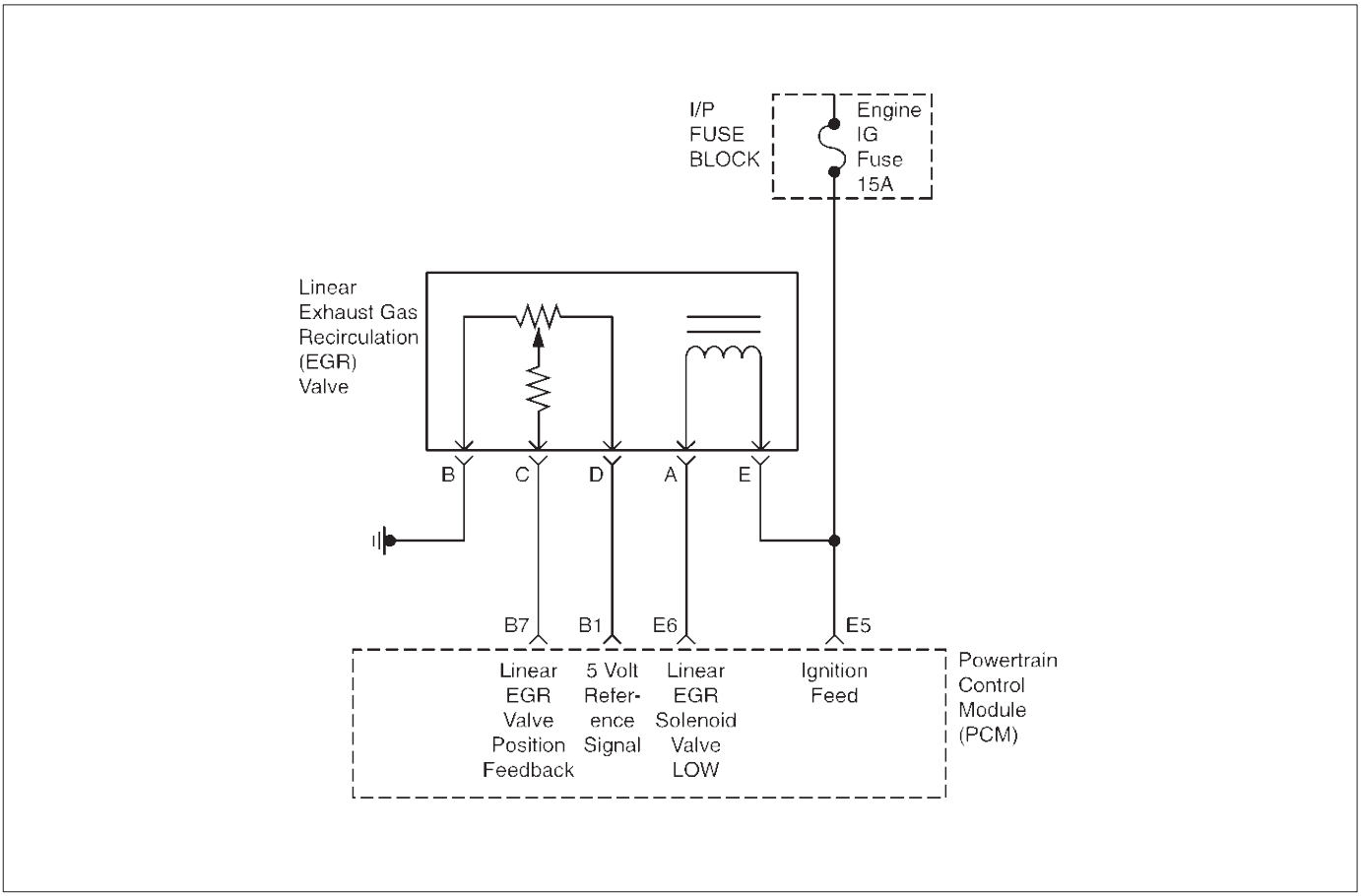
- Poor connection at the PCM – Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connections.
- Damaged harness – Inspect the wiring harness for damage; Open circuits, shorts to ground, or shorts to Voltage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0351 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0352 Ignition Coil ”B” Primary/Secondary Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Check for a faulty connection or damaged terminals at the ignition control module. Was a problem found?	—	Verify Repair	Go to Step 3
3	Check for a faulty connection or damaged terminals at the PCM connector. Was a problem found?	—	Verify Repair	Go to Step 4
4	1. Ignition OFF. 2. Disconnect the PCM and the ignition control module. 3. Check the ignition control circuit for a short to voltage. Was a problem found?	—	Verify Repair	Go to Step 5
5	Check the ignition control circuit for a short to voltage. Was a problem found?	—	Verify Repair	Go to Step 6
6	Check for an open in the ignition control circuit. Was a problem found?	—	Verify Repair	Go to Step 7
7	Replace the ignition control module. Verify repair. Is there still a problem?	—	Go to Step 8	—
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the repair complete?	—	Verify Repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0401 EXHAUST GAS RECIRCULATION (EGR) FLOW INSUFFICIENT DETECTED



060R100039

Circuit Description

The powertrain control module (PCM) tests the exhaust gas recirculation (EGR) system during deceleration by momentarily commanding the EGR valve to open while monitoring the manifold absolute pressure (MAP) sensor signal. When the EGR valve is opened, the PCM monitors the change in MAP input signal. The PCM compares the MAP change to a RPM vs. BARO table. When the PCM interprets the change in MAP to be out of limits, the PCM will set DTC P0401. The number of test samples required to accomplish this may vary according to the severity of the detected flow error.

Normally, the PCM will only allow one EGR flow test sample to be taken during an ignition cycle. To aid in verifying a repair, the PCM allows twelve test samples during the first ignition cycle following a Tech 2 "Clear Info" or a battery disconnect. Between nine and twelve samples should be sufficient for the PCM to determine adequate EGR flow and pass the EGR test. DTC P0401 is a type A code.

Conditions for Setting the DTC

- No TP sensor, VSS, EVAP Purge, IAC, IAT sensor, MAP sensor, EGR Pintle Position sensor, ECT sensor, Excessive EGR DTCs set.
- Barometric pressure is above 72 kPa.
- Engine coolant temperature is greater than 24˚C (165˚F).
- System voltage is between 11.5 and 16 volts.
- Vehicle speed is greater than 29 km/h (18 mph).
- IAC position is steady, changing less than 5 counts.
- A/C clutch status is unchanged.

Start Test

- TP angle is less than 0.8%.
- EGR duty cycle is less than 2%.
- MAP is steady, changing less than 1 kPa.
- Engine speed is between 1400 RPM and 2800 RPM.
- Compensated MAP between 10.3 kPa and 49.8 kPa.

Run Test

- Delta MAP is recorded during valve open conditions.
- EGR valve is ramped over a time interval.

Run Test will be aborted if any of the following are true:

- Vehicle speed changes by greater than 6 km/h (4mph).
- Engine RPM changes by greater than 50 rpm.
- EGR is opened less than 95% of the commanded amount.

During the Start Test and the Run Test, the EGR is closed then opened. The associated change in MAP is compared with the PCM's expected change value. If the

difference between the two values exceeds the PCM's internal limit, a Diagnostic Trouble Code P0401 will set. DTC P0401 is a type A code.

NOTE: Several deceleration cycles will be necessary to run a sufficient number of EGR flow tests to determine a "pass" or "fail" condition.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate the first time the fault is detected.
- A history Diagnostic Trouble Code is stored.
- A history Diagnostic Trouble Code will clear after 40 consecutive warm up cycles without a fault.
- The MIL will turn OFF after three consecutive ignition cycles in which the diagnostic runs without a fault.

Conditions for Clearing the DTC

- The MIL will turn OFF after three consecutive ignition cycles in which the diagnostic runs without a fault.
- A history Diagnostic Trouble Code will clear after 40 consecutive warm up cycles without a fault.
- Diagnostic Trouble Codes can be cleared by using the Tech 2.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Actual EGR Position display on the Tech 2 while moving connectors and wiring harnesses related to the EGR valve. A change in the display will indicate the location of the fault.
- Ensure EGR valve is correctly mounted. See On–Vehicle Service.

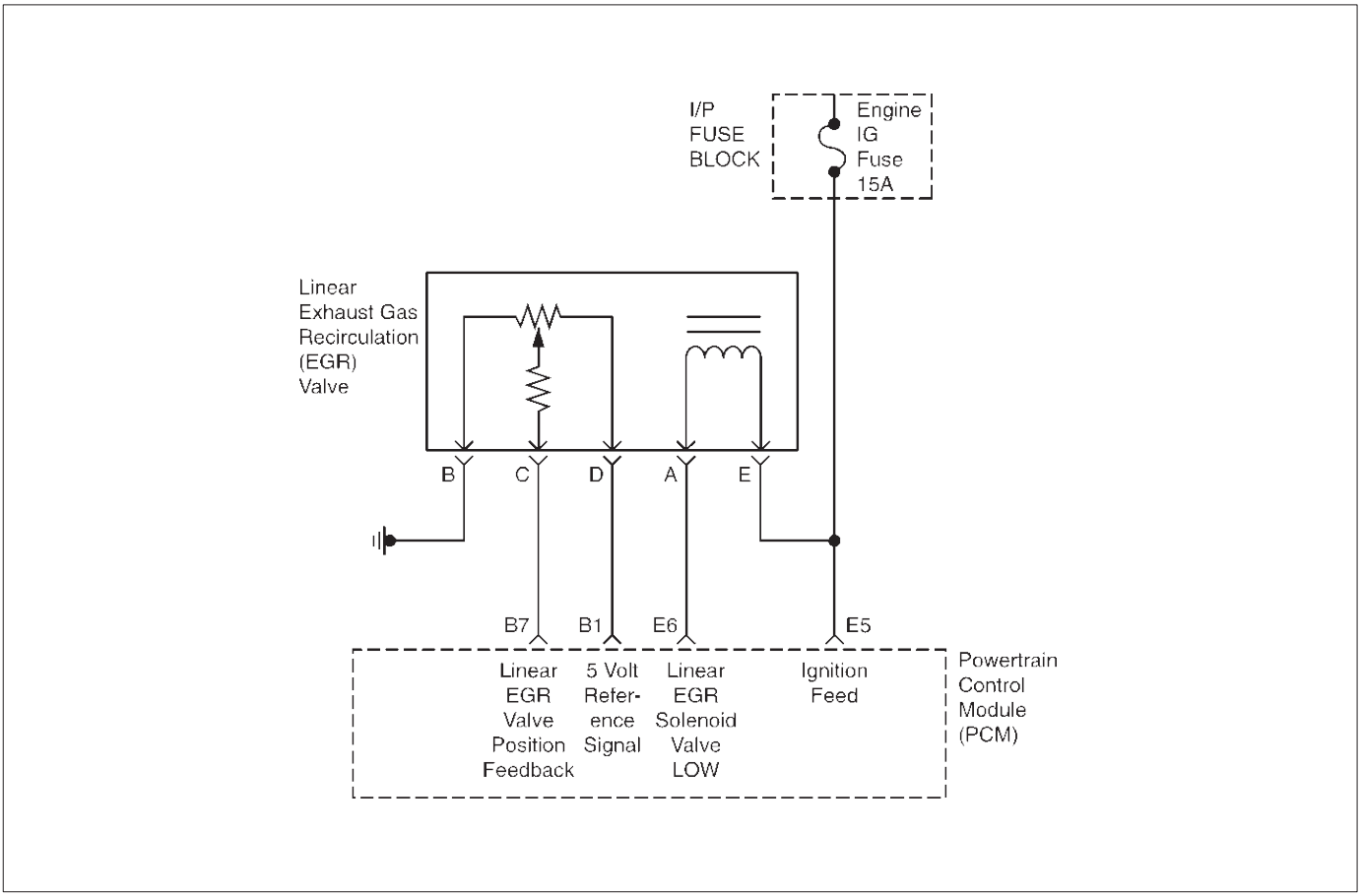
Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

NOTE: If the EGR valve shows signs of excessive heat, check the exhaust system for blockage (possibly a plugged catalytic converter) using the "Restricted Exhaust System Check."

DTC P0401 – Exhaust Gas Recirculation Flow Insufficient Detected

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Start the engine. 2. Monitor the MAP signal with a Tech 2 while idling. 3. While idling, depress the accelerator pedal about halfway down and immediately let the engine return to idle. Did the MAP value on the Tech 2 show an immediate large change?	—	Go to Step 4	Go to Step 3
3	Replace the MAP sensor.	—	Verify repair	—
4	1. Inspect the exhaust system for modification of original installed parts or leaks. 2. If a problem was found, repair exhaust system as necessary. Was a condition present that required repair?	—	Go to Step 7	Go to Step 5
5	1. Remove the EGR valve. 2. Visually and physically inspect the pintle, valve passages and the adapter for excessive deposits or any kind of a restriction. 3. If a problem if found, clean or replace EGR system components as necessary. Was a condition present that required repair?	—	Go to Step 7	Go to Step 6
6	1. Remove the EGR inlet and outlet pipes from the exhaust manifold and the intake manifold. 2. Inspect the manifold EGR ports and the EGR inlet and outlet pipes for a blockage caused by excessive deposits or other damage. 3. If a problem is found, correct the condition as necessary. Was a condition present that required repair?	—	Go to Step 7	Refer to Diagnostic Aids
7	1. Review and record the Tech 2 Failure Records data. 2. Clear Diagnostic Trouble Code and monitor the Tech 2 System Info Screen while operating the vehicle as specified in ”Diagnostic Aids.” 3. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0401 until the Diagnostic Trouble Code P0401 test runs. 4. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0401 failed this ignition?	—	—	Repair complete

DIAGNOSTIC TROUBLE CODE (DTC) P0402 EXHAUST GAS RECIRCULATION (EGR) EXCESSIVE FLOW DETECTED



060R100039

Circuit Description

The Powertrain Control Module (PCM) closes the Exhaust Gas Recirculation (EGR) system on engine start–up to test for excessive (any) flow. If the PCM determines that EGR flow occurred on start–up, in two consecutive trips, then DTC P0402 will set. DTC P0402 is a type B code.

Conditions for Setting the DTC

- Intake Air Temperature (IAT) is above 5˚C (41˚F).
- Engine RPM is less than 500 RPM.
- EGR Pintle Position if greater than 55 counts.

The above mentioned conditions must be met for 0.6 seconds during engine start–up on two consecutive trips.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Actual EGR Position display on the Tech 2 while moving connectors and wiring harnesses related to the EGR valve. A change in the display will indicate the location of the fault.
- Ensure EGR valve is correctly mounted. See On–Vehicle Service.

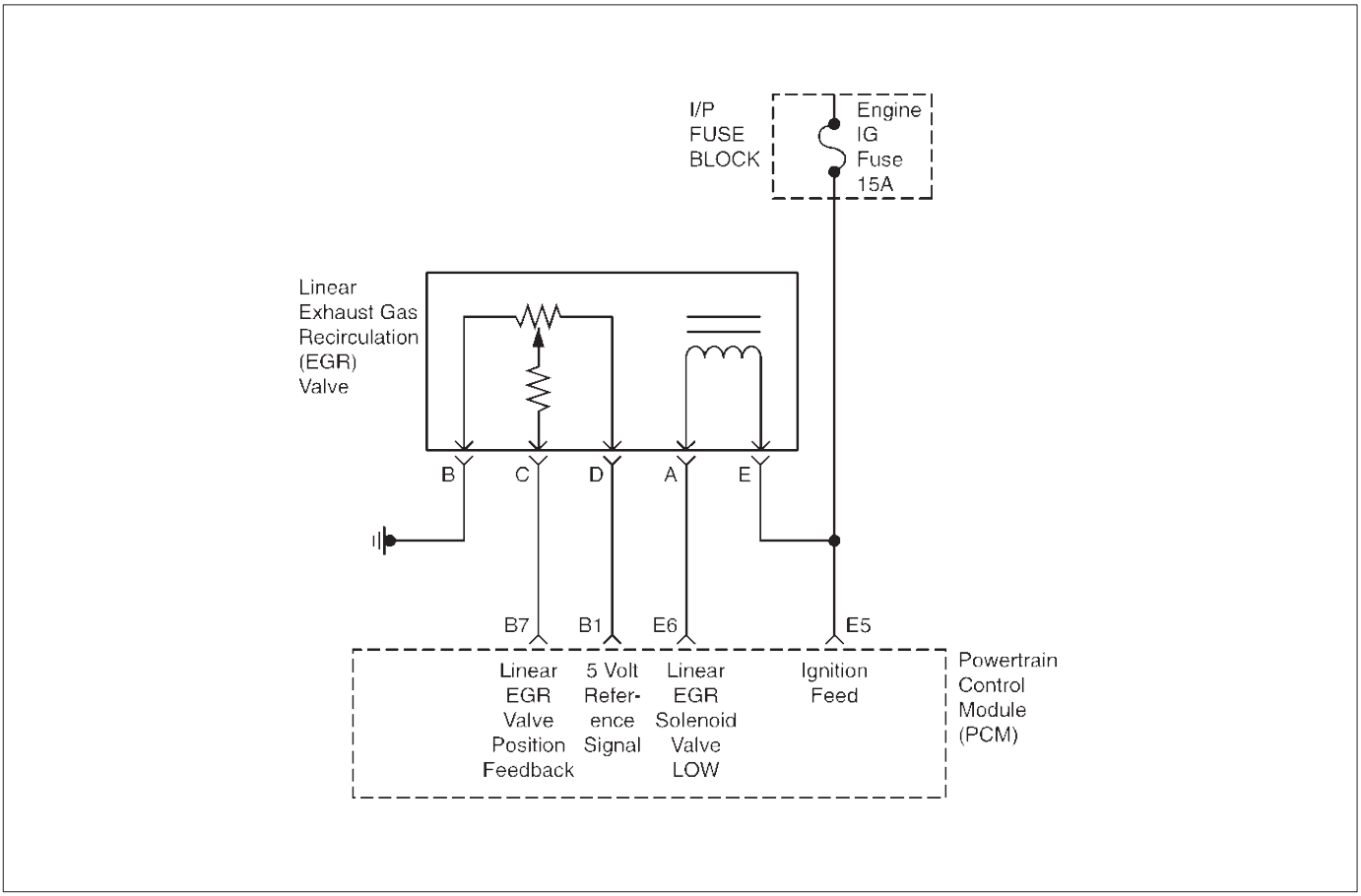
Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

NOTE: If the EGR valve shows signs of excessive heat, check the exhaust system for blockage (possible a plugged catalytic converter) using the ”Restricted Exhaust System Check.”

DTC P0402 EGR Excessive Flow Detected

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Review and record the Tech 2 Failure Records data. 2. Clear Diagnostic Trouble Code and monitor the Tech 2 System Info Screen while operating the vehicle as specified in ”Diagnostic Aids.” 3. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0401 until the Diagnostic Trouble Code P0401 test runs. 4. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0401 failed this ignition?	—	Go to Diagnostic Aids	Go to Step 3
3	1. Inspect the exhaust system for modification of original installed parts or leaks. 2. If a problem was found, repair exhaust system as necessary. Was a condition present that required repair?	—	Verify repair	Go to Step 4
4	1. Remove the EGR valve. 2. Visually and physically inspect the pintle, valve passages and the adapter for excessive deposits or any kind of a restriction. 3. If a problem if found, clean or replace EGR system components as necessary. Was a condition present that required repair?	—	Verify repair	Go to Step 5
5	1. Remove the EGR inlet and outlet pipes from the exhaust manifold and the intake manifold. 2. Inspect the manifold EGR ports and the EGR inlet and outlet pipes for a blockage caused by excessive deposits or other damage. 3. If a problem is found, correct the condition as necessary. Was a condition present that required repair?	—	Verify repair	Refer to Diagnostic Aids

DIAGNOSTIC TROUBLE CODE (DTC) P0404 EXHAUST GAS RECIRCULATION (EGR) CIRCUIT RANGE/PERFORMANCE



060R100039

Circuit Description

An Exhaust Gas Recirculation (EGR) system is used to lower Oxides of Nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with a PCM controlled pintle. The PCM controls the pintle position using inputs from the Throttle Position (TP) and Manifold Absolute Pressure (MAP) sensors. The PCM then commands the EGR valve to operate when necessary by controlling an ignition signal through the PCM. This can be monitored on a Tech 2 as the Desired EGR Position.

The PCM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the PCM. This feedback signal can also be monitored on a Tech 2 and is the actual position of the EGR pintle. The Actual EGR position should always be near the commanded or Desired EGR Position.

If the PCM detects a large difference between the desired EGR position and actual EGR position, then Diagnostic Trouble Code P0404 will set. DTC P0404 is a type B code.

Conditions for Setting the DTC

- IAT is greater than 5°C (41°F).
- EGR commanded ON (EGR Position changes is less than 3%).
- Actual EGR Position and from Desired EGR.

Should be within 15% must fail more than 2 interaions for 5 second.

The above conditions are met 10 second.

Action Taken When the DTC Sets

- Malfunction Indicator Lamp (MIL) will illuminate the second time the fault is detected.
- The PCM will record operating conditions at the time the diagnostic fails.
- A history Diagnostic Trouble Code is stored.
- The EGR Valve is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after three consecutive ignition cycles in which the diagnostic runs without a fault.
- Diagnostic Trouble Code(s) can be cleared by using a Tech 2.

Diagnostic Aids

Due to the moisture associated with exhaust systems, the EGR valve may freeze and stick in colder weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and Desired EGR Positions on a cold vehicle with a Tech 2, the fault can be verified easily. Check the freeze frame data to determine if the Diagnostic Trouble Code was set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the Tech 2 if applicable. This created an electronic copy of the data taken when the fault occurred. The information is then stored on the Tech 2 for later reference.
2. Commanding the EGR valve open determines whether the EGR system can control the EGR valve accurately and if the fault if present.
3. When the EGR valve electrical connector is disconnected, the Tech 2 should display the Actual EGR Position as 0%. If is does not, the fault lies either in the EGR signal circuit or the PCM.
4. A test light, when connected to ground, will glow dimly when the EGR valve is commanded to 25%, and brighter as the EGR valve is commanded to 100%. If the test light flashes, check the sensor ground for an open.
5. An open or poor connection condition may have caused this Diagnostic Trouble Code to set. Be sure to check the terminals for being backed out, improperly formed or damaged, and for poor tension.
7. The test light will have glowed brightly in the previous step if the EGR control circuit was shorted to B+ and the Actual EGR Position on the Tech 2 will display 100%. A test light that did not illuminate, indicates that the circuit may be open or shorted to ground.
9. If the EGR valve 5 volt reference is shorted to voltage, the DVM will read battery voltage and additional Diagnostic Trouble Codes may be set and engine performance will be poor.
12. The replacement PCM must be reprogrammed and the Tooth Error Correction (TEC) procedure must be performed. Refer to the latest procedures for PCM reprogramming and Powertrain Control Module for the Tooth Error Correction (TEC) Procedure.
13. Although the circuitry acted correctly when checked, a problem may still lie within the terminals which would not show up in probe type testing. Be sure to check the terminals for being backed out, improperly formed or damaged, and for poor tension.
17. All circuits to the EGR valve are OK at this point. The fault lies internally in the EGR valve and therefore must be replaced. Be sure all gasket material is removed from the EGR mounting surface. Even a small amount of material may cause a Diagnostic Trouble Code P0401 to set. For on vehicle service of the EGR Valve, refer to EGR Valve.
18. Check the terminals for being backed out, improperly formed or damaged, and for poor tension.
19. Clearing the Diagnostic Trouble Codes is a very important step for this diagnostic. The clearing function allows the EGR valve to relearn a new pintle position as the old position was inaccurate due to the malfunction that caused the Diagnostic Trouble Code. The Diagnostic Trouble Code must be cleared with the ignition switch ON, with the engine OFF or when the engine is idling. If the PCM sees a EGR command, the new pintle position will not be learned.

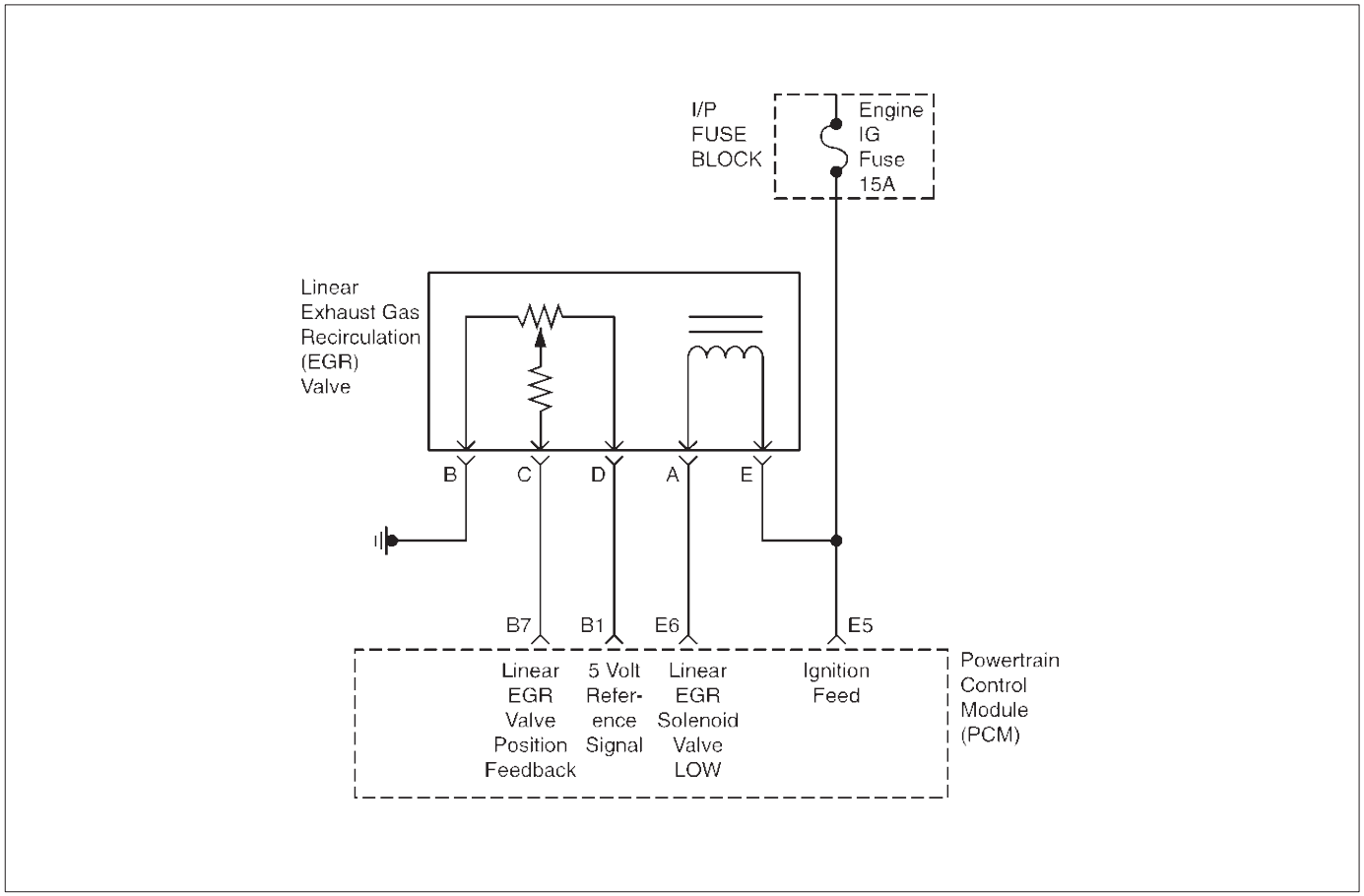
DTC P0404 EGR Circuit Range/Performance

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install a Tech 2. 3. Command the EGR valve to the specified values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to Step 19	Go to Step 3
3	1. Turn the ignition switch ON, with the engine OFF. 2. Disconnect the EGR valve electrical connector. 3. With a test light connected to B+, probe the ground circuit to the EGR valve. Does the light illuminate?	—	Go to Step 4	Go to Step 5
4	1. Connect the test light to ground. 2. Probe the EGR control circuit to the EGR valve. 3. Command the EGR valve to the specified values using a Tech 2. As the command is raised, does the test light glow brighter, flash or maintain a steady glow?	25%, 50%, 75%, 100%	Go to Step 6	Go to Step 7
5	Repair the open or poor connection in the EGR ground circuit. Is the action complete?	—	Go to Step 19	—
6	With the test light still connected to ground, probe the signal circuit. Is the action complete?	—	Go to Step 8	Go to Step 9
7	With the test light still connected to ground, again probe the control circuit without commanding the EGR valve with the Tech 2. Does the test light illuminate?	—	Go to Step 10	Go to Step 11
8	Check the signal circuit for a short to voltage and repair as necessary. Was a repair necessary?	—	Go to Step 19	Go to Step 12
9	With a Digital Voltmeter (DVM) connected to ground, probe the 5 V reference circuit. Is the voltage measured near the specified value?	5 V	Go to Step 13	Go to Step 14
10	Check the control circuit for a short to voltage and repair as necessary. Was a repair necessary?	—	Go to Step 19	Go to Step 12
11	Connect the test light to B+ and again probe the control circuit. Does the light illuminate?	—	Go to Step 15	Go to Step 16

DTC P0404 EGR Circuit Range/Performance (Cont'd)

Step	Action	Value(s)	Yes	No
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to Step 19	—
13	Check the EGR ground circuit for a poor connection or proper terminal tension at the PCM and repair as necessary. Was a repair necessary?	—	Go to Step 19	Go to Step 17
14	Check the 5 V reference circuit for a short to voltage and repair as necessary. Was a repair necessary?	—	Go to Step 19	Go to Step 12
15	Check the control circuit for a short to ground and repair as necessary? Was a repair necessary?	—	Go to Step 19	Go to Step 12
16	Check the control circuit for an open or poor connection at the EGR valve electrical connector and repair as necessary. Was a repair necessary?	—	Go to Step 19	Go to Step 18
17	Replace the EGR valve. Is the action complete?	—	Go to Step 19	—
18	Check the PCM electrical connector for a poor connection and repair as necessary. Was a repair necessary?	—	Go to Step 19	Go to Step 12
19	1. Using the Tech 2, clear Diagnostic Trouble Codes. 2. Start engine and idle at normal operating temperature. 3. Operate vehicle within the conditions for setting this Diagnostic Trouble Code as specified in the supporting text. Does the Tech 2 indicate that this diagnostic "Ran and Passed?"	—	Verify repair	Go to Step 2

DIAGNOSTIC TROUBLE CODE (DTC) P0405 EXHAUST GAS RECIRCULATION (EGR) SENSOR CIRCUIT LOW



060R100039

Circuit Description

An Exhaust Gas Recirculation (EGR) system is used to lower Oxides of Nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold form the exhaust manifold through an orifice with a PCM controlled pintle. The PCM controls the pintle position using inputs from the Throttle Position (TP) and Manifold Absolute Pressure (MAP) sensors. The PCM then commands the EGR valve to operate when necessary by controlling an ignition signal through the PCM. This can be monitored on a Tech 2 as the Desired EGR Position.

The PCM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the PCM. This feedback signal can also be monitored on a Tech 2 and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position.

If the PCM detects a continuous short to ground in the signal circuit or the sensor, then Diagnostic Trouble Code P0405 will set. DTC P0405 is a type A code.

Conditions for Setting the DTC

- IAT is greater than 5°C (41°F).
- A malfunction is present for 10 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate the first time the malfunction is detected.
- The PCM will record operating conditions at the time the diagnostic fails.
- A history Diagnostic Trouble Code is stored.
- The EGR Valve is disabled.

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 Diagnostic Trouble Code will clear after 40 consecutive warm up cycles without a fault.
- Diagnostic Trouble Codes can be cleared by using the Tech 2.

Diagnostic Aids

Due to the moisture associated with exhaust systems, the EGR valve may freeze and stick in colder weather at times. After the vehicle is brought into a warm shop for

repairs, the valve warms and the problem disappears. By watching the Actual EGR and Desired EGR Positions on a cold vehicle with a Tech 2, the fault can be verified easily. Check the freeze frame data to determine if the Diagnostic Trouble Code set when the vehicle was cold by viewing the Engine Coolant Temperature (EGR).

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the Tech 2 if applicable. This creates an electronic copy of the data taken when the fault occurred. The information is then stored on the Tech 2 for later reference.
2. Commanding the EGR valve open determines whether the EGR system can control the EGR valve accurately and if the fault is present.
3. If the EGR valve 5 volt reference is shorted to ground, the DVM will read no voltage and an additional Diagnostic Trouble Code will be set and engine performance will be poor. When this circuit is open, only a Diagnostic Trouble Code P0405 will be set.
4. Jumping the 5 volt reference circuit to the signal circuit checks the signal circuit and PCM. The Tech 2 should display the Actual EGR Position as 100% if the signal circuit and PCM are OK.
6. Although the PCM and circuitry acted correctly in the previous step, a problem may still lie within the terminals which would not show up in probe type testing. Check the terminals for being backed out, improperly formed or damaged, and for poor tension.
10. All circuits to the EGR valve are OK at this point. The fault lies internally in the EGR valve and therefore must be replaced. Be sure all gasket material is removed from the EGR mounting surface. Even a small amount of material may cause a Diagnostic Trouble Code P0405 to set. Refer the EGR Valve for on vehicle service of the EGR valve.
13. The replacement PCM must be reprogrammed and the crankshaft position system variation procedure must be performed. Refer to the latest procedures for PCM reprogramming and Powertrain Control Module for the Tooth Error Correction Variation Procedure.
14. Check the terminals for being backed out, improperly formed or damaged, and for poor tension.

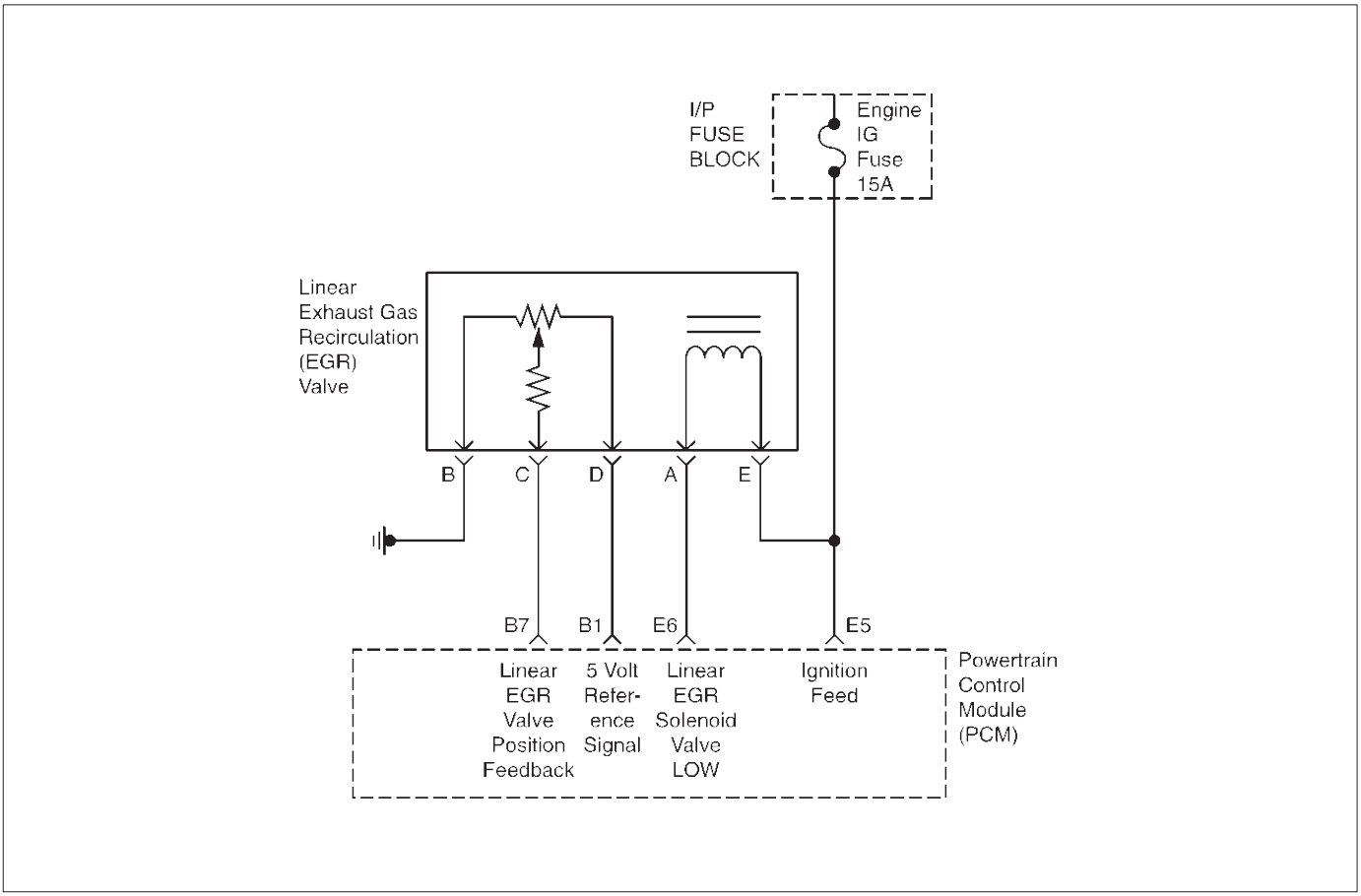
DTC P0405 – EGR Sensor Circuit Low

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install a Tech 2. 3. Command the EGR valve to the specified values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to Step 15	Go to Step 3
3	1. Turn the ignition switch ON, with the engine OFF. 2. Disconnect the EGR valve electrical connector. 3. With a Digital Voltmeter (DVM) connected to ground, probe the 5 V reference circuit to the EGR valve. Does the DVM read near the specified value?	5 V	Go to Step 4	Go to Step 5
4	Jumper the EGR valve 5 volt reference circuit to the signal circuit. Does the Actual EGR Position display the specified value?	100%	Go to Step 6	Go to Step 7
5	1. Connect the test light to B+. 2. Probe the 5 V reference circuit to the EGR valve. Does the test light illuminate?	—	Go to Step 8	Go to Step 9

DTC P0405 – EGR Sensor Circuit Low (Cont'd)

Step	Action	Value(s)	Yes	No
6	Check the 5 V reference and signal circuit's for a poor connection or proper terminal tension and repair as necessary. Was a repair necessary?	—	Go to Step 15	Go to Step 10
7	1. Connect the test light to B+. 2. Probe the signal circuit to the EGR valve. Does the light illuminate?	—	Go to Step 11	Go to Step 12
8	Check for a short to ground in the EGR valve 5 V reference circuit and repair as necessary. Was a repair necessary?	—	Go to Step 15	Go to Step 13
9	Check for an open in the EGR valve 5 V reference circuit and repair as necessary. Was a repair necessary?	—	Go to Step 15	Go to Step 14
10	Replace the EGR valve. Is the action complete?	—	Go to Step 15	—
11	Check for a short to ground in the EGR valve signal circuit and repair as necessary. Was a repair necessary?	—	Go to Step 15	Go to Step 13
12	Check for an open in the EGR valve signal circuit and repair as necessary. Was a repair necessary?	—	Go to Step 15	Go to Step 14
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to Step 15	—
14	Check the affected circuit for a poor connection or proper terminal at the PCM and repair as necessary. Was a repair necessary?	—	Go to Step 15	Go to Step 13
15	1. Using the Tech 2, clear the Diagnostic Trouble Codes. 2. Start engine and idle at normal operating temperature. 3. Operate vehicle within the conditions for setting this Diagnostic Trouble Code as specified in the supporting text. Does the Tech 2 indicate that this diagnostic ran and passed?	—	Verify repair	Go to Step 2

DIAGNOSTIC TROUBLE CODE (DTC) P0406 EXHAUST GAS RECIRCULATION (EGR) SENSOR CIRCUIT HIGH



060R100039

Circuit Description

An Exhaust Gas Recirculation (EGR) system is used to lower Oxides of Nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold form the exhaust manifold through an orifice with a PCM controlled pintle. The PCM controls the pintle position using inputs from the Throttle Position (TP) and Manifold Absolute Pressure (MAP) sensors. The PCM then commands the EGR valve to operate when necessary by controlling an ignition signal through the PCM. This can be monitored on a Tech 2 as the Desired EGR Position.

The PCM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the PCM. This feedback signal can also be monitored on a Tech 2 and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position.

If the PCM detects a continuous short to ground in the signal circuit or the sensor, then DTC P0406 will set. Diagnostic Trouble Code P0406 is a type A code.

Conditions for Setting the DTC

- IAT is greater than 5°C (41°F).
- A malfunction is present for 10 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The PCM will record operating conditions at the time the diagnostic fails.
- A history Diagnostic Trouble Code is stored.
- The EGR Valve is disabled.

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 Diagnostic Trouble Code will clear after 40 consecutive warm–up cycles without a fault.
- Diagnostic Trouble Code(s) can be cleared by using the Tech 2.

Diagnostic Aids

Due to the moisture associated with exhaust systems, the EGR valve may freeze and stick in colder weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By

watching the Actual EGR and Desired EGR Positions on a cold vehicle with a Tech 2, the fault can be verified easily. Check the freeze frame data to determine if the Diagnostic Trouble Code set when the vehicle was cold by viewing the Engine Coolant Temperature (EGR).

DTC P0406 EGR Sensor Circuit High

Step	Action	Value(s)	Yes	No
1	Was the Powertrain ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Turn the ignition switch ON, with the engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTC’s. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P0406. Does the Tech 2 indicate DTC P0406 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Disconnect the Linear Exhaust Gas Recirculation (EGR) Valve from the wiring harness. 3. Ignition ON, Engine OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the ignition feed circuit at the Linear Exhaust Gas Recirculation (EGR) Valve wiring harness connector. Does the DVM read the following value?	12 Volts	Go to Step 6	Go to Step 4
4	Check the ignition feed circuit, between the EGR sensor and the ”Engine IG.” fuse, for the following conditions: ● An open circuit ● A short to ground Was the problem found?	—	Verify repair	—
5	Using a DVM, check the resistance of the EGR solenoid. Does the DVM read the following value?	less then 5 Ω	Go to Step 6	Go to Step 14
6	Check the EGR solenoid valve Low circuit, between the EGR sensor and the PCM, for the following conditions: ● An open circuit ● A short to ground ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 15
7	1. Ignition OFF. 2. Disconnect the Linear Gas Recirculation (EGR) Valve from the wiring harness. 3. Ignition ON, Engine OFF. 4. Observe the EGR value on the Tech 2. Does the Tech 2 display the following value(s)?	0 Volts 0%	Go to Step 9	Go to Step 8

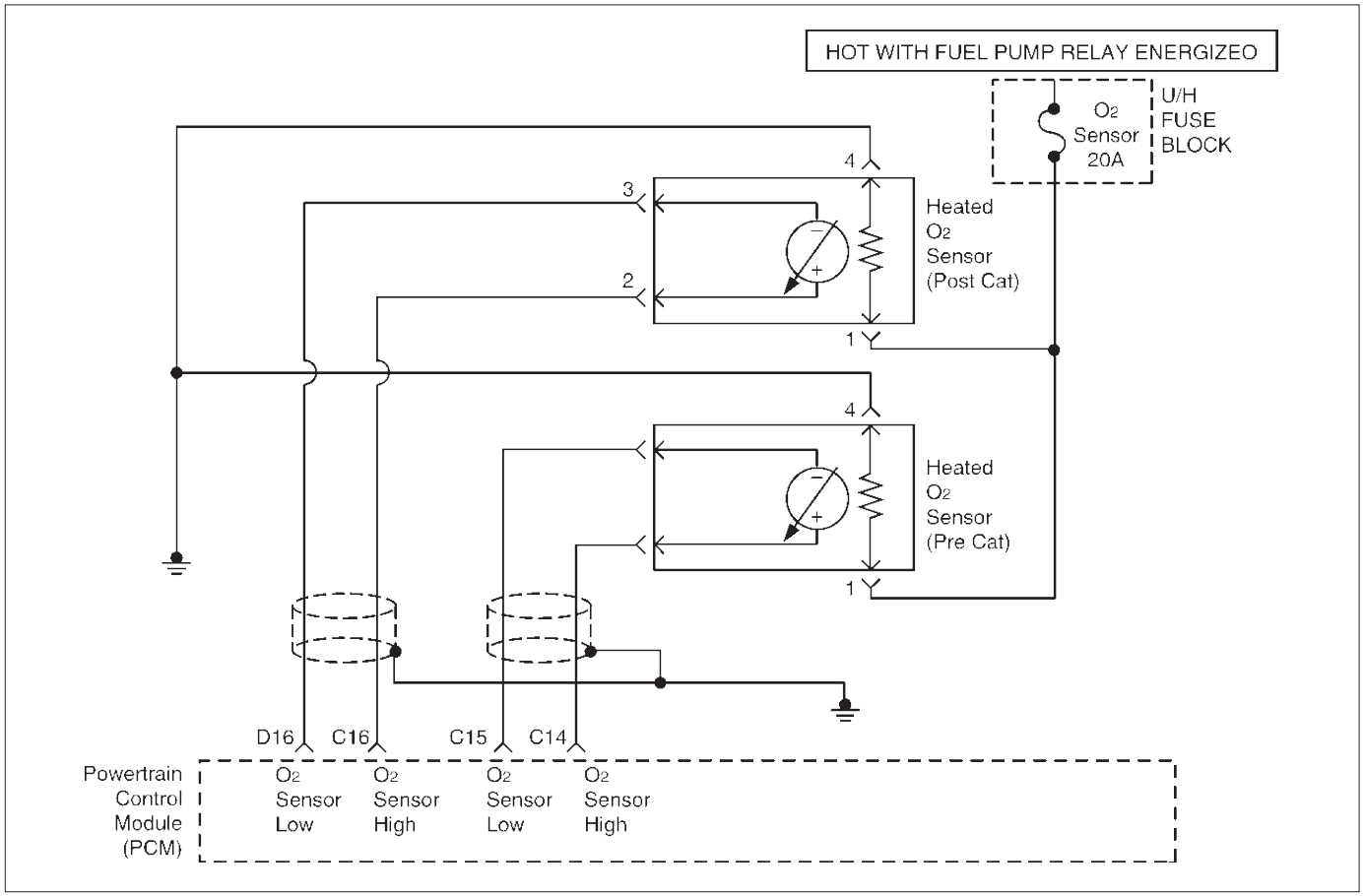
DTC P0406 EGR Sensor Circuit High (Cont'd)

Step	Action	Value(s)	Yes	No
8	Check the EGR position feedback circuit, between the EGR sensor and the PCM, for the following conditions: ● An open circuit ● A short to ground ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 15
9	1. Ignition ON, Engine OFF. 2. Using a Digital Voltmeter (DVM), check for voltage on the 5 volt Reference signal circuit at the Linear Exhaust Gas Recirculation (EGR) Valve wiring harness connector. Does the DVM read the following value?	about 5 volts	Go to Step 11	Go to Step 10
10	Check the 5 volt Reference signal circuit, between the EGR and the PCM, for the following conditions: ● An open circuit ● A short to ground ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 11
11	1. Ignition OFF. 2. Place a DVM between the 5 volt Reference signal circuit and the 5 volt signal return (ground) circuit at the EGR wiring harness connector. 3. Ignition ON, Engine OFF. Does the DVM read the following value?	about 5 volts	Go to Step 13	Go to Step 12
12	Check the 5 volt signal return (ground) circuit, between the EGR and the PCM, for the following conditions: ● An open circuit ● A short to ground ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 15
13	1. Ignition OFF. 2. Place a fused jumper wire between the 5 volt Reference signal circuit and the EGR valve position feedback circuit at the EGR wiring harness connector. 3. Ignition ON, Engine OFF. 4. Observe the EGR value on the Tech 2. Does the Tech 2 display the following value(s)?	5 volts 100%	Go to Step 14	Go to Step 15

DTC P0406 EGR Sensor Circuit High (Cont'd)

Step	Action	Value(s)	Yes	No
14	Replace the Linear Exhaust Gas Recirculation (EGR) Valve. Verify Repair.	—	—	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD



060R100032

Circuit Description

The PCM uses the Bank 1 HO2S 1 and the Bank 1 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three–way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be far more active than that produced by the Bank 1 HO2S 2 sensor. If the PCM detects a level of Bank 1 HO2S 2 activity that indicates the catalyst is no longer operating efficiently, Diagnostic Trouble Code P0420 will be set. DTC P0420 is a type A code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- The engine is operating in "Closed Loop".
- Engine coolant temperature is more than 70°C and less than 120°C (158°F).
- Calculated air flow is between 2.5 g/second and 7 g/second.
- Vehicle speed is less than 3 km/h (3 mph).
- Catalyst temperature is more than 450°C and less than 950°C.
- Airflow reset time more than 8 sec or equal to 8 sec.
- Airflow to reset is equal to 9g/s.
- Absolute pressure more than 72 kpa.
- IAT is more than –10°C and less than 70°C.
- Engine run time is more than 360 sec.
- TPS is less than 3%.
- Idle time less than 60 sec.
- Oxygen capacity (OSC) time is less than 1.5 sec or equal to 1.5 sec.

One pass fail decision per key on unless a step change is OSC time occurs.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0420 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0420 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display 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 Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

- Bank 1 HO2S 1/Bank 1 HO2S 2 Activity Test:

  Ensure that the engine is fully warmed up.

  Using a Tech 2, monitor Bank 1 HO2S 1 and Bank 1 HO2S 2 displays in ”Neutral” while using the Tech 2 IAC RPM control function to maintain a mass air flow of 10 g/second. Compare the amount of activity (frequency and amplitude) on Bank 1 HO2S 1 to the activity on Bank 1 HO2S 2 over a 30 second period.

If the amount of activity on Bank 1 HO2S 2 is nearly as great as the activity on Bank 1 HO2S 1, a problem exists. Use the Diagnostic Trouble Code P0420 diagnostic chart. If much less activity is noted on Bank 1 HO2S 2, the system is functioning properly.

The ”TWC Monitor Test Counter” displayed on the Tech 2 may be used to monitor the progress of the TWC diagnostic. To complete the TWC diagnostic with a good catalyst, the counter must be allowed to increment to 49 samples and roll over to 0 at least twice. A failed catalyst will require three or more 50–sample tests to report a failure.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

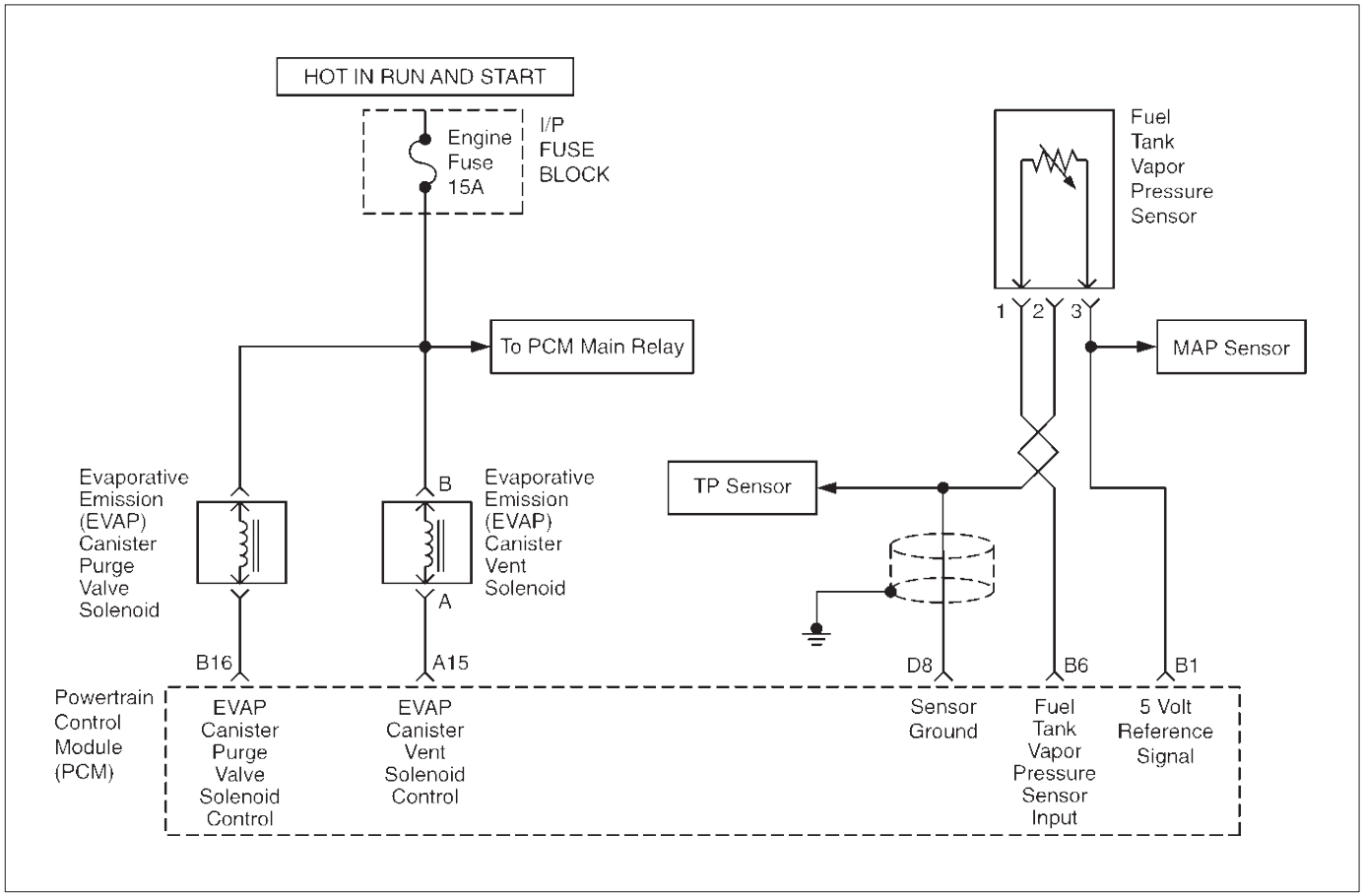
7. Difficulty completing the Diagnostic Trouble Code P0420 ”Status This Ign.” test may be encountered in areas where test conditions cannot be maintained easily, especially in urban areas. To minimize the amount of driving required to complete the Diagnostic Trouble Code P0420 ”Status This Ign.” test, use the following procedure:
   - Allow the engine to warm completely.
   - With the vehicle in ”Neutral,” monitor the calculated air flow on the Tech 2 and hold part throttle to maintain a reading of over 12 g/second for at least 2 minutes. This will achieve the ”warm catalyst” required for running the test.
   - Operate the vehicle in second or third gear to remain in the Diagnostic Trouble Code P0420 test conditions described in ”Conditions for Setting the Diagnostic Trouble Code” as much as possible. If you must stop the vehicle, maintain the ”warm catalyst” criteria as follows:
     – Place the vehicle in ”Neutral.”
     – Hold part throttle to maintain a calculated air flow reading of over 15 g/second for the duration of the stop.

The ”TWC Monitor Test Counter” displayed on the Tech 2 may be used to monitor the progress of the TWC diagnostic. To complete the TWC diagnostic with a good catalyst, the counter must be allowed to increment to 49 samples and roll over to 0 at least twice.

DTC P0420 – Catalyst System Efficiency Below Threshold

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Are any other O2 Sensor Diagnostic Trouble Codes set?	—	Diagnose other Diagnostic Trouble Code(s) first	Go to Step 3
3	1. Visually and physically inspect the three–way catalytic converter for damage. Check for the following: ● dents ● severe discoloration caused by excessive temperatures ● holes ● internal rattle caused by damaged catalyst 2. Also, ensure that the three–way catalytic converter is a proper original equipment manufacturer part. Did your inspection reveal a problem?	—	Go to Step 6	Go to Step 4
4	1. Visually and physically inspect the exhaust system between the three–way catalytic converter and the rear converter flange for leaks, damage, and loose or missing hardware. 2. If a problem is found, repair as necessary. Did your inspection reveal a problem?	—	Go to Step 7 to verify repair	Go to Step 5
5	1. Visually and physically inspect the Bank 1 HO2S 2. 2. Ensure that the Bank 1 HO2S 2 is secure and that the pigtail and wiring harness is not contacting the exhaust pipe or is not other wise damaged. 3. If a problem is found, repair as necessary. Did your inspection reveal a problem?	—	Go to Step 7 to verify repair	Go to Step 6
6	Replace the three–way catalytic converter. NOTE: Check for conditions which may cause catalyst damage (refer to Diagnostic Aids). Is the action complete?	—	Go to Step 7 to verify repair	—
7	1. Review and record the Tech 2 Failure Records data. 2. Clear Diagnostic Trouble Code P0420. 3. Start the engine and allow it to warm up until the engine coolant temperature monitored on the Tech 2 is above the specified value. 4. Run the engine to maintain the specified mass air flow range for at least 2 minutes. 5. Operate the vehicle to maintain Diagnostic Trouble Code P0420 test conditions (for detailed instructions, refer to Diagnostic Trouble Code Test Description in Diagnostic Support). 6. Using a Tech 2, monitor “Diagnostic Trouble Code” info for DTC P0420 until the DTC P0420 test runs. 7. Note the test result. Does the Tech 2 indicate DTC P0420 passed this ignition?	Engine coolant temp: greater than 60°C (140°F) Calculated air flow: between 7 g/second and 41 g/second	Verify repair	Go to Diagnostic Aids

DIAGNOSTIC TROUBLE CODE (DTC) P0440 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM MALFUNCTION



060R100040

Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP vent solenoid
- Fuel tank pressure sensor
- Fuel pipes and hoses
- Fuel vapor lines
- Fuel cap
- EVAP canister
- Purge lines
- EVAP canister purge valve
- EVAP service port

The evaporative emission system is checked by applying vacuum to the EVAP system and monitoring for a vacuum decay. The PCM monitors the vacuum level through the fuel tank pressure sensor signal.

At an appropriate time, the EVAP canister purge valve and the EVAP vent solenoid are turned ON, allowing the engine to draw a small vacuum on the entire evaporative emission system. After the desired vacuum level has been achieved, the EVAP canister purge valve is turned OFF, sealing the system. If a sufficient vacuum level cannot be achieved, a large leak is indicated. This can be caused by the following conditions:

- Missing or faulty fuel cap
- Disconnected or faulty fuel tank pressure sensor
- Disconnected, damaged, pinched, or blocked fuel tank vapor line
- Disconnected or faulty EVAP canister purge valve
- Disconnected or faulty EVAP vent solenoid
- Open ignition feed circuit to the EVAP vent or purge solenoid
- Damaged EVAP canister
- Leaking fuel sender assembly O–ring
- Leaking fuel tank or fuel filler neck

Any of the above conditions can set a Diagnostic Trouble Code P0440. DTC P0440 is a type A code.

Conditions for Setting the DTC

- Diagnostic trouble codes MAP, TPS, IAT, ECT, EGR, VSS, EVAP, Purge solenoid, and EVAP Vent solenoid not set.
- The BARO is greater than 72.3 kPa.
- IAT and ECT are between 4.2˚C and 35˚C (95˚F) at engine start up.
- The difference between IAT and ECT at start up is less than 6.75˚C (12.2˚F).
- The Fuel Tank Level Sensor reads between 15% and 85%.
- Fuel Level counts vary by less than 12 counts in a 0.125 second time frame.
- Maximum Engine Run time is at least 390 seconds.
- Fuel surface is not sloshing.

- Fuel tank pressure change is less than calibrated pressure based on average fuel level.
- Tank vacuum pressure is less than 10.1 mmH2O and integral vacuum pressure more than calibrated pressure based on average fuel level.

The above conditions are met during one injection cycle.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The PCM will disable the EVAP purge vale solenoid.
- The PCM will record operating conditions at the time the diagnostic fails. The Freeze Frame and Failure Records buffers will store this information.
- A history Diagnostic Trouble Code is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after one ignition cycle in which the diagnostic runs without a fault.
- Freeze Frame information and the history Diagnostic Trouble Code will clear after one ignition cycle in which the diagnostic runs without a fault.
- Diagnostic Trouble Codes can be cleared with the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- A missing, loose, or damaged fuel cap.
- Missing or damaged O–rings at the EVAP canister fuel vapor fittings and the purge line fittings.
- A cracked EVAP canister.
- Damaged or disconnected source vacuum line. EVAP purge line, vent hose or fuel tank vapor line.
- The Fuel Pressure Sensor shares a 5 Volt reference with the MAP sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The Fuel Pressure Sensor share a ground with the ECT sensor, the TP sensor, the CKP, the CMP, and Automatic transmission temperature sensor.
- A poor connection at the PCM: Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals.
- Damaged harness: Inspect the wiring harness to the EVAP vent solenoid, the EVAP purge solenoid, and the fuel tank pressure sensor for shorts to ground, shorts to battery positive and open circuits.
- A kinked, pinched or plugged vacuum source, EVAP purge, or fuel tank vapor line. Verify that the lines are not restricted.

Check for charcoal particles. Refer to Carbon Particles Removal from EVAP System before starting repairs.
Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the Tech 2 if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the Tech 2 for later reference.
4. If a vent solenoid or EVAP canister purge valve electrical malfunction is present, the purge system will not operate correctly. Repairing the electrical malfunction will very likely correct the condition that set Diagnostic Trouble Code P0440.
5. Check the fuel tank pressure sensor at ambient pressure.
7. Forces the fuel tank pressure sensor to re–zero.
8. Determines whether or not the EVAP system is sealed sufficiently to be pressurized. If not, the large leak must be located and corrected before continuing with diagnosis.
9. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.
12. Ensures that sufficient source vacuum is present at the EVAP canister purge valve.
13. Check for a stuck closed EVAP canister purge valve.
20. Insures proper system integrity.

DTC P0440 EVAP Control System Malfunction

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	Is Diagnostic Trouble Code P0461, P0462 or P0463 also set?	—	Go to Applicable DTC Chart	Go to Step 3
3	1. Visually/Physically check the fuel cap for missing or loose conditions. 2. Replace or tighten the fuel cap is necessary. Was a loose or missing fuel cap found?	—	Go to Step 20	Go to Step 4
4	1. Install a Tech 2. 2. Command the EVAP canister purge valve and vent solenoid ON and OFF with the Tech 2. Does the purge valve and sent solenoid click when commanded ON and OFF?	—	Go to Step 5	Go to PCM Outputs Diagnosis
5	1. Turn the ignition switch OFF. 2. Remove the fuel cap. 3. Turn the ignition switch ON. Is the Fuel Tank Pressure at the specified value? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	1.51V	Go to Step 8	Go to Step 6
6	Has the battery been disconnected?	—	Go to EVAP Control System Diagnosis	Go to Step 7
7	Disconnect the battery, wait 20 seconds then reconnect the battery. Is the action complete?	—	Go to Step 5	—
8	**IMPORTANT:** Before continuing with this diagnosis, zero the EVAP Pressure and Vacuum gauges on the EVAP pressure/purge cart J41413. Also, read the temperature variation instruction card. (refer to tool operating instructions). 1. Reinstall the fuel cap. 2. Using the Tech 2, command the EVAP vent solenoid ON (closed). 3. Connect the EVAP pressure/purge cart J41413 to the EVAP service port. 4. Attempt to pressurize the EVAP system to the specified value using the EVAP pressure/purge cart J41413 (monitor the pressure using the gauges on the cart with the switch in the HOLD position). Can the specified value be achieved?	5 in. H2O	Go to Step 9	Go to Step 10
9	1. Maintain the fuel tank pressure at the specified value? 2. Observe the Fuel Tank Pressure on the Tech 2. Is the Fuel Tank Pressure at the specified value?	1.47~1.51V	Go to Step 12	Go to Step 11

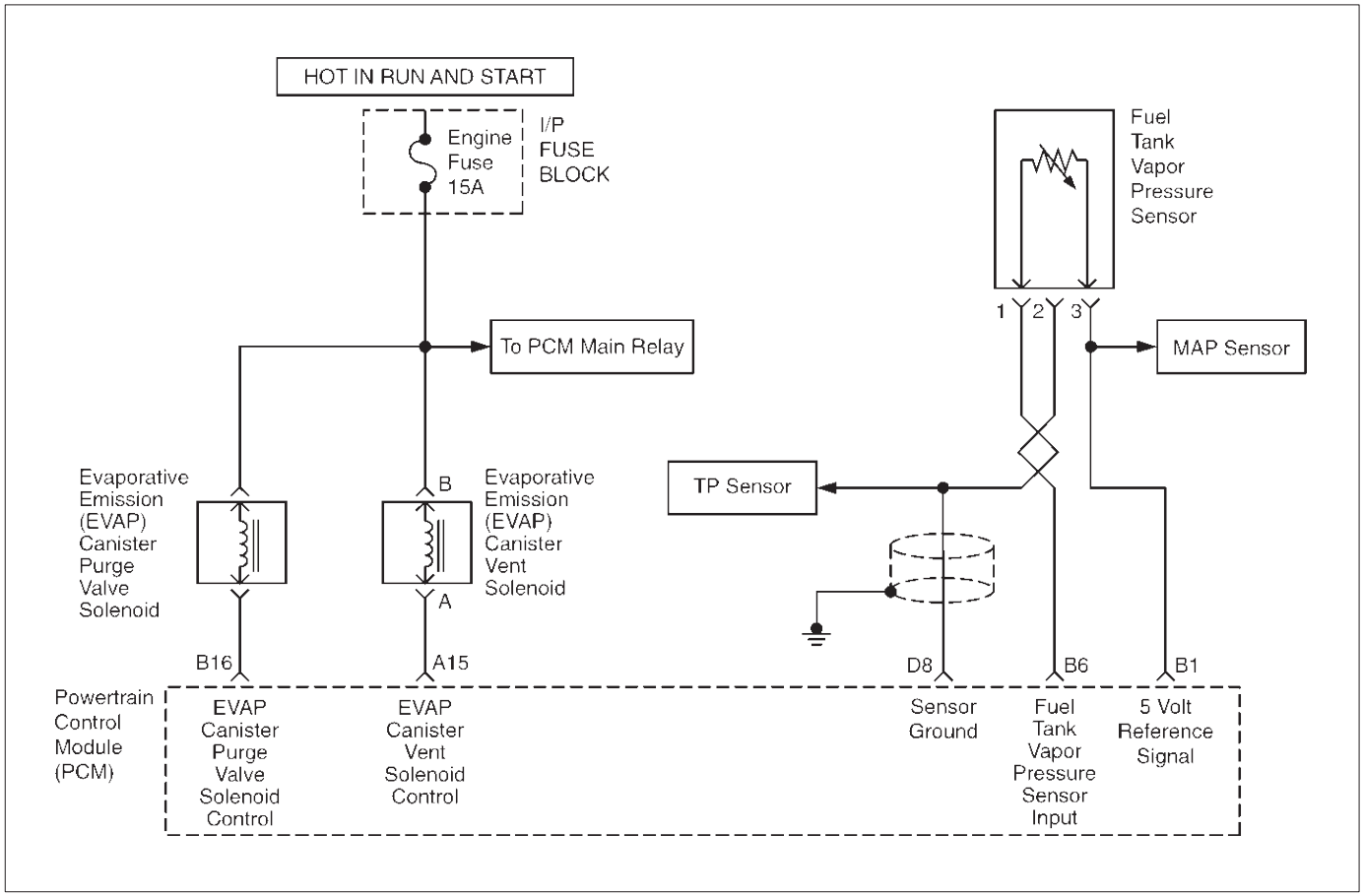
DTC P0440 EVAP Control System Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Disconnect the fuel tank vapor line and the EVAP purge line from the EVAP canister. 2. Block the canister fitting for the fuel tank vapor line. 3. Connect a hand vacuum pump to the canister fitting for the EVAP purge line. 4. Ensure that the EVAP vent solenoid is still commanded ON (closed). 5. Attempt to apply the specified vacuum to the EVAP canister. Can vacuum be maintained at the specified value?	5 in. Hg (17 kPa)	Go to Step 15	Go to Step 14
11	1. Visually/physically check for the following conditions: ● Restricted fuel tank vapor line. ● Restricted EVAP purge line. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to Step 20	Go to EVAP Control System Diagnosis
12	1. Disconnect the throttle body to EVAP emission canister purge vale vacuum hose from the EVAP canister purge valve. 2. Connect a hand vacuum pump to the EVAP canister purge vale vacuum source fitting. 3. Apply the specified amount of vacuum to the EVAP canister purge valve. 4. Command the EVAP purge valve ON, using the Tech 2. Does the EVAP canister purge vale release the vacuum?	10in. of Hg (34 kPa)	Go to Step 13	Go to Step 17
13	1. Connect the in. Hg vacuum gauge on the EVAP pressure/purge cart J41413 of the vacuum source line. 2. Start the engine. 3. Stabilize the engine rpm near the specified value. 4. Momentarily depress the throttle open and then immediately let the throttle return to idle. Did the vacuum gauge read greater than the specified value when the throttle was opened then closed?	2500 RPM 10 in. Hg	Go to Diagnostic Aids	Go to Step 18
14	1. Visually/physically check for the following conditions: ● Vent hose disconnected or damaged. ● EVAP canister damaged. 2. If a problem is found, repair as necessary. Was a repair necessary?	—	Go to Step 20	Go to Step 19
15	1. Visually/physically check for the following conditions: ● Missing or malfunctioning fuel cap. ● Disconnected or leaking fuel tank vapor line. ● Disconnected or damaged EVAP purge line. 2. If a problem is found, repair as necessary. Was a repair necessary?	—	Go to Step 20	Go to Step 16

DTC P0440 EVAP Control System Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
16	1. Using the Tech 2, command the EVAP vent solenoid ON. 2. With the cart connected to the EVAP service port continuously attempt to pressurize the EVAP system by leaving the cart control knob in the pressurized position. 3. Using the ultrasonic leak detector J41416, locate and repair any leaks in the EVAP system (it may be necessary to partially lower the fuel tank to examine the top tank connections). Is the action complete?	—	Go to Step 20	—
17	Replace the EVAP canister purge valve. Refer to Diagnostic Aids Is the action complete?	—	Go to Step 20	—
18	Locate and repair the cause of no source or vacuum to the EVAP canister purge valve. Is the action complete?	—	Go to Step 20	—
19	Replace the EVAP vent solenoid. Refer to Diagnostic Aids Is the action complete?	—	Go to Step 20	—
20	**IMPORTANT:** Review the temperature variation instructions included with J41413 before performing this step. 1. Turn the ignition switch ON, with the engine OFF. 2. Using the Tech 2, command the EVAP vent solenoid ON (closed). 3. Pressurize the EVAP system to the specified value using the EVAP pressure/purge cart J41413 (monitor pressure using the gauge on the cart). 4. Switch the rotary switch on the cart to HOLD and observe the EVAP pressure gauge. Does the pressure decrease to less than the specified value within 2 minutes?	2.14V	System OK	Go to Step 3

DIAGNOSTIC TROUBLE CODE (DTC) P0442 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM SMALL LEAK DETECTED



060R100040

Circuit Description

The evaporative system includes the following components:

- Fuel tank.
- EVAP vent solenoid.
- Fuel tank pressure sensor.
- Fuel pipes and hoses.
- Fuel vapor lines.
- Fuel cap.
- EVAP canister.
- Purge lines.
- EVAP canister purge valve.
- EVAP service port.

The evaporative emission system is checked by applying vacuum to the EVAP system and monitoring for a vacuum decay. The PCM monitors the vacuum level through the fuel tank pressure sensor signal. At an appropriate time, the EVAP canister purge valve and the EVAP vent solenoid are turned ON, allowing the engine to draw a small vacuum on the entire evaporative emission system. After the desired vacuum level has been achieved, the EVAP canister purge valve is turned OFF, sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, when all other variables remain constant. A small leak in the system will cause Diagnostic Trouble Code P0442 to be set. DTC P0442 is a type A code.

Conditions for Setting the DTC

- The BARO is greater than 72.3 kPa.
- No: MAP, TPS, IAT, ECT, EGR, EVAP Purge Solenoid, EVAP Vent Solenoid, VSS, or System Voltage Diagnostic Trouble Codes.
- IAT and ECT at startup are between 4.2°C(40°F) and 35°C (95°F).
- The difference between IAT and ECT at startup is less than 6.75°C (12.2°F).
- Fuel Level counts vary by less than 8 counts in a 0.125 second time frame.
- The Fuel Tank Level Sensor reads between 15% and 85%.
- Maximum Engine Run time is at least 390 seconds.
- The difference between the actual Fuel Tank Pressure and the expected Fuel Tank Pressure is less than the PCM's expectation.
- Fuel Tank Pressure slope is less than or equal to 2.4mm (0.098 inches)of water, per seconds.

The above conditions are met, and the following condition is met once per ignition cycle:

- A single 10 second vacuum decay slope and 2 five second vacuum slopes are all greater than or equal to the PCM's upper threshold.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The PCM will record operating conditions at the time the diagnostic fails. The Freeze Frame and Failure Records buffers will store this information.
- A history Diagnostic Trouble Code is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after 3 consecutive ignition cycles in which the diagnostic runs without a fault.
- A history Diagnostic Trouble Code will clear after 40 consecutive warm up cycles without a fault.
- A Tech 2 can clear the Diagnostic Trouble Codes.

Diagnostic Aids

- A loose, missing, or damaged fuel cap.
- Missing or damaged O–rings at the fuel vapor fittings and the EVAP purge line canister fittings.
- Cracked EVAP canister.
- Damaged source vacuum line, EVAP purge line, EVAP vent hose or fuel vapor line.
- The Fuel Pressure Sensor shares a 5 Volt reference with the MAP sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The Fuel Pressure Sensor share a ground with the ECT sensor, the TP sensor the CMP, the CKP and Automatic transmission temperature sensor.
- Poor connection at PCM: Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness: Inspect the wiring harness to the EVAP vent solenoid, the EVAP purge solenoid, and the fuel tank pressure sensor for an intermittent open or intermittent short circuit.

Check for charcoal particles. Refer to Carbon Particle Removal from EVAP System before starting repairs.

Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that causes the Diagnostic Trouble Code to set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the Tech 2 if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the Tech 2 for later reference.
3. If a vent solenoid or EVAP canister purge valve electrical malfunction is present, the purge system will not operate correctly. Repairing the electrical malfunction will very likely correct the condition that set Diagnostic Trouble Code P0442.
4. Checks the fuel tank pressure sensor at ambient pressure.
6. Forces the fuel tank pressure sensor to re–zero.
7. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.

DTC P0442 EVAP Control System Small Leak Detected

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	Is Diagnostic Trouble Code P0461, P0462, or P0463 also set?	—	Go to Applicable DTC Table	Go to Step 3
3	1. Install a Tech 2. 2. Command the EVAP canister purge valve and vent solenoid ON and OFF with the Tech 2? Does the purge valve and vent solenoid click ON and OFF?	—	Go to Step 4	Go to PCM Outputs Diagnosis
4	1. Turn the ignition switch OFF. 2. Remove the fuel cap. 3. Turn the ignition switch ON. Is the Fuel Tank Pressure at the specified value? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	1.51V	Go to Step 7	Go to Step 5

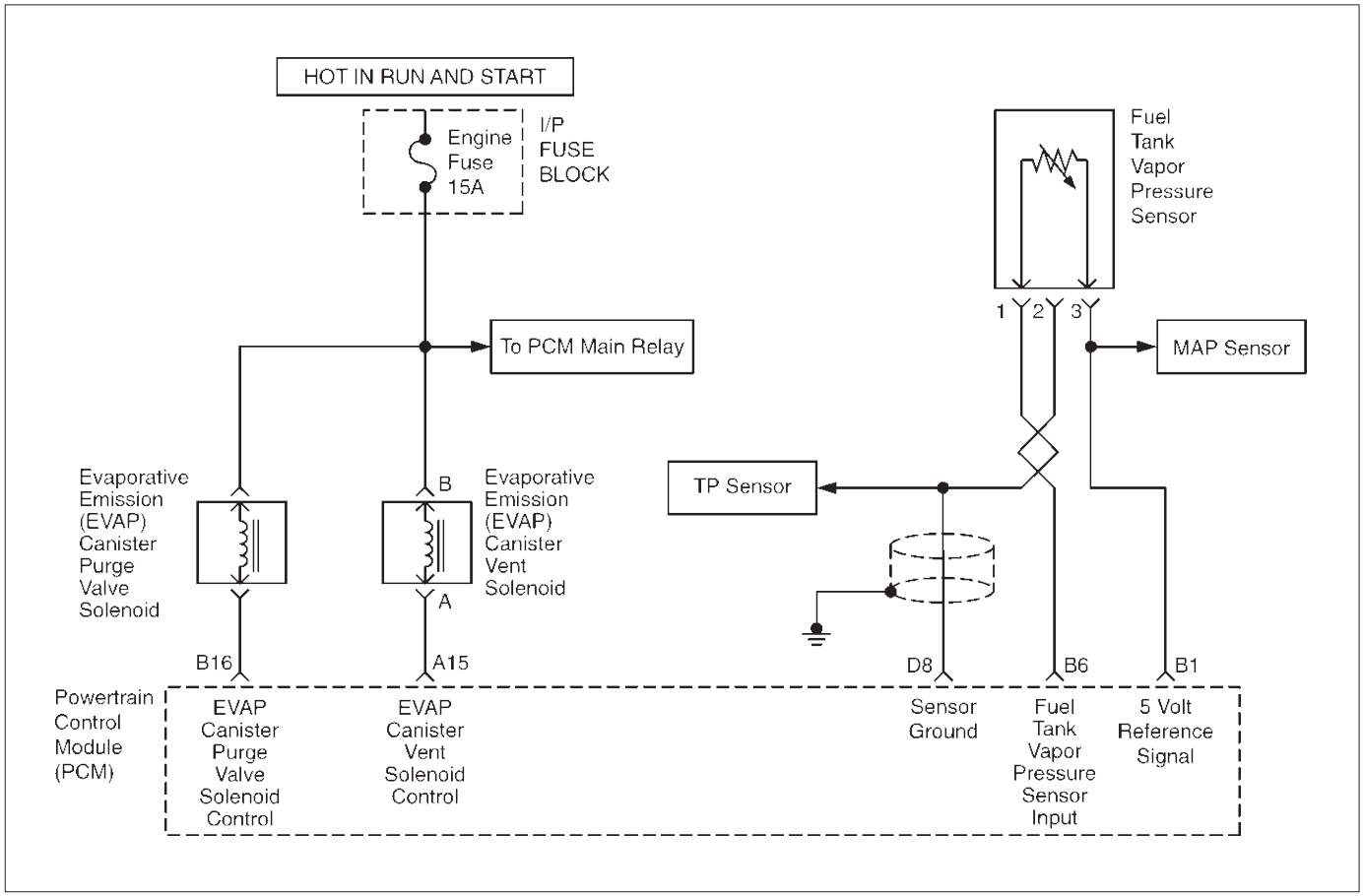
DTC P0442 EVAP Control System Small Leak Detected (Cont'd)

Step	Action	Value(s)	Yes	No
5	Has the battery been disconnected?	—	Go to EVAP Control System Diagnosis	Go to Step 6
6	Disconnect the battery, wait 20 seconds then reconnect the battery. Is the action complete?	—	Go to Step 4	—
7	**IMPORTANT:** Before continuing with this diagnosis, zero the EVAP Pressure and Vacuum Gauges on the EVAP pressure/purge cart J41413. Also read the temperature variation instruction card. (Refer to tool operating instructions). 1. Reinstall the fuel cap. 2. Using the Tech 2, command the EVAP vent solenoid ON (closed). 3. Connect the EVAP pressure/purge cart J41413 to the EVAP service port. 4. Pressurize the EVAP system to the specified value using the EVAP pressure/purge cart J41413 (monitor the pressure using the gauge on the cart with the switch in the HOLD position. 5. Observe the Fuel Tank Pressure on the Tech 2. Is the Fuel Tank Pressure at the specified value?	5 in. H2O (±2 in. H2O)	Go to Step 8	Go to EVAP Control System Diagnosis
8	**IMPORTANT:** Review the temperature variation instructions included with the J41413 before performing this step. 1. Turn the ignition switch ON, with the engine OFF. 2. Using the Tech 2, command the EVAP vent solenoid ON (closed). 3. Pressurize the EVAP system to the specified value using the EVAP pressure/purge cart J41413 (monitor the pressure using the gauge on the cart). 4. Switch the rotary switch on the cart to HOLD and observe the EVAP pressure gauge. Does the pressure decrease to less than the specified value within 2 minutes?	1.47 – 1.51V	Go to Step 9	Refer to Diagnostic Aids
9	1. Disconnect the fuel tank vapor line and the EVAP purge line from the EVAP canister. 2. Block the fuel tank vapor line fitting on the canister. 3. Connect a hand vacuum pump to the EVAP purge line fitting on the canister. 4. Ensure that the EVAP vent solenoid is still commanded ON (closed). 5. Attempt to apply vacuum to the canister. Can the specified vacuum be maintained?	5 in. Hg	Go to Step 12	Go to Step 10
10	1. Visually/physically check for the following conditions: • Vent hose disconnected or damaged. • EVAP canister damaged 2. If a problem is found, repair as necessary Was a repair necessary?	—	Go to Step 14	Go to Step 11

DTC P0442 EVAP Control System Small Leak Detected (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the EVAP vent solenoid. Refer to Diagnostic Aids Is the action complete?	—	Go to Step 14	—
12	1. Visually/physically check for the following conditions: • Malfunctioning fuel cap. • Leaking fuel tank vapor line. • Damaged EVAP purge line. 2. If a problem is found, repair as necessary Was a repair necessary?	—	Go to Step 14	Go to Step 13
13	1. Using the Tech 2, command the EVAP vent solenoid ON (closed). 2. With the EVAP pressure/purge cart J41413 connected to the EVAP system by leaving the cart control knob in the pressurized position. 3. Using the ultrasonic leak detector J41416, locate and repair the leak in the EVAP system (it may be necessary to partially lower the fuel tank to examine the top tank connections). Is the action complete?	—	Go to Step 14	—
14	**IMPORTANT:** Review the temperature variation instructions included with the J41413 before performing this step. 1. Turn the ignition switch ON, with engine OFF. 2. Using the Tech 2, command the EVAP vent solenoid ON (closed). 3. Pressurize the EVAP system to the specified value using the EVAP pressure/purge cart J41413 (monitor the pressure using the gauge on the cart). 4. Switch the rotary switch on the cart to HOLD and observe the EVAP pressure gauge. Does the pressure decrease to less than the specified value within 2 minutes?	2.14V	System OK	Go to Step 3

DIAGNOSTIC TROUBLE CODE (DTC) P0456 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM VERY SMALL LEAK DETECTED



060R100040

Circuit Description

The evaporative system includes the following components:

- Fuel tank.
- EVAP vent solenoid.
- Fuel tank pressure sensor.
- Fuel pipes and hoses.
- Fuel vapor lines.
- Fuel cap.
- EVAP canister.
- Purge lines.
- EVAP canister purge valve.
- EVAP service port.

The evaporative emission system is checked by applying vacuum to the EVAP system and monitoring for a vacuum decay. The PCM monitors the vacuum level through the fuel tank pressure sensor signal. At an appropriate time, the EVAP canister purge valve and the EVAP vent solenoid are turned ON, allowing the engine to draw a small vacuum on the entire evaporative emission system. After the desired vacuum level has been achieved, the EVAP canister purge valve is turned OFF, sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, when all other variables remain constant. A very small leak in the system will cause Diagnostic Trouble Code P0456 to be set. DTC P0456 is a type A code.

Conditions for Setting the DTC

- The BARO is greater than 72.3 kPa.
- No: MAP, TPS, IAT, ECT, EGR, EVAP Purge Solenoid, EVAP Vent Solenoid, VSS, or System Voltage Diagnostic Trouble Codes.
- IAT and ECT at startup are between 4.2°C(40°F) and 35°C (95°F).
- The difference between IAT and ECT at startup is less than 6.75°C (12.2°F).
- Fuel Level counts vary by less than 8 counts in a 0.125 second time frame.
- The Fuel Tank Level Sensor reads between 40% and 85%.
- Maximum Engine Run time is at least 390 seconds.
- The difference between the actual Fuel Tank Pressure and the expected Fuel Tank Pressure is less than the PCM's expectation.
- Fuel Tank Pressure slope is less than or equal to 1.09mm (0.043 inches) of water, per seconds.

The above conditions are met, and the following condition is met once per ignition cycle:

- A single 30 second vacuum decay slope and 5 six second vacuum slopes are all greater than or equal to the PCM's upper threshold.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The PCM will record operating conditions at the time the diagnostic fails. The Freeze Frame and Failure Records buffers will store this information.
- A history Diagnostic Trouble Code is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after 3 consecutive ignition cycles in which the diagnostic runs without a fault.
- A history Diagnostic Trouble Code will clear after 40 consecutive warm up cycles without a fault.
- A Tech 2 can clear the Diagnostic Trouble Codes.

Diagnostic Aids

- A loose, missing, or damaged fuel cap.
- Missing or damaged O–rings at the fuel vapor fittings and the EVAP purge line canister fittings.
- Cracked EVAP canister.
- Damaged source vacuum line, EVAP purge line, EVAP vent hose or fuel vapor line.
- The Fuel Pressure Sensor shares a 5 Volt reference with the MAP sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The Fuel Pressure Sensor share a ground with the ECT sensor, the TP sensor the CMP, the CKP and Automatic transmission temperature sensor.
- Poor connection at PCM: Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness: Inspect the wiring harness to the EVAP vent solenoid, the EVAP purge solenoid, and the fuel tank pressure sensor for an intermittent open or intermittent short circuit.

Check for charcoal particles. Refer to Carbon Particle Removal from EVAP System before starting repairs.
Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that causes the Diagnostic Trouble Code to set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the Tech 2 if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the Tech 2 for later reference.
3. If a vent solenoid or EVAP canister purge valve electrical malfunction is present, the purge system will not operate correctly. Repairing the electrical malfunction will very likely correct the condition that set Diagnostic Trouble Code P0456.
4. Checks the fuel tank pressure sensor at ambient pressure.
6. Forces the fuel tank pressure sensor to re–zero.
7. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.

