





DENSO



MITSUBISHI PAJERO 4M41 ENGINE
COMMON RAIL SYSTEM (CRS)



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DENSO CORPORATION

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1. PRODUCT APPLICATION INFORMATION

1.1 Outline

- This manual describes the 4M41 engine Common Rail System (CRS) installed in the MITSUBISHI PAJERO, on sale from September 2006. As of September 2008, the 4M41 engine CRS has been changed as per the list below. As such, this manual contains additional information related to the aforementioned changes.

- Supply pump change
- Injector change
- Diagnostic Trouble Code (DTC) changes

1.2 Applicable Vehicle

Vehicle Manufacturer	Vehicle Name	Engine Model	Specification	Destination	Line Off Period
MITSUBISHI	PAJERO	4M41	4WD (MT/AT)	Europe, Australia	Sep, 2006*

* : The engine model has not been changed since September 2006. However, the specifications have changed as of September 2008.

1.3 System Component Part Numbers

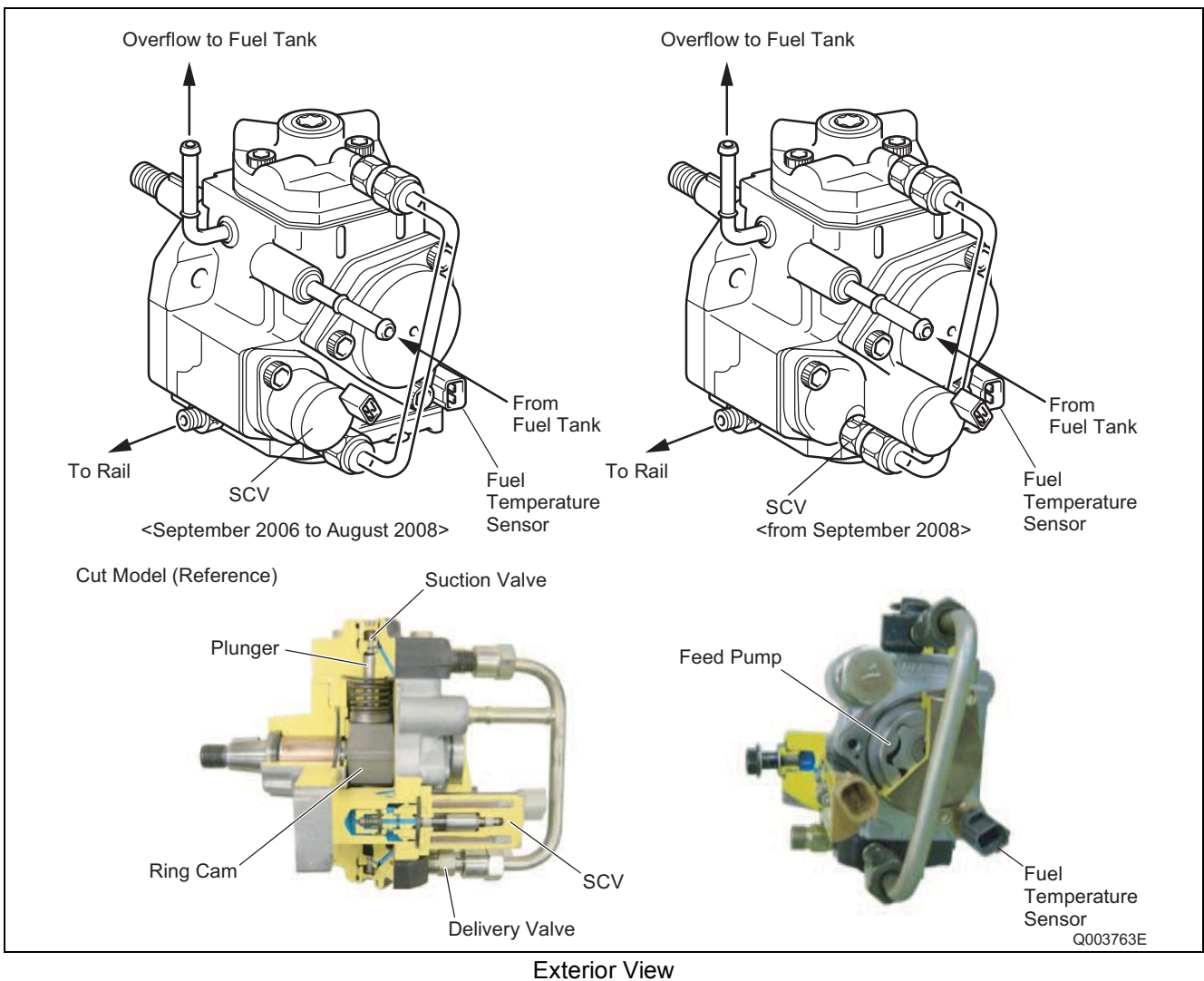
Part Name	DENSO Part Name	Manufacturer Part Name	Remarks
Supply pump	SM294000-034#	1460A003	Sept. 2006 to Aug. 2008
	SM294000-107#	1460A040	from Sept. 2008
Injector	SM095000-576#	1465A054	Sept. 2006 to Aug. 2008
	SM095000-750#	1465A279	from Sept. 2008
Rail	SM095440-064#	1465A034	
Engine ECU	275800-468#	1860A699	Sept. 2006 to Aug. 2008 Manual transmission vehicles only
	275800-469#	1860A702	Sept. 2006 to Aug. 2008 Automatic transmission vehicles only
	275800-932#	1860B029	from Sept. 2008
	275800-933#	1860B028	from Sept. 2008
	275800-934#	1860B027	from Sept. 2008
	275800-935#	1860A261	from Sept. 2008
	275800-936#	1860B100	from Sept. 2008

Part Name	DENSO Part Name	Manufacturer Part Name	Remarks
Manifold absolute pressure (MAP) sensor	079800-779#	1865A035	
Diesel throttle	197920-002#	1450A033	
Fuel temperature sensor	179730-002#	MR547077	
Mass air flow (MAF) meter	197400-227#	1525A016	
Exhaust gas temperature sensor 1	265600-145#	1587A013	Automatic transmission vehicles only
Exhaust gas temperature sensor 2	265600-146#	1587A014	
Exhaust gas temperature sensor 3	265600-147#	1587A015	
Differential pressure sensor	104990-136#	1865A087	
Absolute pressure sensor	104990-135#	0865A086	
Temperature sensor for differential pressure sensor	170400-602#	1865A095	
Electric-Vacuum Regulating Valve (E-VRV) for Variable Geometry Turbo (VGT)	139700-035#	MR258166	

2. SUPPLY PUMP

2.1 Outline

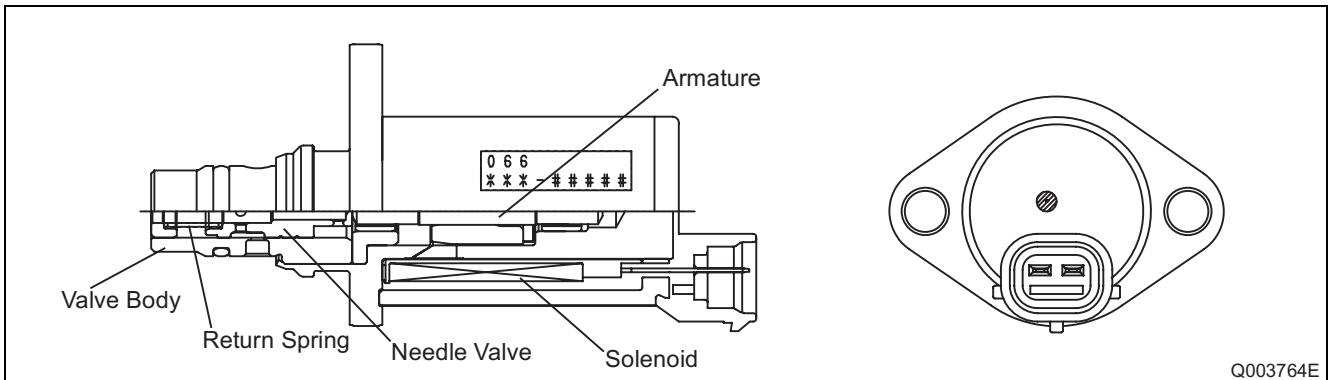
- The supply pump consists primarily of the pump body (eccentric cam, ring cam, and plungers), SCV (Suction Control Valve), fuel temperature sensor, and feed pump.
- The two plungers are positioned vertically on the outer ring cam for compactness.
- The engine drives the supply pump at a ratio of 1:1. The supply pump has a built-in feed pump (trochoid type). The feed pump draws in fuel from the fuel tank for delivery to the plunger chamber.
- The internal camshaft drives the two plungers which pressurize the fuel sent to the plunger chamber, and then send the fuel to the rail. The quantity of fuel supplied to the rail is controlled by the SCV via signals from the engine ECU. The SCV is a normally open type (the intake valve is open during de-energization).
- The HP3 supply pump was equipped with a compact SCV. However, the SCV was changed to the conventional type as of September 2008.
- For information on basic HP3 supply pump operation (suction from the fuel tank, fuel delivery to the rail, etc.), refer to the publication entitled, "General Edition Manual: Common Rail System (Doc ID: 00400076E)."



Exterior View

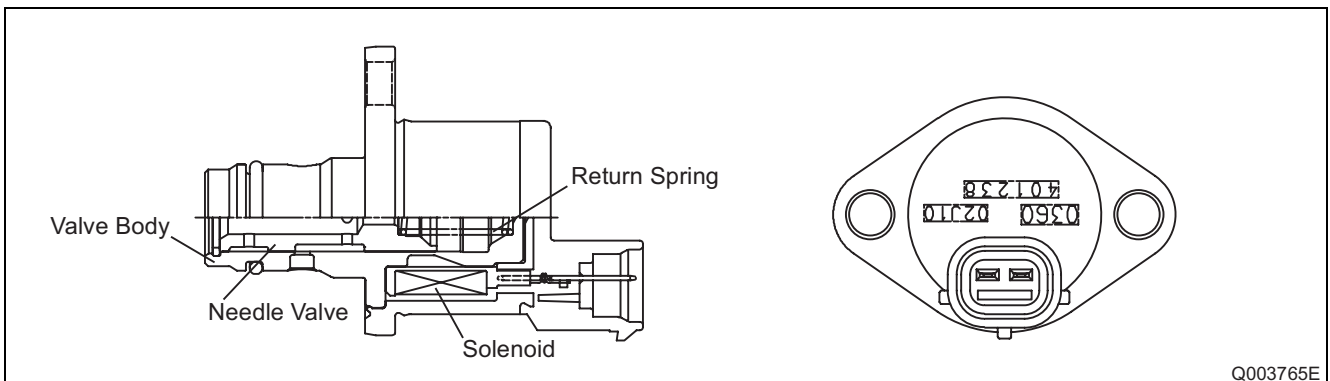
2.2 Suction Control Valve (SCV)

- The supply pump for the 4M41 engine CRS is equipped with a normally open type SCV. From September 2006 to August 2008, a compact SCV was used. However, the SCV was changed to the conventional type as of September 2008.
- While both the conventional and compact type SCVs have identical functions, the operation method differs.
- When the solenoid is not energized, the return spring pushes against the needle valve, completely opening the fuel passage and supplying fuel to the plungers. (Total quantity suctioned → Total quantity discharged)
- When the solenoid is energized, the armature pushes the needle valve, which compresses the return spring and closes the passage. In contrast, the needle valve in the compact SCV is pulled upon, which compresses the return spring and closes the fuel passage.
- The solenoid is actuated by the duty ratio control. Fuel is supplied in an amount corresponding to the open surface area of the passage, which depends on the duty ratio. Fuel is then discharged by the plungers.



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Conventional SCV: from September 2008

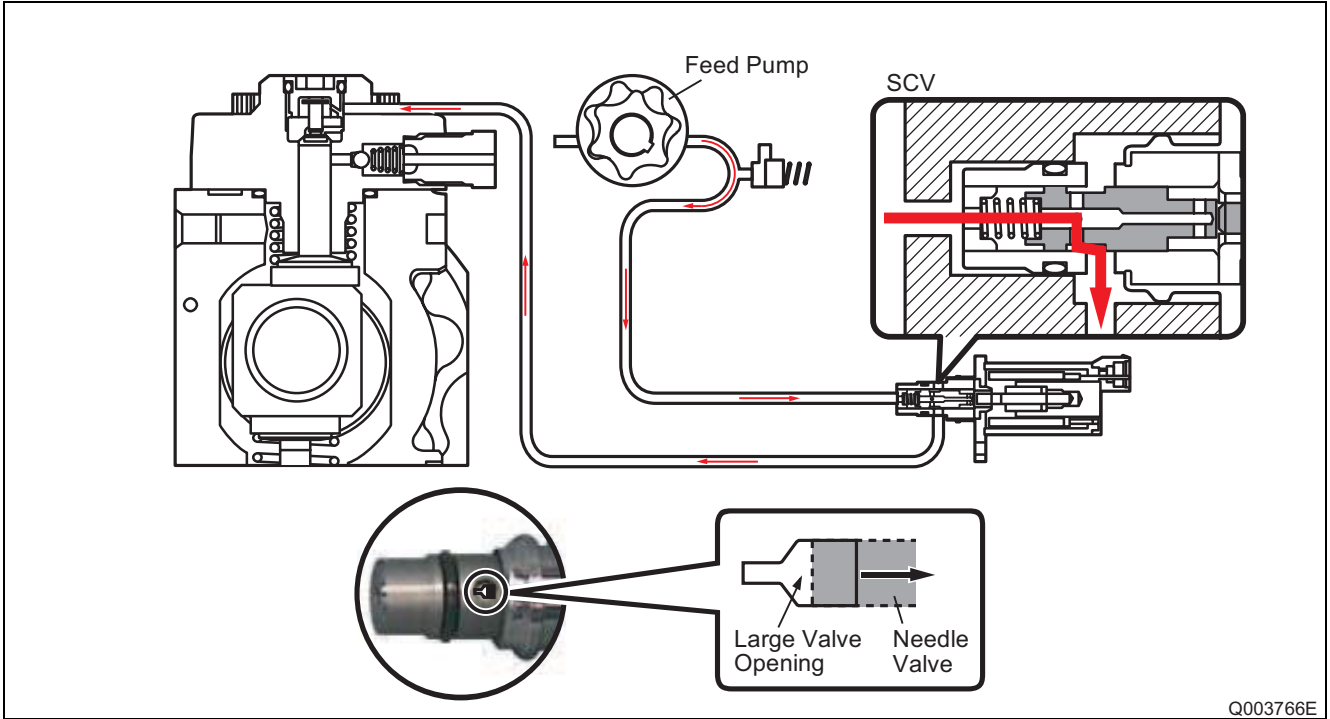


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Compact SCV: from September 2006 to August 2008

