



DENSO

Diesel Injection Pump

SERVICE MANUAL

**New Common Rail System (HP3)
for MAZDA**

OPERATION

June, 2005

DENSO CORPORATION

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Table of Contents

Operation Section

1. PRODUCT APPLICATION INFORMATION

| | | |
|-----|--|-----|
| 1.1 | Outline | 1-1 |
| 1.2 | Application | 1-1 |
| 1.3 | System Components Parts Number | 1-1 |

2. OUTLINE OF SYSTEM

| | | |
|-----|--|-----|
| 2.1 | Outline of Composition and Operation | 1-3 |
|-----|--|-----|

3. SUPPLY PUMP

| | | |
|-----|---------------------------------------|-----|
| 3.1 | Outline | 1-4 |
| 3.2 | Explode View | 1-4 |
| 3.3 | SCV (Suction Control Valve) | 1-5 |

4. RAIL

| | | |
|-----|-------------------|-----|
| 4.1 | Outline | 1-7 |
|-----|-------------------|-----|

5. INJECTOR

| | | |
|-----|---------------------------|-----|
| 5.1 | Outline | 1-8 |
| 5.2 | Characteristics | 1-8 |
| 5.3 | Construction | 1-8 |
| 5.4 | QR Codes | 1-9 |

6. OPERATION OF CONTROL SYSTEM COMPONENTS

| | | |
|-----|--|------|
| 6.1 | Outline | 1-11 |
| 6.2 | Engine ECU (Electronic Control Unit) | 1-11 |
| 6.3 | Operation of Sensors | 1-12 |

7. CONTROL SYSTEM

| | | |
|-----|---|------|
| 7.1 | Outline | 1-14 |
| 7.2 | Fuel Injection Timing Control | 1-16 |

8. DIAGNOSTIC TROUBLE CODES (DTC)

| | | |
|-----|--|------|
| 8.1 | About the Codes Shown in the Table | 1-17 |
| 8.2 | Diagnostic Trouble Code Details | 1-17 |

9. EXTERNAL WIRING DIAGRAM

| | | |
|-----|--|------|
| 9.1 | Engine ECU External Wiring Diagram (Model Name: MAZDA 5) | 1-33 |
| 9.2 | Engine ECU External Wiring Diagram (Model Name: MAZDA 6) | 1-37 |

1. PRODUCT APPLICATION INFORMATION

1.1 Outline

- The common rail system for the MZR-CD engine has been newly installed in the Mazda 5 and Mazda 6. The contents for the common rail system are basically the same as those published in the previous Service Bulletin, "S/B Code: ECD02-06, Subject: New Common Rail System (ECD-U2P) for Mazda." The two major points that have changed for this system are the addition of the DPF system, and injectors equipped with the QR code. Please be sure to use this Service Manual together with the Service Bulletin as this edition explains only points that have changed.

1.2 Application

| Model Name | Engine | Destination | Line Off Period |
|------------|--------|-------------|-----------------|
| MAZDA 5 | MZR-CD | Europe | March, 2005 |
| MAZDA 6 | | | April, 2005 |