DTC P0456 EVAP Control System Very Small Leak Detected

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	Is Diagnostic Trouble Code P0461, P0462, or P0463 also set?	—	Go to Applicable DTC Table	Go to Step 3
3	1. Install a Tech 2. 2. Command the EVAP canister purge valve and vent solenoid ON and OFF with the Tech 2? Does the purge valve and vent solenoid click ON and OFF?	—	Go to Step 4	Go to PCM Outputs Diagnosis
4	1. Turn the ignition switch OFF. 2. Remove the fuel cap. 3. Turn the ignition switch ON. Is the Fuel Tank Pressure at the specified value? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	1.51V	Go to Step 7	Go to Step 5

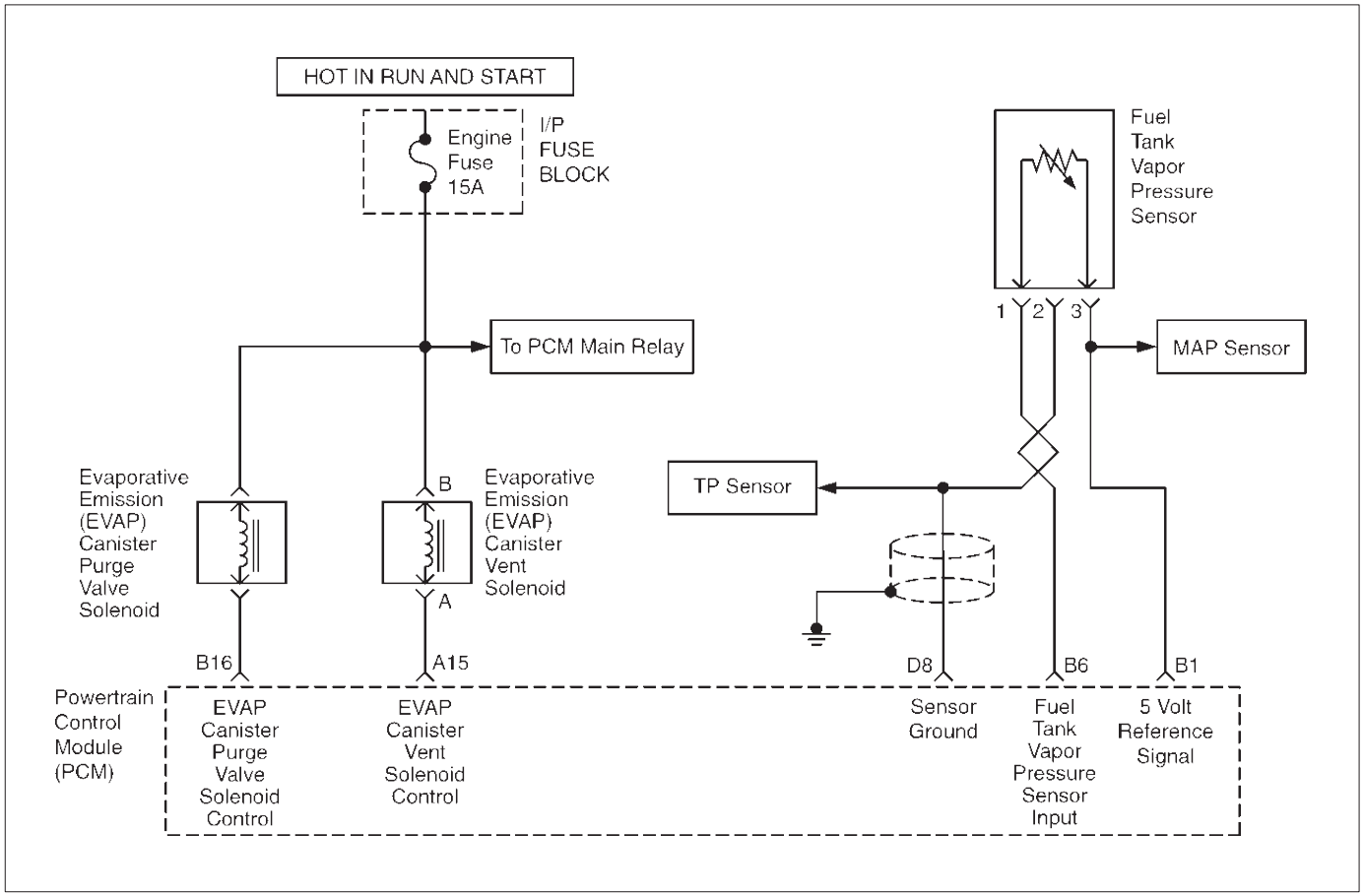
DTC P0456 EVAP Control System Very Small Leak Detected (Cont'd)

Step	Action	Value(s)	Yes	No
5	Has the battery been disconnected?	—	Go to EVAP Control System Diagnosis	Go to Step 6
6	Disconnect the battery, wait 20 seconds then reconnect the battery. Is the action complete?	—	Go to Step 4	—
7	**IMPORTANT:** Before continuing with this diagnosis, zero the EVAP Pressure and Vacuum Gauges on the EVAP pressure/purge cart J41413. Also read the temperature variation instruction card. (Refer to tool operating instructions). 1. Reinstall the fuel cap. 2. Using the Tech 2, command the EVAP vent solenoid ON (closed). 3. Connect the EVAP pressure/purge cart J41413 to the EVAP service port. 4. Pressurize the EVAP system to the specified value using the EVAP pressure/purge cart J41413 (monitor the pressure using the gauge on the cart with the switch in the HOLD position. 5. Observe the Fuel Tank Pressure on the Tech 2. Is the Fuel Tank Pressure at the specified value?	5 in. H2O (±2 in. H2O)	Go to Step 8	Go to EVAP Control System Diagnosis
8	**IMPORTANT:** Review the temperature variation instructions included with the J41413 before performing this step. 1. Turn the ignition switch ON, with the engine OFF. 2. Using the Tech 2, command the EVAP vent solenoid ON (closed). 3. Pressurize the EVAP system to the specified value using the EVAP pressure/purge cart J41413 (monitor the pressure using the gauge on the cart). 4. Switch the rotary switch on the cart to HOLD and observe the EVAP pressure gauge. Does the pressure decrease to less than the specified value within 2 minutes?	1.47 – 1.51V	Go to Step 9	Refer to Diagnostic Aids
9	1. Disconnect the fuel tank vapor line and the EVAP purge line from the EVAP canister. 2. Block the fuel tank vapor line fitting on the canister. 3. Connect a hand vacuum pump to the EVAP purge line fitting on the canister. 4. Ensure that the EVAP vent solenoid is still commanded ON (closed). 5. Attempt to apply vacuum to the canister. Can the specified vacuum be maintained?	5 in. Hg	Go to Step 12	Go to Step 10
10	1. Visually/physically check for the following conditions: • Vent hose disconnected or damaged. • EVAP canister damaged 2. If a problem is found, repair as necessary Was a repair necessary?	—	Go to Step 14	Go to Step 11

DTC P0456 EVAP Control System Very Small Leak Detected (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the EVAP vent solenoid. Refer to Diagnostic Aids Is the action complete?	—	Go to Step 14	—
12	1. Visually/physically check for the following conditions: • Malfunctioning fuel cap. • Leaking fuel tank vapor line. • Damaged EVAP purge line. 2. If a problem is found, repair as necessary Was a repair necessary?	—	Go to Step 14	Go to Step 13
13	1. Using the Tech 2, command the EVAP vent solenoid ON (closed). 2. With the EVAP pressure/purge cart J41413 connected to the EVAP system by leaving the cart control knob in the pressurized position. 3. Using the ultrasonic leak detector J41416, locate and repair the leak in the EVAP system (it may be necessary to partially lower the fuel tank to examine the top tank connections). Is the action complete?	—	Go to Step 14	—
14	**IMPORTANT:** Review the temperature variation instructions included with the J41413 before performing this step. 1. Turn the ignition switch ON, with engine OFF. 2. Using the Tech 2, command the EVAP vent solenoid ON (closed). 3. Pressurize the EVAP system to the specified value using the EVAP pressure/purge cart J41413 (monitor the pressure using the gauge on the cart). 4. Switch the rotary switch on the cart to HOLD and observe the EVAP pressure gauge. Does the pressure decrease to less than the specified value within 2 minutes?	2.14V	System OK	Go to Step 3

DIAGNOSTIC TROUBLE CODE (DTC) P0443 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT MALFUNCTION



060R100040

Circuit Description

The Powertrain Control Module (PCM) controls the Evaporative Emission (EVAP) Canister Purge Solenoid Valve through the use of a control (ground) circuit. If the PCM commands the Purge solenoid to maximum duty cycle (100%) but the voltage remains High (12 Volts); or, if the PCM commands the Purge solenoid to minimum duty cycle (0%) but the voltage remains Low (0 volts), then DTC P0443 will set. DTC P0443 is a type A code.

Conditions for Setting the DTC

- Ignition voltage is greater than 10 volts
- Engine run time is greater than 32 seconds

The above conditions are met for 20 test failures within 40 test samples while 12.5 msec.

- PCM senses voltage is High with the EVAP Canister Purge Solenoid commanded ON.
- PCM senses voltage is Low with the EVAP Canister Purge Solenoid commanded OFF.

Action Taken When the DTC Sets

- The PCM will illuminate the Malfunction Indicator Lamp (MIL) the first time the fault is detected.
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL after three consecutive trips without a reported failure.
- A History DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using the Scan Tool's "Clear Info" function.

Diagnostic Aids

- Poor connections , or a damaged harness – Inspect the harness connectors for: backed–out terminals, improper mating or damaged terminals. Also check for open circuits, shorts to ground, and shorts to voltage.
- The Fuel Pressure Sensor shares a 5 Volt reference with the MAP sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The Fuel Pressure Sensor share a ground with the ECT sensor, the TP sensor the CMP, the CKP, and automatic transmission temperature sensor.

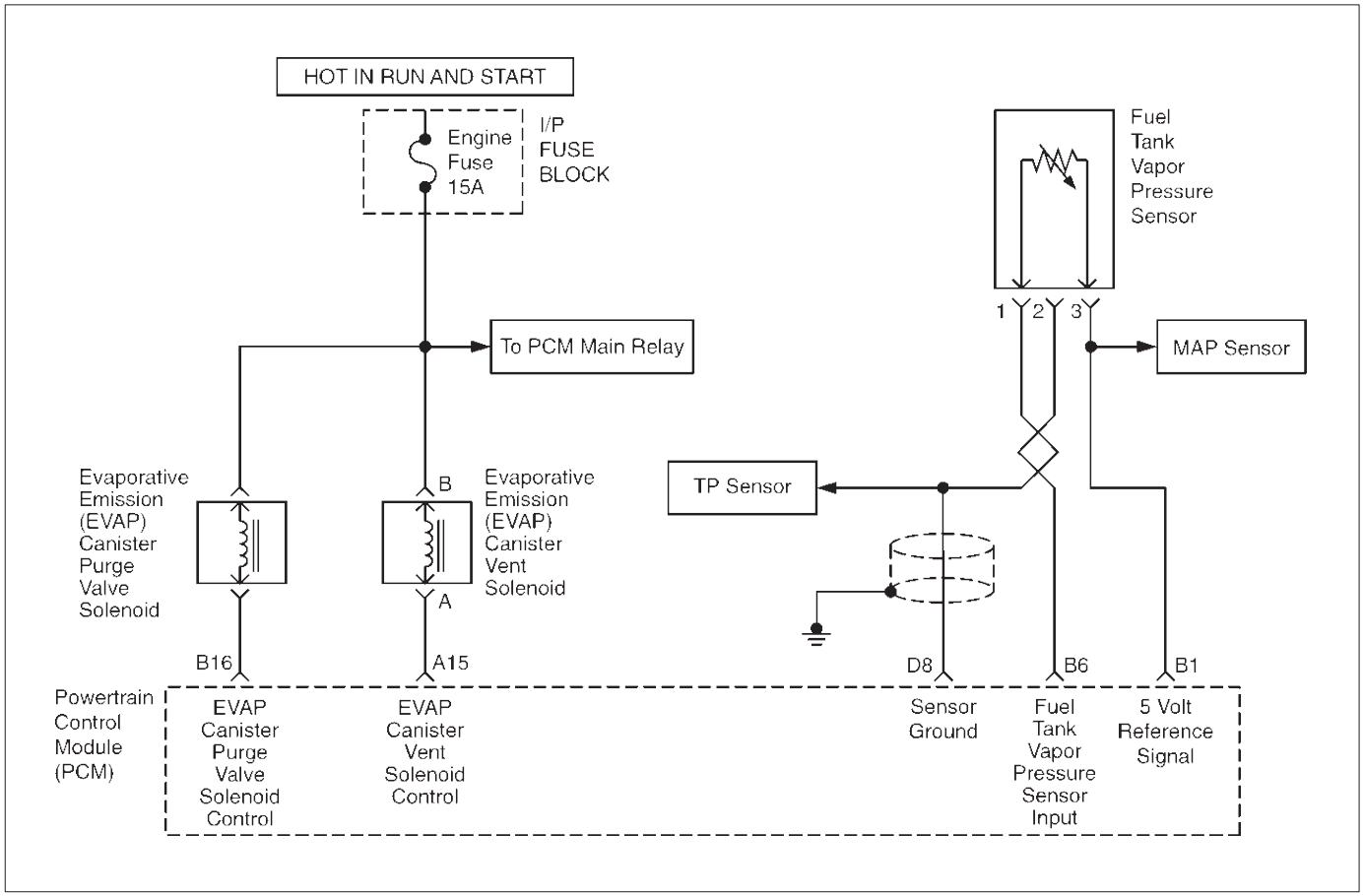
DTC P0443 EVAP Control System Purge Control Valve Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTC’s. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P0443. Does the Tech 2 indicate DTC P0443 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Disconnect the EVAP Canister Purge Solenoid from the wiring harness connector from the EVAP Canister Purge Solenoid. 3. Ignition ON, Engine OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the ”Engine IG.” Fuse pin of the EVAP Canister Purge Solenoid wiring harness connector. Does the DVM read the following value?	12 Volts	Go to Step 5	Go to Step 4
4	Check the suspect circuit between the EVAP Canister Purge Solenoid connector and the ”Engine IG.” Fuse for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	—
5	Using a DVM, check the resistance of the EVAP Canister Purge Solenoid. Does the DVM read the following value?	less than 5 Ω	Go to Step 6	Go to Step 7
6	1. Ignition OFF. 2. Disconnect the Powertrain Control Module (PCM) connectors from the PCM. 3. Check the EVAP Canister Purge Solenoid control circuit between the PCM and EVAP Canister Purge Solenoid for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 8

DTC P0443 EVAP Control System Purge Control Valve Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
7	Replace the EVAP Canister Purge Solenoid. Verify Repair.	—	—	—
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P0446 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM VENT CONTROL CIRCUIT MALFUNCTION



060R100040

Circuit Description

The evaporative system includes the following components:

- Fuel tank.
- EVAP vent solenoid.
- Fuel tank pressure sensor.
- Fuel pipes and hoses.
- Fuel vapor lines.
- Fuel cap.
- EVAP canister.
- Purge lines.
- EVAP canister purge valve.
- EVAP service port.

The evaporative emission system is checked by applying vacuum to the EVAP system and monitoring for a vacuum decay. The PCM monitors the vacuum level through the fuel tank pressure sensor signal.

At an appropriate time, the EVAP canister purge valve and the EVAP vent solenoid are turned ON, allowing the engine to draw a small vacuum on the entire evaporative emission system. After the desired vacuum level has been achieved, the EVAP canister purge valve is turned OFF, sealing the system.

A restricted or blocked EVAP canister vent path is detected by drawing a vacuum on the EVAP system, turning OFF the EVAP vent solenoid and the EVAP canister purge valve (EVAP vent solenoid Open, EVAP purge PWM 0%) and monitoring the fuel tank vacuum sensor input. With the EVAP vent solenoid open, any vacuum in the system should decrease quickly unless the vent path is blocked. A blockage can be caused by the following conditions:

- Faulty EVAP vent solenoid (stuck closed).
- Plugged, kinked or pinched vent hose.
- Shorted EVAP vent solenoid driver circuit.
- Plugged evaporative canister.

If any of these conditions are present, Diagnostic Trouble Code P0446 will set. DTC P0446 is a type B code.

Conditions for Setting the DTC

- The BARO is greater than 72.3 kPa.
- No: MAP, TPS, IAT, ECT, EGR, EVAP Purge Solenoid, EVAP Vent Solenoid, VSS or System Voltage Diagnostic Trouble Codes.
- IAT and ECT at startup are between 4.2˚C(40˚F) and 35˚C (95˚F).
- The difference between IAT and ECT at startup is less than 6.75˚C (12.2˚F).
- The Fuel Tank Level Sensor reads between 15% and 85%.

The above conditions are met, and the following condition is met once while ignition cycle:

- Fuel Tank vacuum is greater than 20 cm (8 inches) of water while 2 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The PCM will records operating conditions at the time the diagnostic fails. The Freeze Frame and Failure Records buffers will store this information.
- A history Diagnostic Trouble Code is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after 3 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.
- A Tech 2 can clear the DTC's.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM: Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- The Fuel Pressure Sensor shares a 5 Volt reference with the MAP sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The Fuel Pressure Sensor share a ground with the ECT sensor, the TP sensor the CKP, the CMP, and automatic transmission temperature sensor.
- Damaged harness: Inspect the wiring harness to the EVAP vent solenoid and the fuel tank pressure sensor for shorts to ground, shorts to battery positive, and open circuits.
- Kinked, pinched or plugged vent hose: Verify that the vent hose between the canister and the EVAP vent solenoid is not restricted.

Check for charcoal particles. Refer to Carbon Particles Removal from EVAP System before starting repairs.

Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that causes the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the Tech 2 if applicable. This creates an electronic copy of the data taken when the malfunction occurs. This may assist in diagnosing the condition.
3. If a vent solenoid electrical malfunction is present, the purge system will not operate correctly. Repairing the electrical malfunction will very likely correct the condition that set Diagnostic Trouble Code P0446.
4. Checks the fuel tank pressure sensor at ambient pressure.
6. Forces the fuel tank pressure sensor to re–zero.
7. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.
9. Checks for a blocked EVAP canister.
13. Duplicates the Powertrain On–Board Diagnostic test.

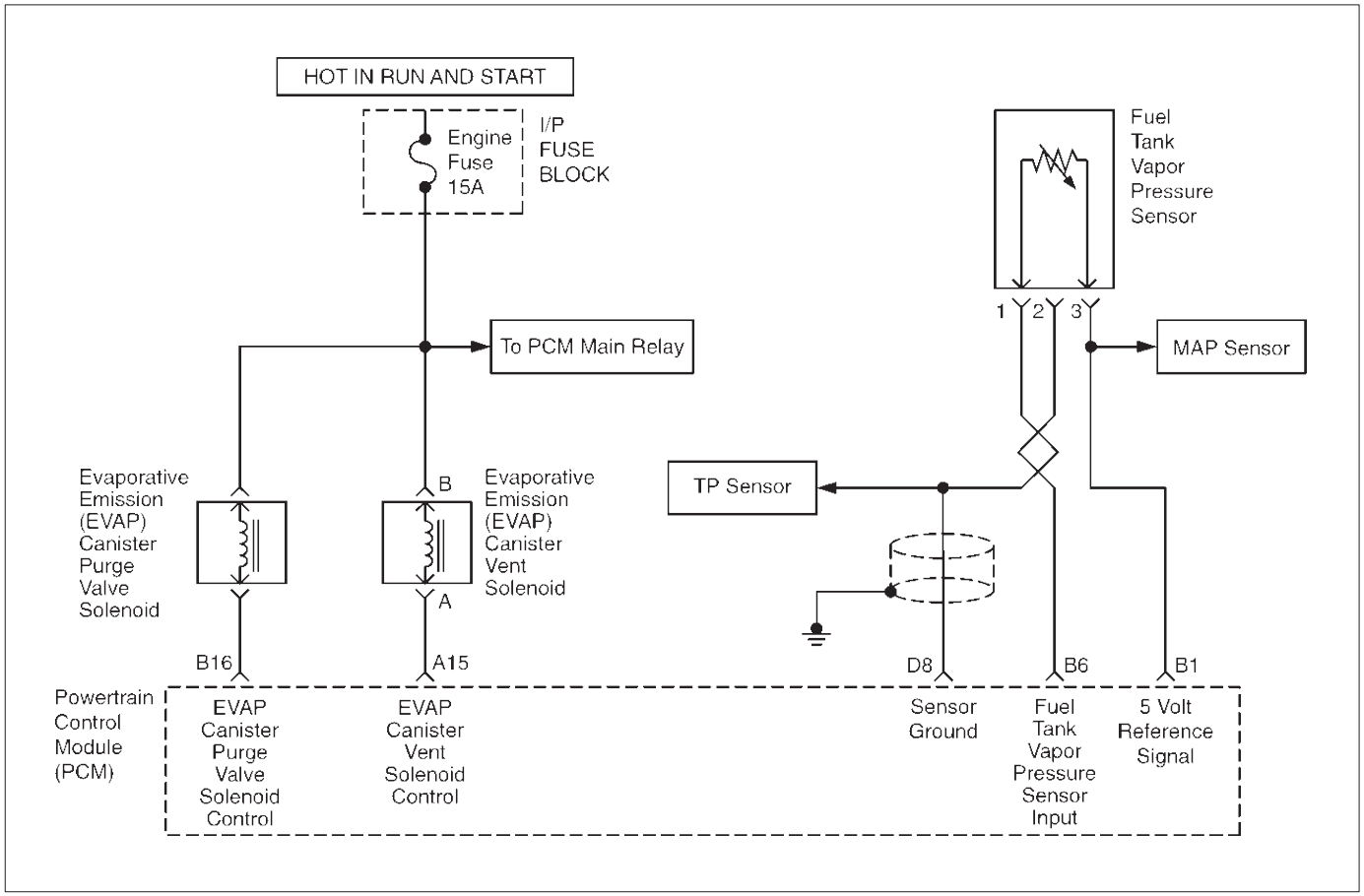
DTC P0446 EVAP Control System Vent Control Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	Is Diagnostic Trouble Code P0461, P0462, or P0463 also set?	—	Go to Applicable DTC chart	Go to Step 3
3	1. Install a Tech 2. 2. Command the EVAP canister purge valve and vent solenoid ON and OFF with the Tech 2? Does the purge valve and vent solenoid click ON and OFF? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	–	Go to Step 4	Go to PCM Outputs Diagnosis
4	1. Turn the ignition switch OFF. 2. Remove the fuel cap. 3. Turn the ignition switch ON. Is the Fuel Tank Pressure at the specified value?	1.51V	Go to Step 7	Go to Step 5
5	Has the battery been disconnected?	—	Go to EVAP Control System Diagnosis	Go to Step 6
6	Disconnect the battery, wait 30 seconds, then reconnect the battery. Is the action complete?	—	Go to Step 4	—
7	**IMPORTANT:** Before continuing with this diagnosis, zero the EVAP Pressure and Vacuum Gauges on the EVAP pressure/purge cart J41413. Also read the temperature variation instruction card. (Refer to tool operating instructions). 1. Reinstall the fuel cap. 2. Using the Tech 2, command the EVAP vent solenoid ON (closed). 3. Connect the EVAP pressure/purge cart J41413 to the EVAP service port. 4. Pressurize the EVAP system to the specified value using the EVAP pressure/purge cart J41413 (monitor the pressure using the gauge on the cart with the switch in the ”HOLD” position. 5. Observe the Fuel Tank Pressure on the Tech 2. Is the Fuel Tank Pressure at the specified value?	1.52 – 1.69V	Go to Step 8	Go to EVAP Control System Diagnosis
8	1. Maintain the specified EVAP pressure. 2. Using the Tech 2, command the EVAP vent solenoid OFF (open) while observing the EVAP pressure gauge on the cart J41413. Does the EVAP pressure return to the specified value within 5 seconds?	0 in. H2O	Refer to Diagnostic Aids	Go to Step 9

DTC P0446 EVAP Control System Vent Control Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Disconnect the large vent hose (marked air) from the EVAP canister. 2. Switch the rotary switch on the cart J41413 to PURGE. 3. Start the engine and allow the engine to reach operating temperature. 4. Observe the vacuum gauge for 5 seconds while holding the engine speed at the specified value. Does the vacuum remain below the specified value?	30 in. H2O 2500 RPM	Go to Step 10	Go to Step 12
10	1. Inspect the EVAP vent hose between the EVAP canister and the EVAP vent solenoid for being kinked, pinched, or other wise blocked. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to Step 13	Go to Step 11
11	Replace the EVAP vent solenoid. Refer to Diagnostic Aids Is the action complete?	—	Go to Step 13	—
12	Replace the EVAP canister. Refer to EVAP Canister Replacement. Is the action complete?	—	Go to Step 13	—
13	1. Using the Tech 2, command the EVAP vent solenoid ON (closed). 2. Pressurize the EVAP system to the specified value. 3. Switch the rotary switch on the cart J41413 to HOLD. 4. Using the Tech 2, command the EVAP vent solenoid OFF (open) while observing the EVAP pressure gauge on the cart J41413. Does the EVAP pressure return to the specified value within 5 seconds?	1.51V	System OK	Go to Step 3

DIAGNOSTIC TROUBLE CODE (DTC) P0449 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM VENT VALVE/SOLENOID CIRCUIT MALFUNCTION



060R100040

Circuit Description

The Powertrain Control Module (PCM) controls the Evaporative Emission (EVAP) Canister Vent Solenoid Valve through the use of a control (ground) circuit. If the PCM commands the Vent solenoid but the voltage remains High (12 Volts); or, if the PCM commands the Vent solenoid OFF but the voltage remains Low (0 volts), then DTC P0449 will set. DTC P0449 is a type A code.

Conditions for Setting the DTC

- Ignition voltage is greater than 10 volts.
- Engine run time is greater than 32 seconds.

The above mentioned conditions are met and one of the following two conditions are met for 20 tests within a 40 tests test sample while 125 msec:

- PCM senses voltage is High with the EVAP Canister Vent Solenoid commanded ON.
- PCM senses voltage is Low with the EVAP Canister Vent Solenoid commanded OFF.

Action Taken When the DTC Sets

- The PCM will illuminate the Malfunction Indicator Lamp (MIL).
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL after three consecutive trips without a reported failure.
- A History DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using the Scan Tool's "Clear Info" function.

Diagnostic Aids

- Poor connections , or a damaged harness – Inspect the harness connectors for: backed–out terminals, improper mating or damaged terminals. Also check for open circuits, shorts to ground, and shorts to voltage.
- The Fuel Pressure Sensor shares a 5 Volt reference with the MAP sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The Fuel Pressure Sensor share a ground with the ECT sensor, the TP sensor, the CKP sensor, the CMP sensor and the automatic transmission temperature sensor.

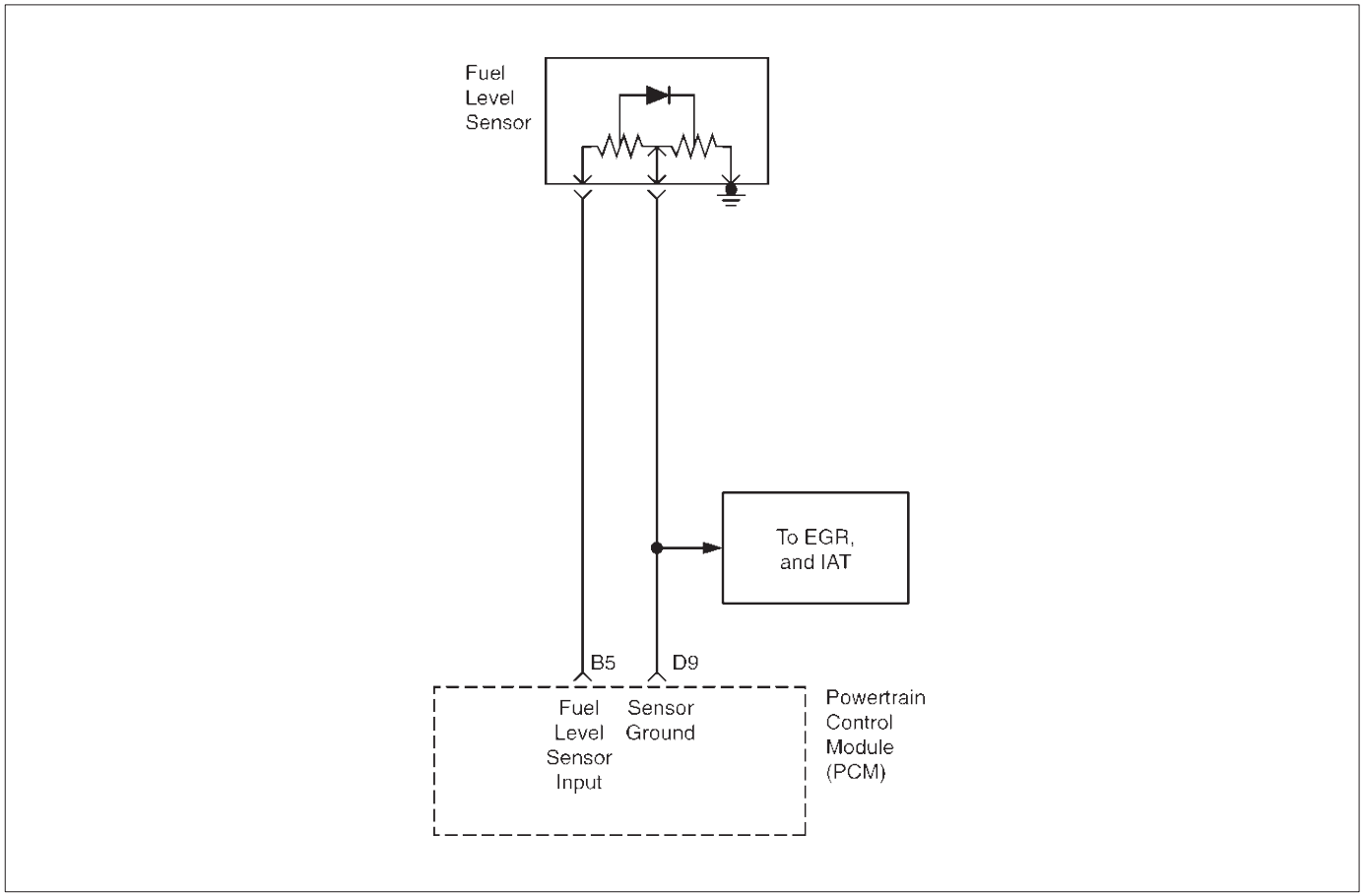
DTC P0449 EVAP Control System Vent Valve/Solenoid Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTC’s. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P0449. Does the Tech 2 indicate DTC P0449 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Disconnect the EVAP Canister Purge Solenoid from the wiring harness connector from the EVAP Canister Purge Solenoid. 3. Ignition ON, Engine OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the ”Engine IG.” Fuse pin of the EVAP Canister Purge Solenoid wiring harness connector. Does the DVM read the following value?	12 Volts	Go to Step 5	Go to Step 4
4	Check the suspect circuit between the EVAP Canister Purge Solenoid connector and the ”Engine IG.” Fuse for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	—
5	Using a DVM, check the resistance of the EVAP Canister Purge Solenoid. Does the DVM read the following value?	less than 5 Ω	Go to Step 6	Go to Step 4
6	1. Ignition OFF. 2. Disconnect the Powertrain Control Module (PCM) connectors from the PCM. 3. Check the EVAP Canister Purge Solenoid control circuit between the PCM and EVAP Canister Purge Solenoid for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	—

DTC P0449 EVAP Control System Vent Valve/Solenoid Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
7	Replace the EVAP Canister Purge Solenoid.	—	Verify repair.	Go to Step 7
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.	—	Verify repair.	Go to Step 8

DIAGNOSTIC TROUBLE CODE (DTC)
P0461 FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE



060R100041

Circuit Description

The Fuel Level sensor is an important input to the PCM for the Enhanced Evaporative System Diagnostic. The PCM needs the fuel level information in order to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the EVAP system. Several of the Enhanced Evaporative System Diagnostic sub–test are dependent upon correct fuel level information. The diagnostic will not run when the tank is greater than 85% or less than 15% full. (This sensor signal disables the misfire when the fuel levels are less than 15%). DTC P0461 is a type D Code.

Conditions for Setting the DTC

- The Fuel Level signal changes by less than 7 counts (0.14 volts) over a distance of 240 km (146 miles).

Action Taken When the DTC Sets

- The PCM will not turn on the MIL.

Conditions for Clearing the DTC

- The PCM turns the MIL off after 3 consecutive driving trips withouta fault condition present.
- A history DTC will clear if no fault conditions have been detected for 40 warm–up cycles (coolant temperature has risen 40˚F from the start–up coolant temperature and the engine coolant temperature exceeds 160˚F during that same ignition cycle) or the Tech 2 clearing feature has been used.

Test Description

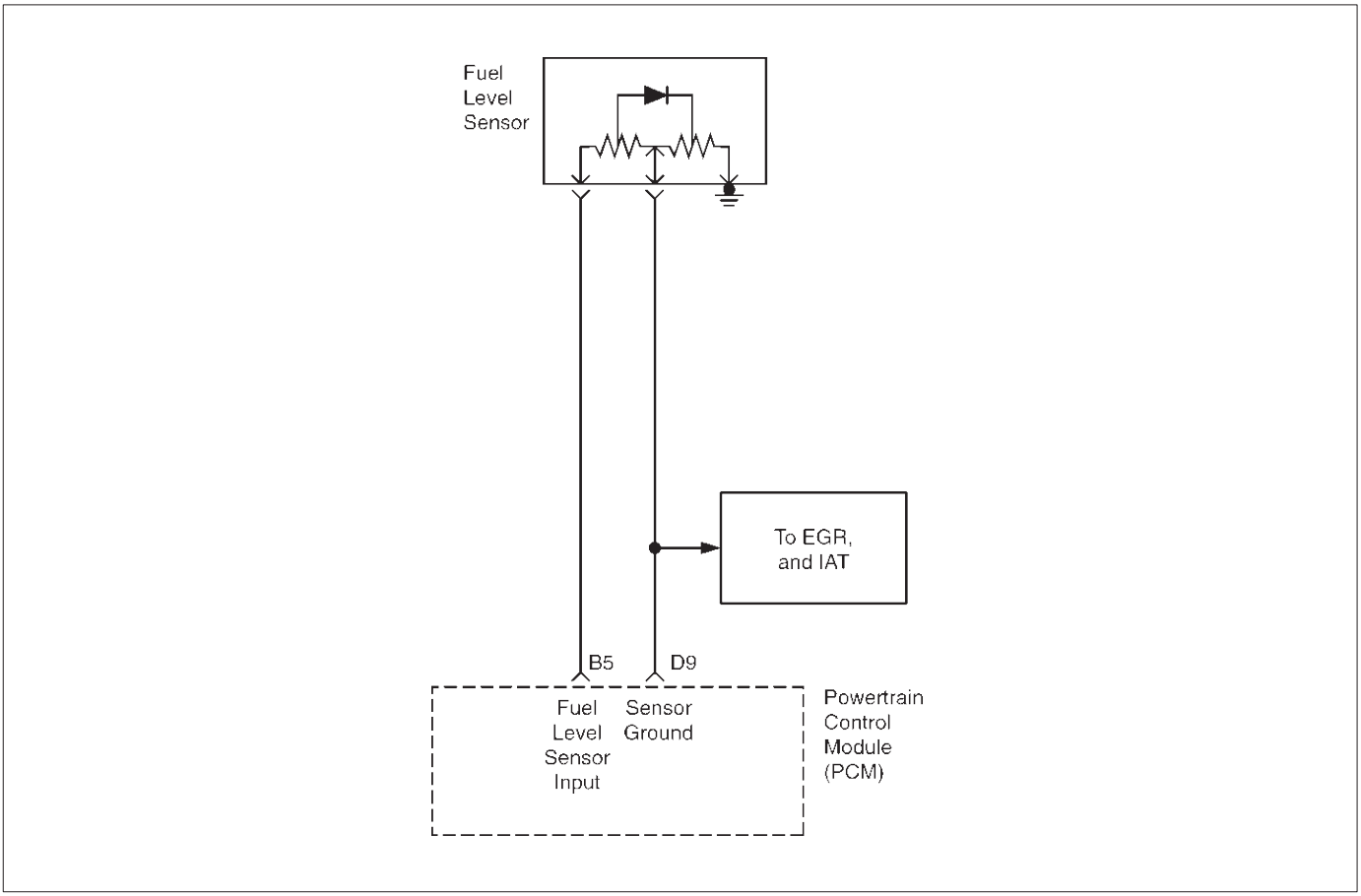
Number(s) below refer to the step number(s) on the Diagnostic Chart:

4. This step determines if the fuel gauge and fuel level sender module are operating correctly.

DTC P0461 Fuel Level Sensor Circuit Range/Performance

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Install the Tech 2. 2. Turn ON the ignition. 3. Compare the fuel level on the Tech 2 with the vehicle fuel gauge. Are the levels approximately the same?	—	Go to Step 3	Go to Step 5
3	1. Record the vehicle fuel gauge reading. 2. Turn OFF the ignition. 3. Disconnect the PCM's connector. 4. Turn ON the ignition. Did the vehicle fuel gauge reading change?	—	Go to Step 4	Go to Step 5
4	1. Turn the ignition OFF. 2. Disconnect the fuel tank level sensor connector. 3. Using a fused jumper wire, jump the fuel level input to the fuel level sensor ground. 4. Turn the ignition ON. Does the Tech 2 and the fuel gauge indicate the specified value?	0% (Empty)	Go to Step 5	Go to Step 6
5	Replace the Fuel tank level sensor.	—	Go to Step 7	—
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to Step 7	—
7	1. Using the Tech 2, select the Diagnostic Trouble Code, and Clear Info. 2. Start the engine. 3. Idle at the normal operating temperature. 4. Select the DTC and the Specific 5. Enter the DTC number which was set. 6. Operate the vehicle within the conditions for setting this DTC. Does the Tech 2 indicate that this diagnostic Ran and Passed?	—	System OK	Go to Step 2

DIAGNOSTIC TROUBLE CODE (DTC)
P0462 FUEL LEVEL SENSOR CIRCUIT LOW INPUT



060R100041

Circuit Description

The Fuel Level Sensor is an important input to the PCM for the Enhanced Evaporative System Diagnostic. The PCM needs the fuel level information in order to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the EVAP system. Several of the Enhanced Evaporative System Diagnostic sub–test are dependent upon correct fuel level information. The diagnostic will not run when the tank is greater than 85% or less than 15% full. (This sensor signal disables the misfire when the fuel levels are less than 15%). If the PCM detects a continuous short to ground in the Fuel Level sensor or circuit, then a code P0462 will set. DTC P0462 is a type D code.

Conditions for Setting the DTC

- The Fuel Level signal voltage is less than 0.06 volts. The condition is met for 150 test failures within 200 test samples.

Action Taken When the DTC Sets

- The PCM will not turn on the MIL.

Conditions for Clearing the DTC

- The PCM turns the MIL OFF after 3 consecutive driving trips without a fault condition present.
- A history Diagnostic Trouble Code will clear if no fault conditions have been detected for 40 warm–up cycles (coolant temperature has risen 40°F from the start–up coolant temperature and the engine coolant temperature exceeds 160°F during that same ignition cycle) or the Tech 2 clearing feature has been used.

Test Description

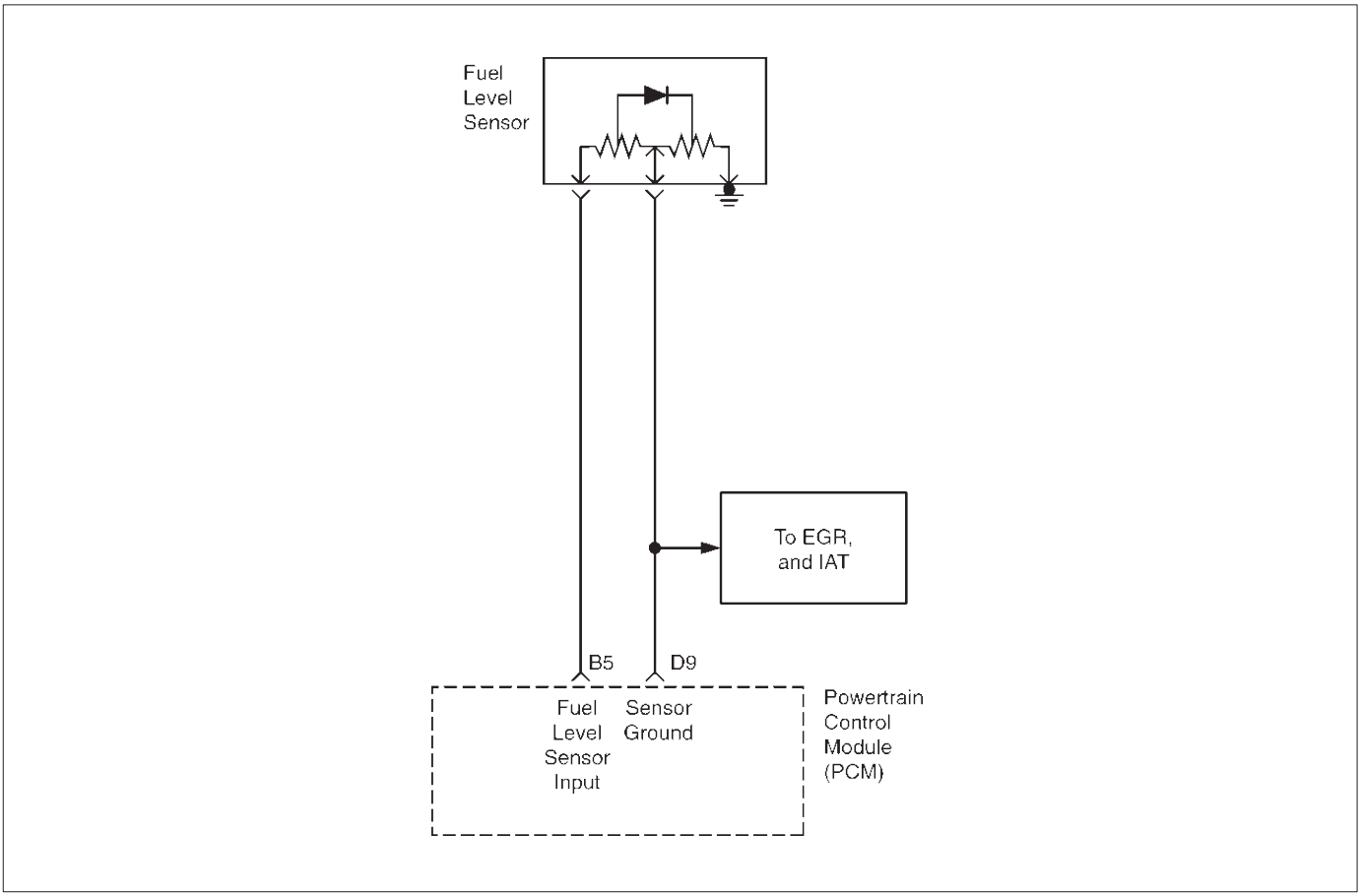
Number(s) below refer to the step number(s) on the Diagnostic Chart:

4. This step checks the wiring, connections, and the PCM.
6. This step checks the wiring, connections, and the PCM.

DTC P0462 Fuel Level Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Install the Tech 2. 2. Ignition ON. 3. Observe the fuel level on the Tech 2. Does the Tech 2 display the specified value?	0%–1%	Go to Step 4	Go to Step 3
3	Refer to Fuel Gauge Diagnosis.	—	—	—
4	With a Digital Voltmeter (DVM) to ground, probe the fuel level sensor input at the Fuel Level sensor. Is the voltage less than the specified value?	0.13 V	Go to Step 5	Go to Step 6
5	Check for a open in the fuel level sensor input circuit. Was a problem found?	—	Go to Step 7	Go to Step 6
6	With a DVM to ground, probe the fuel level module output at the Fuel Level sensor. Is the voltage greater than the specified value?	2.9 V	Go to Step 9	Go to Step 10
7	Repair the open in the fuel level sensor input circuit. Is the action complete?	—	Go to Step 11	—
8	Repair the open in the fuel level output circuit. Is the action complete?	—	Go to Step 11	—
9	Repair the short to voltage in the fuel level output circuit. Is the action complete?	—	Go to Step 11	—
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to Step 11	—
11	1. Using the Tech 2, select the DTC and the Clear Info. 2. Start the engine. 3. Idle at the normal operating temperature. 4. Select the Diagnostic Trouble Code and the Specific. 5. Enter the number which was set. 6. Operate the vehicle within the conditions for setting this Diagnostic Trouble Code as specified in the supporting text. Does the Tech 2 indicate that this diagnostic Ran and Passed?	—	System OK	Go to Step 2

DIAGNOSTIC TROUBLE CODE (DTC)
P0463 FUEL LEVEL SENSOR CIRCUIT HIGH INPUT



060R100041

Circuit Description

The Fuel Level sensor is an important input to the PCM for the Enhanced Evaporative System Diagnostic. The PCM needs the fuel level information in order to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the EVAP system. Several of the Enhanced Evaporative System Diagnostic sub–tests are dependent upon correct fuel level information. The diagnostic will not run when the tank is greater than 85% or less than 15% full. (This sensor signal disables the misfire when the fuel levels are less than 15%). If the PCM detects a continuous short to voltage in the Fuel Level sensor or circuit, then a DTC P0463 will set. DTC P0463 is a type D code.

Conditions for Setting the DTC

- The Fuel Level signal voltage is greater than 4.94 volts. The condition is met for 150 test failures within 200 test samples.

Action Taken When the DTC Sets

- The PCM will not turn on the MIL.

Conditions for Clearing the DTC

- The PCM turns the MIL off after 3 consecutive driving trips without a fault condition present.
- A history DTC will clear if no fault conditions have been detected for 40 warm–up cycles (coolant temperature has risen 40˚F from the start–up coolant temperature and the engine coolant temperature exceeds 160˚F during that same ignition cycle) or the Tech 2 clearing feature has been used.

Test Description

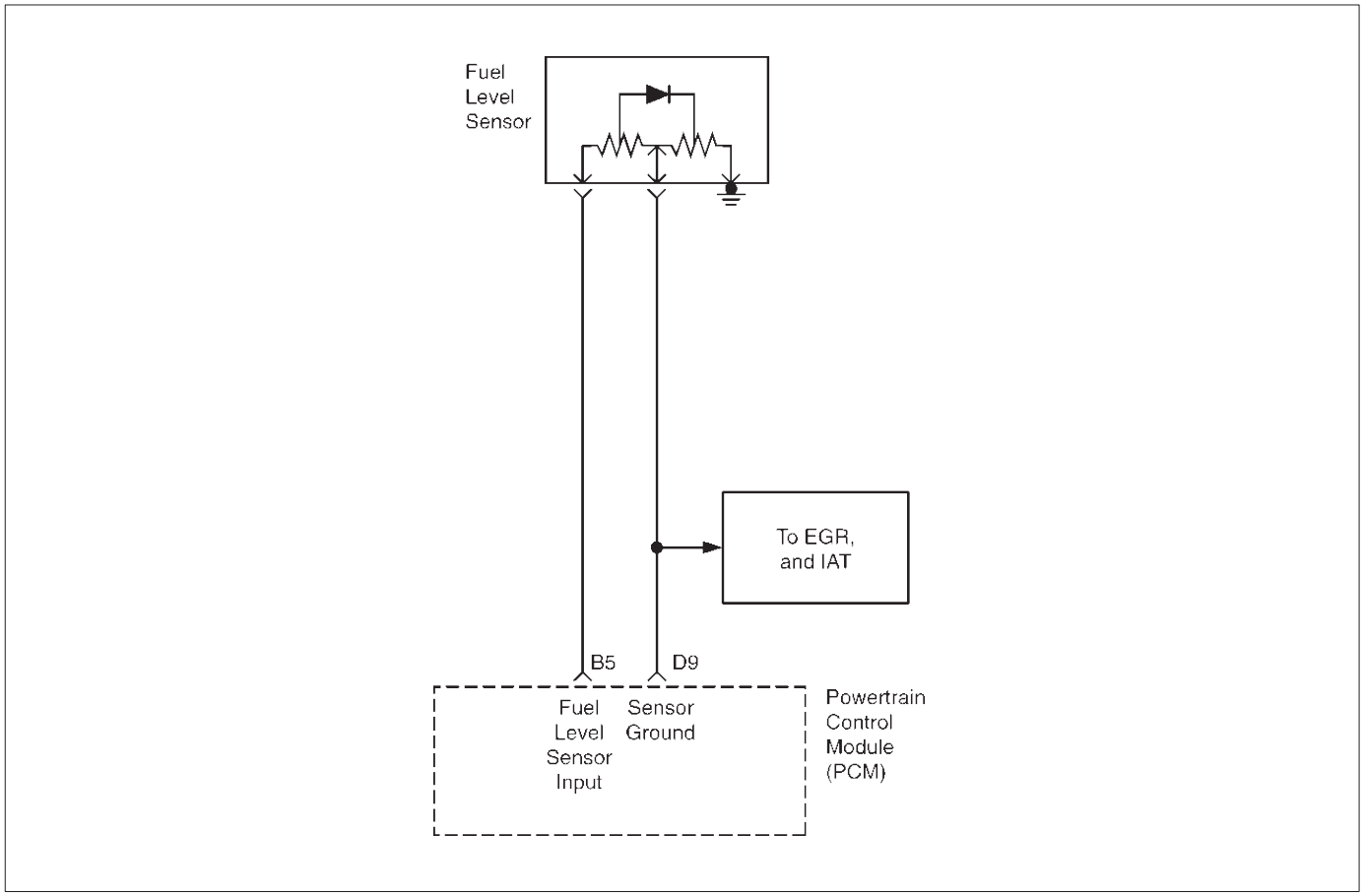
Number(s) below refer to the step number(s) on the Diagnostic Chart:

5. This step checks the wiring, connections, and the PCM.
7. This step checks the wiring, connections, and the PCM.

DTC P0463 Fuel Level Sensor Circuit High Input

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Install the Tech 2. Observe the fuel level on the Tech 2. Does the Tech 2 display the specified value?	99% – 100%	Go to Step 4	Go to Step 3
3	Refer to Fuel Gauge Diagnosis.	—	—	—
4	With a Digital Voltmeter (DVM) to ground, probe the Fuel Level sensor input at the Sensor Input cavity. Is the voltage greater than the specified value?	2.9 V	Go to Step 5	Go to Step 6
5	Check for a open in the Fuel Level sensor ground. Was a problem found?	—	Go to Step 7	Go to Step 6
6	Check for an open in the Fuel Level sensor ground. Was a problem found?	—	Go to Step 9	Go to Step 10
7	Repair the short to voltage in the fuel level input circuit. Is the repair complete?	—	Go to Step 11	—
8	Repair the short to voltage in the fuel level output circuit. Is the repair complete?	—	Go to Step 11	—
9	Repair the open in the fuel level sensor ground. Is the repair complete?	—	Go to Step 11	—
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be reprogrammed. Refer to PCM Replacement/Programming. Is the action complete?	—	Go to Step 11	—
11	1. Using the Tech 2, select the DTC and the Clear Info. 2. Start the engine. 3. Idle at the normal operating temperature. 4. Select the Diagnostic Trouble Code and the Specific. 5. Enter the Diagnostic Trouble Code number which was set. 6. Operate the vehicle within the conditions for setting this Diagnostic Trouble Code as specified in the supporting text. Does the Tech 2 indicate that this diagnostic Ran and Passed?	—	System OK	Go to Step 2

Diagnostic Trouble Code (DTC) P0464 Fuel Level Sensor Noisy Signal



060R100041

Circuit Description

The fuel level sensor is an important input to powertrain control module (PCM) for the enhanced evaporative system diagnostic. Fuel level information is needed for the PCM to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the evaporative system.

The sending unit is a float in the fuel tank which moves a wiper arm across a variable resistor. Low fuel level causes high resistance in the sending unit, and this is recognized by the PCM because the circuit operates at a corresponding low voltage. When the circuit is continuously open or has a high resistance connection, DTC P0464 is set.

Conditions for Setting the DTC

- No Fuel level DTC's set.
- Fuel volume level is more than 3%.
- IAT is more than –10˚C.
- Engine is Running.

When there are 40 test failures within 60 test samples, it is stored.

Action Taken When the DTC Sets

- The PCM records the operating conditions at the time the diagnostic fails. The Failure Records buffers stores this information.
- A history DTC is stored.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions for Clearing the DTC

- A history DTC clears after 40 consecutive warm up cycles without a fault.
- The Tech 2 can clear the DTC.

Diagnostic Aids

- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Test Description

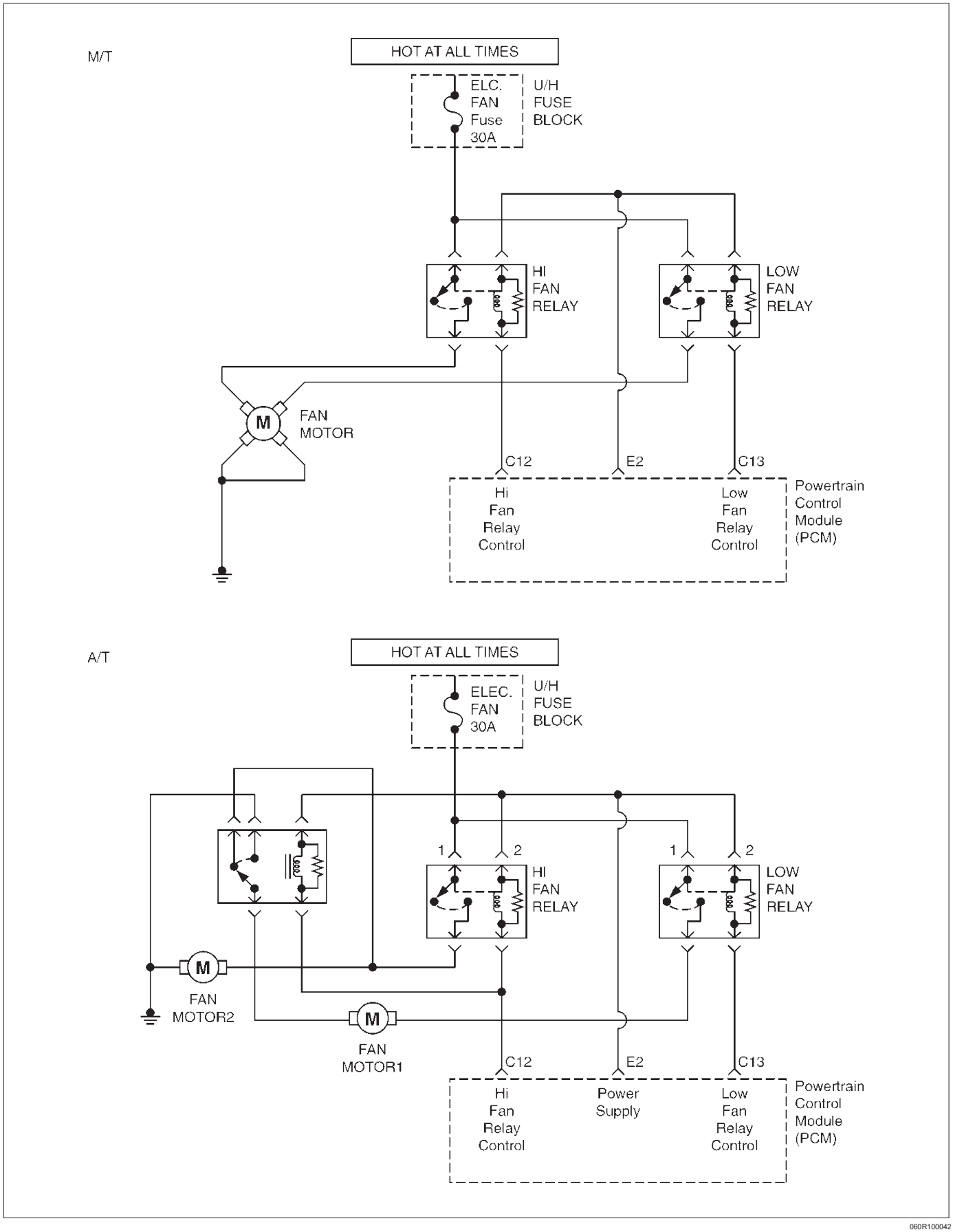
Number(s) below refer to the step number(s) on the Diagnostic Chart.

8. The following chart can be used to check the sending unit:

DTC P0464 Fuel Level Sensor Noisy Signal

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “Off”, Engine “Off”. 2. Perform “Visual/Fiscal Check” for following point. ● Loosen harness connector ● Clacked harness connector ● Poor wires condition ● Fuel tank condition ● Poor sensor condition 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 3*
3	1. Disassemble fuel tank on the vehicle. 2. Check the below items. ● Fuel sender. Was a problem found?	—	Go to *Step 4*	Go to *Step 5*
4	Replace the Fuel sender. Was the action completed?	—	Verify repair	Go to *Step 5*
5	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Was the action complete?	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC)
P0480 COOLING FAN 1 CONTROL CIRCUIT MALFUNCTION



060R100042

Circuit Description

The Powertrain Control Module (PCM) controls the engagement of the cooling fan Low speed through the use of a relay and a control circuit. If the PCM commands the fan to Low speed and then senses that the fan did not turn ON, or if the PCM commands the fan OFF from Low speed and then senses that the fan did not turn OFF, the PCM will set a DTC P0480. DTC P0480 is a type D code.

Conditions for Setting the DTC

- Ignition voltage is greater than 10 volts.
- Engine run time is greater than 32 seconds.

The above conditions are met and one of the following conditions are met for 20 test within 40 test samples while 125 msec.

- PCM sensed voltage is High with the Low Speed Fan OFF.

OR

- PCM sensed voltage is Low with the Low Speed Fan ON.

Action Taken When the DTC Sets

- The PCM will not turn on the Malfunction Indicator Lamp.
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the DTC

- A history DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using the Scan Tool's Clear Info" function.

Diagnostic Aids

- Poor connections or a damaged harness – Inspect the harness connectors for: backed out terminals, improper mating or damaged terminals. Also check for open circuits, shorts to ground, and shorts to voltage.

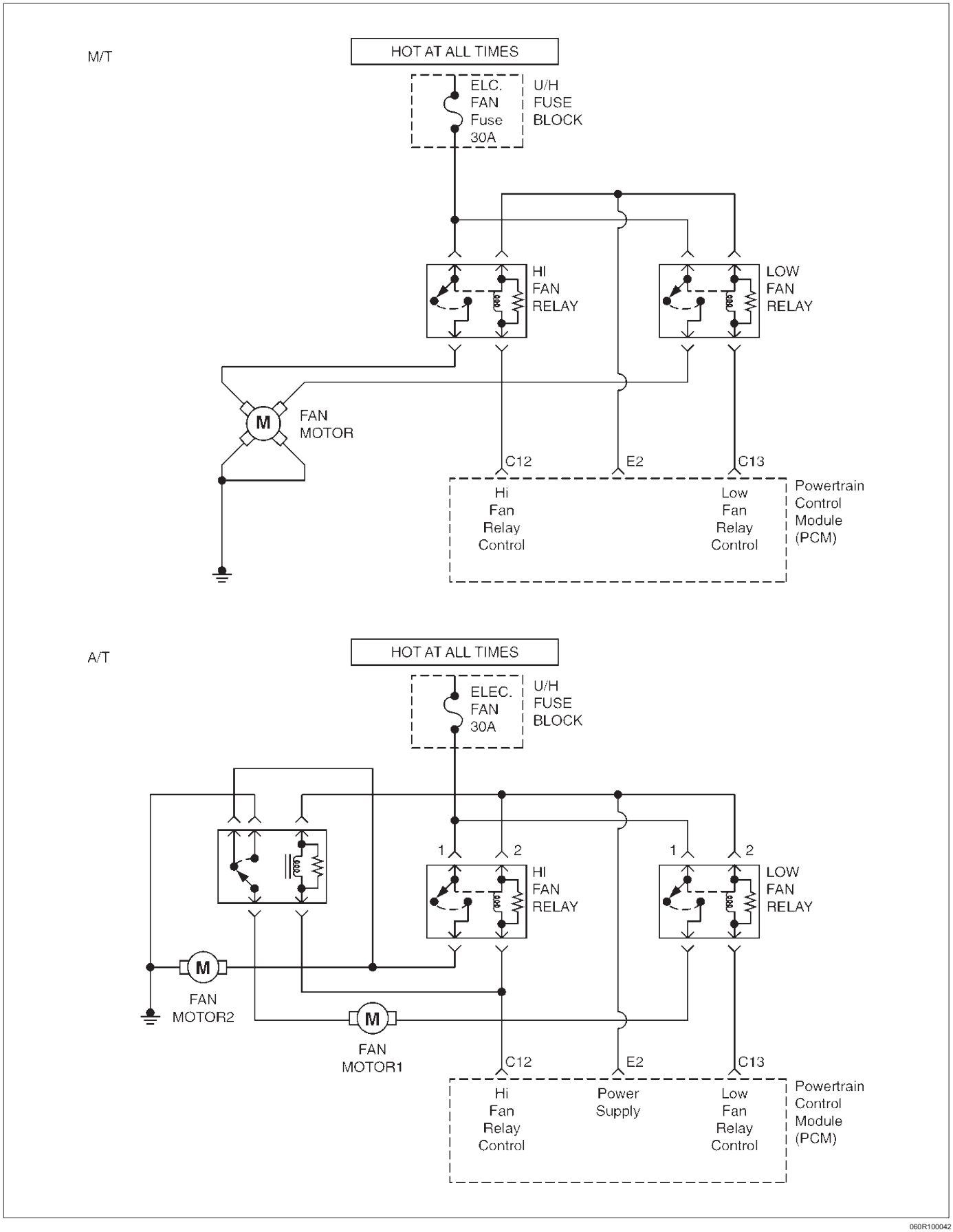
DTC P0480 Cooling Fan 1 Control Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTCs. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor "DTC" info for DTC P0480. Does the Tech 2 indicate that DTC P0480 "Ran and Passed?"	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Remove the Low Fan Relay from the Underhood Electrical Center. 3. Ignition OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the "ELEC. FAN" Fuse pin of the Low fan Relay connector. Does the DVM read the following value?	12 Volts	Go to Step 4	Go to Step 3
4	1. Ignition ON. 2. Using a DVM, check for voltage on the "ENGINE FAN" Fuse pin of the Low Fan Relay connector. Does the DVM read the following value?	12 Volts	Go to Step 6	Go to Step 5
5	Check the suspect circuit between the Low Fan Relay connector and Fuse for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	—

DTC P0480 Cooling Fan 1 Control Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Ignition OFF. 2. Disconnect the Powertrain Control Module (PCM) connectors from the PCM. 3. Check the Low Fan Relay control circuit between the PCM and Underhood Electrical Center for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	Go to Step 7
7	1. Reinstall the Low Fan Relay. 2. Using a fused jumper, ground the Low Fan Relay control circuit at the PCM connector. 3. Ignition ON, Engine OFF. Does the fan run at low speed?	—	Go to Step 9	Go to Step 8
8	Replace the Low Fan Relay. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC)
P0481 COOLING FAN 2 CONTROL CIRCUIT MALFUNCTION



060R100042

Circuit Description

The Powertrain Control Module (PCM) controls the engagement of the cooling fan Low speed through the use of a relay and a control circuit. If the PCM commands the fan to Low speed and then senses that the fan did not turn ON, or if the PCM commands the fan OFF from Low speed and then senses that the fan did not turn OFF, the PCM will set a DTC P0481. DTC P0481 is a type D code.

Conditions for Setting the DTC

- Ignition voltage is greater than 10 volts.
- Engine run time is greater than 32 seconds.

The above conditions are met and one of the following conditions are met for 20 test within 40 test samples while 125 msec.

- PCM sensed voltage is High with the High Speed Fan OFF.

OR

- PCM sensed voltage is High with the High Speed Fan ON.

Action Taken When the DTC Sets

- The PCM will not turn on the Malfunction Indicator Lamp.
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the DTC

- A history DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using the Scan Tool's "Clear Info" function.

Diagnostic Aids

- Poor connections or a damaged harness – Inspect the harness connectors for: backed out terminals, improper mating or damaged terminals. Also check for open circuits, shorts to ground, and shorts to voltage.

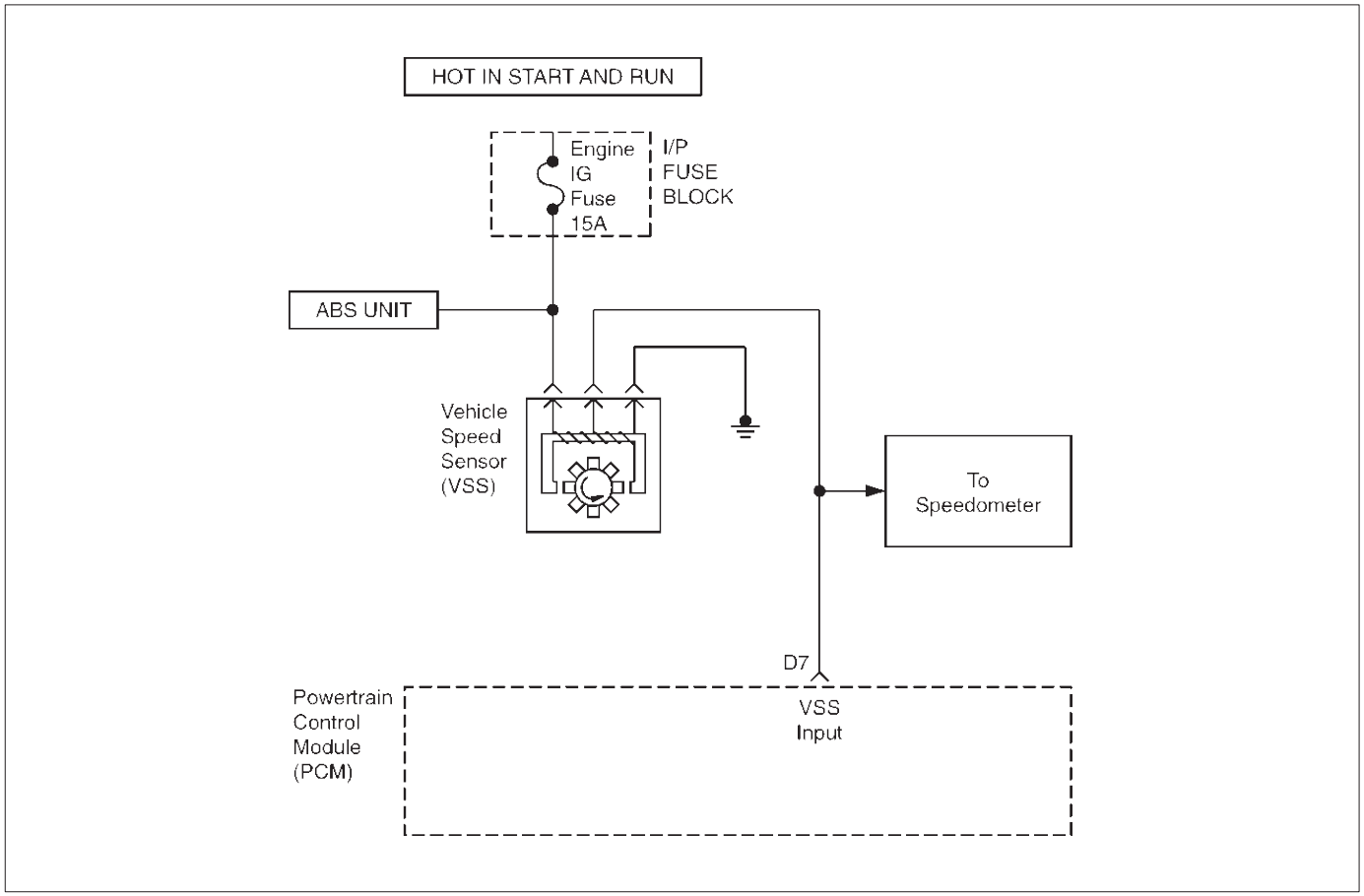
DTC P0481 Cooling Fan 2 Control Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTCs. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor "DTC" info for DTC P0480. Does the Tech 2 indicate that DTC P0480 "Ran and Passed?"	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Remove the Low Fan Relay from the Underhood Electrical Center. 3. Ignition OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the "ELEC. FAN" Fuse pin of the Low fan Relay connector. Does the DVM read the following value?	12 Volts	Go to Step 4	Go to Step 3
4	1. Ignition ON. 2. Using a DVM, check for voltage on the "ENGINE FAN" Fuse pin of the Low Fan Relay connector. Does the DVM read the following value?	12 Volts	Go to Step 6	Go to Step 5
5	Check the suspect circuit between the Low Fan Relay connector and Fuse for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	—

DTC P0481 Cooling Fan 2 Control Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Ignition OFF. 2. Disconnect the Powertrain Control Module (PCM) connectors from the PCM. 3. Check the Low Fan Relay control circuit between the PCM and Underhood Electrical Center for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	Go to Step 7
7	1. Reinstall the High Fan Relay. 2. Using a fused jumper, ground the High Fan Relay control circuit at the PCM connector. 3. Ignition ON, Engine OFF. Does the fan run at High speed?	—	Go to Step 9	Go to Step 8
8	Replace the High Fan Relay. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC)
P0502 VEHICLE SPEED SENSOR (VSS) CIRCUIT LOW INPUT



060R100043

Circuit Description

The vehicle speed sensor has a magnet rotated by the transmission output shaft. Attached to the sensor is a hall effect circuit that interacts with the magnetic field created by the rotating magnet. A 12–volt operating supply for the speed sensor hall circuit is supplied from the meter fuse. The VSS pulses to ground the 5–volt signal sent from the powertrain control module (PCM) on the reference circuit. The PCM interprets vehicle speed by the number of pulses to ground per second on the reference circuit. DTC P0502 is a type B code.

Conditions for Setting the DTC

- Engine is running.
- Engine coolant temperature is above 60˚C (140˚F).
- System voltage is between 10 and 16 volts.

When the above conditions are met, one of the following tests will run:

Decel Test

- MAP is less than 35 kPa.
- Throttle Position is less than 0.8%.
- Engine Speed is between 1500 RPM and 3500 RPM.

The Decel Test will fail if vehicle speed is less than 8 km/h (5mph).

The Decel Test will pass if vehicle speed is greater than 24 km/h (15mph).

Power Test

- MAP is greater than 70 kPa.
- Throttle Position is between 25% and 70%.
- Engine Speed is between 2200 RPM and 4400 RPM.

The Power Test will fail if vehicle speed is less than 8 km/h (5 mph).

The Power Test will pass if vehicle speed is greater than 8km/h (5mph) without any VSS DTC's present, or if vehicle speed is greater than 49 km/h (30mph) with VSS Diagnostic Trouble Codes present.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the second time the fault is detected.
- Base shift logic on RPM only.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0502 will clear after 40 consecutive warm–up cycles have occurred without a fault.

- Diagnostic Trouble Code P0502 can be cleared by using the Scan Tool's "Clear Info" function.

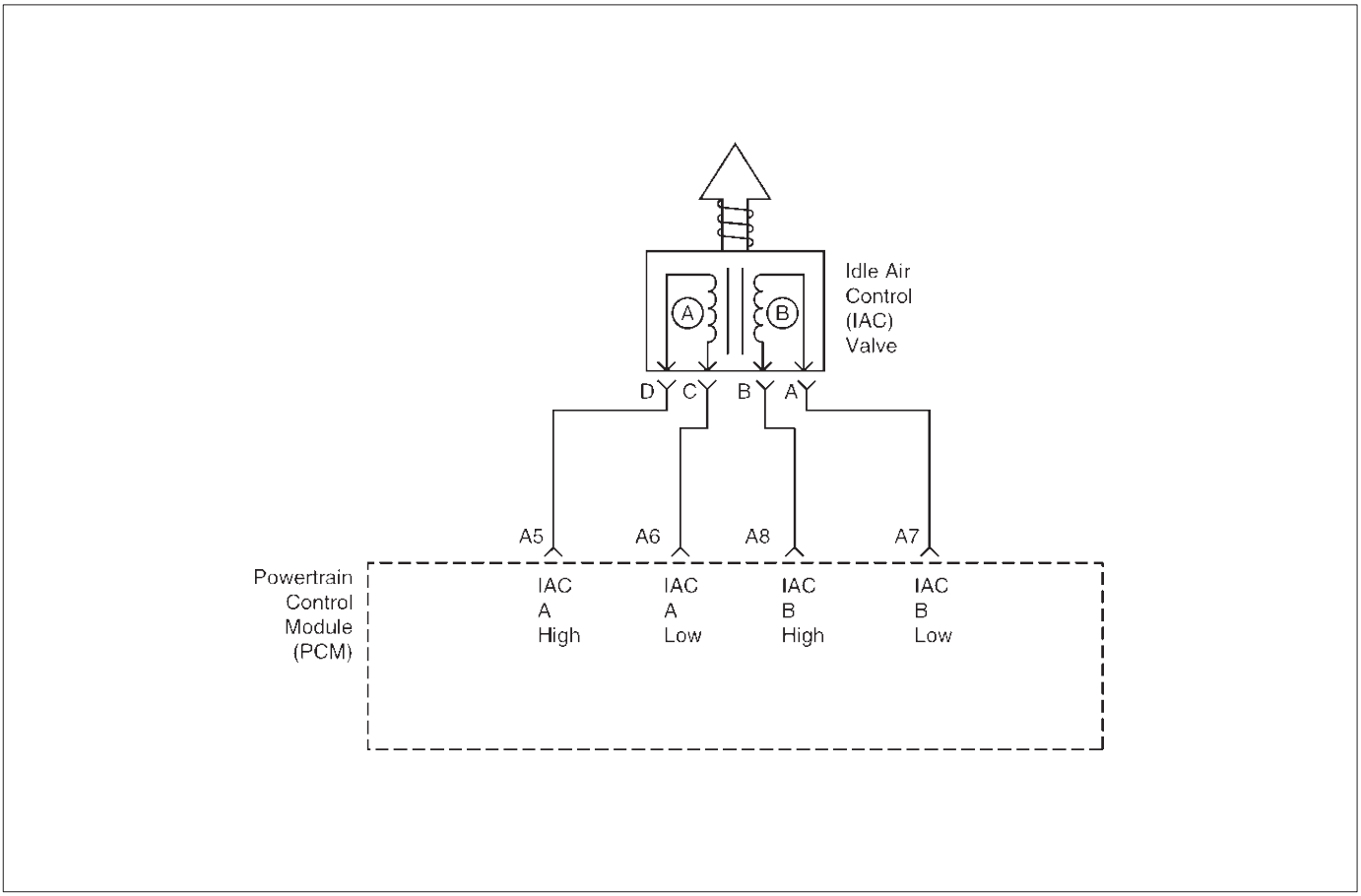
Diagnostic Aids

- Poor connection at PCM: Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness: Inspect the wiring harness to the EVAP vent solenoid, the EVAP purge solenoid, and the fuel tank pressure sensor for an intermittent open or intermittent short circuit.

DTC P0502 – VSS Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition OFF. 2. Disconnect the VSS connector. 3. Using a test light to battery +, probe the connector ground wire. Did the light illuminate?	—	Go to Step 4	Go to Step 3
3	Repair the open in the sensor ground circuit.	—	Verify repair	—
4	1. Ignition ON, sensor disconnected. 2. Using a Digital Voltmeter (DVM), measure at the VSS connector between ground and voltage supply. Was the measurement near the specified value?	Battery voltage	Go to Step 6	Go to Step 5
5	Repair the open or short to ground in the VSS sensor circuit.	—	Verify repair	—
6	1. Ignition OFF. 2. Check the BLU/BLK wire between the VSS sensor connector and the PCM for the following conditions: • An open circuit • A short to ground Was the faulty condition located?	—	Verify repair	Go to Step 9
7	Using a DVM, measure the resistance between the VSS sensor body and transmission case (ground). Is the resistance above the specified value?	10 K Ω	Verify repair	Go to Step 9
8	1. Remove the VSS from the transmission case. 2. Visually inspect the VSS for damage. Does the VSS appear to be OK?	—	Verify repair	—
9	Replace the VSS.	—	Verify repair	—
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC)
P0506 IDLE CONTROL SYSTEM RPM LOWER THAN EXPECTED



060R100025

Circuit Description

The powertrain control module (PCM) controls engine idle speed by adjusting the position of the idle air control (IAC) motor pintle. The IAC is a bi–directional stepper motor driven by two coils. The PCM applies current to the IAC coils in steps (counts) to extend the IAC pintle into a passage in the throttle body to decrease air flow. The PCM reverses the current to retract the pintle, increasing air flow. This method allows highly accurate control of idle speed and quick response to changes in engine load. If the PCM detects a condition where too low of an idle speed is present and the PCM is unable to adjust idle speed by increasing the IAC counts, DTC P0506 will set, indicating a problem with the idle control system. DTC O0506 is a type B code.

Conditions for Setting the DTC

- No intrusive tests being run.
- Engine run time is more than 360 seconds.
- No TPS, VSS, ECT, EGR, MAP, IAT, misfire, low voltage, fuel system CKP, Injector, O_2 Sensor, VSS or canister purge Diagnostic Trouble Codes are set.
- Barometric pressure is greater than 72.7 kPa.
- Canister purge duty cycle is above 0%.
- Engine coolant temperature (ECT) is above 50˚C (122˚F).
- Intake air temperature above –40˚C (–40˚F).
- MAP is less than 60 kPa.
- Ignition voltage is between 9.5 volts and 16 volts.
- The throttle is closed.
- All conditions are met for 10 seconds.
- Engine speed is at least 100 RPM lower than desired idle, based upon PCM expectations.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- Diagnostic Trouble Code P0506 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM or IAC motor – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.

- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits.
- Restricted air intake system – Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system.
- Throttle body – Check for objects blocking the IAC passage or throttle bore, excessive deposits in the IAC passage and on the IAC pintle, and excessive deposits in the throttle bore and on the throttle plate.
- Large vacuum leak – Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty PCV valve or brake booster hose disconnected.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

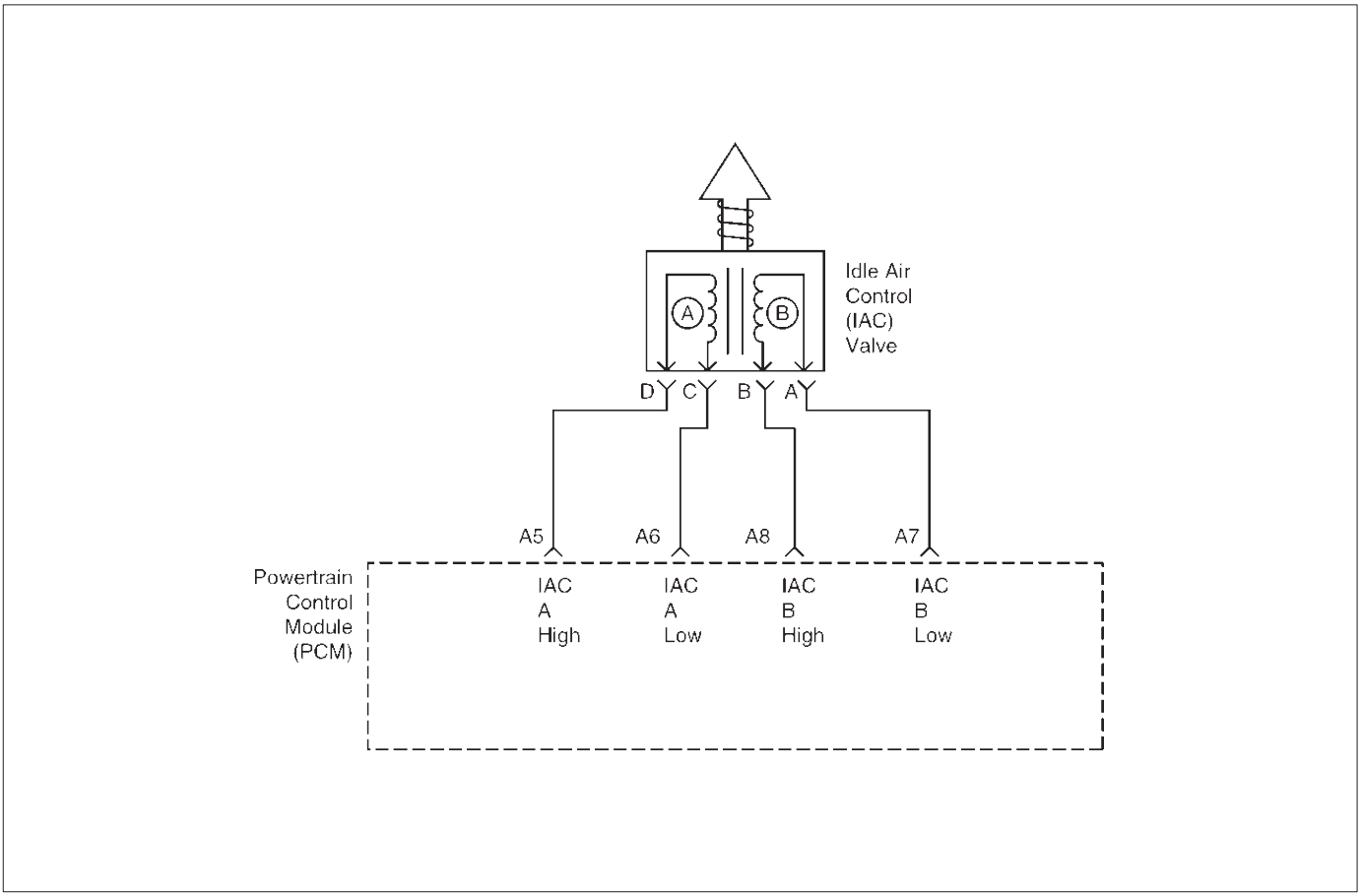
DTC P0506 – Idle Control System RPM Lower Than Expected

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Are any other Diagnostic Trouble Codes set?	—	Go to other Diagnostic Trouble Code first	Go to Step 3
3	1. Start the engine. 2. Turn all accessories OFF (A/C, rear defroster, etc.) 3. Using a Tech 2, command RPM up to 1500, down to 500, and then up to 1500 while monitoring "Engine Speed" on the Tech 2. Does the "Engine Speed" remain within the specified value of "Desired Idle" for each RPM command?	+/–50 RPM	No trouble found. Go to Diagnostic Aids	Go to Step 4
4	1. Disconnect the IAC. 2. Install IAC Noid Light J 37027A or equivalent. 3. With the engine running, command RPM up to 1500, down to 500, and then up to 1500 while observing the noid light. Does each noid light cycle red and green (never OFF)?	—	Go to Step 6	Go to Step 5
5	1. Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: • IAC "A" low • IAC "A" high • IAC "B" low • IAC "B" high 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 8
6	Visually/physically inspect for the following conditions: • Throttle body tampering (adjustment screw plug removed). • Restricted air intake system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. • Throttle body. Check for objects blocking the IAC passage or throttle bore, excessive deposits in the IAC passage and on the IAC pintle, and excessive deposits in the throttle bore and on the throttle plate. Do any of the above require a repair?	—	Refer to appropriate section for on–vehicle service	Go to Step 7

DTC P0506 – Idle Control System RPM Lower Than Expected (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Check for a poor connection at the IAC harness connector. 2. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to Step 8
8	Using a Digital Voltmeter (DVM), check the IAC valve solenoids (A and B) for the following conditions: ● An open circuit ● A short to ground (the IAC body) ● A short together Was the problem found?	—	—	—
9	Replace the IAC valve. Is the action complete?	—	Verify repair	—
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC)
P0507 IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED



060R100025

Circuit Description

The powertrain control module (PCM) controls engine idle speed by adjusting the position of the idle air control (IAC) motor pintle. The IAC is a bi–directional stepper motor driven by two coils. The PCM applies current to the IAC coils in steps (counts) to extend the IAC pintle into a passage in the throttle body to decrease air flow. The PCM reverses the current to retract the pintle, increasing air flow. This method allows highly accurate control of idle speed and quick response to changes in engine load. If the PCM detects a condition where too high of an idle speed is present and the PCM is unable to adjust idle speed by increasing the IAC counts, Diagnostic Trouble Code P0507 will set, indicating a problem with the idle control system. DTC P0507 is a type B code.

Conditions for Setting the DTC

- No intrusive tests being run.
- Engine run time is more than 360 seconds.
- No TPS, VSS, ECT, EGR, MAP, MAT, CKP, Injector, O_2 Sensor, misfire, fuel system or canister purge DTCs are set.
- Barometric pressure is greater than 72.7 kPa.
- Canister purge duty cycle is above 0%.
- Intake air temperature above –50˚C (–58˚F).
- Engine coolant temperature (ECT) is above 50˚C (122˚F).
- Ignition voltage is between 9.5 volts and 16 volts.
- MAT above –40˚C (–40˚F).
- All conditions are met for 5 seconds.
- MAP is less than 60 kPa.
- Engine speed is at least 200 RPM lower than desired idle, based upon PCM's expectations.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0507 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0507 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM or IAC motor – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or

damaged terminals, and poor terminal–to–wire connection.

- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits.
- Vacuum leak – Check for a condition that causes a vacuum leak, such as disconnected or damaged hoses, leaks at EGR valve and EGR pipe to intake manifold, leak at the throttle body, a faulty or incorrectly installed PCV valve, leaks at the intake manifold, etc.
- Throttle body – Check for sticking throttle plate. Also inspect the IAC passage for deposits or objects which will not allow the IAC pintle to fully extend or properly seat.

If Diagnostic Trouble Code P0507 cannot be duplicated, reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

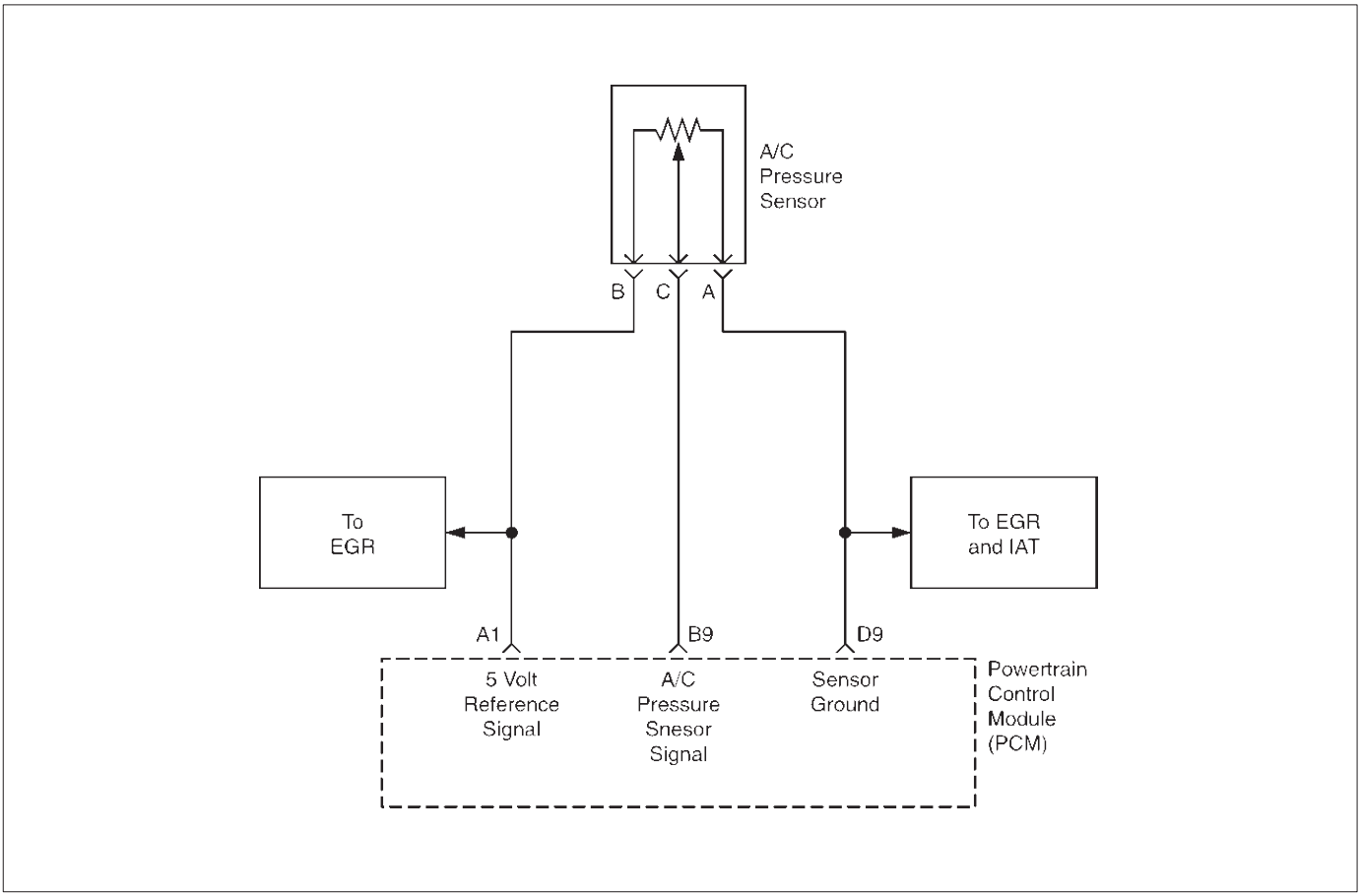
DTC P0507 – Idle Control System RPM Higher Than Expected

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Are any other Diagnostic Trouble Codes set?	—	Go to other Diagnostic Trouble Code first	Go to Step 3
3	1. Start the engine. 2. Turn all accessories OFF (A/C, rear defroster, etc.) 3. Using a Tech 2, command RPM up to 1500, down to 500, and then up to 1500 while monitoring ”Engine Speed” on the Tech 2. Does the ”Engine Speed” remain within the specified value of ”Desired Idle” for each RPM command?	+/–50 RPM	No trouble found. Go to Diagnostic Aids	Go to Step 4
4	1. Disconnect the IAC. 2. Install IAC Noid Light J 37027A or equivalent. 3. With the engine running, command RPM up to 1500, down to 500, and then up to 1500 while observing the noid light. Does each noid light cycle red and green (never OFF)?	—	Go to Step 6	Go to Step 5
5	1. Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: ● IAC ”A” low ● IAC ”A” high ● IAC ”B” low ● IAC ”B” high 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 9
6	Visually/physically inspect for the following conditions: ● Vacuum leaks ● Throttle body tampering (adjustment screw plug removed). ● Throttle plate or throttle shaft for binding. ● Accelerator and cruise control cables for being mis–adjusted or for binding. ● Faulty, missing, or incorrectly installed PCV valve. Do any of the above require a repair?	—	Refer to appropriate section for on–vehicle service	Go to Step 7

DTC P0507 – Idle Control System RPM Higher Than Expected (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Check for a poor connection at the IAC harness connector. 2. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to Step 8
8	Using a Digital Voltmeter (DVM), check the IAC valve solenoids (A and B) for the following conditions: ● An open circuit ● A short to ground (the IAC body) ● A short together Was the problem found?	—	Go to Step 9	Go to Step 10
9	Replace the IAC valve. Is the action complete?	—	Verify repair	—
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC)
P0532 A/C REFRIGERANT PRESSURE SENSOR CIRCUIT LOW INPUT



060R100044

Circuit Description

The Powertrain Control Module (PCM) monitors the A/C refigerant pressure through the use of a three wire sensor. If the PCM senses the pressure falls below a threshold value, then DTC P0532 will set. DTC P0532 is a type D code.