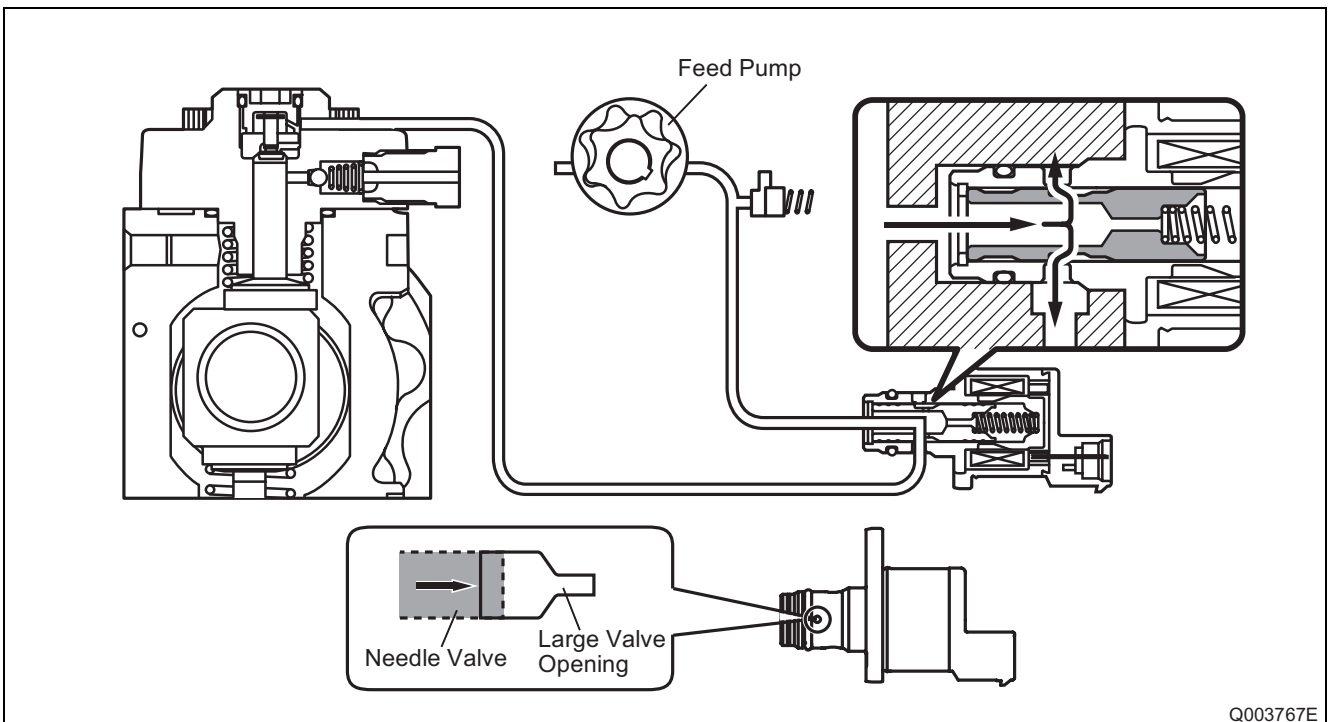
(1) When the SCV energized duration (duty ON time) is short

- When the SCV energization time is short, the average current flowing through the solenoid is small. As a result, the needle valve is returned by spring force, creating a large valve opening. Subsequently, the fuel suction quantity increases.



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Conventional SCV: from September 2008

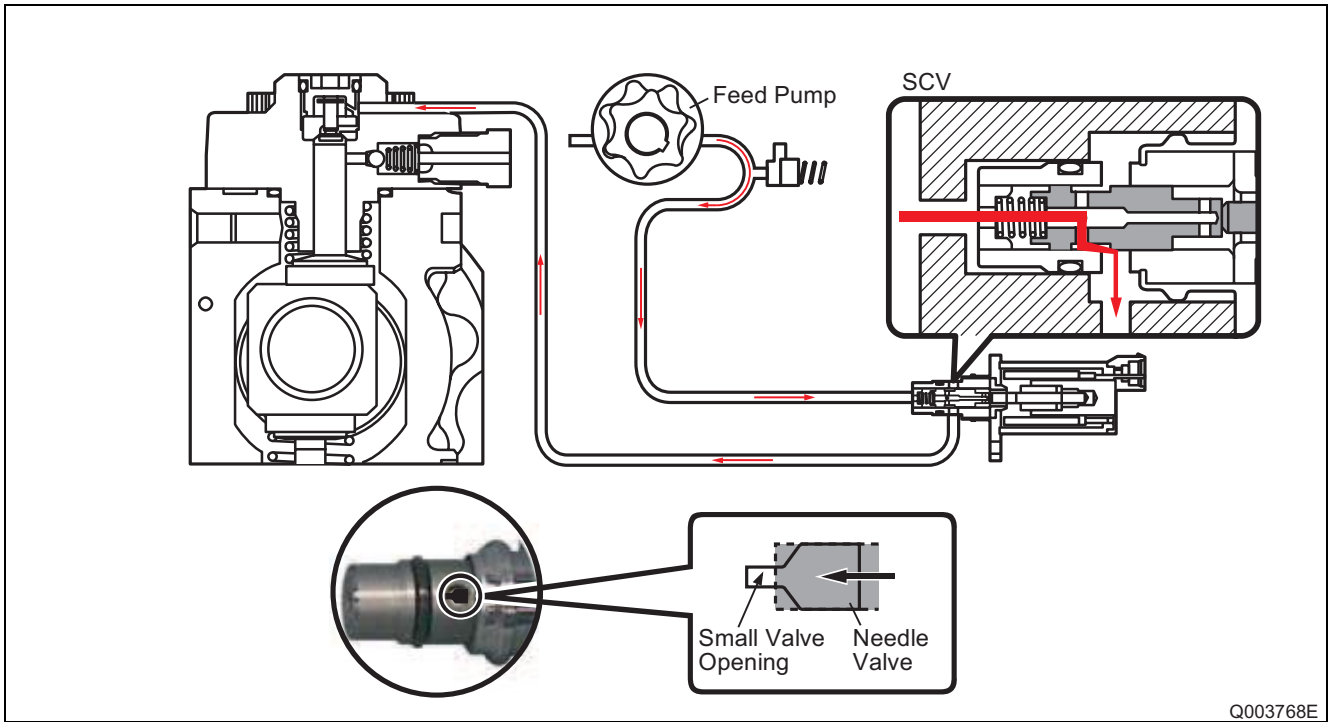


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Compact SCV: from September 2006 to August 2008

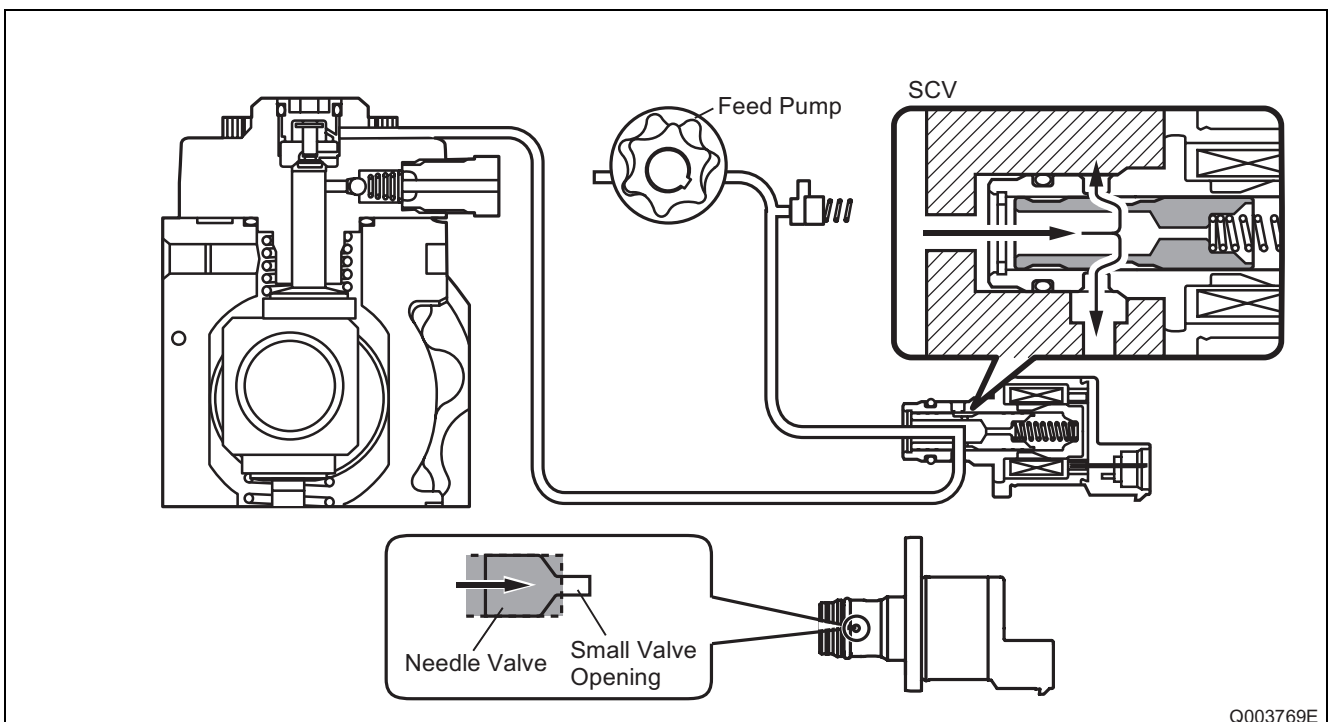
(2) When the SCV energized duration (duty ON time) is long

- When the energization time is long, the average current flowing to the solenoid is large. As a result, the needle valve is pressed out (in the compact SCV, the needle valve is pulled), creating a small valve opening. Subsequently, the fuel suction quantity decreases.



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Conventional SCV: from September 2008

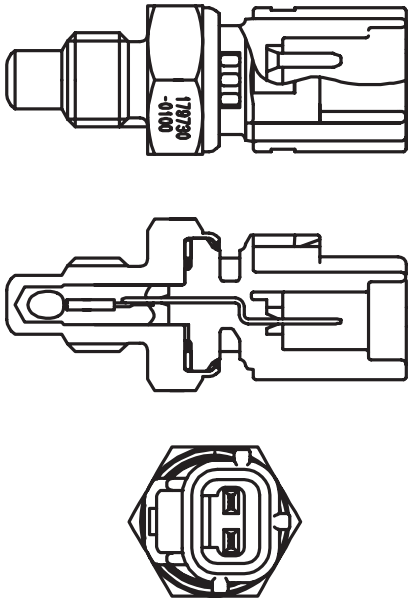


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Compact SCV: from September 2006 to August 2008

2.3 Fuel Temperature Sensor

- Detects the fuel temperature and sends a corresponding signal to the engine ECU. Based on this information, the engine ECU calculates the injection volume correction that is appropriate for the fuel temperature.



<Reference: Temperature-resistance Characteristics>

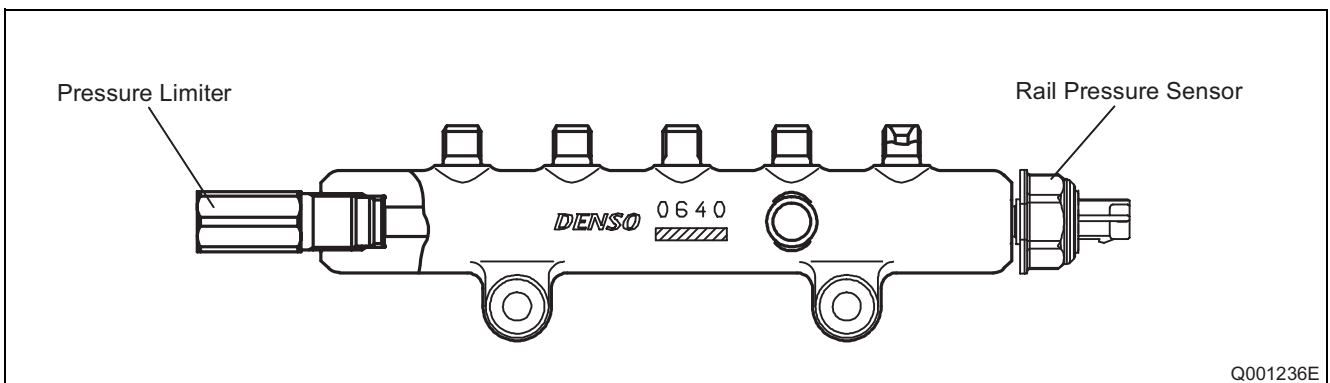
TEMPERATURE (°C)	RESISTANCE (kΩ)
- 30	(25.40)
- 20	15.40 ^{+ 1.29} - 1.20
- 10	(9.16)
0	(5.74)
10	(3.70)
20	2.45 ^{+ 0.14} - 0.13
30	(1.66)
40	(1.15)
50	(0.811)
60	(0.584)
70	(0.428)
80	0.318 ± 0.008
90	(0.240)
100	(0.1836)
110	0.1417 ± 0.0018
120	(0.1108)