1.3 System Components Parts Number

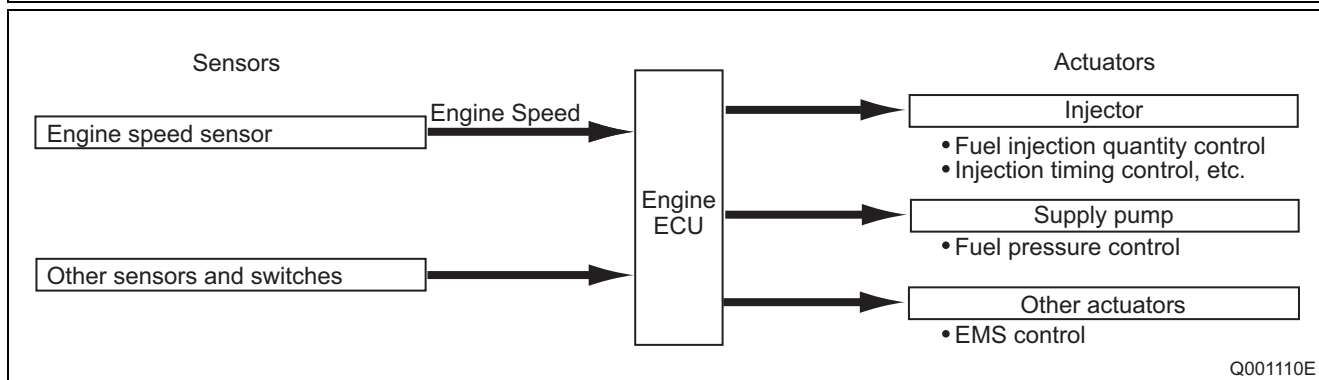
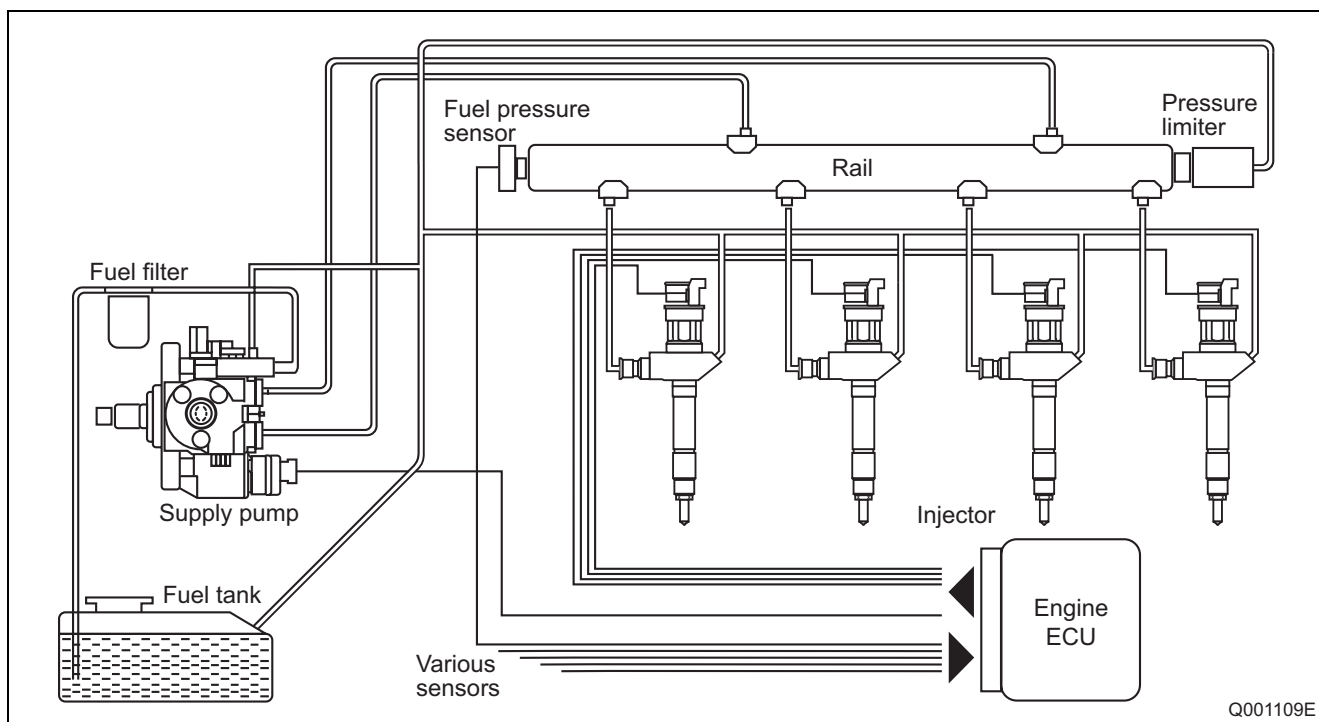
| Parts Name | DENSO P/N | Manufacturer P/N | Remarks |
|---------------------------------------|-------------|------------------|----------------------------|
| Engine ECU | 275800-6401 | RF7J 18 881B | MAZDA 6 |
| | 275800-6441 | RF7K 18 881B | MAZDA 6 High Output Engine |
| | 275800-6450 | RF7N 18 881A | MAZDA 5 |
| | 275800-6460 | RF7P 18 881A | MAZDA 5 High Output Engine |
| Turbo pressure sensor (MAPS) | 079800-7440 | RF7J 18 211 | |
| Injector | 095000-5780 | RF7J 13 H50 | |
| Crankshaft position sensor (NE) | 949979-0200 | RF7J 18 221 | |
| Cylinder recognition sensor (TDC) | 949979-1520 | RF7J 18 230 | |
| Rail | 095440-0740 | RF7J 13 GC0 | |
| Rail pressure sensor | 499000-6210 | — | |
| Pressure limiter | 095420-0201 | — | |
| Supply pump | 294000-0420 | RF7J 13 800A | |
| Suction control valve | 294200-0160 | — | |
| Fuel temperature sensor | 179730-0020 | RF1L 18 840 | |
| Mass air flow meter | 197400-2010 | ZL01 13 215 | |
| Coolant temperature sensor | 179700-0220 | B593 18 840A | |
| Engine compartment temperature sensor | 170400-6020 | BP4W 18 845 | |
| Exhaust temperature sensor 1 | 265600-1050 | RF7N 18 7G0 | MAZDA 6 |
| | 265600-1090 | RF7K 18 7G0A | MAZDA 5 |
| Exhaust temperature sensor 2 | 265600-1060 | RF7P 18 7G0 | MAZDA 6 |
| | 265600-1080 | RF7J 18 7G0A | MAZDA 5 |

| Parts Name | DENSO P/N | Manufacturer P/N | Remarks |
|------------------------------|-------------|------------------|---------|
| Exhaust temperature sensor 3 | 265600-1070 | RF7R 18 7G0 | MAZDA 6 |
| | 265600-1101 | RF7L 18 7G0C | MAZDA 5 |
| A/F sensor (UHEGO) | 211200-4260 | RF7N 18 8G1 | |
| Differential pressure sensor | 104990-1160 | RF7N 18 2B5 | MAZDA 6 |
| | 104990-1150 | RF7J 18 2B5 | MAZDA 5 |
| Accele pedal module | 198800-3480 | CC30 41 600 | MAZDA 6 |
| | 198800-3490 | CC34 41 600 | |
| | 198800-3400 | GR1L 41 600A | MAZDA 5 |
| | 198800-3410 | GR1M 41 600A | |
| | 198800-3440 | GR3D 41 600A | |
| | 198800-3450 | GR3E 41 600A | |

2. OUTLINE OF SYSTEM

2.1 Outline of Composition and Operation

- This system is basically the same as that in Service Bulletin ECD02-06. However the EDU has been discontinued. Please refer to the Service Bulletin for Operation.