Conditions for Setting the DTC

- A/C pressure sensor is below 5 counts (0.1 volt). The condition is met for 100 test failures within 200 samples.

Action Taken When the DTC Sets

- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the DTC

- A History DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using a Scan Tool's "Clear Info" function.

Diagnostic Aids

Poor Conditions, or a damaged harness – Inspect the harness connectors for: backed–out terminals, improper mating or damaged terminals. Also, check for open circuits, shorts to ground, and shorts to voltage.

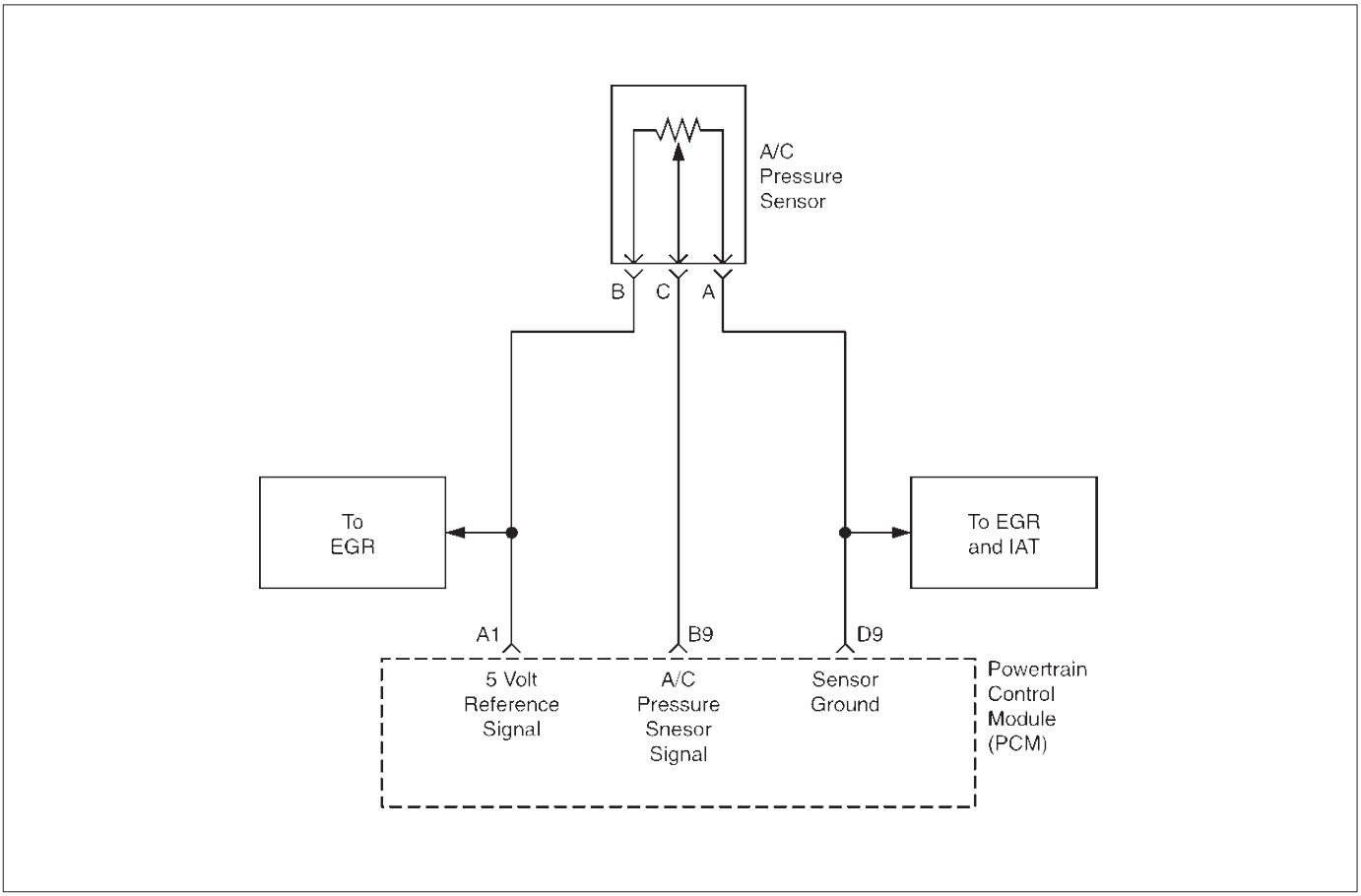
DTC P0532 A/C Refigerant Pressure Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Scan Tool’s Failure Records data, then clear the DTC’s. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P0532. Does the Tech 2 indicate DTC P0532 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Disconnect the A/C refrigerant pressure sensor wiring harness connector from the A/C refrigerant pressure sensor. 3. Start the vehicle, and monitor the A/C refrigerant pressure value with the Tech 2. Does the A/C refrigerant pressure sensor value on the Tech 2 hold steadily at the given value?	less than 0.1 volts	Go to Step 5	Go to Step 4
4	Check the A/C refrigerant pressure sensor signal circuit, between the A/C refrigerant pressure sensor and the Powertrain Control Module (PCM), for a short to voltage. Was the problem found?	—	Verify repair	Go to Step 12
5	Check the A/C refrigerant pressure sensor signal circuit, between the A/C refrigerant pressure sensor and the PCM for the following conditions: ● A short to ground ● An open circuit Was the problem found?	—	Verify repair	Go to Step 6
6	Check the 5 volt signal circuit, between the A/C refrigerant pressure sensor and the PCM, for the following conditions: ● An open circuit ● A short to voltage ● A short to ground Was the problem found?	—	Verify repair	Go to Step 7
7	1. Ignition OFF. 2. Place a Digital Voltmeter (DVM), set to measure voltage between the 5 volt signal circuit and ground. 3. Ignition ON, Engine OFF. Does the DVM indicate the following value?	about 5 volts	Go to Step 8	Go to Step 12

DTC P0532 A/C Refigerant Pressure Sensor Circuit Low Input (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition OFF. 2. Place a fused jumper between the A/C refrigerant pressure sensor and the 5 volt signal circuit, both at the wiring harnesses A/C refrigerant pressure sensor connector. 3. Ignition ON, Engine OFF. 4. Observe the A/C refrigerant pressure sensor value displayed on the Tech 2. Does the Tech 2 read the following value?	about 5 volts	Go to Step 9	Go to Step 12
9	Check the A/C refrigerant pressure sensor and the PCM, for the following conditions: • An open circuit • A short to ground • A short to voltage Was the problem found?	—	Verify repair	Go to Step 10
10	1. Ignition OFF. 2. Place a Digital Voltmeter (DVM), set to measure voltage between the ground circuit and the 5 volt signal circuit, both at the wiring harnesses A/C refigerant pressure sensor connector. 3. Ignition ON, Engine OFF. Does the DVM indicate the following value?	about 5 volts	Go to Step 11	Go to Step 12
11	Replace the A/C refrigerant pressure sensor. Verify Repair.	—	—	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC)
P0533 A/C REFRIGERANT PRESSURE SENSOR CIRCUIT HIGH INPUT



060R100044

Circuit Description

The Powertrain Control Module (PCM) monitors the A/C refigerant pressure through the use of a three wire sensor. If the PCM senses the pressure falls below a threshold value, then DTC P0533 will set. DTC P0533 is a type D code.

Conditions for Setting the DTC

- A/C pressure sensor is above 250 counts (4.88 volts). The condition is met for 100 test failure within 200 samples.

Action Taken When the DTC Sets

- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the DTC

- A history DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using a Scan Tool's "Clear Info" function.

Diagnostic Aids

- Poor Conditions, or a damaged harness – Inspect the harness connectors for: backed–out terminals, improper mating or damaged terminals. Also, check for open circuits, shorts to ground, and shorts to voltage.

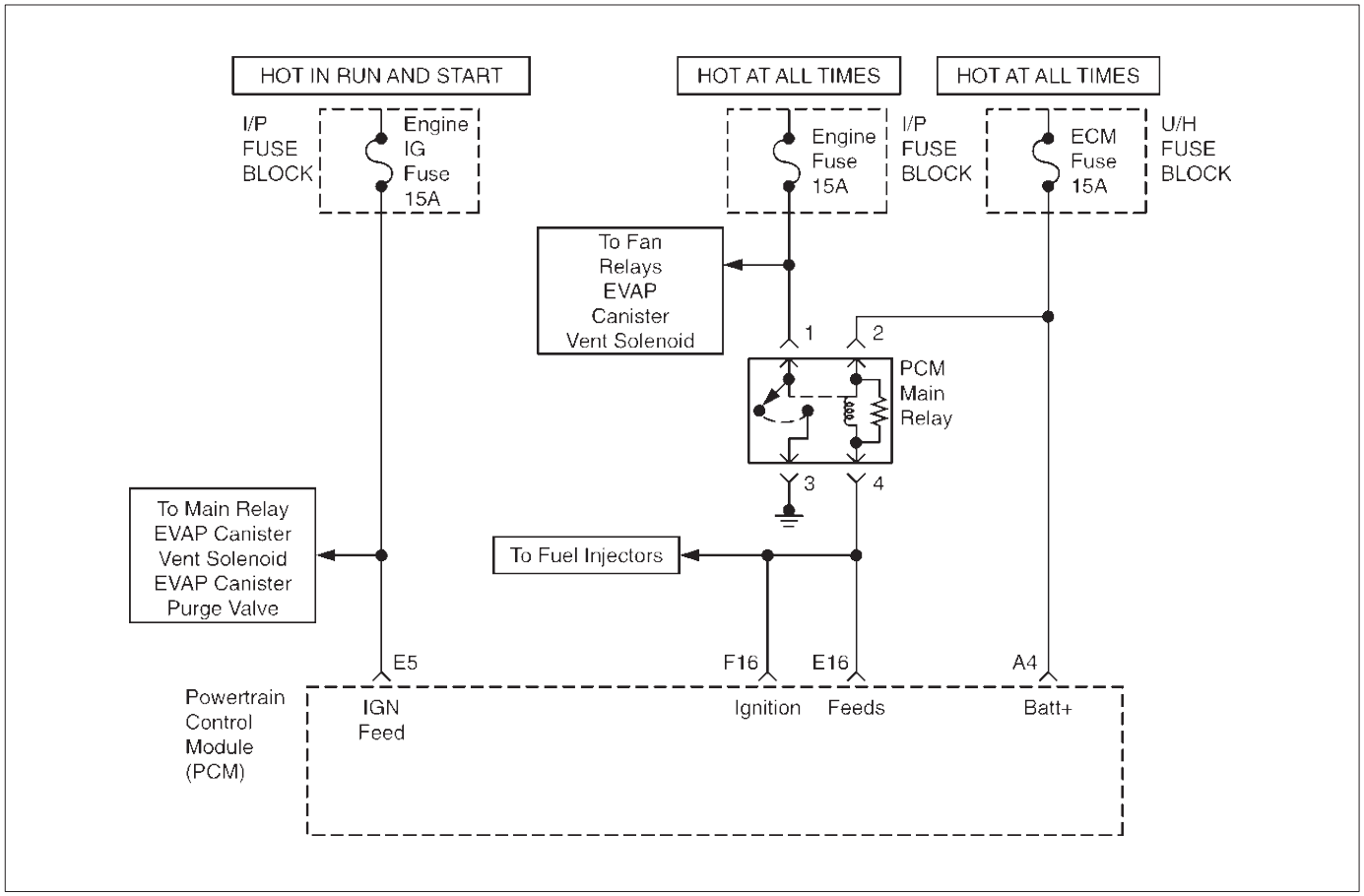
DTC P0533 A/C Refigerant Pressure Sensor Circuit High Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Scan Tool’s Failure Records data, then clear the DTC’s. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P0533. Does the Tech 2 indicate DTC P0533 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Disconnect the A/C refrigerant pressure sensor wiring harness connector from the A/C refrigerant pressure sensor. 3. Start the vehicle, and monitor the A/C refrigerant pressure value with the Tech 2. Does the A/C refrigerant pressure sensor value on the Tech 2 hold steadily at the given value?	less than 0.1 volts	Go to Step 5	Go to Step 4
4	Check the A/C refrigerant pressure sensor signal circuit, between the A/C refrigerant pressure sensor and the Powertrain Control Module (PCM), for a short to voltage. Was the problem found?	—	Verify repair	Go to Step 12
5	Check the A/C refrigerant pressure sensor signal circuit, between the A/C refrigerant pressure sensor and the PCM for the following conditions: ● A short to ground ● An open circuit Was the problem found?	—	Verify repair	Go to Step 6
6	Check the 5 volt signal circuit, between the A/C refrigerant pressure sensor and the PCM, for the following conditions: ● An open circuit ● A short to voltage ● A short to ground Was the problem found?	—	Verify repair	Go to Step 7
7	1. Ignition OFF. 2. Place a Digital Voltmeter (DVM), set to measure voltage between the 5 volt signal circuit and ground. 3. Ignition ON, Engine OFF. Does the DVM indicate the following value?	about 5 volts	Go to Step 8	Go to Step 12

DTC P0533 A/C Refigerant Pressure Sensor Circuit High Input (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition OFF. 2. Place a fused jumper between the A/C refrigerant pressure sensor and the 5 volt signal circuit, both at the wiring harnesses A/C refrigerant pressure sensor connector. 3. Ignition ON, Engine OFF. 4. Observe the A/C refrigerant pressure sensor value displayed on the Tech 2. Does the Tech 2 read the following value?	about 5 volts	Go to Step 9	Go to Step 12
9	Check the A/C refrigerant pressure sensor and the PCM, for the following conditions: • An open circuit • A short to ground • A short to voltage Was the problem found?	—	Verify repair	Go to Step 10
10	1. Ignition OFF. 2. Place a Digital Voltmeter (DVM), set to measure voltage between the ground circuit and the 5 volt signal circuit, both at the wiring harnesses A/C refigerant pressure sensor connector. 3. Ignition ON, Engine OFF. Does the DVM indicate the following value?	about 5 volts	Go to Step 11	Go to Step 12
11	Replace the A/C refrigerant pressure sensor. Verify Repair.	—	—	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P0562 SYSTEM VOLTAGE LOW



060R100045

Circuit Description

The powertrain control module (PCM) monitors the system voltage on the ignition feed terminal to the PCM. A system voltage Diagnostic Trouble Code will set whenever the voltage is below a calibrated value. DTC P0562 is a type D code.

Conditions for Setting the DTC

- Ignition ON.
- System voltage is below 11.5 volts.

The condition is met for 900 test failures at 15 min.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store as Failure Records conditions which were present when the Diagnostic Trouble Code was set. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A history Diagnostic Trouble Code P0562 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0562 can be cleared by using the Scan Tool's "Clear Info" function.

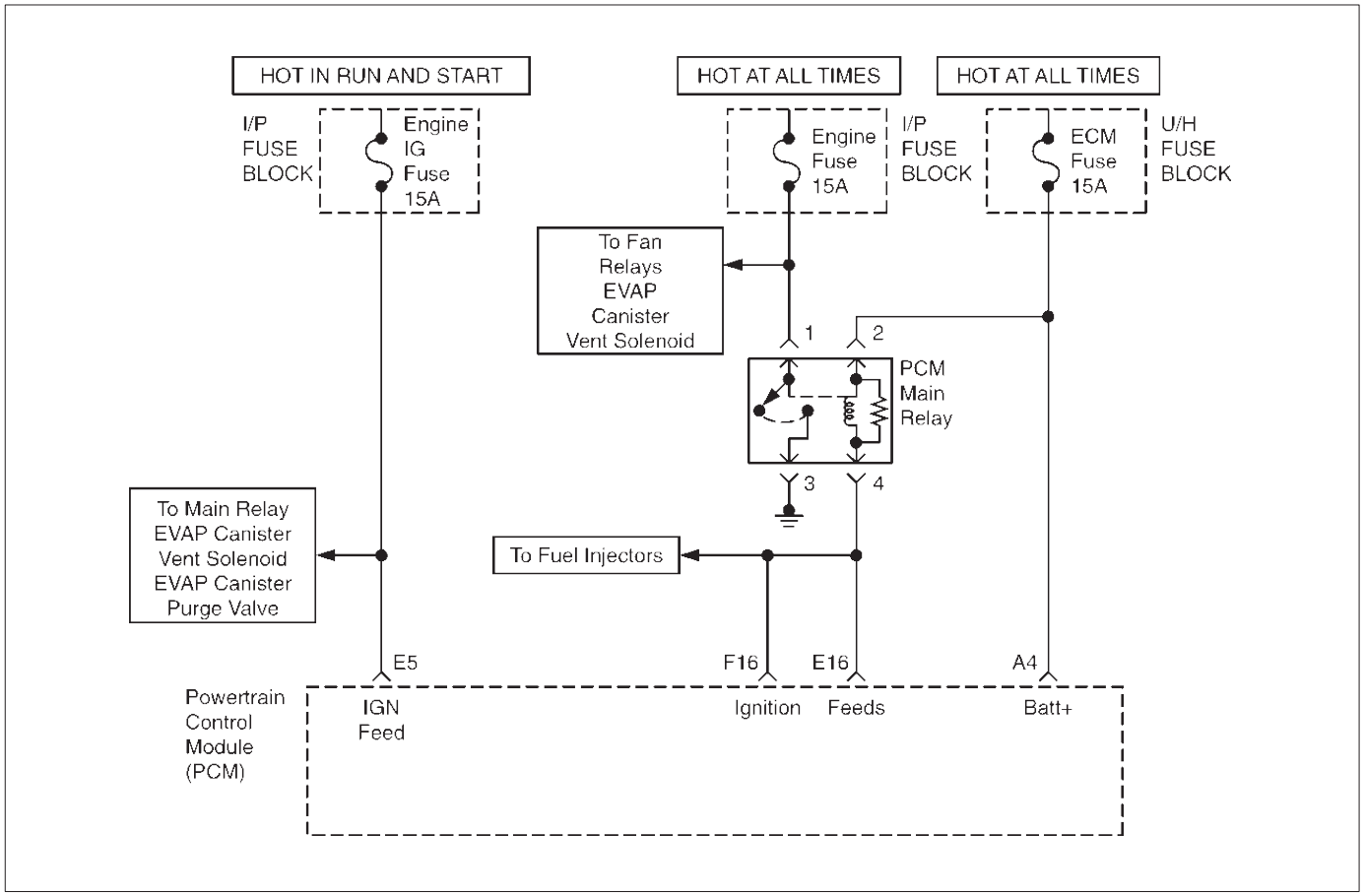
Diagnostic Aids

- If the Diagnostic Trouble Code sets when an accessory is operated, check for a poor connection or excessive current draw.
- Check for an open circuit in the PCM main relay's control (ground) circuit.
- Check for open circuits or shorts to ground on the PCM's battery or ignition inputs.
- Check for a faulty PCM main relay.

DTC P0562 System Voltage Low

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Using a Digital Voltmeter (DVM), measure the battery voltage at the battery. Is the battery voltage greater than the specified value?	11.5 V	Go to Step 3	Charge battery, then go to Step 3
3	1. Install the Tech 2. 2. Select ”Ignition Volts” on the Tech 2. 3. Start the engine and raise the engine speed to 2000 RPM. 4. Load the electrical system by turning on the headlights, high blower, etc. Is the ignition voltage approximately equal to the specified value?	13.2 V	Go to Step 4	Go to Starting/Charging
4	1. Ignition OFF. 2. Disconnect the PCM connector at the PCM. 3. Ignition ON, Engine OFF 4. Using a DVM, measure the voltage at the PCM Main Relay’s two power inputs to the PCM. Is it approximately equal to battery voltage?	—	Check for excessive current draw with ignition OFF, engine OFF.	Go to Step 5
5	1. Check for faulty connections at the PCM harness terminals. 2. Repair as necessary. Was a repair necessary?	—	Verify repair	Go to Step 6
6	Check for an open battery feed circuit to the PCM. Is the action complete?	—	Verify repair	Go to Step 7
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0563 SYSTEM VOLTAGE HIGH



060R100045

Circuit Description

The powertrain control module (PCM) monitors the system voltage on the ignition feed terminals to the PCM. A system voltage Diagnostic Trouble Code will set whenever the voltage is above a calibrated value. DTC P0563 is a type A code.

Conditions for Setting the DTC

- Ignition ON.
- System voltage is above 16V.

The above conditions are met for 900 test failures at 15 min.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL) for the first time the malfunction is detected.
- The PCM will store as Failure Records conditions which were present when the Diagnostic Trouble Code was set. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history Diagnostic Trouble Code P0563 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0563 can be cleared by using the Scan Tool's "Clear Info" function.

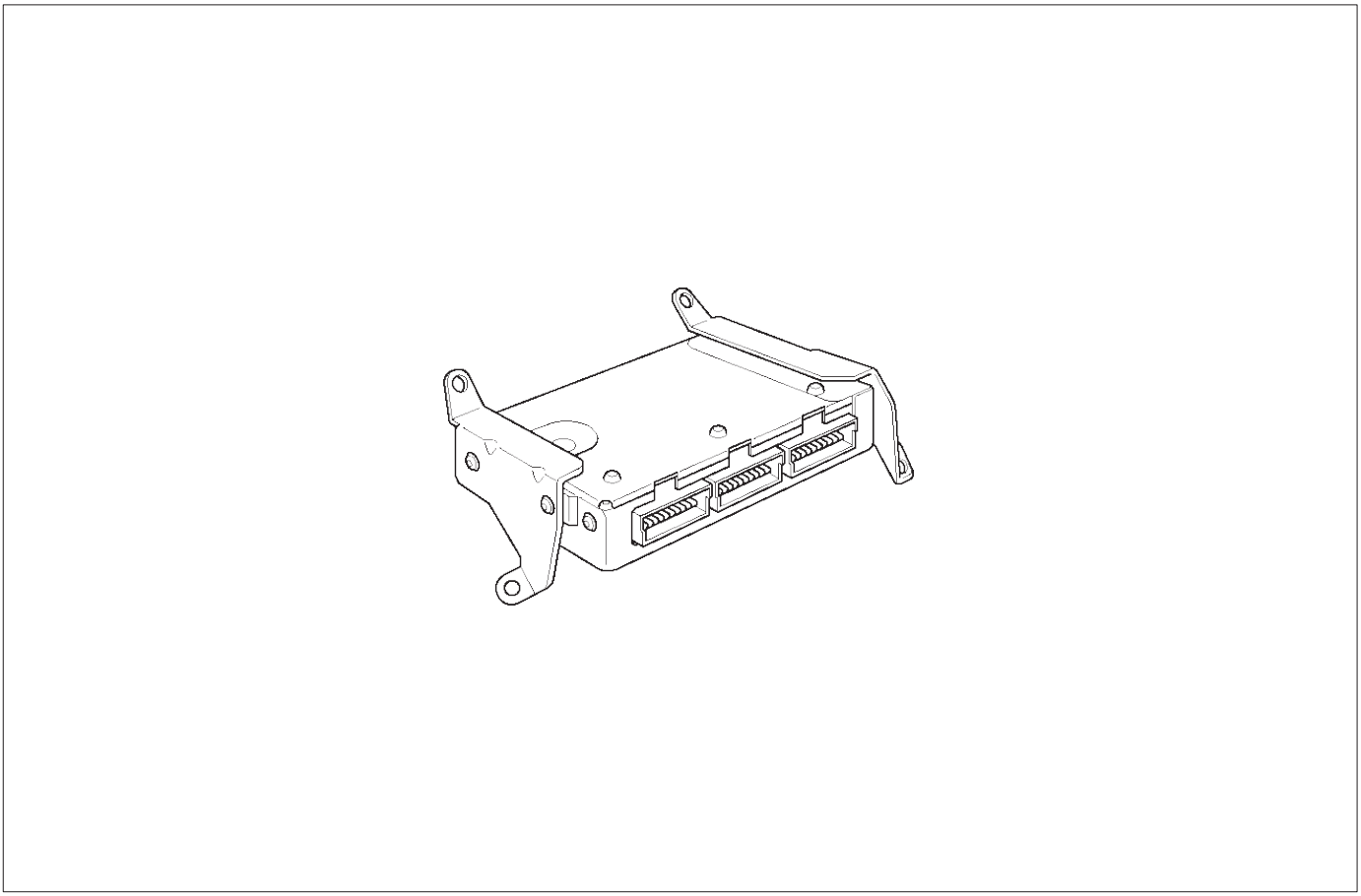
Diagnostic Aids

Check for a faulty charging system components.

DTC P0563 System Voltage High

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition OFF, engine OFF. 2. Using a Digital Voltmeter (DVM), measure the battery voltage at the battery. Is the battery voltage greater than the specified value?	16 V	Go to Step 3	Go to Step 4
3	1. Charge the battery and clean the battery terminals. 2. Clean the battery ground cable connection if corrosion is indicated. Is the battery voltage greater than the specified value?	16 V	Replace battery	Go to Step 4
4	1. Turn OFF all the accessories. 2. Install the Tech 2. 3. Select the ignition voltage parameter on the data list. 4. Start the engine and raise the engine speed to 2000 RPM. Is the voltage above the specified value?	16 V	Go to Step 5	Go to Step 6
5	Replace or repair the generator (see Charging System). Is a malfunction present?	—	Verify repair	—
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC)
P0601 INTERNAL CONTROL MODULE MEMORY CHECK SUM ERROR



014RX002

Circuit Description

The powertrain control module (PCM) used in this vehicle utilizes an electrically erasable programmable read–only memory (EEPROM). The EEPROM contains program information and the calibrations required for engine, transmission, and powertrain diagnostics operation.
Unlike the PROM used in past applications, the EEPROM is not replaceable. When the PCM is replaced or a calibration update is required, the PCM must be programmed using a Tech 2. For the EEPROM programming procedure, Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures.
If the PCM detects a check sum error then DTC P0601 will set. DTC P0601 is a type A code.

Conditions for Setting the DTC

- Ignition on.
- Check sum of soft ware and calibration not equal expected check sum.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the malfunction is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set in the Failure Records data only.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0601 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0601 can be cleared by using the Scan Tool's "Clear Info" function.

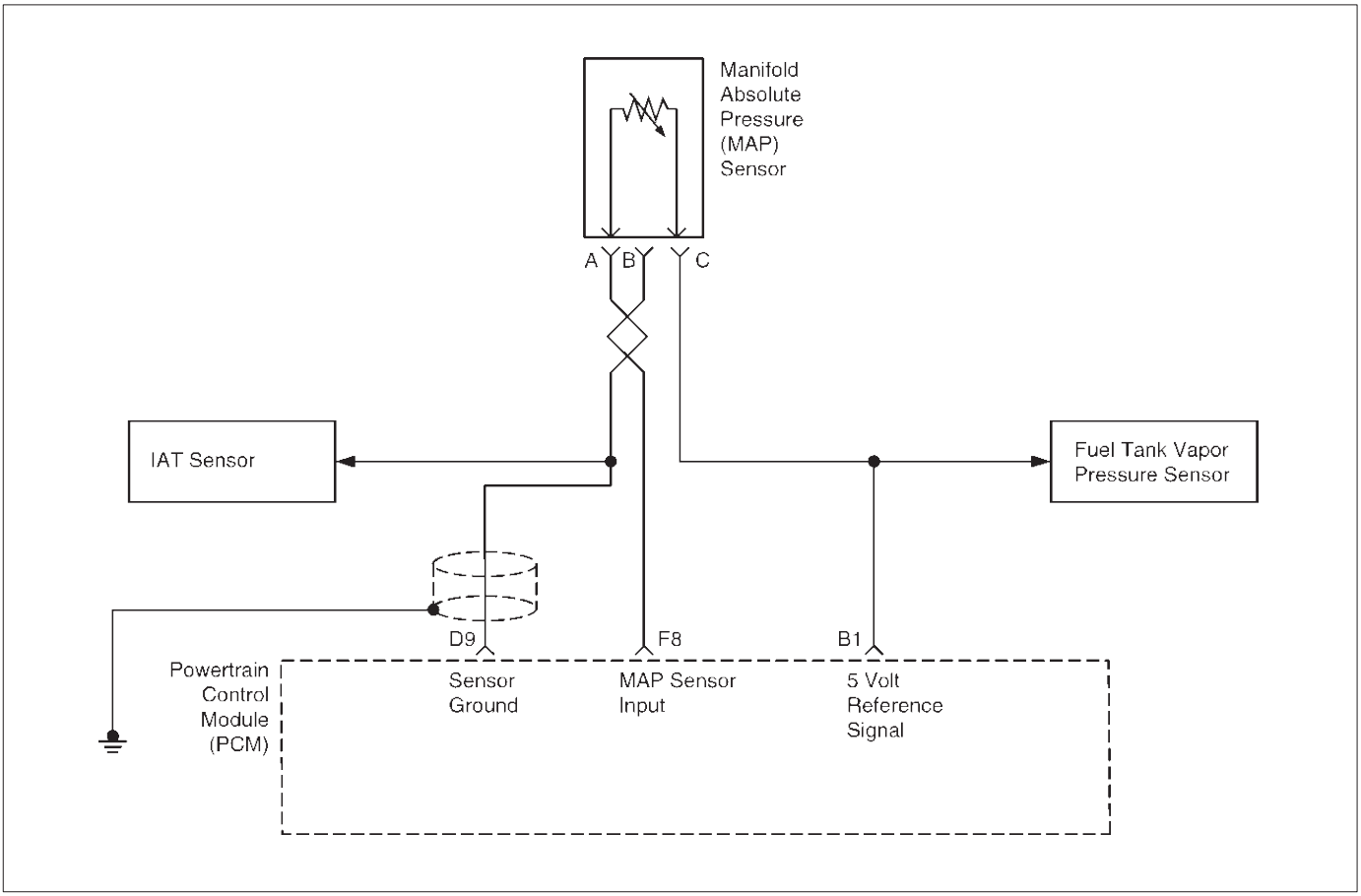
Diagnostic Aids

- Diagnostic Trouble Code P0601 indicates that the contents of the EEPROM have changed since the PCM was programmed. The only possible repair is PCM reprogramming or replacement. Check service bulletins to program the replacement PCM with the correct software and calibration for the vehicle.

DTC P0601 Internal Control Module Memory Check Sum Error

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Reprogram PCM with most recent calibrations. Refer to Service Bulletins and PCM Reprogramming. Is there still a problem?	—	Go to Step 3	Verify repair
3	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P1106 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE



060R100026

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure. The MAP sensor signal voltage to the PCM varies from below 2 volts at idle (low manifold pressure) to above 4 volts with the ignition ON, engine not running or at wide–open throttle (high manifold pressure).

A ”speed density” method of determining engine load is used on the 2.2L engine. This is calculated using inputs from the MAP sensor, RPM, the CKP sensor, and the Intake Air Temperature (IAT) sensor. The MAP sensor is the main sensor used in this calculation, and measuring engine load is its main function.

The MAP sensor is also used to determine manifold pressure changes while the linear EGR flow test diagnostic is being run, to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). Refer to Diagnostic Trouble Code 401.

The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various other engine load factors. If the PCM detects a MAP signal that is intermittently above the calculated value, Diagnostic Trouble Code P1106 will set. DTC P1106 is a type D code.

Conditions for Setting the DTC

- No TP sensor Diagnostic Trouble Codes are present.
- Engine is running.
- Throttle angle is below 2.7% if engine speed is below 1000 RPM.
- Throttle angle is below 10% if engine speed is above 1000 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure above 90 kPa. The conditions are met for 64 test failures within 256 test samples.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A history Diagnostic Trouble Code P1106 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1106 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Leaking or plugged vacuum supply line to the MAP sensor.
- Inspect PCM harness connectors for backed–out terminals, improper mating, broken locks, improperly

formed or damaged terminals, and poor terminal–to–wire connection.

- The MAP sensor shares a 5 Volt Reference with Fuel Pressure sensor.

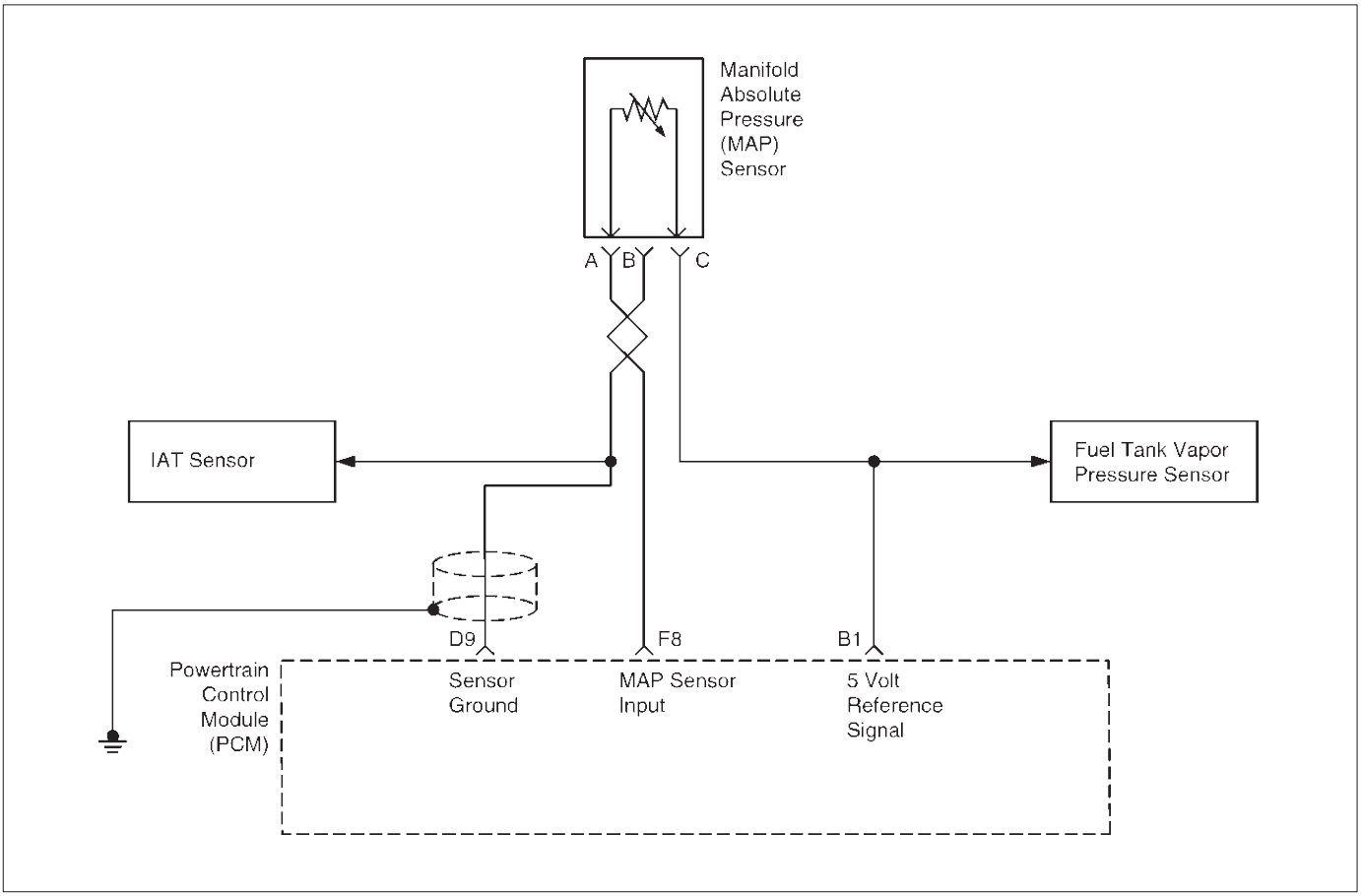
  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor shares a ground with the IAT sensor EGR position sensor, MAP sensor, A/C pressure sensor, Fuel level sensor.
- Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display 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 Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

DTC P1106 – MAP Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Is DTC P0108 also set?	—	Go to DTC P0108 chart first	Go to Step 3
3	Are Diagnostic Trouble Code P0463, and/or P1121 also set?	—	Go to Step 6	Go to Step 4
4	Check for a poor sensor ground circuit terminal connection at the MAP sensor. Was a problem found?	—	Go to Step 9	Go to Step 5
5	Check the MAP signal circuit between the MAP sensor connector and the PCM for an intermittent short to voltage. Was a problem found?	—	Go to Step 10	Go to Step 8
6	Check for an intermittent short to voltage on the 5 volt reference circuit between the PCM and the following components: ● Fuel Tank Vapor Pressure Sensor Was a problem found?	—	Go to Step 10	Go to Step 7
7	Check for a poor sensor ground circuit terminal connection at the PCM. Was a problem found?	—	Go to Step 9	Go to Step 8
8	Check for an intermittent open or a faulty splice in the sensor ground circuit. Was a problem found? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to Step 10	Refer to Diagnostic Aids
9	Replace the faulty harness connector terminal for the sensor ground circuit. Is the action complete?	—	Verify repair	—
10	Locate and repair the intermittent open/short circuit in the wiring harness as necessary. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P1107 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE



060R100026

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure. The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (low manifold pressure) to above 4 volts with the ignition ON, engine not running or at wide–open throttle (high manifold pressure).

A ”speed density” method of determining engine load is used on the 2.2l engine. This is calculated using inputs from the MAP sensor, the CKP sensor, and the Intake Air Temperature (IAT) sensor. The MAP sensor is the main sensor used in this calculation, and measuring engine load is its main function.

The MAP sensor is also used to determine manifold pressure changes while the linear EGR flow test diagnostic is being run, to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). Refer to DTC P0401.

The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various other engine load factors. If the PCM detects a MAP signal that is intermittently below the calculated value, DTC P1107 will set. DTC P1107 is a type D code.

Conditions for Setting the DTC

- No TP sensor Diagnostic Trouble Codes are present.
- Engine is running.
- Throttle angle is below 0% if engine speed is less than 1300 RPM.
- Throttle angle is below 5% if engine speed is above 1300 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure above 11 kPa. The above conditions are met for 64 test failures within 256 test samples.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A history Diagnostic Trouble Code P1107 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1107 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.

- The MAP sensor shares a 5 Volt Reference with the Fuel Pressure sensor.

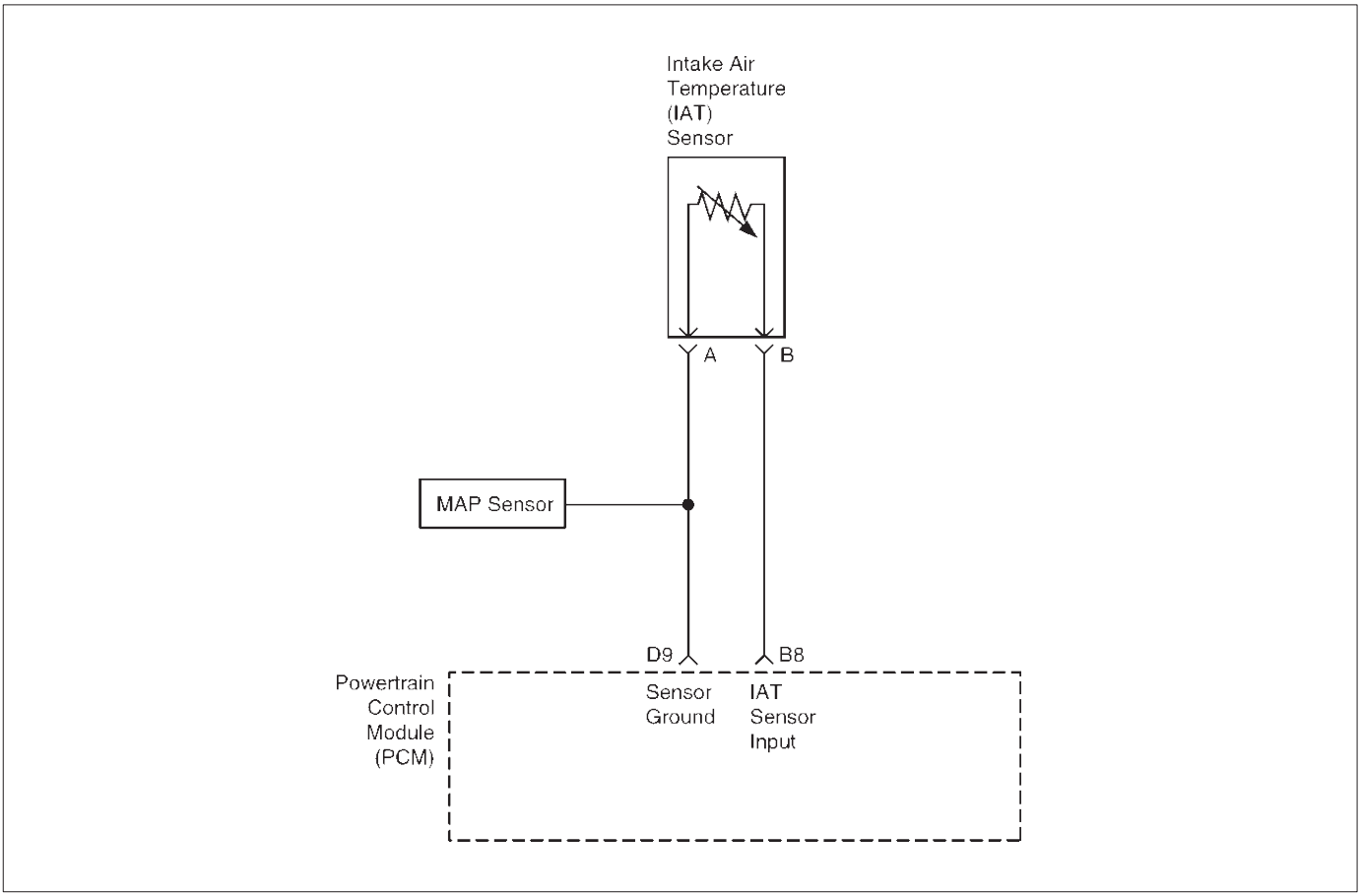
  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor shares a ground with the IAT sensor EGR position sensor, MAP sensor, A/C pressure sensor, Fuel level sensor.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display 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 Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

DTC P1107 – MAP Sensor Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Is DTC P0107 also set?	—	Go to DTC P0107 chart first	Go to Step 3
3	Is DTC P1122 and/or P0462 also set?	—	Go to Step 6	Go to Step 4
4	Check for a poor 5 volt reference circuit terminal connection at the MAP sensor. Was a problem found?	—	Go to Step 9	Go to Step 5
5	Check the MAP signal circuit between the MAP sensor connector and the PCM for an intermittent open or short to ground. Was a problem found?	—	Go to Step 10	Go to Step 8
6	Check for an intermittent short to ground on the 5 volt reference circuit between the PCM and the following components: • Fuel Tank Vapor Pressure Sensor Was a problem found?	—	Go to Step 10	Go to Step 7
7	Check for a poor 5 volt reference terminal connection at the PCM. Was a problem found?	—	Go to Step 9	Go to Step 8
8	Check for an intermittent open or a faulty splice in the 5 volt reference circuit. Was a problem found? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to Step 10	Refer to Diagnostic Aids
9	Replace the faulty harness connector terminal for the 5 volt reference circuit and/or the MAP signal circuit as necessary. Is the action complete?	—	Verify repair	—
10	Repair the intermittent open/short circuit in the wiring harness as necessary. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P1111 INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE



060R100027

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull–up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the PCM to monitor a lower voltage. Diagnostic Trouble Code P1111 will set when the PCM intermittently detects an excessively high signal voltage on the intake air temperature sensor signal circuit. DTC P1111 is a type D code.

Conditions for Setting the DTC

- The engine has been running for over 4 minutes.
- Vehicle speed is less than 32 km/h (20 mph).
- Engine coolant temperature is above 60°C (140°F).
- Calculated air flow is less than 20g/second.
- IAT signal voltage indicates an intake air temperature intermittently less than –39°C (–38°F) (4.94 volts). The above conditions are met for 20 test failures within a 256 test samples.

Action Taken When the DTC Sets

- The PCM will substitute a default value for intake air temperature.
- The PCM will store conditions which were present when the Diagnostic Trouble Code set as Failure Records data only. This information will not be stored as Freeze Frame data.
- Diagnostic Trouble Code P1111 does not illuminate the MIL.

Conditions for Clearing the DTC

- A history DTC P1111 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1111 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to

be set occurs. This may assist in diagnosing the condition.

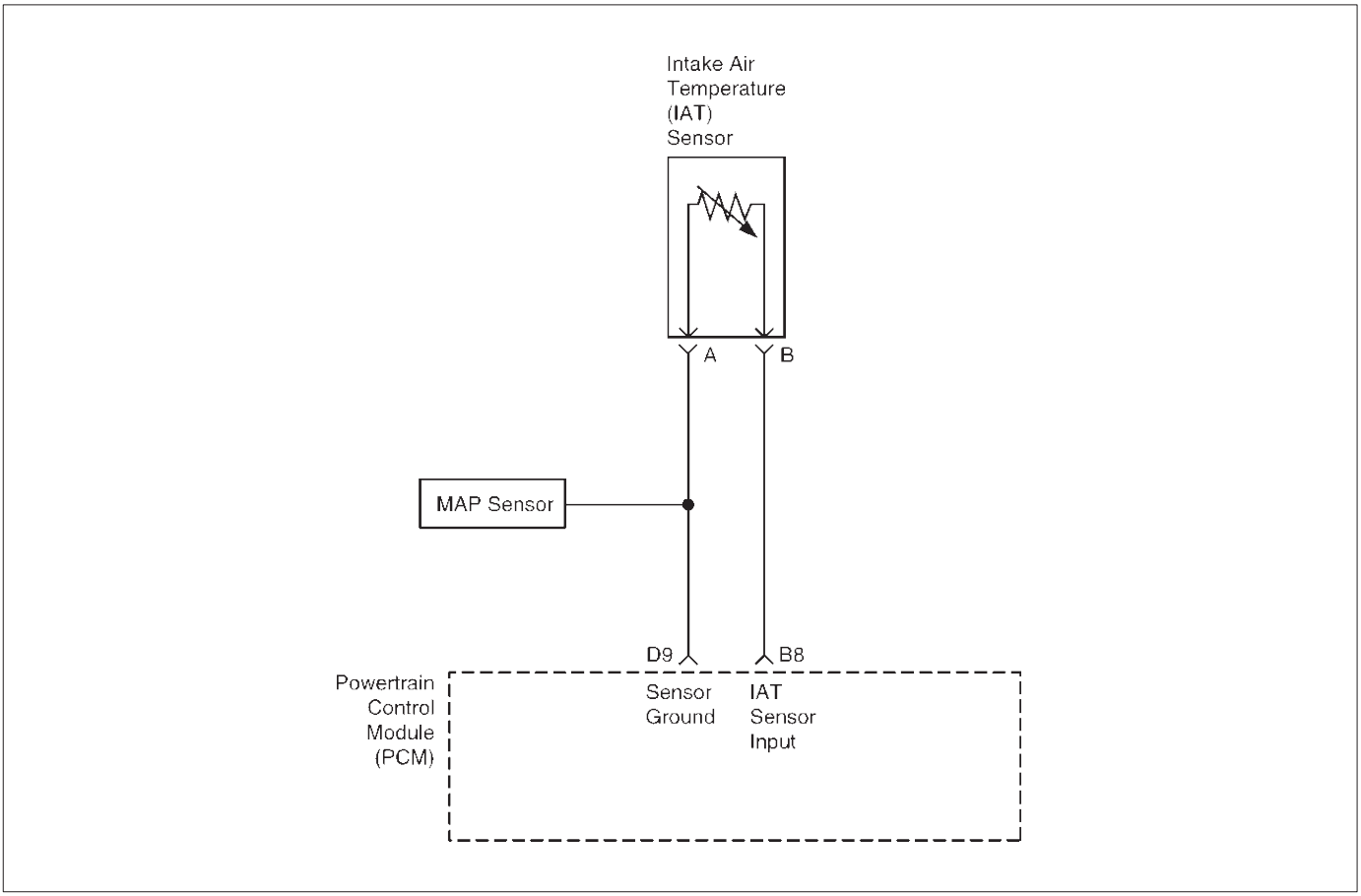
Intake Air Temperature Sensor

˚C	˚F	Ω
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1111 – IAT Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Is DTC P0113 also set?	—	Go to DTC P0113 chart first	Go to Step 3
3	1. Check for a poor sensor ground circuit terminal connection at the IAT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 4
4	1. Check for a poor IAT signal circuit terminal connection at the IAT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent open. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 6
6	1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent short to voltage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Check for a poor sensor ground circuit terminal connection at the PCM. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 8
8	1. Check for an intermittent open or a faulty splice in the sensor ground circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to Diagnostic Aids

DIAGNOSTIC TROUBLE CODE (DTC) P1112 INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE



060R100027

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull–up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance becomes lower, causing the PCM to monitor a lower voltage. Diagnostic Trouble Code P1112 will set when the PCM intermittently detects an excessively low signal voltage on the intake air temperature sensor signal circuit. DTC P1112 is a type D code.

Conditions for Setting the DTC

- The engine has been running for over 2 minutes.
- Vehicle speed is greater than 48 km/h (30 mph).
- IAT signal voltage is greater than 148˚C (298˚F) (about 0.10 volt). The above conditions are met for 20 test failures within 200 test samples.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the Diagnostic Trouble Code set as Failure Records data only. This information will not be stored as Freeze Frame data.
- The PCM will substitute a default value for intake air temperature.

Conditions for Clearing the DTC

- A history Diagnostic Trouble Code P1112 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1112 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to

be set occurs. This may assist in diagnosing the condition.

Test Description

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

2. Verifies that the fault is present.
3. If DTC P1112 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Value Chart."

   The chart may be used to test the IAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the IAT sensor.

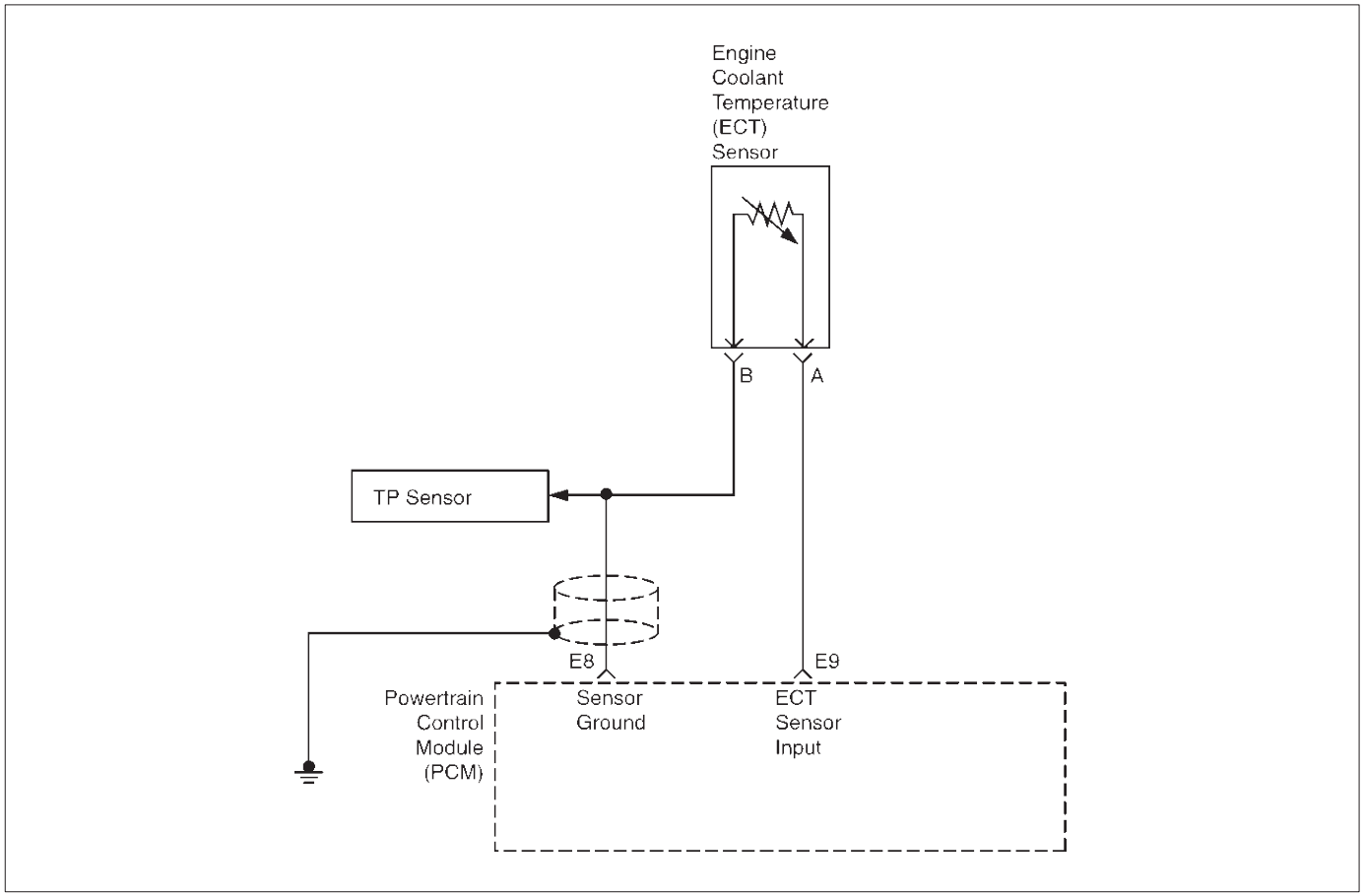
Intake Air Temperature Sensor

˚C	˚F	Ω
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1112 – IAT Sensor Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Is DTC P0112 also set?	—	Go to DTC P0112 chart first	Go to Step 3
3	1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent short to ground. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to Diagnostic Aids

DIAGNOSTIC TROUBLE CODE (DTC) P1114 ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE



060R100028

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The powertrain control module (PCM) applies a voltage (about 5.0 volts) through a pull–up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the PCM detects an ECT signal that is intermittently below the range of the ECT sensor, Diagnostic Trouble Code P1114 will set. DTC P1114 is a type D code.

Conditions for Setting the DTC

- Engine run time longer than 2 minutes.
- The ECT sensor signal is intermittently greater than 150˚C (302˚F) (about 0.10 volt). The above conditions are met for 20 test failures within 200 test samples.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the Diagnostic Trouble Code set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A history Diagnostic Trouble Code P1114 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1114 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

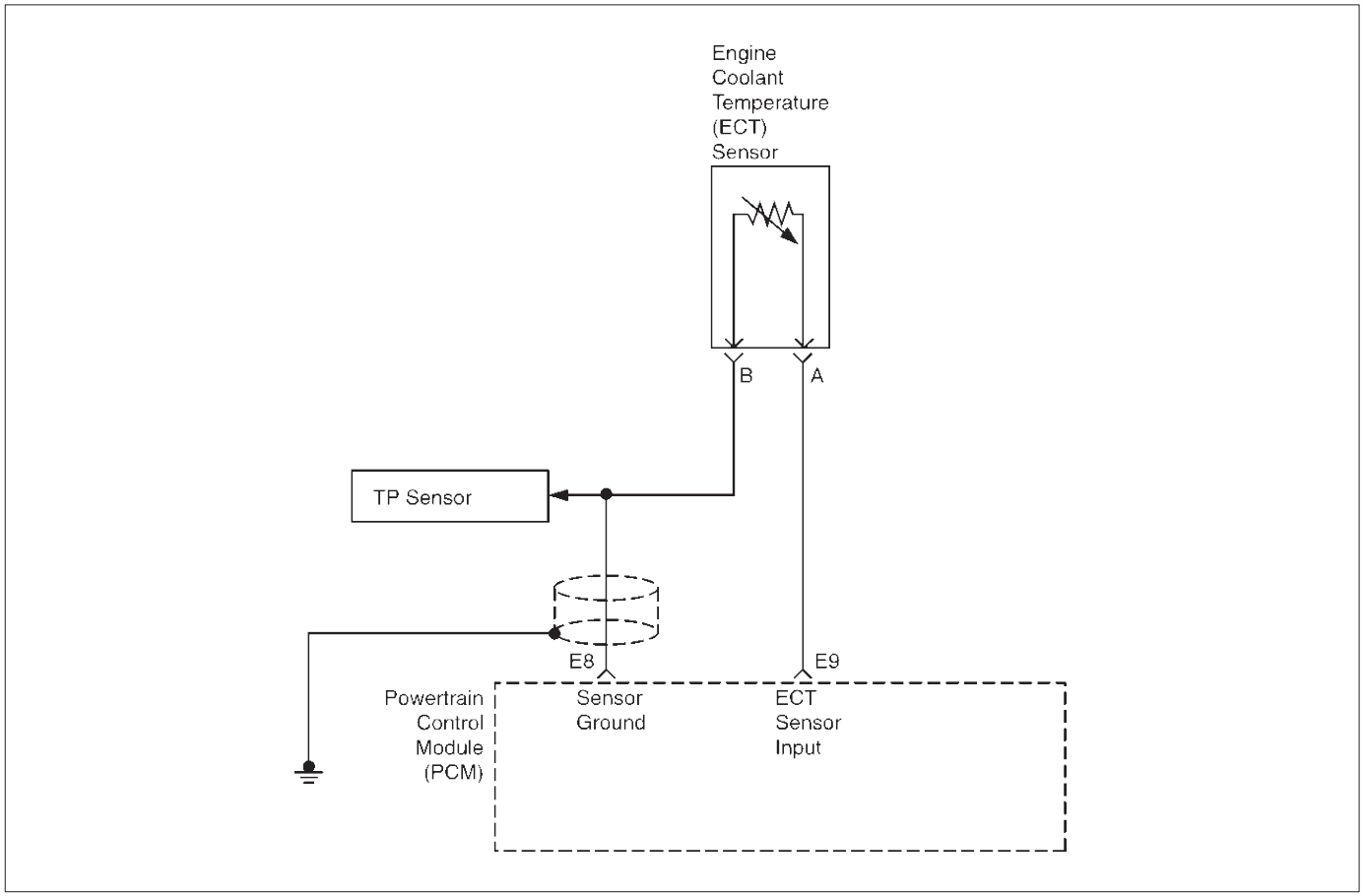
Engine Coolant Temperature Sensor

˚C	˚F	Ω
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1114 – ECT Sensor Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Is DTC P0117 also set?	—	Go to DTC P0117 first	Go to Step 3
3	1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent short to ground. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to Diagnostic Aids

DIAGNOSTIC TROUBLE CODE (DTC) P1115 ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE



060R100028

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The powertrain control module (PCM) applies a voltage (about 5.0 volts) through a pull–up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the PCM detects an ECT signal that is intermittently above the range of the ECT sensor, Diagnostic Trouble Code P1115 will set. Diagnostic Trouble Code P1115 is a type D code.

Conditions for Setting the DTC

- Engine run time longer than 180 seconds.
- The ECT sensor signal is intermittently greater than –39˚C (–38˚F) (4.94 volts) for a total of 10 seconds over a 100–second period.

The conditions are met for 20 test failures within 200 test samples.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the Diagnostic Trouble Code set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A history Diagnostic Trouble Code P1115 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1115 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

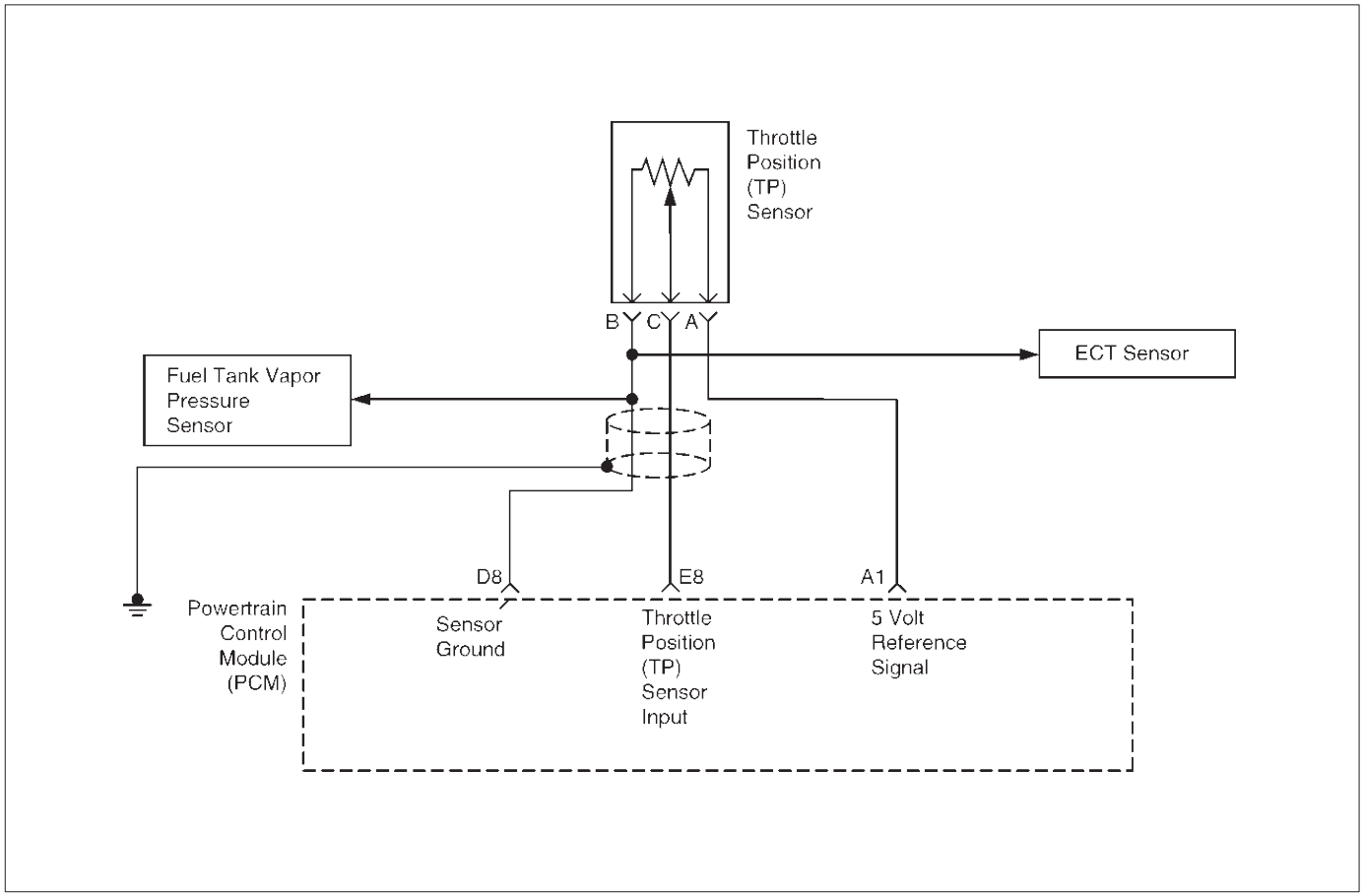
Engine Coolant Temperature Sensor

˚C	˚F	Ω
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1115 ECT Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Is DTC P0118 also set?	—	Go to DTC P0118 first	Go to Step 3
3	1. Check for a poor sensor ground circuit terminal connection at the ECT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 4
4	1. Check for a poor ECT signal circuit terminal connection at the ECT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent open. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 6
6	1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent short to voltage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Check for a poor sensor ground circuit terminal connection at the PCM. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 8
8	1. Check for an intermittent open or a faulty splice in the sensor ground circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to Diagnostic Aids

DIAGNOSTIC TROUBLE CODE (DTC) P1121 THROTTLE POSITION (TP) SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE



060R100029

Circuit Description

The throttle position (TP) sensor circuit provides a voltage signal that changes relative to the throttle blade angle. The signal voltage will vary from less than 1 volt at closed throttle to more than 4 volts at wide open throttle (WOT). The TP signal is used by the powertrain control module (PCM) for fuel control and for most of the PCM controlled outputs. If the PCM detects a TP signal that is intermittently above the range of the TP sensor, Diagnostic Trouble Code P1121 will be set. DTC P1121 is a type D code.

Conditions for Setting the DTC

- The ignition is ON.
- TP sensor indicates a throttle position voltage intermittently greater than 4.88 volts. The above conditions are met for 20 test failures within 200 test samples.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the Diagnostic Trouble Code set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A history Diagnostic Trouble Code P1121 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1121 can be cleared by using the Scan Tool's "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- The TP sensor shares a 5 Volt reference with the MAP sensor and EGR position sensor.

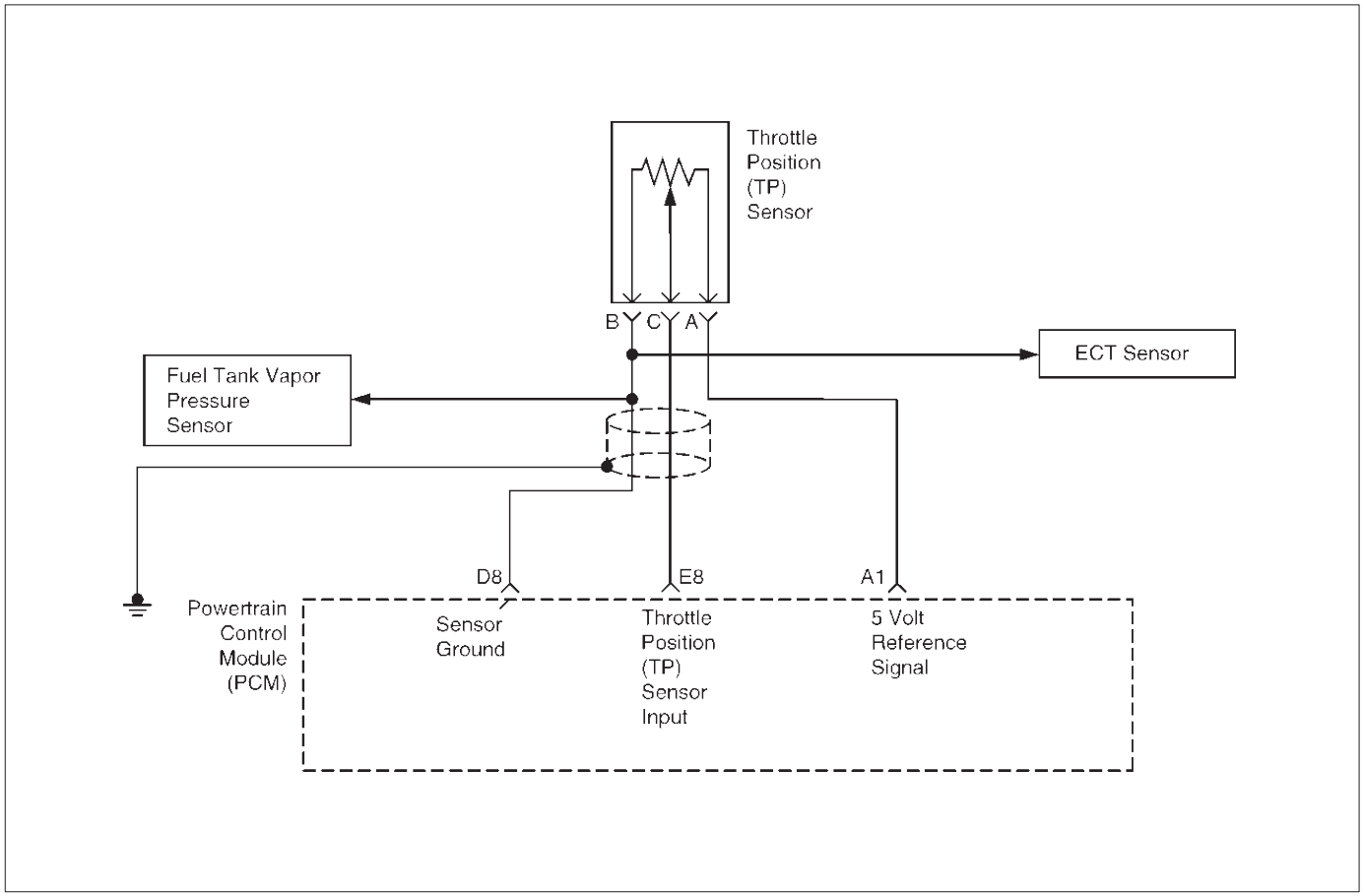
  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The TP sensor share a ground with the ECT, the CKP, the CMP and the automatic transmission position sensor and the Fuel Pressure sensor.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the throttle position display on the Tech 2 while moving connectors and wiring harnesses related to the TP sensor. A change in the display will indicate the location of the fault.

If Diagnostic Trouble Code P1121 cannot be duplicated, reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help to determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

DTC P1121 – TP Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Is Diagnostic Trouble Code P0123 also set?	—	Go to DTC P0123 first	Go to Step 3
3	Is Diagnostic Trouble Code P0463 and/or P1106 also set?	—	Go to Step 6	Go to Step 4
4	Check for a poor sensor ground circuit terminal connection at the TP sensor. Was a problem found?	—	Go to Step 9	Go to Step 5
5	Check the TP signal circuit between the TP sensor connector and the PCM for an intermittent short to voltage. Was a problem found?	—	Go to Step 10	Go to Step 8
6	Check for an intermittent short to voltage on the 5 volt reference circuit between the PCM and the following components: ● MAP Sensor ● EGR Position Sensor Was a problem found?	—	Go to Step 10	Go to Step 7
7	Check for a poor sensor ground terminal connection at the PCM. Was a problem found?	—	Go to Step 9	Go to Step 8
8	Check for an intermittent open or a faulty splice in the sensor ground circuit. Was a problem found? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to Step 10	Refer to Diagnostic Aids
9	Replace the faulty harness connector terminal for the sensor ground circuit. Is the action complete?	—	Verify repair	—
10	Repair intermittent open/short circuit in wiring harness as necessary. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P1122 THROTTLE POSITION (TP) SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE



060R100029

Circuit Description

The throttle position (TP) sensor circuit provides a voltage signal that changes relative to the throttle blade angle. The signal voltage will vary from less than 1 volt at closed throttle to more than 4 volts at wide open throttle (WOT). The TP signal is used by the powertrain control module (PCM) for fuel control and for most of the PCM controlled outputs. If the PCM detects a TP signal that is intermittently above the range of the TP sensor, Diagnostic Trouble Code P1122 will be set. DTC P1122 is a type D code.

Conditions for Setting the DTC

- The ignition is ON.
- TP sensor indicates a throttle position signal intermittently less than 0.235 volt. The above conditions are met for 20 test failures within 200 test samples.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the Diagnostic Trouble Code set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A history Diagnostic Trouble Code P1122 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1122 can be cleared by using the Scan Tool's "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the throttle position display on the Tech 2 while moving connectors and wiring harnesses related to the TP sensor. A change in the display will indicate the location of the fault.
- The TP sensor shares a 5 Volt reference with the MAP sensor and Fuel Pressure sensor.

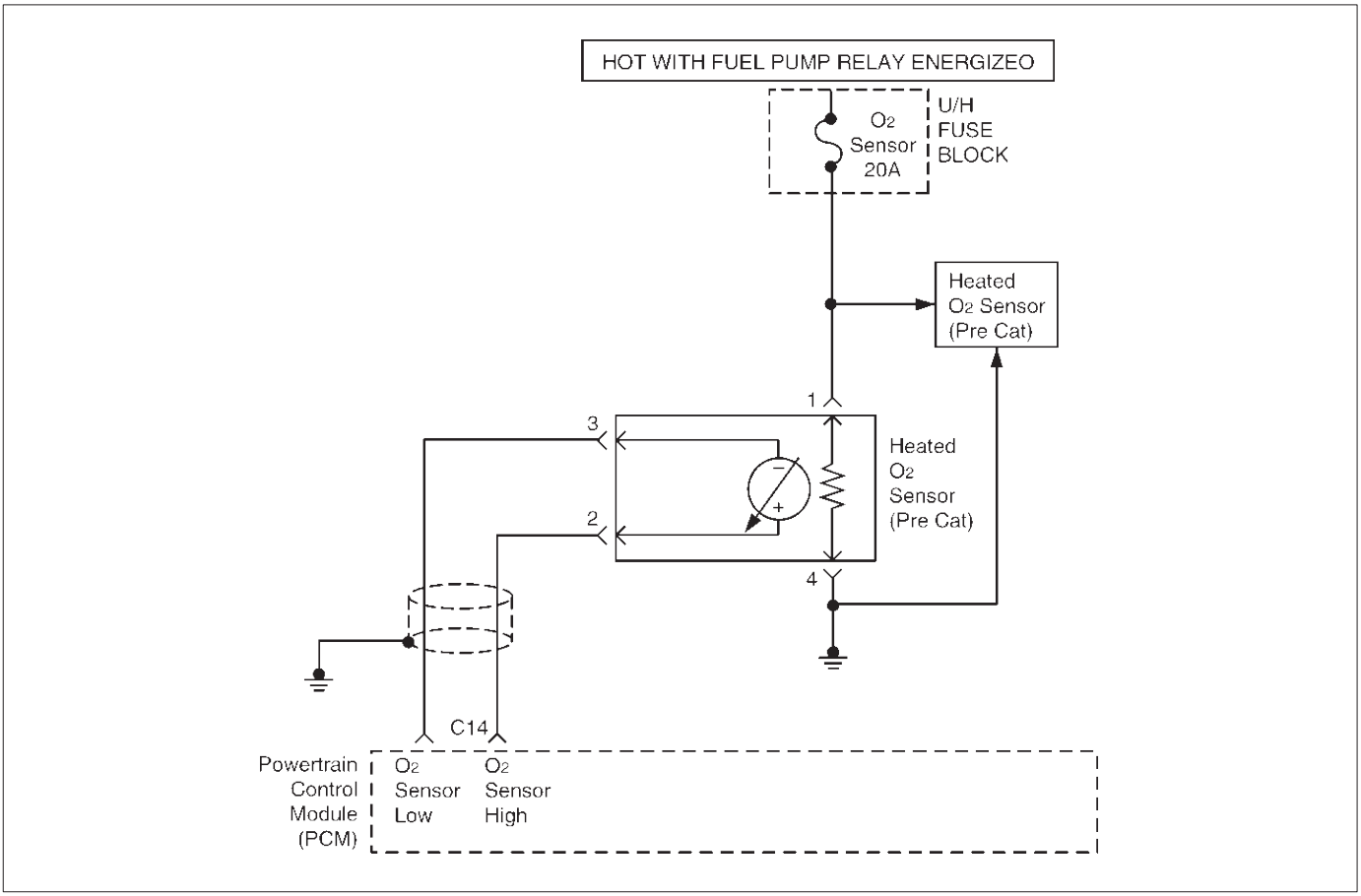
  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The TP sensor share a ground with the ECT, the CKP, the CMP and the automatic transmission position sensor and the Fuel Pressure sensor.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help to determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

DTC P1122 – TP Sensor Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Is DTC P0122 also set?	—	Go to DTC P0122 first	Go to Step 3
3	Is DTC P1107 and/or P0462 also set?	—	Go to Step 6	Go to Step 4
4	Check for a poor 5 volt reference circuit or TP signal circuit terminal connection at the TP sensor. Was a problem found?	—	Go to Step 9	Go to Step 5
5	Check the TP signal circuit between the TP sensor connector and the PCM for an intermittent short to ground. Was a problem found?	—	Go to Step 10	Go to Step 8
6	Check for an intermittent short to ground on the 5 volt reference circuit between the PCM and the following components: ● EGR Position Sensor ● MAP Sensor Was a problem found?	—	Go to Step 9	Go to Step 8
7	Check for a poor 5 volt reference circuit terminal connection at the PCM. Was a problem found?	—	Go to Step 9	Go to Step 8
8	Check for an intermittent open or a faulty splice in the 5 volt reference circuit. Was a problem found? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to Step 10	Refer to Diagnostic Aids
9	Replace the faulty harness connector terminal(s) for the 5 volt reference circuit and/or the TP signal circuit as necessary. Is the action complete?	—	Repair complete. If a driveability symptom still exists, refer to Symptoms.	—
10	Repair intermittent open/short circuit in wiring harness as necessary. Is the action complete?	—	Repair complete. If a driveability symptom still exists, refer to Symptoms.	—

DIAGNOSTIC TROUBLE CODE (DTC)
P1133 O2 SENSOR INSUFFICIENT SWITCHING (BANK 1 SENSOR 1)



060R100030

Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after ”Closed Loop” has been enabled. During this test period the PCM counts the number of times that the HO2S signal voltage crosses the rich–to–lean and lean–to–rich threshold. If the PCM determines that the HO2S did not switch enough times, Diagnostic Trouble Code P1133 will be set.
A lean–to–rich switch is determined when the HO2S voltage changes above and below 450 mV. DTC P1133 is a type B code.

Conditions for Setting the DTC

- No MAP, IAT, ECT, TPS, Fuel Trim, Injector, Misfire, CKP, EGR, EVAP Diagnostic Trouble Codes are present.
- Engine coolant temperature (ECT) is above 60°C (140°F).
- Engine is operating in ”Closed Loop”.
- The engine has been running at least two minutes.
- Canister purge duty cycle is greater than 2%.
- Calculated air flow between 17 and 32 grams/sec.
- Engine speed is between 1500 RPM and 3500 RPM.
- Above conditions are present for 1 second.
- O2 sensor transitions crossing 0.3–0.6 V.
- 90 seconds after ”Closed Loop” and has been achieved, the PCM monitors the oxygen sensor as it switches above and below 450 mV. If fewer than 22 rich–to–lean and 22 lean–to–rich switches are detected, Diagnostic Trouble Code P1133 will be set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P1133 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1133 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

A malfunction in the HO2S heater ignition feed or ground circuit may cause a Diagnostic Trouble Code P1133 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and

Diagnostic Trouble Code P1133 continues to set, replace the Bank 1 HO2S 1.
Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help to determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging the replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
11. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

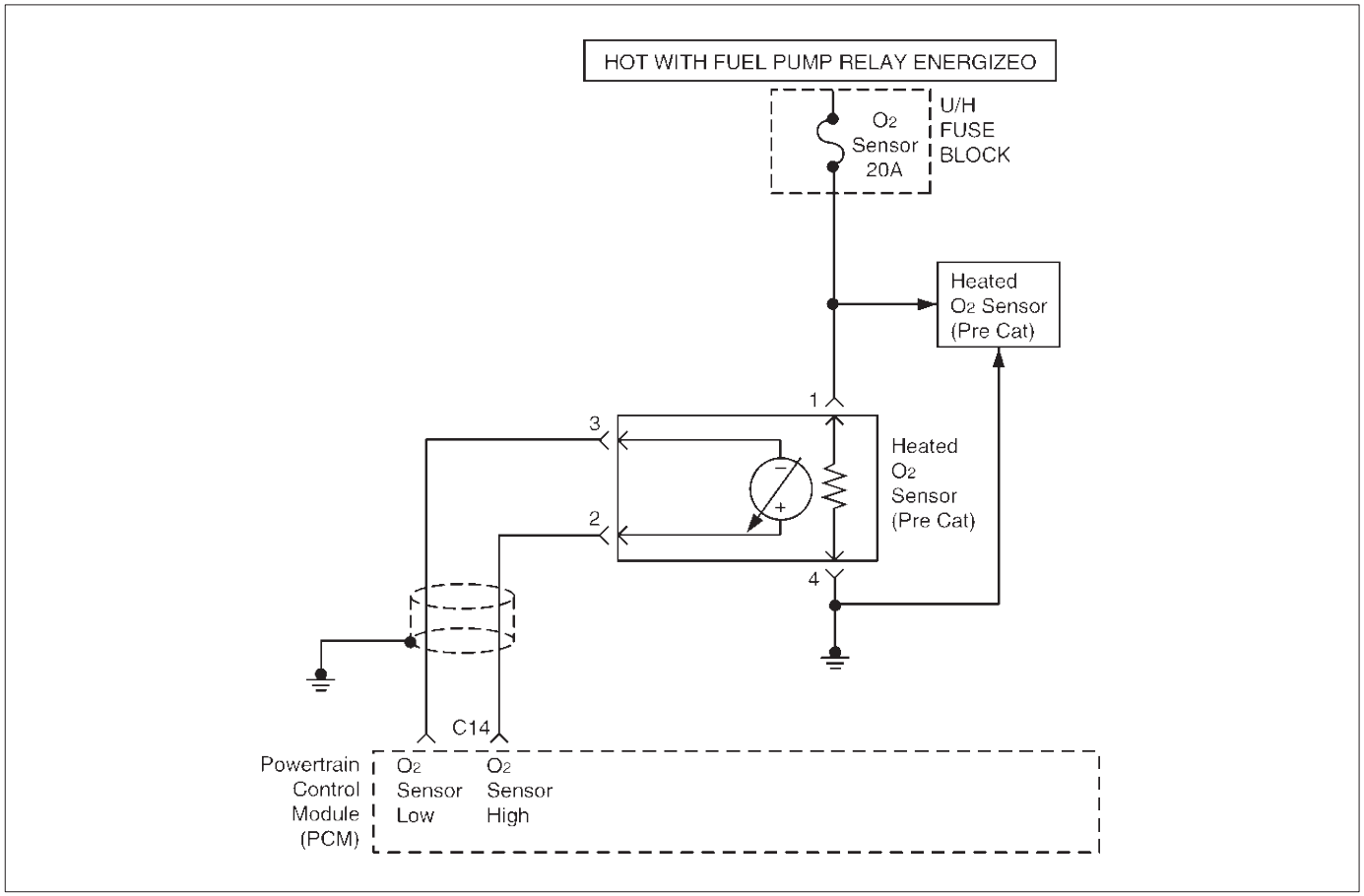
DTC P1133 – O2 Sensor Insufficient Switching (Bank 1 Sensor 1)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	**IMPORTANT:** If any Diagnostic Trouble Codes are set refer to those Diagnostic Trouble Codes before proceeding with this diagnostic chart. 1. Engine idling at operating temperature. 2. Operate the vehicle within parameters specified under ”Conditions for Setting the Diagnostic Trouble Code” criteria. 3. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P1133 until the Diagnostic Trouble Code P1133 test runs. 4. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P1133 failed this ignition?	—	Go to Step 3	Refer to Diagnostic Aids
3	Did the Tech 2 also indicate that the P1153 or P1154 tests failed?	—	Go to Step 11	Go to Step 4
4	1. Perform the ”Exhaust System Leak Test” (refer to Exhaust System). After the ”Exhaust System Leak Test” has been performed, return to this diagnostic. 2. If an exhaust leak is found, repair as necessary. Was an exhaust leak isolated?	—	Go to Step 2	Go to Step 5
5	Visually/physically inspect the following items: ● Ensure that the Bank 1 HO2S 1 is securely installed. ● Check for corrosion on the terminals. ● Check the terminals at Bank 1 HO2S 1 and at the PCM. ● Check for damaged wiring; shorts to ground, shorts to battery positive, and open circuits. Was a problem found in any of the above areas?	—	Verify repair	Go to Step 6
6	1. Disconnect Bank 1 HO2S 1. 2. Ignition ON. 3. Using a Digital Voltmeter (DVM) at the PCM side of the connector, check the voltage between the high signal circuit and ground. Also measure between the low signal circuit and ground. Are both voltages in the specified range?	3–4 mV	Go to Step 9	Go to Step 7

DTC P1133 – O2 Sensor Insufficient Switching (Bank 1 Sensor 1) (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition OFF. 2. Check for damage to PCM pins or terminals. Was a problem found?	—	Verify repair	Go to Step 8
8	Check for a short to voltage or ground or an open in the signal circuit. Was a problem found?	—	Verify repair	Go to Step 9
9	1. Ignition OFF. 2. Disconnect the PCM connector. 3. With the HO2S disconnected, check for high and low signal circuits shorted together between the PCM and HO2S. Was a problem found?	—	Verify repair	Go to Step 10
10	With the PCM connected and Bank 1 HO2S 1 disconnected from the harness, check Bank 1 HO2S 1 with a Tech 2. Is the voltage in the specified range?	430–470 mV	Go to Step 11	Go to Step 12
11	Replace the affected heated oxygen sensors. NOTE: Before replacing the sensors, the cause of the contamination must be determined and corrected. ● Fuel contamination. ● Use of improper RTV sealant. ● Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC)
P1134 O2 SENSOR TRANSITION TIME RATIO (BANK 1 SENSOR 1)



060R100030

Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after ”Closed Loop” has been established. During the monitoring period the PCM counts the number of times that the HO2S responds from rich–to–lean and from lean–to–rich and adds the amount of time it took to complete all transitions. With this information, an average time for all transitions can be determined. The PCM then divides the rich–to–lean average by the lean–to–rich average to obtain a ratio. If the HO2S transition time ratio is not within this range, Diagnostic Trouble Code P1134 will be set, indicating that the oxygen sensor is not responding as expected to changes in exhaust oxygen content. DTC P1134 is a type B code.