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3. RAIL

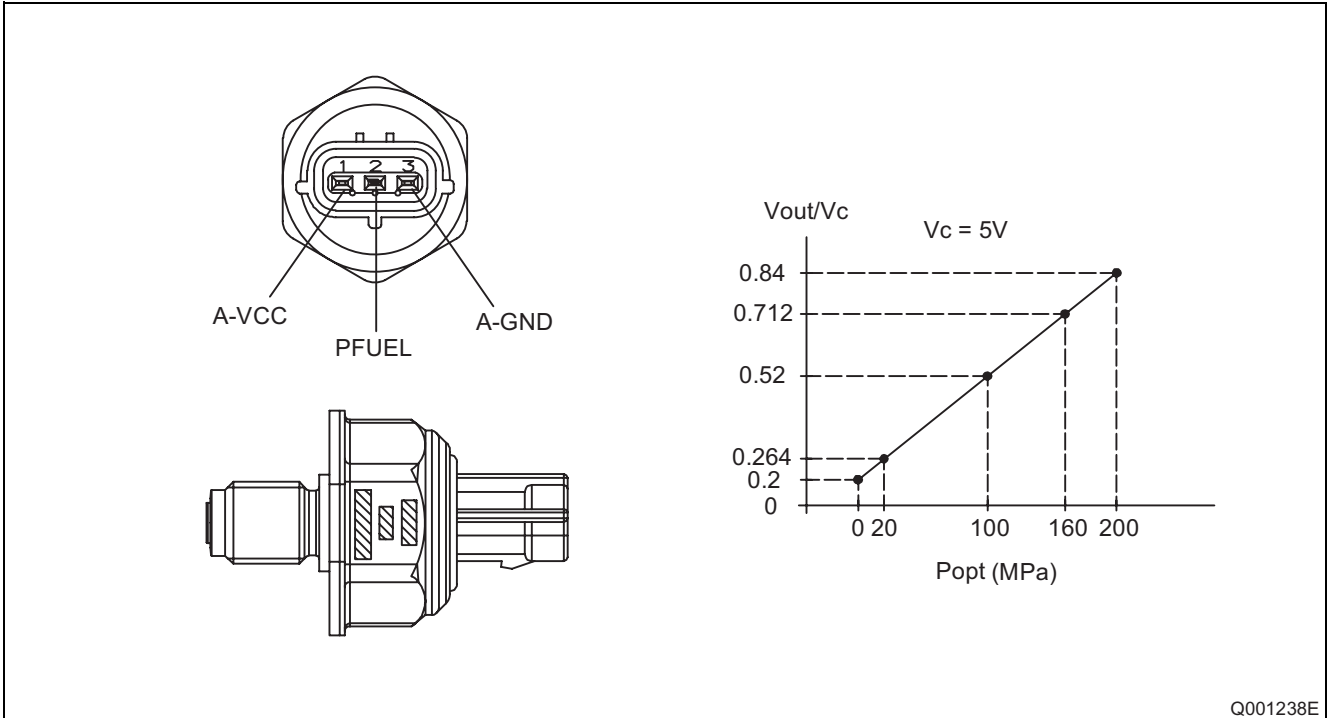
3.1 Outline

- The rail stores pressurized fuel (25 to 180 MPa) that has been delivered from the supply pump and distributes the fuel to each cylinder injector. The rail is equipped with a rail pressure sensor and a pressure limiter valve.
- The rail pressure sensor (Pc sensor) detects fuel pressure in the rail and sends a signal to the engine ECU; the pressure limiter controls the excess pressure. As a result, both optimum combustion and a combustion noise reduction are achieved.



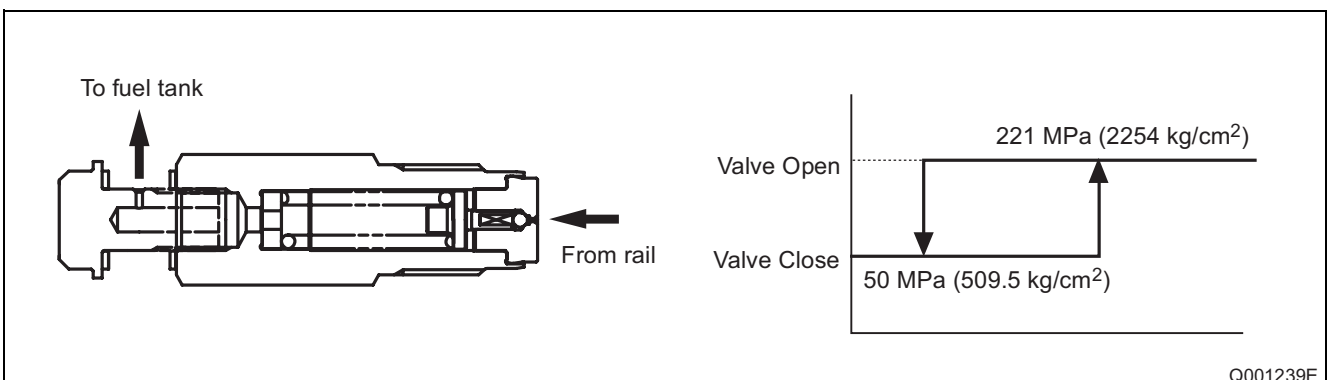
3.2 Rail Pressure Sensor (Pc Sensor)

- The pressure sensor detects the fuel pressure of the rail, and sends a signal to the engine ECU. The sensor is made from a semiconductor that uses the Piezo resistive effect to detect changes in electrical resistance based on the pressure applied to the elemental silicon. In comparison to the old model, this sensor is compatible with high pressure.



3.3 Pressure Limiter

- The pressure limiter releases pressure when the internal rail pressure becomes abnormally high. The pressure limiter opens when internal pressure reaches 221 MPa (2254 kg/cm²), and closes when rail pressure reaches a given set pressure. Fuel released from the pressure limiter is returned to the fuel tank.



4. INJECTOR (G2 TYPE)

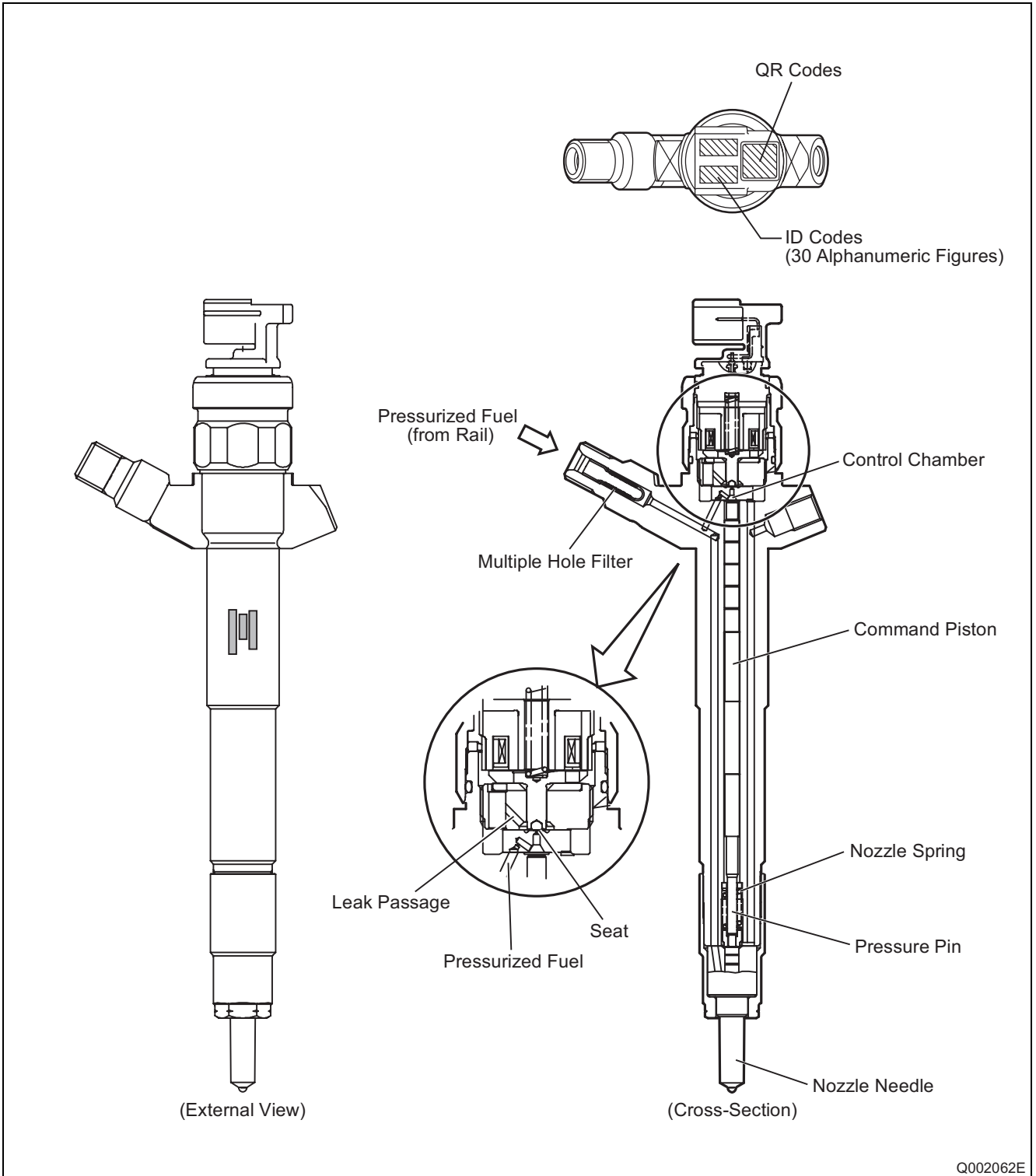
4.1 Outline

- The injectors inject the high-pressure fuel from the rail into the combustion chambers at the optimum injection timing, rate, and spray condition, in accordance with commands received from the ECU.
- For information on both basic injector operation and handling injectors with QR codes, refer to the publication entitled, "General Edition Manual: Common Rail System (Doc ID: 00400076E)."

4.2 Characteristics

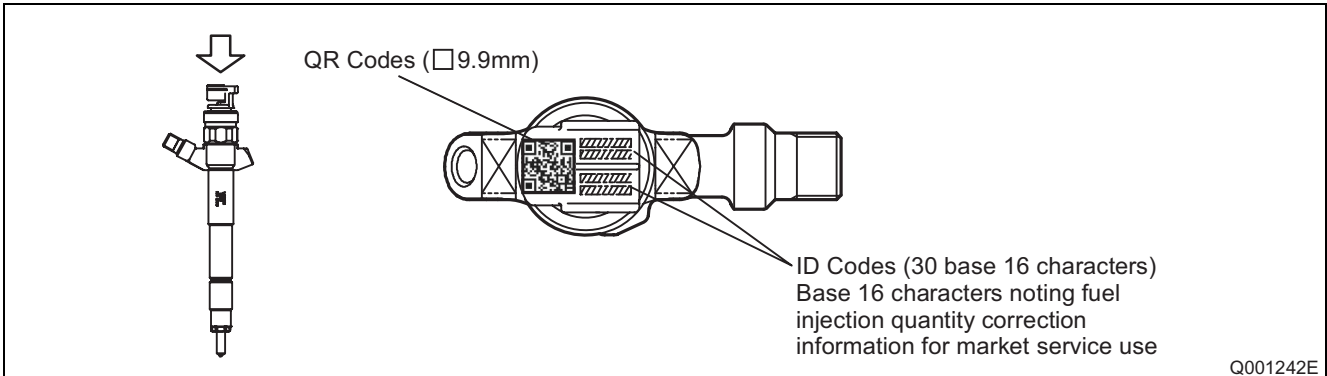
- A compact, energy-saving solenoid-control type TWV (Two-Way Valve) injector has been adopted.
- QR codes displaying various injector characteristics and the ID codes showing these in numeric form (30 alphanumeric figures) are engraved on the injector head. The common rail system optimizes injection volume control using this information. When an injector is newly installed in a vehicle, it is necessary to enter the ID codes in the engine ECU using the MITSUBISHI diagnosis tool (MUT III).
- Compared to the injectors used up to August 2008, the injectors used from September 2008 have different nozzle specifications and QR code correction points.

4.3 Construction

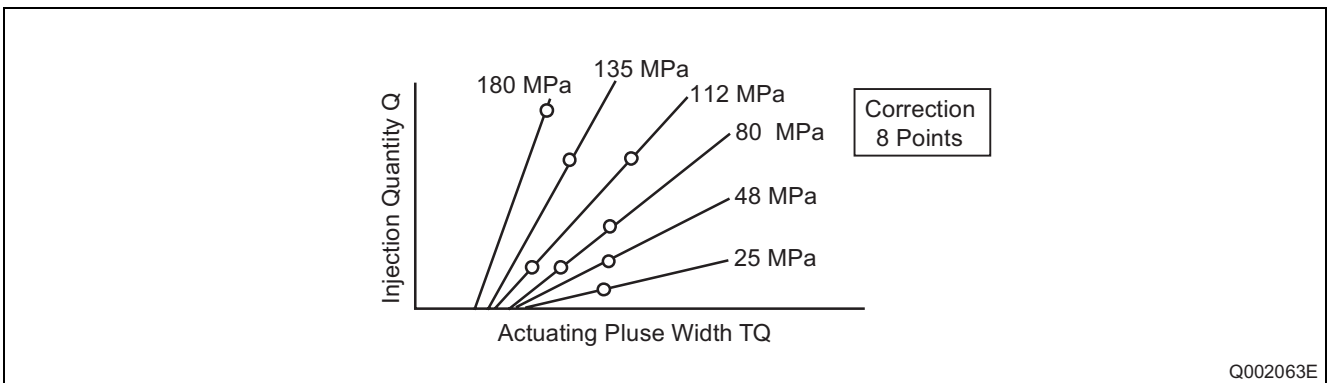


4.4 QR Codes

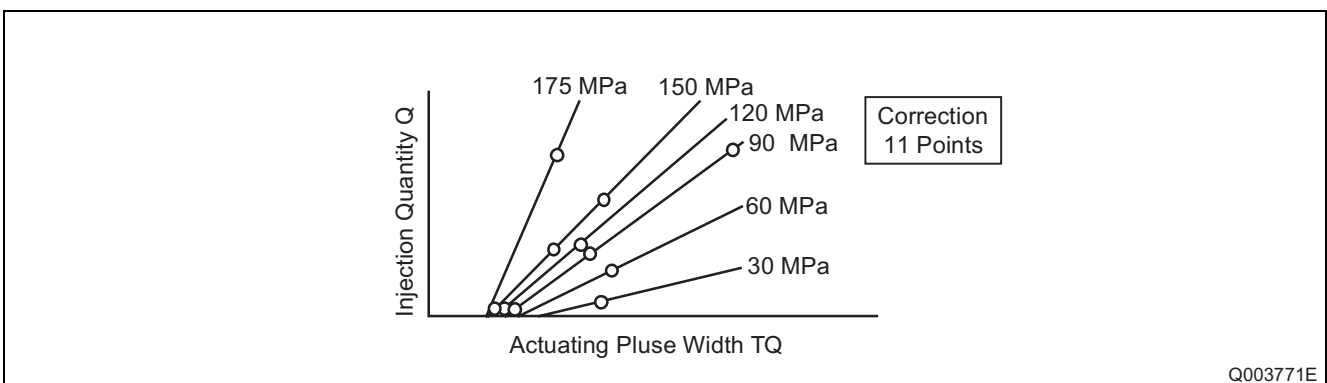
- Conventionally, the entire injector assembly was replaced during injector replacement. However, the QR codes currently in use improve injector quantity precision.