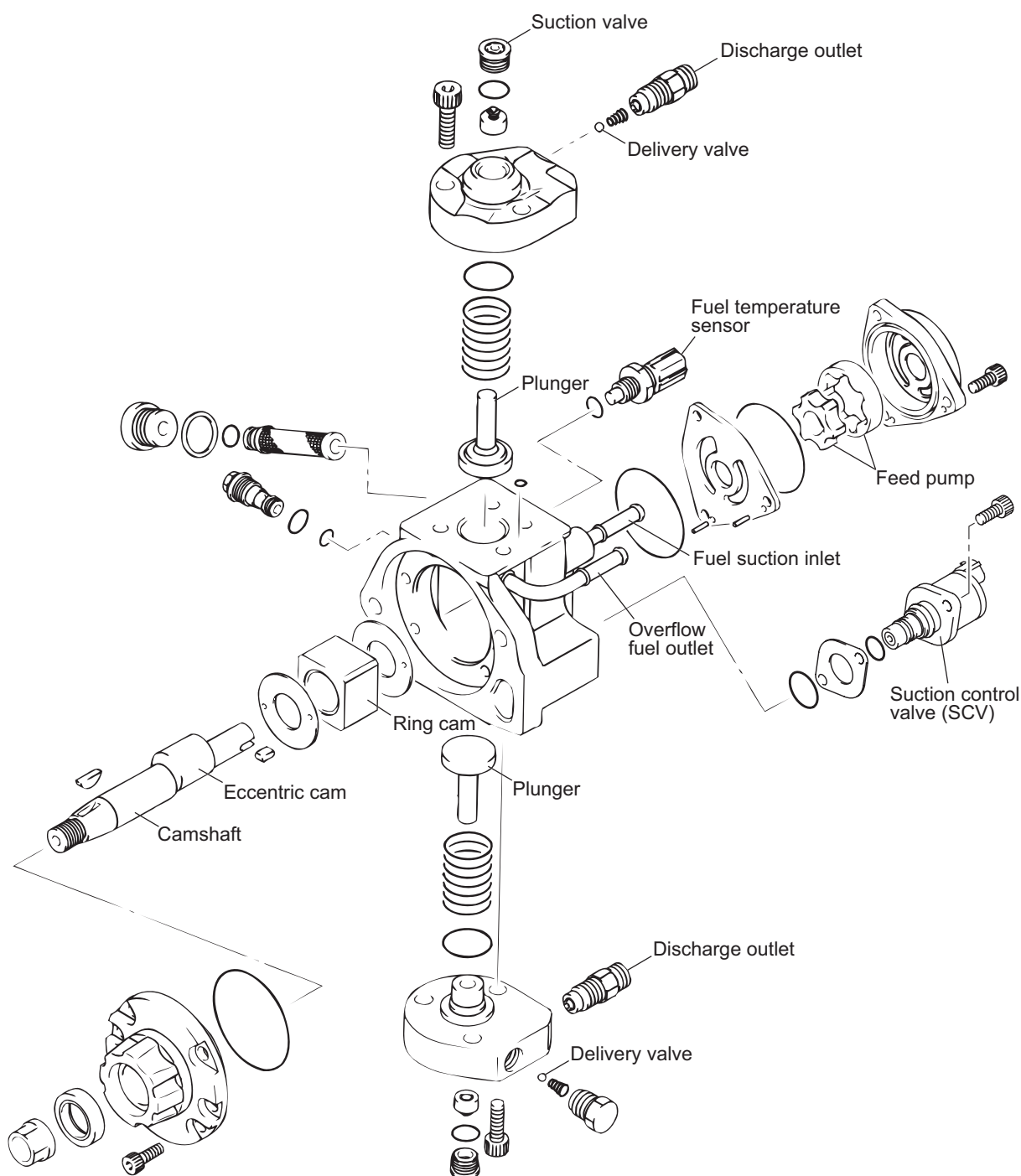


3. SUPPLY PUMP

3.1 Outline

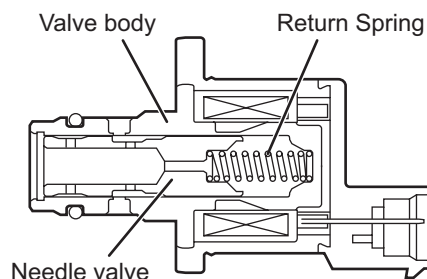
- The HP3 supply pump comes with the compact SCV (Suction Control Valve) installed. Please refer to Service Bulletin ECD02-06 as only the SCV has changed.

3.2 Explode View



3.3 SCV (Suction Control Valve)

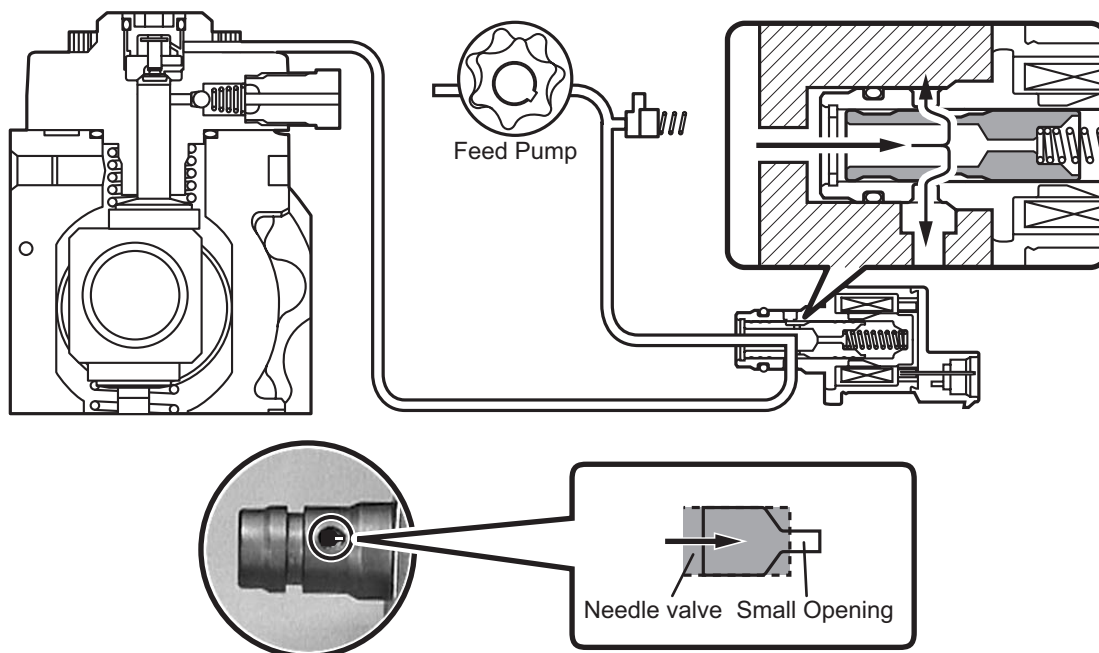
- A linear solenoid type solenoid valve has been adopted. The length of time in which the ECU applies current to the SCV is controlled (duty cycle control) in order to regulate the volume of suction of fuel into the pumping area. Because only the volume of fuel that is required by the target rail pressure is drawn in, the drive load on the supply pump decreases, thus resulting in improved fuel economy.



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(1) SCV Opening Small (Duty ON time long - Refer to the "Relationship Between Actuation Signal and Current" Diagram.)