Conditions for Setting the DTC

- No MAP, IAT, ECT, TPS, Fuel Trim, Injector, Misfire CKP, EGR, EVAP DTCs Set.
- Engine coolant temperature (ECT) is above 60˚C (140˚F).
- Engine is operating in ”Closed Loop”.
- The engine has been running at least two minutes.
- Calculated air flow between 17 and 32 grams/sec.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3500 RPM.
- Above conditions are present for a 1–second monitoring period.
- 90 seconds after ”Closed Loop” has been enabled, Bank 1 HO2S 1 transition ratio between lean–to–rich and rich–to–lean is less than 0.25 or greater than 4.43.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P1134 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1134 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

A malfunction in the HO2S heater ignition feed or ground circuit may cause a Diagnostic Trouble Code P1133 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and

Diagnostic Trouble Code P1134 continues to set, replace the Bank 1 HO2S 1.
Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging the replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
11. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

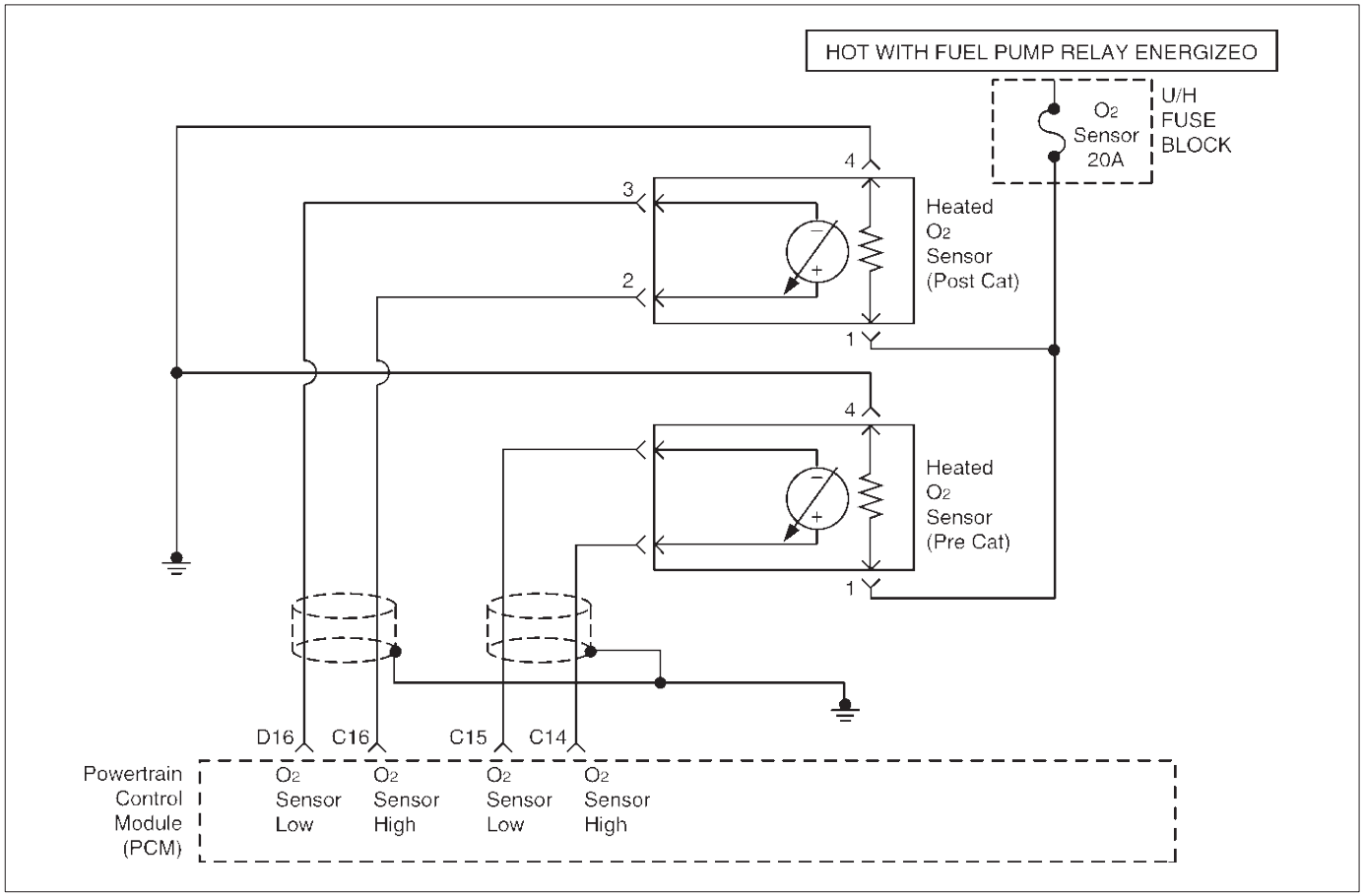
DTC P1134 – O2 Sensor Transition Time Ratio (Bank 1 Sensor 1)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	**IMPORTANT:** If any DTCs are set refer to those DTCs before proceeding with this diagnostic chart. 1. Idle the engine at operating temperature. 2. Operate the vehicle within parameters specified under ”Conditions for Setting the Diagnostic Trouble Code” criteria included in Diagnostic Support. 3. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P1134 until the Diagnostic Trouble Code P1134 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P1134 failed this ignition?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Perform the ”Exhaust System Leak Test” (refer to Exhaust System). After the ”Exhaust System Leak Test” has been performed, return to this diagnostic. 2. If an exhaust leak is found, repair as necessary. Was an exhaust leak isolated?	—	Verify repair	Go to Step 4
4	Visually/physically inspect the following items: • Ensure that the Bank 1 HO2S 1 is securely installed. • Check for corrosion on the terminals. • Check the terminals at Bank 1 HO2S 1 and at the PCM. • Check for damaged wiring; shorts to ground, shorts to battery positive, and open circuits. Was a problem found in any of the above areas?	—	Go to Step 7	Go to Step 5
5	1. Disconnect Bank 1 HO2S 1. 2. Ignition ON. 3. Using a Digital Voltmeter (DVM) at the PCM side of the connector, check the voltage between the high signal circuit and ground. Also measure between the low signal circuit and ground. Are both voltages in the specified range?	3–4 V	Go to Step 6	Go to Step 8

DTC P1134 – O2 Sensor Transition Time Ratio (Bank 1 Sensor 1) (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. With Bank 1 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition ON. 3. Using a Tech 2, monitor the Bank 1 HO2S 1 voltage. Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to Step 10	Go to Step 11
7	Repair condition as necessary. Is the action complete?	—	Verify repair	—
8	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to Step 9
9	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	Go to Step 6
10	Remove the Bank 1 H02S 1 and examine it for signs of: ● Fuel contamination; ● Improper RTV sealant (white powdery coating on sensor); ● Engine oil/coolant consumption. Were signs of contamination observed?	—	Go to Step 13	Go to Step 12
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the repair complete?	—	Verify repair	—
12	Replace the Bank 1 H02S 1. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC)
P1171 FUEL SYSTEM LEAN DURING ACCELERATION



060R100032

Circuit Description

The powertrain control module (PCM) internal circuitry can identify if the vehicle fuel system is capable of supplying adequate amounts of fuel during heavy acceleration (power enrichment). The PCM monitors the voltage of the oxygen sensor during power enrichment. When a power enrichment mode of operation is requested during ”Closed Loop” operation (by heavy acceleration), the PCM will provide more fuel to the engine. Under these conditions the PCM should detect a ”rich” condition (high oxygen sensor voltage). If this ”rich” exhaust is not detected at this time, a Diagnostic Trouble Code P1171 will set. A plugged fuel filter or restricted fuel line can prevent adequate amounts of fuel from being supplied during power enrichment mode. DTC P1171 is a type A code.

Conditions for Setting the DTC

- No MAP, IAT, ECT, TPS, Fuel Trim, Injector, Misfire, CKP, EGR, EVAP DTCs Set.
- Engine is operating in ”Closed Loop”.
- Engine coolant temperature is above 60˚C (140˚F).
- While in ”power enrichment” mode the oxygen sensor voltage remains below 400 mV for 3 seconds.
- The commanded Air Flow Ratio is less than 3 sec.

The above conditions are met for 40 failures in 40 samples.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P1171 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1171 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

- A restricted fuel filter or fuel line can supply adequate amounts of fuel at idle, but may not be able to supply enough fuel during heavy acceleration.
- Water or alcohol in the fuel may cause low HO2S voltage during acceleration.
- Check for faulty or plugged fuel injector(s).
- Check for low fuel.

Test Description

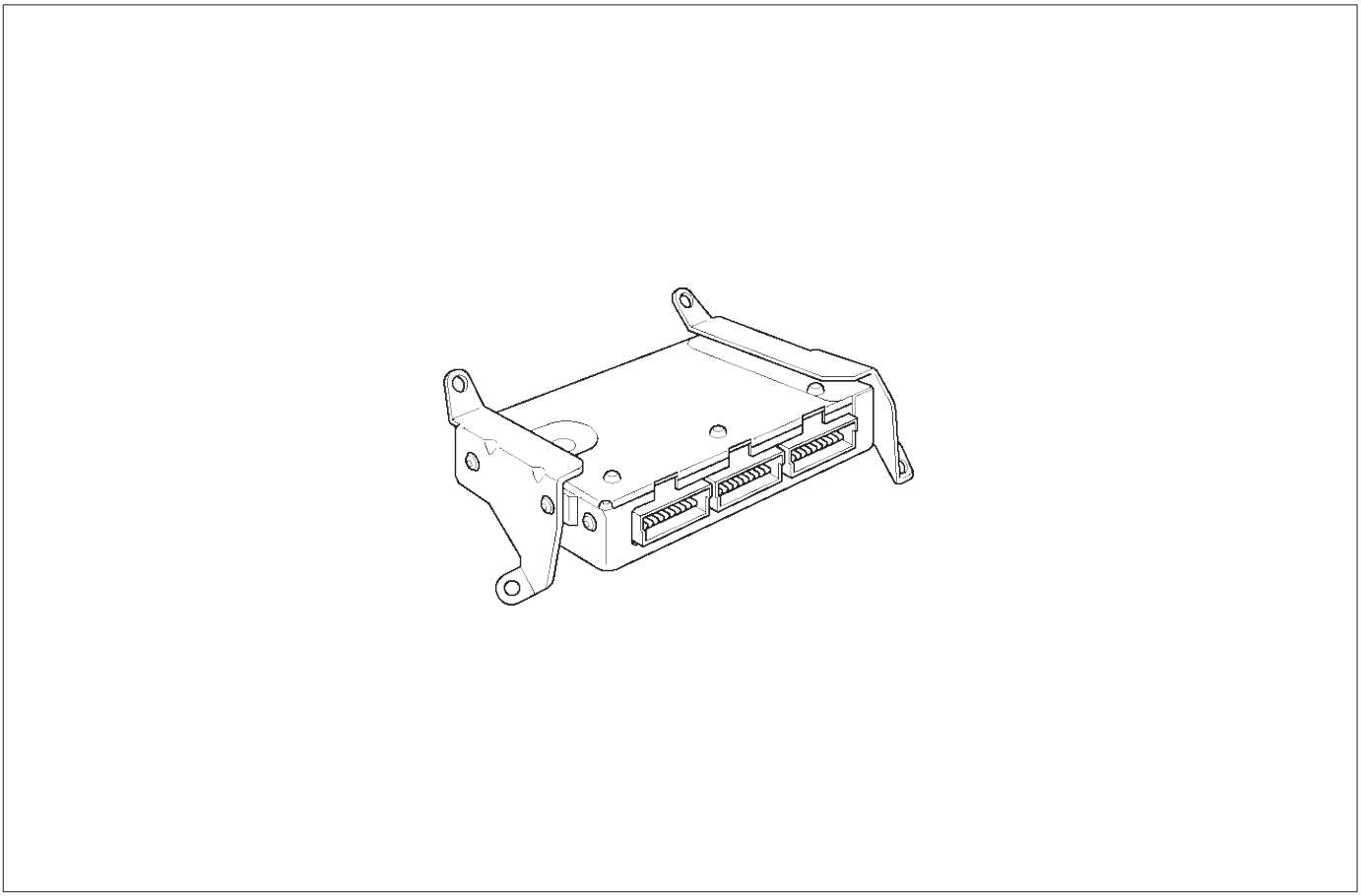
Number(s) below refer to the step number(s) on the Diagnostic Chart:

4. When the engine is idling or at steady cruise, the HO2S voltage should vary from between approximately 100 mV to 900 mV. During ”power enrichment” mode, more fuel is needed and the HO2S voltage should rise above 447 mV. This step checks to see if the HO2S is operating properly.
5. Wrap a shop towel around the fuel pressure connector to absorb any small amount of fuel leakage that may occur when installing the gauge. Ignition ON, pump pressure should be 235–320 kPa.
7. Add Caution: Use correct pliers so damage to fuel lines will not occur.

DTC P1171 – Fuel System Lean During Acceleration

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Are any component–related Diagnostic Trouble Codes set?	—	Go to component DTC charts	Go to Step 3
3	1. Check the vehicle's fuel tank for an adequate amount of fuel. 2. Add fuel to the vehicle's fuel tank if the tank is almost empty. Was fuel added to the vehicle's fuel tank?	—	Go to Step 4	Go to Step 5
4	1. Using a Tech 2, observe HO2S 1 voltage while running warm engine(75°C–95°C [167°F–203°F]) at 1200 RPM. 2. HO2S 1 voltage should vary within the specified range. Does the voltage toggle back and forth within the specified range?	100– 900 mV	Go to Diagnostic Aids	Go to Step 5
5	1. Disconnect the fuel pump relay and crank the engine to relieve the fuel pressure. 2. Install the fuel pressure gauge. 3. Start the engine and idle at normal operating temperature. 4. Disconnect the vacuum line going to the fuel pressure regulator. With the engine running, is the fuel pressure within the specified range?	284– 325 kPa	Go to OBD System Check	Go to Step 6
6	Check for restricted fuel lines or restricted in–line filter. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Ignition OFF. 2. Ignition ON, engine OFF. 3. Using a Tech 2, enable the fuel pump to operate. 4. Using pliers, slowly close the return line (do not exceed the first specified value). Using the pliers, can the fuel pressure be manipulated to exceed the second specified value?	414 kPa 325 kPa	Go to Diagnostic Aids	Go to Step 8
8	Check for: • Faulty fuel pump • Restricted fuel pump strainer (sock) • Incorrect fuel pump • Incorrect fuel being used • Hot fuel	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P1336 CRANKSHAFT POSITION SENSOR (CKP) SYSTEM VARIATION NOT LEARNED



014RX002

Circuit Description

In order to detect engine misfire at higher engine speeds, the Powertrain Control Module (PCM) must know of any variation between the crankshaft sensor pulse. Most variations are due to the machining of the crankshaft reluctor wheel, however, other sources of variation are also possible. A Crankshaft Position Sensor Tooth Error Correction (TEC) procedure must be performed any time a change is made to the crankshaft sensor, crankshaft, or if the PCM measures the variations and then calculates compensation factors needed to enable the PCM to accurately detect engine misfire at all speeds and loads. The Tech 2 must be used to command the PCM to learn these variations. If for any reason the PCM is unable to learn these variations or they are out of an acceptable range, the PCM will set a DTC P1336. A PCM that has not had the Crankshaft Position Sensor Tooth Error Correction (TEC) Procedure performed due to replacement or reprogramming will also set a DTC P1336. DTC P1336 is a type A code.

Conditions for Setting the DTC

- No ECT, Knock, CKP, or injector sensor DTCs.
- PCM has not successfully learned crankshaft position Tooth Error Correction(TEC) within 5 attempts or 5 Km (3 miles).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate the first time the error is detected.
- The PCM 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.
- DTC(s) can be cleared by using the Tech 2.

Diagnostic Aids

- Refer to ”TEC Learn Procedure”

CAUTION: When performing the Crankshaft Position Sensor Tooth Error Correction (TEC) Procedure always set the vehicle parking brake and block the drive wheels. Release the throttle immediately when the engine starts to decelerate. Once the learn procedure is completed, engine control will be returned to the operator and the engine will respond to throttle position.

DTC P1336 will only set if the PCM has not learned the crankshaft position sensor Tooth Error Correction (TEC). The PCM only needs to learn this variation once per life

cycle of the vehicle unless the crank sensor to crankshaft relationship is disturbed. Removing a part for inspection and then reinstalling the same part is considered a disturbance. A fully warmed up engine is critical to learning the variation correctly. If a valid learn occurs, no other learns can be completed that ignition cycle. If the engine cuts out before the specified learn procedure engine speed or at normal fuel cut–off RPM. The PCM is not in the learn procedure mode. Review the Crankshaft Position Sensor Tooth Error Correction (TEC) Procedure and re–enable the learn procedure. Verify that the Tech 2 says ”Test in Progress.”

Excessive Crankshaft Variation Symptom

Tech 2 Display	Possible Causes
Factors out of range	Reluctor wheel–matching quality, run out, incorrect air gap
Opposing factors out of range	Disturbance–noise on crank sensor circuit, reattempt the Learn procedure
Sum out of range	Engine too cold, reattempt the Learn Procedure
Crank pulse count error	Crank or Cam sensor DTCs set–Repair first

Test Description

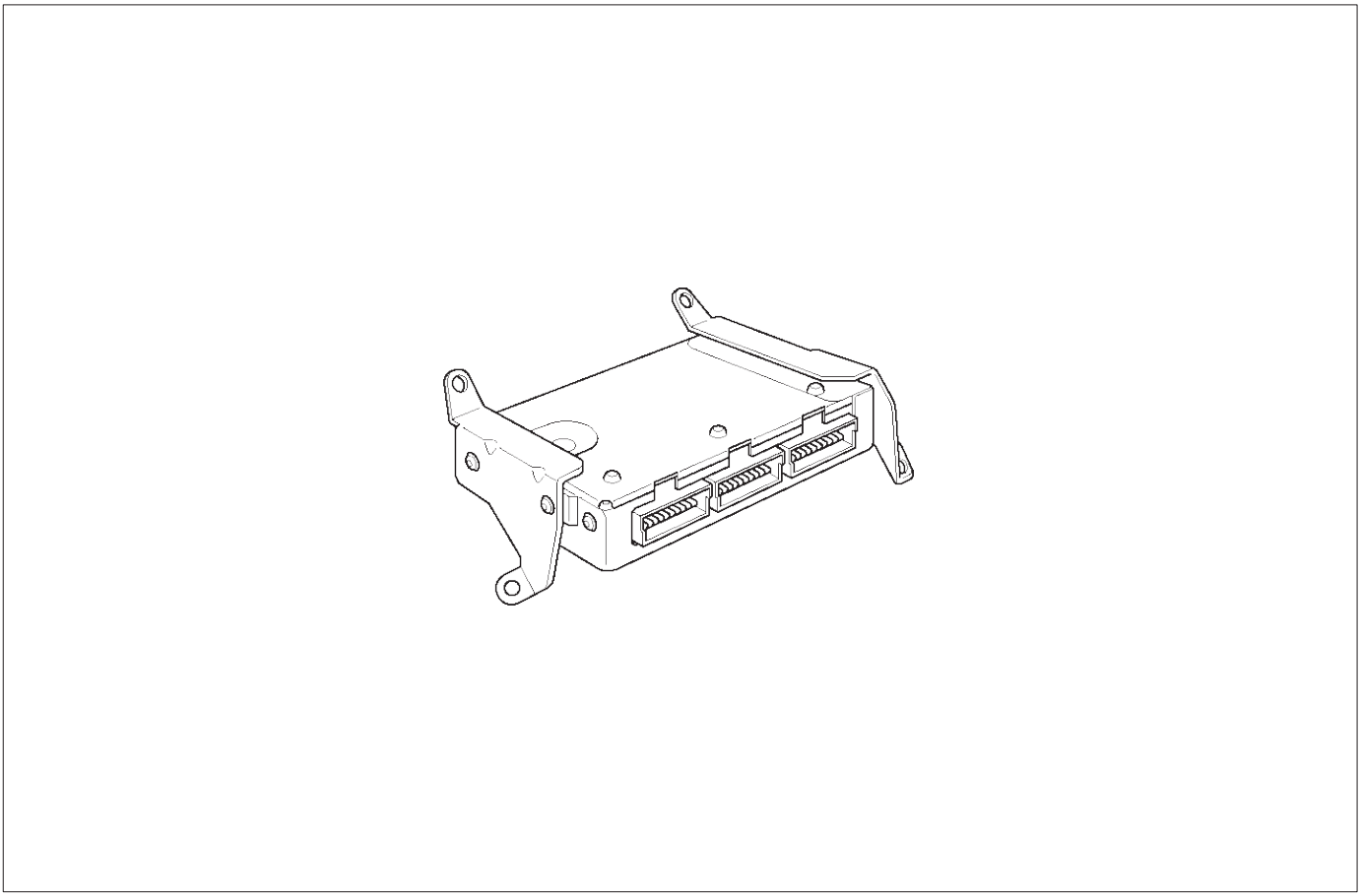
Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the Tech 2 if applicable. This created an electronic copy of the data taken when the fault occurred. The information is then stored on the Tech 2 for later reference.
2. Engine temperature if critical to properly learn the Crankshaft Position Sensor Tooth Error Correction (TEC). Failure to properly warm the engine before performing this procedure will result in an inaccurate measurement of the Crankshaft Position Sensor Tooth Error Correction (TEC). The PCM learns this variation as the engine is decelerating and then allows engine control to be returned to the operator. All accessories must be turned OFF when learning the Crankshaft Position System angle variation. If the A/C is not disabled when the learn procedure is enable, the PCM will disable the A/C. When the PCM is ready to allow the learn procedure to run, the Tech 2 will display ”Test in Progress.”
3. If after the specified number attempts the PCM cannot learn the crankshaft position Sensor Tooth Error Correction (TEC) then the variation is too large and no variation problem is corrected.
4. Being unable to learn the Crankshaft Position Sensor Tooth Error Correction (TEC) indicates that the variation is out of range. Using the Excessive Crankshaft Variation Trouble shooting will help to diagnose the area where the problem lies.

DTC P1336 CKP System Variation Not Learned

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	Perform the Crankshaft Position Sensor Tooth Error Correction(TEC) Learning Procedure as follows: When performing the Crankshaft Position Sensor Tooth Error Correction (TEC) Learning Procedure always set the vehicle parking brake and block the drive wheels. Release the throttle immediately when the engine starts to decelerate. Once the learn procedure is completed, engine control will be returned to the operator and the engine will respond to throttle position. 1. Install a Tech 2. 2. Put vehicle in Park or Neutral. 3. Run the engine until it is above the specified temperature. 4. Set the vehicle parking brake and block the drive wheels. 5. Turn all accessories OFF. 6. Enable the Crankshaft Position Sensor Tooth Error Correction (TEC) Learning Procedure with the Tech 2. 7. Raise the engine RPM to the specified value RELEASING the throttle as soon as the engine shuts out. Does the Tech 2 indicate that Crankshaft Position System variation has been learned?	70˚C (158˚F) 3920 RPM	Go to Step 5	Go to Step 3
3	Attempt Crankshaft Position System Variation Learning Procedures many times as the specified value. Does the Tech 2 indicate that Crankshaft Position System variation has been learned?	5	Go to Step 5	Go to Step 4
4	Repair Check for a problem with the a Crank Sensor to Crankshaft relationship and repair as necessary? Refer to the Excessive Crankshaft Variation Symptom Table.	—	Go to Step 5	—
5	1. Using the Tech 2, clear DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Tech 2 indicate that this diagnostic ”Ran and Passed?”	—	Go to Step 6	Go to Step 2
6	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	—	Go to applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC)
P1380 ABS ROUGH ROAD SYSTEM FAULT



014RX002

Circuit Description

The PCM identifies an engine misfire by detecting the variations in crankshaft speed. The crankshaft speed variations can also occur when a vehicle is operated over a rough surface. The ABS (Anti–Lock Brake System) can detect when the vehicle is on a rough surface based on the wheel acceleration/deceleration data supplied by each wheel speed sensor. The EBCM (Electronic Brake Control Module) over the Class 2 serial data line sends this information to the PCM. The PCM then uses this information in order to determine if the crankshaft variations are being caused by an actual engine misfire or from being driven on a rough surface.
This Diagnostic determines if the ABS system is not capable of detecting a rough road situation. DTC P1380 is a type D code.

Conditions for Setting the DTC

- 20 unusable ABS data values within a 50 value sample.

Conditions for Clearing the DTC

- A history DTC clears after 40 consecutive warm–up cycles without a fault.
- The Tech 2 can clear the DTC.

Diagnostic Aids

The setting of this DTC indicates that a misfire was detected and that the PCM could not determine if the detected misfire was true or due to operating the vehicle on a rough surface. A misfire can be a true misfire with or without setting this DTC. Check the EBCM for poor connections at the Class 2 serial data terminals. Be sure no true misfire exists after repairing the cause of this DTC.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

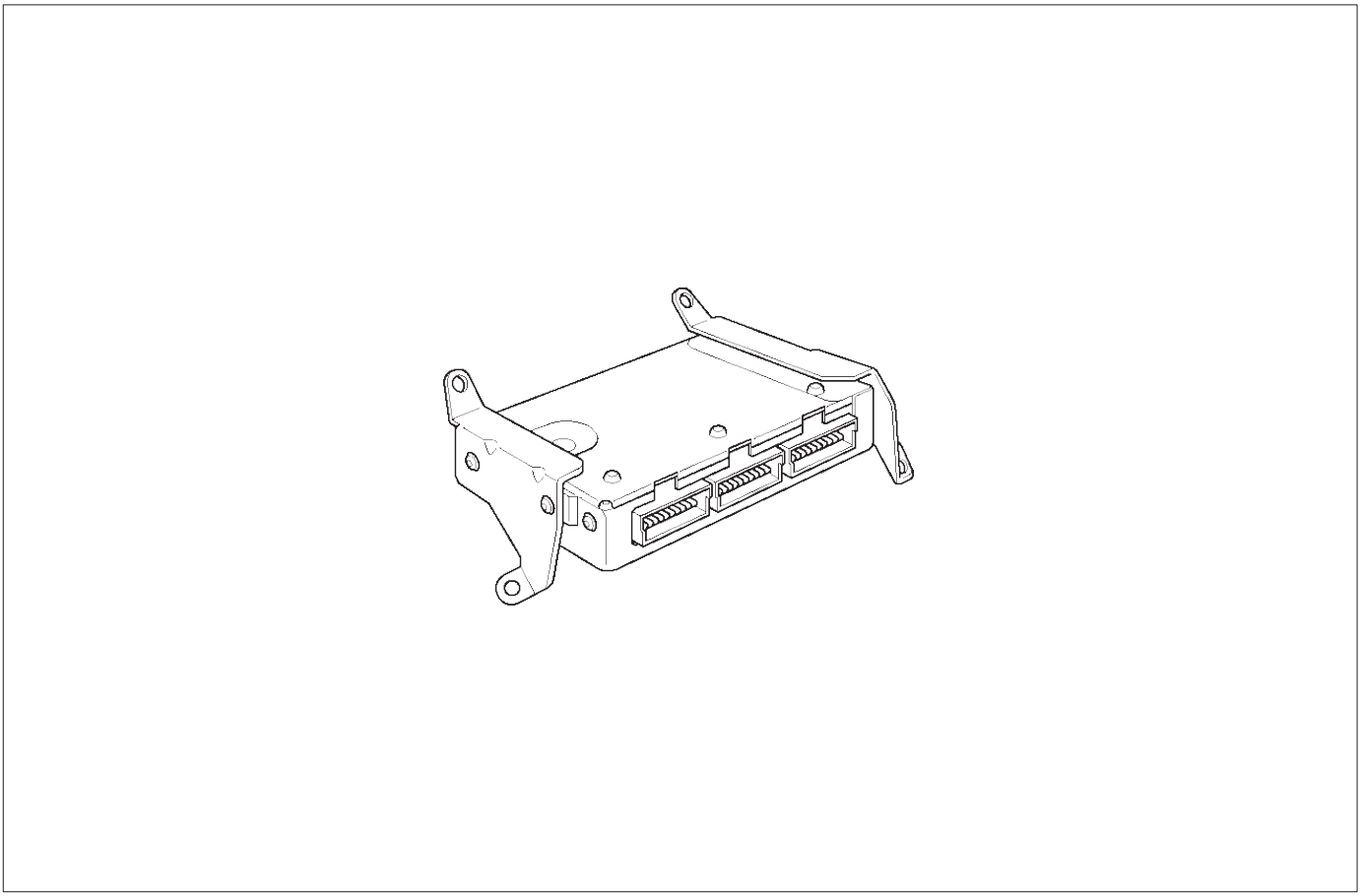
1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the Tech 2 is applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the Tech 2 for later reference.
2. ABS DTCs are found by selecting Chassis on the Tech 2.
3. Be careful to clear only DTCs and not the captured information stored on the Tech 2. The Tech 2 will issue a warning if this is about to happen.
4. A DTC P1380 being reset indicated that the PCM is not receiving the correct information from the EBCM due to an ABS DTC.
5. When DTC P1380 is set, and ABS DTC should also be set.
6. Refer to Section 5A of the service manual for ABS DTCs and repairs.

8. Repair any condition that remains and is causing a misfire by following the table for any DTC that has set.
9. Replacement PCMs must be reprogrammed. Refer to the latest Isuzu Technical Communication System information for programming procedures.

DTC P1380 ABS Rough Road System Fault

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install the Tech 2. 3. Check for any ABS DTCs. Were any ABS DTCs set?	—	Go to Step 6	Go to Step 3
3	1. Turn the ignition switch ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. Did a misfire DTC set?	—	Go to Step 4	Go to Step 10
4	Was a DTC P1380 also set?	—	Go to Step 5	Go to Step 8
5	Did a ABS DTC also set?	—	Go to Step 6	Go to Step 9
6	Repair the condition causing the ABS DTC. Is the action complete?	—	Go to Step 7	—
7	Check if any additional DTCs are set. Are any DTCs displayed that has not been diagnosed?	—	Go to applicable DTC table	System OK
8	Repair the condition causing the misfire. Is the action complete?	—	Go to Step 10	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed.Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to Step 10	—
10	1. Using the Tech 2, 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 Tech 2 indicate that this diagnostic has ”Ran and Passed?”	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC)
P1381 ABS ROUGH ROAD CLASS 2 SERIAL DATA FAULT



014RX002

Circuit Description

The PCM identifies an engine misfire by detecting the variations in crankshaft speed. The crankshaft speed variations can also occur when a vehicle is operated over a rough surface. The ABS (Anti–Lock Brake System) can detect when the vehicle is on a rough surface based on the wheel acceleration/deceleration data supplied by each wheel speed sensor. The EBCM (Electronic Brake Control Module) over the Class 2 serial data line sends this information to the PCM. The PCM then uses this information in order to determine if the crankshaft variations are being caused by an actual engine misfire or from being driven on a rough surface. DTC P1381 is a type D code.

Conditions for Setting the DTC

- No serial data for 15 second after previous data received.

Action Taken When the DTC Sets

- The PCM records the operating conditions at the time the diagnostic fails. The Failure Records buffers stores this information.
- A history DTC is stored.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions for Clearing the DTC

- A history DTC clears after 40 consecutive warm up cycles without a fault.
- The Tech 2 can clear the DTC.

Diagnostic Aids

The setting of this DTC indicates that a misfire was detected and that the PCM could not determine if the detected misfire was true or due to operating the vehicle on a rough surface. A misfire can be a true misfire with or without setting this DTC. Check the EBCM for poor connections at the Class 2 serial data terminals. Be sure no true misfire exists after repairing the cause of this DTC.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

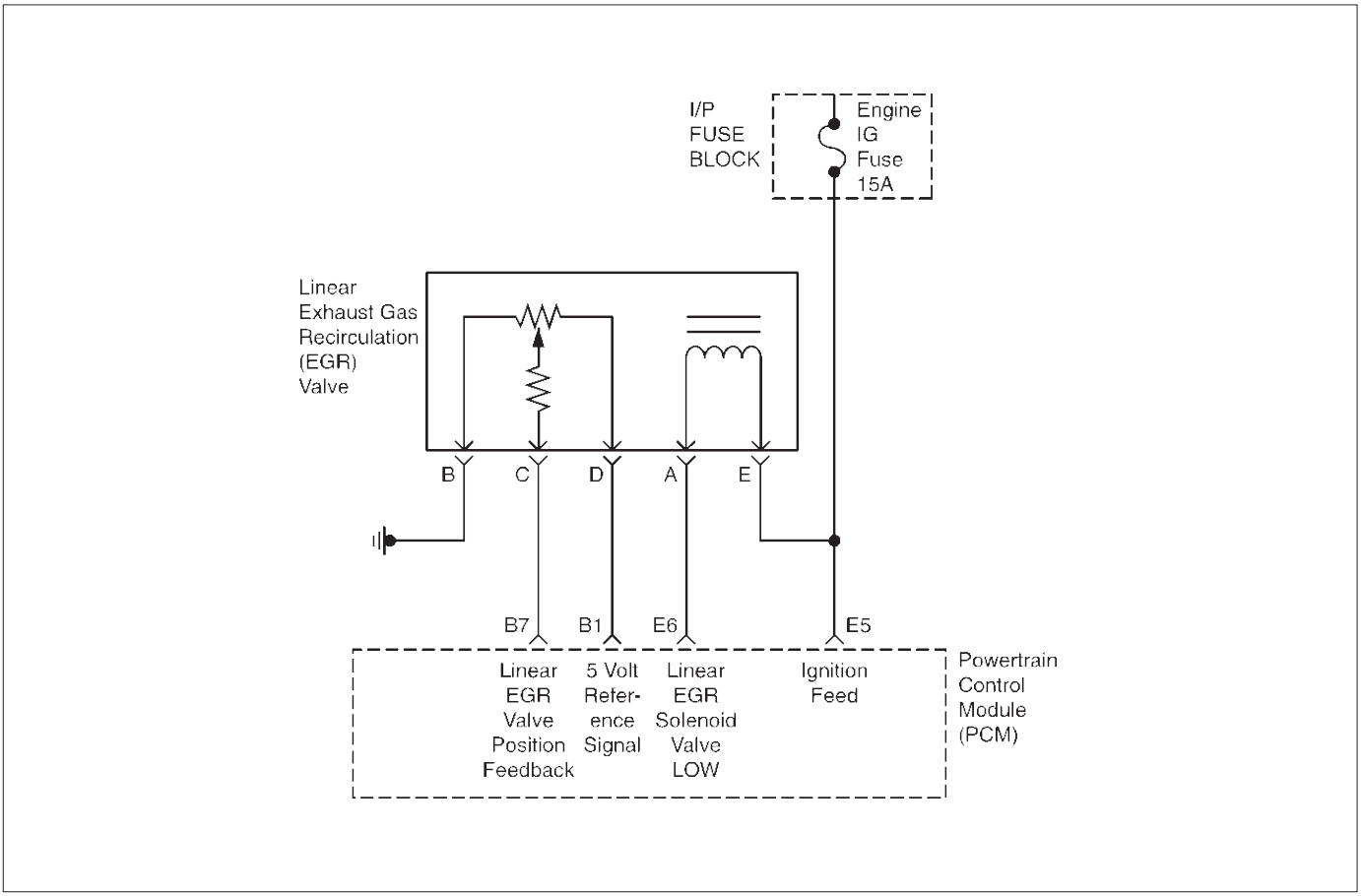
1. The Powertrain OBD System Check indicates that a misfire was detected and that the PCM could not determine if the detected misfire was true or due to operating the vehicle on a rough surface. A misfire can be a true misfire with or without setting this DTC. Check the EBCM for poop connections at the Class 2 serial data terminals. Be sure no true misfire exists after repairing the cause of this DTC.

3. Refer to the ABS portion of the service manual for ABS DTCs and repairs. Performing the ABS Diagnostic System Check is the first step in diagnosing a serial data problem.
4. Be careful to clear only DTCs and not the captured information stored on the Tech 2. The Tech 2 will issue a warning if this is about to happen.
5. A DTC P1381 being reset indicates that the PCM is not receiving serial data from the EBCM due to a EBCM problem.
6. When DTC P1381 is set, ABS serial data should not be able to be displayed.
7. Repair any condition that is causing a misfire by following the table for any DTC that has set.
10. Replacement PCMs must be reprogrammed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures.

DTC P1381 ABS Rough Road Class 2 Serial Data Fault

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install the Tech 2. 3. Attempt to display the ABS data on the Tech 2. Can the ABS be displayed?	—	Go to Step 4	Go to Step 3
3	Repair the condition causing the ABS data not to be displayed. Is the action complete?	—	Go to Step 4	Go to Step 10
4	1. Clear the DTCs. 2. Operate the vehicle within the same conditions as indicated within the Freeze Frame data and Conditions for Setting the DTC as noted while driving on rough surfaces. Did a misfire DTC set?	—	Go to Step 5	Go to Step 8
5	Was a DTC P1380 also set?	—	Go to Step 6	Go to Step 7
6	Can the ABS data be displayed?	—	Go to Step 10	Go to Step 4
7	Repair the condition causing the misfire. Is the action complete?	—	Go to Step 8	—
8	1. Using the Tech 2, 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 Tech 2 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
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC)
P1404 EXHAUST GAS RECIRCULATION (EGR) CLOSED VALVE



060R100039

Circuit Description

The powertrain control module (PCM) monitors the exhaust gas recirculation(EGR) valve pintle position input to ensure that the valve responds properly to commands from the PCM to detect a fault if the pintle position sensor and control circuits are open or shorted. If the PCM detects a pintle position signal voltage below the normal range of the pintle position sensor, or a signal voltage that is not within a tolerance considered acceptable for proper EGR control system operation, the PCM will set a DTC P1404.

Conditions for Setting the DTC

- IAT is above 5°C (41°)
- EGR actual position is 16 counts below the EGR low threshold for 3 iterations per 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the Malfunction Indicator Lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1404 will clear after 40 consecutive warm up cylcles without a fault.
- DTC P1404 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Excessive deposits on EGR valve pintle or seat – Check for deposits that may interfere with the EGR valve pintle extending completely or cause the pintle to stick.
- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to the EGR valve. A change in the display 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.

NOTE: If the EGR valve show signs of excessive heat, check the exhaust system for blockage (possible a plugged catalytic converter) using the "Restricted Exhaust System Check".

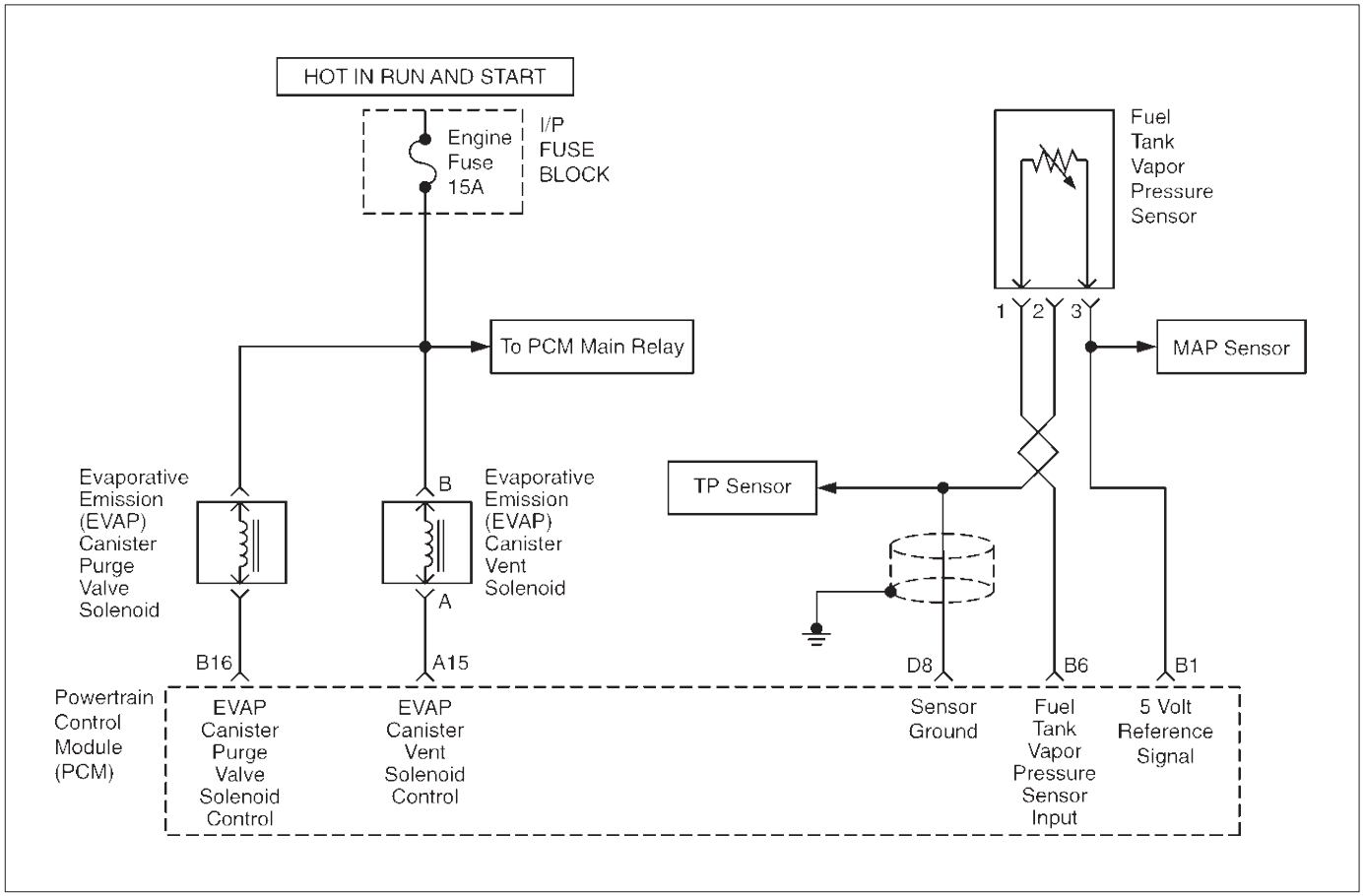
DTC P1404 EGR Closed Valve

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Turn the ignition switch ON, with the engine OFF. 2. Review and record the Tech 2 Failure Records data, the clear the DTCs. 3. Operate the vehicle within the Failure Records conditions noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P1404. Does the Tech 2 indicate DTC P1404 ”Ran and Passed”	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Disconnect the Linear Exhaust Gas Recirculation (EGR) Valve from the wiring harness. 3. Ignition ON, Engine OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the Ignition feed circuit at the Linear Exhaust Gas Recirculation (EGR) Valve wiring harness connector. Does the DVM read the following value?	12 volts	Go to Step 6	Go to Step 4
4	Check the Ignition feed circuit, between the EGR sensor and the ”Engine IG.” fuse, for the following conditions: ● An Open circuit ● A short to ground Was the problem found?	—	Verify repair	—
5	Using a DVM, check the resistance of the EGR solenoid. Does the DVM read the following value?	less than 5 Ω	Go to Step 6	Go to Step 14
6	Check the EGR solenoid valve Low circuit, between the EGR sensor and the PCM, for the following conditions: ● An Open circuit ● A short to ground Was the problem found?	—	Verify repair	Go to Step 15
7	1. Ignition OFF. 2. Disconnect the Linear Exhaust Gas Recirculation (EGR) Valve from the wiring harness. 3. Ignition ON, Engine OFF. 4. Observe the EGR value on the Tech 2. Does the Tech 2 display the following value(s)?	0 volts 0%	Go to Step 9	Go to Step 8
8	Check the EGR position feedback circuit, between the EGR sensor and the PCM, for the following conditions: ● An Open circuit ● A short to ground Was the problem found?	—	Verify repair	Go to Step 15

DTC P1404 EGR Closed Valve (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Ignition ON, engine OFF. 2. Using a Digital Voltmeter (DVM), check for voltage on the 5 volt Reference signal circuit at the Linear Exhaust Gas Recirculation (EGR) Valve wiring harness connector. Does the DVM read the following value?	about 5 volts	Go to Step 11	Go to Step 10
10	Check the 5 volt reference signal circuit, between the EGR and the PCM, for the following conditions: • An Open circuit • A short to ground Was the problem found?	—	Verify repair	Go to Step 11
11	1. Ignition OFF. 2. Place a DVM between the 5 volt reference signal circuit and the 5 volt signal return (ground) circuit at the EGR wiring harness connector. 3. Ignition ON, Engine OFF. Does the DVM read the following value?	about 5 volts	Go to Step 13	Go to Step 12
12	Check the 5 volt signal return (ground) circuit, between the EGR and the PCM, for the following conditions: • An Open circuit • A short to ground Was the problem found?	—	Verify repair	Go to Step 15
13	1. Ignition OFF. 2. Place a fused jumper wire between the 5 volt reference signal circuit and the EGR valve position feedback circuit at the EGR wiring harness connector. 3. Ignition ON, Engine OFF. 4. Observe the EGR value on the Tech 2. Does the Tech 2 display the following value?	5 volts 100%	Go to Step 14	Go to Step 15
14	Replace the Linear Exhaust Gas Recirculation (EGR) Value. Verify repair.	—	—	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P1441 EVAPORATIVE EMISSION (EVAP) SYSTEM FLOW DURING NON–PURGE



060R100040

Circuit Description

Canister purge is controlled by a solenoid valve that allows manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge ON). The EVAP purge solenoid control is pulse–width modulated (PWM) and is turned ON and OFF several times a second. The duty cycle (pulse width) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the output is commanded when the appropriate conditions have been met.

The EVAP purge vacuum switch is a normally closed switch positioned in the purge line between the canister and the EVAP purge solenoid. The EVAP purge vacuum switch will open when vacuum increases to greater than 5 inches of water pressure in the purge line. The PCM monitors the EVAP purge vacuum switch signal to determine if the evaporative emission control system is working properly. If the switch is open (purge flow detected) when the PCM is not commanding the EVAP purge solenoid ON, DTC P1441 will be set. DTC P1441 is a type A code.

Conditions for Setting the DTC

- No active system voltage, ECT sensor, IAT sensor, VS sensor, MAP sensor, vacuum switch, or TP sensor, EGR, EVAP DTCs set.
- BARO reading is above 72.3 kPa.
- Start–up intake air temperature (IAT) and start–up engine coolant temperature(ECT) are both between 4.2˚C (40˚F) and 35˚C (95˚F).
- The difference between start–up ECT and start–up IAT is less than 6.75˚C(12.2˚F).
- The Fuel Tank Level Sensor reads between 15% and 85%.
- Fuel thank vacuum is greater than 5 cm (2 inches) of water for 2 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1441 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P1441 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- The Fuel Pressure Sensor shares a 5 Volt reference with the MAP sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The Fuel Pressure Sensor share a ground with the TP sensor, the CKP sensor, the CAM sensor, ECT sensor, and the automatic transmission temperature sensor.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the EVAP vacuum switch display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display 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

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. The canister purge vacuum switch is normally closed when no vacuum (purge) is present. With the ignition ON and the engine OFF, there shouldn't be any vacuum (purge) present in the EVAP system.
3. Determines if the PCM is able to control the EVAP purge solenoid valve.
4. Determines if the DTC will set under the conditions present when the DTC was originally stored. If not, the fault is intermittent.
5. Checks for a grounded EVAP purge solenoid driver circuit, a faulty EVAP vacuum switch, or a leaking EVAP purge solenoid valve.

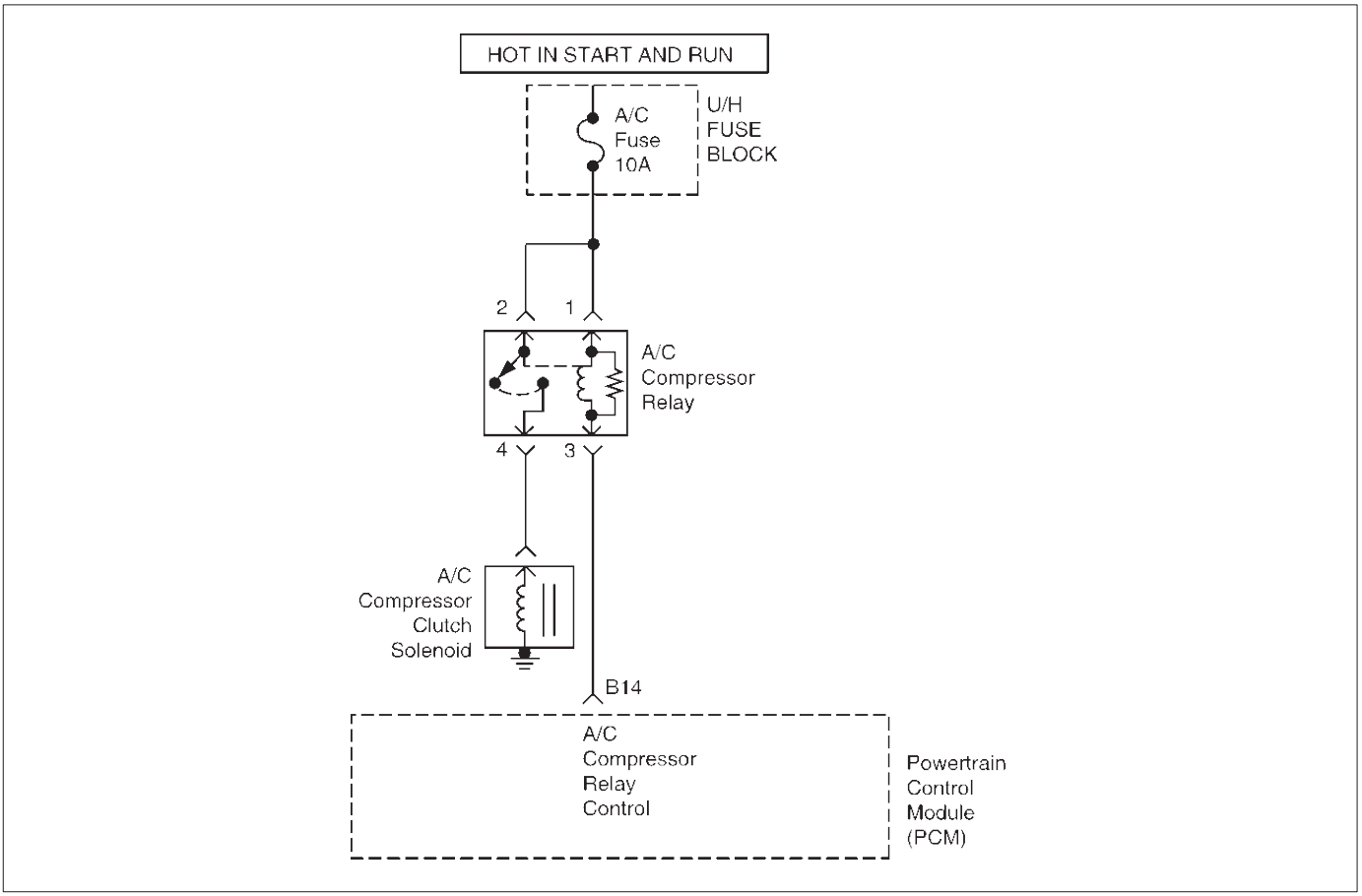
DTC P1441 – EVAP System Flow During Non-Purge

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "OFF." 2. Remove the fuel filler cap. 3. Ignition "ON." Observe "Fuel Tank Pressure" on the Tech 2. Is "Fuel Tank Pressure" at the specified value?	1.51 V	Go to *Step 3*	Go to *P0452 or P0453*
3	1. Re–install the fuel filler cap. 2. Using the Tech 2, command the EVAP Vent Solenoid Valve "ON" (Closed). 3. Disconnect the canister side rubber hose end that hose is connected between the Purge Solenoid Valve and Canister. **IMPORTANT:** Before continuing with the diagnosis, zero the EVAP pressure and vacuum gauges on EVAP pressure / purge cart J41413 (refer to the tool operating instructions). And then monitor the fuel tank inner pressure using the Tech 2. Does the fuel tank pressure hold the specified value?	1.52 - 1.60 V	Go to *Step 4*	Go to *Step 6*

DTC P1441 – EVAP System Flow During Non-Purge (Cont'd)

Step	Action	Value(s)	Yes	No
4	1. Disconnect the EVAP pressure / purge cart J41413, and then plug the hose end. 2. Disconnect the rubber hose end of engine vacuum source side, (the hose connected between Purge Solenoid Valve and engine). 3. Connect a vacuum hand pump to this rubber hose end. 4. Then apply -15 in H2O vacuum by the vacuum pump. 5. Monitor the fuel tank inner pressure using the Tech 2. Does the fuel tank inner pressure hold the specified value?	1.47 - 1.51 V	Go to *Step 6*	Go to *Step 5*
5	Replace the Purge Solenoid Valve.	—	Verify repair	—
6	1. Check for leaks, kinks or pinched hoses at the EVAP system rubber hose line, and also check if the rubber hoses are correctly connected or not. 2. Check for a leak from Vent Solenoid Valve and EVAP system rubber hoses, and also check for clogged Filter of air separator which is located near the vent solenoid valve. Was a problem found? Using the Vacuum Hose Routing Diagram, repair or re-connect the rubber hoses correctly.	—	Verify repair	Go to *Step 7*
7	1. Start engine. 2. Remove the Fuel Filler Cap. 3. Using the Tech 2, command the EVAP Vent Solenoid Valve "ON" (closed) and Purge Solenoid Valve "OFF" (0%). 4. Replace the Fuel Filler Cap. 5. Run the engine at 2500RPM constant while monitoring "Fuel Tank Vacuum" on the Tech 2. Does the fuel tank vacuum remain at the specified value while the EVAP Vent Solenoid Valve "ON" (closed) and Purge Solenoid Valve "OFF" (0%)?	30 - 40%	Verify repair	Go to *Diagnostic Aids*

DIAGNOSTIC TROUBLE CODE (DTC) P1546 A/C COMPRESSOR CLUTCH OUTPUT CIRCUIT MALFUNCTION



060R100022

Circuit Description

The Powertrain Control Module (PCM) controls the A/C Compressor Clutch Solenoid through the use of a relay and a control (ground) circuit. If the PCM commands the A/C Compressor Clutch Solenoid ON but the voltage remains High (12 volts) or, if the PCM commands the A/C Compressor Clutch Solenoid OFF but the voltage remains Low (0 volts), then DTC P1546 will set. DTC P1546 is a type D code.

Conditions for Setting the DTC

- Ignition voltage is greater than 10 volts.
- Engine run time is greater than 32 seconds.

The above mentioned conditions are met and one of the following two conditions are met for 20 test failure within a 40 test samples.

- PCM senses voltage is High with the A/C Compressor Clutch Solenoid commanded ON.

OR

- PCM senses voltage is Low with the A/C Compressor Clutch Solenoid commanded OFF.

Action Taken When the DTC Sets

- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the DTC

- A history DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using the Scan Tool's "Clear Info" function.

Diagnostic Aids

- Poor connections, or a damaged harness – Inspect the harness connectors for: backed–out terminals, improper mating or damaged terminals. Also check for open circuits, shorts to ground, and shorts to voltage.

DTC P1546 A/C Compressor Clutch Output Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTCs. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P1546. Does the Tech 2 indicate DTC P1546 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Remove the A/C Compressor Clutch Relay from the Underhood Electrical Center. 3. Ignition ON, Engine OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the Fused pins of the A/C Compressor Clutch Relay connector. Does the DVM read the following value?	12 Volts	Go to Step 5	Go to Step 4
4	Check the suspect circuit(s) between the A/C Compressor Clutch Relay connector and the Fuse for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	—
5	1. Ignition OFF. 2. Disconnect the Powertrain Control Module (PCM) connectors from the PCM. 3. Check the A/C Compressor Clutch Relay control circuit between the PCM and Underhood Electrical Center for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 6
6	1. Reinstall the A/C Compressor Clutch Relay. 2. Using a fused jumper, ground the A/C Compressor Clutch Relay control circuit at the PCM connector. 3. Ignition ON, Engine OFF. Does the A/C Compressor turn ON?	—	Go to Step 9	Go to Step 7
7	1. Ignition OFF. 2. Check the A/C Compressor Clutch circuit between the A/C Compressor Clutch Relay and A/C Compressor Clutch for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 8

DTC P1546 A/C Compressor Clutch Output Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the A/C Compressor Clutch Relay. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

Diagnostic Trouble Code (DTC) P1618 Serial Peripheral Interface (SPI) PCM Interprocessor Communication Error

Circuit Description

The serial peripheral interface (SPI) communication is used internally by the PCM to send messages between the engine processor and the automatic transmission processor. Included in each message sent between the two-processors is a check sum of the message. Both the engine processor and automatic transmission processor will compare this check sum value with the calculated value. If the check sums don't match, the processor will view the new data as being corrupted and ignore the values. The processor will then use the previous message. The receiving processor will then send a message to the sending processor informing it that it's last message was corrupted.

Conditions for Setting the DTC

- Ignition on.
- Icluded check sum do not equal to a calculated check sum based on messages in either the engine processor or the automatic transmission processor.

The above conditions are met for 5 test failures within 20 test samples.

Action Taken When the DTC Sets

- The PCM will flash the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

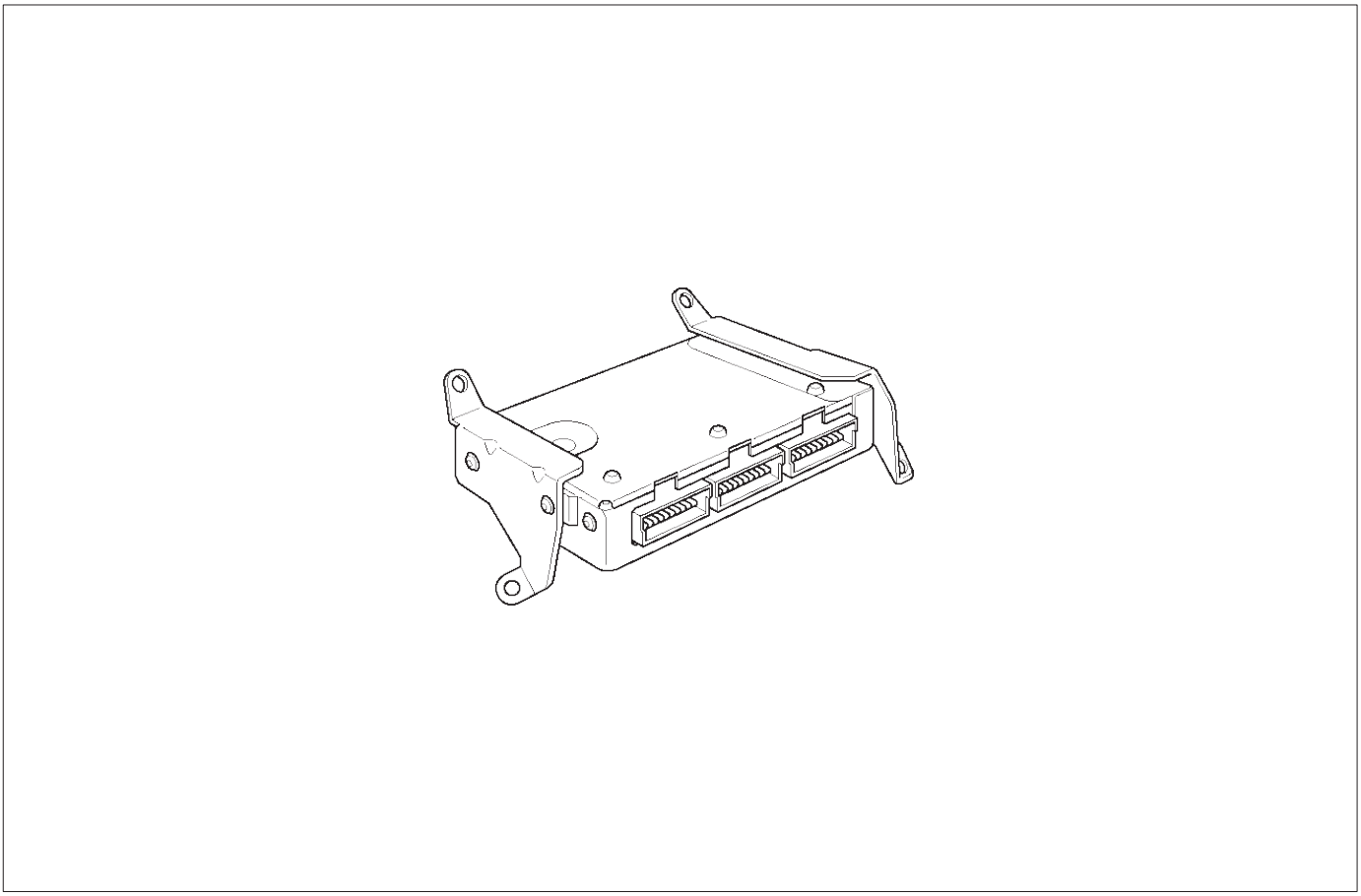
Conditions for Clearing the MIL/DTC

- The PCM will turn the "Check Trans" lamp "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault is no longer present.
- A history DTC P1618 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1618 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

DTC P1618 – Serial Peripheral Interface (SPI) PCM Interprocessor Communication Error

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to *OBD System Check*
2	Is the EEPROM calibration the latest version available?	—	Go to *Step 4*	Go to *Step 3*
3	Reprogram the PCM with the latest available calibrations. Does DTC 1618 re-appear when the *OBD System Check* is repeated?	—	Go to *Step 4*	Repair completed
4	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1625 PCM Unexpected Reset



014RX002

Circuit Description

The powertrain control module (PCM) monitors unexpected PCM reset. This will not turn on MIL light on, only records code DTC P1625.

Conditions for Setting the DTC

- Clock or COP (Computer Operating Properly) reset.
- Illegal operational code software interupt.
- Null interupt.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1625 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1625 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

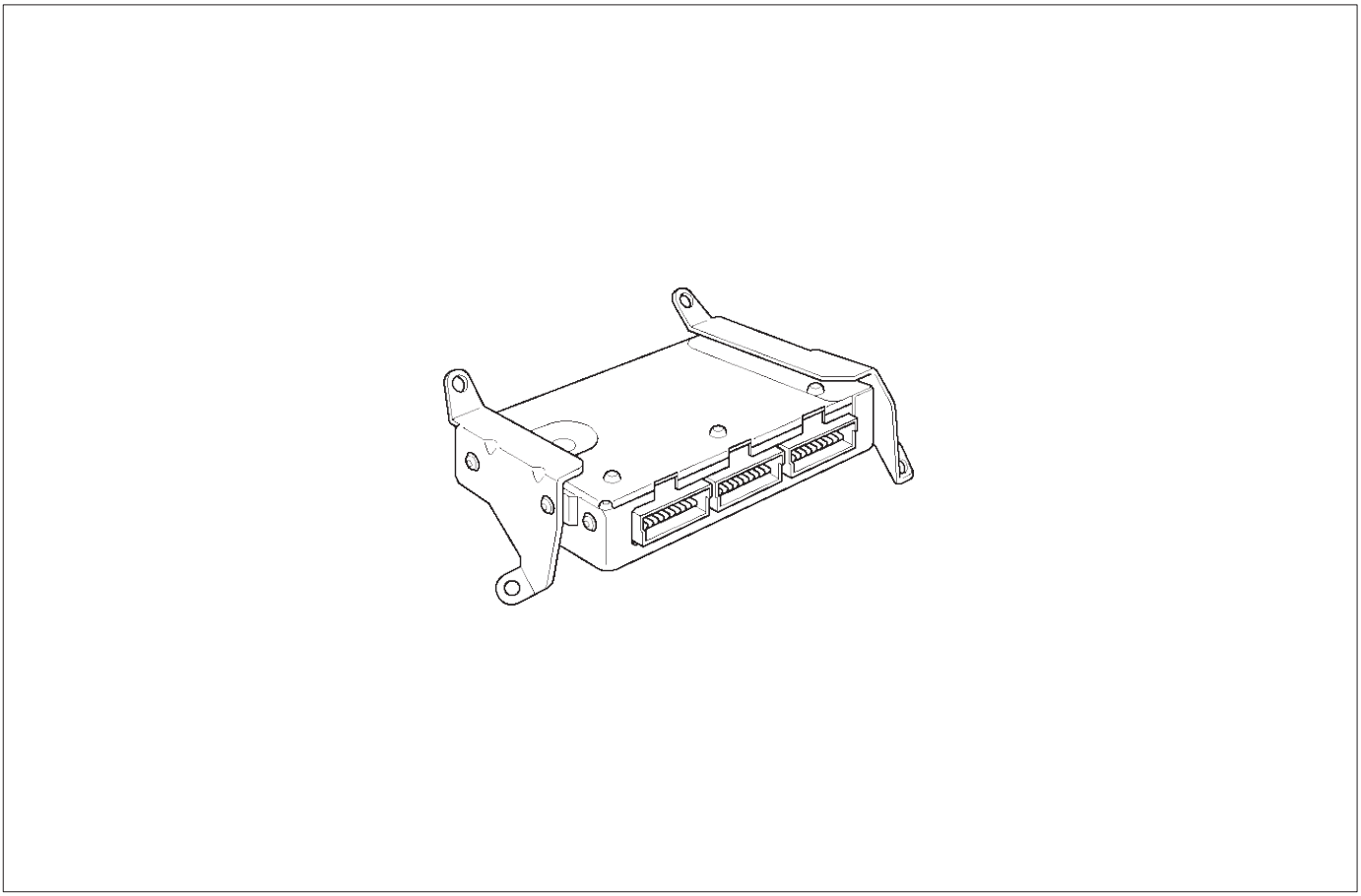
- P1625 alone stored does not need diagnosis. Clear DTC code.

NOTE: DTC P1625 is a DTC to record a PCM reset history. If DTC P1625 is not reset and no engine abnormality is found after clearance of DTC, it is not necessary to do any farther processing.

DTC P1625–PCM Unexpected Reset

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition is “On”. 2. Install the Tech 2. 3. Start the engine at let it Idle. 4. On the Tech 2, select “DTC info”. Does the Tech 2 indicate DTC P1625 failed?	—	Go to Step 3	Go to *Diagnostic Aids*
3	1. Ignition is “On”. 2. Clear DTC P1625 by using the Tech 2 “Clear Info”. 3. Start the engine at let it Idle. 4. On the Tech 2, select “DTC info”. Does the Tech 2 indicate DTC P1625 failed?	—	Go to Step 4	Go to *Diagnostic Aids*
4	1. Check for aftermarket electronics, such as transceiver stereos, and anti theft devices, they may radiate EMI into the control system if they are improperly installed. (This may cause a false sensor reading and turn on the MIL.) 2. If a problem is found, repair as necessary. Was the problem found?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC)
P1627 PCM A/D CONVERSION MALFUNCTION



014RX002

Circuit Description

The Powertrain Control Module (PCM) monitors the 5 volt reference signal when the Ignition is ON. If the PCM senses an Analog to Digital (A/D) conversion error within the PCM, then DTC P1627 will set. DTC P1627 is a type A code.

Conditions for Setting the DTC

- Engine is running.
- Any A/D DTC's set.

Action Taken When the DTC Sets

- The PCM will illuminate the Malfunction Indicator Lamp (MIL) the first time the fault is detected.
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL on the third consecutive trip without a reported failure.
- A History DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using the Scan Tool's "Clear Info" function.

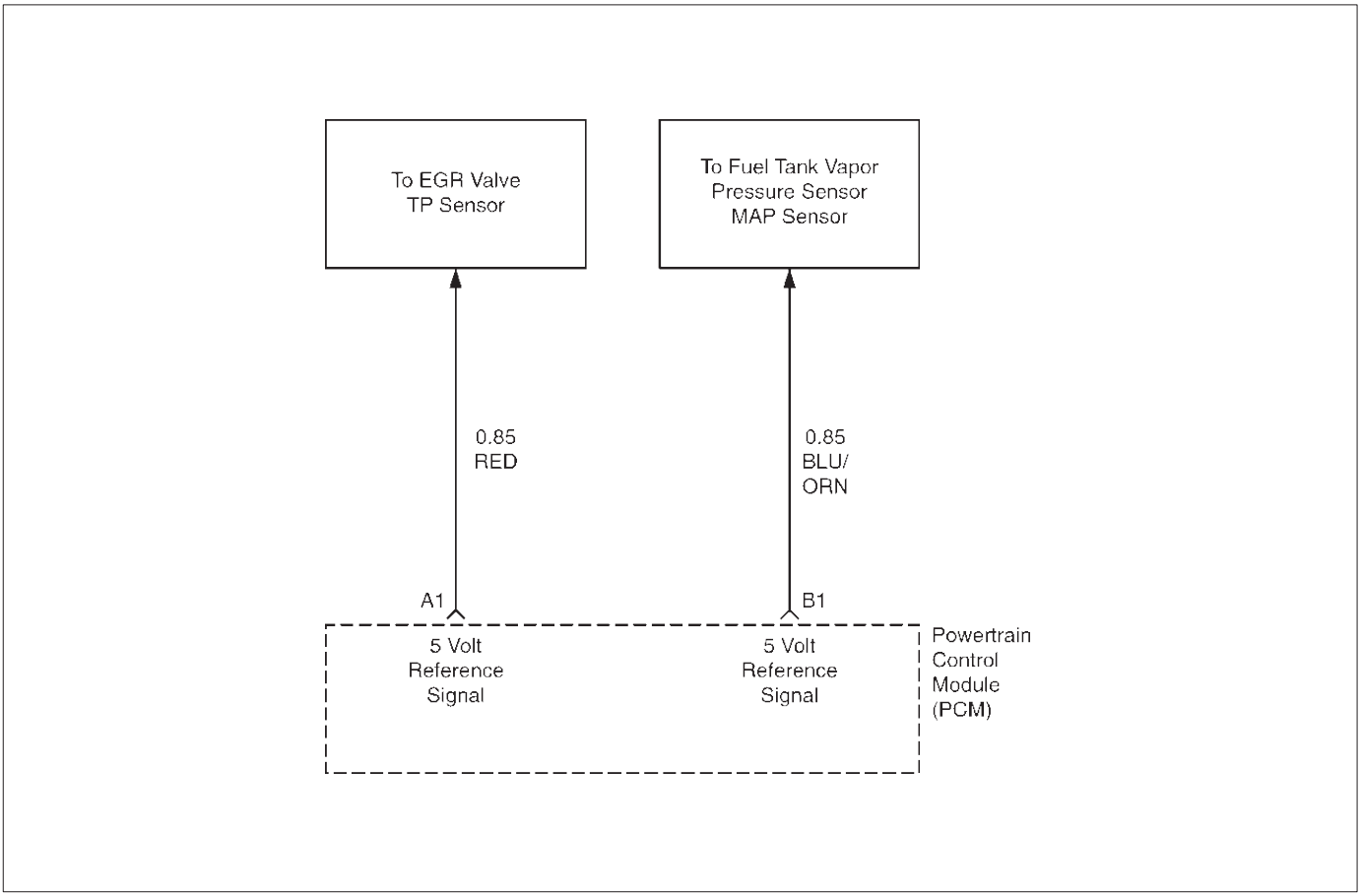
Diagnostic Aids

- Poor connections, or a damaged harness – Inspect the harness connectors for: backed–out terminals, improper mating or damaged terminals. Also, check for open circuits, shorts to ground, and shorts to voltage.

DTC P1627 PCM A/D Conversion Malfunction

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTCs. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P1627. Does the Tech 2 indicate DTC P1627 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	Check the suspect 5 volt reference circuit(s) for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 4
4	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P1635 5 VOLT REFERENCE VOLTAGE CIRCUIT MALFUNCTION



060R100046

Circuit Description

The Powertrain Control Module (PCM) monitors the 5 volt reference signal when the Ignition is ON. If the PCM senses the 5 volt reference signal circuit is above 5.12 volts or below 4.88 volts, then DTC P1635 will set. DTC P1635 is a type A code.

Conditions for Setting the DTC

- Ignition voltage is greater than 6.3 volts.

The above mentioned conditions are met and one of the following two conditions are met for 40 test failures within 80 test samples while 125 msec.

- PCM senses the 5 volt reference signal circuit is above 5.12 volts.

OR

- PCM senses the 5 volt reference signal circuit is below 4.88 volts.

Action Taken When the DTC Sets

- The PCM will illuminate the Malfunction Indicator Lamp (MIL) the first time the fault is detected.
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL on the third consecutive trip without a reported failure.
- A History DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Poor connections, or a damaged harness – Inspect the harness connectors for: backed–out terminals, improper mating or damaged terminals. Also, check for open circuits, shorts to ground, and shorts to voltage.

DTC P1635 5 Volt Reference Voltage Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTCs. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P1635. Does the Tech 2 indicate DTC P1635 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	Check the suspect 5 volt reference circuit(s) for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 4
4	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

SYMPTOM DIAGNOSIS

PRELIMINARY CHECKS

Before using this section, perform the ”On–Board Diagnostic (OBD) System Check” and verify all of the following items:

- The powertrain control module (PCM) and malfunction indicator lamp (MIL)(Check Engine lamp) are operating correctly.
- There are no DTC(s) stored.
- Tech 2 data is within normal operating range. Refer to Typical Scan Data Values.
- Verify the customer complaint and locate the correct symptom in the table of contents. Perform the procedure included in the symptom chart.

VISUAL/PHYSICAL CHECK

Several of the symptom procedures call for a careful visual/physical check. This can lead to correcting a problem without further checks and can save valuable time. This check should include the following items:

- PCM grounds for cleanliness, tightness and proper location.
- Vacuum hoses for splits, kinks, and proper connections, as shown on the ”Vehicle Emission Control Information” label. Check thoroughly for any type of leak or restriction.
- Air intake ducts for collapsed or damaged areas.
- Air leaks at throttle body mounting area, manifold absolute pressure (MAP) sensor and intake manifold sealing surfaces.
- Ignition component for cracking, hardness, and carbon tracking.
- Wiring for proper connections, pinches and cuts.

INTERMITTENTS

An intermittent problem may or may not turn on the malfunction indicator lamp (MIL) or store a Diagnostic Trouble Code. DO NOT use the Diagnostic Trouble Code (DTC) charts for intermittent problems. The fault must be present to locate the problem.

Most intermittent problems are caused by faulty electrical connections or wiring. Perform a careful visual/physical check for the following conditions:

- Poor mating of the connector halves or a terminal not fully seated in the connector (backed out).
- Improperly formed or damaged terminal.
- All connector terminals in the problem circuit should be carefully checked for proper contact tension.
- Poor terminal–to–wire connection. This requires removing the terminal from the connector body to check.

Road test the vehicle with a J 39200 Digital Multimeter connected to a suspected circuit. An abnormal voltage when the malfunction occurs is a good indication that there is a fault in the circuit being monitored.

Use a Tech 2 to help detect intermittent conditions.

The Scan Tools have several features that can be used to locate an intermittent condition. Use the following feature to find intermittent faults:

- Using a Scan Tool’s ”Freeze Frame” buffer or ”Failure Records” buffer can aid in locating an intermittent condition. Review and record the information in the freeze frame or failure record associated with the intermittent DTC being diagnosed. The vehicle can be driven within the conditions that were present when the DTC originally set.

To check for loss of diagnostic code memory, disconnect the MAP sensor and idle the engine until the MIL (Check Engine lamp) comes on. Diagnostic Trouble Code P0107 should be stored and kept in memory when the ignition is turned OFF. If not, the PCM is faulty. When this test is completed, make sure that you clear the Diagnostic Trouble Code P0107 from memory.

An intermittent MIL (Check Engine lamp) with no stored Diagnostic Trouble Code may be caused by the following:

- Ignition coil shorted to ground and arcing at ignition wires or plugs.
- MIL (Check Engine lamp) wire to PCM shorted to ground.
- Poor PCM grounds. Refer to the PCM wiring diagrams.

Check for improper installation of electrical options such as lights, cellular phones, etc. Check all wires from the PCM to the ignition coils for poor connections.

Check for an open diode across the A/C compressor clutch and check for other open diodes (refer to wiring diagrams in Electrical Diagnosis).

If problem has not been found, refer to PCM Connector Symptom tables.

- Check the ”Broadcast Code” of the PCM, and compare it with the latest Isuzu service bulletins and/or Isuzu EEPROM reprogramming equipment to determine if an update to the PCM’s reprogrammable memory has been released. To check the ”Broadcast Code,” connect the Tech 2, then look for ”ID info,” then select ”Broadcast Code.” This should display a 4 character code, such as ”XBYA” (example only). This identifies the contents of the reprogrammable software and calibration contained in the PCM. If the Broadcast code is not the most current available, it is advisable to reprogram the PCM’s EEPROM memory, which may either help identify a hard–to–find problem or may fix the problem.

HARD START SYMPTOM

DEFINITION:
Engine cranks, but does not start for a long time. Does eventually run, or may start but immediately stalls.

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	Check engine coolant temperature (ECT) sensor for shift in value. 1. After 8 hours with the hood up and the engine not running, connect the Tech 2. 2. Ignition ON, engine not running. 3. Using the Tech 2, compare Engine Coolant Temperature to Intake Air Temperature. Are ECT and IAT within the specified value of each other?	± 5°C (± 9°F)	Go to Step 8	Go to Step 5
5	1. Using a Tech 2, display the engine coolant temperature and note the value. 2. Check the resistance of the engine coolant temperature sensor. 3. For resistance specifications, refer to Temperature vs. Resistance chart in DTC P0118. Is the actual resistance near the resistance value in the chart for the temperature that was noted?	—	Go to Step 7	Go to Step 6
6	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
7	Locate and repair high resistance or connection in the ECT signal circuit or the ECT signal circuit or the PCM sensor ground.	—	Verify repair	—
8	Check for a faulty, plugged, or incorrectly installed PCV valve. Was a problem found?	—	Verify repair	Go to Step 9
9	Visually/Physically inspect the secondary ignition wires. Check for the following conditions: ● Verify that all ignition wire resistance are less than the specified value. ● Verify that ignition wires are correctly routed to eliminate cross–firing. ● Verify that ignition wires are not arcing to ground. Spraying the secondary ignition wires with a light mist of water may help locate an intermittent problem. Was a problem found?	22.4 k Ω	Verify repair	Go to Step 10

Step	Action	Value(s)	Yes	No
10	Check for proper ignition voltage output with a spark testerJ 26792. Was a problem found?	——	Verify repair	Go to Step 11
11	1. Remove the spark plugs and check for gas or oil fouling cracks, wear, improper gap, burned electrodes, heavy deposits, or improper heat range. 2. If spark plugs are fouled, the cause of fouling must be determined before replacing the spark plugs. Was a problem found?	——	Verify repair	Go to Step 12
12	Check for a loose ignition control module ground. Was a problem found?	——	Verify repair	Go to Step 13
13	1. Check the ignition coil secondary resistance. 2. Replace the coil if it is not within the specified range of resistance. Did the coil require replacement?	9 kΩ–12 kΩ	Verify repair	Go to Step 14
14	Check IAC operation. Perform the procedure in the diagnostic chart DTC P0506, Step 6. Was a problem found?	——	Verify repair	Go to Step 15
15	Check for water or alcohol contaminated fuel. Was a problem found?	——	Verify repair	Go to Step 16
16	Perform the procedure in Fuel System Pressure Test to determine if there is a problem with fuel delivery. Was a problem found?	——	Verify repair	Go to Step 17
17	Check for the following engine mechanical problems (refer to Engine Mechanical): ● Low compression ● Leaking cylinder head gaskets ● Worn camshaft ● Camshaft drive belt slipped or stripped Was a problem found?	——	Verify repair	Go to Step 18
18	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system Was a problem found?	——	Verify repair	Contact Technical Assistance

SURGES AND/or CHUGGLES SYMPTOM

DEFINITION:
Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	Be sure that the driver understands A/C compressor operation as explained in the owner's manual. Inform the customer how the A/C clutch operate. Is the customer experiencing a normal condition?	—	System OK	Go to Step 5
5	Check the fuel control Heated Oxygen Sensor (HO2S1). When monitored on the Tech 2, the H02S1 should respond quickly to different throttle positions. If it doesn't check for silicon or other contaminants from fuel or use of improper RTV sealant. The sensors may have a white powdery coating. Silicone contamination sends a rich exhaust signal which causes the PCM to command an excessively lean air/fuel mixture. Was a problem found?	—	Verify repair	Go to Step 6
6	Check the fuel pressure. Refer to Fuel System Pressure Test. Was a problem found?	—	Verify repair	Go to Step 7
7	Monitor "Long Term Fuel Trim" on the Tech 2. Is "Long Term Fuel Trim" in the negative range (rich condition)?	—	Go to Step 8	Go to Step 9
8	Check items that can cause the engine to run rich. Refer to Diagnostic Aids in DTC P0172. Was a problem found?	—	Verify repair	Go to Step 10
9	Check items that can cause the engine to run lean. Refer to Diagnostic Aids in DTC P0171. Was a problem found?	—	Verify repair	Go to Step 10
10	Check for proper ignition voltage output with the spark tester J 26792. Was a problem found?	—	Verify repair	Go to Step 11
11	Check for a loose ignition control module ground. Was a problem found?	—	Verify repair	Go to Step 12

Step	Action	Value(s)	Yes	No
12	Visually/Physically inspect the secondary ignition wires. Check for the following conditions. ● Verify that all ignition wire resistance are less than the specified value. ● Verify that ignition wires are correctly routed to eliminated cross–firing. ● Verify that ignition wires are not arcing to ground. Spraying the secondary ignition wires with a light mist of water may help to locate an intermittent problem. Was a problem found?	22.4 Ω	Verify repair	Go to Step 13
13	1. Check ignition coil secondary resistance. 2. Replace the coil if it is not within the specified range of resistance. Did the coil require replacement?	9 kΩ– 12 kΩ	Verify repair	Go to Step 14
14	1. Remove the spark plugs and check for gas or oil fouling, cracks, wear, improper gap, burned electrodes, heavy deposits or improper heat range. 2. If spark plugs are fouled, the cause of fouling must be determined before replacing the spark plugs. Was a problem found?	—	Verify repair	Go to Step 15
15	1. Check the injector connectors. 2. If any of the connectors are connected at an improper cylinder, correct as necessary. Was a problem found?	—	Verify repair	Go to Step 16
16	Check the PCM grounds to verify that they are clean and tight. Refer to the PCM wiring diagrams in Electrical Diagnosis. Was a problem found?	—	Verify repair	Go to Step 17
17	Visually/physically check the vacuum hoses for splits, kinks and proper connections and routing as shown on the ”Vehicle Emission Control Information” label. Was a problem found?	—	Verify repair	Go to Step 18
18	Check the exhaust system for a possible restriction: ● damaged or collapsed pipes ● internal muffler failure ● Refer to Restricted Exhaust System Check to measure back pressure and determine if the catalytic converter is plugged.	—	Verify repair	Go to Step 19
19	1. Review all the diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ● Visual/physical inspection. ● Tech 2 data. ● Freeze Frame data/Failure Records buffer. ● All electrical connections within a suspected circuit and/or system. Was a problem found?	—	Verify repair	Contact Technical Assistance

LACK OF POWER, SLUGGISH OR SPONGY SYMPTOM

DEFINITION:
Engine delivers less than expected power. Little or no increase in speed when accelerator pedal is pushed down part–way.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	1. Remove and check the air filter element for dirt or restrictions. Refer to Air Intake System in On–Vehicle Service. 2. Replace the air filter element if necessary. Was a problem found?	—	Verify repair	Go to Step 5
5	Check for proper ignition voltage output with the spark tester J 26792. Was a problem found?	—	Verify repair	Go to Step 6
6	1. Remove the spark plugs and check gas or oil fouling, cracks, wear, improper gap, burned electrodes, heavy deposits or improper heat range. 2. If spark plugs are fouled, the cause of fouling must be determined before replacing the spark plugs. Was a problem found?	—	Verify repair	Go to Step 7
7	Check the fuel pressure. Refer to Fuel System Test. Was a problem found?	—	Verify repair	Go to Step 8
8	1. Install the Tech 2. 2. Run the engine at idle. 3. On the Tech 2, select F3: Miscellaneous Test, F6: Variable Intake Manifold. 4. Repeat Switch ON or OFF of VIM solenoid valve by using the Tech 2. 5. Check the solenoid working sound. 6. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 9
9	Check for water or alcohol contaminated fuel. Was a problem found?	—	Verify repair	Go to Step 10
10	Check the PCM grounds to verify that they are clean and tight. Refer to the PCM wiring diagrams in Electrical Diagnosis. Was a problem found?	—	Verify repair	Go to Step 11

Step	Action	Value(s)	Yes	No
11	Check the exhaust system for a possible restriction: ● Damaged or collapsed pipes ● Internal muffler failure ● Refer to Restricted Exhaust System Check to measure backpressure and determine if the catalytic converter is plugged. Was a problem found?	——	Verify repair	Go to Step 12
12	Check for the following engine mechanical problems: ● Low compression ● Leaking cylinder head gasket ● Worn or incorrect camshaft ● Loose timing belt Was a problem found?	——	Verify repair	Go to Step 13
13	1. Review all the diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ● Visual/physical inspection. ● Tech 2 data ● Freeze Frame data/Failure Records buffer. ● All electrical connections within suspected circuit and/or system. Was a problem found?	——	Verify repair	Contact Technical Assistance

DETONATION/SPARK KNOCK SYMPTOM

DEFINITION:
A mild to severe ping, usually worse under acceleration.
The engine makes sharp metallic knocks that change with throttle opening.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	1. If Tech 2 readings are normal and there are no engine mechanical faults, fill the fuel tank with a known quality gasoline that has a minimum octane rating of 87. Refer to Typical Scan Values. 2. Re–evaluate the vehicle performance. Is detonation present?	—	Go to Step 5	Verify repair
5	1. Check for obvious overheating problems: • Low engine coolant. • Restricted air flow to radiator, or restricted water flow through radiator. • Incorrect coolant solution. It should be a 50/50 mix of approved antifreeze/water. • Incorrect EGR operation. Refer to DTC P0401. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 6
6	Check fuel pressure. Refer to Fuel System Pressure Test. Was a problem found?	—	Verify repair	Go to Step 7
7	Check items that can cause an engine to run lean. Refer to Diagnostic Aids in DTC P0171. Was a problem found?	—	Verify repair	Go to Step 8
8	Check spark plugs for proper heat range. Refer to General Information. Were incorrect spark plugs installed?	—	Verify repair	Go to Step 9
9	1. Remove excessive carbon buildup with a top engine cleaner. Refer to instructions on the top engine cleaner can. 2. Re–evaluate vehicle performance. Is detonation still present?	—	Go to Step 10	Verify repair

Step	Action	Value(s)	Yes	No
10	Check for an engine mechanical problem. Perform a cylinder compression check. Refer to Engine Mechanical. Was a problem found?	—	Verify repair	Go to Step 11
11	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system Was a problem found?	—	Verify repair	Contact Technical Assistance

ROUGH, UNSTABLE, OR INCORRECT IDLE, STALLING SYMPTOM

DEFINITION:
Engine runs unevenly at idle. If severe, the engine or vehicle may shake. Engine idle speed may vary in RPM. Either condition may be severe enough to stall the engine.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed, including the rotor, ignition coil and secondary ignition wires?	—	Go to Step 4	Go to Visual / Physical Check
4	Verify that the EGR valve is not mounted backwards. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Check for incorrect idle speed. Ensure that the following conditions are present: • Engine fully warm. • Accessories are OFF. 2. Using a Tech 2, monitor IAC position. Is the IAC position within the specified values?	Between 10 and 50 counts	Go to Step 8	Go to Step 7
6	1. Visually/physically inspect for the following conditions: • Restricted air intake system. Check for a restricted air filter element, or foreign objects blocking the air intake system. • Check for objects blocking the IAC passage or throttle bore, excessive deposits in the IAC passage and on the IAC pintle, and excessive deposits in the throttle bore and on the throttle plate. • Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty crankcase ventilation valve brake booster hose. Was a problem found?	—	Verify repair	Go to Step 7
7	Using a Tech 2, monitor TP angle with the engine idling. Is the TP angle at the specified value and steady?	0%	Go to Step 8	For further diagnosis, refer to DTC P0123
8	Check for proper ignition voltage output with the spark tester J 26792. Was a problem found?	—	Verify repair	Go to Step 9
9	1. Remove the spark plugs and check for gas or oil fouling, cracks, wear, improper gap, burned electrodes, heavy deposits or improper heat range. 2. If spark plugs are fouled, the cause of the fouling must be determined before replacing the spark plugs. Was a problem found?	—	Verify repair	Go to Step 10

Step	Action	Value(s)	Yes	No
10	Check for a loose ignition control module ground. Refer to Electrical Ignition System. Was a problem found?	— —	Verify repair	Go to Step 11
11	Monitor ”Long Term Fuel Trim” on the Tech 2. Is ”Long Term Fuel Trim” in the negative range (rich condition)?	— —	Go to Step 12	Go to Step 13
12	Check the items that can cause the engine to run rich. Refer to Diagnostic Aids in DTC P0172. Was a problem found?	— —	Verify repair	Go to Step 13
13	Is ”Long Term Fuel Trim” significantly in the positive range (lean condition)? —	— —	Go to Step 14	Go to Step 15
14	Check items that can cause the engine to run leading. Refer to ”Diagnostic Aids” in DTC P0171. Was a problem found?	— —	Verify repair	Go to Step 14
15	Check the injector connections. If any of the injectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	— —	Verify repair	Go to Step 16
16	Perform the Injector Coil/Balance Test. Was a problem found?	— —	Verify repair	Go to Step 17
17	1. Check the following engine mechanical problems: ● Low compression ● Leaking cylinder head gasket ● Worn or incorrect camshaft ● Sticking or leaking valves ● Valve timing ● Broken valve springs ● Camshaft drive belt slipped or stripped. Was a problem found?	— —	Verify repair	Go to Step 18
18	1. Check for faulty motor mounts. Refer to Engine Mechanical for inspection of mounts. 2. If a problem is found, repair as necessary. Was a problem found?	— —	Verify repair	Go to Step 19
19	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system Was a problem found?	— —	Verify repair	Contact Technical Assistance

POOR FUEL ECONOMY SYMPTOM

DEFINITION:
Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	Check owner's driving habits. • Is the A/C ON full time (defroster mode ON)? • Are tires at the correct pressure? • Are excessively heavy loads being carried? • Is acceleration too much, too often?	—	Go to Step 5	Go to Step 6
5	Review the items in Step 4 with the customer and advise as necessary. Is the action complete?	—	System OK	—
6	1. Visually/physically check: Vacuum hoses for splits, kinks, and improper connections and routing as shown on the "Vehicle Emission Control Information" label. Was a problem found?	—	Verify repair	Go to Step 7
7	Remove and check the air filter element for dirt or for restrictions. Was a problem found?	—	Verify repair	Go to Step 8
8	1. Remove the spark plugs and check for gas or oil fouling, cracks, wear, improper gap, burned electrodes of heavy deposits. 2. Is spark plugs are fouled, the cause of fouling must be determined before replacing the spark plugs. Was a problem found?	—	Verify repair	Go to Step 9
9	Check for low engine coolant level. Was a problem found?	—	Verify repair	Go to Step 10
10	Check for an incorrect or faulty engine thermostat. Refer to Engine Cooling. Was a problem found?	—	Verify repair	Go to Step 11
11	Check for low engine compression. Refer to Engine Mechanical. Was a problem found?	—	Verify repair	Go to Step 12

Step	Action	Value(s)	Yes	No
12	Check for excessive exhaust system back–pressure. Refer to Restricted Exhaust System Check. Possible problems could be: ● Damaged or collapsed pipes. ● Internal muffler failure. ● Plugged catalytic converter. Was a problem found?	—	Verify repair	Go to Step 13
13	Check for proper calibration of the speedometer. Does the speed indicated on the speedometer closely match the vehicle speed displayed on the Tech 2?	—	Go to Step 15	Go to Step 14
14	Diagnose and repair the inaccurate speedometer condition as necessary. Refer to Vehicle Speed Sensor in Electrical Diagnosis.	—	Verify repair	—
15	Check the air intake system and the crankcase for air leaks. Was a problem found?	—	Verify repair	Go to Step 16
16	1. Review all the diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All connections within a suspected circuit and/or system Was a problem found?	—	Verify repair	Go to Step 17
17	Perform the procedure in Fuel System Pressure Test. Was the fuel pressure normal?	—	Contact Technical Assistance	Verify repair

EXCESSIVE EXHAUST EMISSIONS OR ODORS SYMPTOM

DEFINITION:
Vehicle fails an emission test. There is excessive ”rotten egg” smell. (Excessive odors do not necessarily indicate excessive emissions.)