- QR codes have resulted in a substantial increase in the number of fuel injection quantity correction points, greatly improving precision. The characteristics of the engine cylinders have been further unified, contributing to improvements in combustion efficiency, reductions in exhaust gas emissions and so on.



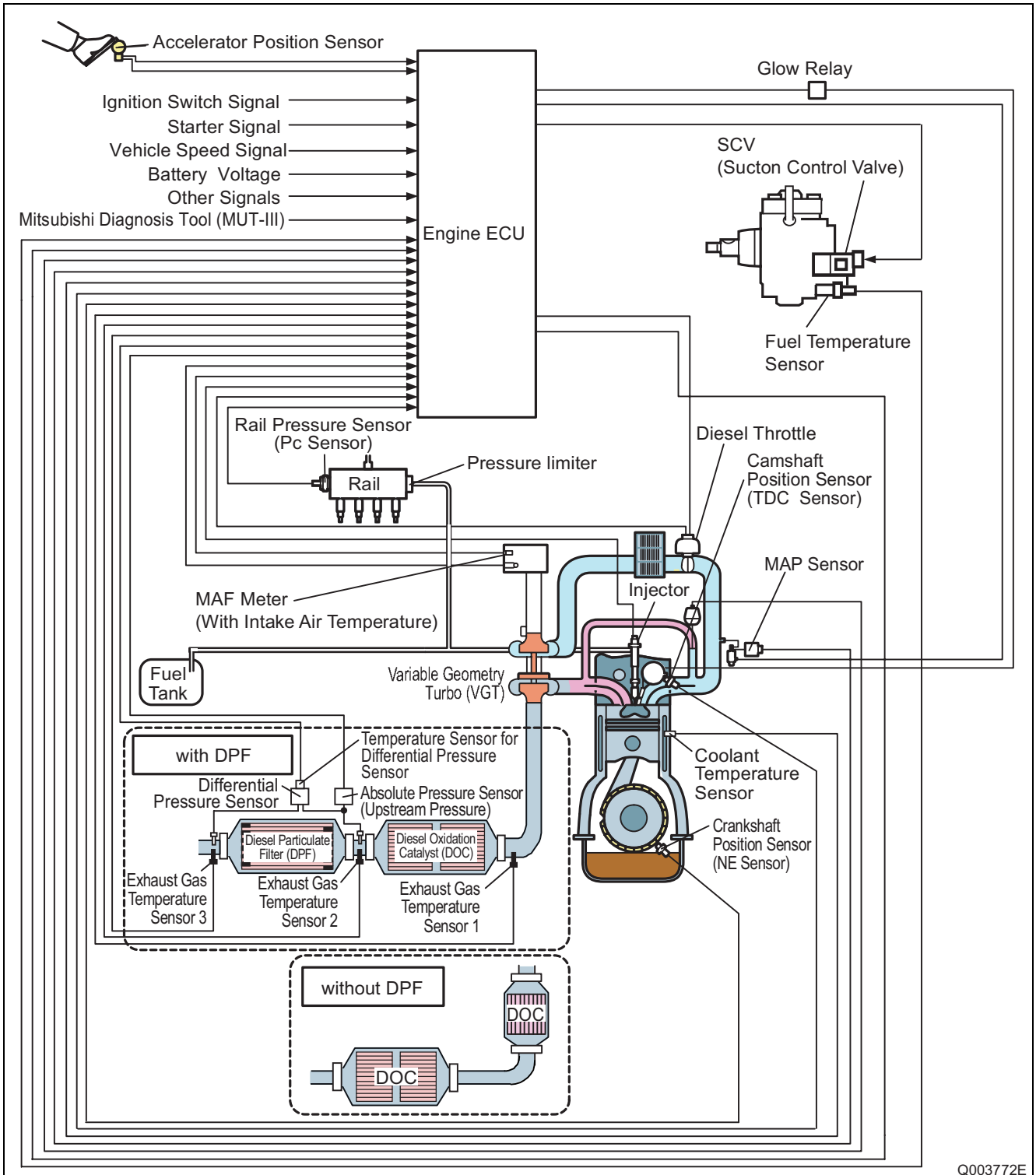
September 2006 to August 2008



from September 2008

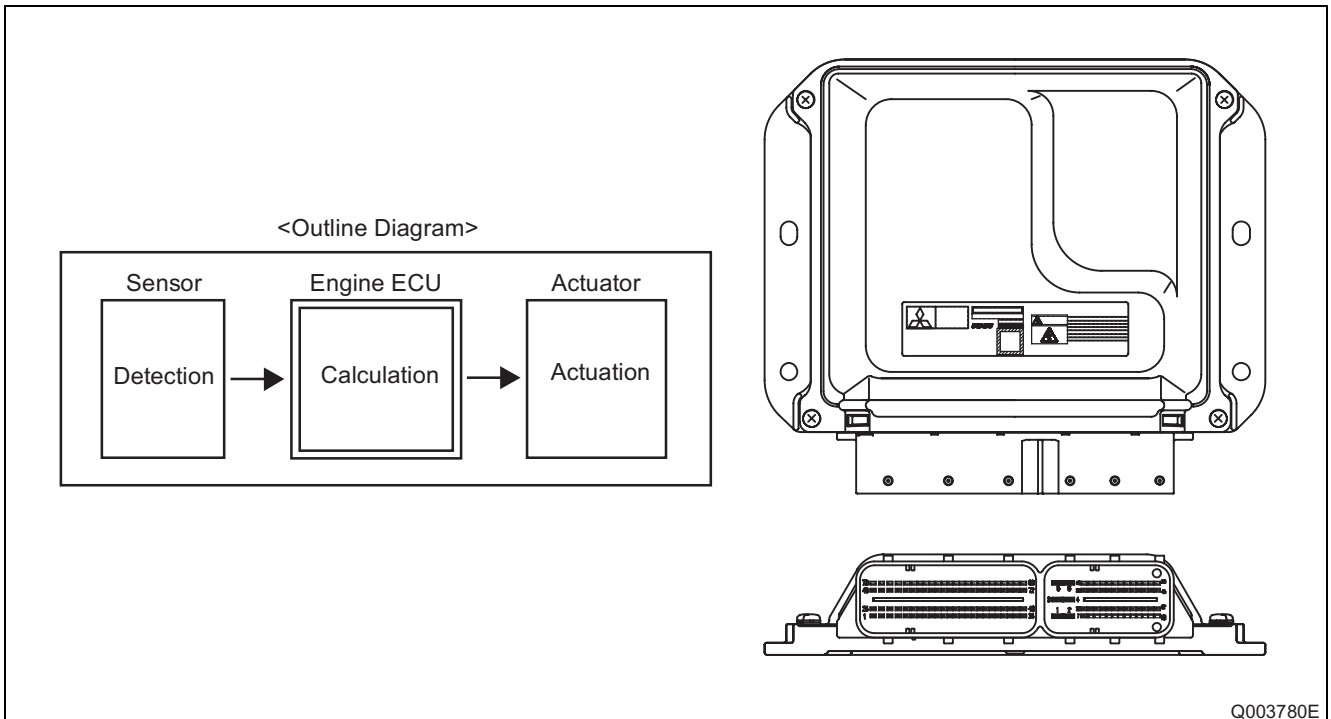
5. OPERATION OF CONTROL SYSTEM COMPONENTS

5.1 Engine Control System Diagram

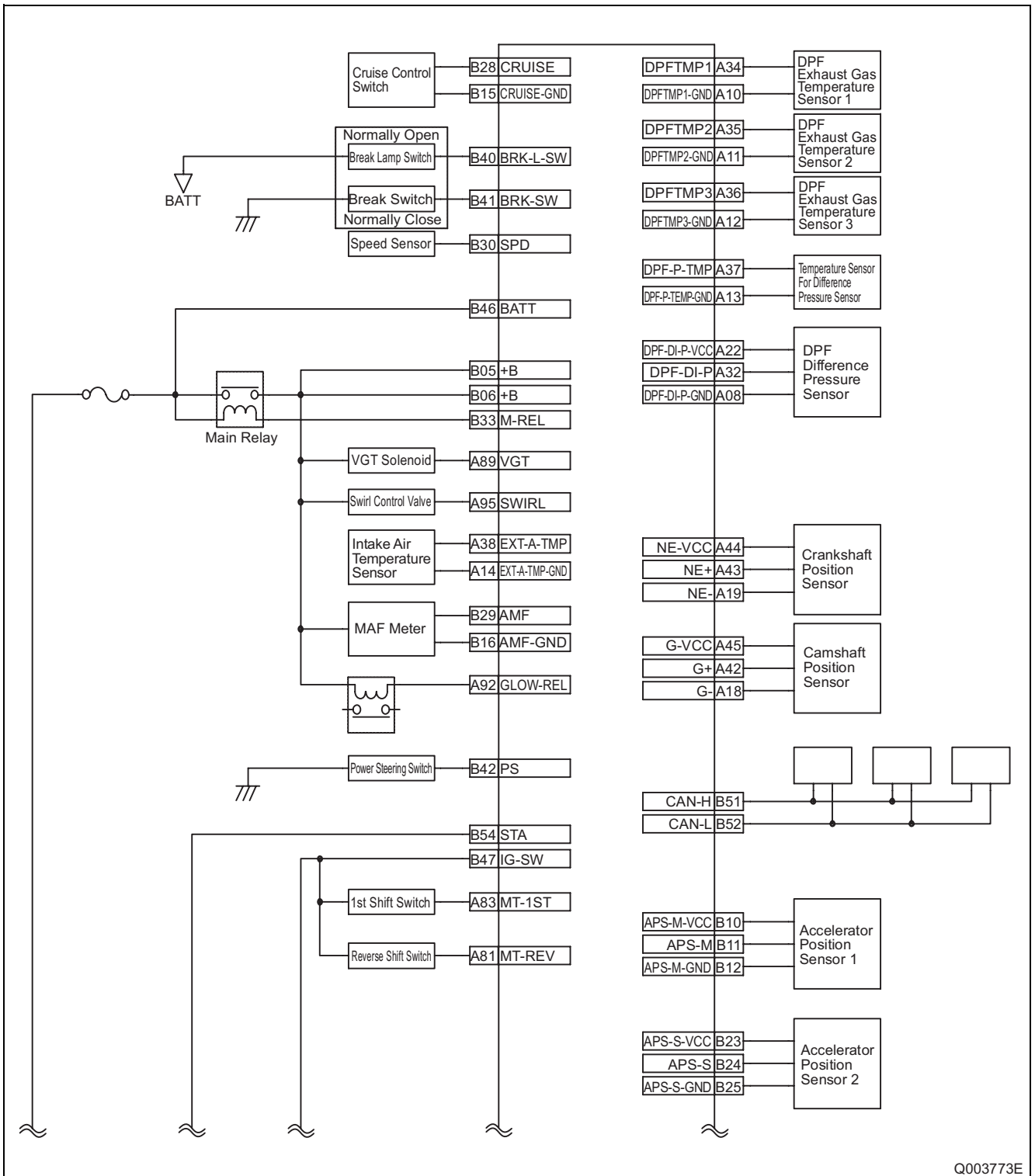


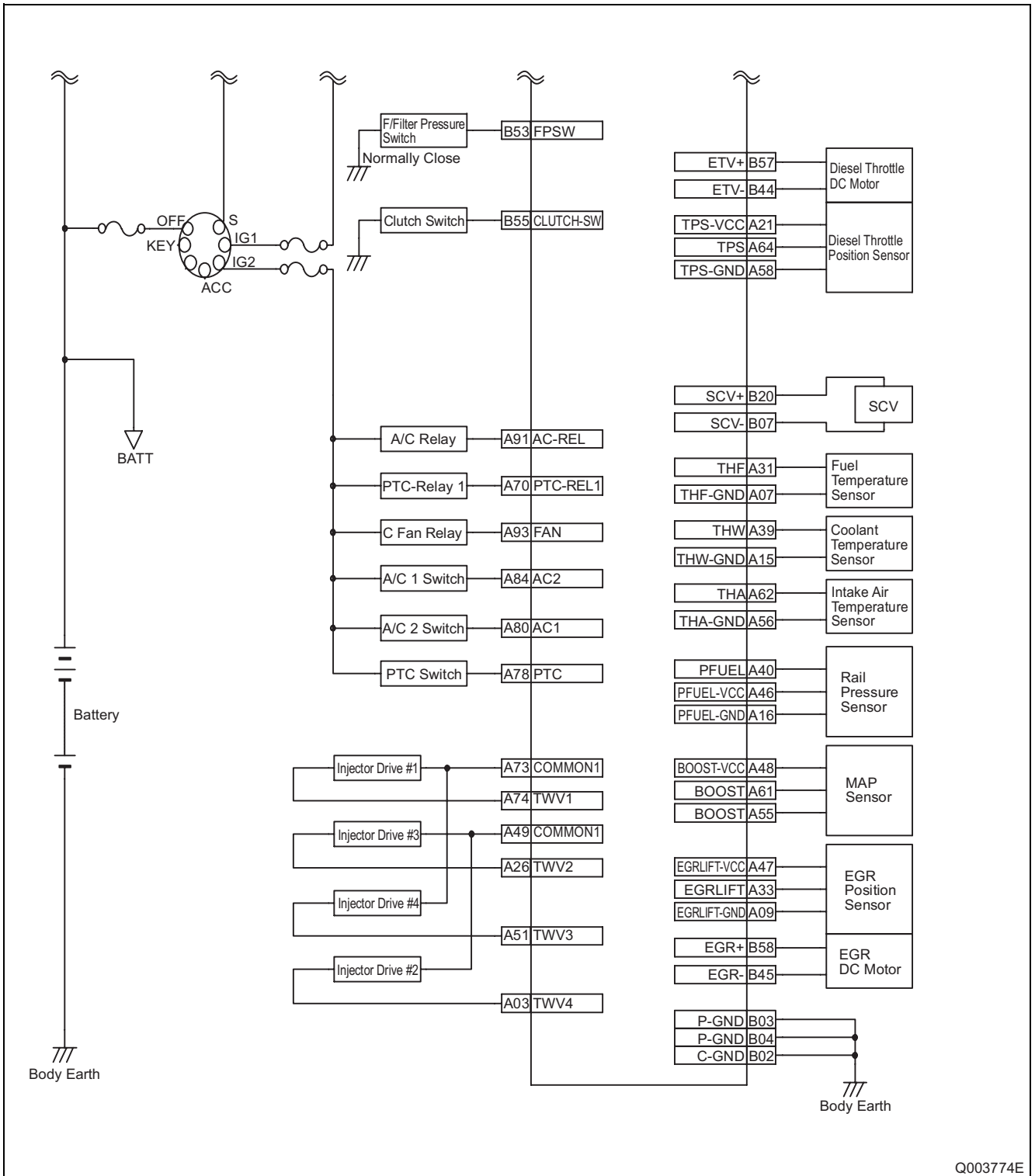
5.2 Engine Electronic Control Unit (ECU)

- The engine ECU is the command center that controls the fuel injection system and engine operation in general.