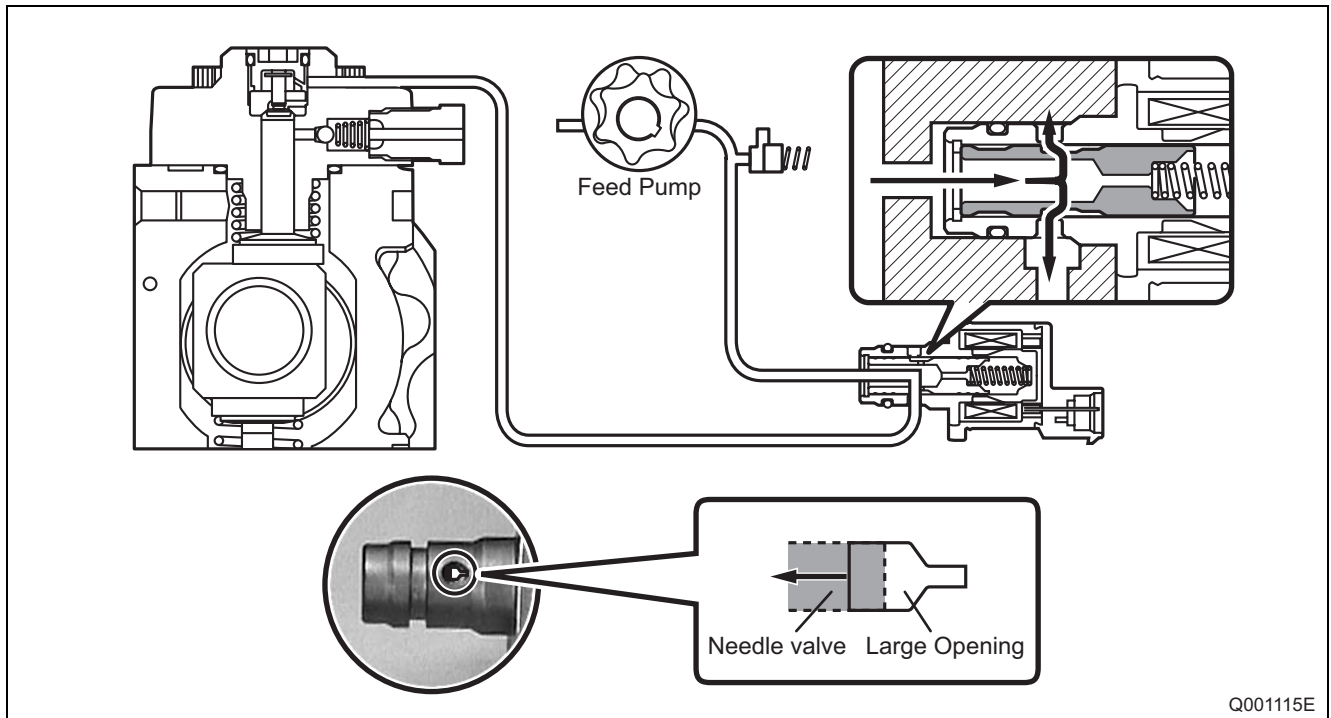
- When the opening of the SCV is small, the fuel suction area is kept small, which decreases the transferable fuel volume.



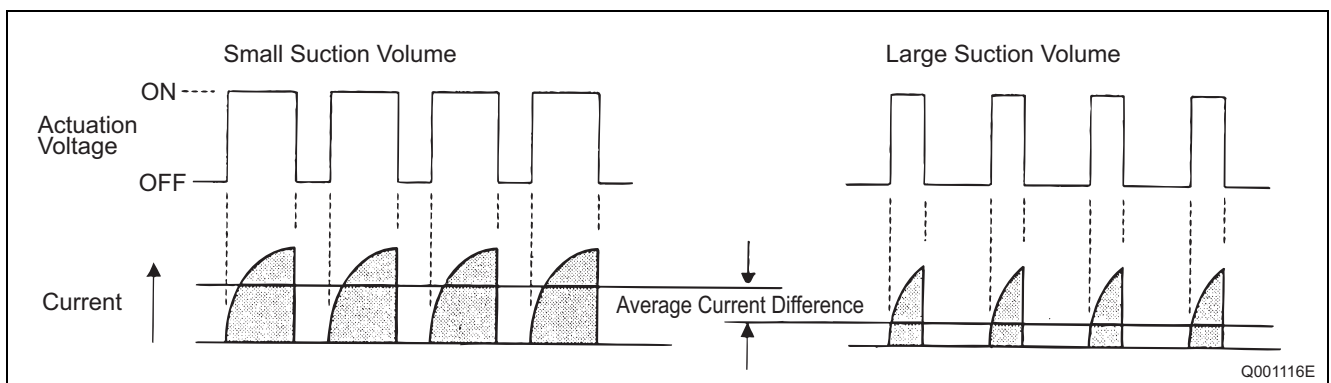
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(2) SCV Opening Large (Duty ON time short - Refer to the "Relationship Between Actuation Signal and Current" Diagram.)

- When the opening of the SCV is large, the fuel suction area is kept large, which increases the transferable fuel volume.