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Go to Step 13	Go to Step 3
3	Was visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	Check for vacuum leaks (vacuum lines, intake manifold, throttle body, etc.) Were any vacuum leaks found?	—	Go to Step 13	Go to Step 5
5	1. Check fuel cap for proper installation. 2. Secure the fuel cap if necessary. Was a problem found?	—	Go to Step 13	Go to Step 6
6	1. Check the fuel pressure. Refer to Fuel System Pressure Test. Was a problem found?	—	Go to Step 13	Go to Step 7
7	1. Check for faulty, plugged or incorrectly installed PCV valve. 2. Verify that the PCV system is not plugged. Was a problem found?	—	Go to Step 13	Go to Step 8
8	Check the injector connections. If any of the injectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Go to Step 13	Go to Step 9
9	Perform the Injector Coil/Balance Test. Was a problem found?	—	Go to Step 13	Go to Step 10
10	Check for a problem with the engine cooling system. Was a problem found?	—	Go to Step 13	Go to Step 11
11	Check the EVAP canister for fuel loading. Refer to Evaporative Emission Control System. Was a problem found?	—	Go to Step 13	Go to Step 12
12	1. Remove excessive carbon build-up with a top engine cleaner. Refer to the instructions on the top engine cleaner can. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to Step 14
13	Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to Step 14
14	Does the exhaust emission test indicate excessive HC levels, or is ”Long Term Fuel Trim” significantly in the negative range (rich condition)?	—	Go to Step 15	Go to Step 16

Step	Action	Value(s)	Yes	No
15	1. Check items that can cause the engine to run rich. Refer to Diagnostic Aids in DTC P0172 Diagnostic Support. Make any necessary repairs. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to Step 17
16	1. Check items that can cause the engine to run lean. Refer to Diagnostic Aids in DTC P0171. Make any necessary repairs. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to Step 17
17	Check the EGR system (refer to DTC P0401). Was a problem found?	—	Verify repair	Go to Step 18
18	Check for the following engine mechanical problems. ● Low compression ● Leaking cylinder head gasket ● Worn or incorrect camshaft ● Sticking or leaking valves ● Valve timing ● Broken Valve springs Was a problem found?	—	Verify repair	Go to Step 19
19	1. Review all the diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system Was a problem found?	—	Verify repair	Contact Technical Assistance

DIESELING, RUN–ON SYMPTOM

DEFINITION:
Engine continues to run after key is turned OFF, but runs very rough. If engine runs smoothly, check the ignition switch and adjustment.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	1. Check for a short between B+ and the ignition feed circuit. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Review all the diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All connections within a suspected circuit and/or system Was a problem found?	—	Verify repair	Contact Technical Assistance

BACKFIRE SYMPTOM

DEFINITION:
Fuel ignites in the intake manifold, or in the exhaust system, making a loud popping noise.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	Check for proper ignition voltage output with spark tester J 26792. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Remove the spark plugs and check for gas or oil fouling, cracks, wear, improper gap, burned electrodes of heavy deposits. 2. If spark plugs are fouled, the cause of fouling must be determined before replacing the spark plugs. Was a problem found?	—	Verify repair	Go to Step 6
6	1. Visually/physically inspect the secondary ignition wires. Check for the following conditions: • Verify that all ignition wire resistances are less than the specified value. • Verify that ignition wires are correctly routed to eliminate cross–firing. • Verify that ignition wires are not arcing to ground. Spraying the secondary ignition wires with a light mist of water may help locate an intermittent problem. Was a problem found?	—	Verify repair	Go to Step 7
7	Check for an intermittent ignition system malfunction: • Intermittent CKP 58X signal. • Intermittent ignition feed circuit or sensor ground circuit to the crankshaft position sensor. Was a problem found?	—	Verify repair	Go to Step 8
8	To determine if there is a problem with fuel delivery, refer to Fuel System Diagnosis. Was a problem found?	—	Verify repair	Go to Step 9
9	1. Check for the following engine mechanical problems: • Low compression • Leaking cylinder head gasket • Worn or incorrect camshaft • Incorrect valve timing • Sticking or leaking valves • Camshaft drive belt slipped or stripped. Was a problem found?	—	Verify repair	Go to Step 10

Step	Action	Value(s)	Yes	No
10	Check the intake and exhaust manifold(s) for casting flash. Refer to Engine Mechanical. Was a problem found?	——	Verify repair	Go to Step 11
11	1. Review all the diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system Was a problem found?	——	Verify repair	Contact Technical Assistance

CUTS OUT, MISSES SYMPTOM

DEFINITION:
Steady pulsation or jerking that follows engine speed; usually more pronounced as engine load increases.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	Check the PCM grounds to verify that they are clean and tight. Refer to the PCM wiring diagrams in Electrical Diagnosis. Was a problem found?	—	Verify repair	Go to Step 5
5	Monitor ”Long Term Fuel Trim” on the Tech 2. Is the ”Long Term Fuel Trim” in the negative range (rich condition)?	—	Go to Step 6	Go to Step 7
6	Check items that can cause the engine to run rich. Refer to ”Diagnostic Aids” in DTC P0172. Was a problem found?	—	Verify repair	Go to Step 9
7	Is the long term fuel trim significantly in the positive range (lean condition)?	—	Go to Step 8	Go to Step 9
8	Check items that can cause the engine to run lean. Refer to Diagnostic Aids in DTC P0171. Was a problem found?	—	Verify repair	Go to Step 9
9	1. Check for incorrect idle speed. Ensure that the following conditions are present: ● Engine fully warm. ● Accessories are OFF. 2. Using a Tech 2, monitor the IAC position. Is the IAC position within the specified values?	Between 5 and 50 counts	Go to Step 11	Go to Step 10
10	1. Visually/physically inspect for the following conditions: ● Restricted air intake system. Check for a restricted air filter element, or foreign objects blocking the air intake system. ● Check for objects blocking the IAC passage or throttle bore, excessive deposits in the IAC passage and on the IAC pintle, and excessive deposits in the throttle bore and on the throttle plate. ● Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty crankcase ventilation valve or brake booster hose disconnected. Was a problem found?	—	Verify repair	Go to Step 11

Step	Action	Value(s)	Yes	No
11	Check the injector connections. If any of the injectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	——	Verify repair	Go to Step 12
12	1. Perform the Injector Coil/Balance Test. Was a problem found?	——	Verify repair	Go to Step 13
13	1. Check for fuel in the pressure regulator vacuum hose. 2. If fuel is present, replace the fuel pressure regulator assembly. Was a problem found?	——	Verify repair	Go to Step 14
14	Check for proper ignition voltage output with spark tester J 26792. Was a problem found?	——	Verify repair	Go to Step 15
15	1. Remove spark plugs and check for gas or oil fouling, cracks, wear, improper gap, burned electrodes of heavy deposits. 2. If spark plugs are fouled, the cause of fouling must be determined before replacing the spark plugs. Was a problem found?	——	Verify repair	Go to Step 16
16	Check for a loose ignition control module ground. Was a problem found?	——	Verify repair	Go to Step 17
17	Using a Tech 2, monitor the TP angle with the engine idling. Is the TP angle at the specified value and steady?	0%	Go to Step 18	For further diagnosis, refer to DTC P0123
18	Check the PCV valve for proper operation. Was a problem found?	——	Verify repair	Go to Step 19
19	Check for the following engine mechanical problems: ● Low compression ● Leaking cylinder head gasket ● Worn or incorrect camshaft ● Incorrect valve timing ● Sticking or leaking valves ● Camshaft drive belt slipped or stripped. Was a problem found?	——	Verify repair	Go to Step 20
20	Check for faulty motor mounts. Refer to Engine Mechanical for inspection of the mounts. Was a problem found?	——	Verify repair	Go to Step 21
21	1. Review all the diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system Was a problem found?	——	Verify repair	Contact Technical Assistance

HESITATION, SAG, STUMBLE SYMPTOM

DEFINITION:
Momentary lack of response as the accelerator is pushed down. Can occur at any vehicle speed. Usually most pronounced when first trying to make the vehicle move, as from a stop sign. May cause the engine to stall if severe enough.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	1. Check the fuel control heated oxygen sensor (HO2S1). The HO2S1 should respond quickly to different to throttle positions. If it doesn't, check for silicon or other contaminants from fuel or use of improper RTV sealant. The sensors may have a white powdery coating. Silicon contamination sends a rich exhaust signal which causes the PCM to command an excessively lean air/fuel mixture. Was a problem found?	—	Verify repair	Go to Step 5
5	Check the fuel pressure. Refer to Fuel System Pressure Test. Was a problem found?	—	Verify repair	Go to Step 6
6	Observe the "TP angle" display on the Tech 2 while slowly increasing throttle pedal. Does the TP angle display steadily increase from 0% at closed throttle to 100% at WOT?	—	Go to Step 7	Go to Step 13
7	Monitor "Long Term Fuel Trim" on the Tech 2. Is the "Long Term Fuel Trim" in the negative range (rich condition)?	—	Go to Step 8	Go to Step 9
8	Check items that can cause the engine to run rich. Refer to Diagnostic Aids in DTC P0172. Was a problem found?	—	Verify repair	Go to Step 10
9	Check items that can cause the engine to run lean. Refer to Diagnostic Aids in DTC P0171. Was a problem found?	—	Verify repair	Go to Step 10
10	Check for proper ignition voltage output with spark tester J 26792 (ST–125). For the procedure, refer to Electronic Ignition System. Was a problem found?	—	Verify repair	Go to Step 11
11	Check for a loose ignition control module ground. Was a problem found?	—	Verify repair	Go to Step 12

Step	Action	Value(s)	Yes	No
12	Visually/physically inspect the secondary ignition wires. Check for the following conditions: • Verify that all ignition wire resistances are less than the specified value. • Value that ignition wires are correctly routed to eliminate cross–firing. • Verify that ignition wires are not arcing to ground. Spraying the secondary ignition wires with a light mist of water may help locate an intermittent problem. Was a problem found?	30,000 Ω	Verify repair	Go to Step 14
13	Replace the TP sensor.	—	Verify repair	—
14	1. Check the ignition coil secondary resistance. 2. Replace the coil if it is not within the specified value. Was a problem found?	9 kΩ– 12kΩ	Verify repair	Go to Step 15
15	1. Remove the spark plugs and check for gas or oil fouling, cracks, wear, improper gap, burned electrodes of heavy deposits. 2. If spark plugs are fouled, the cause of fouling must be determined before replacing the spark plugs. Was a problem found?	—	Verify repair	Go to Step 16
16	Check the PCM grounds to verify that they are clean and tight. Refer to the PCM wiring diagrams in Electrical Diagnosis. Was a problem found?	—	Verify repair	Go to Step 17
17	Visually/physically check vacuum hoses for splits, kinks, and proper connections and routing as shown on the Vehicle Emission Control Information label. Was a problem found?	—	Verify repair	Go to Step 18
18	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

RESTRICTED EXHAUST SYSTEM CHECK

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Remove the HO2S2. ● For removal procedures, refer to Heated Oxygen Sensors in On–Vehicle Service. 2. Install the Exhaust Backpressure Tester in place of the Bank 1 HO2S. 3. Idle the engine at normal operating temperature. Does the reading on the gauge exceed the specified value?	8.62 kPa (1.25 psi)	Go to Step 5	Go to Step 3
3	With the exhaust back–pressure tester in place of HO2S, and the engine at normal operating temperature: Increase the engine speed to 2000 RPM while observing the gauge. Does the reading exceed the amount of the value column?	8.62 kPa (1.25 psi)	Go to Step 5	Go to Step 4
4	1. Re–install the HO2S2. (Refer to Heated Oxygen Sensors in On–Vehicle Service for installation procedure.) 2. Remove the HO2S1. 3. Install the Exhaust Back–Pressure Tester BT8515V or equivalent in place of the HO2S1. 4. Bring the engine to normal operating temperature while observing the gauge. 5. Increase the engine speed to 2000 RPM (allow 10 seconds for pressure build) and observe the gauge. Did the reading exceed the specified value?	8.62 kPa (1.25 psi)	Go to Step 6	System OK
5	Repair a restiction in the exhaust system after the catalytic converter. Possible faults include: ● Collapsed pipe ● Internal muffler failure	—	Verify repair	—
6	Replace the restricted catalytic converter.	—	Verify repair	—

NOTE: Diagnostic Trouble Codes will be set by running the vehicle to normal operating temperature after a cold start with the O2 sensor disconnected. After performing these tests, use the Tech 2 to erase the Diagnostic Trouble Codes that were set by the lack of O2 sensor activity.

DEFAULT MATRIX TABLE

SERVICE PROCEDURE DEFAULT STRATEGY

A referral strategy has been established to assist the technician with additional information when the cause of the failure cannot be determined. If no problem is found after performing diagnostics, then for further diagnostic information, refer to the default matrix table.

DEFAULT MATRIX TABLE

Strategy Based Diagnostic Charts	Initial Diagnosis	Default Section(s)
On–Board Diagnostic (OBD) System Check	Vehicle does not enter diagnostics.	Chassis Electrical
On–Board Diagnostic (OBD) System Check	Vehicle enters diagnostics and communicates with the Tech 2. MIL is ON in diagnostics. Engine does not start and run.	Ignition System Check
On–Board Diagnostic (OBD) System Check	Engine starts and runs, no PCM codes set. Customer complains of vibration.	—
PCM Power and Ground Check	On–Board Diagnostic (OBD) System Check.	Chassis Electrical
PCM Power and Ground Check	On–Board Diagnostic (OBD) System Check. PCM power and ground circuits OK. Data link voltage incorrect.	Chassis Electrical

Symptoms	Initial Diagnosis	Default Section(s)
Intermittents	1. On–board diagnostic (OBD) system check. 2. Careful visual/physical inspections.	Chassis Electrical
Hard Starts	1. OBD system check. 2. Sensors (ECT, MAP, TP); MAP output chart. 3. Fuel system electrical test, fuel system diagnosis. 4. Ignition system. 5. IAC system check.	Engine Mechanical Ignition System Check Exhaust System Diagnosis
Surges and/or Chuggles	1. OBD system check. 2. Heated oxygen sensors. 3. Fuel system diagnosis. 4. Ignition system.	Calibration ID ”Broadcast Code”/Service Bulletins Ignition System Check Generator Output Exhaust System Diagnosis
Lack of Power, Sluggish or Spongy	1. OBD system check. 2. Fuel system diagnosis. 3. Ignition system. 4. EGR operation. 5. EGR system check.	Refer to Exhaust System in Engine Exhaust TCC Operation Calibration ID/Service Bulletins
Detonation / Spark Knock	1. OBD system check. 2. EGR operation. 3. EGR system check. 4. Fuel system diagnosis. 5. Ignition system.	Cooling System Ignition System Check Calibration ID/Service Bulletins

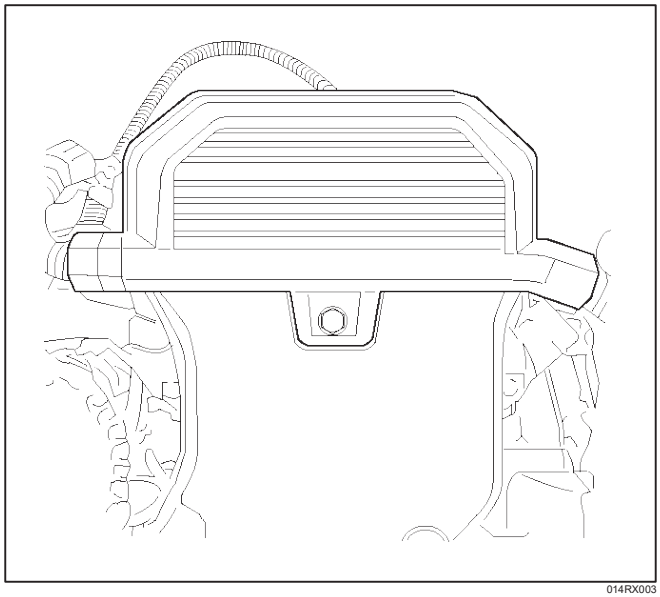
Hesitation, Sag, Stumble	1. OBD system check. 2. TP. 3. MAP output check. 4. Fuel system diagnosis. 5. Fuel injector and fuel injector balance test. 6. EVAP emission canister purge valve. 7. Ignition system.	EGR Operation EGR System Check Generator Output Voltage (refer to Chassis Electrical) Calibration ID/Service Bulletins Ignition System Check
Cuts Out, Misses	1. OBD system check. 2. Cylinder balance test.	Ignition System Check
Rough, Unstable, or Incorrect Idle, Stalling	1. OBD system check. 2. Fuel injector and fuel injector balance test. 3. EVAP emission canister purge valve check. 4. Ignition system. 5. IAC operation. 6. EGR operation.	MAP Output Check Throttle Linkage IAC System Check EGR System Check A/C Clutch Control Circuit Diagnosis Crankcase Ventilation System Calibration ID/Service Bulletins Generator Output Voltage (refer to Chassis Electrical) Exhaust Diagnosis
Poor Fuel Economy	1. OBD system check. 2. Careful visual/physical inspection. 3. Ignition system. 4. Cooling system.	TCC Operation Exhaust System (refer to Engine Exhaust)
Engine Cranks But Will Not Run	1. OBD system check.	Fuel System Electrical Diagnosis Fuel System Diagnosis Fuel Injector Fuel Injector Balance Test
Excessive Exhaust Emissions or Odors	1. OBD system check. 2. Emission test. 3. Cooling system. 4. Fuel system diagnosis. 5. Fuel injector and fuel injector balance test. 6. EVAP emission canister purge valve. 7. Crankcase ventilation system. 8. Ignition system. 9. MAP output check.	EGR System Check Exhaust Diagnosis Calibration ID/Service Bulletins
Dieseling, Run–On	1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis.	—
Backfire	1. OBD system check. 2. Ignition system. 3. Fuel system diagnosis. 4. Fuel injector and fuel injector balance test. 5. EGR operation, EGR system check.	Exhaust System Diagnosis, Intake Casting Flash, Ignition System Check

Misfire	1. OBD system check. 2. Ignition system. 3. Fuel system diagnosis. 4. Fuel injector and fuel injector balance test.	Vibrations, Transmission, Driveshaft and Axle
Catalyst Monitor	1. OBD system check. 2. Careful visual/physical inspection. 3. Heated oxygen sensors.	Exhaust System
Fuel Trim	1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis. 4. Heated oxygen sensors.	Exhaust System Intake Air System
Evaporative Emissions	1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis.	—
Heated Oxygen Sensors	1. OBD system check. 2. Careful visual/physical inspection.	Exhaust System

Camshaft Position (CMP) Sensor

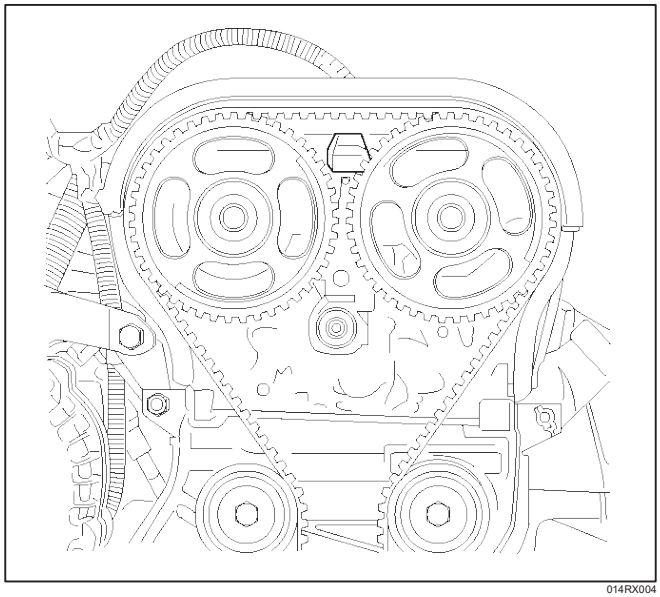
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove spark plug cover on top of valve cover by removing four retaining bolts.
3. Disconnect electrical connector from the sensor.



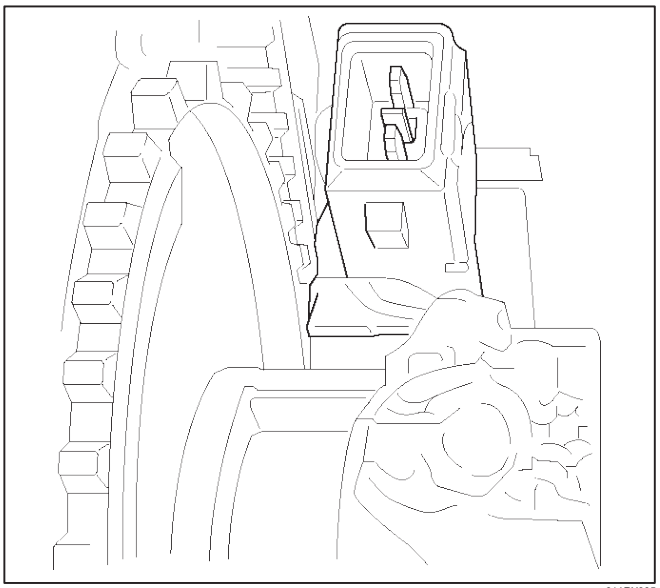
014RX003

4. Remove drive belt. Refer to Engine Mechanical Section.
5. Remove top harness cover installed on timing belt cover by removing a retaining screw.
6. Remove the retaining bolts holding crankshaft pulley, and pull crankshaft pulley while wiggling. Refer to Engine Mechanical Section.
7. Remove the retaining screws for timing belt cover and timing belt cover.



014RX004

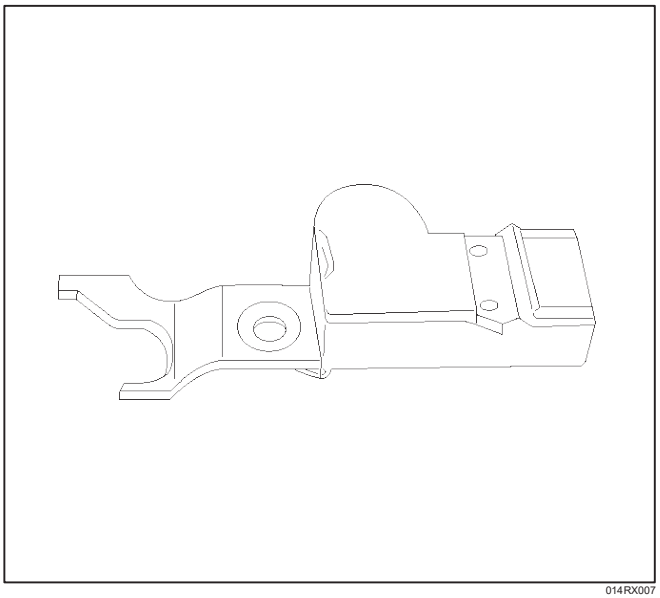
8. Remove the retaining bolt for the sensor and pull up camshaft position sensor.



014RX005

Installation Procedure

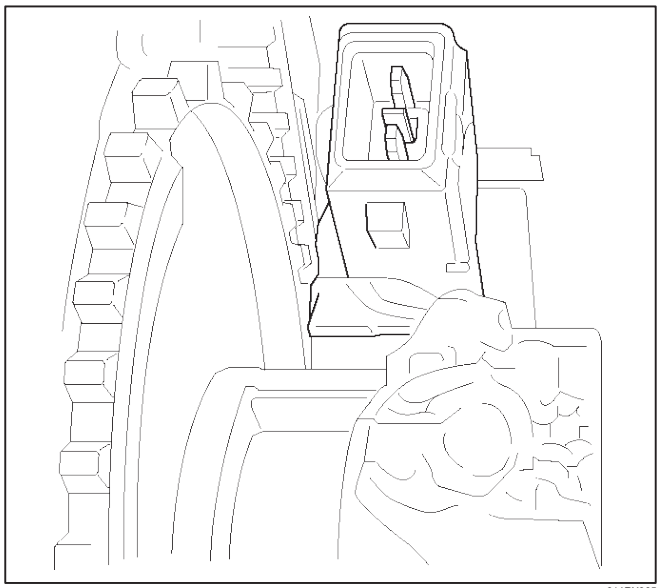
1. Insert camshaft position sensor in position.
2. Install retaining bolt.



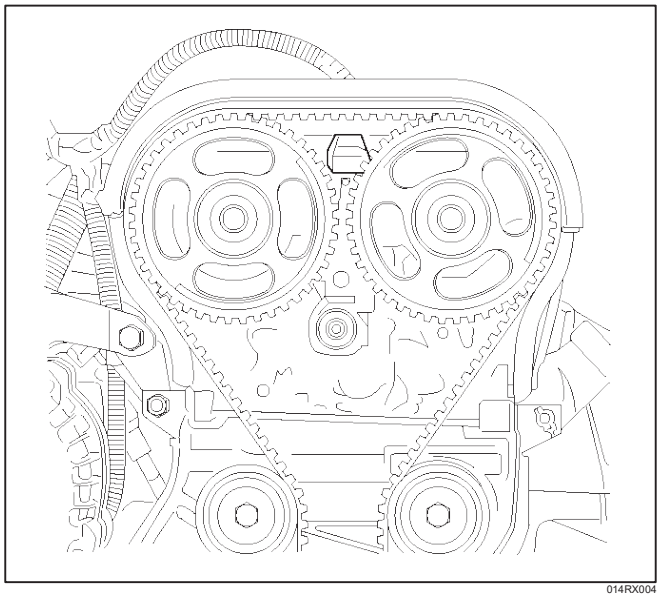
014RX007

3. Install the timing belt cover and the retaining screws.
4. Install the crank shaft pulley and the mounting bolts. Holes for mounting bolts are off the pitch. The pulley can be mounted only one way to install all mounting bolts. Tighten the bolts. Refer to Engine Mechanical section.

5. Install the drive belt. Refer to Engine Mechanical Section.


014RX005

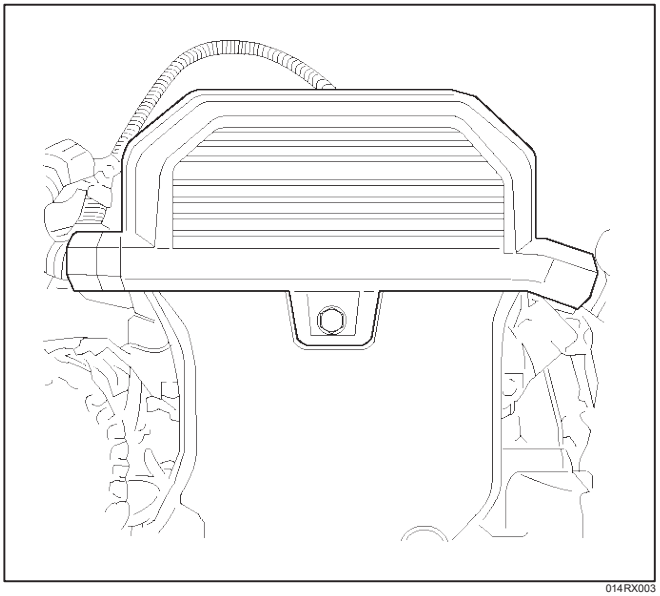
6. Install the top harness cover onto timing belt cover.
7. Connect electrical connector to the sensor and securely lock it.
8. Install the spark plug cover.
9. Connect the negative battery cable.


014RX004

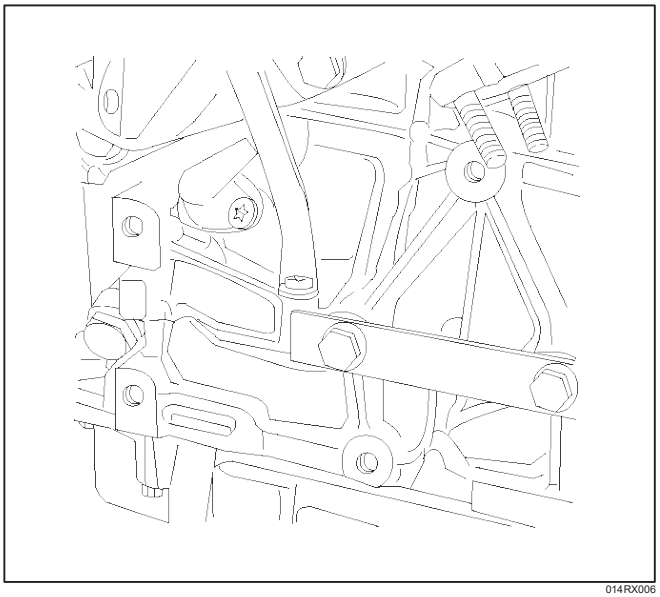
Crankshaft Position (CKP) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the drive belt. Refer to Engine Mechanical Section.

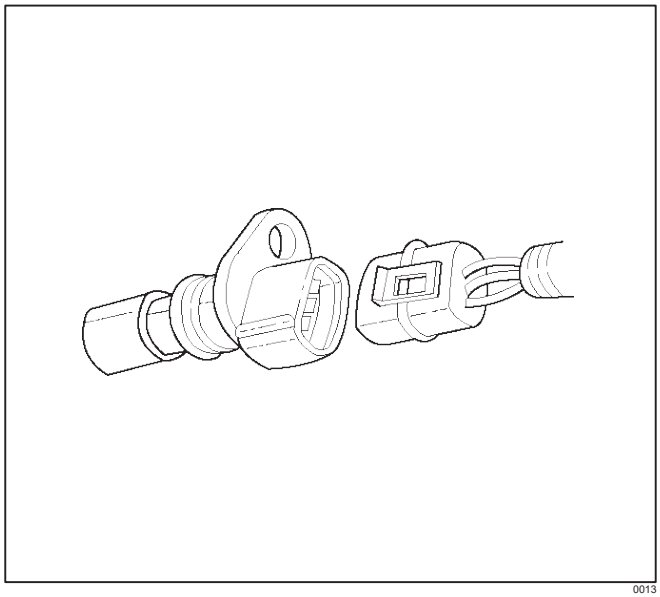

014RX003

3. Remove the power steering pump and mounting–bracket from engine. Refer to Engine Mechanical Section.
4. Disconnect electrical connector from the sensor.


014RX006

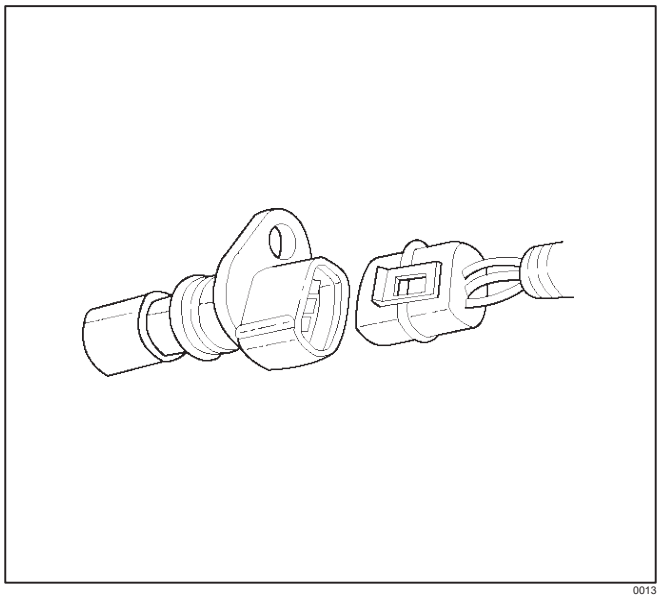
5. Remove the retaining bolt and sensor from the engine block.

NOTE: Use caution to avoid any hot oil that might drip out.

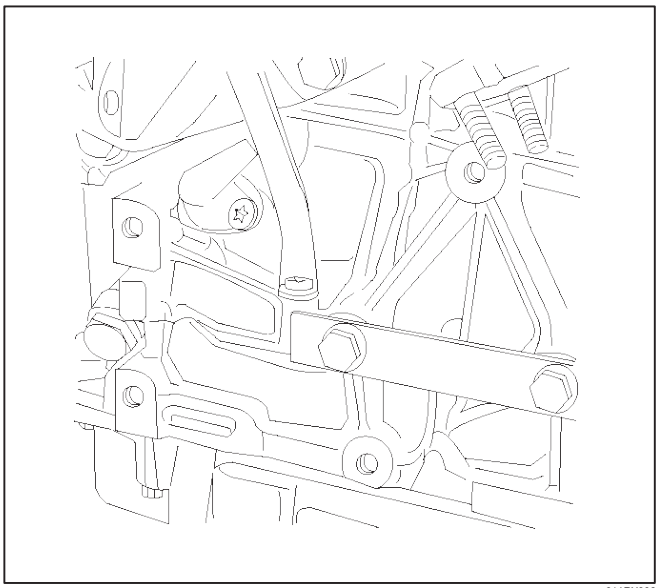

0013

Installation Procedure

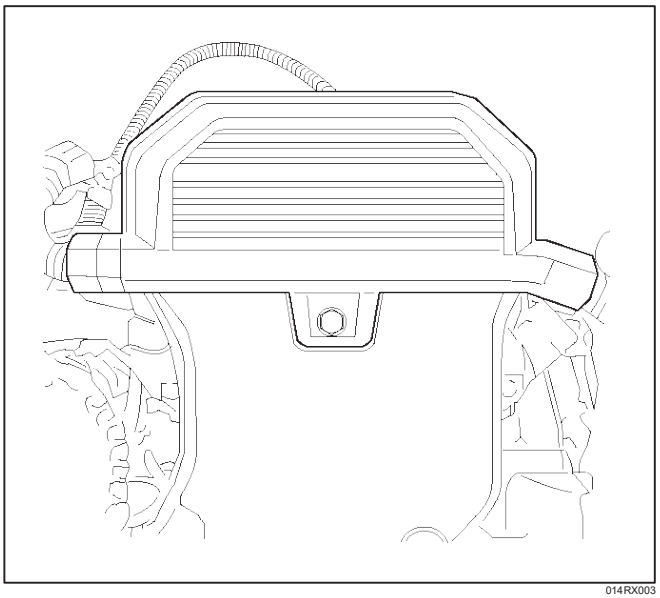
1. Install the crank shaft position sensor to its position.
2. Install and tighten the mounting bolt. Refer to Engine Mechanical Section.


0013

3. Reinstall the power steering pump and bracket to the engine.


014RX006

4. Reinstall the accessory drive belt.
5. Connect the negative battery cable.

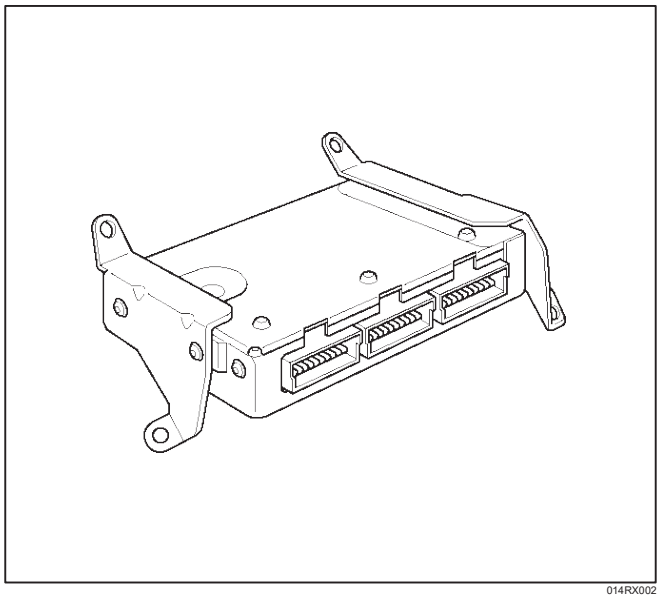

014RX003

IMPORTANT: PCM must re–learn Crankshaft Position when the CKP sensor is replaced. Refer to CKP sensor learn mode on the Tech 2, or Tooth Error Correction in the Service Manual.

EEPROM

EEPROM

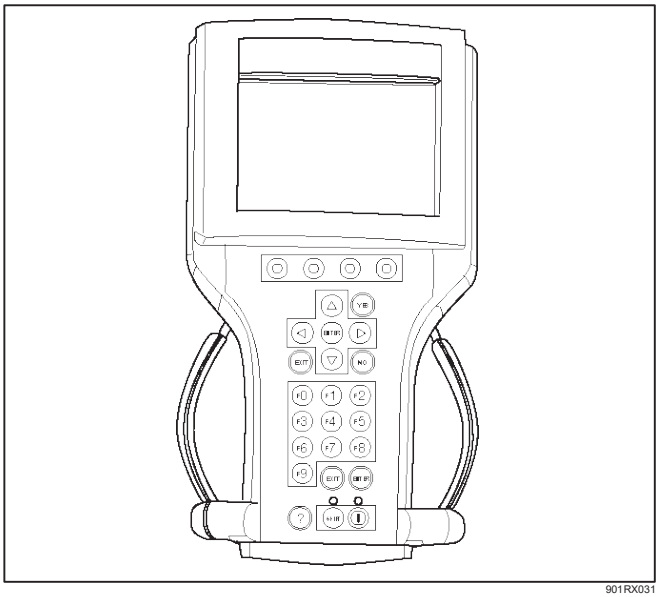
The Electronically Erasable Programmable Read Only Memory (EEPROM) is a permanent memory that is physically soldered within the PCM. The EEPROM contains program and calibration information that the PCM needs to control Powertrain operation.



014RX002

EEPROM Programming

1. Connect Tech 2 to the vehicle DLC and retrieve information from the PCM. Ensure that the following condition have been met:
   - Battery is fully charged.
   - The Ignition is in ON position.
   - Tech 2 cable is securely connected to DLC.
2. Download latest program and calibration from ITCS. Always use latest ITCS software to program PCM. Refer to Up–to–date ITCS user's guide.
3. Reconnect Tech 2 to the DLC and program PCM.
   - Make sure the ignition is recycled after information is retrieved.
   - Ensure the ignition is stay in ON position after programming is started.



901RX031

Functional Check

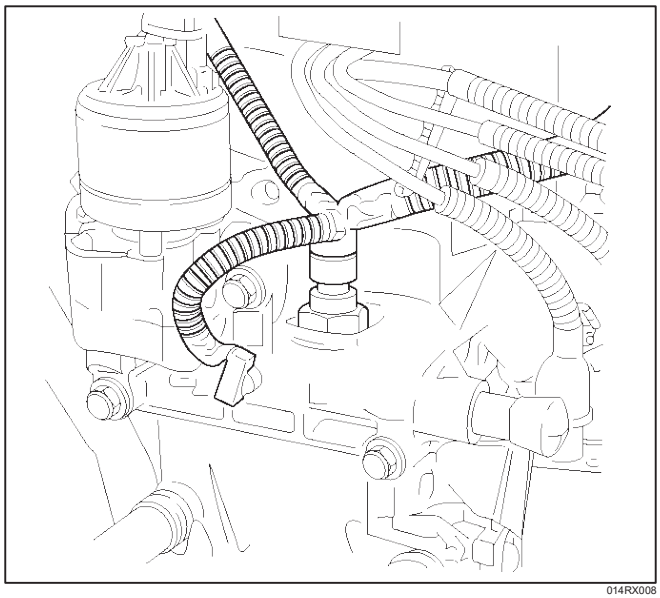
1. Perform the On–Board Diagnostic System Check.
2. Start the engine and run for least one minute.
3. Check for DTCs using Tech 2.
4. If the PCM fails to program, proceed as follow:
   - Ensure that all PCM connections are OK.
   - Check the ITCS for latest version software.
   - Attempt to program PCM again. If PCM still cannot be programmed properly, replace PCM. The replacement PCM must be programmed.

Engine Coolant Temperature (ECT) Sensor

Removal Procedure

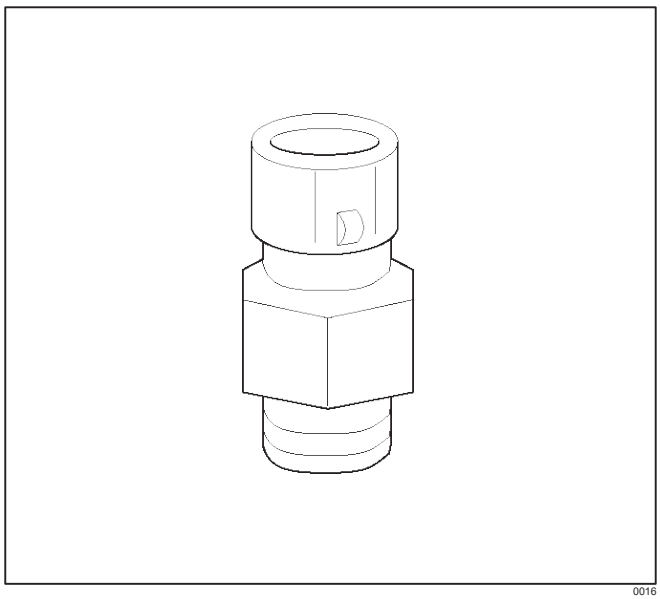
1. Disconnect the negative battery cable.
2. Drain enough engine coolant so that the coolant level will be below the ECT sensor.
3. Remove electrical connector from the sensor located on the intake manifold above the ignition coil.

4. Unscrew the sensor from the manifold.


014RX008

Installation Procedure

1. Install the sensor into the intake manifold. Do not over tighten.
2. Connect electrical connector.
3. Add engine coolant to required level. Refer to Engine Cooling System Section.
4. Connect the negative battery cable.

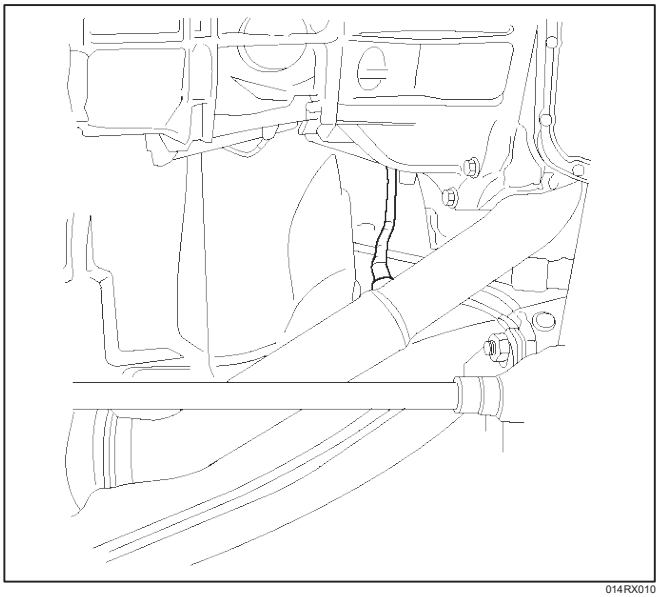

0016

Heated Oxygen Sensor (HO2S)

Removal Procedure

1. Disconnect the negative battery cable.
2. Locate the two oxygen sensors.
   - Bank 1 sensor 1 is mounted on the exhaust pipe ahead of the catalytic converter.
   - Bank 1 sensor 2 is mounted on the exhaust pipe behind the catalytic converter.
3. Disconnect pig tail electrical connector.

IMPORTANT: The pigtail is permanently attached to the sensor. Be careful not to pull the wires out.

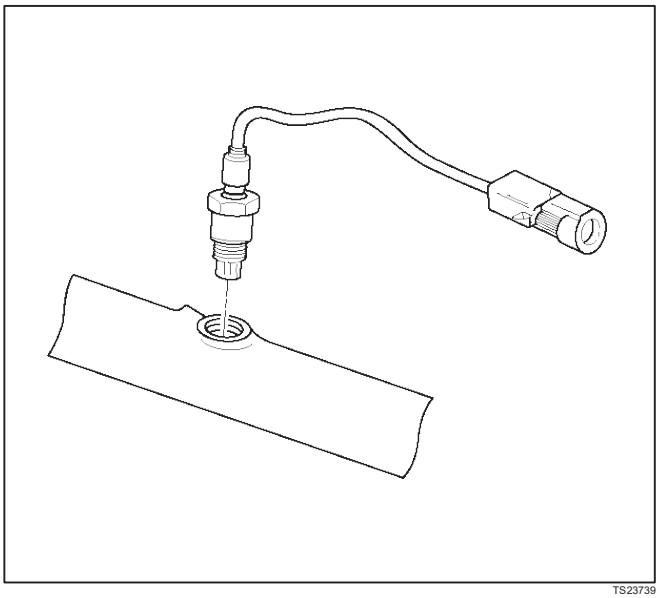

014RX010

4. Unscrew sensors form the exhaust pipe. Because of the expansion and contraction of the metal in the exhaust system over time, this may be difficult if the engine temperature is below 48 degree C.

Inspection Procedure

NOTE: Both sensors are identical. Inspect each in the same way.

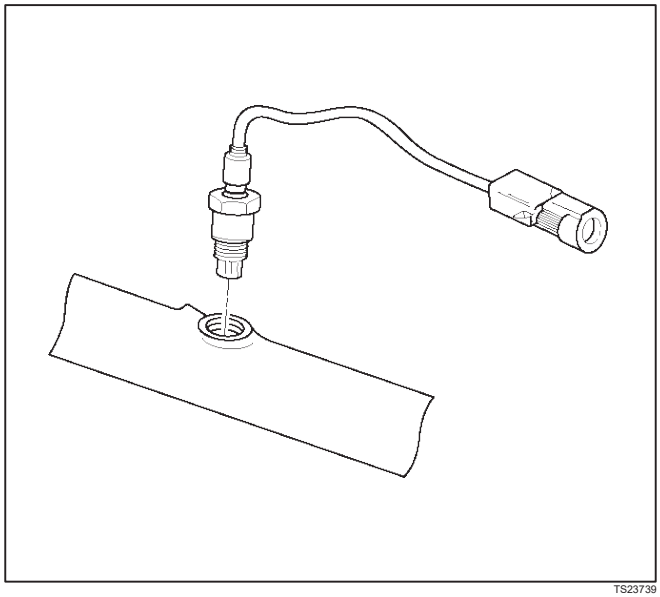
1. Inspect the pigtail and the electrical connector for grease, dirt, corrosion and bare wire or worn insulation.
2. Inspect the louvered end of the sensor for grease, dirt, excessive carbon build up or other contaminants.


TS23739

Installation Procedure

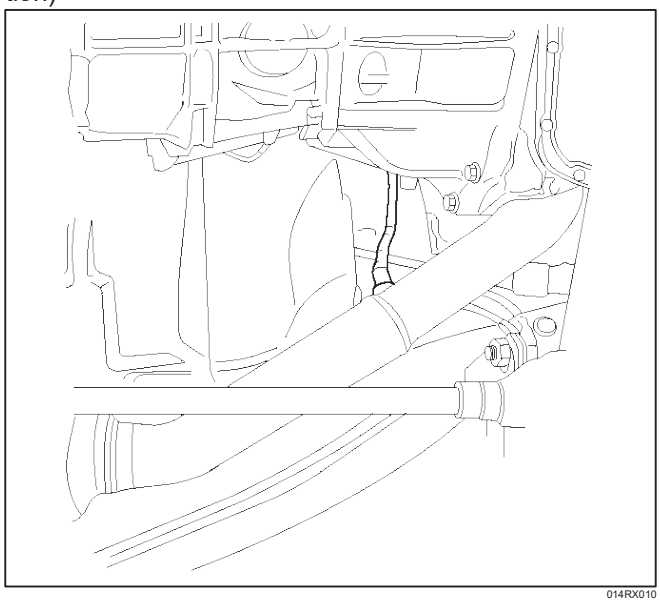
NOTE: If HO2S is reinstalled after removal, special anti–seize compound or the equivalent should be applied to the threads. Special anti–seize compound, (P/N 5613695), is used on the HO2S threads. This compound consists of glass beads suspended in a liquid graphite solution. The graphite burns away with exhaust heat, but the glass beads will remain, making the sensor easier to remove.

1. Apply anti–seize compound or the equivalent to the thread.

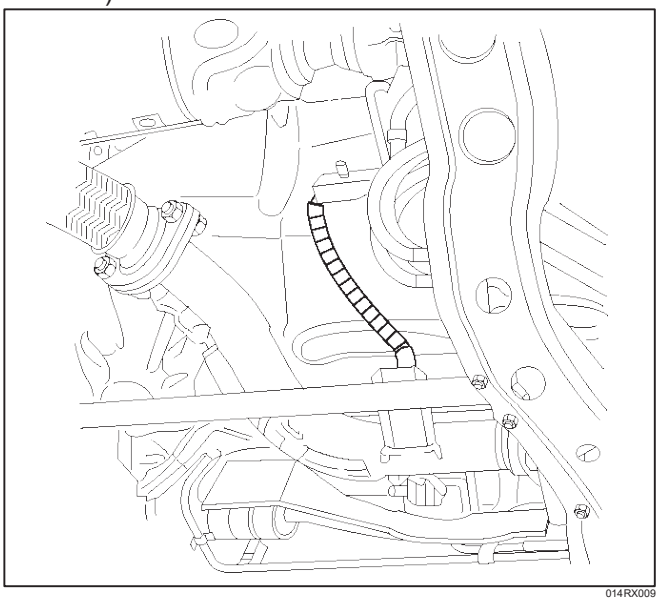

TS23739

2. Install HO2S on the exhaust pipe.
3. Tighten the sensor to 55 Nm (40 lb ft)
4. Connect the pig tail to the wiring harness.
5. Connect the negative battery cable.

(Pre–Catalytic Converter Heater Oxygen Sensor Location)


014RX010

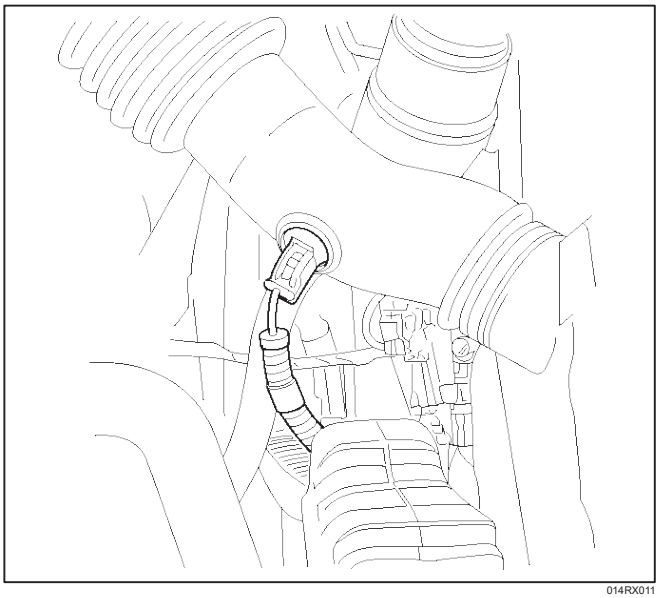
(Post–Catalytic Converter Heater Oxygen Sensor Location)


014RX009

Intake Air Temperature (IAT) Sensor

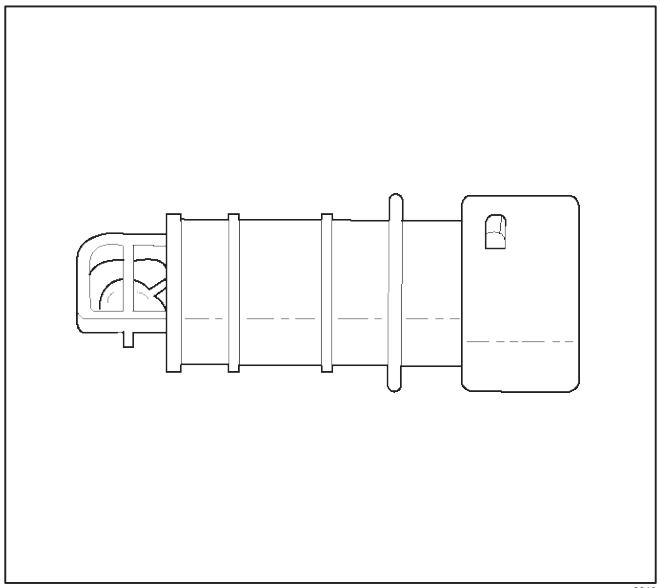
Removal Procedure

1. Disconnect the negative battery cable.
2. The IAT sensor is located in the intake air duct between the air filter and the throttle body.


014RX011

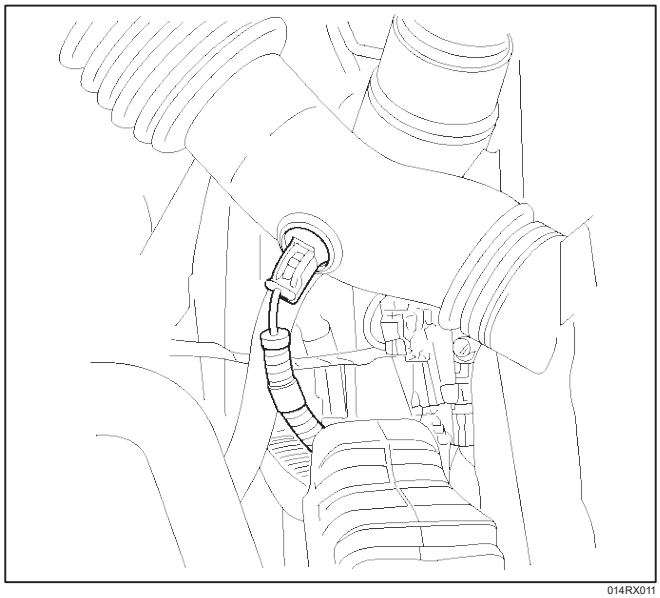
3. Disconnect the electrical connector from the sensor.

4. Remove the sensor from intake air duct by using a rocking motion while pulling the sensor.



Installation Procedure

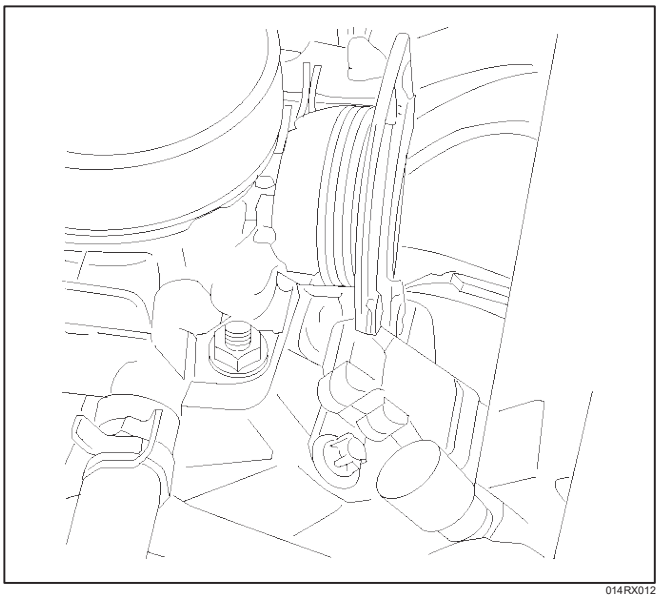
1. Install the IAT sensor into intake air duct. Make sure the sensoris pushed all the way into the intake air duct.
2. Connect electrical connector.
3. Connect the negative battery cable.



Manifold Absolute Pressure (MAP) Sensor

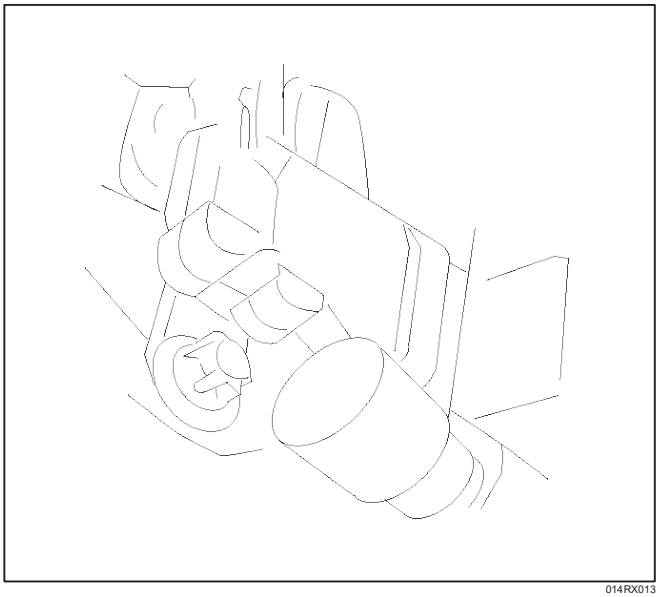
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the sensor. (The MAP sensoris located on the intake manifold behind throttle body.)
3. Remove a mounting bolt securing the sensor to the manifold.
4. Remove the sensor from the intake manifold using rocking motion while pulling the sensor.



Installation Procedure

1. Push MAP sensor into the manifold. Make sure the sensor is pushed always into its position.
2. Install a mounting bolts and tighten.
3. Connect electrical connector.
4. Connect the negative battery cable.



Malfunction Indicator Lamp (MIL)

Malfunction Indicator Lamp (MIL)

Refer to Instrument Panel Removal Procedure.

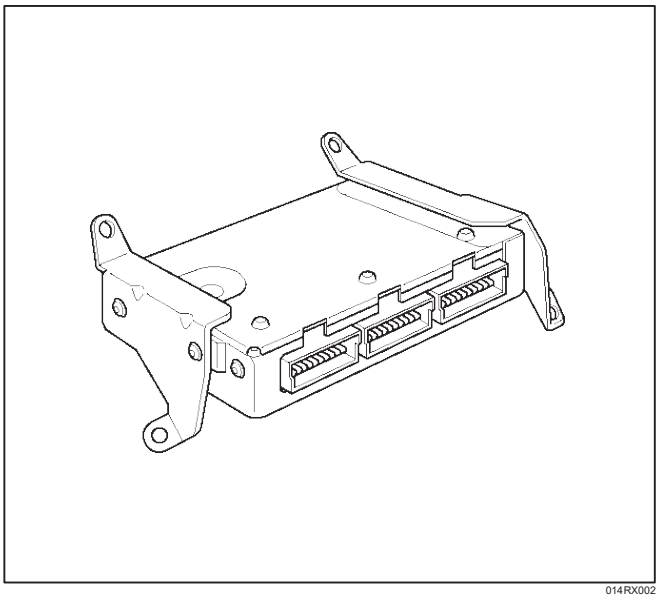
Powertrain Control Module (PCM)

Electrostatic Discharge (ESD) Damage

Electronic components used in the control system are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to same electronic components. By comparison, it takes as much as 4000 volts for a person to even feel the zap of a static discharge. There are several way for a person to become statically charged. The most common methods of charging are by friction and by induction. An example of charging by friction is a person sliding across a car seat. Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charge of the same polarity are drained off leaving the person highly charged with opposite polarity. Static charge can cause damage, therefore, it is important to use care when handling and testing electronic components.

NOTE: To prevent possible Electrostatic Discharge damage, follow these guidelines:

- Do not touch the control module connector pins or soldered components on the control module circuit board.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the parts from the package, ground the package to a known good ground on the vehicle.
- If the parts been handled while sliding across the seat, or while sitting from standing position, or walking a distance, touch a known good ground before installing the parts.



014RX002

NOTE: To prevent internal PCM damage, the ignition must be OFF position in order to disconnect or reconnect power to the PCM (for example: battery cable. pig tail, PCM fuse, jumper cable, etc.).

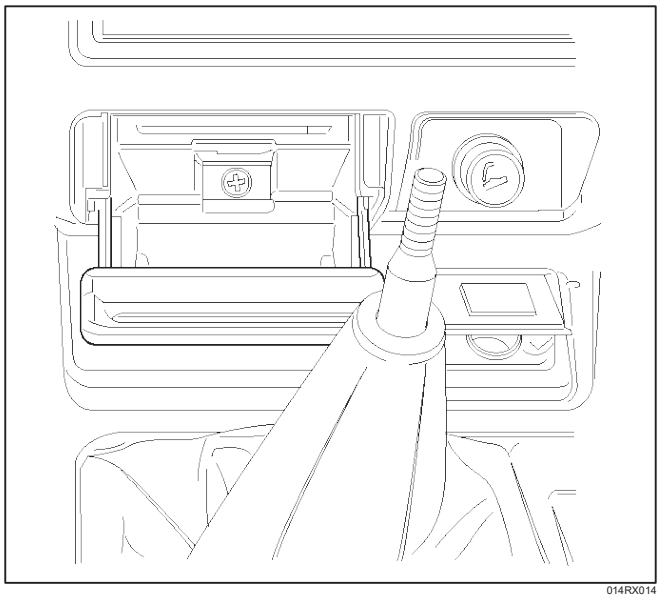
IMPORTANT: When replacing the production PCM with a service PCM, it is important to transfer the broadcast code and production PCM number to the service PCM label. This will allow positive identification of PCM parts throughout the service life of the vehicle. Do not record this information on PCM metal cover.

IMPORTANT: The ignition should always be in the OFF position in order to install or remove the PCM connectors. Service of the PCM should normally consist of either replacement of the PCM or EEPROM reprogramming. If the diagnostic procedure call for the PCM to be replaced, the replacement PCM should be checked first to ensure it has the correct part number. If it is, remove the faulty PCM and install the new service PCM. The service PCM EEPROM will need to be programmed. Additionally, after programming, the CKP Sensor Tooth Error Correction (TEC) Learn procedure will need to be performed.

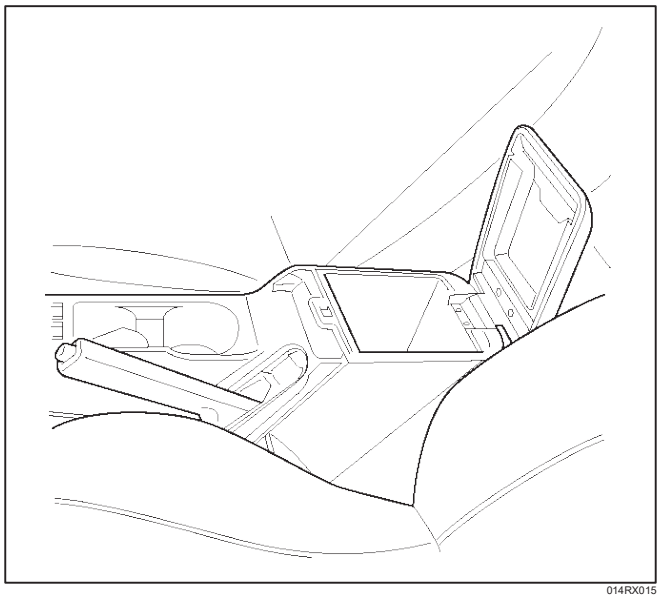
Removal Procedure

1. Disconnect the negative battery cable.
2. Block the wheels.
3. Remove ashtray inner.

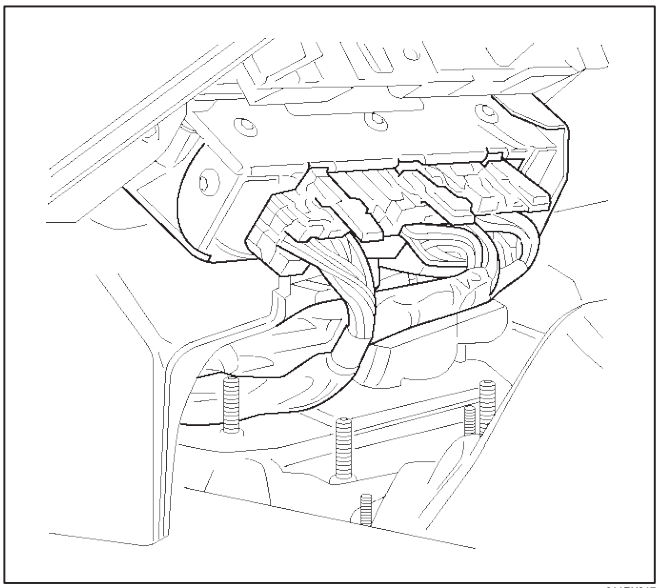
4. Remove a screw located behind ashtray.


014RX014

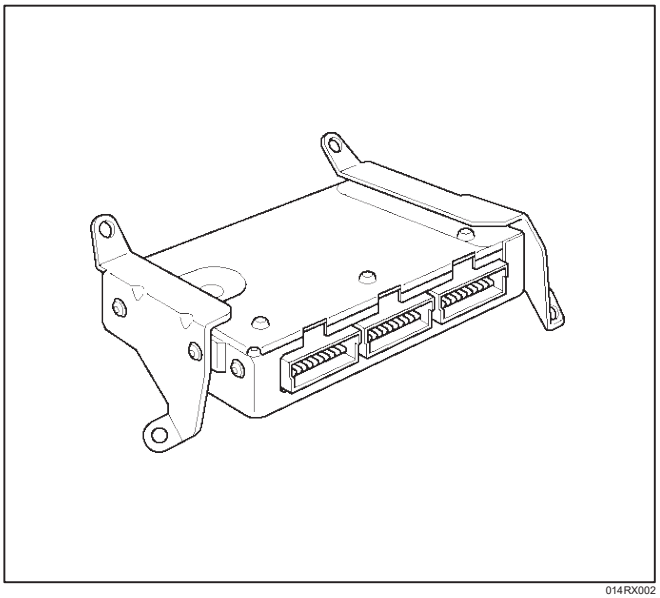
5. Pull out Face trim of console.
6. Remove two screws located inside of center console storage box and pull up rear part of center console.


014RX015

7. Unscrew the shift knob.
8. Remove four screw holding front part of the console and pull the console up.
9. Disconnect the red, white and blue electrical connector at the PCM.

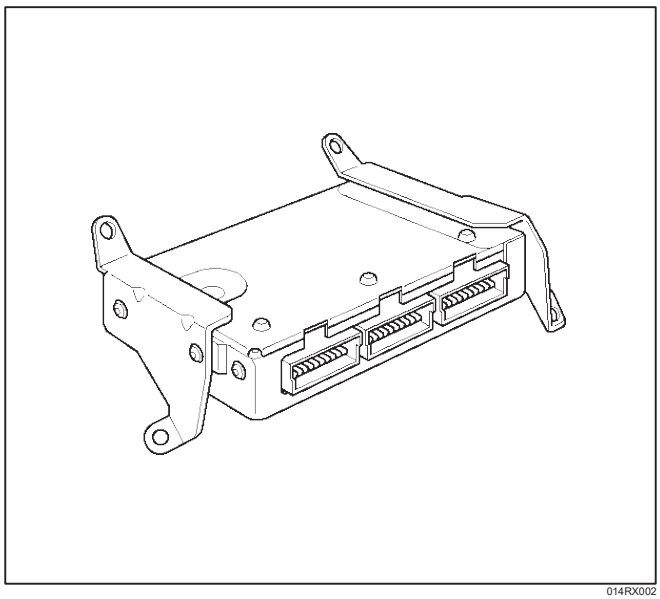

014RX017

10. Remove two nuts in the front of PCM.
11. Remove two nuts in the rear of PCM.
12. Pull the PCM out from dashboard.

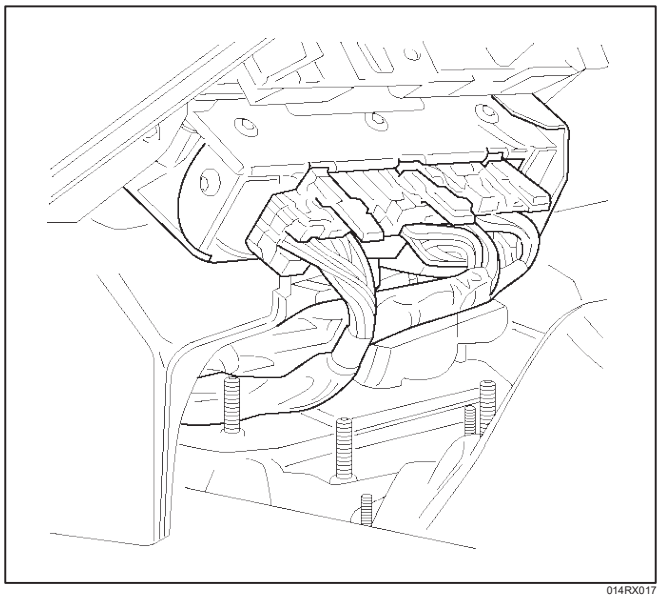

014RX002

Installation Procedure

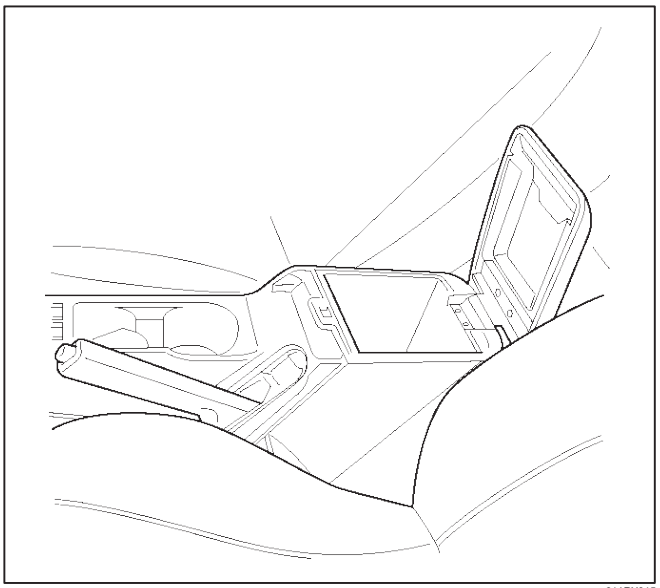
1. Place PCM into its position and secure by four mounting screws.


014RX002

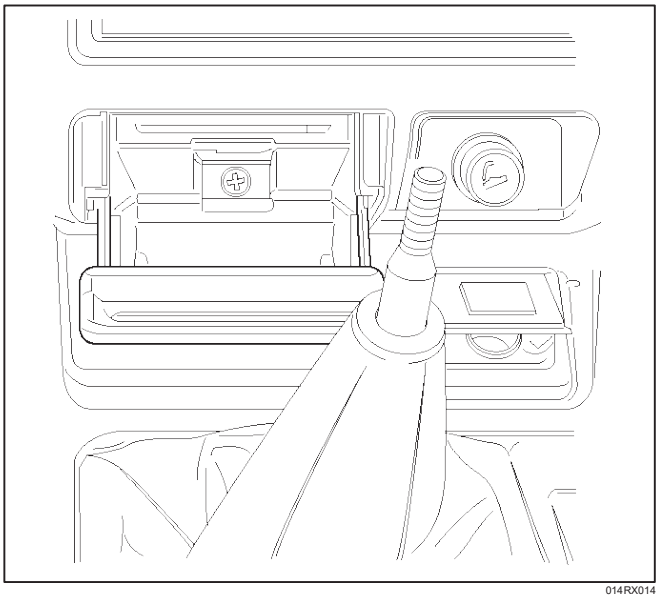
2. Connect all three connectors to PCM. All connectors are color keyed. Same color male and female connectors join together.


014RX017

3. Install the front center console and secure by four retaining screws.


014RX015

4. Install the rear center console and secure it by two retaining screw into storage box.


014RX014

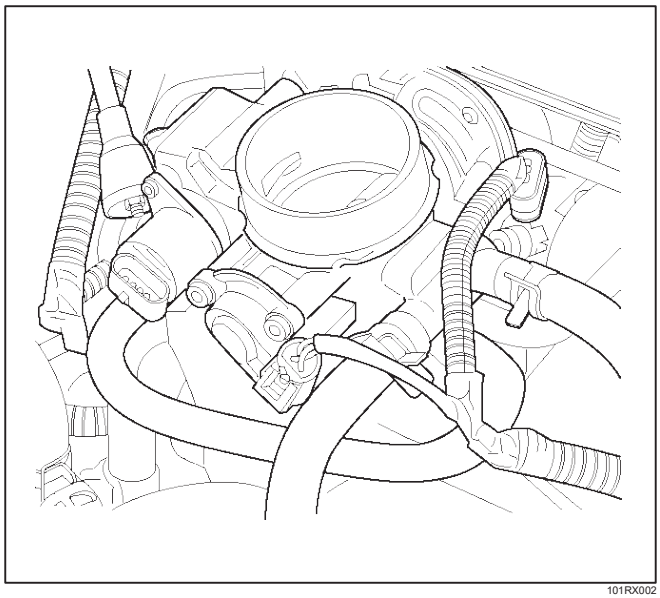
5. Snap face plate into its position and secure it by a screw.
6. Insert ashtray inner.
7. Insert the shift knob.
8. Connect the negative battery cable.
9. Remove wheel blocks.

Throttle Position (TP) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the TPS electrical connector.
3. Remove the two screws and TP sensor from the throttle body.

NOTE: Do not clean the TP sensor by soaking it in solvent. The sensor will be damaged as a result.

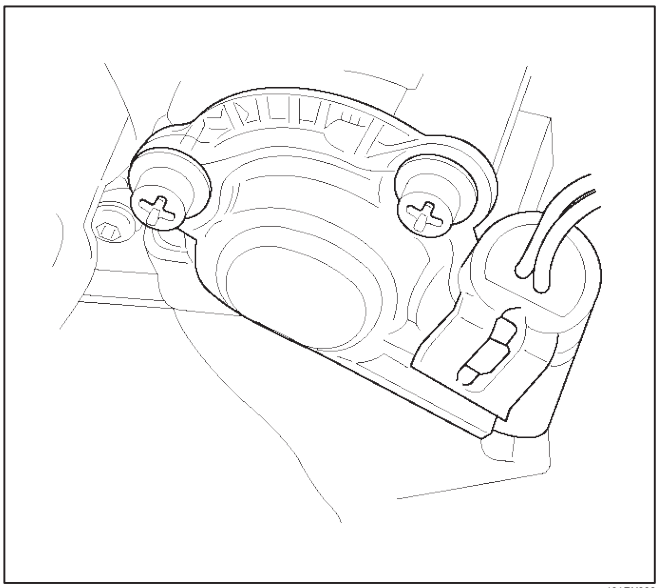


101RX002

Function Check

Use a Tech 2 to check the TP sensor output voltage at closed throttle.

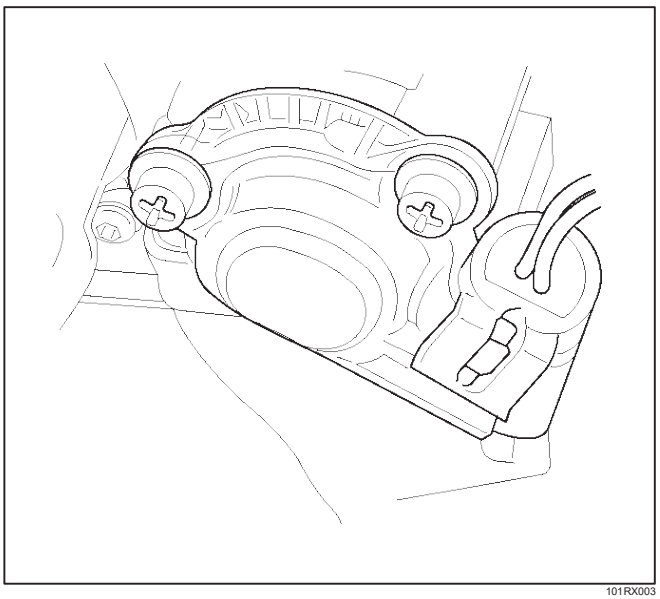
- The voltage should be under 0.25 volts.
- If the reading is greater than 0.25 volts, check the throttle shaft to see if it is binding. Check that the throttle cable is properly adjusted, also. Refer to Throttle Cable Adjustment.
- If the throttle shaft is not binding and the throttle cable is properly adjusted, install a new TP sensor.



101RX003

Installation Procedure

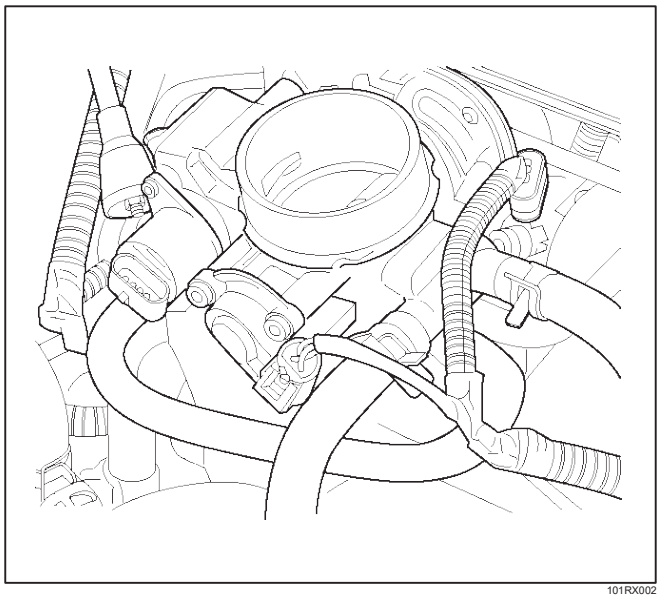
1. Install the TP sensor on the throttle body with two screws.



101RX003

2. Connect the electrical connector.

3. Connect the negative battery cable.

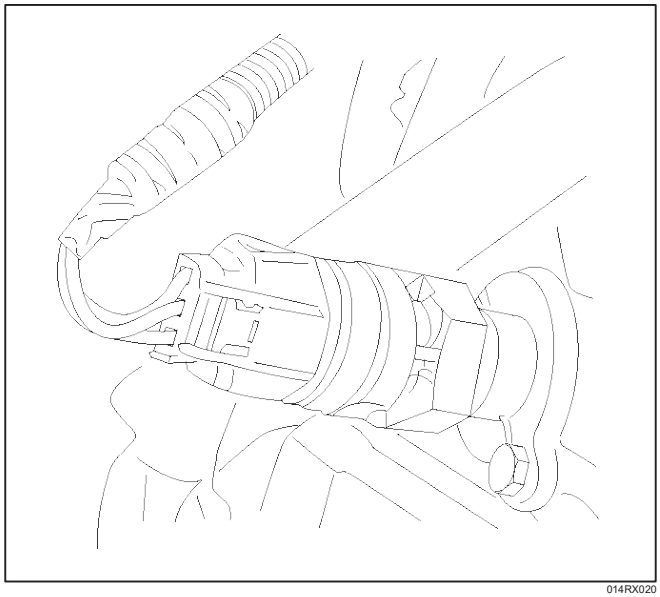

101RX002

Vehicle Speed Sensor (VSS)

Removal Procedure

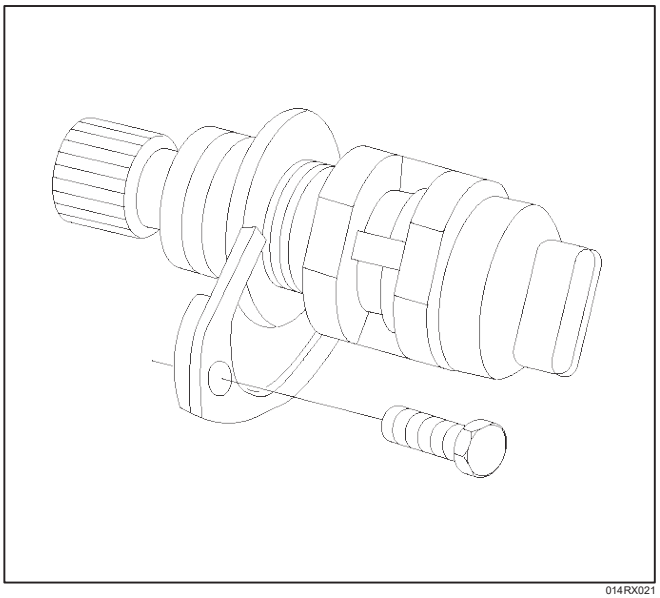
1. Disconnect the negative battery cable.
2. VSS is located on the right side of the transmission case just ahead of the rear propeller shaft. Disconnect the VSS electrical connector.
3. Remove the bolt and the VSS from the transmission case by wiggling it slightly and pulling it straight out.

IMPORTANT: Have a container ready to catch any fluid that leaks out when the VSS is removed from the transfer case.


014RX020

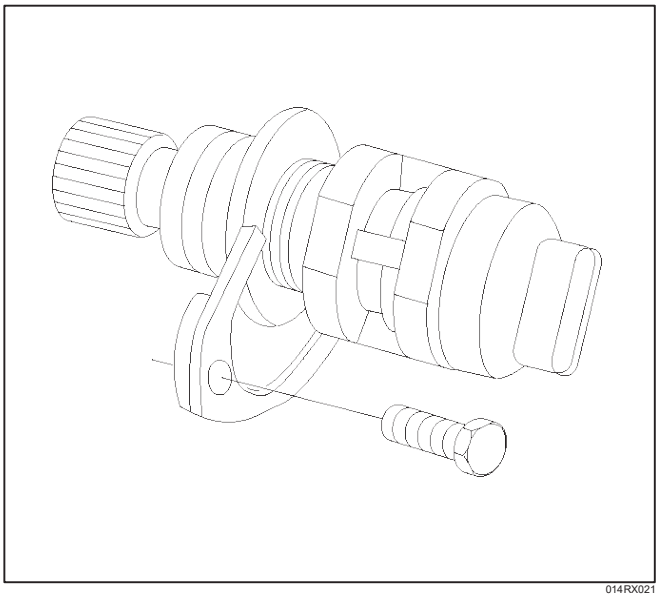
Inspection Procedure

1. Inspect the electrical connector for signs of corrosion or warping. Replace the VSS if the electrical connector is corroded or warped.
2. Inspect the VSS driven gear for chips, breaks, or worn condition. Replace the VSS if the driven gear is chipped, broken or worn.
3. Inspect the O–ring for wear, nicks, tears, or looseness. Replace the O–ring if necessary.


014RX021

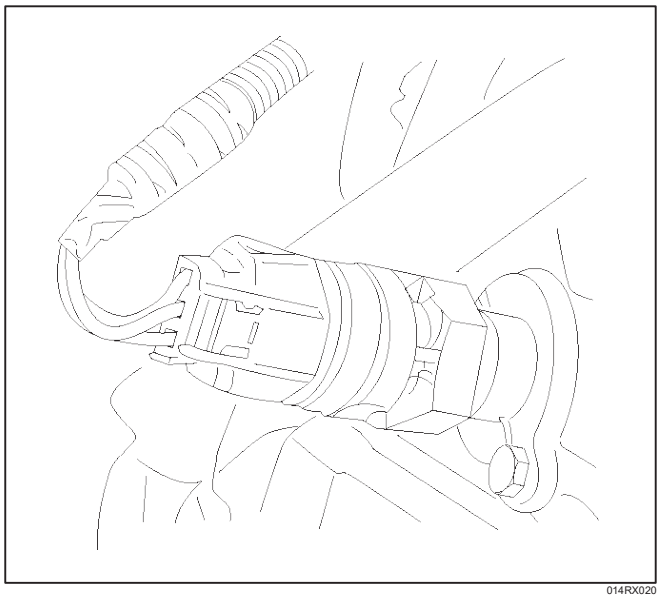
Installation Procedure

1. Install the VSS in the transmission case with the notch for the connector facing the rear.
2. Secure the VSS with mounting bolt. Tighten the bolt to 16 Nm (12 lb ft).


014RX021

3. Connect electrical connector to the VSS.
4. Check the transmission oil level. Add oil if necessary.

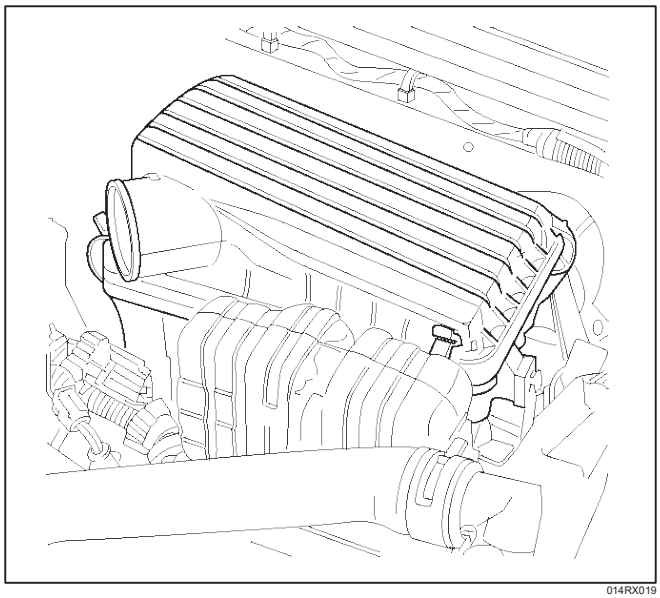
5. Connect the negative battery cable.



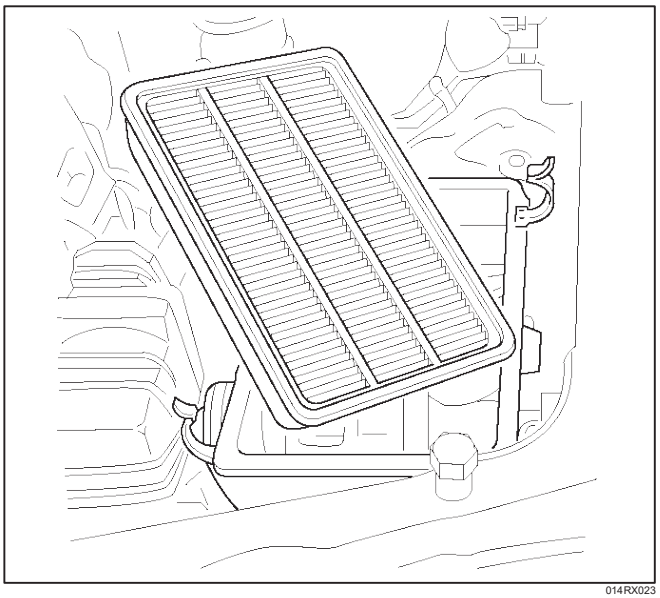
Air Filter

Removal Procedure

1. Disconnect electrical connector at the IAT sensor.
2. Release the four latches securing the lid to the air cleaner housing.
3. Remove the air cleaner lid.