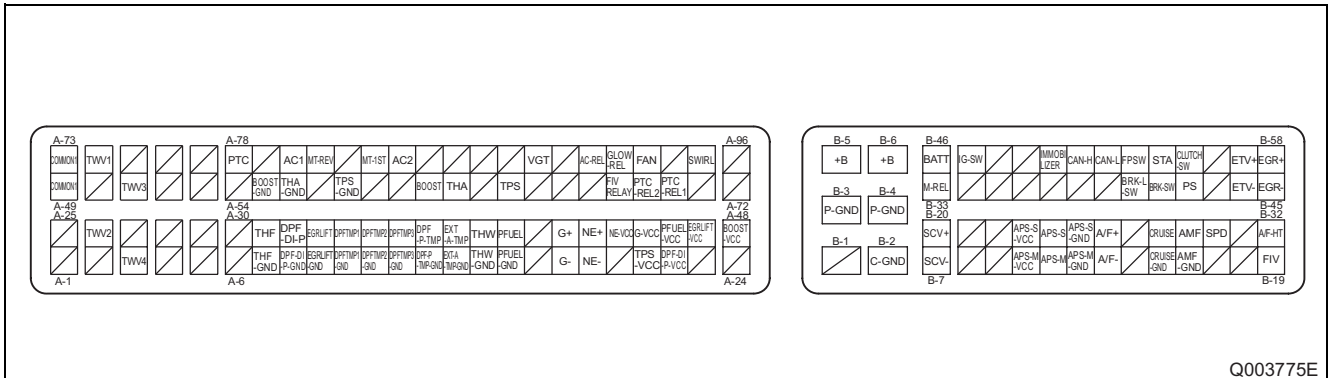


(1) External wiring diagram





(2) Connector diagram



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Terminal connections

No.	Pin Symbol	Signal Name
A01	—	
A02	—	
A03	TWV4	Injector #2
A04	—	
A05	—	
A06	—	
A07	THF-GND	Fuel Temperature Sensor Ground
A08	DPF-DI-P-GND	DPF Difference Pressure Sensor Ground
A09	EGRLIFT-GND	EGR Position Sensor Ground
A10	DPFTMP1-GND	DPF Exhaust Gas Temperature Sensor 1 Ground (Before FCC)
A11	DPFTMP2-GND	DPF Exhaust Gas Temperature Sensor 2 Ground (Before UCC)
A12	DPFTMP3-GND	DPF Exhaust Gas Temperature Sensor 3 Ground (After DPF)
A13	DPF-P-TMP-GND	DPF Temperature Sensor for Difference Pressure Sensor Ground
A14	EXT-A-TMP-GND	Intake Air Temperature Sensor Ground (W/AFS)
A15	THW-GND	Coolant Temperature Sensor Ground
A16	PFUEL-GND	Rail Pressure Sensor Ground
A17	—	
A18	G-	Camshaft Position Sensor Ground
A19	NE-	Crankshaft Position Sensor Ground
A20	—	
A21	TPS-VCC	Diesel Throttle Position Sensor Source
A22	DPF-DI-P-VCC	DPF Difference Pressure Sensor Source
A23	—	
A24	—	
A25	—	
A26	TWV2	Injector #3
A27	—	
A28	—	

No.	Pin Symbol	Signal Name
A29	—	
A30	—	
A31	THF	Fuel Temperature Sensor
A32	DPF-DI-P	DPF Difference Pressure Sensor
A33	EGRLIFT	EGR Position Sensor
A34	DPFTMP1	DPF Exhaust Gas Temperature Sensor 1 (Before FCC)
A35	DPFTMP2	DPF Exhaust Gas Temperature Sensor 2 (Before UCC)
A36	DPFTMP3	DPF Exhaust Gas Temperature Sensor 3 (After DPF)
A37	DPF-P-TMP	DPF Temperature Sensor for Difference Pressure Sensor
A38	EXT-A-TMP	Intake Air Temperature Sensor (W/AFS)
A39	THW	Coolant Temperature Sensor
A40	PFUEL	Rail Pressure Sensor
A41	—	
A42	G+	Camshaft Position Sensor
A43	NE+	Crankshaft Position Sensor
A44	NE-VCC	Crankshaft Position Sensor Battery
A45	G-VCC	Camshaft Position Sensor Battery
A46	PFUEL-VCC	Rail Pressure Sensor Source
A47	EGRLIFT-VCC	EGR Position Sensor Source
A48	BOOST-VCC	MAP Sensor Source
A49	COMMON1	Injector #2/#3 Battery
A50	—	
A51	TWV3	Injector #4
A52	—	
A53	—	
A54	—	
A55	BOOST-GND	MAP Sensor Ground
A56	THA-GND	Intake Air Temperature Sensor Ground
A57	—	
A58	TPS-GND	Diesel Throttle Position Sensor Ground
A59	—	
A60	—	
A61	BOOST	MAP Sensor
A62	THA	Intake Air Temperature Sensor
A63	—	
A64	TPS	Diesel Throttle Position Sensor
A65	—	
A66	—	
A67	—	

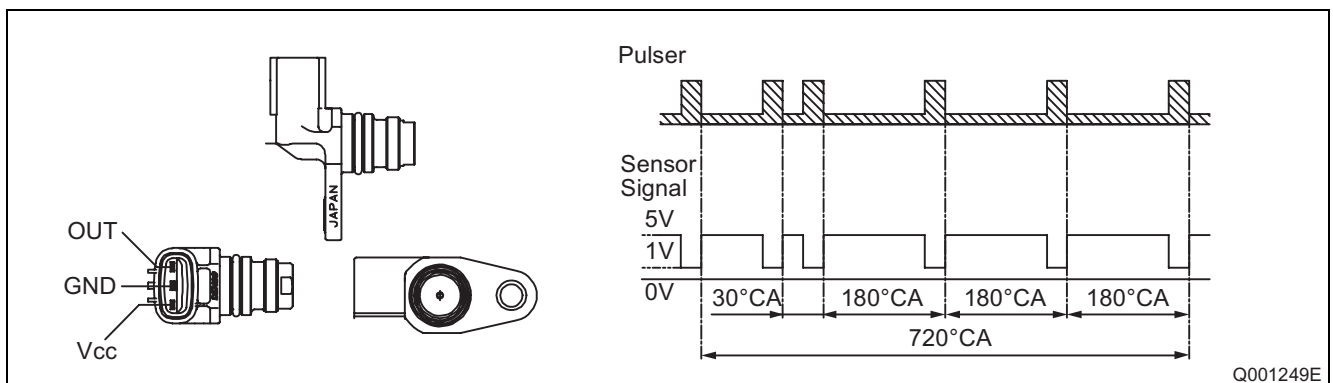
No.	Pin Symbol	Signal Name
A68	—	
A69	—	
A70	PTC-REL1	PTC Relay 1
A71	—	
A72	—	
A73	COMMON1	Injector #1/#4 Battery
A74	TWV1	Injector #1
A75	—	
A76	—	
A77	—	
A78	PTC	PTC Switch
A79	—	
A80	AC1	A/C 1 Switch
A81	MT-REV	Reverse Switch
A82	—	
A83	MT-1ST	1st Shift Switch
A84	AC2	A/C 2 Switch
A85	—	
A86	—	
A87	—	
A88	—	
A89	VGT	VGT Solenoid
A90	—	
A91	AC-REL	A/C Relay
A92	GLOW-REL	Glow Plug Relay
A93	FAN	C Fan Relay
A94	—	
A95	SWIRL	Swirl Control Valve
A96	—	
B01	—	
B02	C-GND	SIG Ground
B03	P-GND	Power Ground
B04	P-GND	Power Ground
B05	+B	Battery
B06	+B	Battery
B07	SCV-	Suction Control Valve (-)
B08	—	
B09	—	
B10	APS-M-VCC	Accelerator Position Sensor Main Source

No.	Pin Symbol	Signal Name
B11	APS-M	Accelerator Position Sensor Main
B12	APS-M-GND	Accelerator Position Sensor Main Ground
B13	—	
B14	—	
B15	CRUISE-GND	Cruise Control Switch Ground
B16	AMF-GND	Mass Air Flow Meter Ground
B17	—	
B18	—	
B19	—	
B20	SCV+	Suction Control Valve (+)
B21	—	
B22	—	
B23	APS-S-VCC	Accelerator Position Sensor Sub Source
B24	APS-S	Accelerator Position Sensor Sub
B25	APS-S-GND	Accelerator Position Sensor Sub Earth
B26	—	
B27	—	
B28	CRUISE	Cruise Control Switch (without IG)
B29	AMF	MAF Meter
B30	SPD	Vehicle Speed Sensor
B31	—	
B32	—	
B33	M-REL	Main Relay (with Diode)
B34	—	
B35	—	
B36	—	
B37	—	
B38	—	
B39	—	
B40	BRK-L-SW	Brake Lamp Switch
B41	BRK-SW	Brake Switch (Large Current)
B42	PS	Power Steering Switch
B43	—	
B44	ETV-	Diesel Throttle DC Motor (-)
B45	EGR-	EGR DC Motor (-)
B46	BATT	Battery (Backup with Monitor)
B47	IG-SW	Ignition Switch
B48	—	
B49	—	

No.	Pin Symbol	Signal Name
B50	—	
B51	CAN-H	CAN high (without Resistor)
B52	CAN-L	CAN Lo (without Resistor)
B53	FPSW	Fuel Filter Pressure Switch
B54	STA	Starter Signal
B55	CLUCH-SW	Cluch Switch
B56	—	
B57	ETV+	Diesel Throttle DC Motor (+)
B58	EGR+	EGR DC Motor (+)

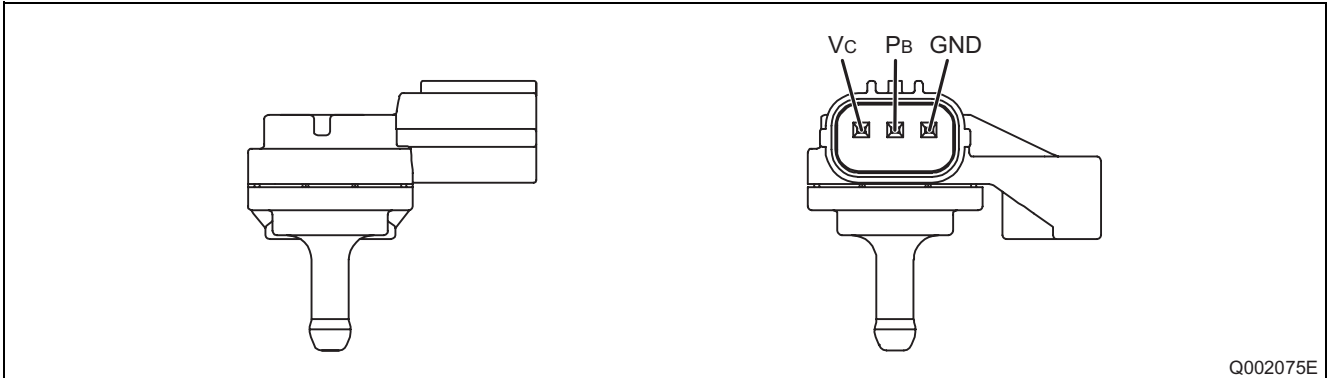
5.3 Camshaft Position Sensor (TDC)

- The camshaft position sensor outputs cylinder identification signals. The sensor outputs five pulses for every two revolutions (720°CA) of the engine.



5.4 Manifold Absolute Pressure (MAP) Sensor

- The MAP sensor is a type of semiconductor pressure sensor that utilizes changes in electrical resistance that occur when the pressure applied to a silicon crystal changes. Since a single sensor is used to measure both manifold absolute pressure and atmospheric pressure, a VSV is used to alternate between atmospheric and turbo pressure measurement.