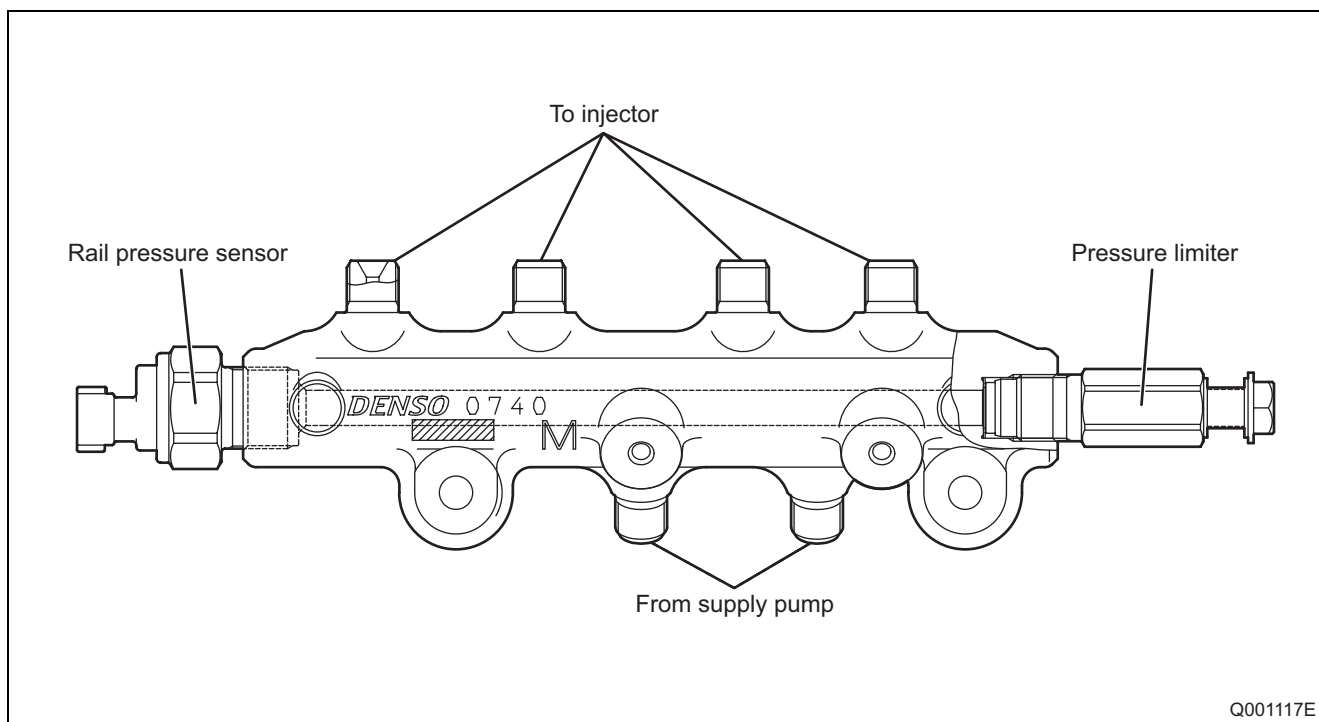
(3) Diagram of Relationship Between Actuation Signal and Current (Magnetomotive Force)



4. RAIL

4.1 Outline

- Although the characteristics of both the Fuel Pressure Sensor and Pressure limiter have not changed, the shape of the Rail Pressure Sensor has been altered. Please refer to Service Bulletin ECD02-06.



5. INJECTOR

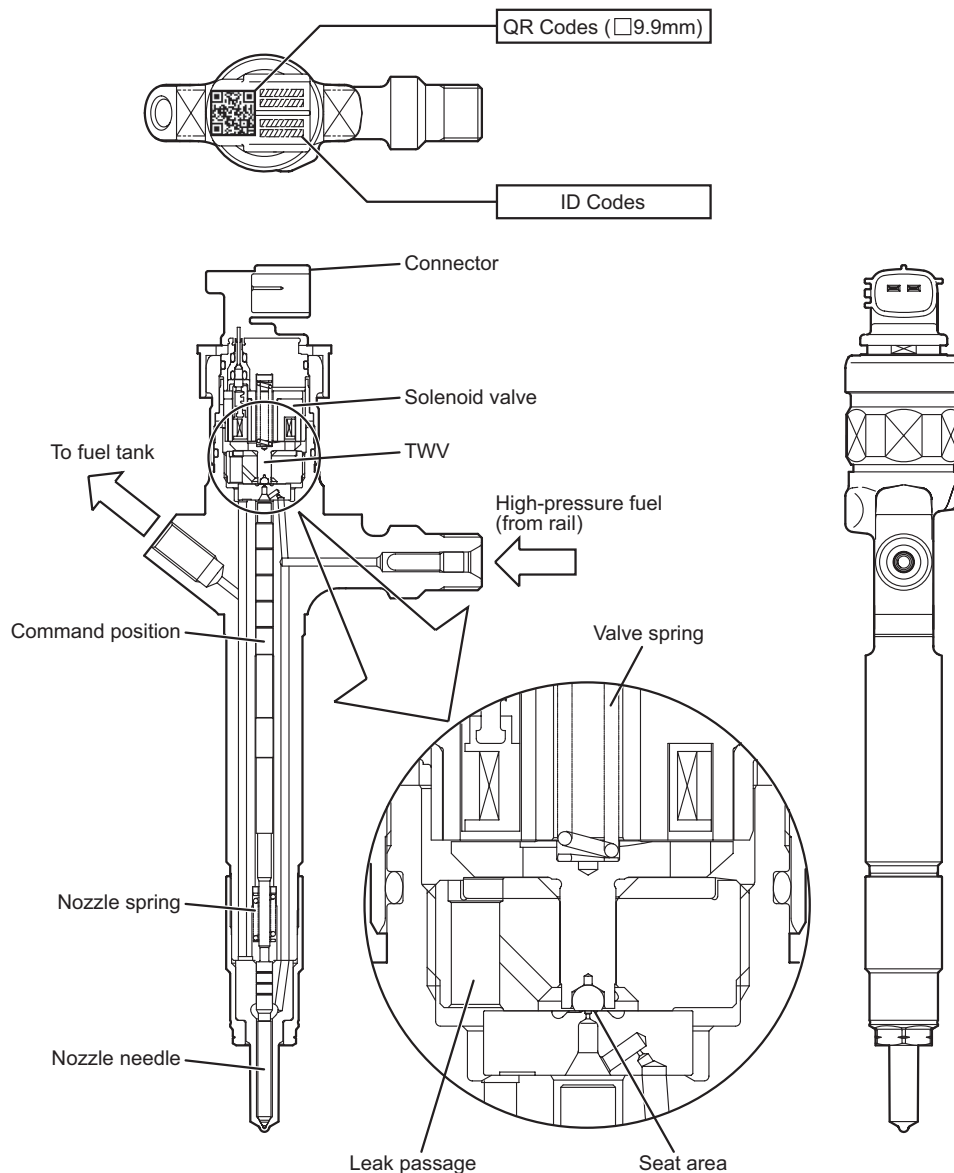
5.1 Outline

- 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 the commands received from the ECU. In addition, the correction resistor has been discontinued and replaced by a QR code injector.