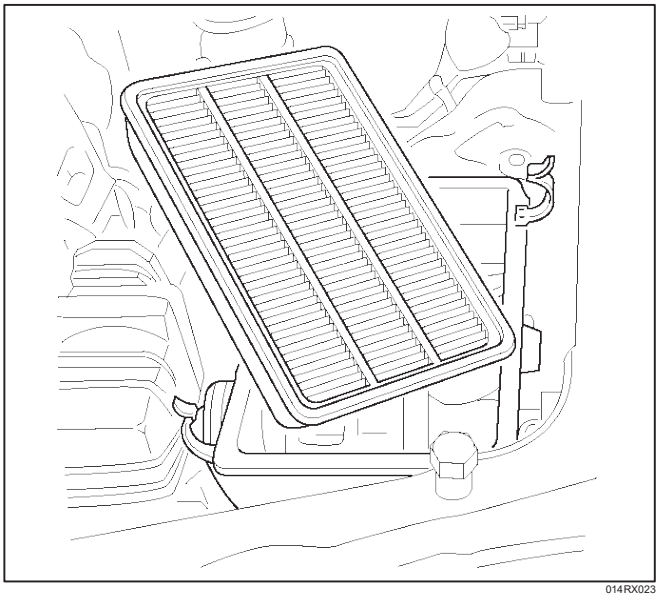


4. Remove the air filter element.



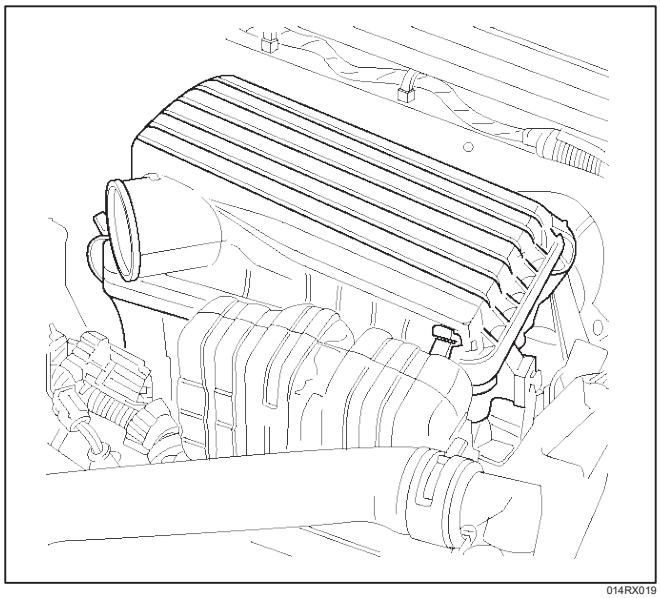
Installation Procedure

1. Install the air filter element in the air cleaner housing.



2. Install the air cleaner lids.
3. Secure the three latches, holding the lid on the air cleaner housing.

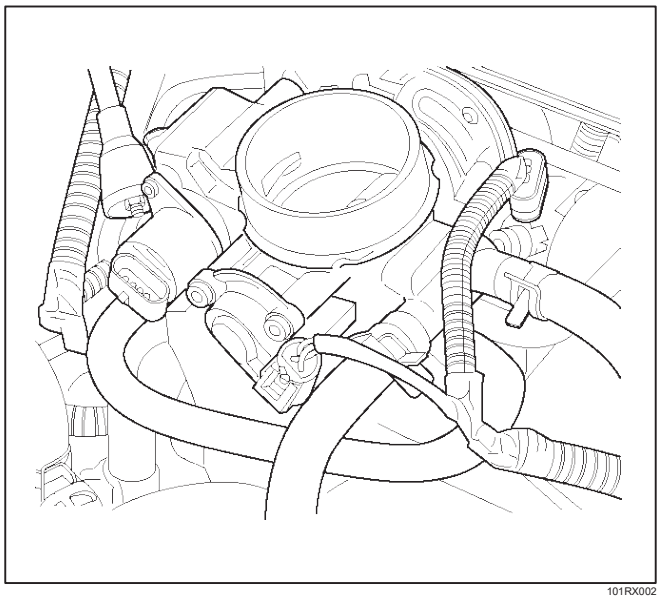
4. Connect the electrical connector to the IAT sensor.



Idle Air Control (IAC) Valve

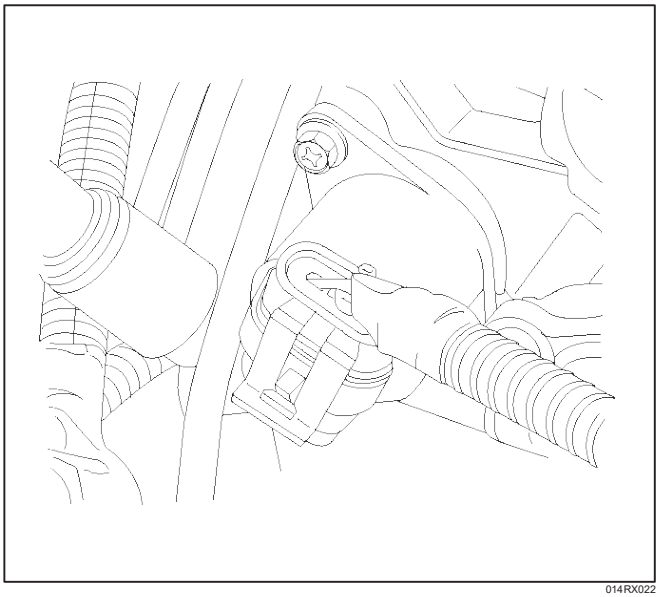
Removal Procedure

1. Disconnect the negative battery cable.



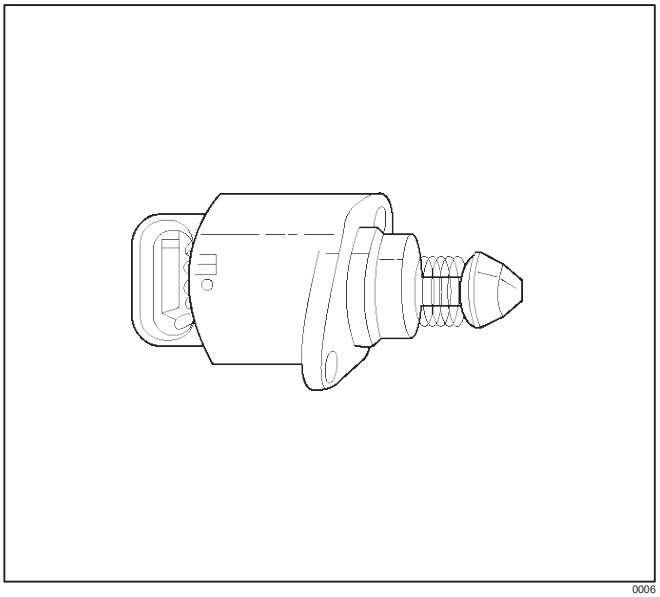
2. Disconnect the IAC electrical connector.
3. Remove the two screws and IAC valve from the throttle body.

NOTE: Do not clean the IAC valve by soaking it in solvent. The valve will be damaged as a result.



Cleaning and Inspection Procedure

- Clean the IAC valve O–ring sealing surface, pintle valve seat and air passage.
- Use carburetor cleaner and a parts cleaning brush to remove carbon deposit. Do not use a cleaner that contain methyl ethyl ketone. This is an extremely strong solvent and not necessary for this type of deposit.
- Shiny spots on the pintle are normal and do not indicate misalignment or a bent pintle shaft.
- Inspect the IAC valve O–ring for cuts, cracks or distortion. Replace the O–ring if damaged.

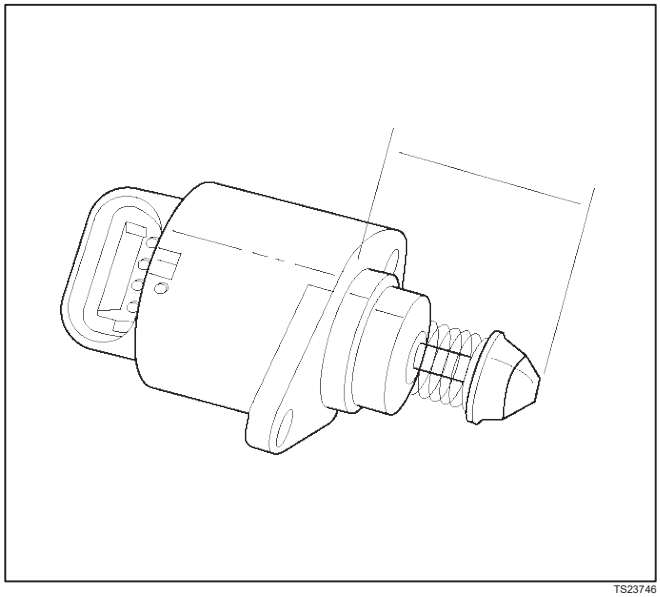


Measurement Procedure

- In order to install a new IAC valve, measure the distance between the tip of the pintle and the mounting flange. If that measurement is 28 mm or less, the valve need no adjustment. If the measurement is greater than 28 mm, apply finger pressure and retract the valve. The force required to retract the pintle on a new valve will not damage the valve, shaft or pintle.

NOTE: Do not push or pull on the IAC valve pintle on IAC valve that have been in service. The force required to move the pintle may damage it.

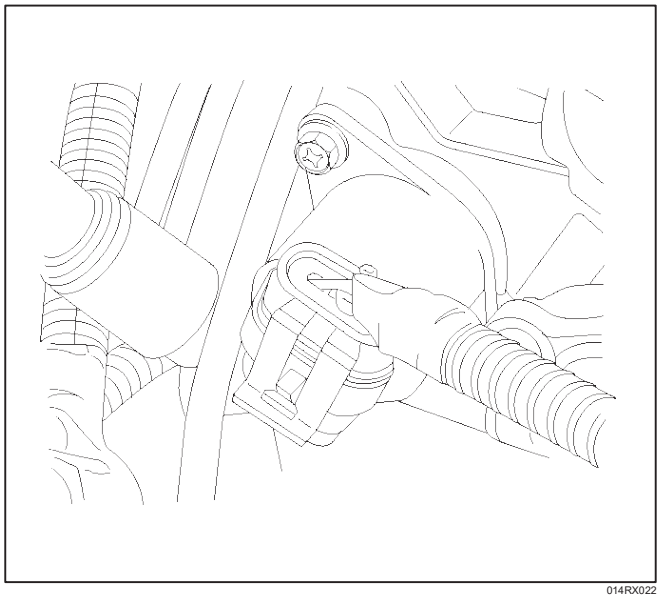
IMPORTANT: Use an identical replacement part in order to replace a valve. IAC valve pintle shape and diameter are designed for the specific application.



TS23746

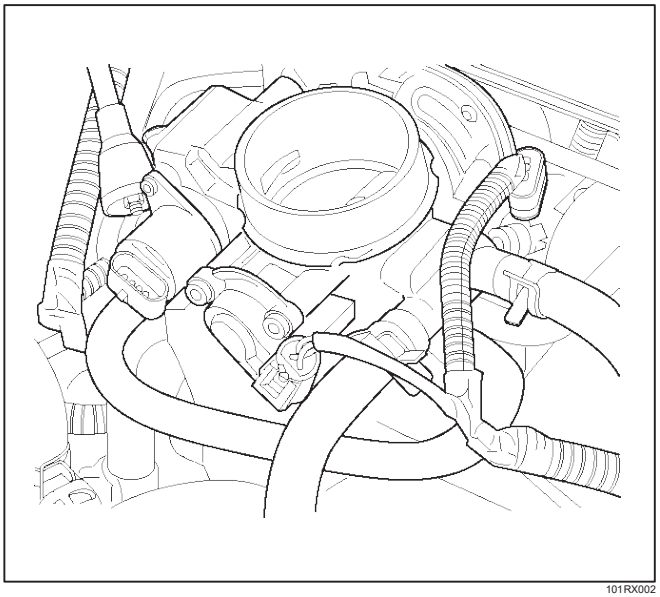
Installation Procedure

1. Install IAC valve on the throttle valve body with the two screws. Tighten the screw to 1 Nm (9 lb in).



014RX022

2. Connect electrical connector to IAC valve.
3. Connect the negative battery cable.

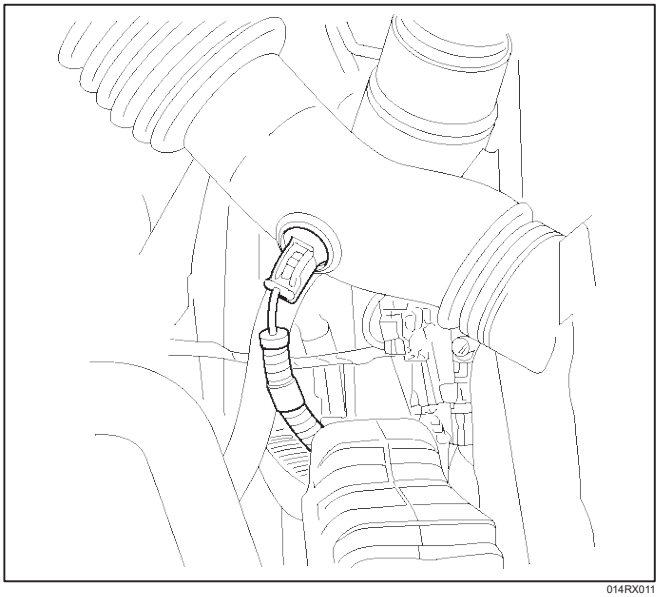


101RX002

Intake Air Duct

Removal Procedure

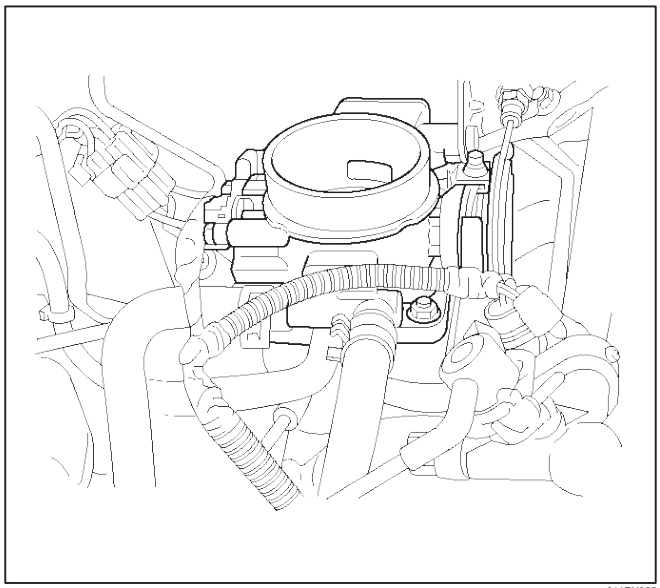
1. Disconnect the negative battery cable.
2. Disconnect electrical connector at IAT sensor.
3. Remove the IAT sensor if necessary. Refer to Intake Air Temperature Sensor Removal.



014RX011

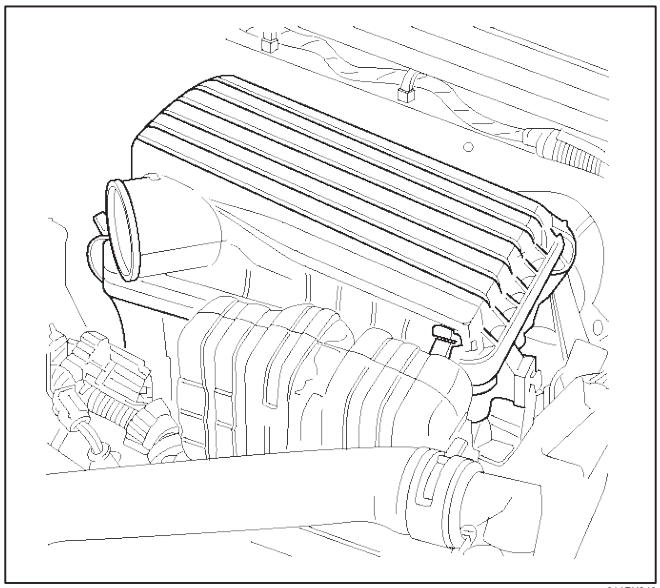
4. Loosen retaining clamps at the throttle body and at the air filter box.

5. Disconnect brake booster vacuum hose at intake manifold and at brake booster.



014RX025

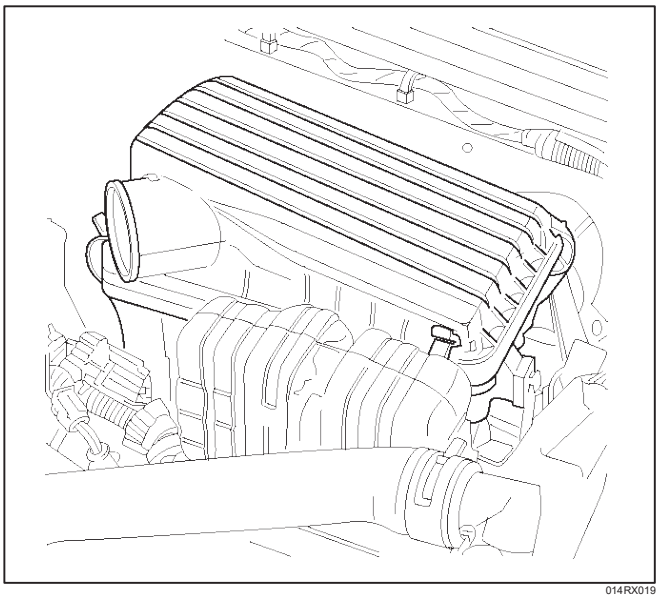
6. Remove retaining nut at the intake air duct bracket at top of valve cover.
7. Disconnect the intake air duct from the throttle body and at the air filter box.



014RX019

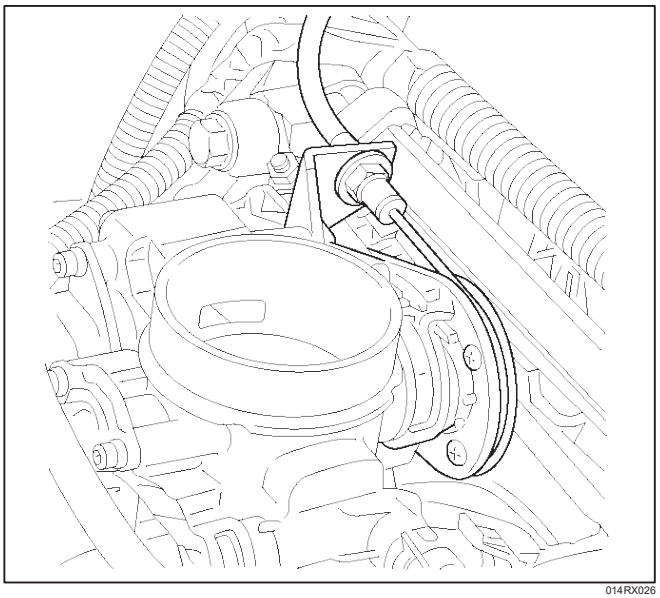
Installation Procedure

1. Connect the intake air duct at the throttle body and at the air filter box. Make sure retaining hole is inserted to the intake air duct bracket.



014RX019

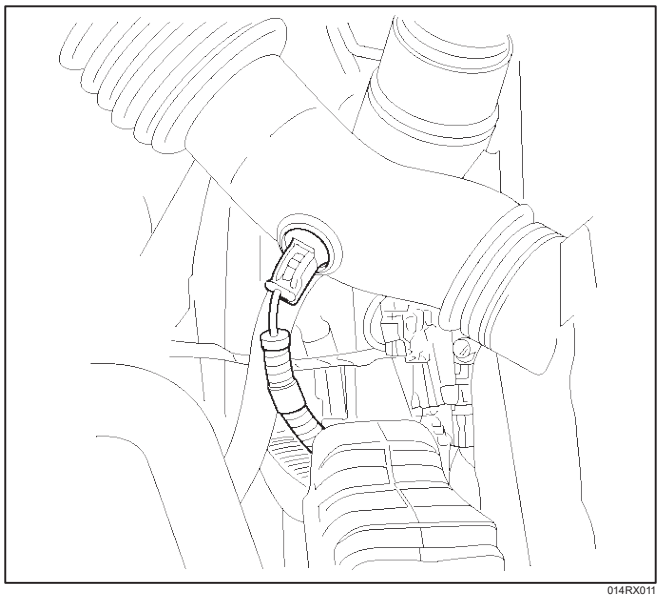
2. Tighten retaining clamp at the throttle body and at the air filter box.
3. Install a nut to the intake air duct bracket and tighten.
4. Connect brake booster vacuum hose to intake manifold and to brake booster and secure them with clamps.



014RX026

5. Install IAT sensor if necessary. Refer to Intake Air Temperature Sensor Installation.
6. Connect electrical connector at IAT sensor.

7. Connect the negative battery cable.

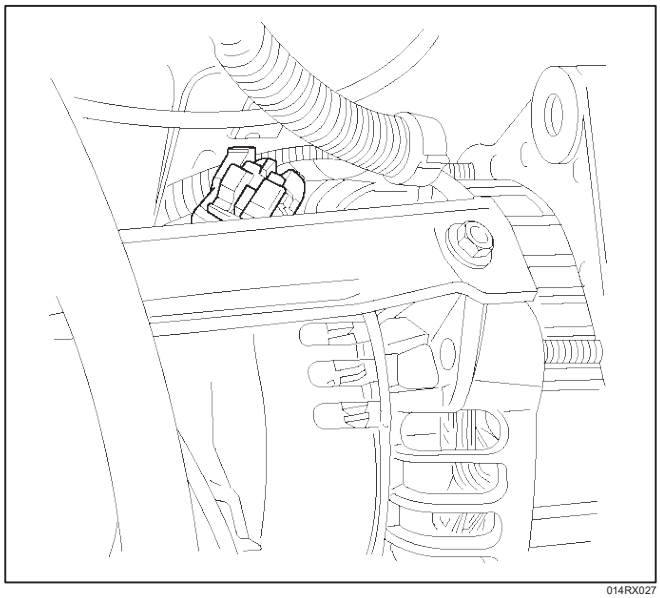

014RX011

IMPORTANT: Use an identical replacement part in order to replace a valve. IAC valve pintle shape and diameter are designed for the specific application.

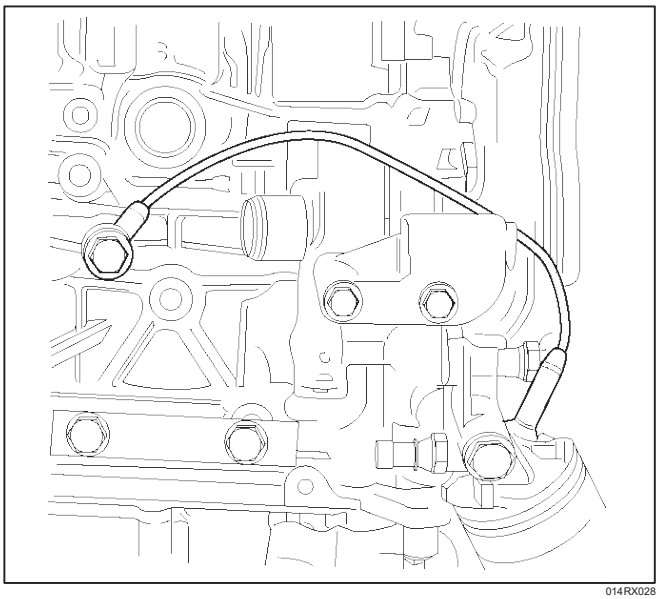
Knock Sensor

Removal Procedure

1. Disconnect negative battery cable.
2. Disconnect pig tail electrical connector at near the top of generator.


014RX027

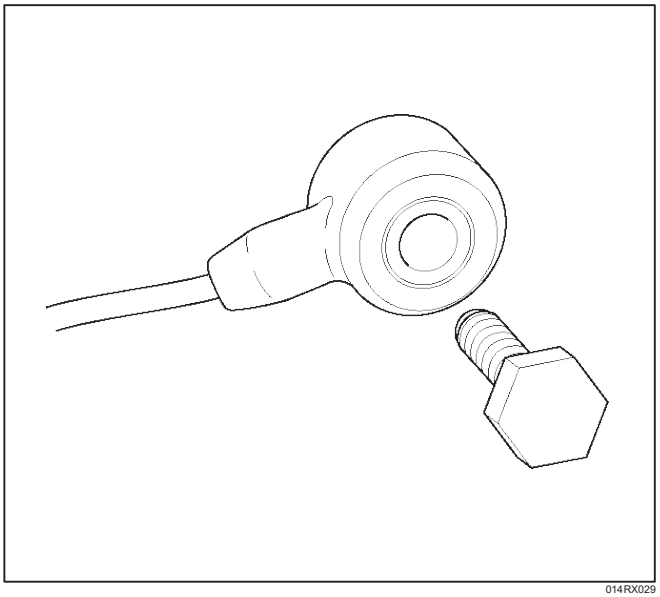
3. Unscrew retaining bolt from Knock Sensor located passenger side of engine block just front of starter.


014RX028

4. Remove Knock Sensor with retaining bolt.

Installation Procedure

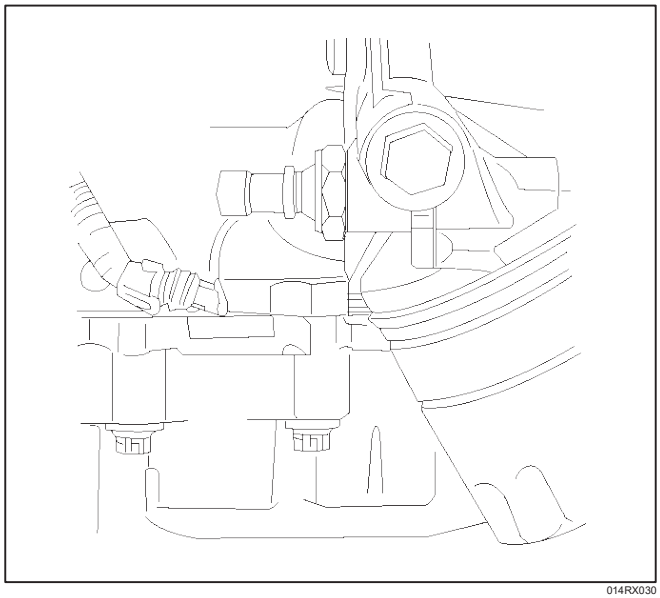
1. Install Knock Sensor with retaining bolt.
2. Connect pig tail electrical connector.
3. Connect battery negative cable.


014RX029

Oil Pressure Switch

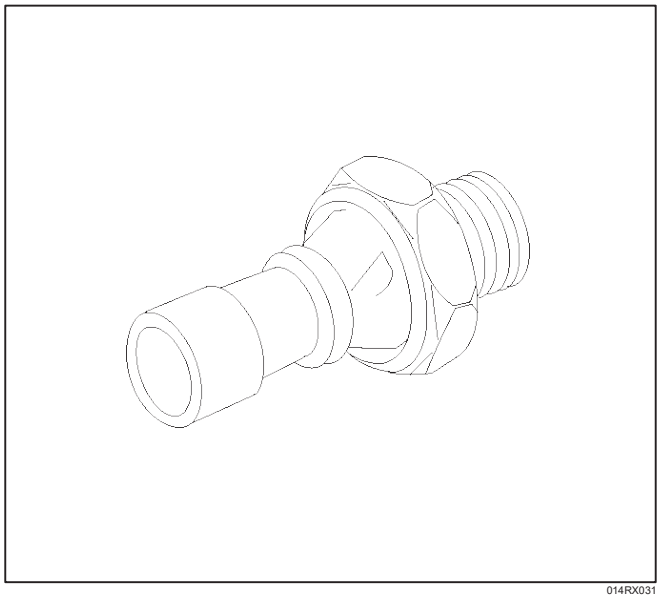
Removal Procedure

1. Disconnect battery negative cable.
2. Disconnect electrical connector at Oil Pressure Switch.



014RX030

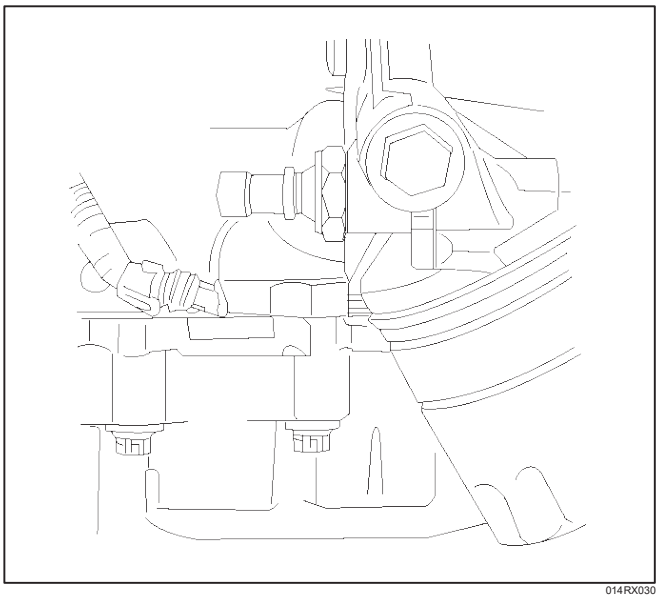
3. Unscrew Oil Pressure Switch from Oil Filter Mounting Housing.



014RX031

Installation Procedure

1. Install Oil Pressure Switch into Oil Filter Mounting Housing and tighten.
2. Connect electrical connector.
3. Connect battery negative cable.

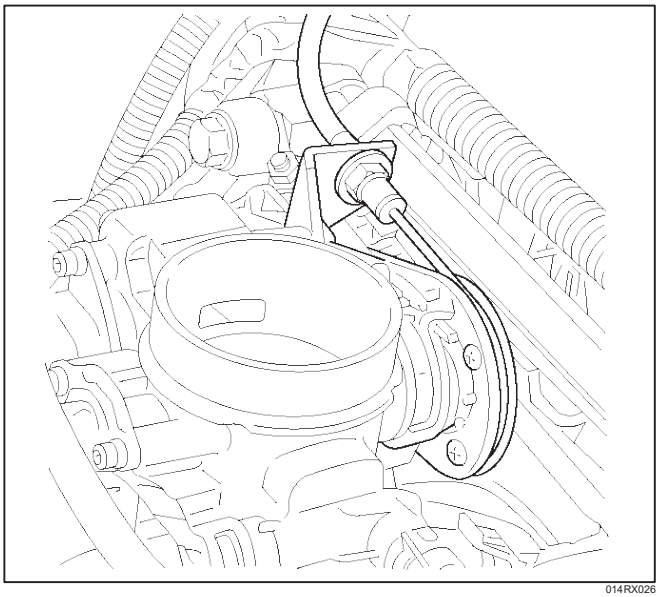


014RX030

FUEL METERING SYSTEM
Accelerator Cable Assembly

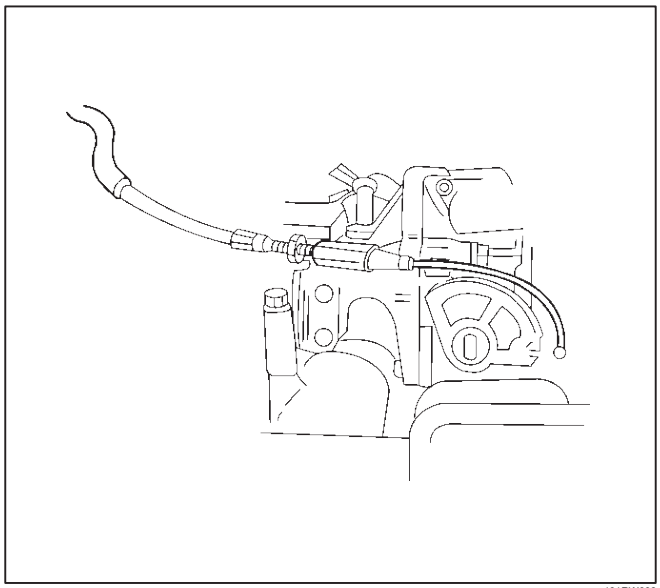
Removal Procedure

1. Loosen the adjusting nut on the cable bracket mounting on the throttle body.
2. Remove the cable clip from holding bracket.



014RX026

3. Remove accelerator control cable (on the throttle valve end).

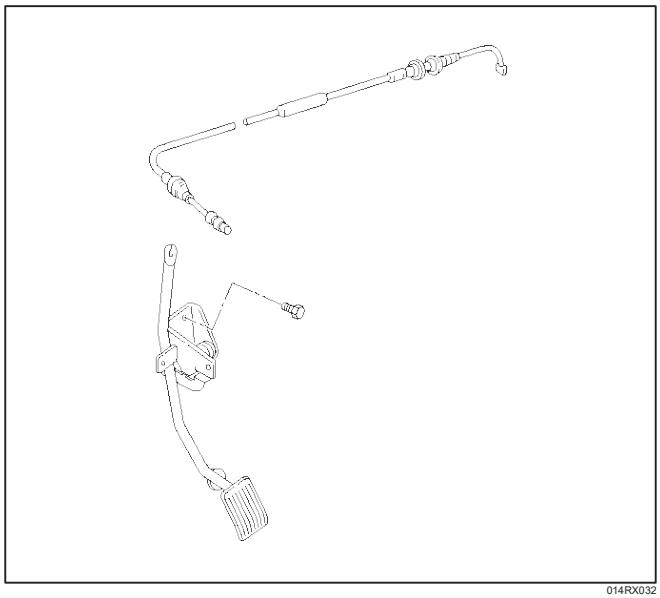

101RW006

4. Remove the accelerator control cable (on the accelerator pedal end).
5. Remove the grommet.
6. Remove the accelerator control cable.

Inspection Procedure

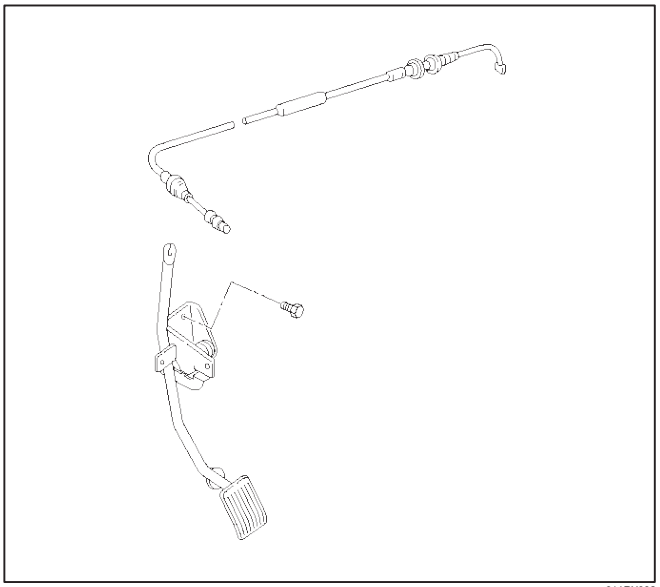
Check the following items, and replace the control cable if any abnormality is found:

- The control cable should move smoothly.
- The control cable should not be bent or kinked.
- The control cable should be free of damage and corrosion.

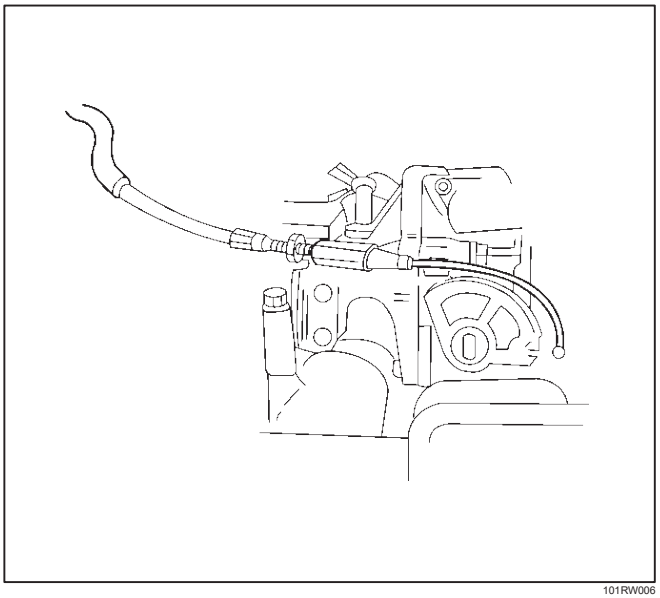

014RX032

Installation Procedure

1. Install the accelerator control cable.
2. Install the grommet.
3. Install the accelerator control cable on the accelerator pedal.

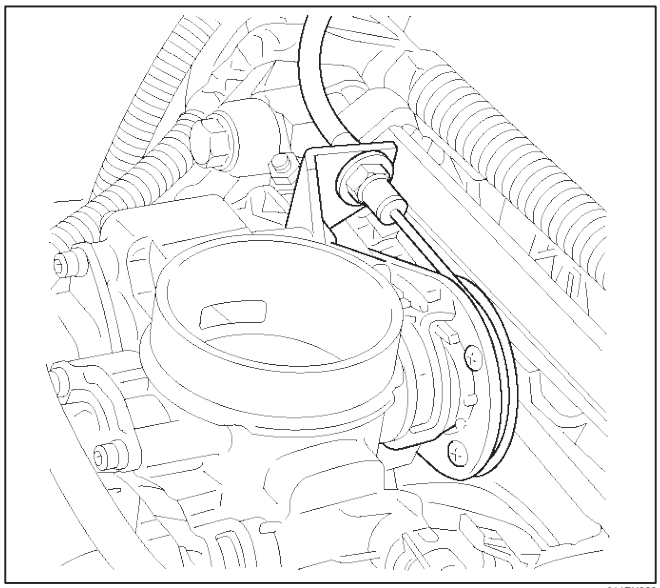

014RX032

4. Install the accelerator control cable on the throttle valve.


101RW006

5. Install the cable clip to the holding bracket.

6. Adjust the accelerator cable. Refer to Accelerator Cable Adjustment Section.

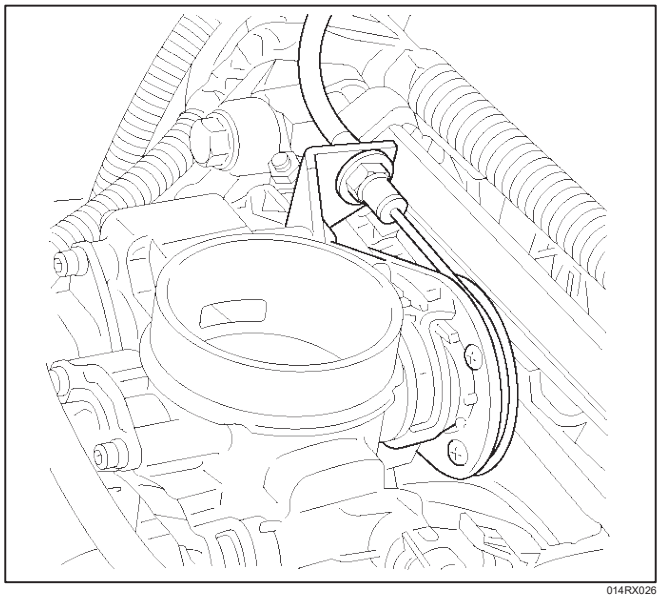

014RX026

Accelerator Cable Adjustment

Adjustment Procedure

1. Loosen the adjusting nut.
2. Loosen the jam nut.
3. Pull the outer cable while fully closing the throttle valve.
4. Tighten the adjusting nut.
5. Tighten the jam nut.
6. Loosen the adjusting nut by three turns.
7. Tighten the jam nut again.
8. Manually operate valve.

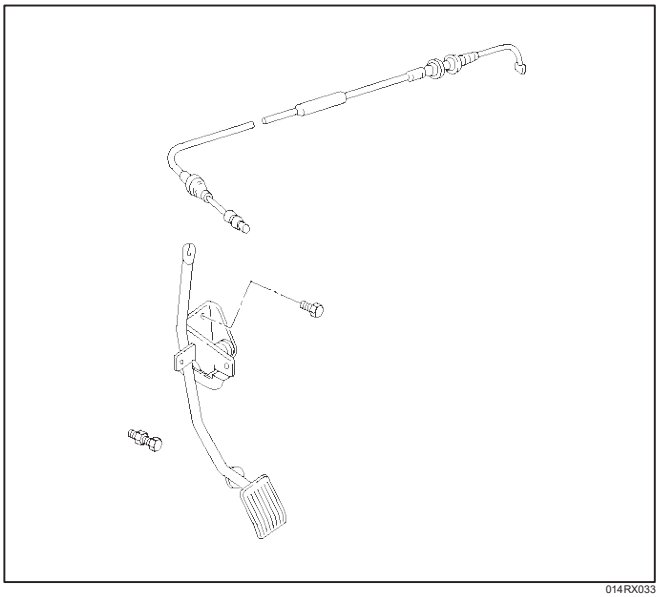
IMPORTANT: The valve lever must return up to the stopper screw. If the valve lever does not reach the stopper screw, repeat the procedure again from Step 1.


014RX026

Accelerator Pedal Replacement

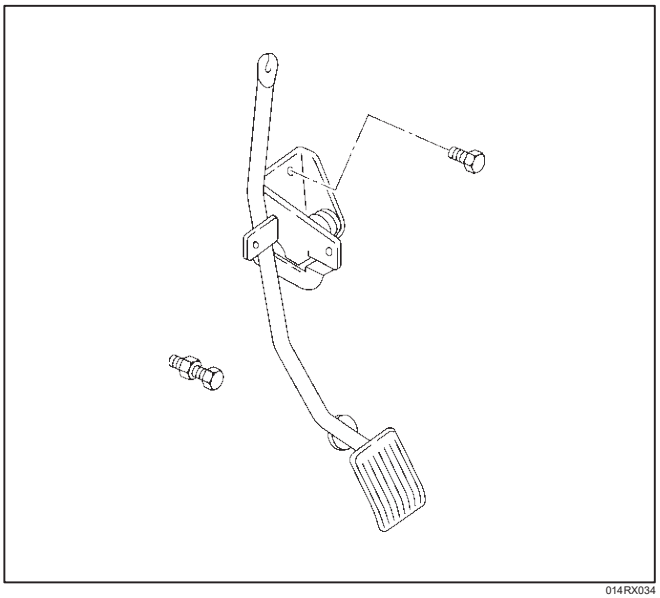
Removal Procedure

1. Disconnect the accelerator pedal control cable from the acceleratorpedal assembly.
2. Remove the two screws retaining the accelerator pedal to the bulkhead.
3. Remove the accelerator pedal from the bulkhead.


014RX033

Installation Procedure

1. Install the accelerator pedal assembly to the bulkhead with two screws.
2. Connect the accelerator control cable to the accelerator pedal assembly.
3. Adjust accelerator cable if necessary. Refer to Accelerator Cable Adjustment Section.


014RX034

Fuel Filler Cap

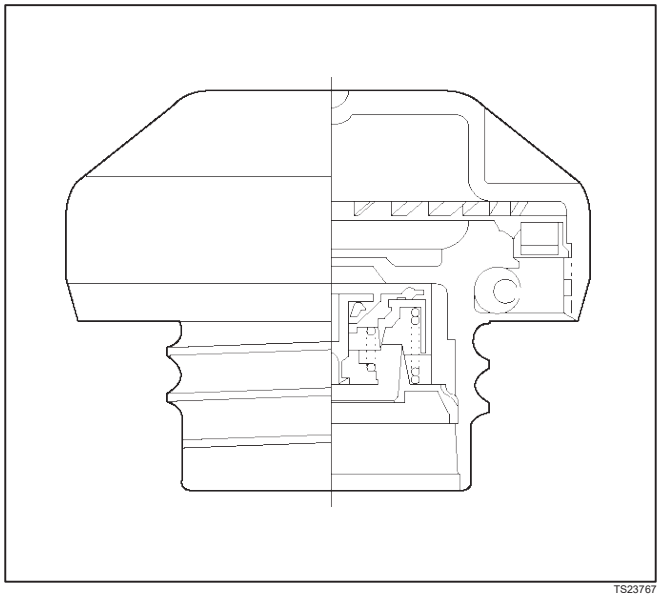
Fuel Filler Cap

The Fuel filter cap includes a vacuum valve and a pressure valve. If high vacuum or pressure occurs in the fuel tank, each valve works to adjust the pressure in order to prevent damage to the tank at the EGR valve.

Inspection Procedure

NOTE: Replace the fuel filler cap with the same typeof filler cap that was originally installed on the vehicle.

- Check the seal ring in the filler cap for any abnormality and for seal condition.
- Replace the filler cap if any abnormality is found.

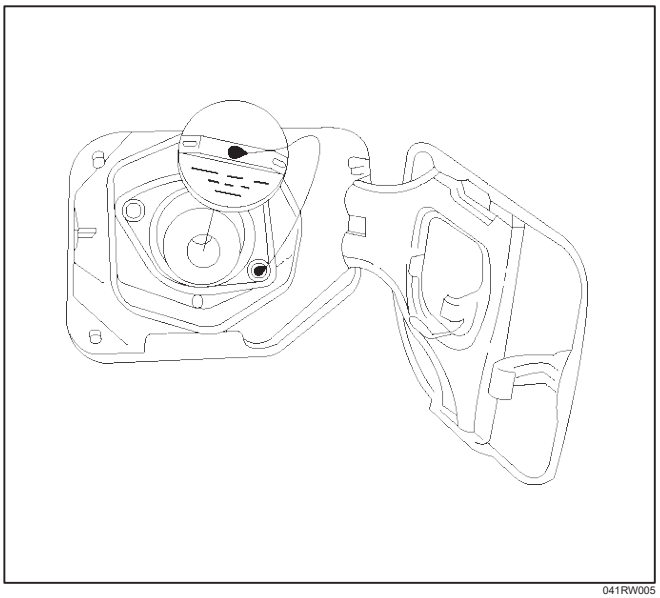


TS23767

Fuel Filter

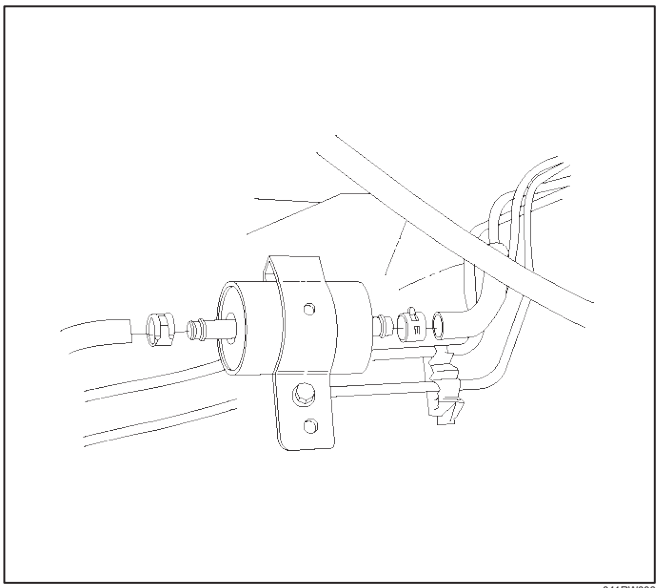
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the fuel filler cap.



041RW005

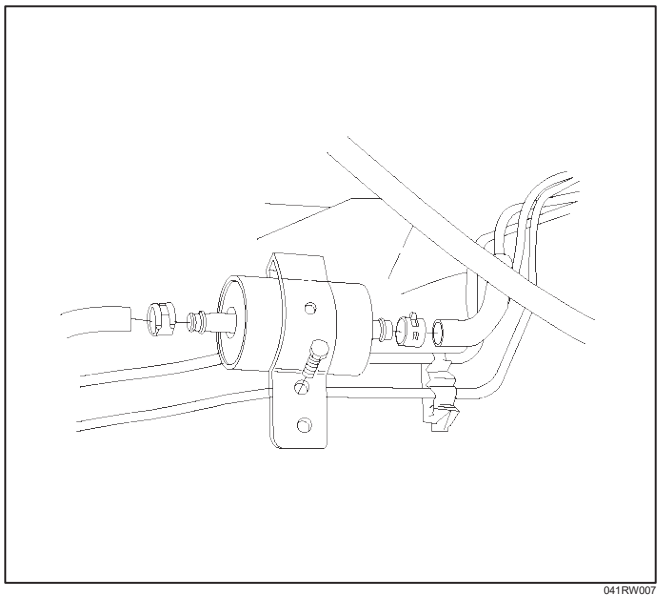
3. Disconnect the fuel lines from the fuel filter on the engine side.
4. Disconnect the fuel line from the fuel filter on the fuel tank side.



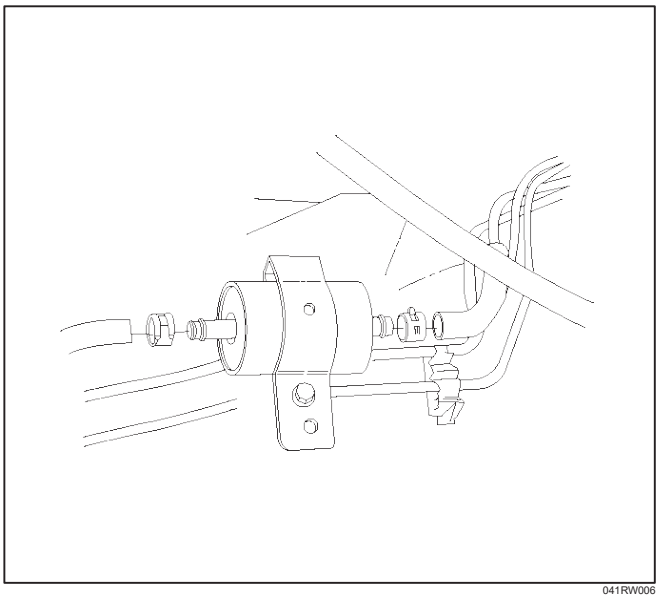
041RW006

5. Remove the bolt on the fuel filter holder.

6. Remove the fuel filter.

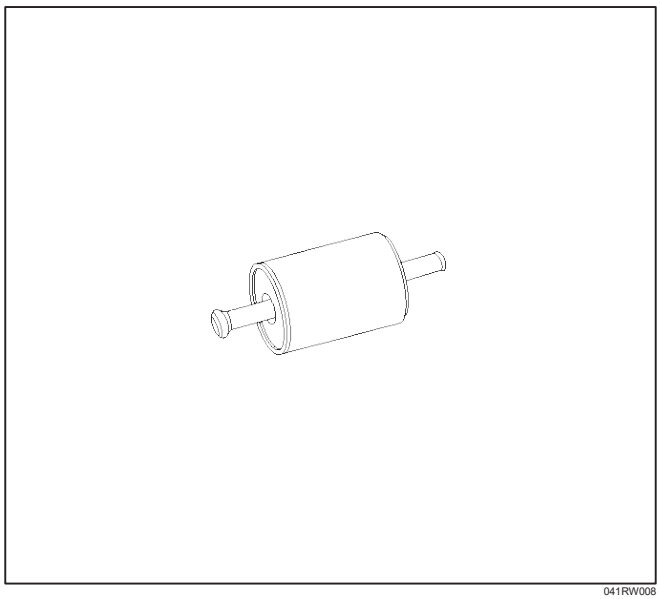

041RW007

6. Connect the negative battery cable.


041RW006

Inspection Procedure

1. Replace the fuel filter when the following occur:
   - Fuel leaks from the fuel filter body
   - The fuel filter body is damaged
   - The fuel filter is clogged with dust or sediment
2. If the drain hole is clogged at filler neck is clogged with dust, clean the drain hole with air.


041RW008

Installation Procedure

1. Install the fuel filter in the correct direction.
2. Install the bolt on the fuel filter holder.
3. Connect the fuel line on the engine side.
4. Connect the fuel line on the fuel tank side.
5. Install the fuel filler cap.

Fuel Injectors

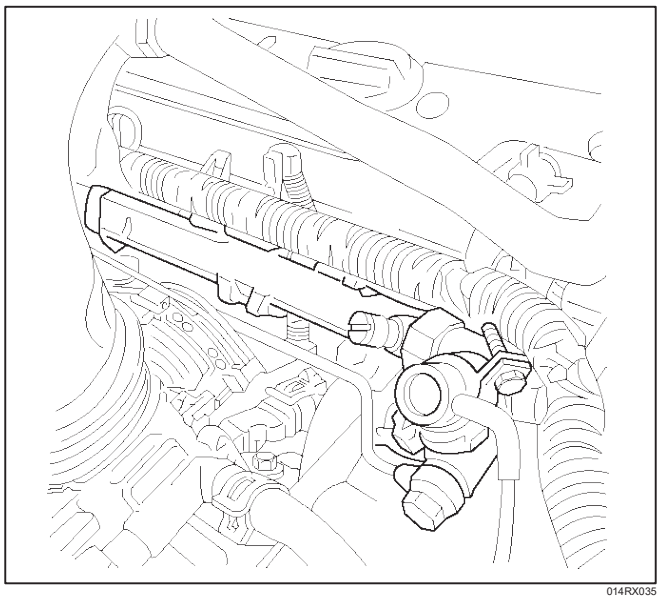
Removal Procedure

NOTE: If the fuel injectors are leaking, the engine oil may be contaminated with fuel. Check the oil for signs of contamination and change the oil and filter if necessary.

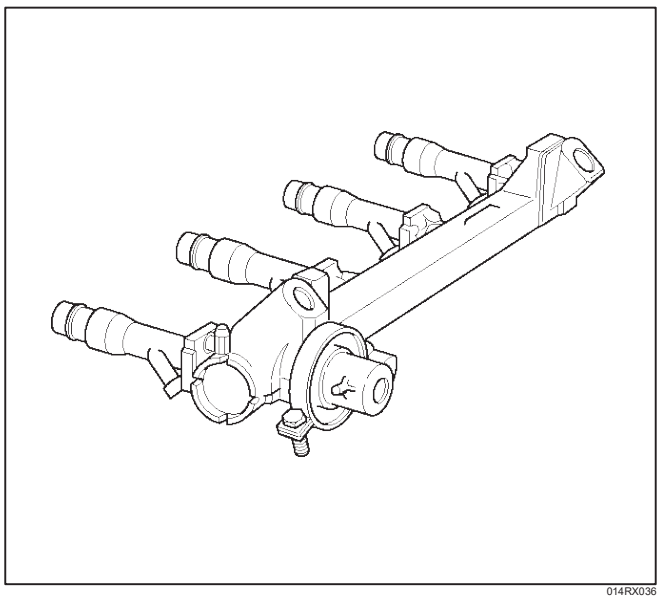
NOTE: Use care in removing the fuel injector in order to prevent damage to the fuel injector electrical connector pins or fuel injector nozzles. The fuel injector is an electrical component and should not be immersed in any type of cleaner as this may damage the fuel injector.

IMPORTANT: Fuel injectors are serviced as complete assembly only.

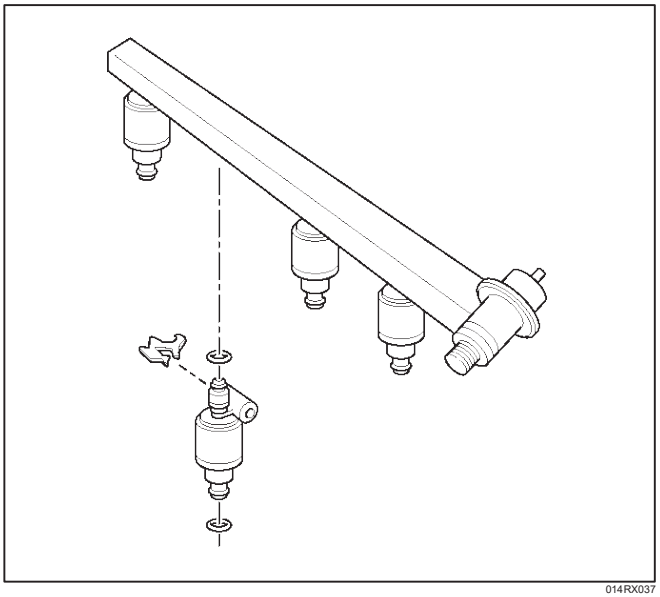
1. Disconnect the negative battery cable.


014RX035

2. Disconnect electrical connector from fuel injector.
3. Remove the fuel rail. Refer to Fuel Rail Removal Procedure.


014RX036

4. Remove the fuel injector retainer clip.
5. Remove fuel injector assembly from fuel rail.
6. Remove O–ring from the fuel injector.
7. Remove O–ring backup from fuel injector.

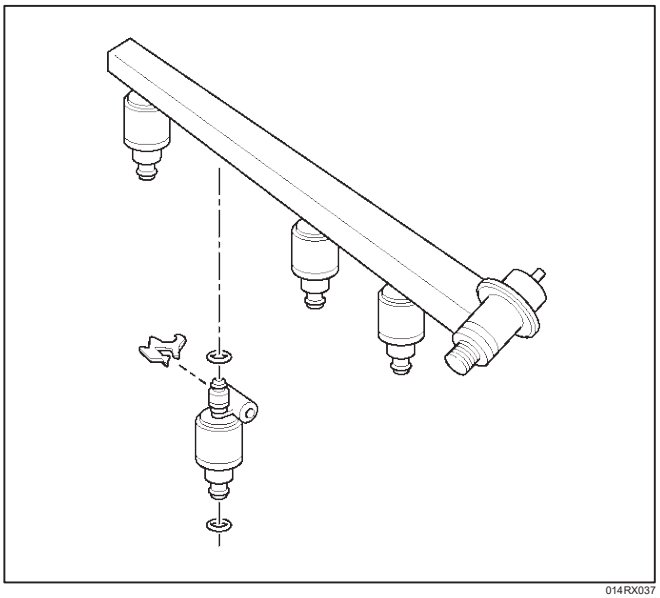

014RX037

Inspection Procedure

1. Inspect O–ring for crack, damage or leaks.
2. Replace worn or damaged O–ring.
3. Lubricate the new O–rings with engine oil before installation.

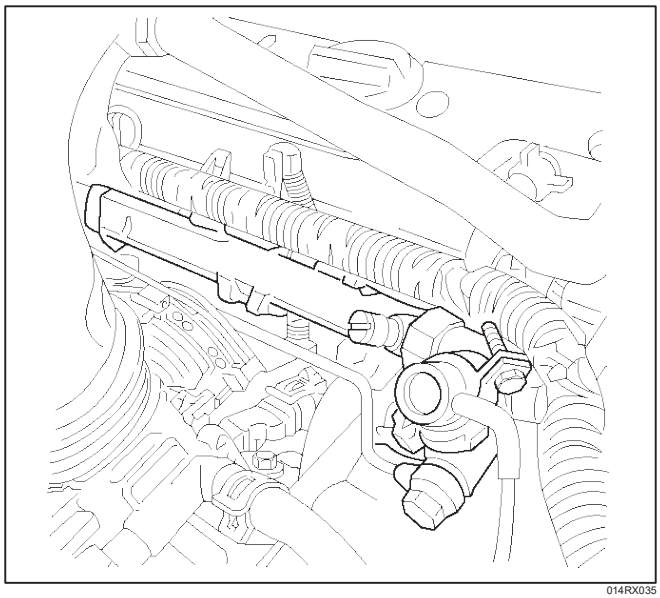
Installation Procedure

1. Lubricate the new O–ring with engine oil.
2. Install the O–ring backup on the fuel injector.
3. Install new O–ring on the fuel injector.
4. Install all four injector on the fuel rail.
5. Use new injector retainer clip to retain the injector to the fuel rail.
6. Coat the end of the fuel injector with engine oil.


014RX037

7. Install fuel rail assembly. Refer to Fuel Rail Installation Procedure.

8. Connect the negative battery cable.


014RX035

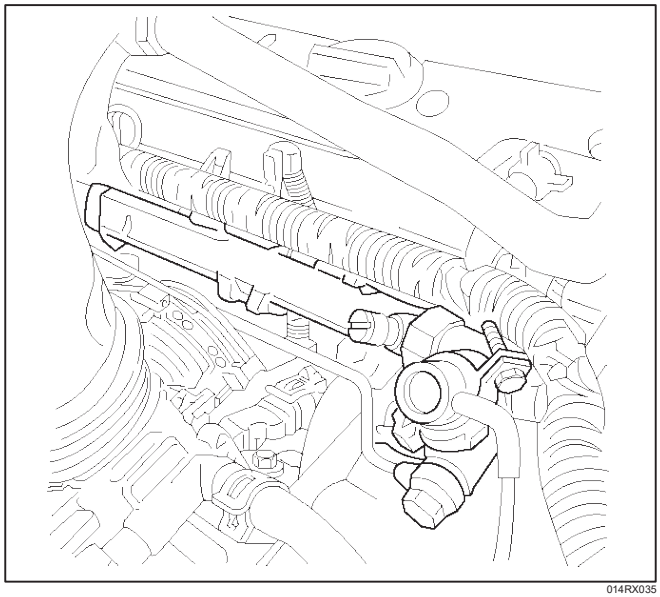
Fuel Pressure Regulator

Removal Procedure

CAUTION: To reduce the risk of fire and personal injury, it is necessary to relieve the fuel system pressure before servicing the fuel system components.

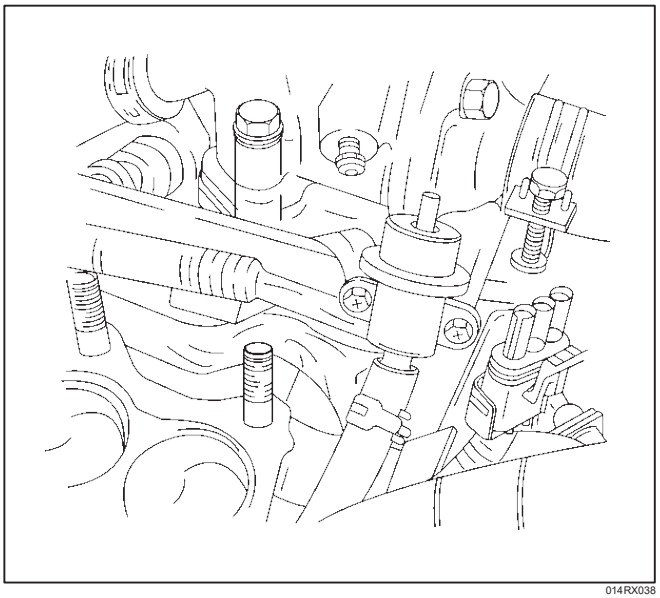
CAUTION: After relieving the fuel system pressure, a small amount of fuel may be released when servicing fuel lines or connections. Reduce the chance of personal injury by covering the fuel line fitting with a shop towel before disconnecting the fittings. The towel will absorb any fuel that may leak out. When the disconnect is completed, place the towel in an approved container.

NOTE: Compressed air must never used to test or clean a fuel pressure regulator, as damage to the fuel pressure regulator may occur.

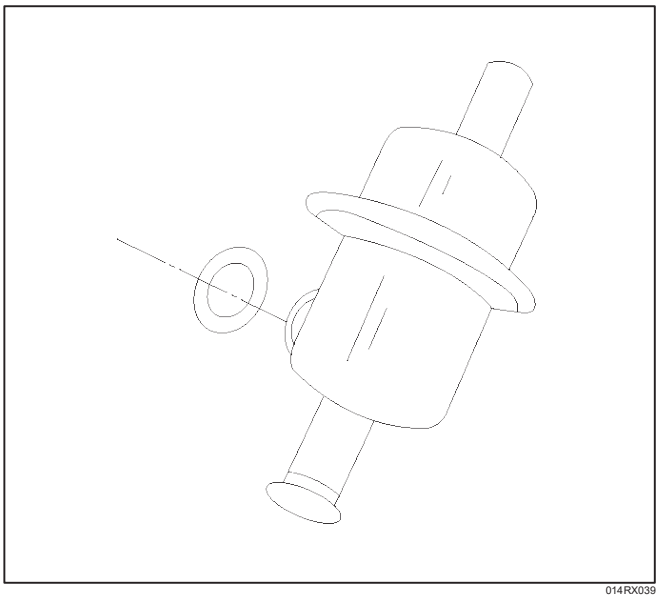

014RX035

NOTE: To prevent damage to the fuel pressure regulator, do not immerse the pressure regulator in solvent.

1. Depressurize the fuel system. Referto Fuel Pressure Relief Procedure.
2. Disconnect the negative battery cable.
3. Remove the fuel pump relay.
4. Disconnect the vacuum line form fuel pressure regulator.

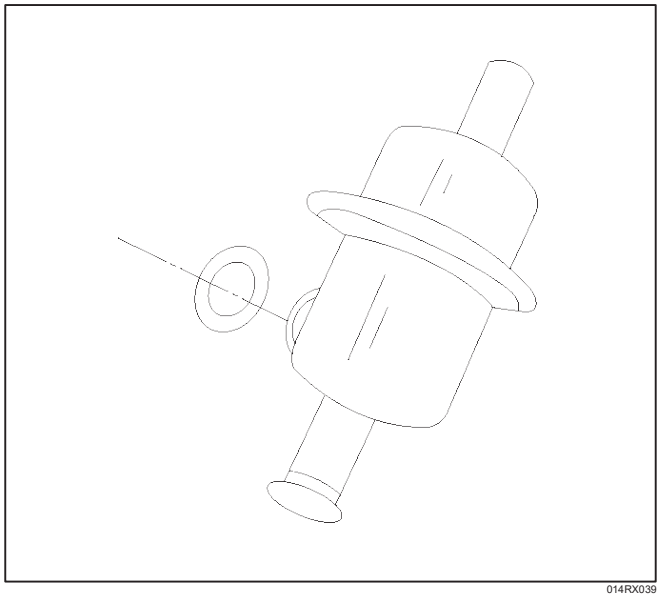

014RX038

5. Remove the fuel pressure regulator retaining screw.
6. Remove the fuel pressure regulator retaining bracket.
7. Remove the fuel pressure regulator from fuel rail.


014RX039

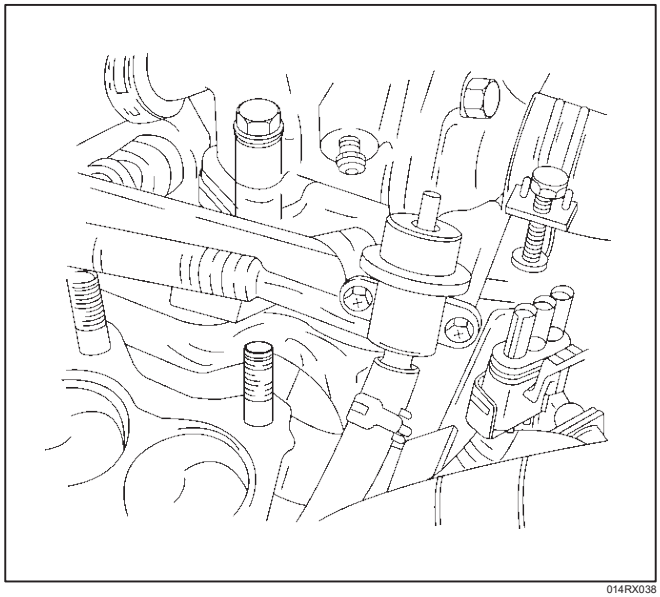
Installation Procedure

1. Insert the fuel pressure regulator into the fuel rail.



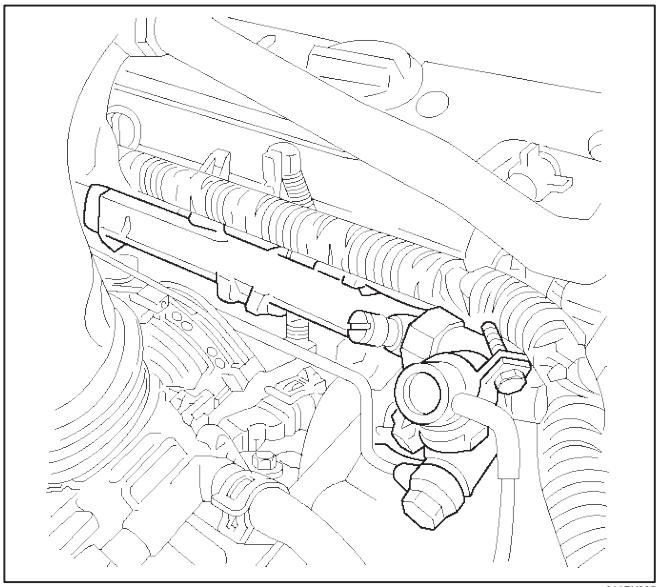
014RX039

2. Install the fuel pressure regulator retaining bracket ant tighten with a screw.
3. Connect vacuum line onto the fuel pressure regulator.



014RX038

4. Install the fuel pump relay.
5. Connect the negative battery cable.
6. Crank the engine until it starts. Cranking the engine may take longer than usual due to trapped air in the fuel line.



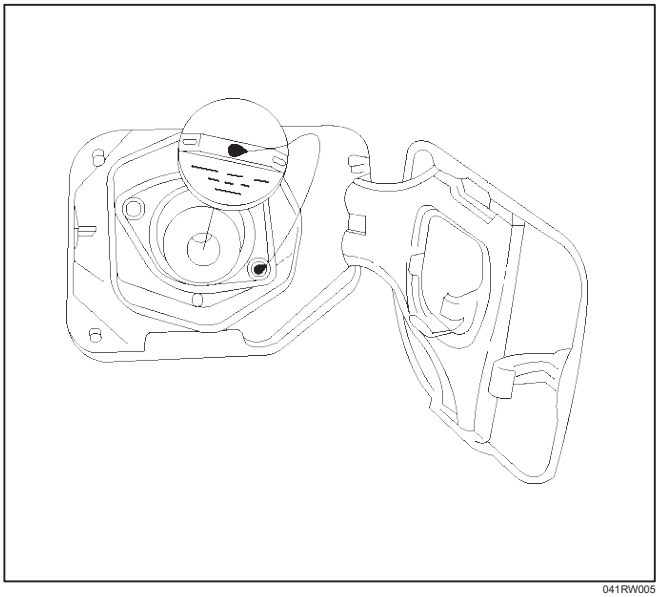
014RX035

Fuel Pressure Relief Procedure

CAUTION: To reduce the risk of fire and personal injury, it is necessary to relieve the fuel system pressure before servicing the fuel system components.

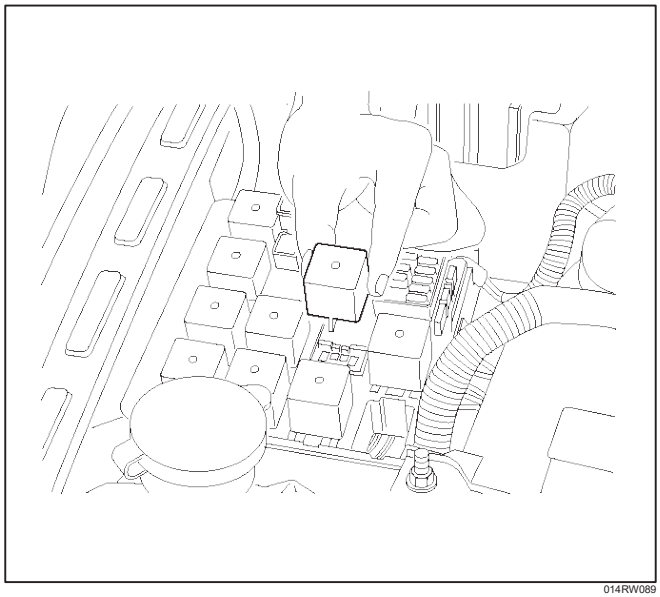
CAUTION: After relieving the fuel system pressure, a small amount of fuel may be released when servicing fuel lines or connections. Reduce the chance of personal injury by covering the fuel line fitting with a shop towel before disconnecting the fittings. The towel will absorb any fuel that may leak out. When the disconnect is completed, place the towel in an approved container.

1. Remove the fuel filler cap.



041RW005

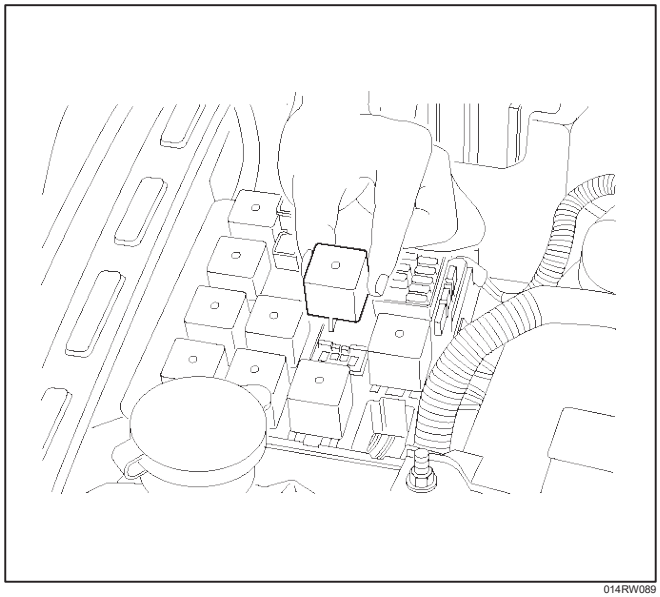
2. Remove the fuel pump relay from the underhood relay box.
3. Start the engine and allow it to stall.
4. Crank the engine for about 30 seconds.
5. Disconnect the negative battery cable.


014RW089

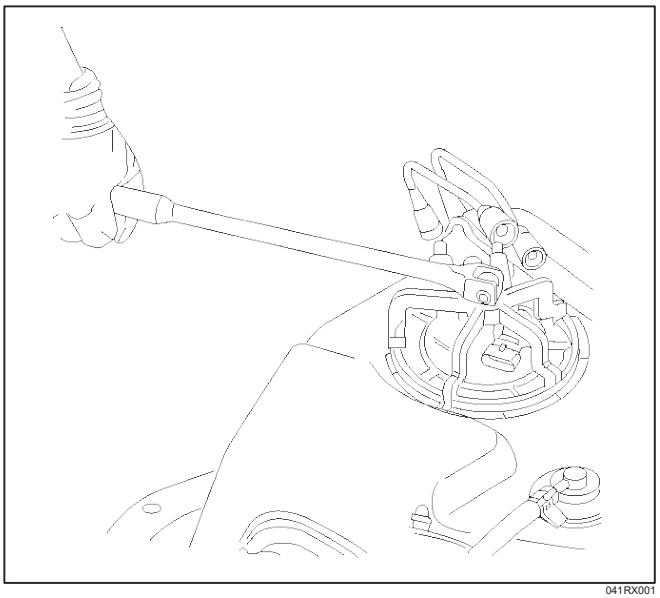
Fuel Pump Assembly

Removal Procedure

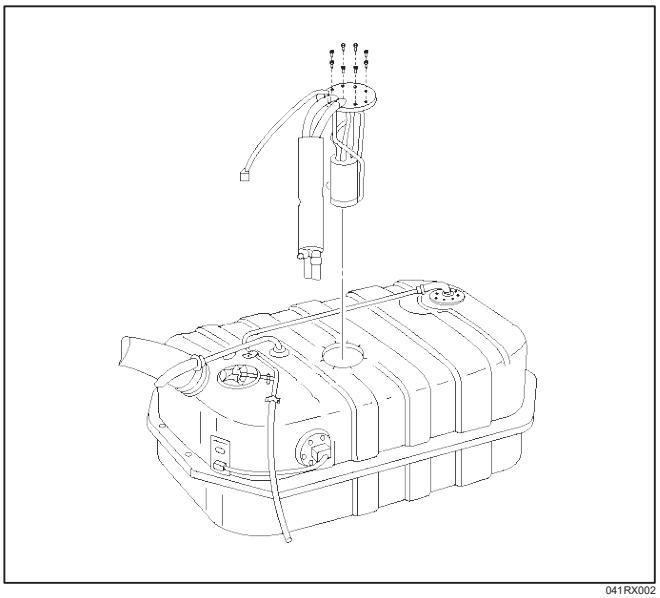
1. Disconnect the negative battery cable.
2. Drain all fuel from fuel tank from filler neck.
3. Remove the fuel pump relay from the fuse and relay box at right side of engine room.


014RW089

4. Remove fuel tank. Refer to Fuel Tank Removal Procedure.
5. Using J–39763, twist the fuel pump counter–clock wise to release from fuel tank.

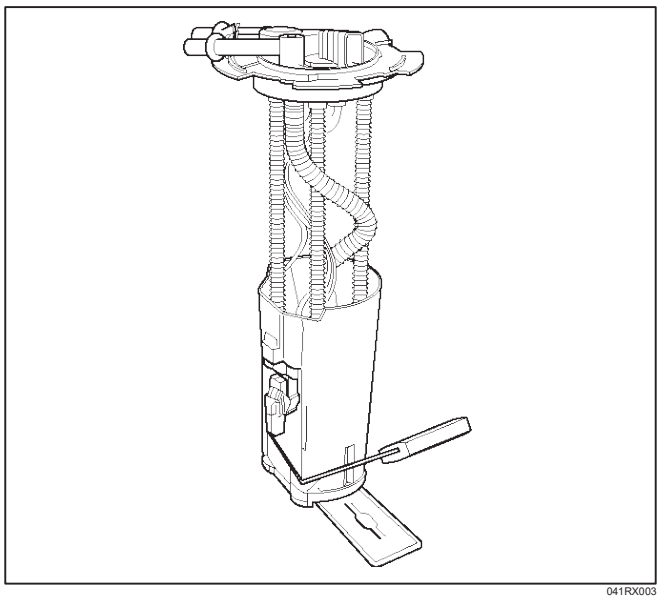

041RX001

6. Lift fuel pump to remove from fuel tank.


041RX002

Inspection Procedure

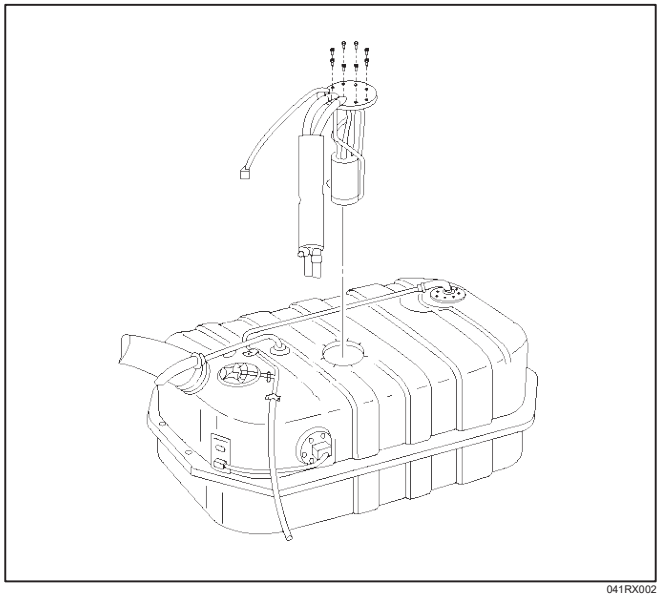
Inspect in–tank fuel filter for tears, damage or evidence of dirt derbies or water in the fuel. If any of these condition exist, replace the in–tank fuel filter.



041RX003

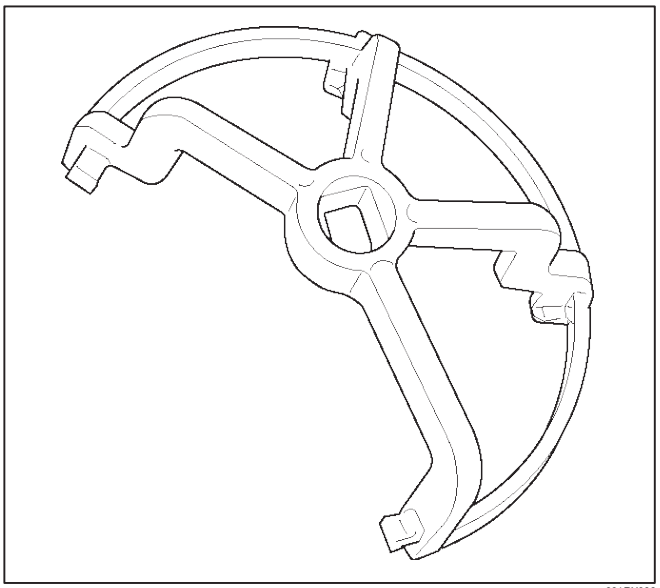
Installation Procedure

1. Insert the fuel pump assembly into fuel tank and place them at its position.



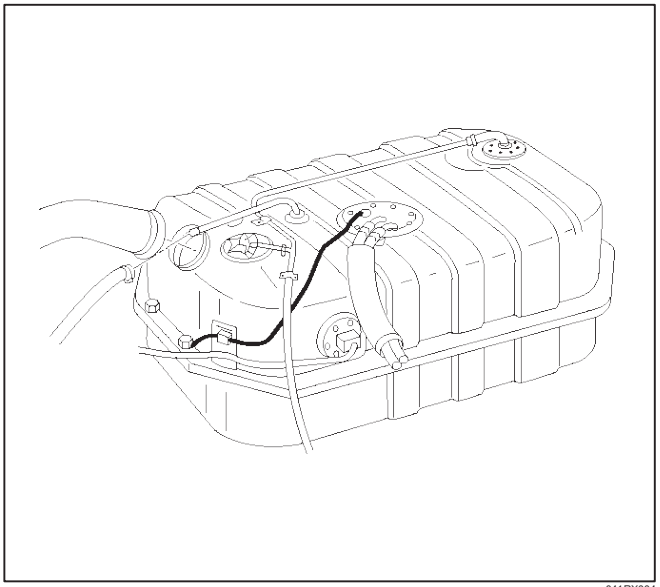
041RX002

2. Using J–39763, twist fuel pump assembly clock wise into the lock.



901RX036

3. Install the fuel tank. Refer to Fuel Tank Installation Procedure.
4. Install the fuel pump relay.
5. Connect the negative battery cable.



041RX004

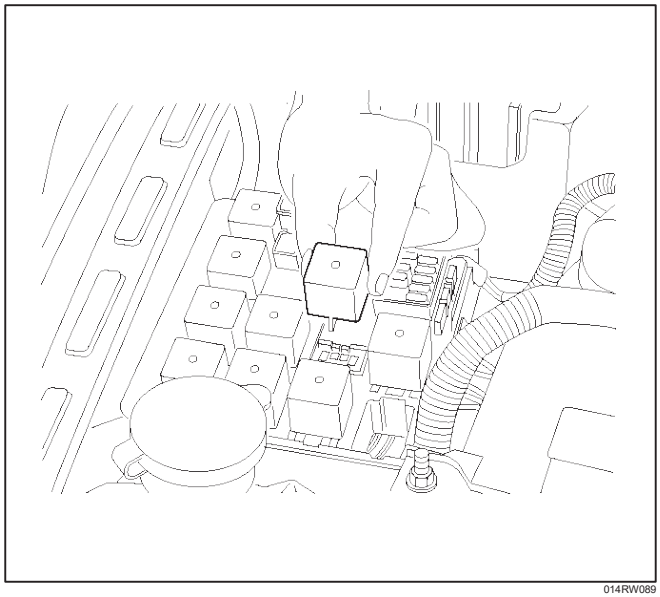
Fuel Pump Relay

Removal Procedure

1. Remove the fuse and relay box cover located right side of engine room.
2. Determine correct relay by consulting to the diagram on the cover.
3. Insert a small screwdriver or use thumb pressure to release the retainer of the relay.
4. Pull the relay straight up and out of the fuse and relay box.

Installation Procedure

1. Inserts the relay into the correct place in the fuse and relay box with the catch slot aligned to retainer.
2. Press down until the catch of retainer engages.
3. Install fuse and relay box cover.



014RW089

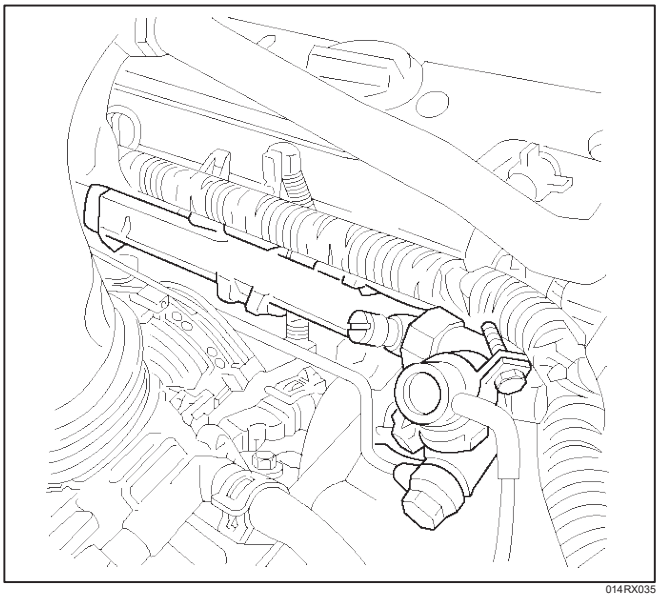
Fuel Rail Assembly

Removal Procedure

NOTE:

- Use care when removing the fuel rail assembly in order to prevent damage to the injector electrical connector terminal and the injector spray tips.
- Fitting should be capped and holes plugged during servicing to prevent dirt and other contaminants from entering open lines and passage.

IMPORTANT: An eight–digit identification number is stamped on side of the fuel rail. Refer to this number when you service the fuel rail or when a replacement part is required.



014RX035

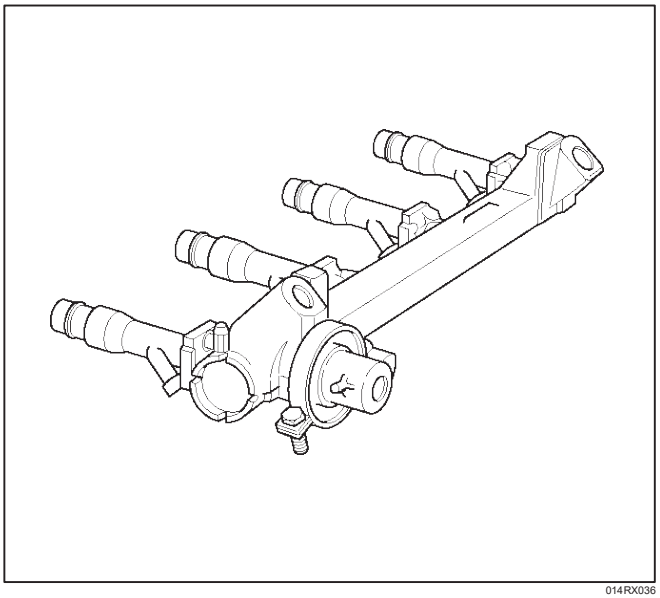
1. Depressurize the fuel system. Refer to Fuel Pressure Relief Procedure.
2. Disconnect the fuel inlet at the rear of the engine.
3. Disconnect the fuel return line at front of the engine.
4. Disconnect the injector electrical connectors.
5. Remove the nuts holding wiring harness onto fuel rail.
6. Remove the bolts retaining fuel rail to the intake manifold.

Lift up the injectors carefully to separate them from intake manifold.

Lift up the fuel rail with injectors as assembly. Do not separate the fuel injectors from fuel rail.

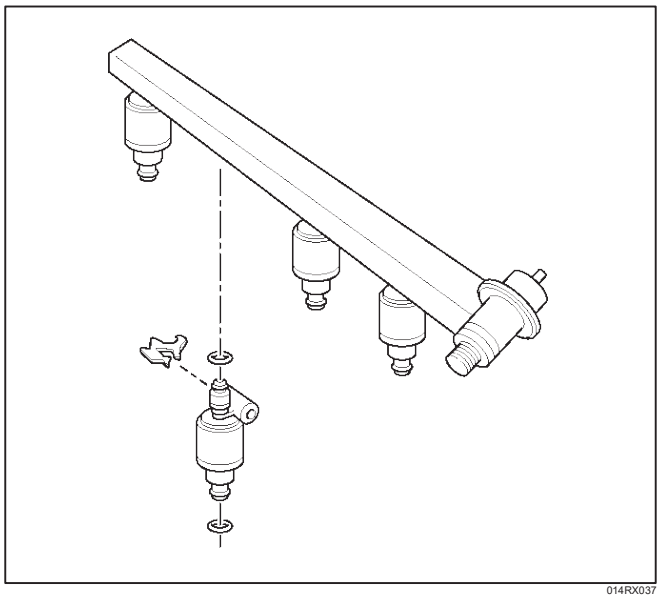
If an injector become separated from fuel rail, injector backup O–ring and injector retainer clip must be replaced.

Drain residual fuel from fuel rail into an approved container.



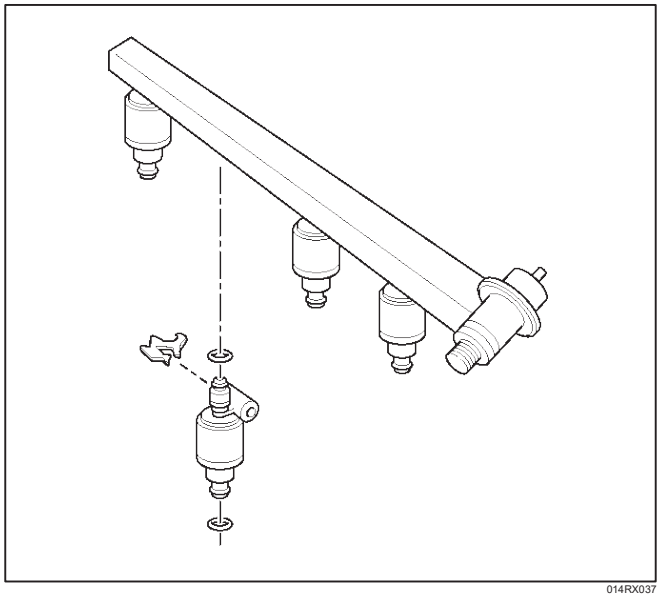
014RX036

7. If removal of fuel pressure regulator is necessary. Refer to Fuel Pressure Regulator Removal Procedure.
8. If removal of fuel injector is necessary. Refer to Fuel Injectors Removal Procedure.