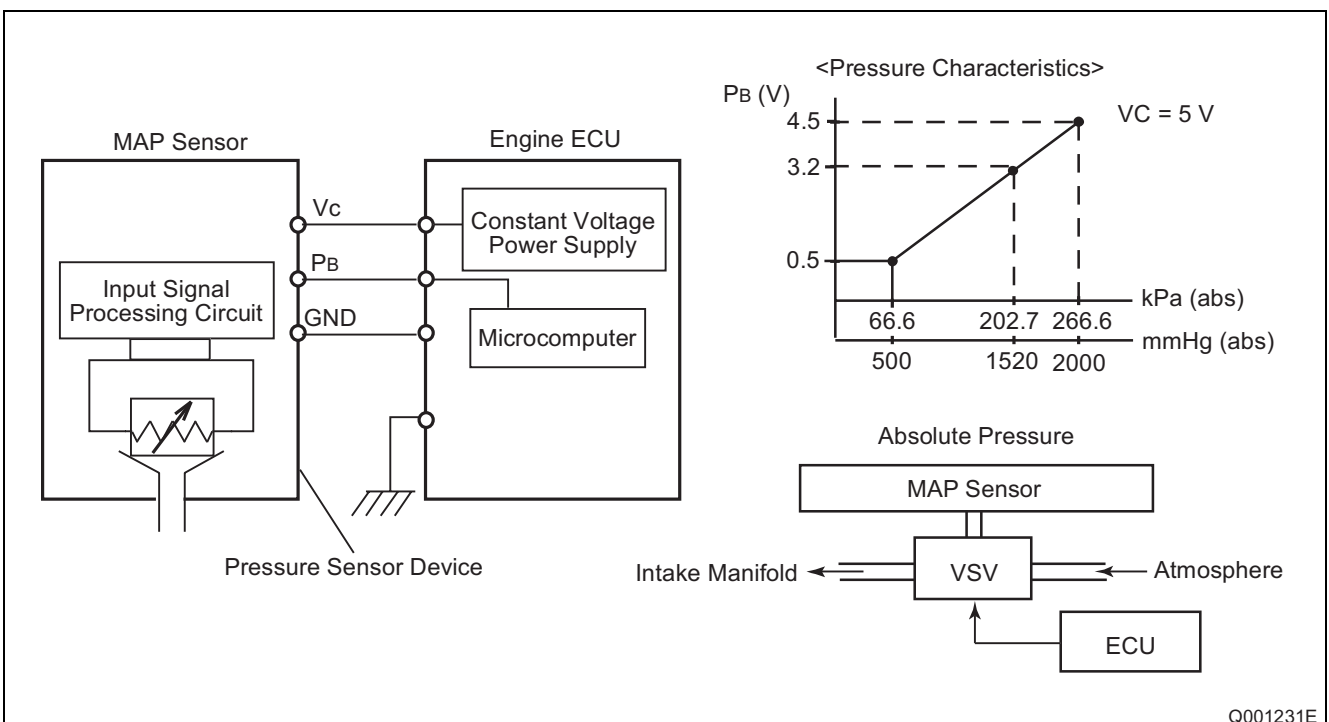
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(1) Atmospheric pressure measurement conditions

- The VSV turns ON for 150 msec to detect the atmospheric pressure when one of the conditions below is met:
 - Engine speed = 0 rpm
 - Starter is on
 - Idle is stable

(2) Turbo pressure measurement conditions

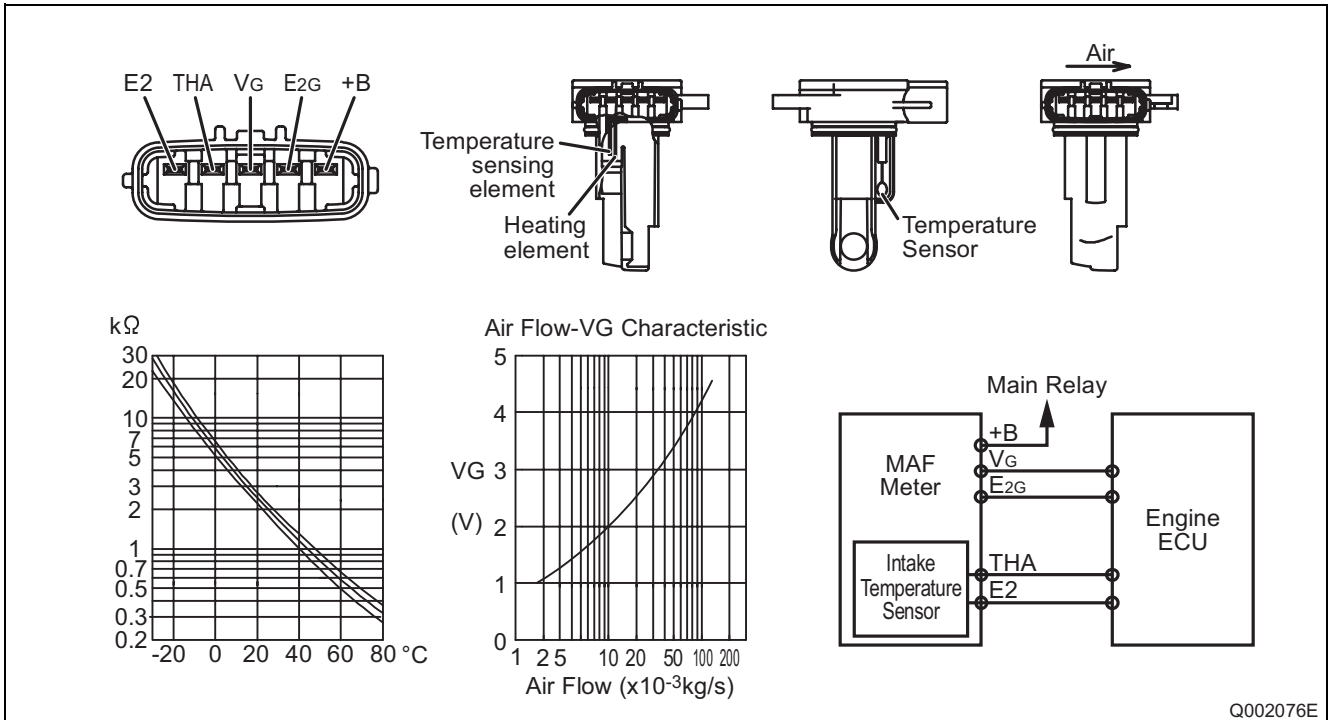
- The VSV turns OFF to detect the turbo pressure if the atmospheric pressure measurement conditions are not met.



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5.5 Mass Air Flow (MAF) Meter

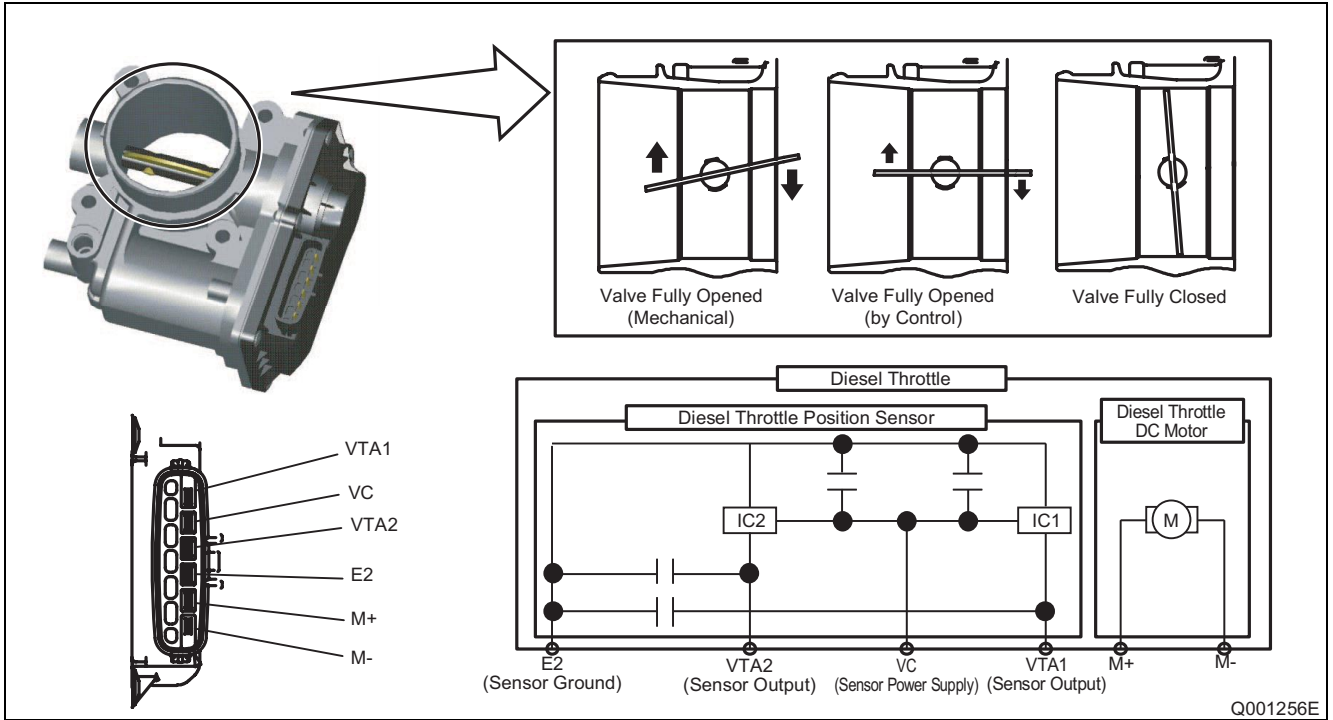
- The MAF meter is a plug-in type that allows a portion of the intake air to flow through the detection area. Detection precision has been improved, and the intake air resistance has been reduced by directly measuring the mass and flow rate of the intake air.
- This MAF meter has a built-in intake air temperature sensor.



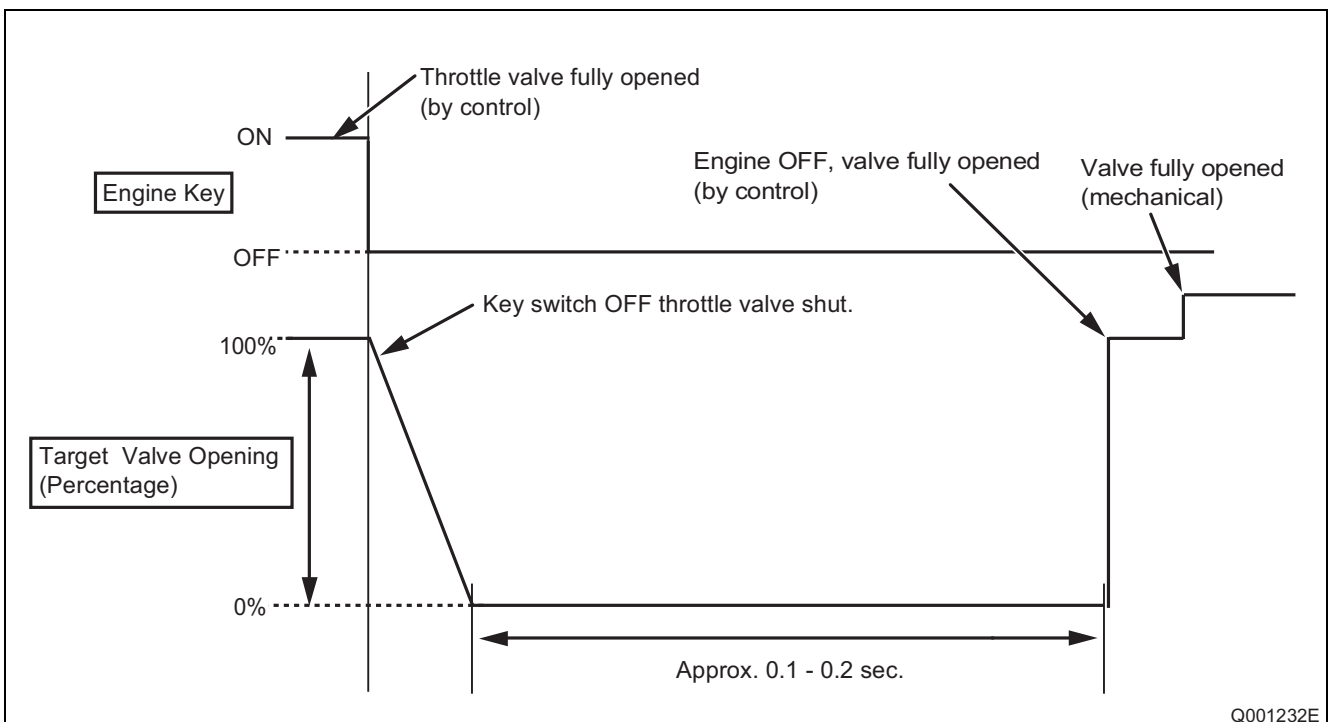
5.6 Diesel Throttle

(1) Outline

- The diesel throttle stops the suctioning of air through interlocking the intake throttle with the key switch in order to reduce engine vibration when the vehicle is not running.



(2) Operation



6. FUEL INJECTION CONTROL

6.1 Outline

- The following explains the types of control used in the PAJERO system. For details on each type of control, refer to the publication entitled, "General Edition Manual: Common Rail System (Doc ID: 00400076E)."

(1) Fuel injection rate control function

- Pilot injection control injects a small amount of fuel before the main injection.

(2) Fuel injection quantity control function

- The fuel injection quantity control function replaces the conventional governor function. Fuel injection quantity control adjusts the fuel injection to the optimal injection quantity based on the engine speed and accelerator position signals.

(3) Fuel injection timing control function

- The fuel injection timing control function replaces the conventional timer function. It controls the injection to an optimal timing based on the engine speed and the injection quantity.

(4) Fuel injection pressure control function (rail pressure control function)

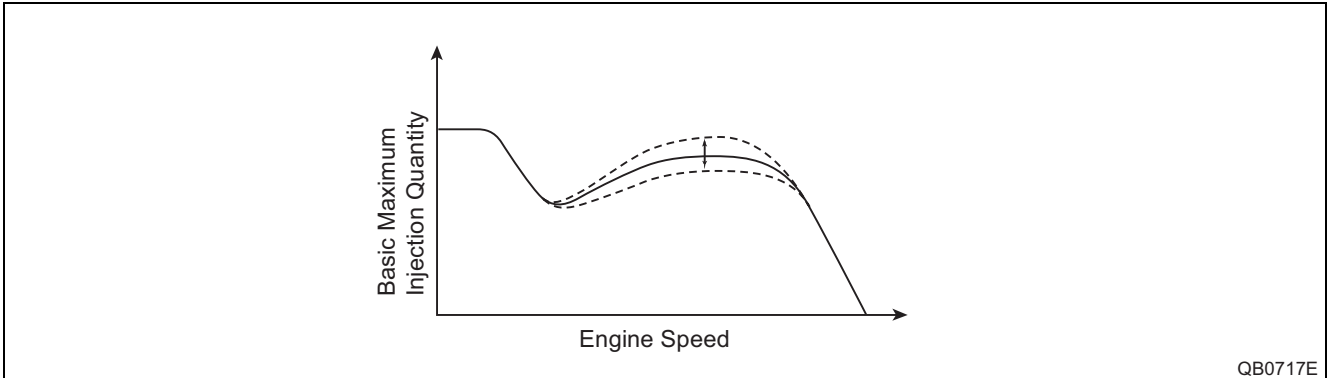
- The fuel injection pressure control function (rail pressure control function) controls the discharge volume of the pump by measuring the fuel pressure at the rail pressure sensor and feeding it back to the ECU. It effects pressure feedback control so that the discharge volume matches the optimal (command) value set in accordance with the engine speed and the injection quantity.

6.2 Fuel Injection Quantity Control

- The following explains controls unique to the PAJERO. For other types of basic fuel injection quantity control, refer to the publication entitled, "General Edition Manual: Common Rail System (Doc ID: 00400076E)."