5.2 Characteristics

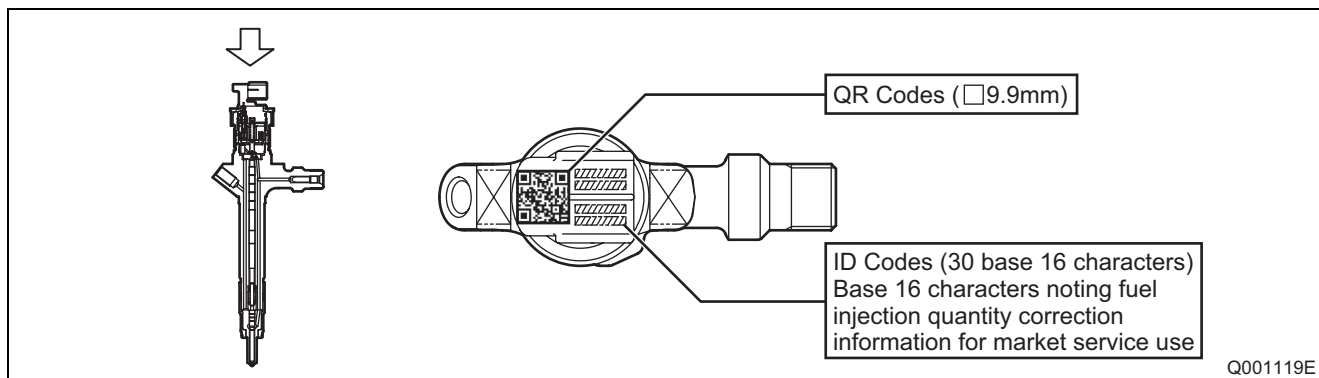
- A compact, energy-saving, solenoid-control type TWV (Two-Way Valve) injector has been adopted.

5.3 Construction

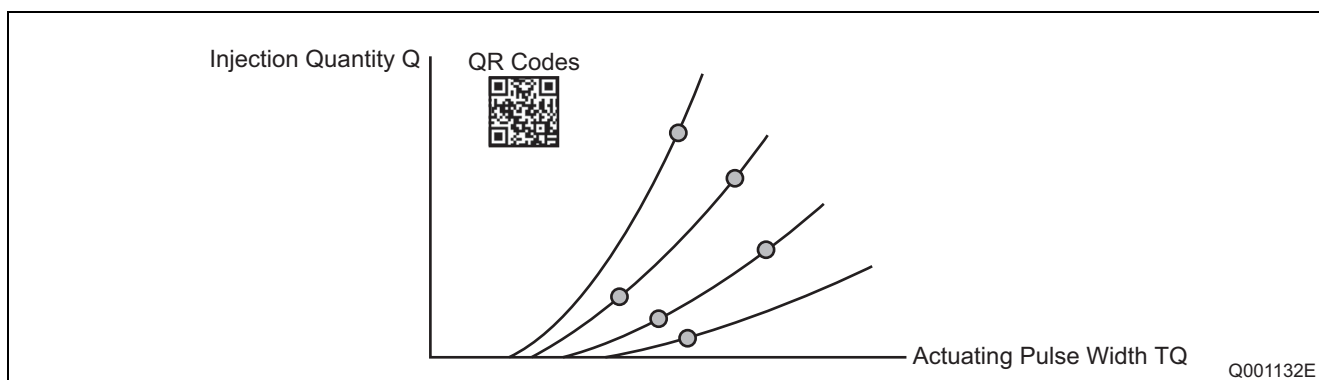


5.4 QR Codes

- Conventionally the whole injector Ass'y was replaced during injector replacement, but QR (Quick Response) codes have been adopted to improve injector quantity precision.



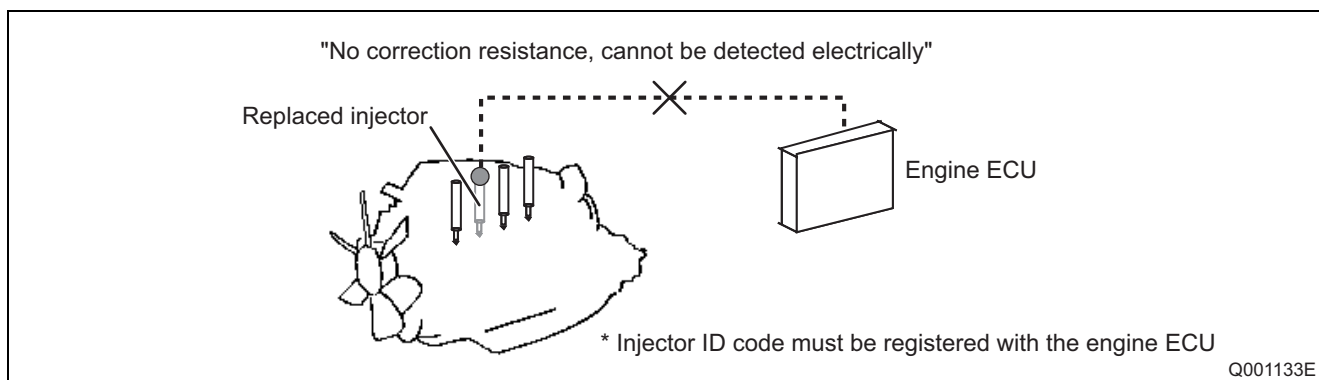
- QR codes have resulted in a substantial increase in the number of fuel injection quantity correction points, greatly improving precision. The characteristics of the engine cylinders have been further unified, contributing to improvements in combustion efficiency, reductions in exhaust gas emissions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

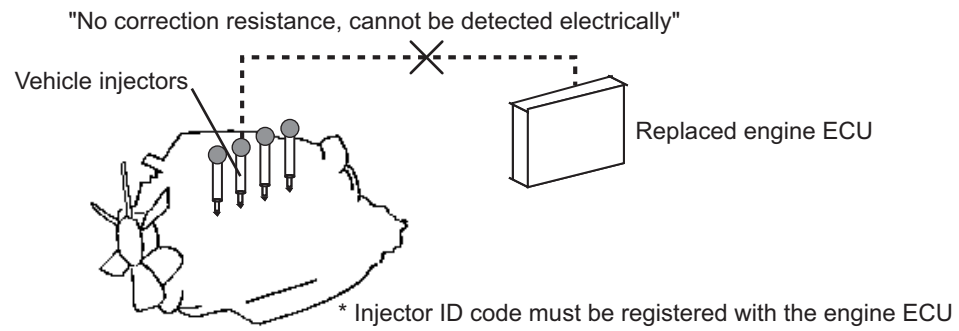


(1) Repair Procedure Changes (Reference)

- When replacing injectors with QR codes, or the engine ECU, it is necessary to record the ID codes in the ECU. (If the ID codes for the installed injectors are not registered correctly, engine failure such as rough idling and noise will result). The ID codes will be registered in the ECU at a MAZDA dealer using approved MAZDA tools.