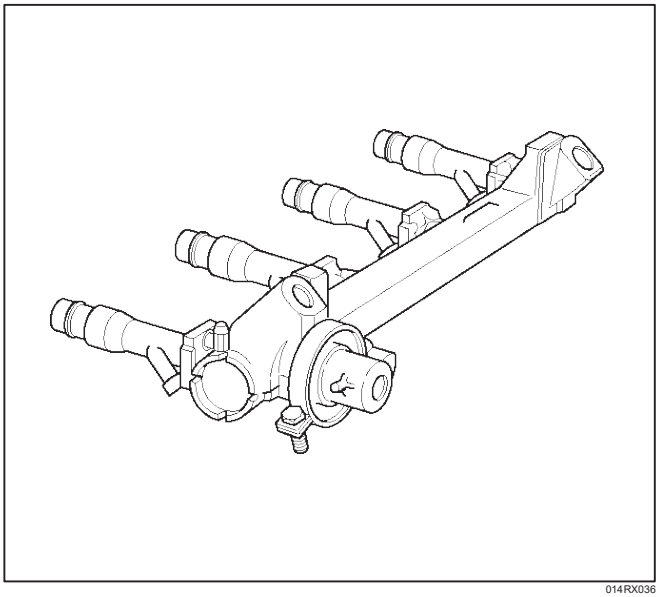

014RX037

Installation Procedure

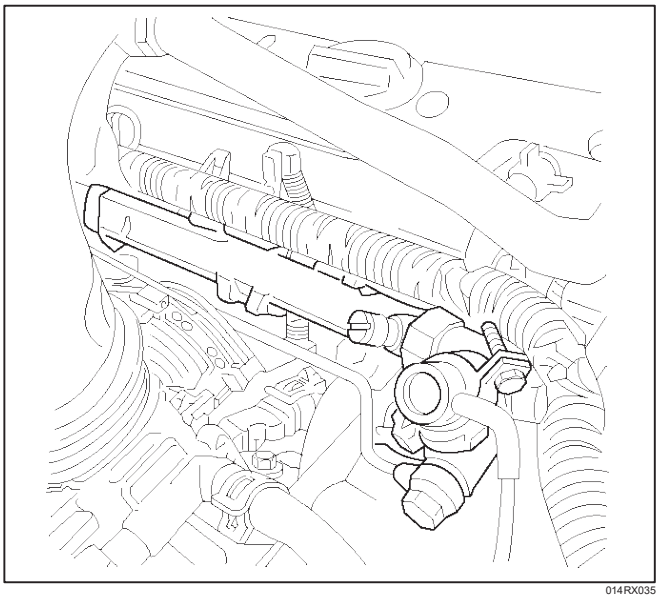
1. Install the fuel injectors if necessary. Refer to Fuel Injector Installation Procedure.
2. Install the fuel pressure regulator if necessary. Refer to Fuel Pressure Regulator Installation Procedure.
3. Place the fuel injector rail assembly on the manifold and insert the injectors into each port by pushing fuel rail.


014RX037

4. Install two fuel rail retaining bolts. Tighten fuel rail retaining bolts to 19 Nm (14 lb ft)
5. Place wiring harness in its place and secure it with two nuts.
6. Connect electrical connector to each fuel injector.


014RX036

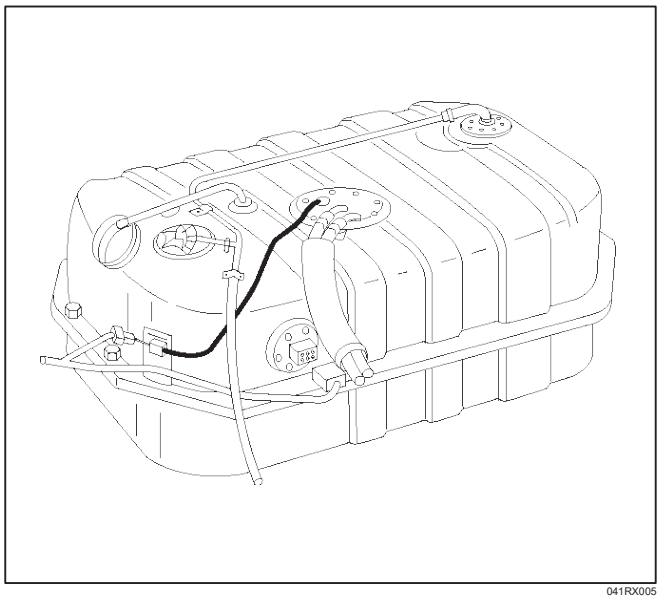
7. Connect the fuel supply line securely. Do not over tighten.
8. Connect the fuel return line securely. Do not over tighten.
9. Connect the negative battery cable.
10. Crank the engine until it start. Cranking the engine may take longer than usual due to trapped air in the fuel system. Check for leak. If fuel leak is observed, stop engine immediately. Before correct fuel leak, be sure to depressurize system again.


014RX035

Fuel Tank

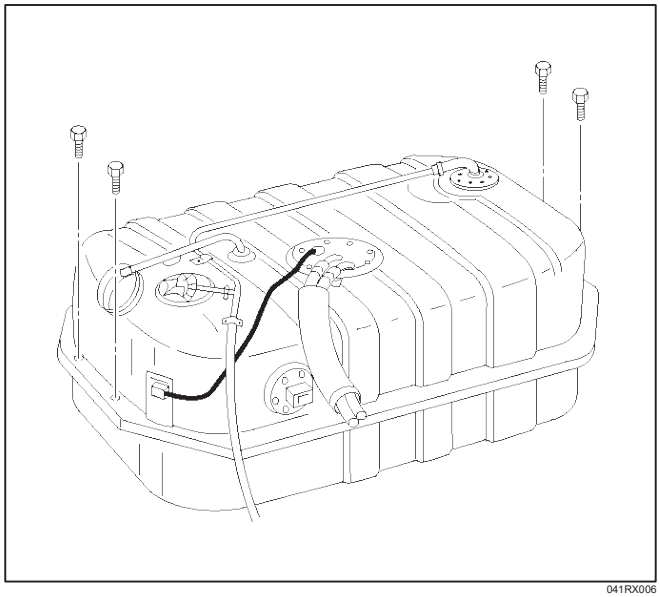
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove fuel filer cap.
3. Drain the fuel from fuel filler neck.
4. Disconnect the fuel filler hose at fuel tank.
5. Disconnect the air breather hose at the fuel tank.
6. Disconnect the evaporator hose at the fuel tank.
7. Hold entire fuel tank at the bottom with stands.
8. Disconnect fuel supply lines and fuel return line at near the fuel filter inside of body frame.



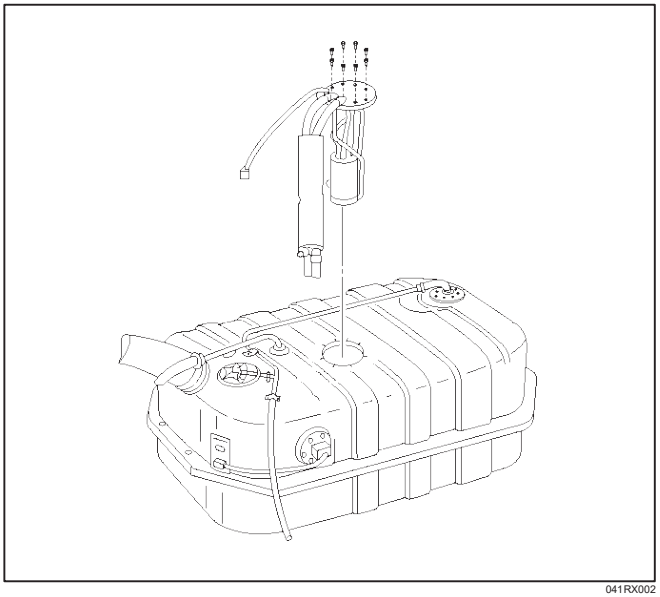
041RX005

9. Remove four bolts (two in front and two in rear) holding fuel tank to the frame.
10. Lower tank assembly from the vehicle a little to make access space on top.
11. Disconnect two electrical connectors at fuel pump.



041RX006

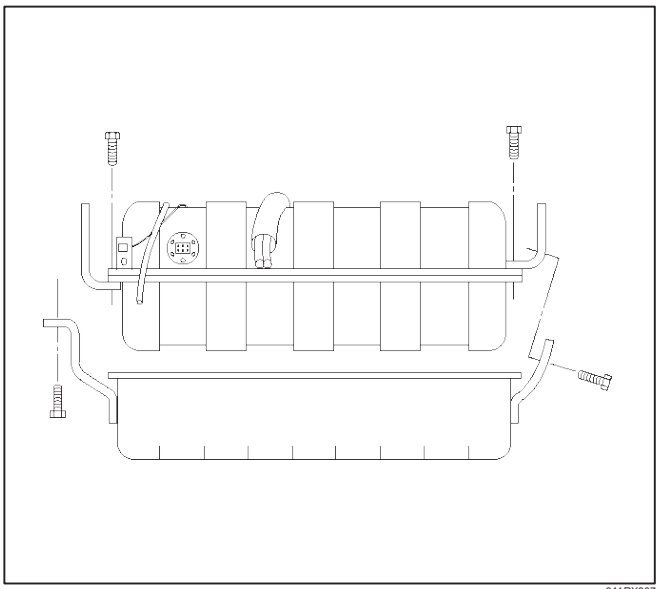
12. Remove fuel tank assembly from the vehicle.
13. Remove four nuts retaining tank under guard to the tank.
14. Remove the tank from the guard.



041RX002

Installation Procedure

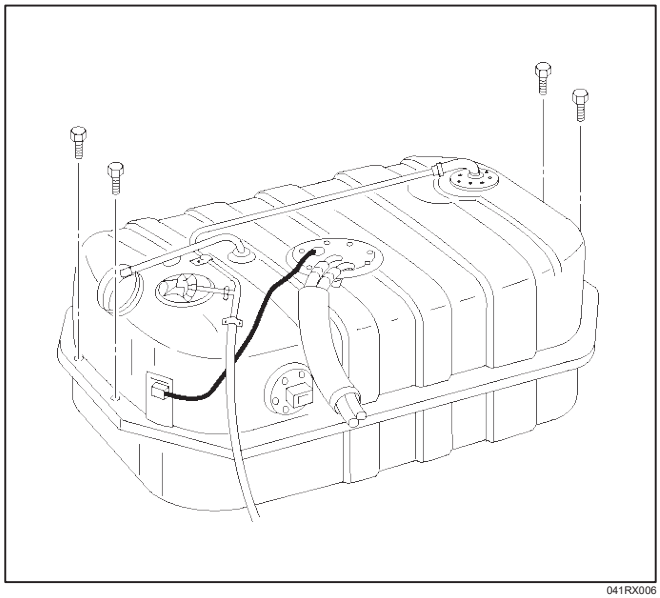
1. Secure fuel tank into under guard with four retaining bolts, if necessary.
2. Place the fuel tank assembly onto stands.
3. Lift the fuel tank assembly near the position.
4. Connect two electrical connectors at fuel pump.
5. Lift the fuel pump to its position and secure it with four mounting bolts. Make sure that all hoses and fuel lines are out of way between the fuel tank and the fuel tank bracket. Tighten the fuel tank retaining bolts to 36 Nm (27 lb ft).



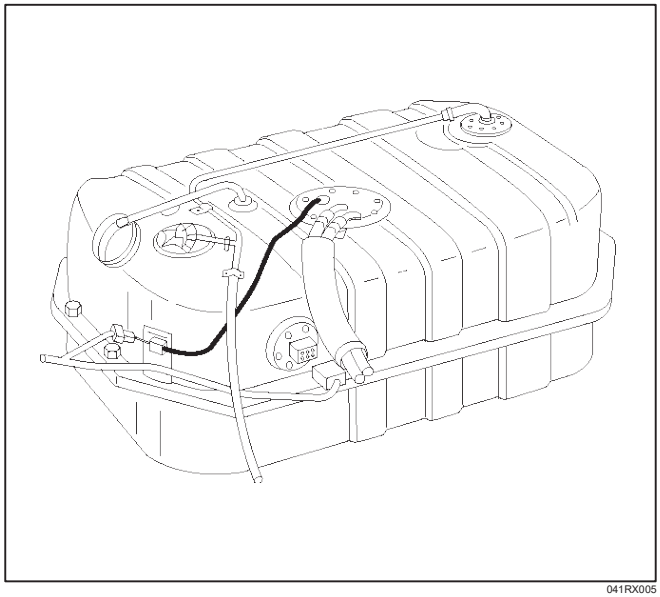
041RX007

6. Connect fuel supply and return lines.

7. Connect the fuel filler hose, the air breather hose and EVAP hose onto fuel tank and secure them with clamps.


041RX006

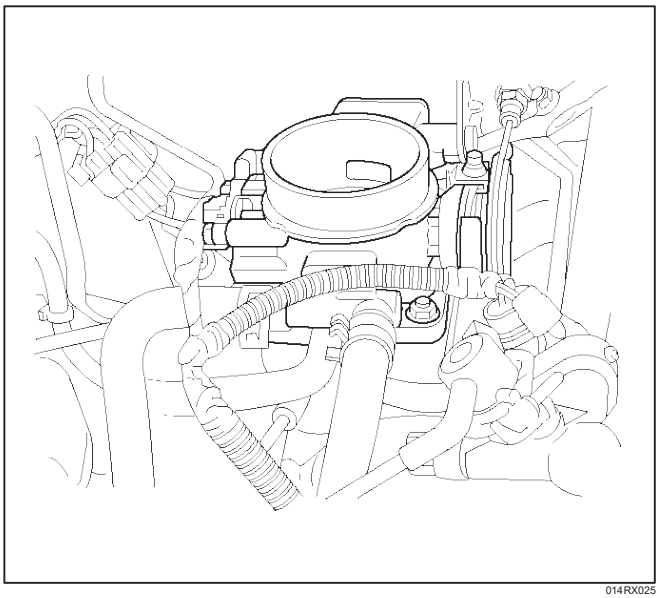
8. Pour fuel into fuel tank.
9. Install fuel filler cap securely.
10. Connect the battery negative cable.


041RX005

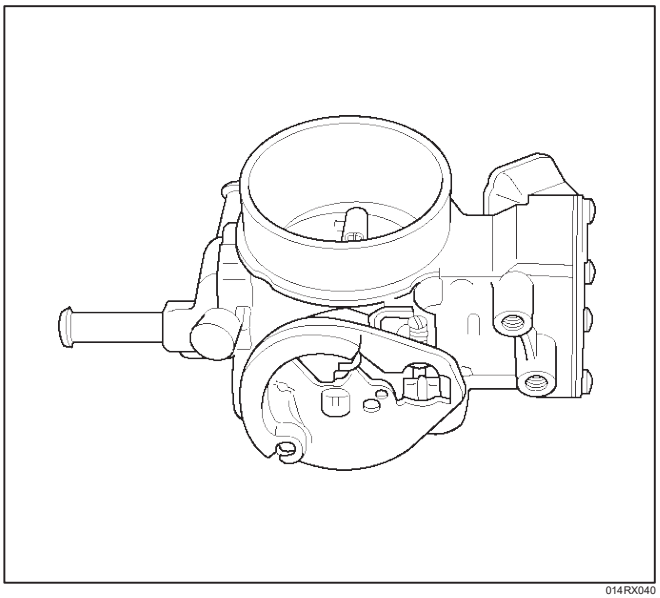
Throttle body (TB)

Removal Procedure

1. Disconnect the negative battery cable.
2. Drain the cooling system. Refer to Cooling System.
3. Remove the air intake duct. Refer to Air Intake Duct Removal Procedure.
4. Remove the accelerator cable from throttle. Refer to Accelerator Cable Assembly Removal Procedure.
5. Disconnect the electrical connectors from the throttle position sensor and the idle air control valve solenoid.
6. Disconnect all vacuum hoses below air horn.
7. Disconnect coolant lines.


014RX025

8. Remove the mounting bolts retaining the throttle body the intake manifold.
9. Lift up the throttle body from the intake manifolds.


014RX040

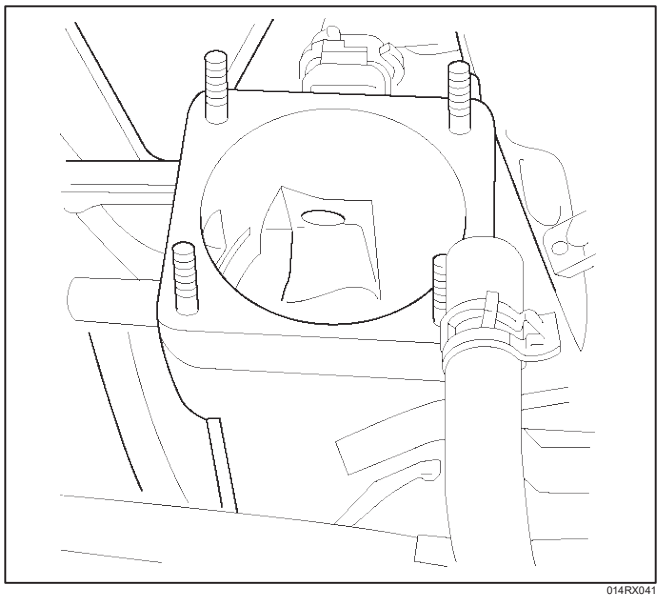
10. Remove the gaskets from the intake manifolds.
11. Remove the IAC. Refer to Idle Air Control Valve Solenoid Removal Procedure.
12. Remove TPS. Refer to Throttle Position Sensor Removal Procedure.

Inspection Procedure

NOTE: Do not use solvent of any type when you clean the gasket surfaces on the intake manifold and the throttle body assembly. The gasket surface and the throttle body assembly may be damaged as results.

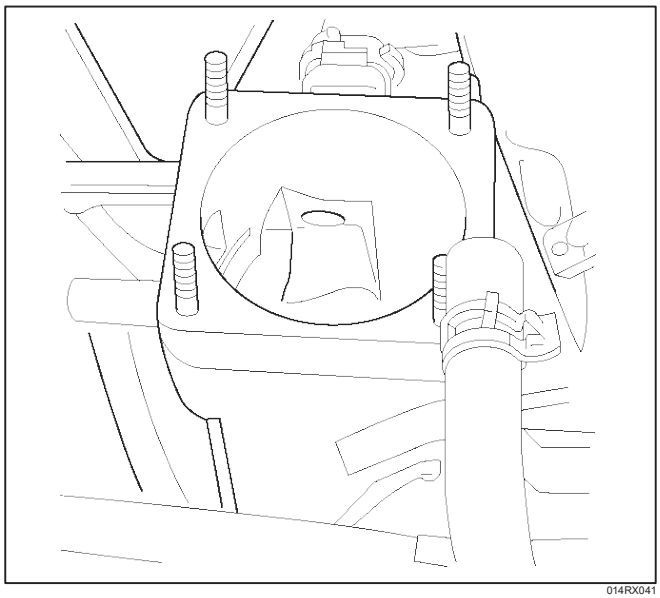
1. If the throttle body gasket needs to be released, remove any gasket material that may be stuck to the mating surfaces of the manifold.

2. Do not leave any scratches in the aluminum casting.

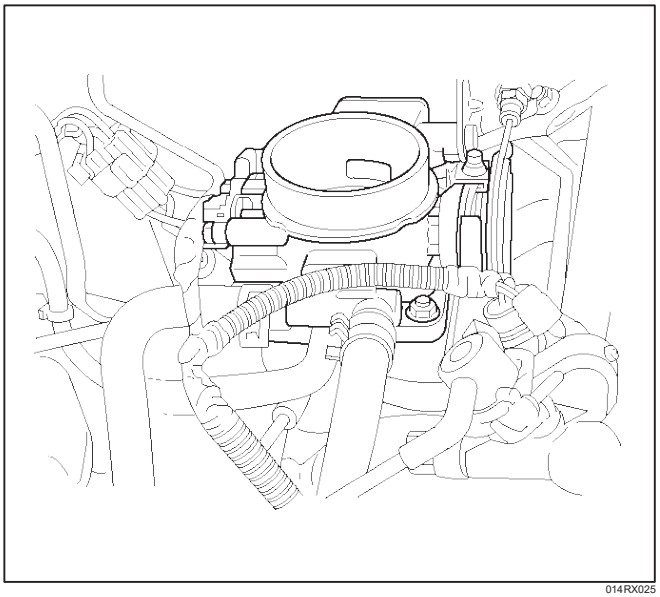

014RX041

Installation Procedure

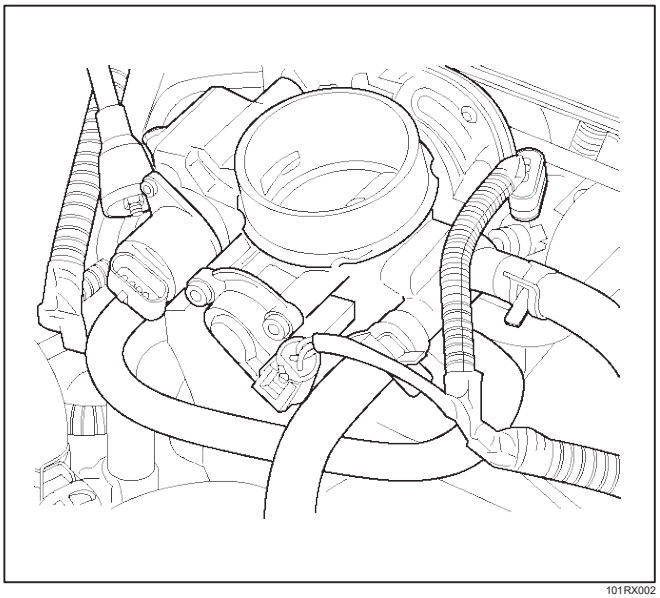
1. Install IAC valve onto the throttle body. Refer to Idle Air Control Valve Solenoid Installation Procedure.
2. Install TPS onto the throttle body if necessary. Refer to TPS Installation Procedure.
3. Place the gasket then the throttle body on the manifold.
4. Install four mounting bolt. Tighten the throttle body mounting bolt to 13.5 Nm (10 lb ft).


014RX041

5. Connect coolant line and secure them with clamps.
6. Connect all vacuum hoses and secure them with clamps if necessary.
7. Install accelerator control cable bracket onto the throttle body.
8. Connect accelerator control cable to throttle plate.


014RX025

9. Connect electrical connector at IAC valve and TPS.
10. Install the air intake duct. Refer to Air Intake Duct Installation Procedure.
11. Fill the cooling system with required coolant. Refer to Engine Cooling System.
12. Connect the negative battery cable.


101RX002

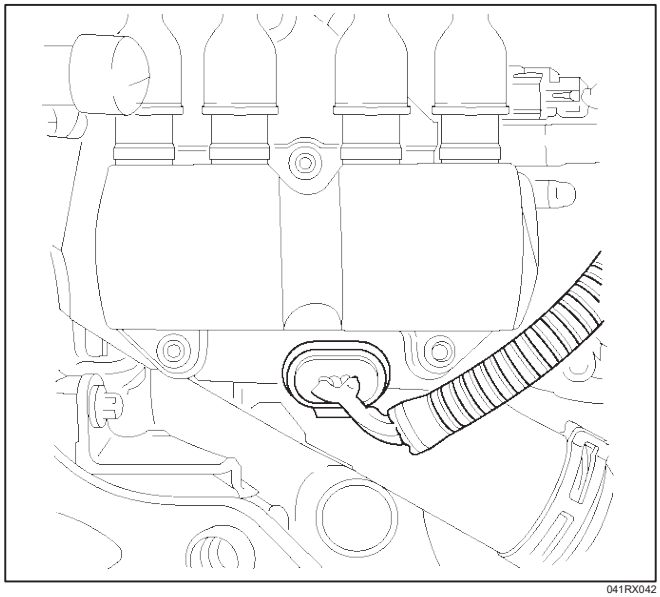
ELECTRONIC IGNITION SYSTEM Ignition Control Module (ICM)

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the ignition control module.
3. Remove the two attaching screws.
4. Remove the ignition control module from the engine block.

Installation Procedure

1. Fasten the module to the engine block with two screws.
2. Reconnect the electrical connector.
3. Reconnect the negative battery terminal.

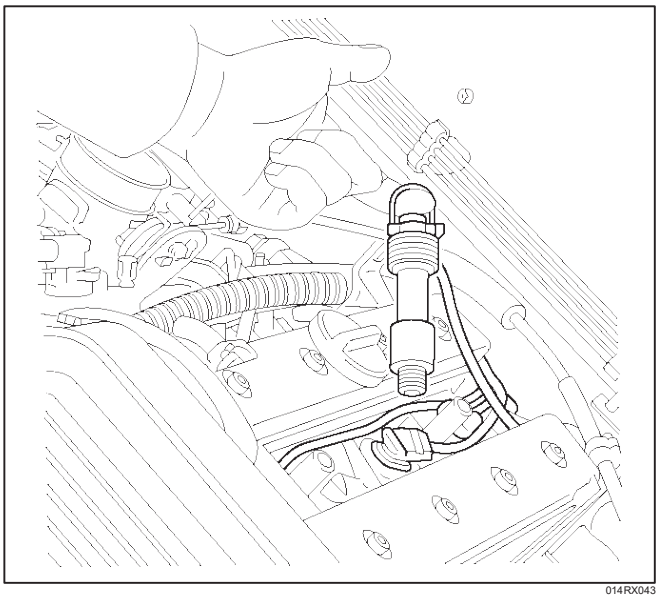


041RX042

Ignition Coil

Removal Procedure

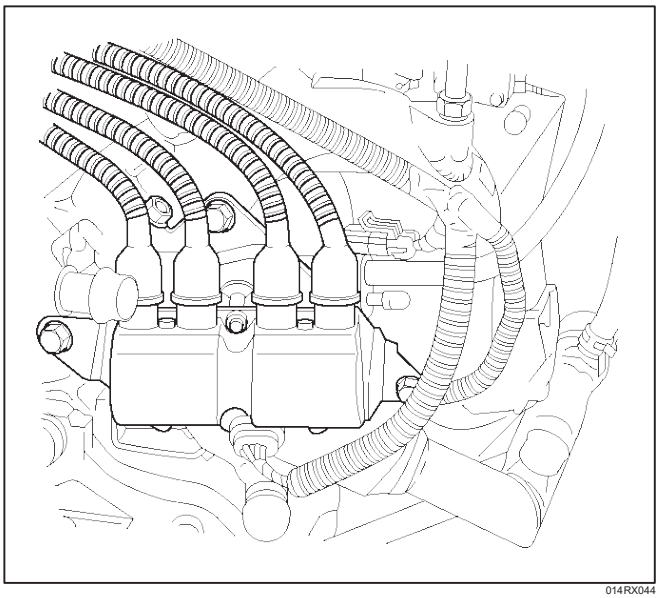
1. Disconnect the negative battery cable.
2. Drain the cooling system. Refer to Engine Cooling System.
3. Remove the heater supply and return hose.
4. Remove the coolant return hose.
5. Disconnect all four spark plug cables from the coil.
6. Disconnect electrical connector from the ignition coil.
7. Remove three mounting bolt from the ignition coil.
8. Remove the ignition coil from the bracket.



014RX043

Installation Procedure

1. Install the ignition coil onto the bracket with three mounting bolts.
2. Connect electrical connector at the ignition coil.
3. Connect spark plug cable to the ignition coil.
4. Connect heater supply and return hose and secure them with clamps.
5. Connect coolant return line and secure them with clamps.
6. Fill the cooling system with required coolant. Refer to Engine Cooling System.
7. Connect the negative battery cable.



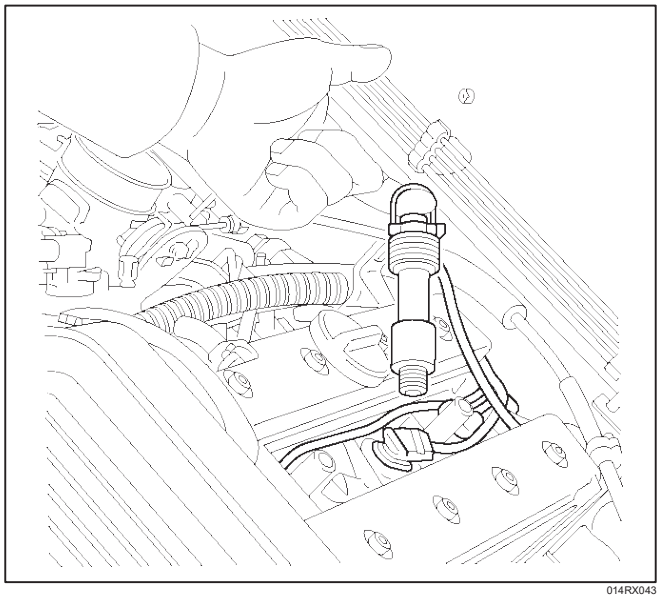
014RX044

Spark Plugs

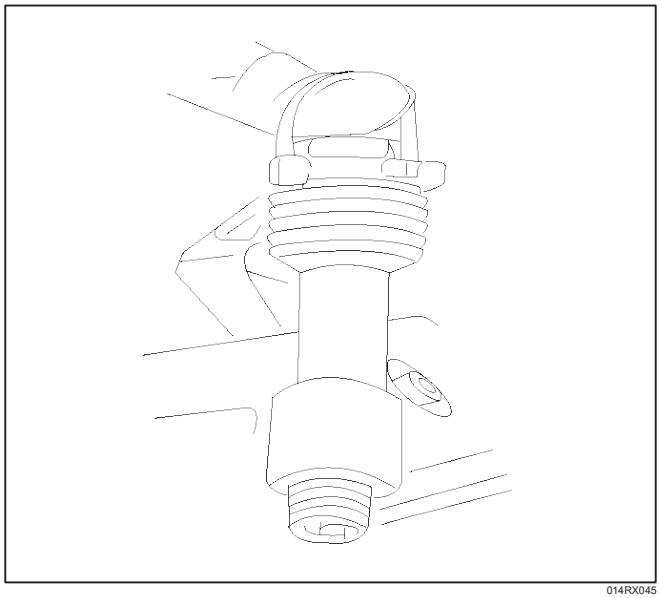
Removal Procedure

Type: NGK BPR6ES–11
Spark Gap : 1.05 MM (0.040”)
Spark Plug Torque : 25 Nm (18 lb ft)

1. Disconnect the negative battery cable.
2. Remove four bolt holding spark plug cover plate to top of valve cover, and remove the cover plate.
3. Pull ignition wire using hocks attached to end of spark plug cable.

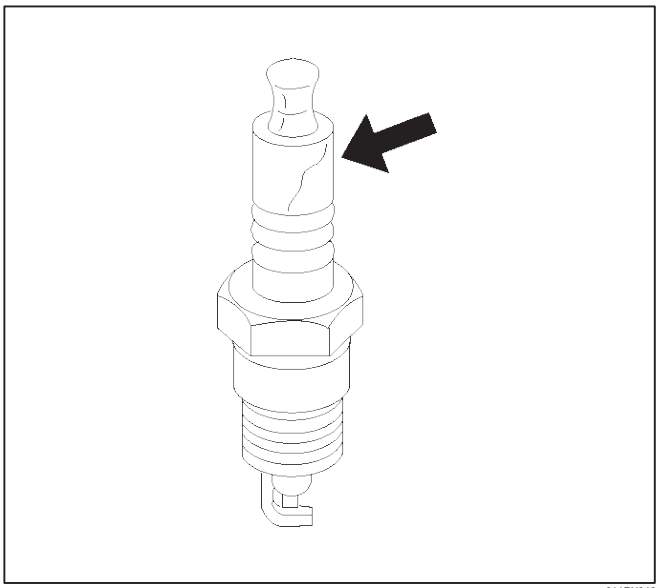

014RX043

4. Remove the spark plug.


014RX045

Inspection Procedure

1. Check the insulator for cracks. Replace the spark plug if crack are present.
2. Check the electrode condition and replace the spark plug if necessary.

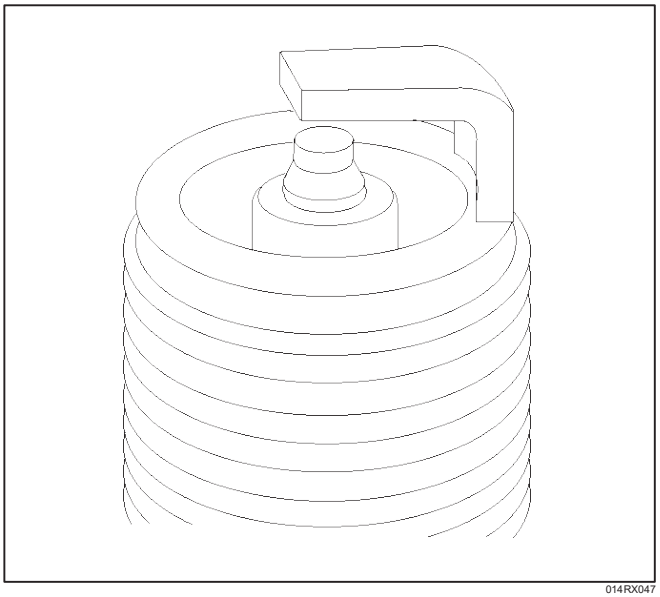

014RX046

If the spark plug electrodes and insulators are fouled with carbon or oil, the engine will not operate efficiently.
There are number of possible causes:

- Fuel mixture is too rich.
- Oil in the combustion chamber.
- The spark plug gap is not set correctly.

If spark plug fouling is excessive, check the fuel and electrical system for possible causes of trouble. If fuel and electrical system are normal, install spark plug of a higher heat range which have the same physical dimensions as the original equipment spark plug.
The following symptoms are characteristics of spark plugs that are running too hot:

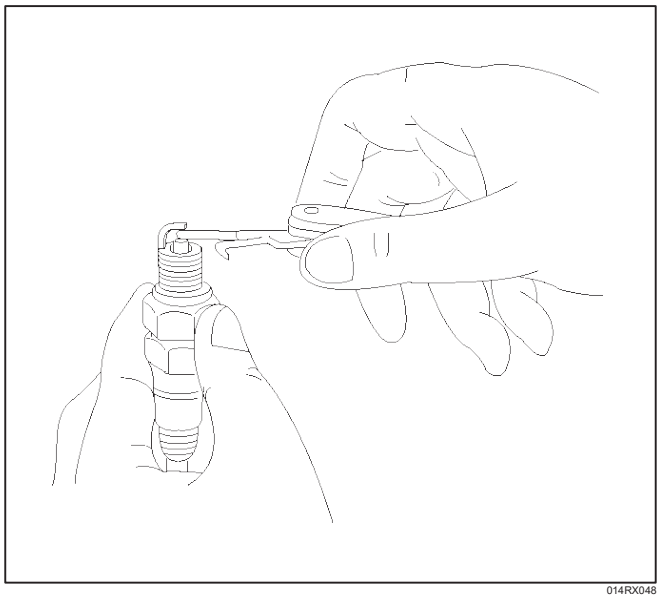
- Fuel mixture is too lean.
- Heat range is incorrect.


014RX047

If vehicle usage does not conform to normal driving conditions, a more suitable spark plug may be substituted.
If fuel and electrical system are normal, in most cases of this sort, the problem can be corrected by using a colder

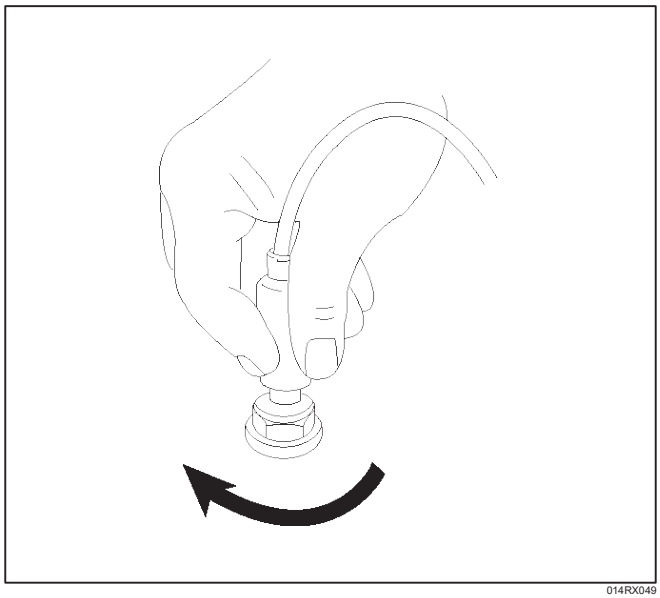
type spark plug with the same physical dimensions as the original equipment spark plug.

3. Check the gaskets for damage and replace if necessary.
4. Measure the spark plug gap. The specification is 1.05 mm (0.040”).
5. Adjust the spark gap by bending the grounded electrode.


014RX048

Installation Procedure

1. Tighten the spark plug to the 25 Nm (18 lb ft).
2. Push the spark plug cable in until it snaps in.
3. Install spark plug cover onto valve cover and secure it with four retaining bolts.

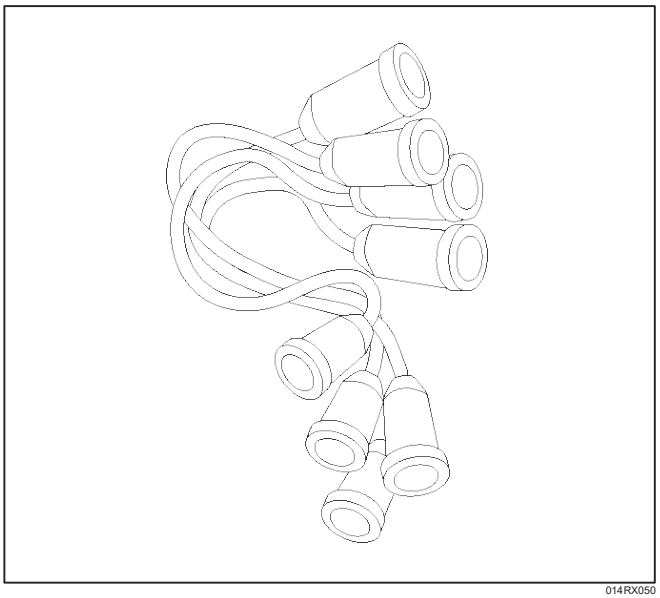

014RX049

Spark Plug Cables

Spark Plug Cables

The cable contains a synthetic conductor which is easily damaged. Never stretch or kink the cable. Disconnect the cable from spark plug and the ignition coil.

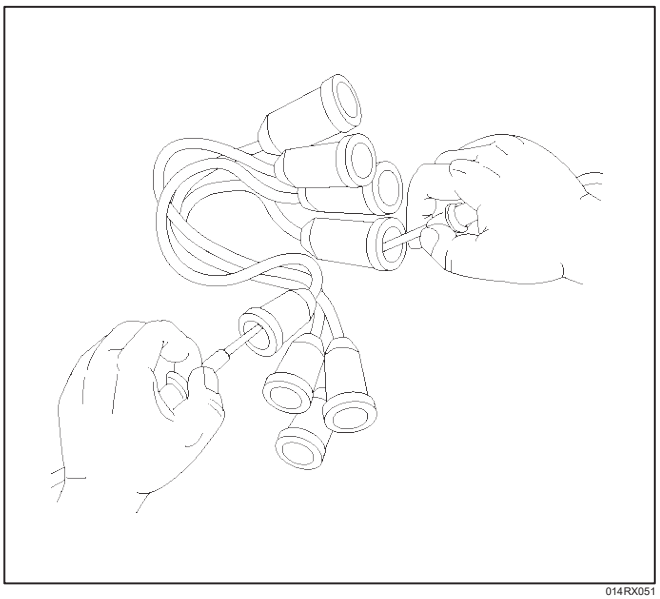
The original equipment cables and the ignition coil are marked to show correct location of the cables. If spark plug cables or the ignition coil are replaced previously, before cables are removed from the ignition coil, mark the cables and the coil so they can be reconnected in the same position.


014RX050

Inspection Procedure

NOTE: Never puncture the spark plug cable’s insulation with a needle or the pointed end of a probe into the cable. An increase in resistance would be created which would cause the cable to become defective.

1. If the cable has broken or cracked insulation, it must be replaced.
2. If the terminals are corroded or loose, the cable must be replaced.
3. Check that the cable resistance does not exceed 10 k Ω per foot.


014RX051

EMISSIONS Catalytic Converter

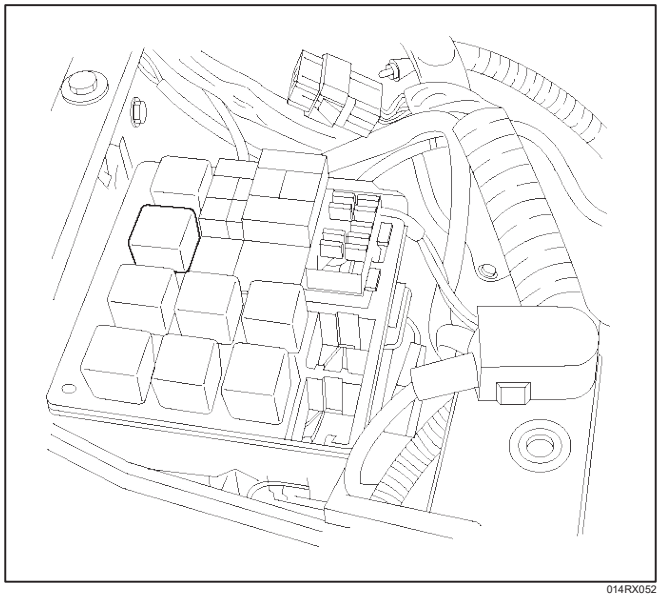
Catalytic Converter

Refer to Engine Exhaust.

Air Conditioning Relay

Removal Procedure

1. Remove the fuse and relay box cover at right side of engine room.
2. Refer to the diagram on the cover to determine which is the correct relay.
3. Insert small screwdriver or use thumb pressure to release the retainer of the relay.
4. Pull the relay straight up and out of the fuse and relay box.



014RX052

Installation Procedure

1. Insert the relay into the correct place in the fuse and relay box with the catch slot aligned to retainer.
2. Press down until the catch of retainer engages.
3. Install fuse and relay box cover.

Ignition Timing Adjustment

Ignition Timing Adjustment

There is no timing adjustment. The timing signal is furnished by the CKP and the CMP signal. PCM control the ignition timing.

EVAP Canister Hoses

EVAP Canister Hoses

To see the routing of the EVAP canister hoses, refer to Vehicle Emission Control Information in Diagnosis or Emission Label located bottom side ofthe hood. Use 6148M or equivalent when you replace the EVAP canister hoses.

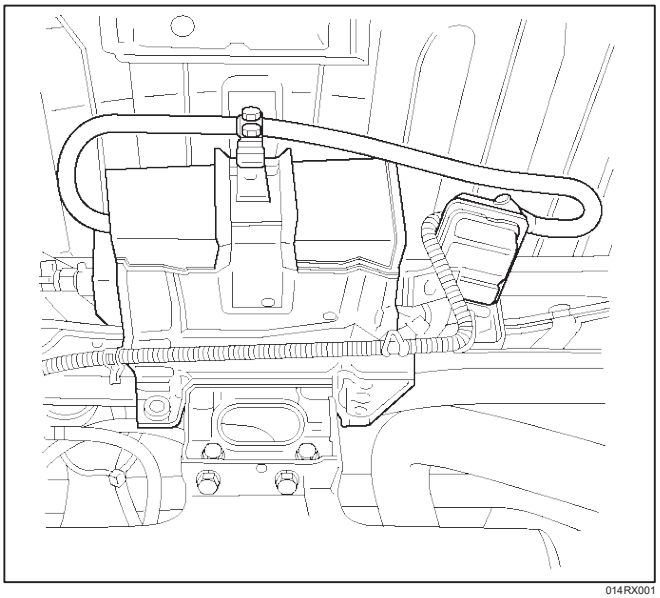
EVAP Canister

Removal Procedure

1. Disconnect all hoses.
2. Remove two mounting bracket nuts.

Inspection Procedure

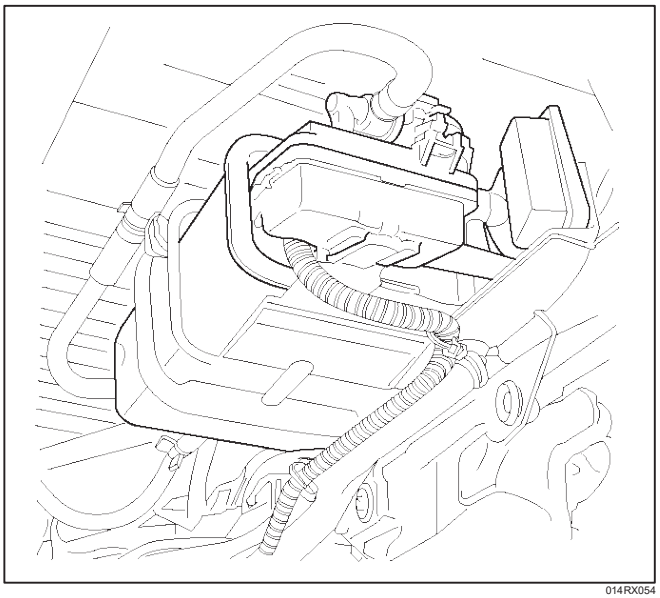
1. Inspect the hoses for cracks, damage and leaks.
2. Inspect the canister for damages.



014RX001

Installation Procedure

1. Install EVAP canister onto crossmember with two mounting bolts.
2. Connect all hoses and secure them with clamps.

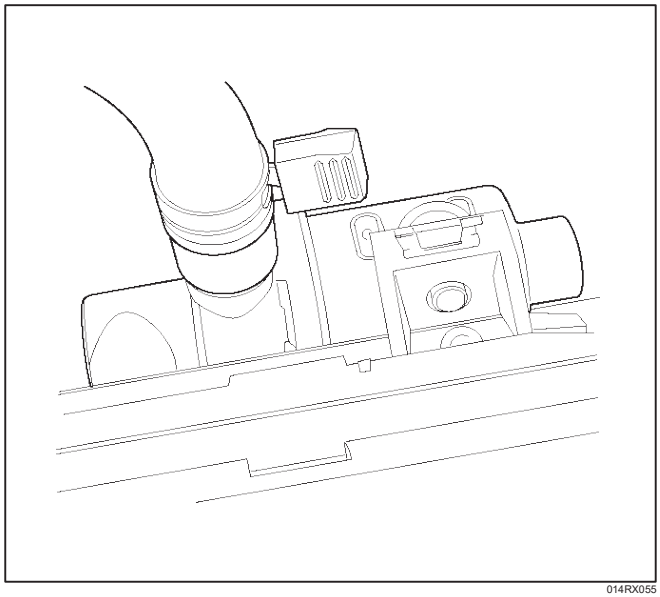


014RX054

EVAP Canister Vent Solenoid

Removal Procedure

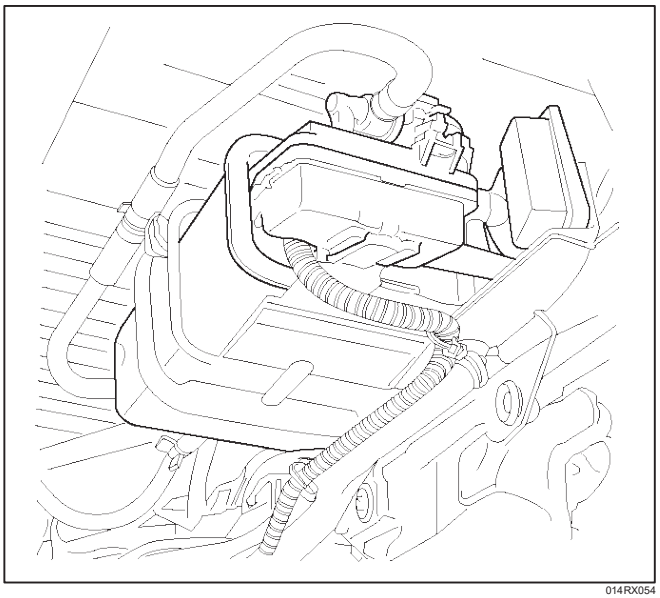
1. Disconnect the negative battery cable.
2. Disconnect electrical connector at the vent valve.
3. Disconnect vent hoses from the solenoid valve.
4. Remove the filter and vent valve solenoid assembly by pulling it out from bracket.
5. Remove a screw holding the solenoid.
6. Remove vent valve solenoid from filter.



014RX055

Installation Procedure

1. Install the vent valve solenoid to the filter and secure it witha screw.
2. Insert the vent valve assembly onto EVAP canister bracket.
3. Connect all hoses and secure them with clamps.
4. Connect electrical connector at vent valve solenoid.
5. Connect the negative battery cable.

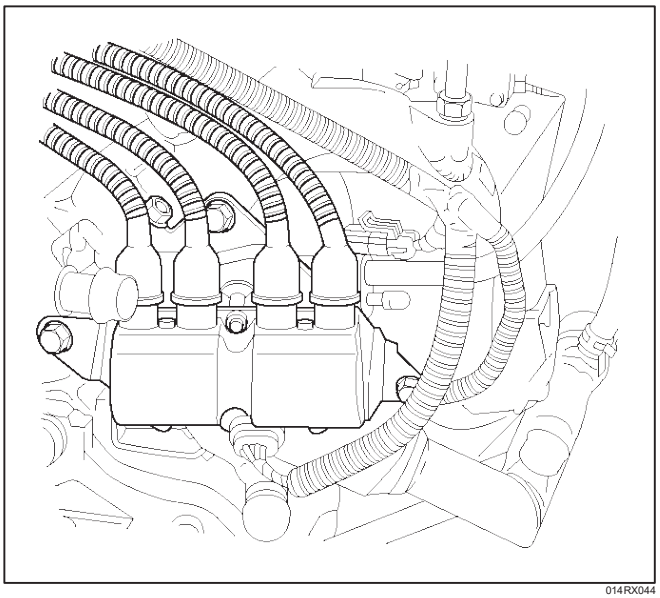


014RX054

EVAP Canister Purge Valve Solenoid

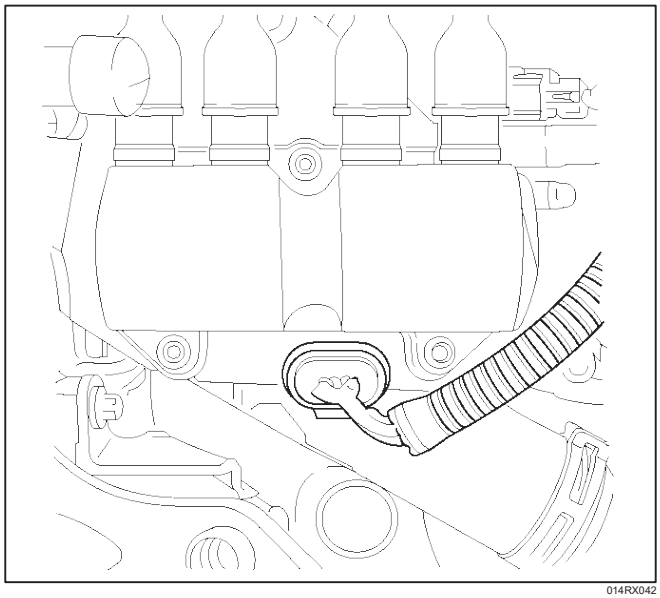
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect electrical connector from EVAP purge solenoid located just front of the ignition coil.
3. Disconnect the vacuum hoses from the solenoid.
4. Remove the ignition coil. Refer toIgnition Coil Removal Procedure.



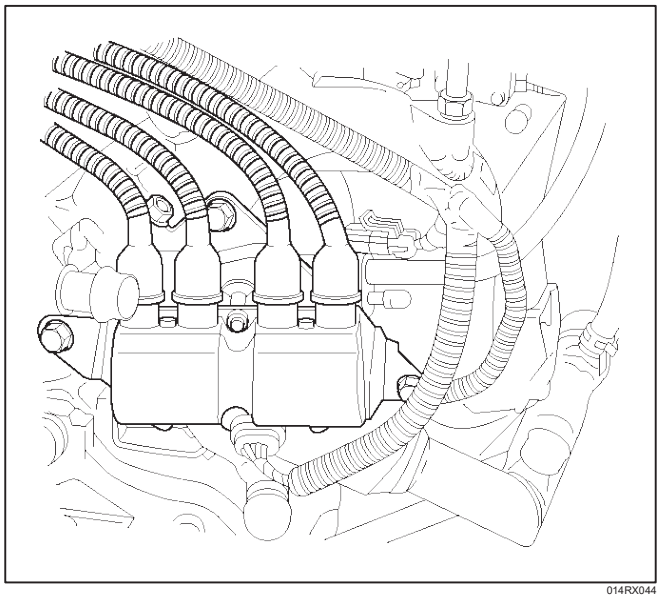
014RX044

5. Remove the three bolts holding the ignition coil bracket.
6. Remove the ignition coil bracket with the purge solenoid still attached to it.
7. Insert small screw driver into the catch from the bottom hole to release the catch.
8. Slide EVAP purge solenoid out form the ignition bracket.


014RX042

Installation Procedure

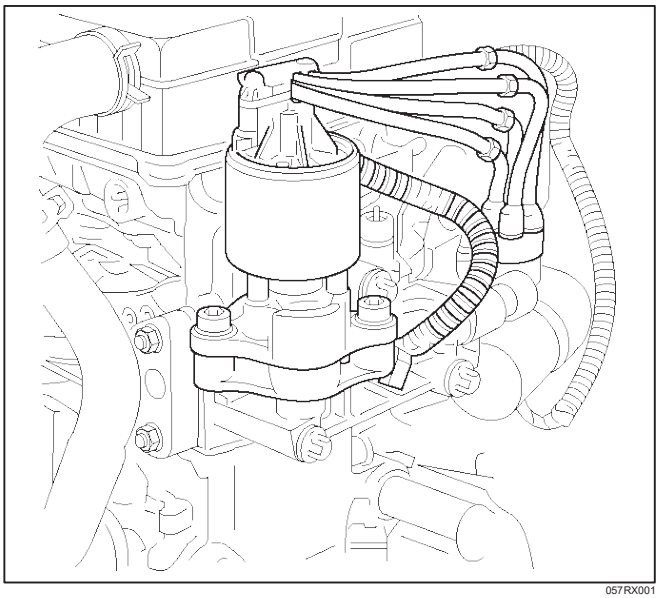
1. Insert EVAP purge solenoid valve onto the ignition coil bracket.
2. Install the ignition coil bracket to back of intake manifold.
3. Install the ignition coil. Refer to Ignition Coil Installation Procedure.
4. Connect vacuum hoses and electrical connector at the purge valve.


014RX044

Linear Exhaust Gas Recirculation (EGR) Valve

Removal Procedure

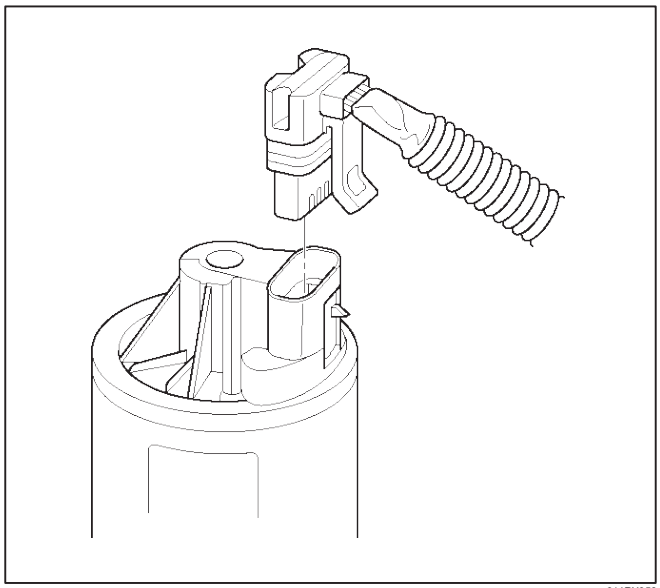
1. Disconnect the negative battery cable.
2. Disconnect electrical connector at EGR valve.
3. Disconnect the electrical connector at Intake Air Temperature Sensor.
4. Remove air intake duct. Refer to Air Intake Duct Removal Procedure.
5. Remove crankshaft breather hose.
6. Remove two bolts holding EGR valve.
7. Remove EGR valve and gasket from the manifold.


057RX001

Inspection Procedure

1. Inspect the air passage for a restrtiction. If there is restriction, remove the object. Do not use any type of solvent, it may damage electrical system of EGR valve.

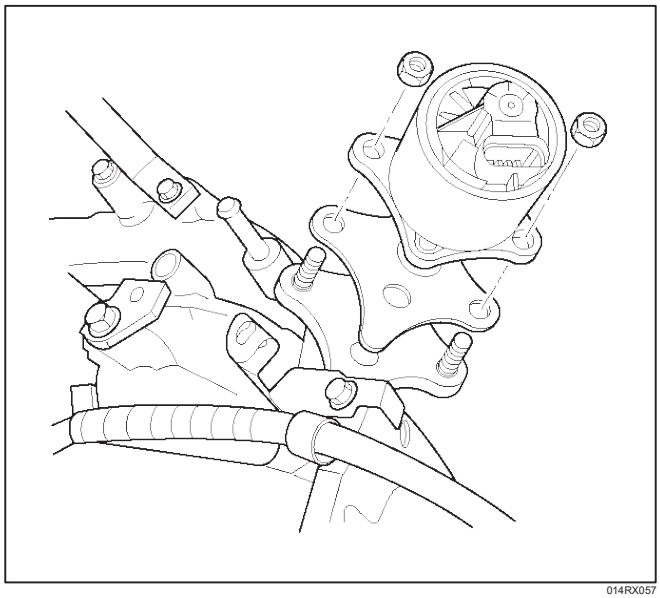
2. Inspect restriction for valve movement. If there is restriction remove the object.



014RX056

Installation Procedure

1. Place the gasket and EGR valve on to the intake manifold.
2. Install mounting bolts and tighten.
3. Connect electrical connector at EGR valve
4. Connect the crankshaft breather hose and secure it with clamps.
5. Install the air intake duct. Refer to Air Intake Duct Installation Procedure.
6. Connect the negative battery cable.



014RX057

Wiring and Connectors

Wiring Harness Service

The control module harness electrically connects the control module to the various solenoids, switches and sensors in the vehicle engine compartment and passenger compartment.
Replace wire harnesses with the proper part number replacement.
Because of the low amperage and voltage levels utilized in powertrain control systems, it is essential that all wiring in environmentally exposed areas be repaired with crimp and seal splice sleeves.
The following wire harness repair information is intended as a general guideline only. Refer to Chassis Electrical for all wire harness repair procedures.

PCM Connectors And Terminals

Removal Procedure

1. Remove the connector terminal retainer.
2. Push the wire connected to the affected terminal through the connector face so that the terminal is exposed.
3. Service the terminal as necessary.

Installation Procedure

1. Bend the tab on the connector to allow the terminal to be pulledinto position within the connector.
2. Pull carefully on the wire to install the connector terminal retainer.

Connectors And Terminals

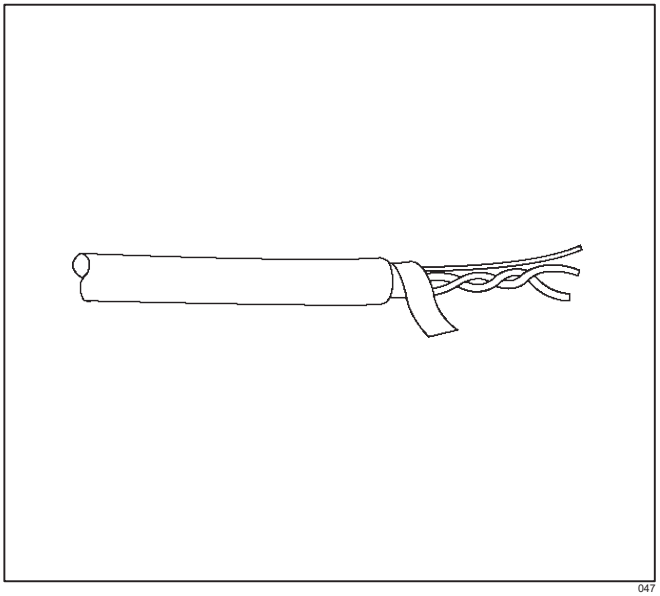
Connectors And Terminals

Use care when probing a connector and when replacing terminals. It is possible to short between opposite terminals. Damage to components could result. Always use jumper wires between connectors for circuit checking. NEVER probe through Weather–Pack seals. Use an appropriate connector test adapter kit which contains an assortment of flexible connectors used to probe terminals during diagnosis. Use an appropriate fuse remover and test tool for removing a fuse and to adapt the fuse holder to a meter for diagnosis.
Open circuits are often difficult to locate by sight because oxidation or terminal misalignment are hidden by the connectors. Merely wiggling a connector on a sensor, or in the wiring harness, may temporarily correct the open circuit. Intermittent problems may also be caused by oxidized or loose connections.
Be certain of the type of connector/terminal before making any connector or terminal repair. Weather–Pack and Com–Pack III terminals look similar, but are serviced differently.

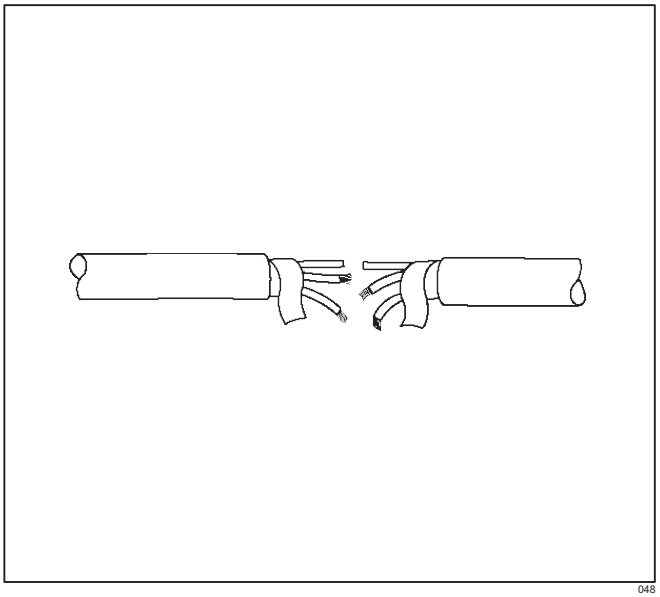
Wire Harness Repair: Twisted Shielded Cable

Removal Procedure

1. Remove the outer jacket.
2. Unwrap the aluminum/mylar tape. Do not remove the mylar.

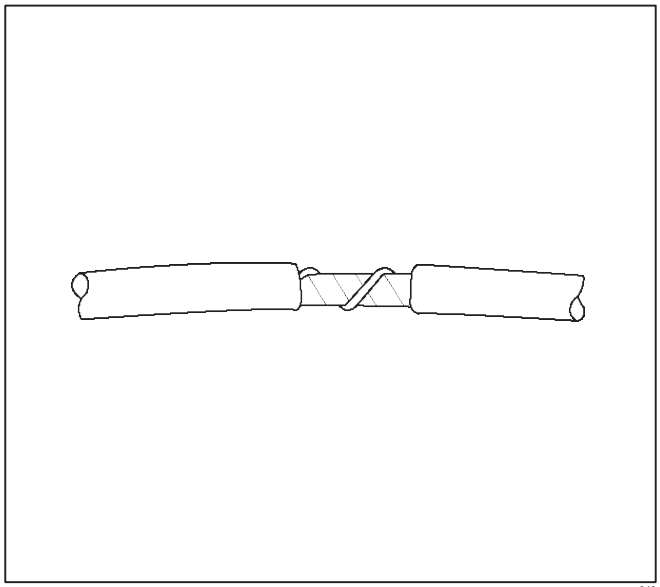

047

3. Untwist the conductors.
4. Strip the insulation as necessary.

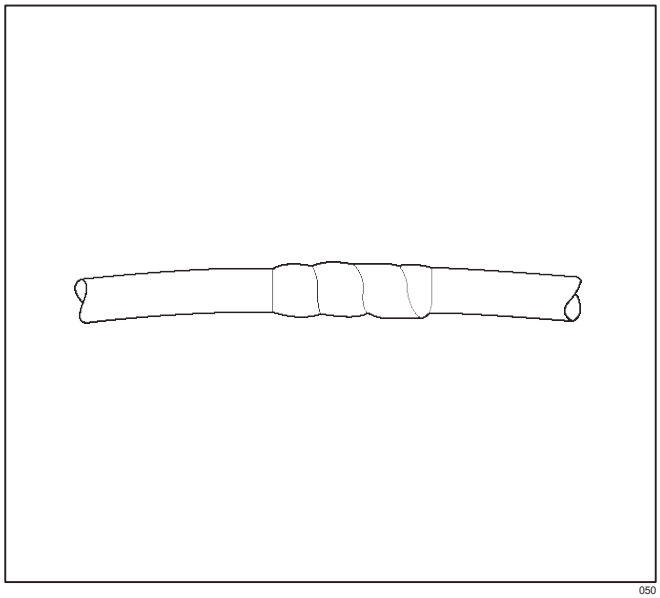

048

Installation Procedure

1. Splice the wires using splice clips and rosin core solder.
2. Wrap each splice to insulate.
3. Wrap the splice with mylar and with the drain (uninsulated) wire.


049

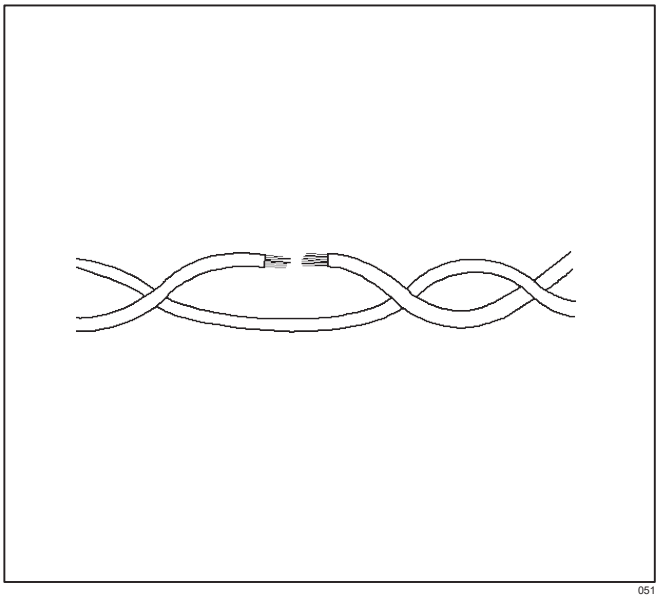
4. Tape over the whole bundle to secure.


050

Twisted Leads

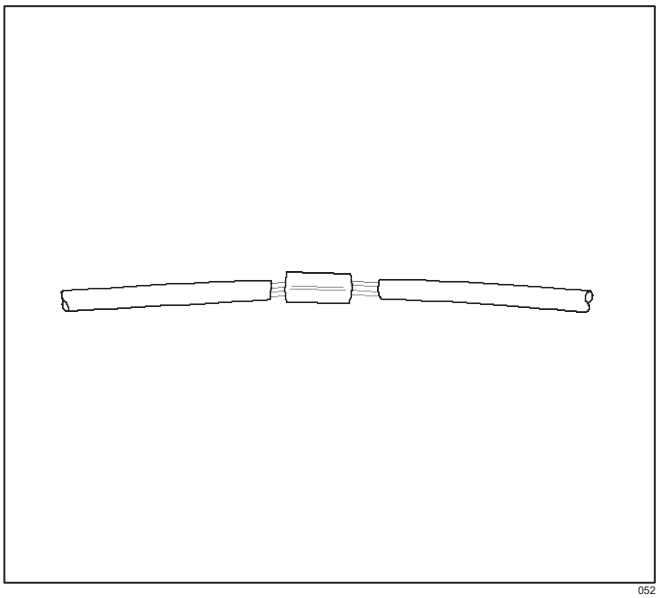
Removal Procedure

1. Locate the damaged wire.
2. Remove the insulation as required.

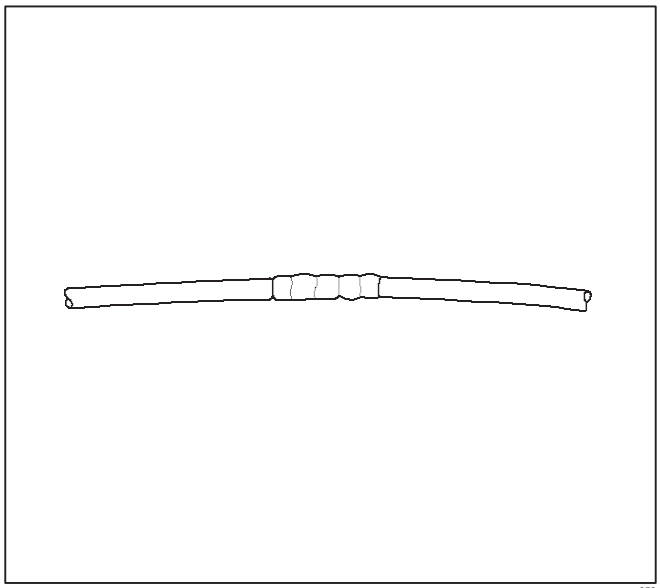

051

Installation Procedure

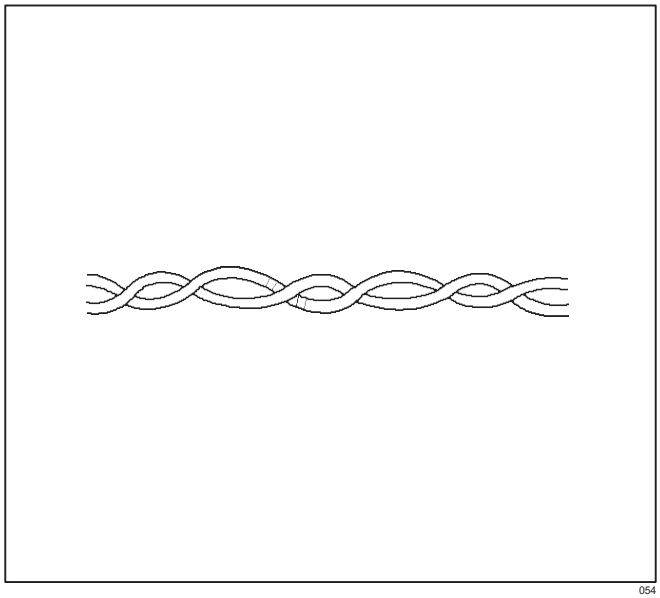
1. Use splice clips and rosin core solder in order to splice the two wires together.


052

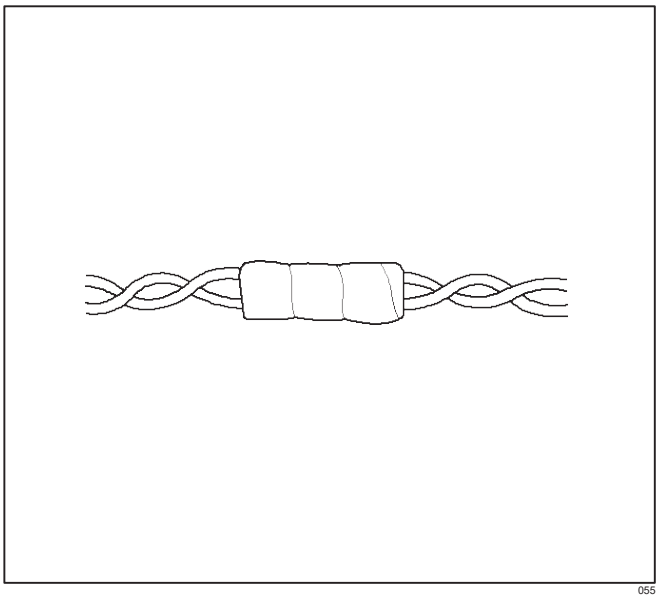
2. Cover the splice with tape in order to insulate it from the other wires.



3. Twist the wires as they were before starting this procedure.



4. Tape the wires with electrical tape.



Weather–Pack Connector

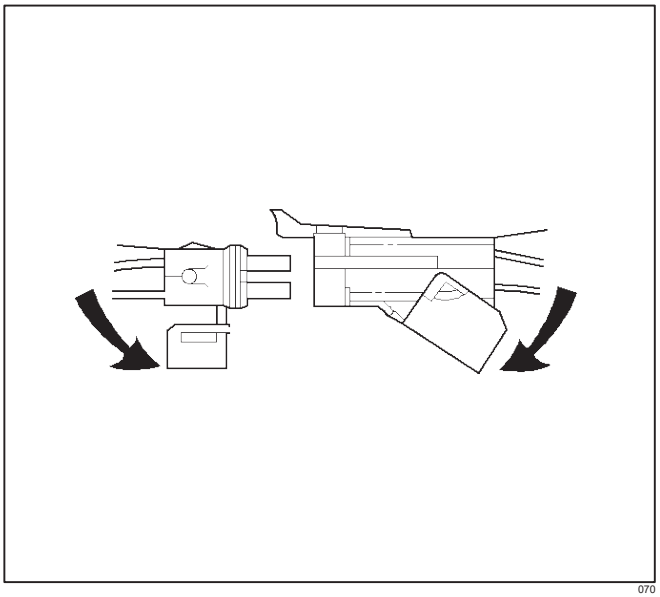
Tools Required

J 28742–A Weather–Pack II Terminal Remover

Removal Procedure

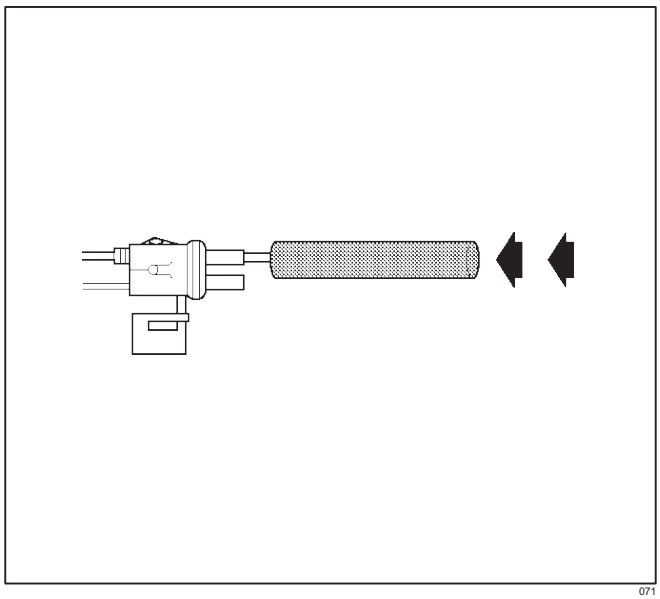
A Weather–Pack connector can be identified by a rubber seal at the rear of the connector. This engine room connector protects against moisture and dirt, which could form oxidation and deposits on the terminals. This protection is important, because of the low voltage and the low amperage found in the electronic systems.

1. Open the secondary lock hinge on the connector.

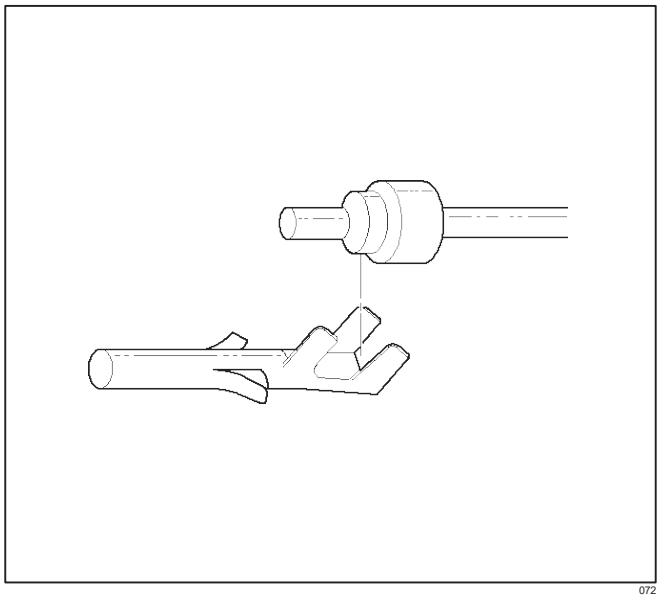


2. Use tool J 28742–A or the equivalent to remove the pin and the sleeve terminals. Push on J 28742–A to release.

NOTE: Do not use an ordinary pick or the terminal may be bent or deformed. Unlike standard blade terminals, these terminals cannot be straightened after they have been improperly bent.


071

3. Cut the wire immediately behind the cable seal.

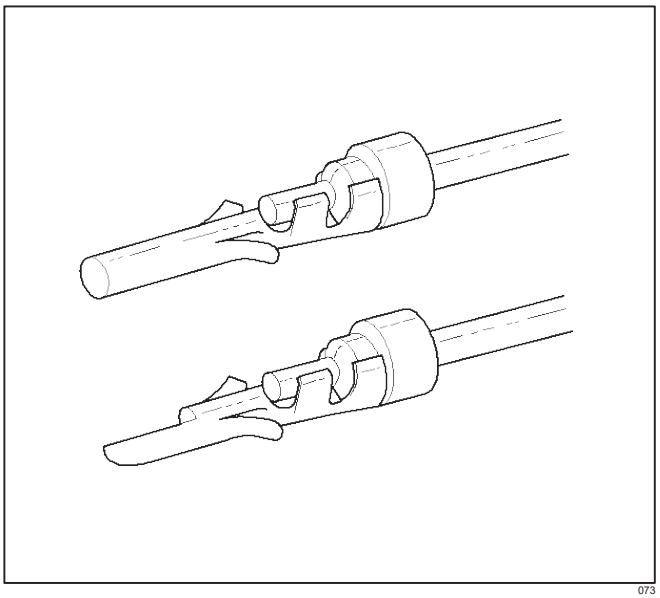

072

Installation Procedure

Make certain the connectors are properly seated and all of the sealing rings are in place when you reconnect the leads. The secondary lock hinge provides a backup locking feature for the connector. The secondary lock hinge is used for added reliability. This flap should retain the terminals even if the small terminal lock tangs are not positioned properly.

Do not replace the Weather–Pack connections with standard connections. Read the instructions provided with the Weather–Pack connector and terminal packages.

1. Replace the terminal.
2. Slip the new seal onto the wire.
3. Strip 5 mm (0.2”) of insulation from the wire.
4. Crimp the terminal over the wire and the seal.

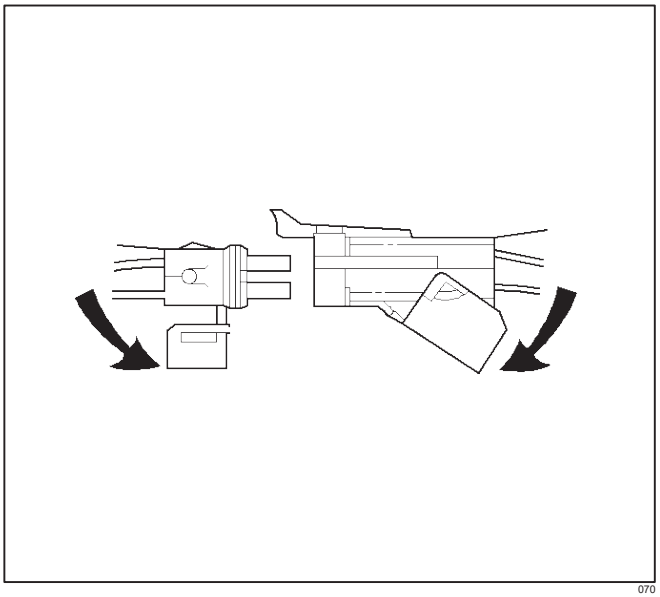

073

5. Push the terminal and the connector to engage the locking tangs.
6. Close the secondary locking hinge.

Com–Pack III

Com–Pack III

The Com–Pack III terminal looks similar to some Weather–Pack terminals. This terminal is not sealed and is used where resistance to the environment is not required. Use the standard method when repairing a terminal. Do not use the Weather–Pack terminal tool J 28742–A or equivalent. These will damage the terminals.


070

Metri–Pack

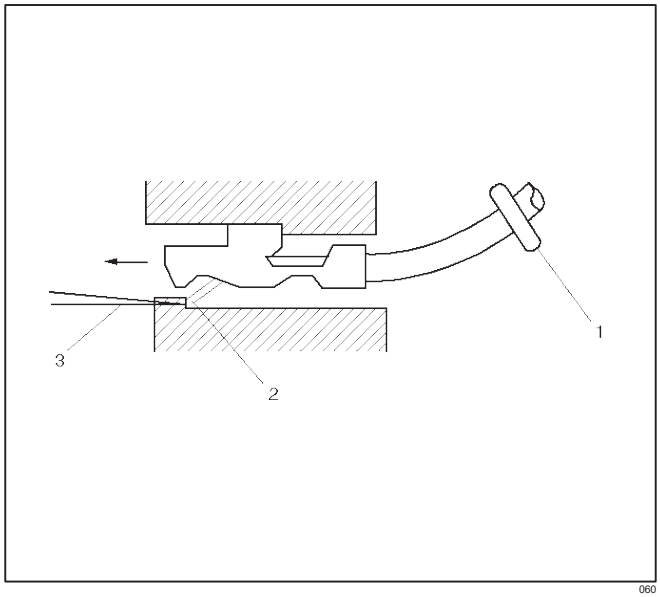
Tools Required

J 35689 Terminal Remover

Removal Procedure

Some connectors use terminals called Metri–Pack Series 150. These may be used at the engine coolant temperature (ECT) sensor.

1. Slide the seal (1) back on the wire.
2. Insert the J 35689 tool or equivalent (3) in order to release the terminal locking tang (2).
3. Push the wire and the terminal out through the connector. If you reuse the terminal, reshape the locking tang.

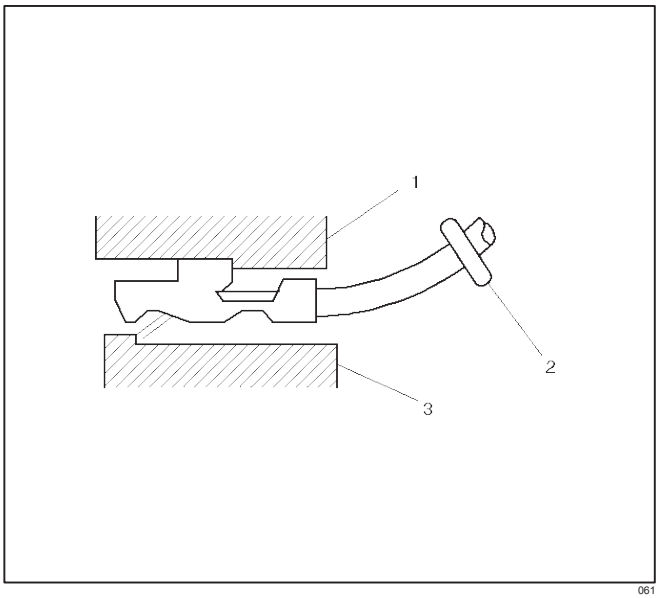


060

Installation Procedure

Metri–Pack terminals are also referred to as ”pull–to–seat” terminals.

1. In order to install a terminal on a wire, the wire must be inserted through the seal (2) and through the connector (3).
2. The terminal (1) is then crimped onto the wire.
3. Then the terminal is pulled back into the connector to seat it in place.



061

GENERAL DESCRIPTION — PCM AND SENSORS

58X Reference PCM Input

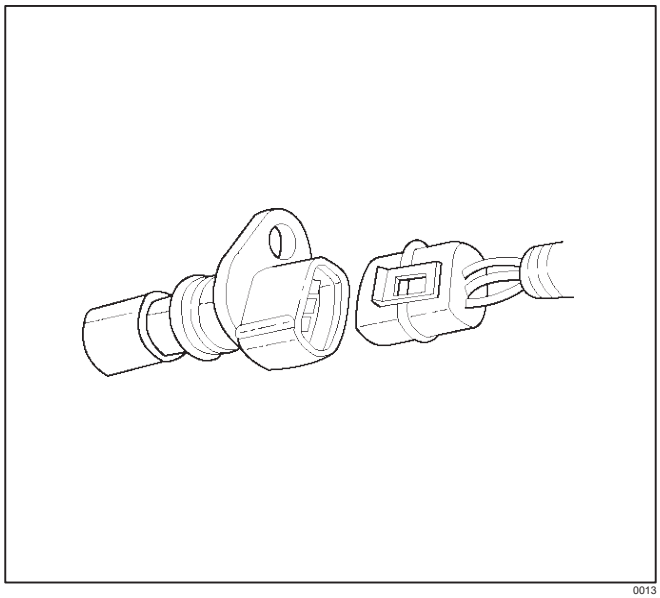
The powertrain control module (PCM) uses this signal from the crankshaft position (CKP) sensor to calculate engine RPM and crankshaft position at all speeds. The PCM also uses the pulses on this circuit to initiate injector pulses. If the PCM receives no pulses on this circuit, DTC P0337 will set. If the PCM receives a number of pulses other than the expected amount, DTC P0336 will set. The engine will not start and run without using the 58X reference signal.

A/C Request Signal

This signal tells the PCM when the A/C mode is selected at the A/C control switch. The PCM uses this signal to adjust the idle speed before turning ON the A/C clutch. The A/C compressor will be inoperative if this signal is not available to the PCM.
For A/C wiring diagrams and diagnosis for the A/C electrical system, refer to A/C Clutch Circuit Diagnosis.

Crankshaft Position (CKP) Sensor

The crankshaft position (CKP) sensor provides a signal used by the powertrain control module (PCM) to calculate the ignition sequence. The CKP sensor initiates the 58X reference pulses which the PCM uses to calculate RPM and crankshaft position. For additional information, refer to Electronic Ignition System.

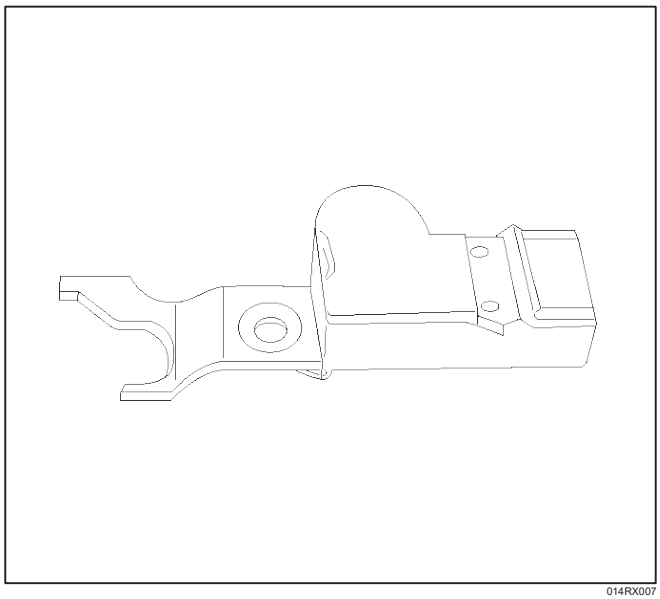

0013

Camshaft Position (CMP) Sensor And Signal

The camshaft position (CMP) sensor sends a signal to the PCM. The PCM uses this signal as a ”sync pulse” to trigger the injectors in the proper sequence. The PCM uses the CMP signal to indicate the position of the #1 piston during its power stroke. The CMP allows the PCM to calculate true sequential fuel injection (SFI) mode of operation. If the PCM detects an incorrect CMP signal while the engine is running, DTC P0341 will set.

If the CMP signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection mode based on the last fuel injection pulse, and the engine will continue to run. It will run in the calculated sequential mode with a 1–in–4 chance of the injector sequence being correct.

For further information, refer to
DTC P0341
DTC P0342.

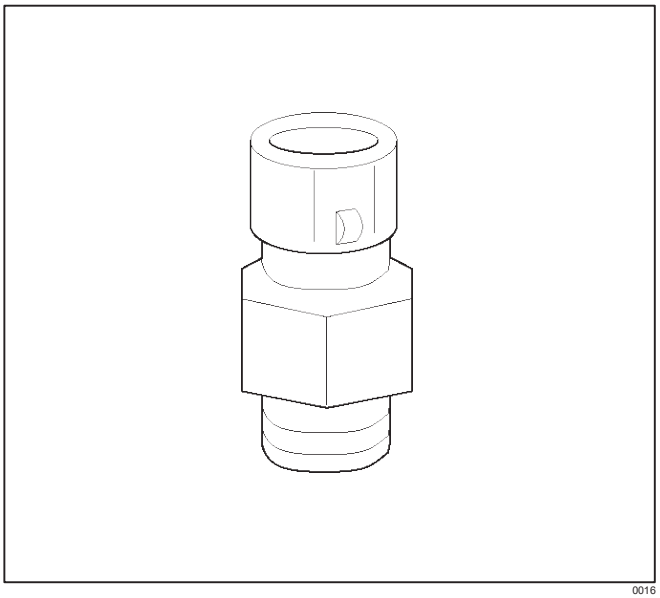

014RX007

Engine Coolant Temperature (ECT) 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 of about 100,000 Ω at –40˚C (–40˚F). High temperature causes a low resistance of about 70 Ω at 130˚C (266˚F).