(1) Maximum injection quantity

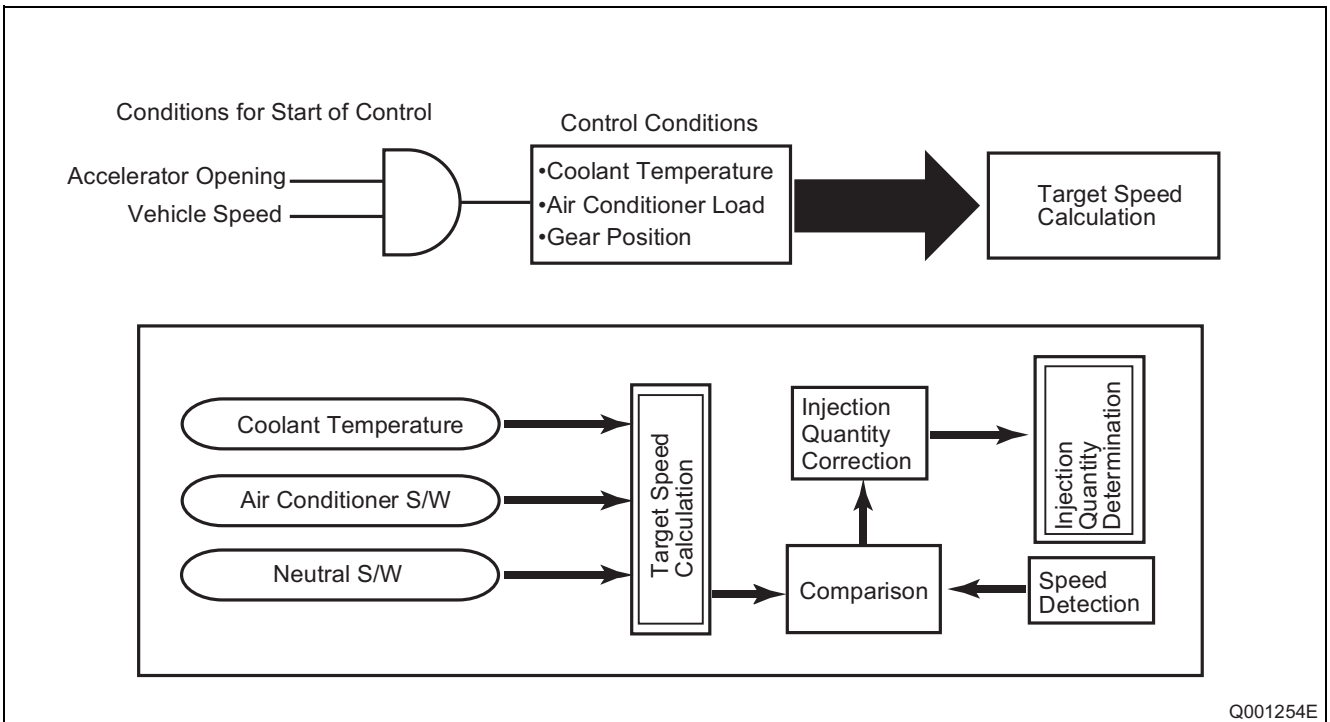
- The basic maximum injection quantity is determined by the engine speed, the added corrections for intake air pressure, and gear position.



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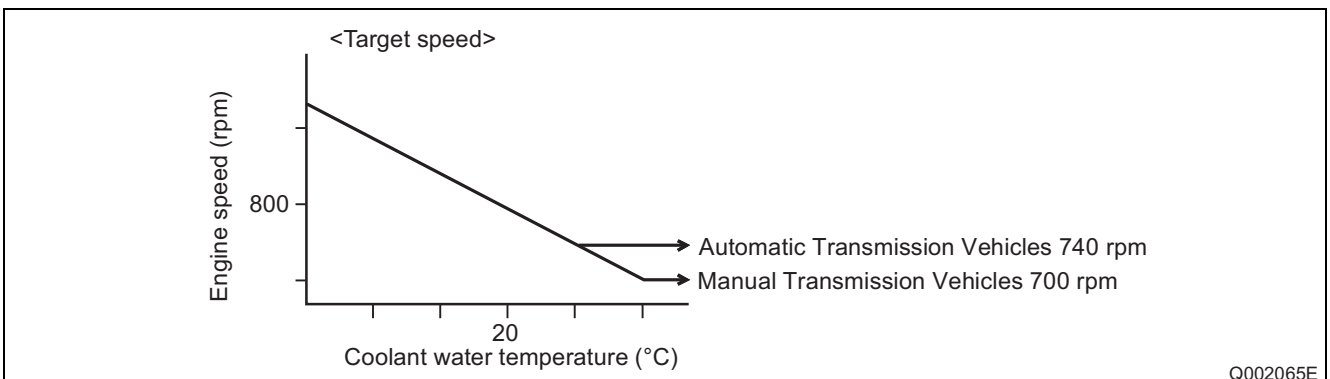
(2) Idle speed control (ISC) system

- The ISC system controls the idle speed by regulating the injection quantity so that the actual speed matches the target speed calculated by the engine ECU.



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- The target speed varies depending on whether the A/C is on or off, and the coolant temperature.



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6.3 Other Controls

- The following explains microinjection quantity learning control.

(1) Microinjection quantity learning control

Outline

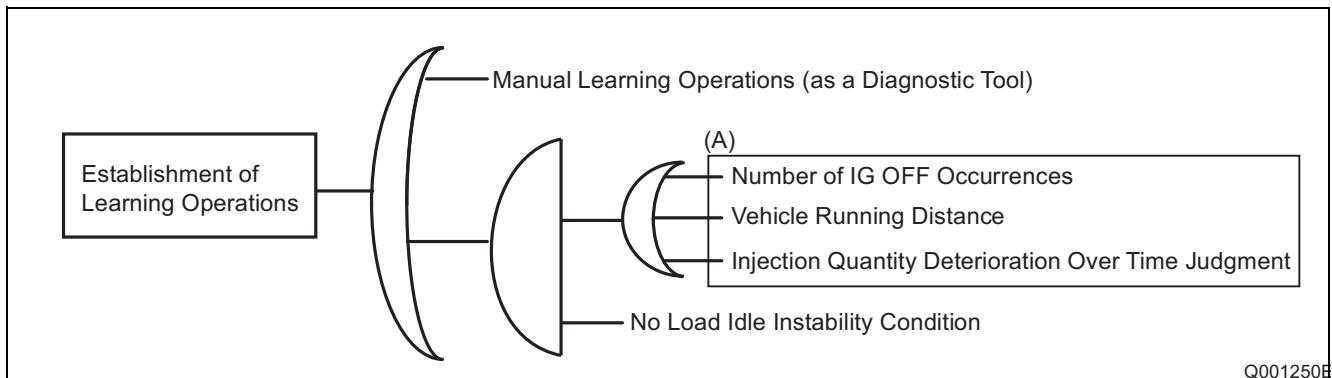
- Microinjection quantity learning control is used in every vehicle engine (injector) to preserve the accuracy of quantity (specifically, pilot injection quantity.)

This type of control is first performed when shipped from the factory (L/O), and later is automatically performed every time the vehicle runs a set distance (for details, see item "A".) Because of quantity learning control, the accuracy of each injector can be preserved not only initially, but also as deterioration in injection occurs over time. As a result of this learning, correction values are recorded in the ECU. During normal driving operations, this correction value is used to make modifications to injection commands, resulting in accurate microinjection.

Learning operations

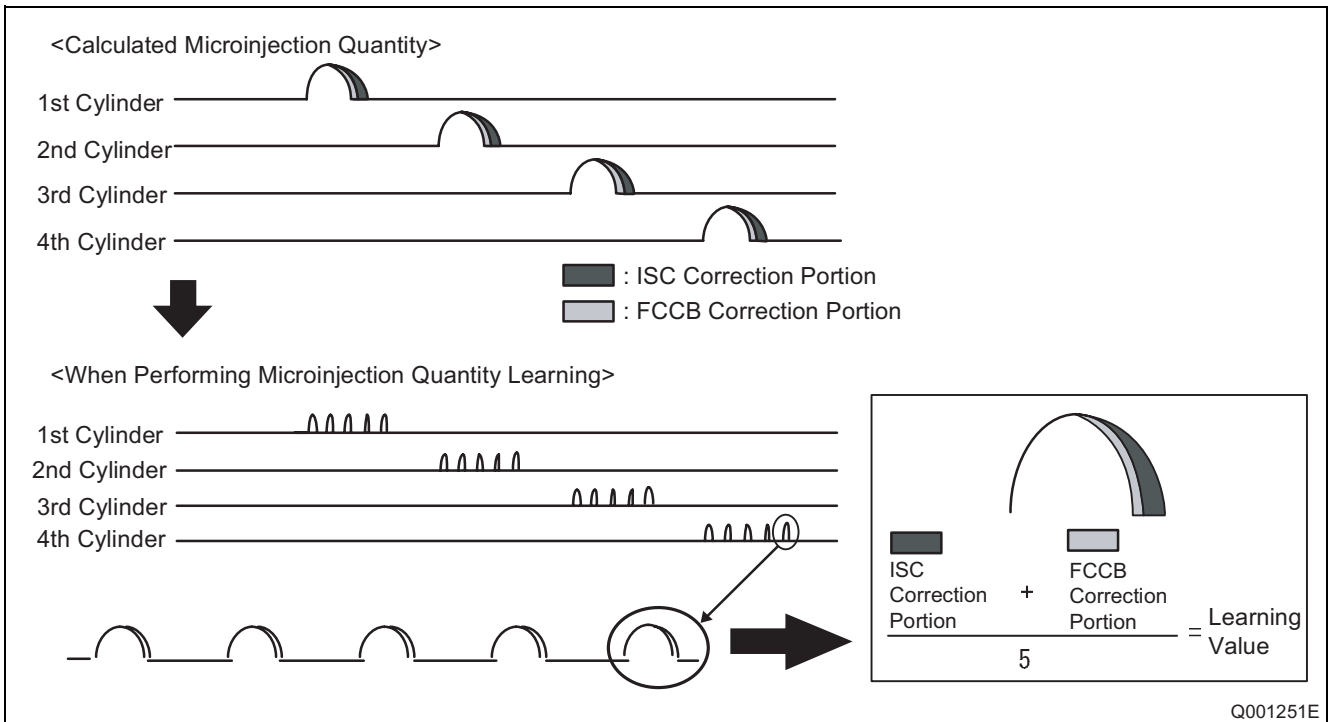
- For every two no load, idle instability conditions established (See chart "A" below) quantity learning takes place.

In addition, it is also possible to perform quantity learning control manually as a diagnostic tool.



Operational outline

- Learning control sends ISC (target speed correction quantity) and FCCB (cylinder-to-cylinder correction quantity) feedback based on engine speed to apply injection control. The correction quantity is added to each cylinder based on ISC and FCCB correction information. The corrected injection quantity is then calculated. Through the use of quantity learning control, injection is divided into 5 injections. In this state, the value for ISC and FCCB corrected injection quantity that has been divided into five injections is calculated as the "learning value".



7. OTHER SYSTEMS

7.1 Outline

- The following explains the Diesel Particulate Filter (DPF) system installed in PAJEROs equipped with an automatic transmission.

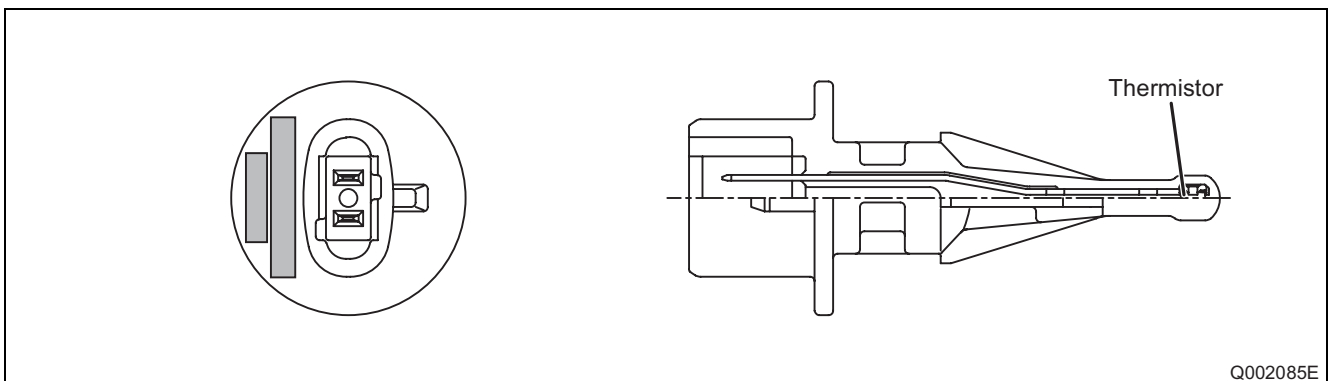
7.2 Diesel Particulate Filter (DPF) System

Outline

- For details on basic DTP construction and operation, refer to the publication entitled, "General Edition Manual: Common Rail System (Doc ID: 00400076E)." The following explains the newly added temperature sensor, used for differential pressure sensor learning.

Temperature Sensor for Differential Pressure Sensor Learning

- The temperature sensor for differential pressure sensor learning is attached to the differential pressure sensor. The temperature sensor detects differential pressure sensor temperature in order to make temperature corrections.