Replacing the Injector



Replacing the Engine ECU

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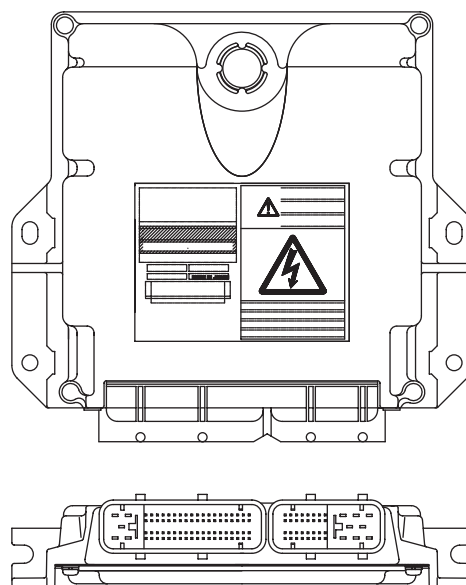
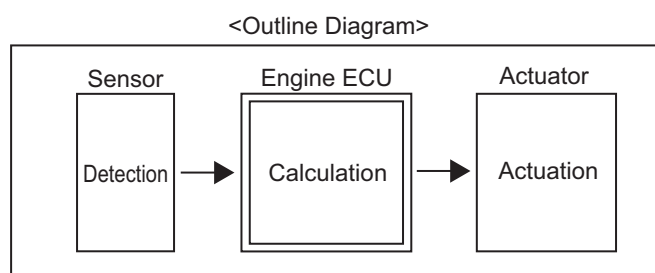
6. OPERATION OF CONTROL SYSTEM COMPONENTS

6.1 Outline

- The EDU (Electronic Driving Unit) functions have been built into the Engine ECU (Electronic Control Unit). Therefore the EDU has been done away with. In addition the system sensor has been changed. Please refer to Service Bulletin ECD02-06 as only this sensor has changed.

6.2 Engine ECU (Electronic Control Unit)

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



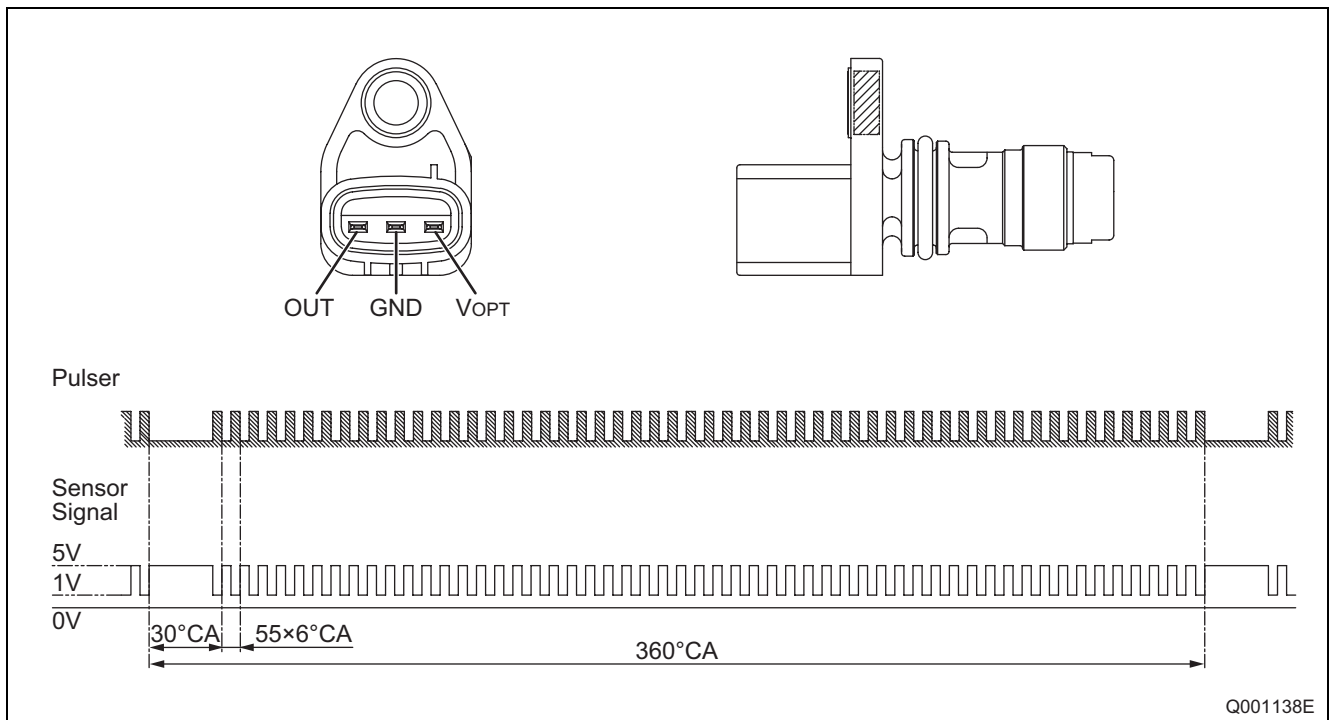
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6.3 Operation of Sensors

- The Crankshaft Position Sensor (NE Sensor) as well as the Cylinder Recognition Sensor (TDC Sensor) have been changed to the MRE (Magnetic Resistance Element) type. For the MRE type, when the pulsar passes the sensor, the magnetic resistance changes and the voltage passing through the sensor changes. The change in voltage is amplified by the internal IC circuit and is output to the engine ECU. In addition the Intake Air Pressure Sensor (MAPS) output characteristics have also changed.