The PCM supplies a 5–volt signal to the ECT sensor through resistors internal to the PCM and then measures the voltage after the internal resistor. This signal voltage will be high when the engine is cold and low when the engine is hot. By measuring the voltage, the PCM calculates the engine coolant temperature. Engine coolant temperature affects most of the systems that the PCM controls.

The Tech 2 displays engine coolant temperature in degrees. After engine start–up, the temperature should rise steadily to about 85˚C (185˚F). It then stabilizes when the thermostat opens. If the engine has not been run for several hours (overnight), the engine coolant temperature and intake air temperature displays should be close to each other. A hard fault in the engine coolant sensor circuit will set DTC P0117 or DTC P0118. An intermittent fault will set a DTC P1114 or P1115.


0016

Electrically Erasable Programmable Read Only Memory (EEPROM)

The electrically erasable programmable read only memory (EEPROM) is a permanent memory chip that is physically soldered within the PCM. The EEPROM contains the program and the calibration information that the PCM needs to control powertrain operation.

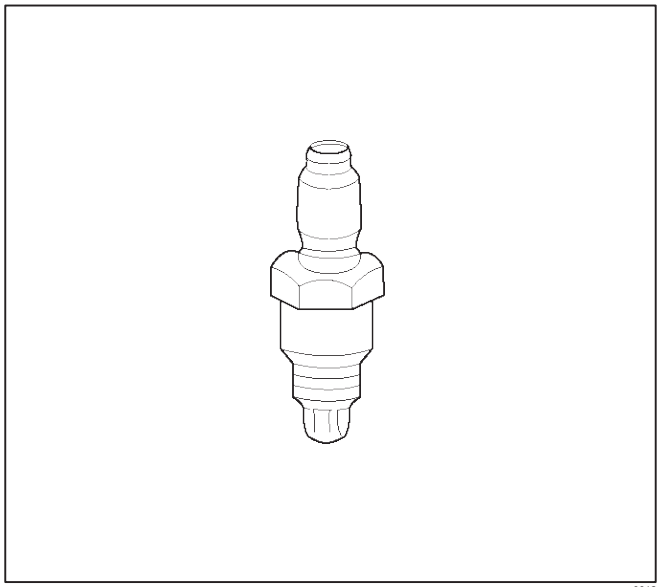
Unlike the PROM used in past applications, the EEPROM is not replaceable. If the PCM is replaced, the new PCM will need to be programmed. Equipment containing the correct program and calibration for the vehicle is required to program the PCM.

Fuel Control Heated Oxygen Sensor (Pre Catalyst)

The fuel control heated oxygen sensor (Bank 1 HO2S 1) is mounted in the exhaust stream where it can monitor the oxygen content of the exhaust gas. The oxygen present in the exhaust gas reacts with the sensor to produce a voltage output. This voltage should constantly fluctuate from approximately 100 mV to 900 mV. The heated oxygen sensor voltage can be monitored with a Tech 2. By monitoring the voltage output of the oxygen sensor, the PCM calculates the pulse width command for the injectors to produce the proper combustion chamber mixture.

- Low HO2S voltage is a lean mixture which will result in a rich command to compensate.
- High HO2S voltage is a rich mixture which will result in a lean command to compensate.

An open Bank 1 HO2S 1 signal circuit will set a DTC P0134 and the Tech 2 will display a constant voltage between 400–500 mV. A constant voltage below 300 mV in the sensor circuit (circuit grounded) will set DTC P0131. A constant voltage above 800 mV in the circuit will set DTC P0132. A slow transition between 300mV and 800mV will cause a DTC P0133 to set. A fault in the Bank 1 HO2S 1 heater circuit will cause DTC P0135 to set. The PCM can also detect HO2S response problems. If the response time of an HO2S is determined to be too slow, the PCM will store a DTC that indicates degraded HO2S performance.

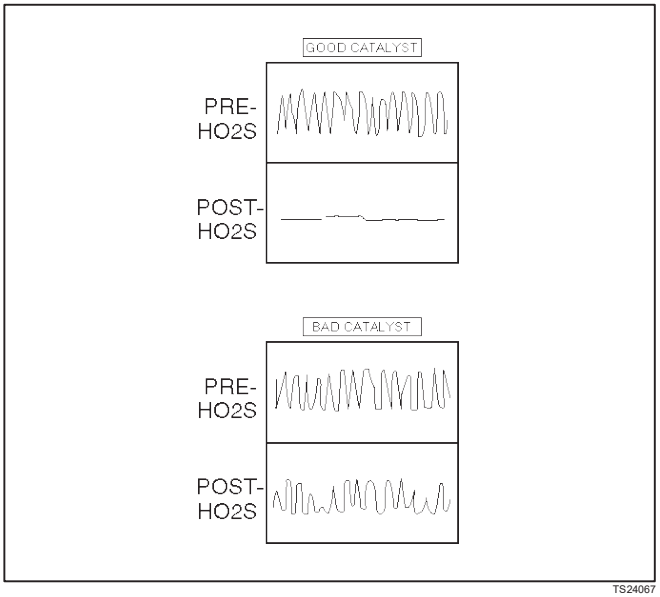


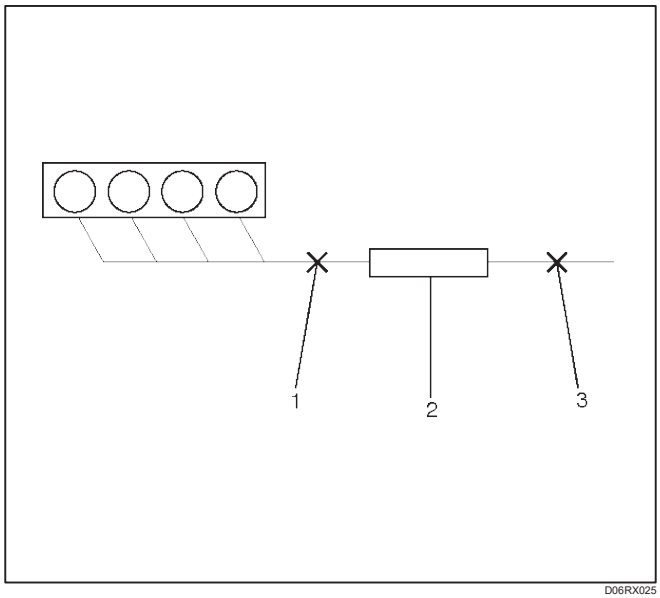
Catalyst Monitor Heated Oxygen Sensor (Post Catalyst)

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 PCM can monitor this process using the Bank 1 HO2S 2 heated oxygen sensor. The Bank 1 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three–way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst. This indicates the catalyst's ability to efficiently convert exhaust gases. If the catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be more active than the signal produced by the Bank 1 HO2S 2 sensor.

The catalyst monitor sensors operate the same as the fuel control sensors. The Bank 1 HO2S 2 sensor's main function is catalyst monitoring, but it also has 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 PCM will make a slight adjustment to fuel trim to ensure that fuel delivery is correct for catalyst monitoring.

A problem with the Bank 1 HO2S 2 signal circuit will set DTC P0137, P0138, P0140, OR P0141, depending on the specific condition. A fault in the heated oxygen sensor heater element or its ignition feed or ground will result in lower oxygen sensor response. This may cause incorrect catalyst monitor diagnostic results.





D06RX025

Legend
(1) Bank 1 Sensor 1 (Fuel Control)
(2) Catalytic Converter
(3) Bank 1 Sensor 2 (Catalyst Monitor)

Intake Air Temperature (IAT) Sensor

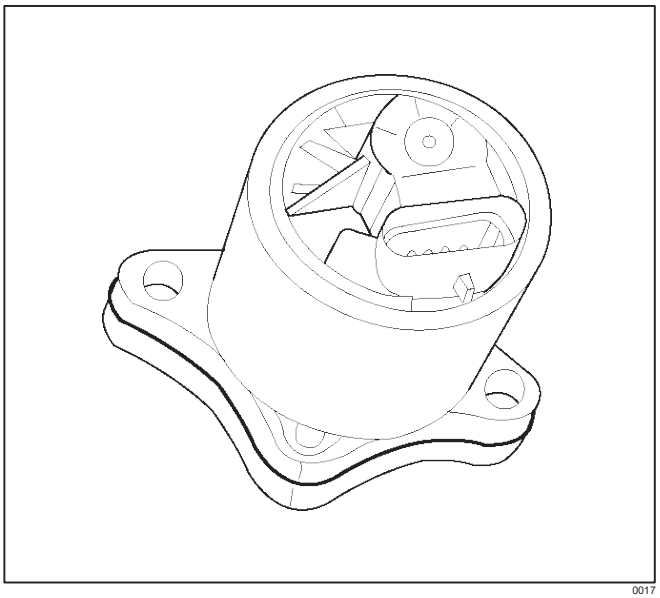
The intake air temperature (IAT) sensor is a thermistor which changes its resistance based on the temperature of air entering the engine. Low temperature produces a high resistance of about 100,000 Ω at –40˚C (–104˚F). High temperature causes low resistance of about 70 Ω at 130˚C (266˚F). The PCM supplies a 5–volt signal to the sensor through a resistor internal to the PCM, and then monitors the signal voltage. The voltage will be high when the incoming air is cold. The voltage will be low when the incoming air is hot. By measuring the voltage, the PCM calculates the incoming air temperature. The IAT sensor signal is used to adjust spark timing according to the incoming air density.

The Tech 2 displays the temperature of the air entering the engine. The temperature should read close to the ambient air temperature when the engine is cold and rise as underhood temperature increases. If the engine has not been run for several hours (overnight), the IAT sensor temperature and engine coolant temperature should read close to each other. A failure in the IAT sensor circuit will set DTC P0112, DTC P1111, DTC P1112, or DTC P0113.

Linear Exhaust Gas Recirculation (EGR) Control

The PCM monitors the exhaust gas recirculation (EGR) actual position and adjusts the pintle position accordingly. The PCM uses information from the following sensors to control the pintle position:

- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- Manifold Absolute Pressure (MAP) sensor.


0017

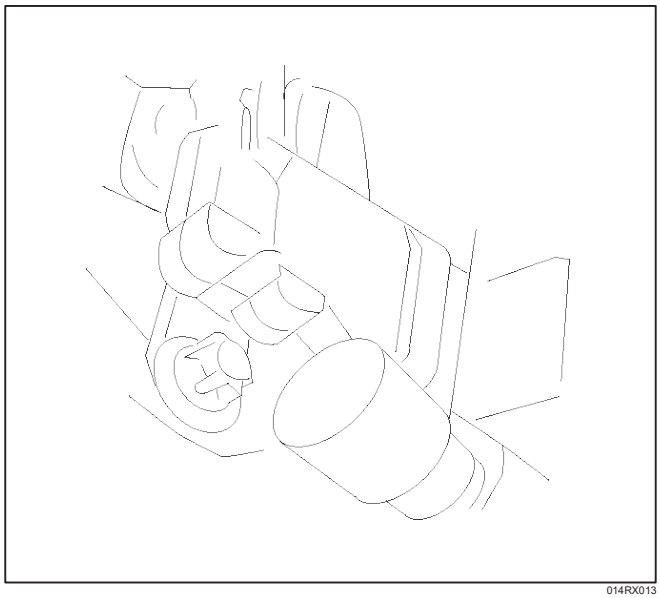
Manifold Absolute Pressure (MAP) Sensor

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition ON, engine not running or at wide–open throttle (low vacuum).

The MAP sensor is used to determine the following:

- Manifold pressure changes while the linear EGR flow test diagnostic is being run. Refer to DTC P0401.
- Engine vacuum level for other diagnostics.
- Barometric pressure (BARO).

If the PCM detects a voltage that is lower than the possible range of the MAP sensor, DTC P0107 will be set. A signal voltage higher than the possible range of the sensor will set DTC P0108. An intermittent low or high voltage will set DTC P1107 or P1106, respectively. The PCM can detect a shifted MAP sensor. The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that varies excessively above or below the calculated value, DTC P0106 will set.


014RX013

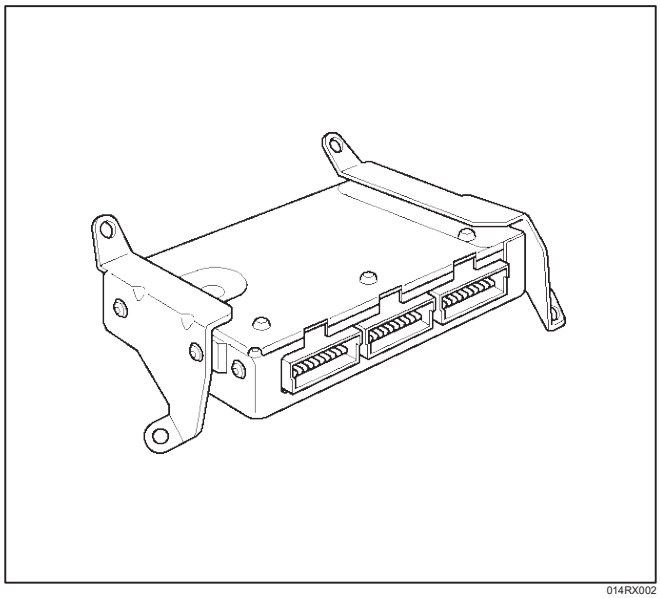
Powertrain Control Module (PCM)

The powertrain control module (PCM) is located in the passenger compartment below the center console. The PCM controls the following:

- Fuel metering system.
- Ignition timing.
- On–board diagnostics for powertrain functions.

Automatic Transmission Control System.

The PCM constantly observes the information from various sensors. The PCM controls the systems that affect vehicle performance. The PCM performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Check Engine lamp, and store diagnostic trouble codes (DTCs). DTCs identify the problem areas to aid the technician in making repairs.


014RX002

PCM Function

The PCM supplies either 5 or 12 volts to power various sensors or switches. The power is supplied through resistors in the PCM which are so high in value that a test light will not light 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. Therefore, a digital voltmeter with at least 10 megΩ input impedance is required to ensure accurate voltage readings. Tool J 39200 meets this requirement.

The PCM controls output circuits such as the injectors, IAC, cooling fan relays, etc., by controlling the ground or the power feed circuit through transistors or through either of the following two devices:

- Output Driver Module (ODM)
- Quad Driver Module (QDM)

PCM Components

The PCM is designed to maintain exhaust emission levels to government mandated standards while providing excellent driveability and fuel efficiency. The PCM monitors numerous engine and vehicle functions via electronic sensors such as the throttle position (TP) sensor, heated oxygen sensor (HO2S), and vehicle speed sensor (VSS). The PCM also controls certain engine operations through the following:

- Fuel injector control
- Ignition control module
- Evaporative emission (EVAP) purge
- A/C clutch control

PCM Voltage Description

The PCM supplies a buffered voltage to various switches and sensors. It can do this because resistors in the PCM which are so high in value that a test light may not illuminate when connected to the circuit. An ordinary shop voltmeter may not give an accurate reading because the voltmeter input impedance is too low. Use a 10–megohm input impedance digital voltmeter (such as J 39200) to assure accurate voltage readings.

The input/output devices in the PCM include analog–to–digital converters, signal buffers, counters, and special drivers. The PCM controls most components with electronic switches which complete a ground circuit when turned ON. These switches are arranged in groups of 4 and 7, called either a quad driver module (QDM), which can independently control up to 4 output terminals, or Output Driver Module (ODM) which can independently control up to 7 outputs. Not all outputs are always used.

PCM Inputs/Outputs

Inputs – Operating Conditions Read

- Air Conditioning Compressor Clutch ON or OFF
- Engine Coolant Temperature
- Crankshaft Position
- Exhaust Oxygen Content
- Manifold Absolute Pressure
- Battery Voltage
- Throttle Position
- Fuel Tank Vapor Pressure
- Fuel Tank Level
- Exhaust Gas Recirculation (EGR) Feedback

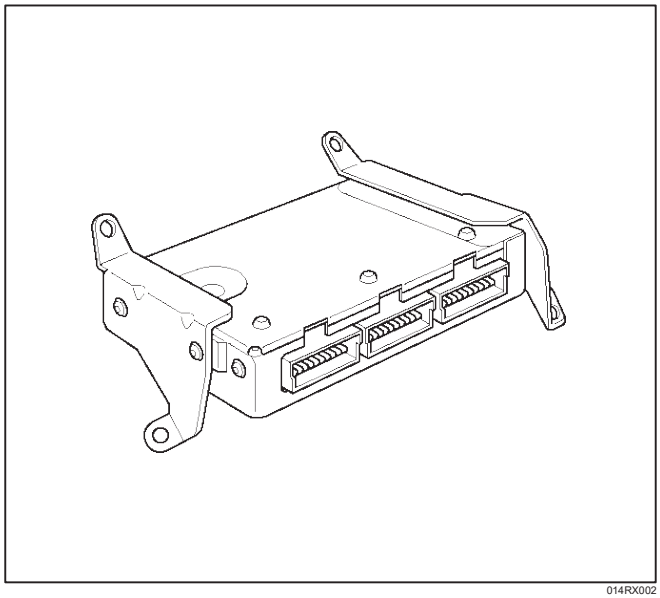
- Knock
- Vehicle Speed
- Fuel Pump Voltage
- Power Steering Pressure
- Intake Air Temperature
- Camshaft Position
- Automatic Transmission Oil Temperature Sensor
- Automatic Transmission Speed Sensor

Outputs – Systems Controlled

- EVAP Canister Purge Solenoid
- Exhaust Gas Recirculation (EGR)
- Ignition Control
- Fuel Injector Control
- Idle Air Control
- Coolant Fan Relays
- Electric Fuel Pump Relay Compressor Clutch Relay
- Air Conditioning
- Diagnostics
  - OBD II Malfunction Indicator Lamp (Check Engine lamp)
  - Data Link Connector (DLC)
  - Data Output
- Tachometer Signal
- Automatic Transmission Control Solenoid

PCM Service Precautions

The PCM is designed to withstand normal current draws associated with vehicle operation. Avoid over loading any circuit. When testing for opens and shorts, do not ground or apply voltage to any of the PCM's circuits unless instructed to do so. These circuits should only be tested using digital voltmeter J 39200. The PCM should remain connected to the PCM or to a recommended breakout box.



014RX002

Reprogramming the PCM

The Rodeo allows reprogramming of the PCM without removing it from the vehicle. This provides a flexible and cost–effective method of making changes in software calibrations.
Refer to the latest Isuzu Technical Communication System information for reprogramming or flashing procedures.

Tooth Error Correction (TEC) Service Bay Guidelines

Deceleration Fuel Cut–Off

This procedure is very convenient because it can be done in the service bay.

CAUTION: Appropriate safety measures should be taken to assure the safest conditions possible for all those people in the nearby vicinity of where the tooth error learn procedure is being performed.

Vehicle Preparation Requirements and Safety Issues

The vehicle needs sufficient engine oil, automatic transmission fluid, manual transmission gear box oil, power steering fluid, coolant, and brake fluid. Engine noise and exhaust should be considered by each assembly plant when deciding the location to perform the tooth error learn. Proper safety precautions should be taken. Anticipate unusual events such as a manual transmission accidentally being bumped into gear or a foot slipping off a clutch at high engine speed. The vehicle may cause other vehicles to be hit. If the transmission is in Park during the high engine speeds, the transmission Park Ratchet experiences excessive vibration and may momentarily slip. The vehicle is typically then in a Neutral type state and may roll, especially if the vehicle is on an incline. Under this condition the transmission should not slip into gear.
The following summarizes the engine preparation requirements for a tooth error learn.

Requirements:

1. At least 4 minutes of engine run time is required to have occurred at lest once during the life of the vehicle to insure that all of the oil passages are flushed of debris from machining, casting, and assembly.
2. At least 5 seconds of engine run time is required during the same key cycle as the tooth error learn to fill the oil passages and provide proper lubrication. 10 seconds is the preferred guideline.
3. At least 65 degrees Celsius Coolant temperature. Engine oil temperature of 38 degrees Celsius is required for lubrication, which correlates (in most engines) to 65 degrees Celsius Coolant temperature. This is a recommendation to insure a sufficiently lubricated engine 65 degrees Celsius Coolant temperature correlates to an engine oil temperature of 38 degrees Celsius.

4. Vehicle must be in Park or Neutral. For a manual transmission vehicle, the clutch does not need to be depressed. The tooth error learn may be performed with either:
   1. Gear box in Neutral, it does not matter if the clutch is depressed or not.
   2. Gear Box in a gear and clutch depressed.

NOTE: The first option is the recommended option due to safety concerns. The second option has the risk of the operators foot slipping off of the clutch with the vehicle being revved up and in gear.

5. A/C should always be turned OFF before performing the TEC learn procedure.
6. A Class II command from the Tech 2 is required to invoke the TEC learn procedure.
7. No Camshaft and/or Crankshaft Sensor DTC Codes present.

Tooth Error Learn Procedures

The following steps are required to learn the tooth error once the above mentioned vehicle preparation requirements are met:

1. Make sure that the tooth error learn procedure has been invoked with the Tech 2, other wise when the throttle is depressed, the RPM would go to the high RPM fuel cutoff and not be cutoff at the lower tooth error learning fuel cutoff limit.
2. Depress the brake pedal for safety reasons.
3. Depress the throttle pedal to Wide Open Throttle (WOT) and keep the throttle at 100% for the duration of the Tooth Error Correction (TEC) learning process until the TEC is learned or the number of attempts to learn has been exceeded. The RPM will be limited to the upper TEC RPM limit until one of the two above mentioned conditions are met and the throttle is released to less than 5% Throttle Position Sensor (TPS). After this, the RPM limit will be the normal redline RPM limit.
4. The tooth error learning diagnostic will learn the tooth error as the engine decelerates in fuel cutoff.
5. During the tooth error learning procedure. TEC specific information is available which will indicate that the tooth error was properly learned and completed.

Considerations For Locating The Tooth Error Learning Procedure

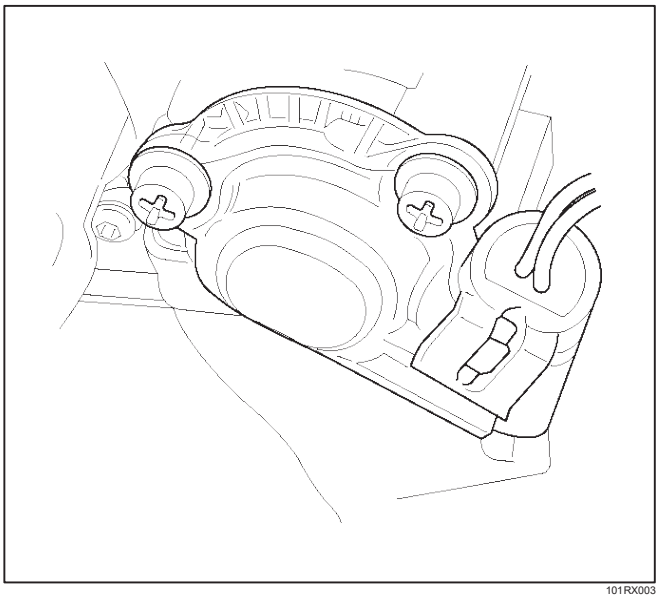
The area that the tooth error learn is done should be well ventilated or have vehicle exhaust elimination system which attaches to the tail pipe and draws the vehicle exhaust out of the building.

CAUTION: Appropriate safety measures should be taken to assure the safest conditions possible for all those people in the nearby vicinity of where the tooth error learn procedure is being performed. If possible, anchored or secured safety barriers should be in place in at least the front of the vehicle and in the back of the vehicle if possible to reduce the possibility of accidents. The figure below shows the proper placement of a frontal safety barrier.

The area that the tooth error learn is done should be well ventilated or have vehicle exhaust elimination system which attaches to the tail pipe and draws the vehicle exhaust out of the building.

Throttle Position (TP) Sensor

The throttle position (TP) sensor is a potentiometer connected to the throttle shaft on the throttle body. The PCM monitors the voltage on the signal line and calculates throttle position. As the throttle valve angle is changed (accelerator pedal moved), the TP sensor signal also changes. At a closed throttle position, the output of the TP sensor is about 0.25 volts. As the throttle valve opens, the output increases so that at wide open throttle (WOT), the output voltage should be about 4.75 volts.
The PCM calculates fuel delivery based on throttle valve angle (driver demand). A broken or loose TP sensor may cause intermittent bursts of fuel from an injector and unstable idle because the PCM thinks the throttle is moving. A hard failure in the TP sensor 5–volt reference or signal circuits will set either a DTC P0122 or DTC P0123. A hard failure with the TP sensor ground circuit may set DTC P0123 and DTC P0122. Once a DTC is set, the PCM will use an artificial default value based on engine RPM and mass air flow for the throttle position, and some vehicle performance will return. A high idle may result when either DTC P0122 or DTC P0123 is set. The PCM can detect intermittent TP sensor faults. DTC P1121 or DTC P1122 will set if an intermittent high or low circuit failure is being detected.



101RX003

Transmission Range Switch

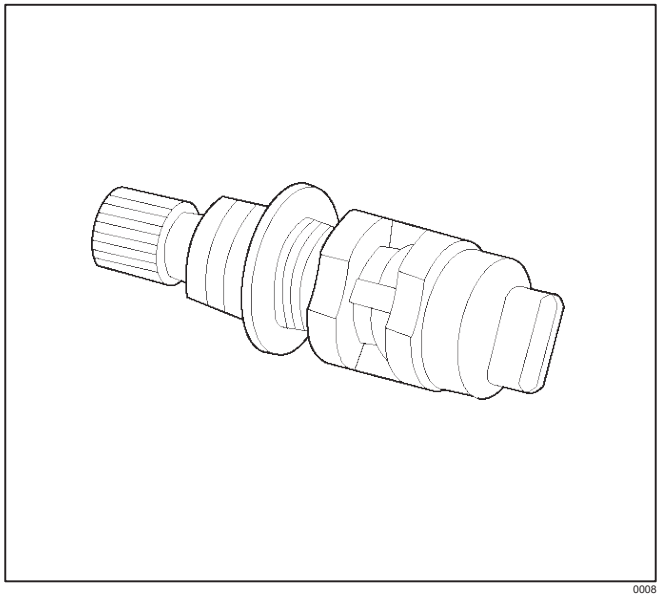
IMPORTANT: The vehicle should not be driven with the transmission range switch disconnected; idle quality will be affected.

The four inputs from the transmission range switch indicate to the PCM which position is selected by the transmission selector lever. This information is used for ignition timing, EVAP canister purge, EGR and IAC valve operation.

For more information on the transmission range switch, refer to 4L30–E Automatic Transmission.

Vehicle Speed Sensor (VSS)

The PCM determines the speed of the vehicle by converting a pulsing voltage signal from the vehicle speed sensor (VSS) into miles per hour. The PCM uses this signal to operate the speedometer.



0008

Use of Circuit Testing Tools

Do not use a test light to diagnose the powertrain electrical systems unless specifically instructed by the diagnostic procedures. Use Connector Test Adapter Kit J 35616 whenever diagnostic procedures call for probing connectors.

Aftermarket Electrical And Vacuum Equipment

Aftermarket (add–on) electrical and vacuum equipment is defined as any equipment which connects to the vehicle's electrical or vacuum systems that is installed on a vehicle after it leaves the factory. No allowances have been made in the vehicle design for this type of equipment.

NOTE: No add–on vacuum equipment should be added to this vehicle.

NOTE: Add–on electrical equipment must only be connected to the vehicle's electrical system at the battery (power and ground).

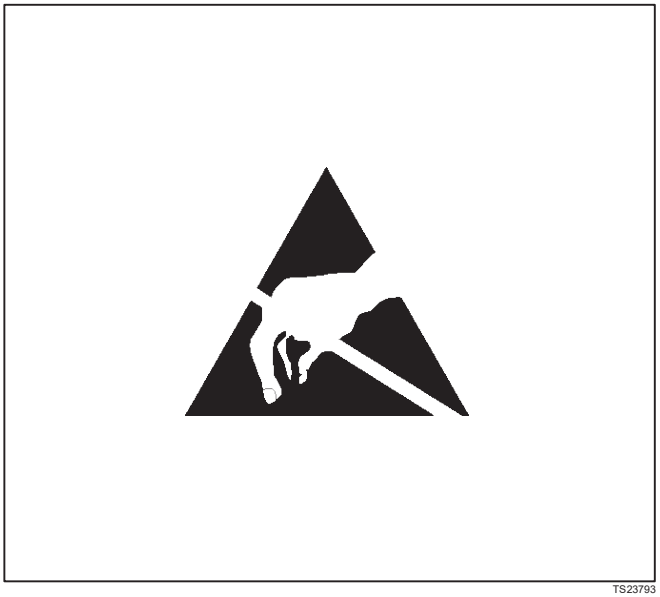
Add–on electrical equipment, even when installed to these guidelines, may still cause the powertrain system to malfunction. This may also include equipment not connected to the vehicle electrical system such as portable telephones and radios. Therefore, the first step in diagnosing any powertrain problem is to eliminate all aftermarket electrical equipment from the vehicle. After this is done, if the problem still exists, it may be diagnosed in the normal manner.

Electrostatic Discharge Damage

Electronic components used in the PCM are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to some electronic components. By comparison, it takes as much as 4000 volts for a person to feel even the zap of a static discharge.

There are several ways for a person to become statically charged. The most common methods of charging are by friction and induction.

- An example of charging by friction is a person sliding across a vehicle seat.
- Charge by induction occurs when a person with well–insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off leaving the person highly charged with the opposite polarity. Static charges can cause damage, therefore it is important to use care when handling and testing electronic components.



TS23793

NOTE: To prevent possible electrostatic discharge damage, follow these guidelines:

- Do not touch the PCM connector pins or soldered components on the PCM circuit board.
- Do not touch any electronic sensor module component leads.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the part from the package, ground the package to a known good ground on the vehicle.
- If the part has been handled while sliding across the seat, while sitting down from a standing position, or while walking a distance, touch a known good ground before installing the part.

Upshift Lamp

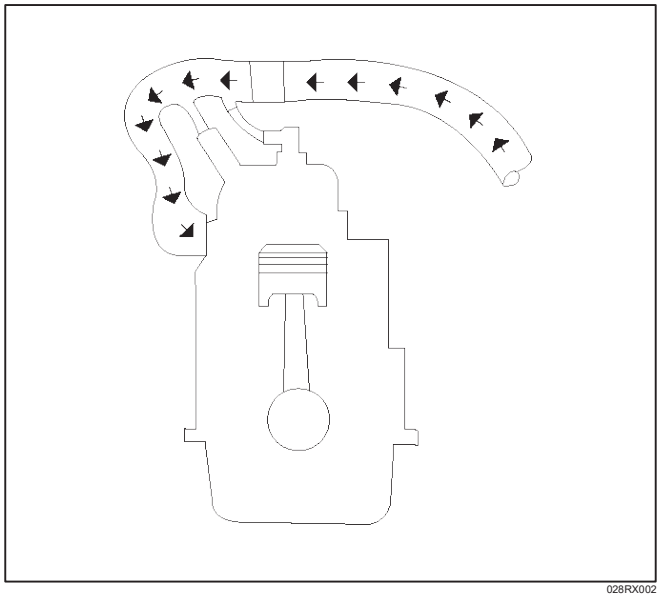
Refer to Up shift lamp diagnosis.

GENERAL DESCRIPTION — AIR INDUCTION

Air Induction System

The air induction system filters contaminants from the outside air, and directs the progress of the air as it is drawn into the engine. A remote–mounted air cleaner prevents dirt and debris in the air from entering the engine. The air duct assembly routes filtered air to the throttle body. Air enters the engine by the following steps:

1. Through the throttle body.
2. Into the intake manifold.
3. Through the cylinder head intake ports.
4. Into the cylinders.



028RX002

GENERAL DESCRIPTION — FUEL METERING

Acceleration Mode

The PCM provides extra fuel when it detects a rapid increase in the throttle position and the air flow.

Accelerator Controls

The accelerator control system is a cable–type system with specific linkage adjustments.
Refer to Cable Adjustment.

Battery Voltage Correction Mode

When battery voltage is low, the PCM will compensate for the weak spark by increasing the following:

- The amount of fuel delivered.
- The idle RPM.

CMP Signal

The PCM uses the camshaft position (CMP) sensor signal to determine the position of the number 1 piston during its power stroke, allowing the PCM to calculate true sequential multiport fuel injection (SFI). Loss of this signal will set a DTC P0341 or DTC P0342. If the CMP signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection based on the last fuel injection pulse, and the engine will continue to run. The engine can be restarted and will run in the calculated sequential mode with the fault is present, with a 1–in–4 chance of being correct.

Clear Flood Mode

Clear a flooded engine by pushing the accelerator pedal down all the way. The PCM then de–energizes the fuel injectors. The PCM holds the fuel injectors de–energized as long as the throttle remains above 80% and the engine speed is below 800 RPM. If the throttle position becomes less than 80%, the PCM again begins to pulse the injectors ON and OFF, allowing fuel into the cylinders.

Deceleration Fuel Cutoff (DFCO) Mode

The PCM reduces the amount of fuel injected when it detects a decrease in the throttle position and the air flow. When deceleration is very fast, the PCM may cut off fuel completely for short periods.

Engine Speed/Vehicle Speed/ Fuel Disable Mode

The PCM monitors engine speed. It turns off the fuel injectors when the engine speed increases above 6000 RPM. The fuel injectors are turned back on when engine speed decreases below 5750 RPM.

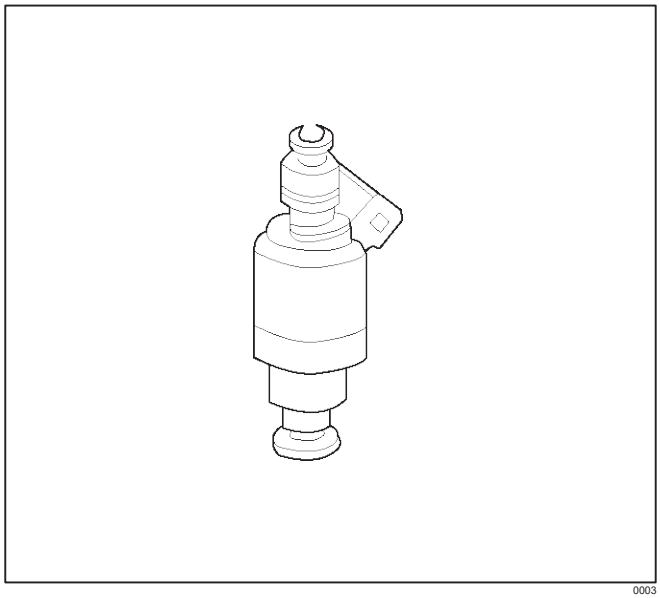
Fuel Cutoff Mode

No fuel is delivered by the fuel injectors when the ignition is OFF. This prevents engine run–on. In addition, the PCM suspends fuel delivery if no reference pulses are detected (engine not running) to prevent engine flooding.

Fuel Injector

The sequential multiport fuel injection (SFI) fuel injector is a solenoid–operated device controlled by the PCM. The PCM energizes the solenoid, which opens a valve to allow fuel delivery.
The fuel is injected under pressure in a conical spray pattern at the opening of the intake valve. Excess fuel not used by the injectors passes through the fuel pressure regulator before being returned to the fuel tank.

A fuel injector which is stuck partly open will cause a loss of fuel pressure after engine shut down, causing long crank times.



0003

Fuel Metering System Components

The fuel metering system is made up of the following parts:

- The fuel injectors.
- The throttle body.
- The fuel rail.
- The fuel pressure regulator.
- The PCM.
- The crankshaft position (CKP) sensor.
- The camshaft position (CMP) sensor.
- The idle air control (IAC) valve.
- The fuel pump.
- The fuel pump relay.
- The fuel tank vapor pressure sensor.

Basic System Operation

The fuel metering system starts with the fuel in the fuel tank. An electric fuel pump, located in the fuel tank, pumps fuel to the fuel rail through an in–line fuel filter. The pump is designed to provide fuel at a pressure above the pressure needed by the injectors. A fuel pressure regulator in the fuel rail keeps fuel available to the fuel injectors at a constant pressure. A return line delivers unused fuel back to the fuel tank. Refer to Section 6C for further information on the fuel tank, line filter, and fuel pipes.

Fuel Metering System Purpose

The basic function of the air/fuel metering system is to control the air/fuel delivery to the engine. Fuel is delivered to the engine by individual fuel injectors mounted in the intake manifold near each intake valve.

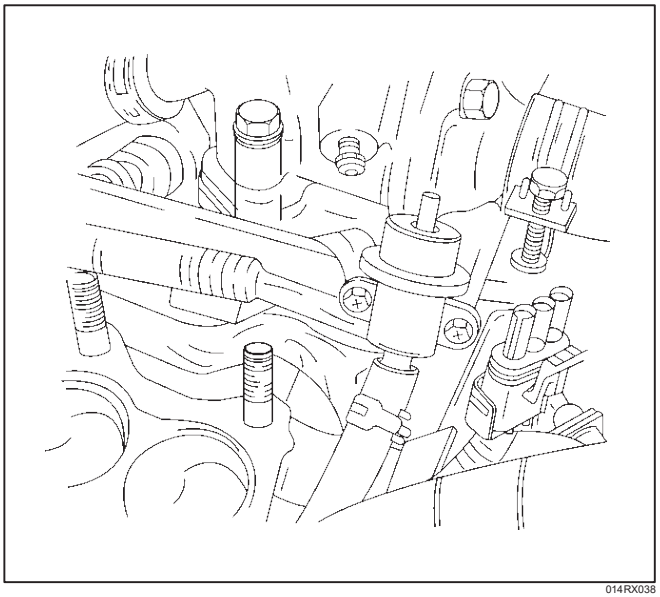
The main control sensor is the heated oxygen sensor (HO2S) located in the exhaust system. The HO2S tells the PCM how much oxygen is in the exhaust gas. The PCM changes the air/fuel ratio to the engine by controlling the amount of time that the fuel injector is ON. The best mixture to minimize exhaust emissions is 14.7 parts of air to 1 part of gasoline by weight, 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 PCM monitors signals from several sensors in order to determine the fuel needs of the engine. Fuel is delivered under one of several conditions called ”modes.” All modes are controlled by the PCM.

Fuel Pressure Regulator

The fuel pressure regulator is a diaphragm–operated relief valve mounted on the fuel rail with fuel pump pressure on one side and manifold pressure on the other side. The fuel pressure regulator maintains the fuel pressure available to the injector at three times barometric pressure adjusted for engine load. It may be serviced separately.

If the pressure is too low, poor performance and a DTC P0171, or DTC P1171 will be the result. If the pressure is too high, a DTC P0172 will be the result. For information on diagnosing fuel pressure conditions, refer to Fuel System Diagnosis.



014RX038

Fuel Pump Electrical Circuit

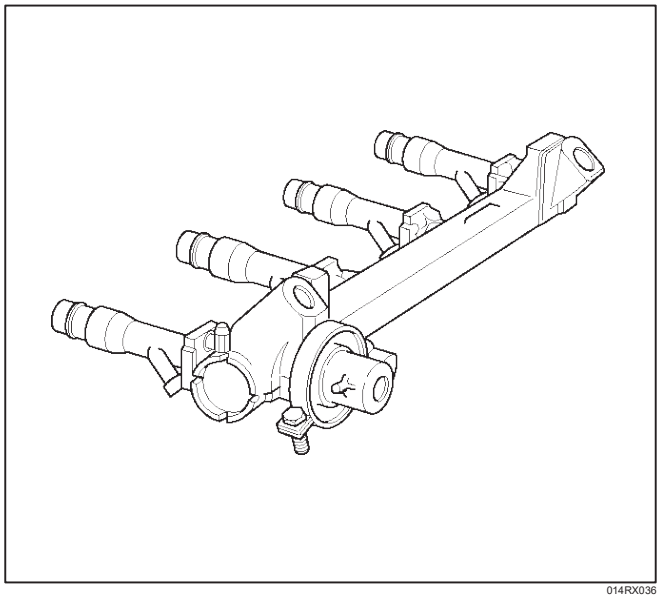
When the key is first turned ON, the PCM energizes the fuel pump relay for two seconds to build-up the fuel pressure quickly. If the engine is not started within two seconds, the PCM shuts the fuel pump off and waits until the engine is cranked. When the engine is cranked and the 58X crankshaft position signal has been detected by the PCM, the PCM supplies 12 volts to the fuel pump relay to energize the electric in–tank fuel pump.

An inoperative fuel pump will cause a ”no–start” condition. A fuel pump which does not provide enough pressure will result in poor performance.

Fuel Rail

The fuel rail is mounted to the top of the engine and distributes fuel to the individual injectors. Fuel is delivered to the fuel inlet tube of the fuel rail by the fuel lines. The fuel goes through the fuel rail to the fuel pressure

regulator. The fuel pressure regulator maintains a constant fuel pressure at the injectors. Remaining fuel is then returned to the fuel tank.



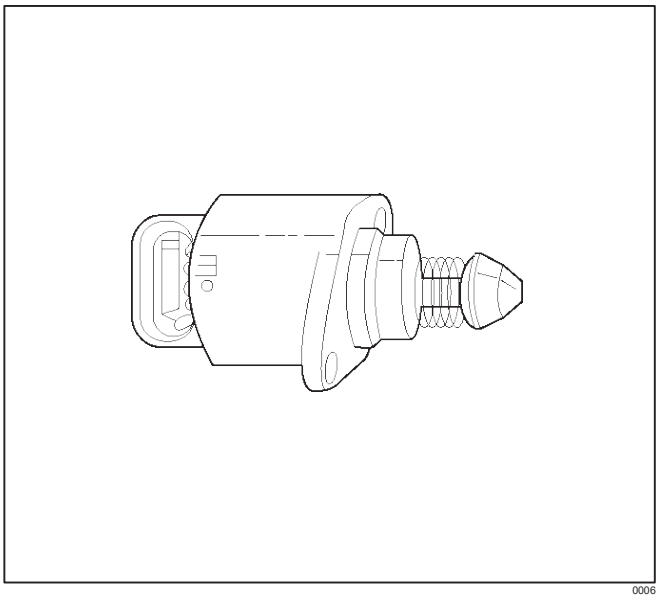
Idle Air Control (IAC) Valve

The purpose of the idle air control (IAC) valve is to control engine idle speed, while preventing stalls due to changes in engine load. The IAC valve, mounted in the throttle body, controls bypass air around the throttle plate. By moving the conical valve (pintle) in (to decrease air flow) or out (to increase air flow), a controlled amount of air can move around the throttle plate. If the RPM is too low, the PCM will retract the IAC pintle, resulting in more air moving past the throttle plate to increase the RPM. If the RPM is too high, the PCM will extend the IAC pintle, allowing less air to move past the throttle plate, decreasing the RPM.

The IAC pintle valve moves in small steps called counts. During idle, the proper position of the IAC pintle is calculated by the PCM based on battery voltage, coolant temperature, engine load, and engine RPM. If the RPM drops below a specified value, and the throttle plate is closed, the PCM senses a near–stall condition. The PCM will then calculate a new IAC pintle valve position to prevent stalls.

If the IAC valve is disconnected and reconnected with the engine running, the idle RPM will be wrong. In this case, the IAC must be reset. The IAC resets when the key is cycled ON then OFF. When servicing the IAC, it should only be disconnected or connected with the ignition OFF.

The position of the IAC pintle valve affects engine start–up and the idle characteristics of the vehicle. If the IAC pintle is fully open, too much air will be allowed into the manifold. This results in high idle speed, along with possible hard starting and a lean air/fuel ratio. DTC P0507 may set. If the IAC pintle is stuck closed, too little air will be allowed in the manifold. This results in a low idle speed, along with possible hard starting and a rich air/fuel ratio. DTC P0506 may set. If the IAC pintle is stuck part–way open, the idle may be high or low and will not respond to changes in the engine load.



Run Mode

The run mode has the following two conditions:

- Open Loop
- Closed Loop

When the engine is first started, the system is in ”Open Loop” operation. In ”Open Loop,” the PCM ignores the signal from the heated oxygen sensor (HO2S). It calculates the air/fuel ratio based on inputs from the TP, ECT, and MAP sensors.

The system remains in ”Open Loop” until the following conditions are met:

- The HO2S has a varying voltage output showing that it is hot enough to operate properly (this depends on temperature).
- The ECT has reached a specified temperature.
- A specific amount of time has elapsed since starting the engine.
- Engine speed has been greater than a specified RPM since start–up.

The specific values for the above conditions vary with different engines and are stored in the programmable read only memory (PROM). When these conditions are met, the system enters ”Closed Loop” operation. In ”Closed Loop”, the PCM calculates the air/fuel ratio (injector on–time) based on the signal from the HO2S. This allows the air/fuel ratio to stay very close to 14.7:1.

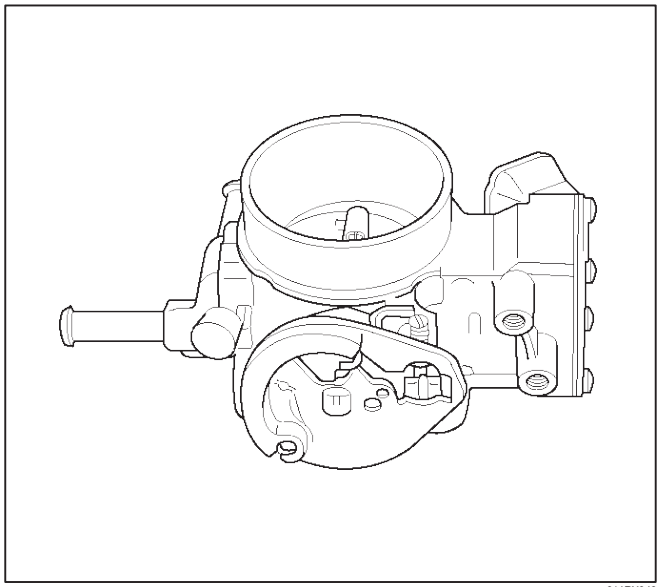
Starting Mode

When the ignition is first turned ON, the PCM energizes the fuel pump relay for two seconds to allow the fuel pump to build up pressure. The PCM then checks the engine coolant temperature (ECT) sensor and the throttle position (TP) sensor to determine the proper air/fuel ratio for starting.

The PCM controls the amount of fuel delivered in the starting mode by adjusting how long the fuel injectors are energized by pulsing the injectors for very short times.

Throttle Body Unit

The throttle body has a throttle plate to control the amount of air delivered to the engine. The TP sensor and IAC valve are also mounted on the throttle body.
Vacuum ports located behind the throttle plate provide the vacuum signals needed by various components. Engine coolant is directed through a coolant cavity in the throttle body to warm the throttle valve and to prevent icing.

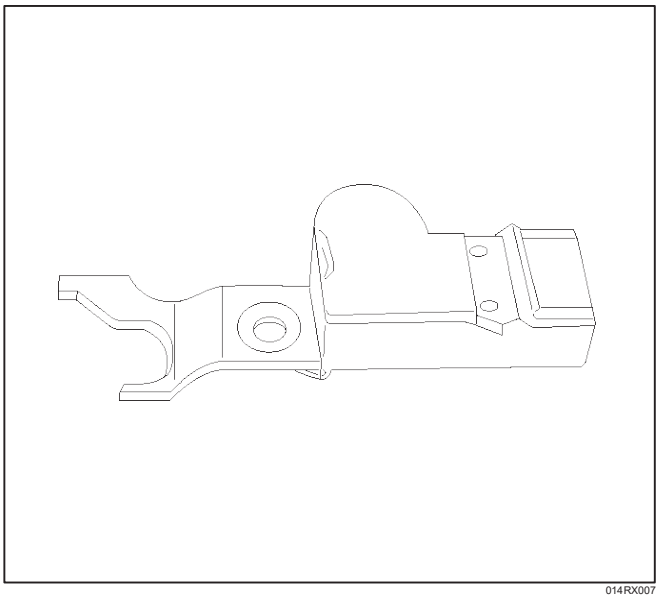


014RX040

GENERAL DESCRIPTION — ELECTRONIC IGNITION SYSTEM

Camshaft Position (CMP) Sensor

The camshaft position (CMP) sensor sends a signal to the PCM. The PCM uses this signal as a ”sync pulse” to trigger the injectors in the proper sequence. The PCM uses the CMP signal to indicate the position of the #1 piston during its power stroke. The CMP allows the PCM to calculate true sequential fuel injection (SFI) mode of operation. If the PCM detects an incorrect CMP signal while the engine is running, DTC P0341 will set.
If the CMP signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection mode based on the last fuel injection pulse, and the engine will continue to run. It will run in the calculated sequential mode with a 1–in–4 chance of the injector being correct.
For additional information, refer to DTC P0342.



014RX007

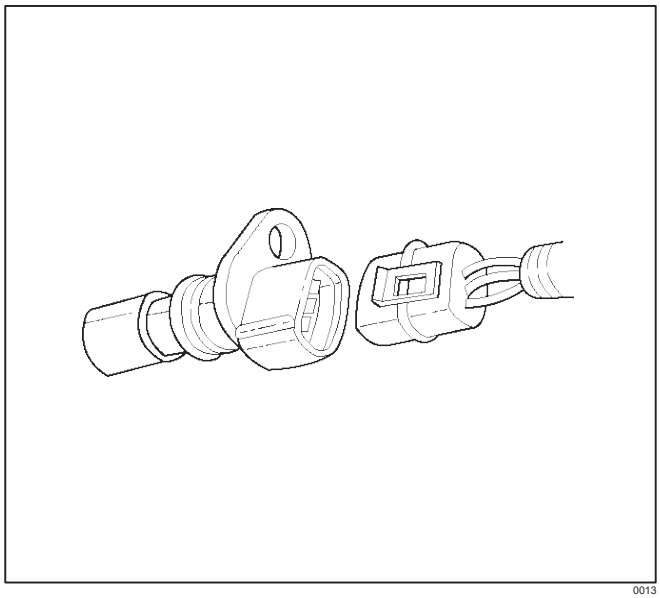
Crankshaft Position (CKP) Sensor

The crankshaft position (CKP) sensor provides a signal used by the powertrain control module (PCM) to calculate the ignition sequence. The sensor initiates the 58X reference pulses which the PCM uses to calculate RPM and crankshaft position. For additional information, refer to Electronic Ignition System.

Electronic Ignition

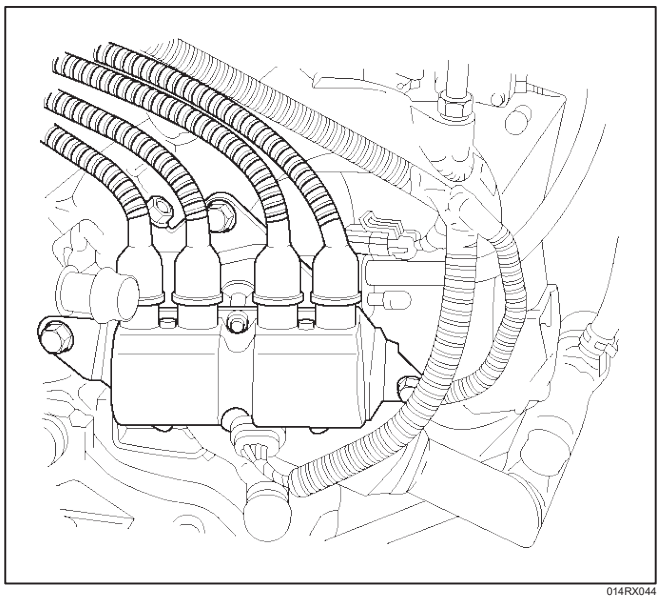
The electronic ignition system controls fuel combustion by providing a spark to ignite the compressed air/fuel mixture at the correct time. To provide optimum engine performance, fuel economy, and control of exhaust emissions, the PCM controls the spark advance of the ignition system. Electronic ignition has the following advantages over a mechanical distributor system:

- No moving parts.
- Less maintenance.
- Remote mounting capability.
- No mechanical load on the engine.
- More coil cooldown time between firing events.
- Elimination of mechanical timing adjustments.
- Increased available ignition coil saturation time.


0013

Ignition Coils

The 2.2L engine uses 2 ignition coils, 1 per 2 cylinders. A two–wire connector provides a 12–volt primary supply through the 15–amp ignition coil fuse, and the ground wire is connected to a ground–switching ignition module. Radio frequency interference produced by the coil is controlled by a condenser which is mounted near the ignition coil.


014RX044

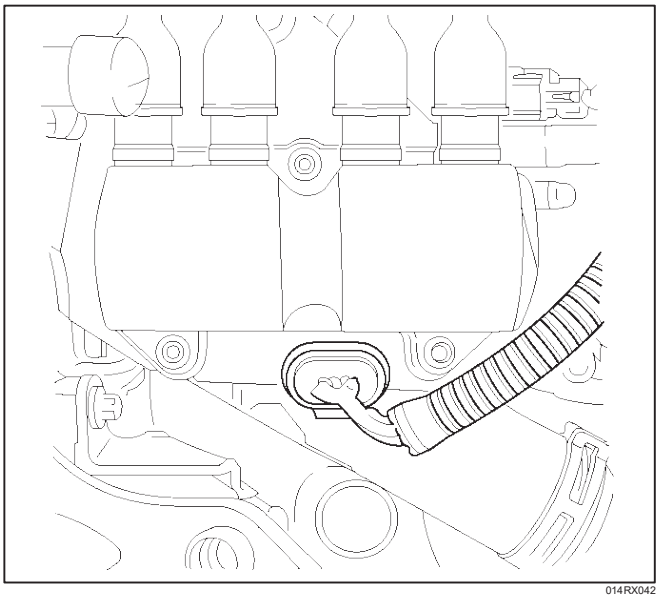
Ignition Control

The ignition control (IC) spark timing is the PCM's method of controlling the spark advance and the ignition dwell. The IC spark advance and the ignition dwell are calculated by the PCM using the following inputs:

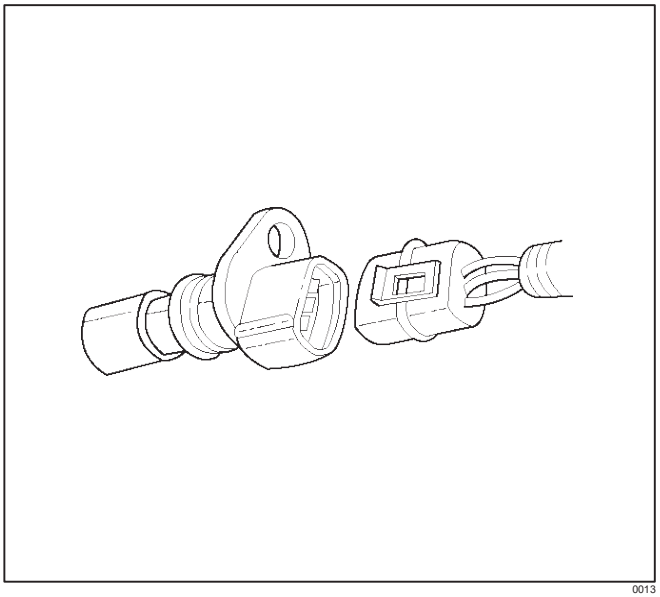
- Engine speed.
- Crankshaft position (58X reference).
- Camshaft position (CMP) sensor.
- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- Vehicle speed (vehicle speed sensor).
- PCM and ignition system supply voltage.

Ignition Control Module (ICM)

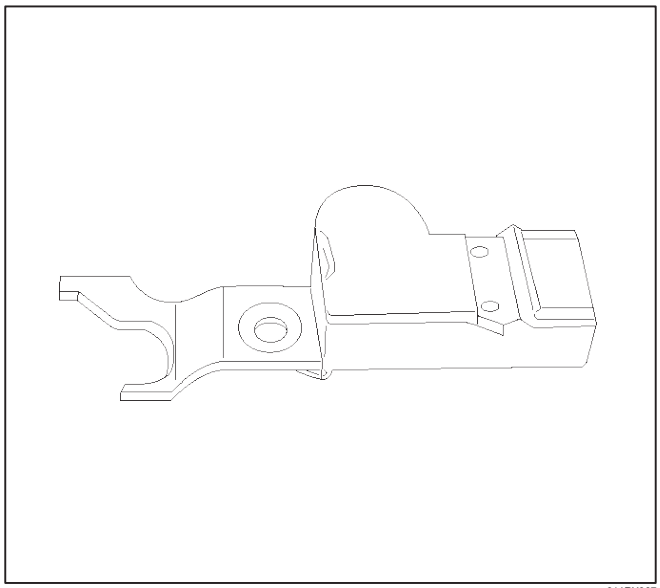
The powertrain control module (PCM) controls engine ignition through a solid–state switching unit called the ignition control module (ICM). The software in the PCM uses input from several sensors to determine the timing, duration, and strength of the spark.


014RX042

- The crankshaft position (CKP) sensor sends the PCM a 58X signal related to the exact position of the crankshaft.


0013

- The camshaft position (CMP) sensor sends a signal related to the position of the camshaft.



Based on these sensor signals, as well as engine load and engine coolant temperature information, the PCM controls the switching function of the ICM by sending it a 5V signal. As long as the ICM receives the signal, it allows battery voltage to the ignition coil. That voltage allows a magnetic field to build in the coil.
When the PCM requires a spark plug to fire, it shuts off the 5V signal to the ICM grounding it internally. This triggers the ICM to switch off the battery voltage to the ignition coil, which causes the field to collapse. The lines of magnetic force pass through the secondary portion of the coil as they collapse. As they intersect the coil, they induce high voltage in the secondary ignition circuit which travels toward ground through the spark plug.

Ignition Control PCM Output

The PCM provides a zero volt (actually about 100 mV to 200 mV) or a 5–volt output signal to the ignition control (IC) module. When the ignition control (IC) module receives the 5–volt signal from the PCM, it provides a ground path for the B+ supply to the primary side of the coil and creates a magnetic field in the coil. When the PCM shuts off the 5–volt signal to the ignition control module, the ground path for the primary coil is broken. The magnetic field collapses and induces a high voltage secondary impulse which fires the spark plug and ignites the air/fuel mixture.

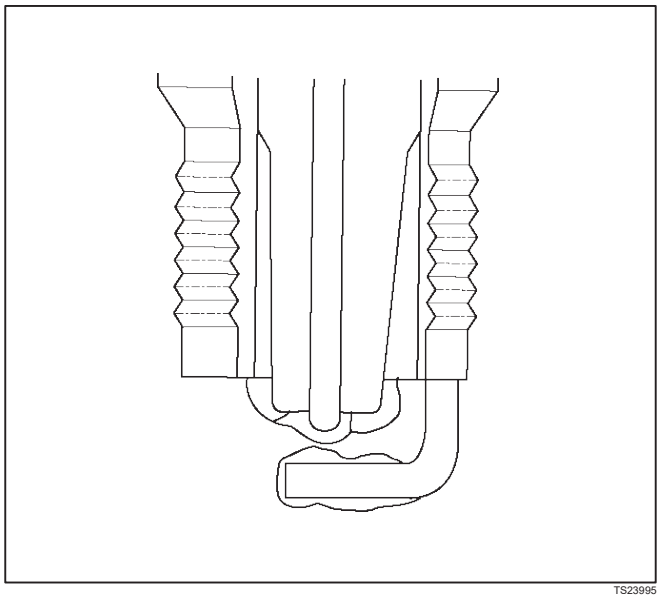
Powertrain Control Module (PCM)

The PCM is responsible for maintaining proper spark and fuel injection timing for all driving conditions. To provide optimum driveability and emissions, the PCM monitors the input signals from the following components in order to calculate spark timing:

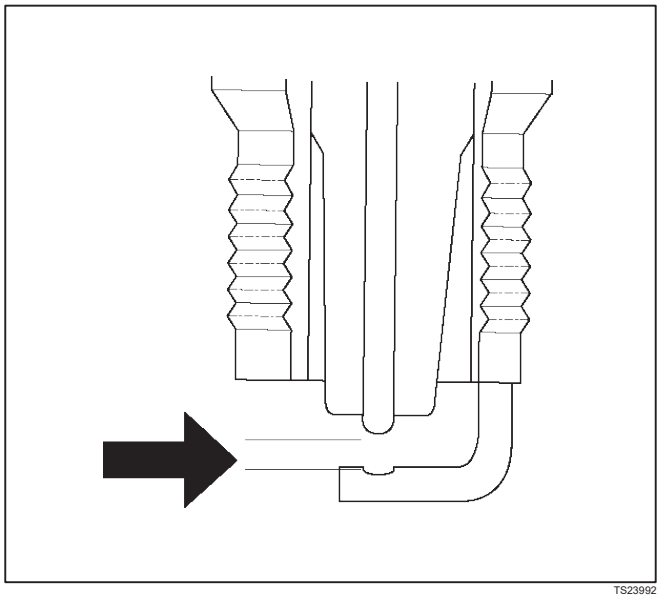
- Engine coolant temperature (ECT) sensor.
- Intake air temperature (IAT) sensor.
- Throttle position (TP) sensor.
- Vehicle speed sensor (VSS).
- Crankshaft position (CKP) sensor.

Spark Plug

Although worn or dirty spark plugs may give satisfactory operation at idling speed, they frequently fail at higher engine speeds. Faulty spark plugs may cause poor fuel economy, power loss, loss of speed, hard starting and generally poor engine performance. Follow the scheduled maintenance service recommendations to ensure satisfactory spark plug performance. Refer to Maintenance and Lubrication.
Normal spark plug operation will result in brown to grayish–tan deposits appearing on the insulator portion of the spark plug. A small amount of red–brown, yellow, and white powdery material may also be present on the insulator tip around the center electrode. These deposits are normal combustion by–products of fuels and lubricating oils with additives. Some electrode wear will also occur.
Engines which are not running properly are often referred to as ”misfiring.” This means the ignition spark is not igniting the air/fuel mixture at the proper time. While other ignition and fuel system causes must also be considered, possible causes include ignition system conditions which allow the spark voltage to reach ground in some other manner than by jumping across the air gap at the tip of the spark plug, leaving the air/fuel mixture unburned. Refer to DTC P0300.
Misfiring may also occur when the tip of the spark plug becomes overheated and ignites the mixture before the spark jumps. This is referred to as ”pre–ignition.”
Spark plugs may also misfire due to fouling, excessive gap, or a cracked or broken insulator. If misfiring occurs before the recommended replacement interval, locate and correct the cause.
Carbon fouling of the spark plug is indicated by dry, black carbon (soot) deposits on the portion of the spark plug in the cylinder. Excessive idling and slow speeds under light engine loads can keep the spark plug temperatures so low that these deposits are not burned off. Very rich fuel mixtures or poor ignition system output may also be the cause.Refer to DTC P0172.
Oil fouling of the spark plug is indicated by wet oily deposits on the portion of the spark plug in the cylinder, usually with little electrode wear. This may be caused by oil during break–in of new or newly overhauled engines.
Deposit fouling of the spark plug occurs when the normal red–brown, yellow or white deposits of combustion by–products become sufficient to cause misfiring. In some cases, these deposits may melt and form a shiny glaze on the insulator around the center electrode. If the fouling is found in only one or two cylinders, valve stem clearances or intake valve seals may be allowing excess lubricating oil to enter the cylinder, particularly if the deposits are heavier on the side of the spark plug facing the intake valve.

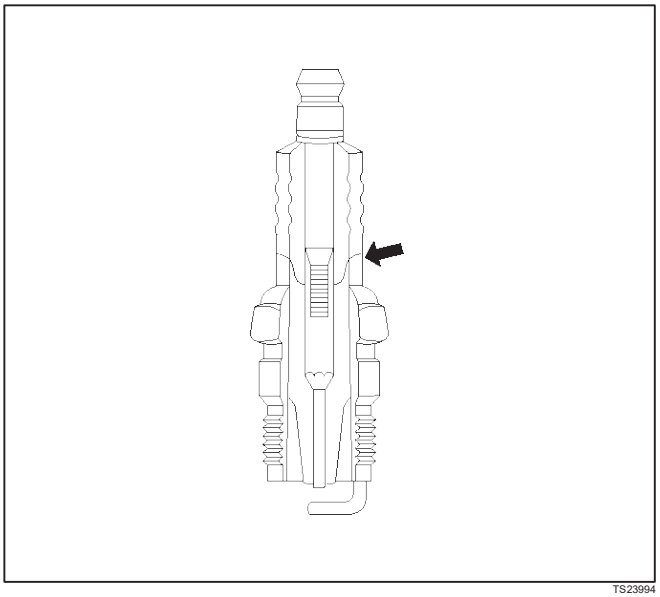

TS23995

Excessive gap means that the air space between the center and the side electrodes at the bottom of the spark plug is too wide for consistent firing. This may be due to improper gap adjustment or to excessive wear of the electrode during use. A check of the gap size and comparison to the gap specified for the vehicle in Maintenance and Lubrication will tell if the gap is too wide. A spark plug gap that is too small may cause an unstable idle condition. Excessive gap wear can be an indication of continuous operation at high speeds or with engine loads, causing the spark to run too hot. Another possible cause is an excessively lean fuel mixture.

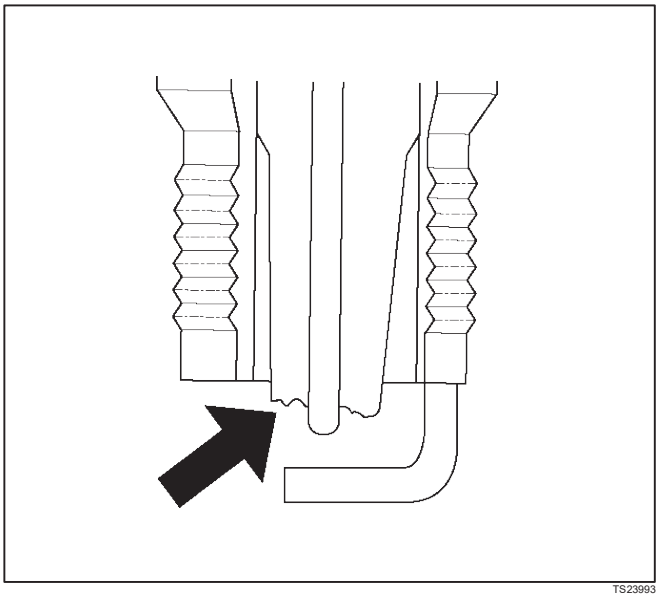

TS23992

Low or high spark plug installation torque or improper seating can result in the spark plug running too hot and can cause excessive center electrode wear. The plug and the cylinder head seats must be in good contact for proper heat transfer and spark plug cooling. Dirty or damaged threads in the head or on the spark plug can keep it from seating even though the proper torque is applied. Once spark plugs are properly seated, tighten them to the torque shown in the Specifications Table. Low torque may result in poor contact of the seats due to a loose spark plug. Overtightening may cause the spark plug shell to be stretched and will result in poor contact between the seats. In extreme cases, exhaust blow–by and damage beyond simple gap wear may occur.

Cracked or broken insulators may be the result of improper installation, damage during spark plug re–gapping, or heat shock to the insulator material. Upper insulators can be broken when a poorly fitting tool is used during installation or removal, when the spark plug is hit from the outside, or is dropped on a hard surface. Cracks in the upper insulator may be inside the shell and not visible. Also, the breakage may not cause problems until oil or moisture penetrates the crack later.


TS23994

A broken or cracked lower insulator tip (around the center electrode) may result from damage during re–gapping or from ”heat shock” (spark plug suddenly operating too hot).


TS23993

- Damage during re–gapping can happen if the gapping tool is pushed against the center electrode or the insulator around it, causing the insulator to crack. When re–gapping a spark plug, make the adjustment by bending only the ground side terminal, keeping the tool clear of other parts.
- ”Heat shock” breakage in the lower insulator tip generally occurs during several engine operating conditions (high speeds or heavy loading) and may be caused by over–advanced timing or low grade fuels. Heat shock refers to a rapid increase in the tip temperature that causes the insulator material to crack.

Spark plugs with less than the recommended amount of service can sometimes be cleaned and re–gapped, then returned to service. However, if there is any doubt about the serviceability of a spark plug, replace it. Spark plugs with cracked or broken insulators should always be replaced.

A/C CLUTCH DIAGNOSIS

A/C Clutch Circuit Operation

A 12–volt signal is supplied to the A/C request input of the PCM when the A/C is selected through the A/C control switch.

The A/C compressor clutch relay is controlled through the PCM. This allows the PCM to modify the idle air control position prior to the A/C clutch engagement for better idle quality. If the engine operating conditions are within their specified calibrated acceptable ranges, the PCM will enable the A/C compressor relay. This is done by providing a ground path for the A/C relay coil within the PCM. When the A/C compressor relay is enabled, battery voltage is supplied to the compressor clutch coil. The PCM will enable the A/C compressor clutch whenever the engine is running and the A/C has been requested. The PCM will not enable the A/C compressor clutch if any of the following conditions are met:

- The engine speed is greater than 6315 RPM.
- The ECT is greater than 119˚C (246˚F).
- The throttle is more than 80% open.

A/C Clutch Circuit Purpose

The A/C compressor operation is controlled by the powertrain control module (PCM) for the following reasons:

- It improves idle quality during compressor clutch engagement.
- It improves wide open throttle (WOT) performance.
- It provides A/C compressor protection from operation with incorrect refrigerant pressures.

The A/C electrical system consists of the following components:

1. The A/C control switch.
2. The A/C refrigerant pressure switches.
3. The A/C compressor clutch.
4. The A/C compressor clutch relay.
5. The PCM.

A/C Request Signal

This signal tells the PCM when the A/C mode is selected at the A/C control switch. The PCM uses this input to adjust the idle speed before turning on the A/C clutch. The A/C compressor will be inoperative if this signal is not available to the PCM.

For A/C wiring diagrams and diagnosis for the A/C electrical system, refer to A/C Clutch Circuit Diagnosis.

GENERAL DESCRIPTION — EVAPORATIVE EMISSION (EVAP) SYSTEM

EVAP Emission Control System Purpose

The basic evaporative emission (EVAP) control system used on all vehicles is the charcoal canister storage method. Gasoline vapors from the fuel tank flow into the canister through the inlet labeled ”TANK.” These vapors are absorbed into the activated carbon (charcoal) storage device (canister) in order to hold the vapors when the vehicle is not operating. The canister is purged by PCM control when the engine coolant temperature is over 60˚C (140˚F), the IAT reading is over 10˚C (50˚F), and the engine has been running. Air is drawn canister through the air inlet grid. The air mixes with the vapor and the mixture is drawn into the intake manifold.

EVAP Emission Control System Operation

The EVAP canister purge is controlled by a solenoid valve that allows the manifold vacuum to purge the canister. The Powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge on). The EVAP purge solenoid control is pulse–width modulated (PWM) (turned on and off several times a second). The duty cycle (pulse width) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM. The output is commanded when the appropriate conditions have been met. These conditions are:

- The engine is fully warmed up.
- The engine has been running for a specified time.
- The IAT reading is above 10˚C (50˚F).
- A continuous purge condition with no purge commanded by the PCM willset a DTC P1441.

Poor idle, stalling and Poor driveability can be caused by:

- A malfunctioning purge solenoid.
- A damaged canister.
- Hoses that are split, cracked, or not connected properly.

Enhanced Evaporative Emission Control System

The basic purpose of the Enhanced Evaporative Emissions control system is the same as other EVAP systems. A charcoal–filled canister captures and stores gasoline fumes. When the PCM determines that the time is right, it opens a purge valve which allows engine vacuum to draw the fumes into the intake manifold. The

difference between this and other systems is that the PCM monitors the vacuum and/or pressure in the system to determine if there is any leakage. If the PCM determines that the EVAP system is leaking or not functioning properly, it sets a Diagnostic Trouble Code (DTC) in the PCM memory.

The enhanced EVAP system is required to detect evaporative fuel system leaks as small as 0.040 in. (1.0 mm) between the fuel filler cap and purge solenoid. The system can test the evaporative system integrity by applying a vacuum signal (ported or manifold) to the fuel tank to create a small vacuum. The PCM then monitors the ability of the system to maintain the vacuum. If the vacuum remains for a specified period of time, there are no evaporative leaks and a PASS report is sent to the diagnostic executive. If there is a leak, the system either will not achieve a vacuum, or a vacuum cannot be maintained. Usually, a failure can only be detected after a cold start with a trip of sufficient length and driving conditions to run the needed tests. The enhanced EVAP system diagnostic will conduct up to eight specific sub–tests to detect fault conditions. If the diagnostic fails a sub–test, the PCM will store a Diagnostic Trouble Code (DTC) to indicate the type of fault detected.

Electrical Components

The electrical components that make up the enhanced EVAP system are:

Fuel Tank Pressure Sensor – The fuel tank pressure sensor is a three–wire strain gauge sensor similar to a common MAP sensor. However, the fuel tank pressure sensor has very different electrical characteristics due to its pressure differential design. The sensor measures the difference between the air pressure (or vacuum) in the fuel tank and the outside air pressure.

The sensor mounts at the top of the fuel pump assembly. A three–wire electrical harness connects it to the PCM. The PCM supplies a five–volt reference voltage and a ground to the sensor. The sensor will return a voltage between 0.1 and 4.9 volts. When the air pressure in the fuel tank is equal to the outside air pressure, such as when the fuel cap is removed, the output voltage of the sensor will be 1.3 to 1.7 volts.

When the air pressure in the fuel tank is 4.5 in. H_2O (1.25 kPa), the sensor output voltage will be 0.5 +/– 0.2 V. When there is neither vacuum nor pressure in the fuel tank, the sensor voltage will be 1.5 V. At –14 in. H_2O (–3.75 kPa), the sensor voltage will be 4.5 +/– 0.2 V.

EVAP Canister Purge Solenoid – Normally closed, the purge solenoid opens upon the PCM's signal to allow engine vacuum to purge gasoline fumes from the canister. Mounted on top of the upper intake manifold assembly.

EVAP Canister Vent Solenoid – Located next to the canister, the vent solenoid opens to allow air into the EVAP system. Fresh air is necessary to completely remove gasoline fumes from the canister during purge. The EVAP vent solenoid closes to seal off the evaporative emissions system for leak testing.

Fuel Level Sensor – The fuel level sensor is an important input to the PCM for the enhanced EVAP system diagnostic. The PCM needs fuel level information to know the volume of fuel in the tank. The fuel level affects the rate of change of air pressure in the EVAP system. Several of the enhanced EVAP system diagnostic sub–tests are dependent upon correct fuel level information. The diagnostic will not run when the tank is less than 15% or more than 85% full. Be sure to diagnose any Fuel Level Sensor DTCs first, as they can cause other DTCs to set.

Manifold Absolute Pressure (MAP) Sensor – The PCM compares the signals from the fuel tank pressure sensor and the MAP sensor to ensure that a relative vacuum is maintained in the EVAP system.

Non–Electrical Components

Purge/Vacuum Hoses – Made of rubber compounds, these hoses route the gasoline fumes from their sources to the canister and from the canister to the intake air flow.

EVAP Canister – Mounted on a bracket ahead of the fuel tank, the canister stores fuel vapors until the PCM determines that engine conditions are right for them to be removed and burned.

Fuel Tank – The tank has a built–in air space designed for the collection of gasoline fumes.

Vacuum Source – The vacuum source is split between two ports, one on either side of the throttle body.

Fuel Cap – The fuel cap is designed to be an integral part of the EVAP system.

System Fault Detection

The EVAP leak detection strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The PCM monitors vacuum level via the fuel tank pressure sensor. At an appropriate time, the EVAP purge solenoid and the EVAP vent solenoid are turned ON, allowing the engine vacuum to draw a small vacuum on the entire evaporative emission system.

After the desired vacuum level has been achieved, the EVAP purge solenoid is turned OFF, sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, all other variables remaining constant. A small leak in the system will cause DTC P0442 to be set.

If the desired vacuum level cannot be achieved in the test described above, a large leak or a faulty EVAP purge solenoid is indicated.

Leaks can be caused by the following conditions:

- Disconnected or faulty fuel tank pressure sensor
- Missing or faulty fuel cap
- Disconnected, damaged, pinched, or blocked EVAP purge line
- Disconnected or damaged EVAP vent hose
- Disconnected, damaged, pinched, or blocked fuel tank vapor line
- Disconnected or faulty EVAP purge solenoid
- Disconnected or faulty EVAP vent solenoid
- Open ignition feed circuit to the EVAP vent or purge solenoid
- Damaged EVAP canister

- Leaking fuel sender assembly O–ring
- Leaking fuel tank or fuel filler neck

A restricted or blocked EVAP vent path is detected by drawing vacuum into the EVAP system, turning OFF the EVAP vent solenoid and the EVAP purge solenoid (EVAP vent solenoid OPEN, EVAP purge Pulse Width Modulate (PWM) ”0%”) and monitoring the fuel tank vacuum sensor input. With the EVAP vent solenoid open, any vacuum in the system should decrease quickly unless the vent path is blocked. A blockage like this will set DTC P0446 and can be caused by the following conditions:

- Faulty EVAP vent solenoid (stuck closed)
- Plugged, kinked or pinched vent hose
- Shorted EVAP vent solenoid driver circuit
- Plugged EVAP canister

The PCM supplies a ground to energize the purge solenoid (purge ON). The EVAP purge control is PWM, or turned ON and OFF, several times a second. The duty cycle (pulse width) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the output is commanded when the appropriate conditions have been met.

The system checks for conditions that cause the EVAP system to purge continuously by commanding the EVAP vent solenoid ON and the EVAP purge solenoid OFF (EVAP vent solenoid CLOSED, EVAP purge PWM ”0%”). If fuel tank vacuum level increases during the test, a continuous purge flow condition is indicated, which will set a DTC P1441. This can be caused by the following conditions:

- EVAP purge solenoid leaking
- EVAP purge and engine vacuum lines switched at the EVAP purge solenoid
- EVAP purge solenoid driver circuit grounded

GENERAL DESCRIPTION — EXHAUST GAS RECIRCULATION (EGR) SYSTEM

EGR Purpose

The exhaust gas recirculation (EGR) system is used to reduce emission levels of oxides of nitrogen (NOx). NOx emission levels are caused by a high combustion temperature. The EGR system lowers the NOx emission levels by decreasing the combustion temperature.

Linear EGR Valve

The main element of the system is the linear EGR valve. The EGR valve feeds small amounts of exhaust gas back into the combustion chamber. The fuel/air mixture will be diluted and combustion temperatures reduced.

Linear EGR Control

The PCM monitors the EGR actual position and adjusts the pintle position accordingly. The PCM uses information from the following sensors to control the pintle position:

- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.

Linear EGR Valve Operation And Results Of Incorrect Operation

The linear EGR valve is designed to accurately supply EGR to the engine independent of intake manifold vacuum. The valve controls EGR flow from the exhaust to the intake manifold through an orifice with a PCM–controlled pintle. During operation, the PCM controls pintle position by monitoring the pintle position feedback signal. The feedback signal can be monitored with a Tech 2 as ”Actual EGR Pos.” ”Actual EGR Pos.” should always be near the commanded EGR position (”Desired EGR Pos.”). The PCM also tests for EGR flow. If incorrect flow is detected, DTC P0401 will set. If DTC P0401 is set, refer to the DTC charts.

The linear EGR valve is usually activated under the following conditions:

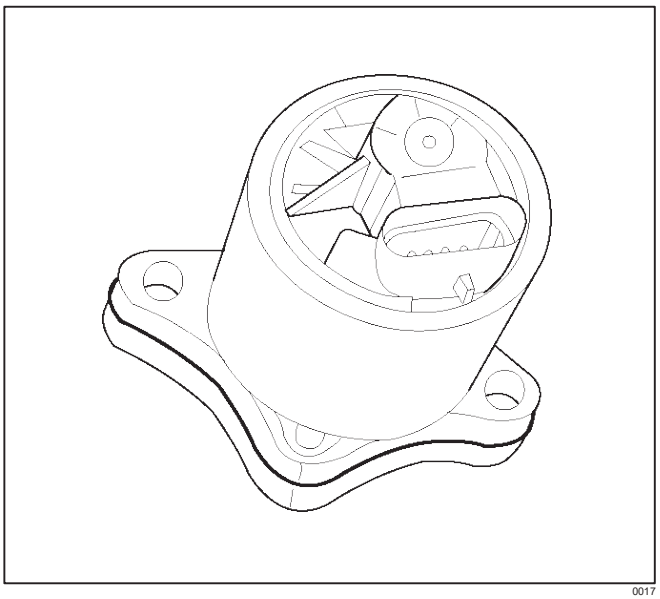
- Warm engine operation.
- Above–idle speed.

Too much EGR flow at idle, cruise or cold operation may cause any of the following conditions to occur:

- Engine stalls after a cold start.
- Engine stalls at idle after deceleration.
- Vehicle surges during cruise.
- Rough idle.
- DTC P0300 (misfire detected).

Too little or no EGR flow may allow combustion temperatures to get too high. This could cause:

- Spark knock (detonation).
- Engine overheating.
- Emission test failure.
- DTC P0401 (EGR Flow Insufficient detected).
- Poor fuel economy.


0017

EGR Pintle Position Sensor

The PCM monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM and to detect a fault if the pintle position sensor and control circuits are open or shorted. If the PCM detects a pintle position signal voltage outside the normal range of the pintle position sensor, or a signal

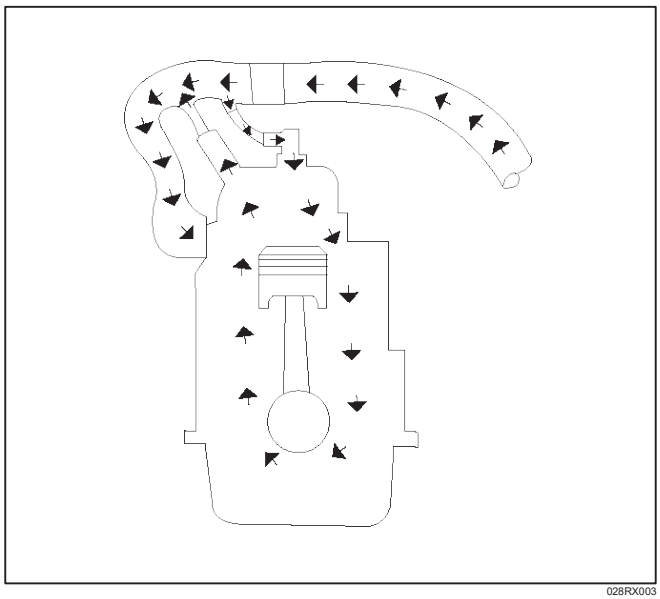
voltage that is not within a tolerance considered acceptable for proper EGR system operation, the PCM will set DTC P0404.

GENERAL DESCRIPTION — POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

Crankcase Ventilation System Purpose

The crankcase ventilation system is used to consume crankcase vapors in the combustion process instead of venting them to the atmosphere. Fresh air from the throttle body is supplied to the crankcase and mixed with blow–by gases. This mixture is then passed through the positive crankcase ventilation (PCV) port into the intake manifold.

While the engine is running, exhaust gases and small amounts of the fuel/air mixture escape past the piston rings and enter the crankcase. These gases are mixed with clean air entering through a tube from the air intake duct.



028RX003

During normal, part–throttle operation, the system is designed to allow crankcase gases to flow through the PCV valve into the throttle body to be consumed by normal combustion.

A plugged valve or PCV hose may cause the following conditions:

- Rough idle.
- Stalling or slow idle speed.
- Oil leaks.
- Sludge in the engine.

A leaking PCV hose would cause:

- Rough idle.
- Stalling.
- High idle speed.

SPECIAL TOOLS

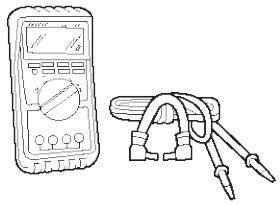
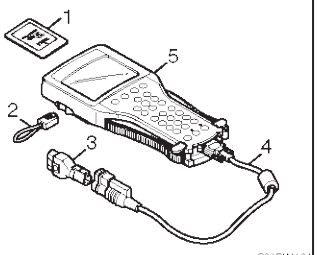
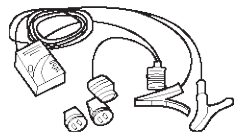
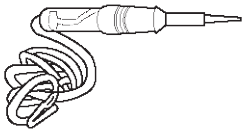
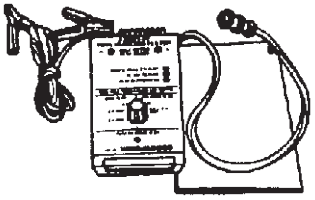
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J 39200** High Impedance Multimeter (Digital Voltmeter – DVM)
	(1) PCMCIA Card (2) RS232 Loop Back Connector (3) SAE 16/19 Adapter (4) DLC Cable (5) TECH–2
	**J 37027–A** IAC Motor Analyzer
	**J 34142–B** Unpowered Test Light
	**J 39021–5V** Port Fuel Injector Tester
	J 35616–A/BT–8637 Connector Test Adapter Kit

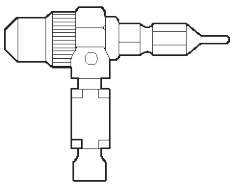
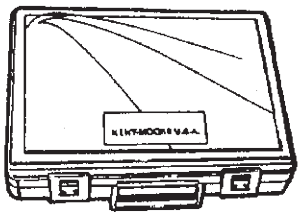
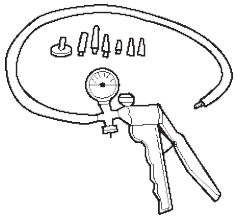
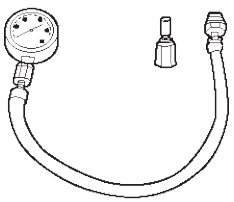
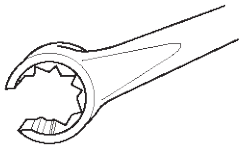
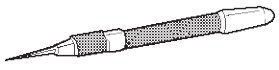
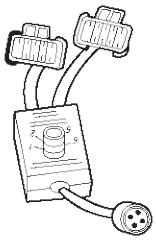
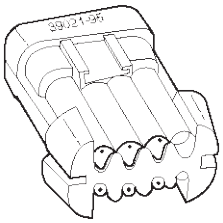
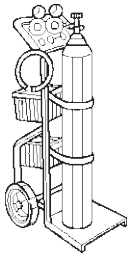
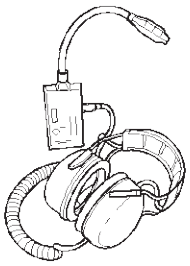
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J 26792/BT–7220–1** Spark Tester
	**J 39021–Box** Port Fuel Injection Diagnostic Kit
	**J 23738–A** Vacuum Pump with Gauge
	**BT–8515–V** Exhaust Back Pressure Tester
	**J 39194–B** Heated Oxygen Sensor Wrench
	**J 35689–A** Terminal Remover

ILLUSTRATION	**TOOL NO.** TOOL NAME
	J 28742–A Weather Pack II Terminal Remover
	**J 39021–90** Injector Switch Box
	**J 39021–45** Injector Test Light
	**J 41413**[1] EVAP Pressure/Purge Diagnostic Station
	**J 41416**[2] Ultrasonic Leak Detector

1. J 41413 EVAP Pressure/Purge Diagnostic Station is a multipurpose tool which is used to perform several diagnostic procedures for enhanced emission testing. The station will accommodate a nitrogen gas filled cylinder which is used to pressurize the vehicle EVAP system for a leakdown test and leak location test when a vehicle is repaired for leakage in the enhanced evaporative emission control system. It also has two additional gauges (inches of mercury and inches of water) which are used to measure both source vacuum and EVAP canister purge vacuum to verify correct operation and vapor flow within the canister purge circuit.
2. J 41416 Ultrasonic Leak Detector is a microprocessor–based device used to detect leaks in the enhanced evaporative emission control system. The evaporative system is pressurized to 30 inches of water using the J 41413 EVAP Pressure/Purge Diagnostic System. Small leaks in the EVAP system will emit sound at a high frequency undetectable by a human ear but detectable with the J 41416. The technician traces along the evaporative system and can pinpoint leaks due to corroded lines, cracked hoses, or a damaged EVAP component. The detector includes a high quality set of headphones to block out surrounding shop noise and the LED sensitivity meter allows a visual reference for locating leaks in conjunction with the audio output heard through the headphones. Powered by (1) nine volt battery.