Q002085E

8. DIAGNOSTIC TROUBLE CODES (DTC)

8.1 Codes Shown in the Table

- The "SAE" diagnostic trouble code indicates the code that is output through the use of the STT (MUT-III).
(SAE: Society of Automotive Engineers)

8.2 DTC Details

(1) September 2006 to August 2008

DTC Number (SAE)	Diagnostic Item	Light ON	Remarks
P0016	Crankshaft position-camshaft position correlation	Yes	
P0047	Turbo PWM output - low	Yes	Automatic transmission vehicles only
P0048	Turbo PWM output - high	Yes	
P0072	Intake manifold temperature sensor - low	Yes	
P0073	Intake manifold temperature sensor - high	Yes	
P0088	Abnormally high rail pressure	Yes	
P0089	Fuel pressure regulator 1 performance (Pressure limiter valve opening abnormality)	Yes	
P0093	Fuel system leak detected-large leak	Yes	
P0102	Mass Air Flow (MAF) circuit low input	Yes	
P0103	Mass Air Flow (MAF) circuit high input	Yes	
P0106	Manifold absolute pressure/Barometric pressure circuit range/Performance	Yes	
P0107	Manifold absolute pressure/Barometric pressure circuit low input	Yes	
P0108	Manifold absolute pressure/Barometric pressure circuit high input	Yes	
P0112	Intake air temperature sensor 1 circuit low	Yes	
P0113	Intake air temperature sensor 1 circuit high	Yes	
P0117	Engine coolant temperature circuit low	Yes	
P0118	Engine coolant temperature circuit high	Yes	
P0122	Throttle/Pedal position sensor/Switch circuit low (Diesel throttle sensor low)	Yes	
P0123	Throttle/Pedal position sensor/Switch circuit high (Diesel throttle sensor high)	Yes	
P0182	Fuel temperature sensor circuit low	Yes	
P0183	Fuel temperature sensor circuit high	Yes	

DTC Number (SAE)	Diagnostic Item	Light ON	Remarks
P0191	Abnormal rail pressure sensor characteristics	Yes	
P0192	Rail pressure sensor circuit low	Yes	
P0193	Rail pressure sensor circuit high	Yes	
P0201	Injector circuit/Open-cylinder 1 (TWV 1 actuation system open circuit)	Yes	
P0202	Injector circuit/Open-cylinder 2 (TWV 3 actuation system open circuit)	Yes	
P0203	Injector circuit/Open-cylinder 3 (TWV 2 actuation system open circuit)	Yes	
P0204	Injector circuit/Open-cylinder 4 (TWV 4 actuation system open circuit)	Yes	
P0219	Engine over speed condition	No	
P0234	High boost abnormality diagnosis	Yes	Manual transmission vehicles only
P0301	Cylinder 1 misfire detected	Yes	
P0302	Cylinder 2 misfire detected	Yes	
P0303	Cylinder 3 misfire detected	Yes	
P0304	Cylinder 4 misfire detected	Yes	
P0335	Crankshaft position sensor circuit	Yes	
P0336	Crankshaft position sensor circuit range/Performance	Yes	
P0340	Camshaft position sensor circuit (No cylinder recognition sensor pulse input)	Yes	
P0341	Camshaft position sensor circuit range/Performance (Abnormal number of cylinder recognition sensor pulse inputs)	Yes	
P0403	Exhaust Gas Recirculation (EGR) control circuit	Yes	
P0405	Exhaust Gas Recirculation (EGR) sensor circuit low	Yes	
P0406	Exhaust Gas Recirculation (EGR) sensor circuit high	Yes	
P0420	Diesel Oxidation Catalyst (DOC) temperature increase failure during regeneration	Yes	Automatic transmission vehicles only
P0427	Exhaust gas temperature sensor 2 - low	Yes	
P0428	Exhaust gas temperature sensor 2 - high	Yes	
P0472	Diesel Particulate Filter (DPF) absolute pressure sensor - low	Yes	
P0473	DPF absolute pressure sensor - high	Yes	
P0502	Vehicle speed abnormality	Yes	
P0513	Incorrect immobilizer key	Yes	
P0545	Exhaust gas temperature sensor circuit low	Yes	Automatic transmission vehicles only
P0546	Exhaust gas temperature sensor circuit high	Yes	
P0551	Power steering switch ON malfunction	Yes	

DTC Number (SAE)	Diagnostic Item	Light ON	Remarks
P0603	EEPROM abnormality	Yes	
P0604	RAM abnormality	Yes	
P0605	Engine ECU Flash ROM abnormality	Yes	
P0606	CPU abnormality (main IC abnormality)	Yes	
P0607	Engine ECU abnormality (monitoring IC abnormality)	Yes	
P0628	Fuel pump control circuit low (Suction Control Valve (SCV) actuation system abnormality)	Yes	
P0629	Fuel pump control circuit high (SCV +B short)	Yes	
P0630	Vehicle Identification Number (VIN) not registered in Engine ECU	Yes	
P0638	Throttle actuator control range/Performance	Yes	
P0642	Sensor - voltage 1 low	Yes	
P0643	Sensor - voltage 1 high	Yes	
P0652	Sensor - voltage 2 low	Yes	
P0653	Sensor - voltage 2 high	Yes	
P1203	Low charge	Yes	
P1204	Over charge	Yes	
P1272	Pressure limiter open valve abnormality	Yes	
P1273	Supply pump single-side element abnormality	Yes	
P1274	Supply pump protective fail flag	Yes	
P1275	Supply pump replace fail flag	Yes	
P1298	Turbo system (positive deviation)	Yes	Automatic transmission vehicles only
P1299	Turbo system (negative deviation)	Yes	
P1427	Exhaust gas temperature sensor 3 - low	Yes	
P1428	Exhaust gas temperature sensor 3 - high	Yes	
P1474	Differential pressure sensor temperature sensor low	Yes	
P1475	Differential pressure sensor temperature sensor high	Yes	
P1497	DOC regeneration time exceeded	Yes	
P1498	Regeneration timing abnormality	Yes	
P1499	DPF heat loss temperature abnormality	Yes	
P1564	Cruise control switch abnormality	No	
P1571	Brake switch abnormality	No	
P1625	QR data abnormality	Yes	
P1626	QR data failure to write abnormality	Yes	
P2009	Swirl control (VSS) output (VSV) open load/short to GND	Yes	
P2010	Swirl control (VSS) output (VSV) short to BATT	Yes	
P2118	Diesel throttle DC motor over current abnormality	Yes	

DTC Number (SAE)	Diagnostic Item	Light ON	Remarks
P2122	Throttle/Pedal position sensor/Switch "D" circuit low input (Accelerator position sensor 1 low)	Yes	
P2123	Throttle/Pedal position sensor/Switch "D" circuit low input (Accelerator position sensor 1 high)	Yes	
P2124	Accelerator position sensor-1 high	No	
P2127	Throttle/Pedal position sensor/Switch "E" circuit low input (Accelerator position sensor 2 low)	Yes	
P2128	Throttle/Pedal position sensor/Switch "E" circuit high input (Accelerator position sensor 2 high)	Yes	
P2138	Accelerator position sensor - duplicate malfunction high	Yes	
	Accelerator position sensor - duplicate malfunction low	Yes	
	Accelerator position sensor characteristic abnormality	Yes	
P2146	Fuel injector group "A" supply voltage circuit/Open	Yes	
P2147	Fuel injector group "A" supply voltage circuit low	Yes	
P2148	Fuel injector group "A" supply voltage circuit high	Yes	
P2149	Fuel Injector group "B" supply voltage circuit/Open	Yes	
P2228	Barometric pressure circuit low	Yes	
P2229	Barometric pressure circuit high	Yes	
P2413	EGR system performance	Yes	
P2454	Differential pressure sensor low	Yes	Automatic transmission vehicles only
P2455	Differential pressure sensor high	Yes	
P252F	Oil level abnormality	No	
UD073	CAN bus OFF error	No	
UD101	CAN time out flag (trans)	No	Automatic transmission vehicles only
UD102	CAN time out flag (ESP)	No	
UD109	CAN time out flag (ETACS)	No	
UD117	CAN time out flag (immobilizer)	No	

(2) from September 2008

DTC Number (SAE)	Diagnostic Item	Light ON	Remarks
P0016	Crankshaft position-camshaft position correlation	Yes	
P0047	Turbo PWM output - low	Yes	
P0048	Turbo PWM output - high	Yes	
P0072	Intake manifold temperature sensor - low	Yes	
P0073	Intake manifold temperature sensor - high	Yes	
P0088	Abnormally high rail pressure	Yes	
P0089	Fuel pressure regulator 1 performance (Pressure limiter valve opening abnormality)	Yes	
P0093	Fuel system leak detected-large leak	Yes	
P0102	Mass Air Flow (MAF) circuit low input	Yes	
P0103	Mass Air Flow (MAF) circuit high input	Yes	
P0106	Manifold absolute pressure/Barometric pressure circuit range/Performance	Yes	
P0107	Manifold absolute pressure/Barometric pressure circuit low input	Yes	
P0108	Manifold absolute pressure/Barometric pressure circuit high input	Yes	
P0112	Intake air temperature sensor 1 circuit low	Yes	
P0113	Intake air temperature sensor 1 circuit high	Yes	
P0117	Engine coolant temperature circuit low	Yes	
P0118	Engine coolant temperature circuit high	Yes	
P0122	Throttle/Pedal position sensor/Switch circuit low (Diesel throttle sensor low)	Yes	
P0123	Throttle/Pedal position sensor/Switch circuit high (Diesel throttle sensor high)	Yes	
P0182	Fuel temperature sensor circuit low	Yes	
P0183	Fuel temperature sensor circuit high	Yes	
P0191	Abnormal rail pressure sensor characteristics	Yes	
P0192	Rail pressure sensor circuit low	Yes	
P0193	Rail pressure sensor circuit high	Yes	
P0201	Injector circuit/Open-cylinder 1 (TWV 1 actuation system open circuit)	Yes	
P0202	Injector circuit/Open-cylinder 2 (TWV 3 actuation system open circuit)	Yes	
P0203	Injector circuit/Open-cylinder 3 (TWV 2 actuation system open circuit)	Yes	

DTC Number (SAE)	Diagnostic Item	Light ON	Remarks
P0204	Injector circuit/Open-cylinder 4 (TWW 4 actuation system open circuit)	Yes	
P0219	Engine over speed condition	No	
P0299	Low boost abnormality diagnosis	Yes	
P0301	Cylinder 1 misfire detected	Yes	
P0302	Cylinder 2 misfire detected	Yes	
P0303	Cylinder 3 misfire detected	Yes	
P0304	Cylinder 4 misfire detected	Yes	
P0335	Crankshaft position sensor circuit	Yes	
P0336	Crankshaft position sensor circuit range/Performance	Yes	
P0340	Camshaft position sensor circuit (No cylinder recognition sensor pulse input)	Yes	
P0341	Camshaft position sensor circuit range/Performance (Abnormal number of cylinder recognition sensor pulse inputs)	Yes	
P0403	Exhaust Gas Recirculation (EGR) control circuit	Yes	
P0405	Exhaust Gas Recirculation (EGR) sensor circuit low	Yes	
P0406	Exhaust Gas Recirculation (EGR) sensor circuit high	Yes	
P0420	Diesel Oxidation Catalyst (DOC) temperature increase failure during regeneration	Yes	
P0427	Exhaust gas temperature sensor 1 - low	Yes	
P0428	Exhaust gas temperature sensor 1 - high	Yes	
P0502	Vehicle speed abnormality (low)	Yes	
P0513	Incorrect immobilizer key	Yes	
P0545	Exhaust gas temperature sensor circuit low	Yes	
P0546	Exhaust gas temperature sensor circuit high	Yes	
P0551	Power steering switch ON malfunction	Yes	
P0603	EEPROM abnormality	Yes	
P0604	RAM abnormality	Yes	
P0605	Engine ECU Flash ROM abnormality	Yes	
P0606	CPU abnormality (main IC abnormality)	Yes	
P0607	Engine ECU abnormality (monitoring IC abnormality)	Yes	
P0628	Fuel pump control circuit low (Suction Control Valve (SCV) actuation system abnormality)	Yes	
P0629	Fuel pump control circuit high (SCV +B short)	Yes	
P0630	Vehicle Identification Number (VIN) not registered in Engine ECU	Yes	
P0638	Throttle actuator control range/Performance	Yes	
P0642	Sensor - voltage 1 low	Yes	

DTC Number (SAE)	Diagnostic Item	Light ON	Remarks
P0643	Sensor - voltage 1 high	Yes	
P0652	Sensor - voltage 2 low	Yes	
P0653	Sensor - voltage 2 high	Yes	
U1073	CAN bus OFF error	No	
U1101	CAN time out flag (trans)	No	Automatic transmission vehicles only
U1102	CAN time out flag (ESP)	No	
U1109	CAN time out flag (ETACS)	No	
U1117	CAN time out flag (immobilizer)	No	
P1203	Low charge	Yes	
P1204	Overcharge	Yes	
P1272	Pressure limiter open valve abnormality	Yes	
P1273	Supply pump single-side element abnormality	Yes	
P1274	Supply pump protective fail flag	Yes	
P1275	Supply pump replace fail flag	Yes	
P1427	Exhaust gas temperature sensor 3 - low	Yes	
P1428	Exhaust gas temperature sensor 3 - high	Yes	
P1474	Differential pressure sensor temperature sensor low	Yes	
P1475	Differential pressure sensor temperature sensor high	Yes	
P1497	DOC regeneration time exceeded	Yes	
P1498	Regeneration timing abnormality	Yes	
P1499	DPF heat loss temperature abnormality	Yes	
P1564	Cruise control switch abnormality	No	
P1571	Brake switch abnormality	No	
P1625	QR data abnormality	Yes	
P1626	QR data failure to write abnormality	Yes	
P2009	Swirl control (VSS) output (VSV) open load/short to GND	Yes	
P2010	Swirl control (VSS) output (VSV) short to BATT	Yes	
P2118	Diesel throttle DC motor over current abnormality	Yes	
P2122	Throttle/Pedal position sensor/Switch "D" circuit low input (Accelerator position sensor 1 low)	Yes	
P2123	Throttle/Pedal position sensor/Switch "D" circuit low input (Accelerator position sensor 1 high)	Yes	
P2124	Accelerator position sensor-1 high	No	
P2127	Throttle/Pedal position sensor/Switch "E" circuit low input (Accelerator position sensor 2 low)	Yes	

DTC Number (SAE)	Diagnostic Item	Light ON	Remarks
P2128	Throttle/Pedal position sensor/Switch "E" circuit high input (Accelerator position sensor 2 high)	Yes	
P2138	Accelerator position sensor - duplicate malfunction high	Yes	
	Accelerator position sensor - duplicate malfunction low	Yes	
	Accelerator position sensor characteristic abnormality	Yes	
P2146	Fuel injector group "A" supply voltage circuit/Open	Yes	
P2147	Fuel injector group "A" supply voltage circuit low	Yes	
P2148	Fuel injector group "A" supply voltage circuit high	Yes	
P2149	Fuel Injector group "B" supply voltage circuit/Open	Yes	
P2228	Barometric pressure circuit low	Yes	
P2229	Barometric pressure circuit high	Yes	
P2413	EGR system performance	Yes	
P2454	Differential pressure sensor - low	Yes	
P2455	Differential pressure sensor - high	Yes	
P252F	Oil level abnormality	No	

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