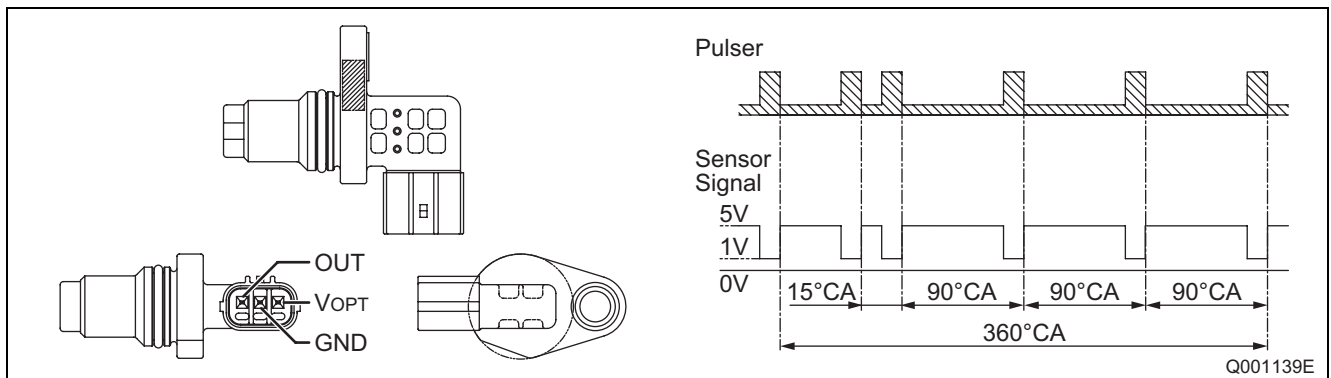
(1) Crankshaft Position Sensor (NE Sensor)

- An NE pulsar is mounted on the crankshaft timing gear in order to output the signals that are used for detecting the crankshaft position. The pulsar gear consists of 55 teeth and 5 missing tooth per pulse, thus enabling the sensor to output 55 pulses for every revolution (360°CA) of the crankshaft.



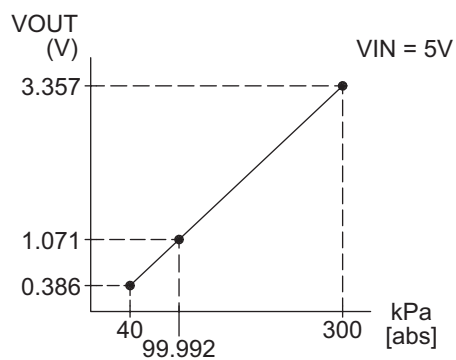
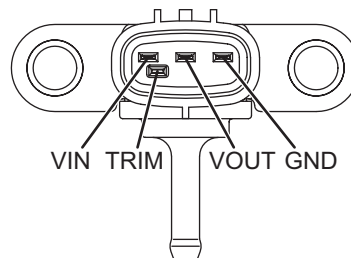
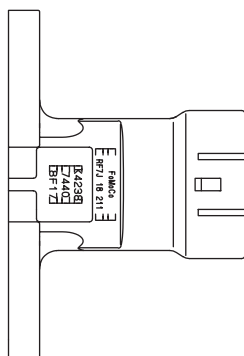
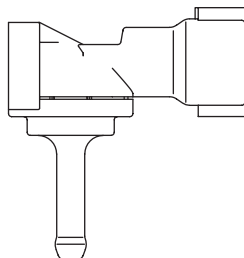
(2) Cylinder Recognition Sensor (TDC Sensor)

- Outputs a cylinder identification signal. The sensor outputs 5 pulses for every two revolutions (720°CA) of the engine.



(3) Turbo Pressure Sensor

- This is a semiconductor type pressure sensor, which utilizes the electrical resistance of the silicon element that changes with the changes in the pressure that is applied to the silicon element.



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7. CONTROL SYSTEM

7.1 Outline

- A new DPF (Diesel Particulate Filter) has been added to the control system. In addition, control regarding the system has been changed. Please refer to Service Bulletin ECD02-06 as only these controls have changed.

(1) Sensor System

| Sensor Name | Function | Fuel Injection | Rail Pressure | Intake Restriction | EGR | VGT | DPF |
|--|---|----------------|---------------|--------------------|-----|-----|-----|
| Airflow meter | Uses a hot wire to detect the intake airflow rate. | | | | ○ | | |
| Air temperature sensor | Located in the airflow meter, this sensor detects the intake air temperature. | ○ | ○ | ○ | ○ | | |
| Intake air temperature sensor | Detects the intake air temperature past the turbocharger. | ○ | | | | | ○ |
| Coolant temperature sensor | Detects the water temperature. | ○ | ○ | | ○ | | ○ |
| Rail pressure sensor | Detects the fuel pressure in the rail. | ○ | ○ | | | | ○ |
| Fuel temperature sensor | Detects the fuel temperature in the supply pump | ○ | ○ | | | | |
| Turbo pressure sensor | Detects the intake air pressure. | ○ | | | ○ | ○ | ○ |
| Air pressure sensor | Detects the air pressure. | ○ | ○ | ○ | ○ | ○ | ○ |
| Accelerator position sensor | Attached to the accelerator pedal, this sensor detects the travel of the accelerator pedal. | ○ | | ○ | ○ | | |
| Crankshaft position sensor (NE sensor) | Detects the engine speed based on the crankshaft position. | ○ | ○ | ○ | ○ | ○ | ○ |
| Cylinder recognition sensor (TDC sensor) | Identifies the cylinder based on the rotation of the rotor attached to the camshaft. | ○ | ○ | | | | |
| Starter signal | This is the starter voltage signal during starting. | ○ | ○ | ○ | ○ | ○ | |
| Vehicle speed sensor | Detects the vehicle speed. | ○ | | ○ | | | ○ |
| A/F Sensor (UHEGO) | Detects the exhaust gas A/F value. | | | | ○ | | ○ |
| Differential Pressure Sensor | Detects pressure both before and after the DPF. | | | | | | ○ |
| Exhaust Temperature Sensor 1 | Detects the exhaust temperature before the DPF. | | | | | | ○ |
| Exhaust Temperature Sensor 2 | Detects the exhaust temperature inside the DPF. | | | | | | ○ |
| Exhaust Temperature Sensor 3 | Detects the exhaust temperature after the DPF. | | | | ○ | | ○ |
| Engine Compartment Temperature Sensor | Detects the ambient temperature in the vicinity of the engine compartment differential pressure sensor. | | | | | | ○ |

(2) Actuator System

| Actuator Name | Function | Fuel Injection | Rail Pressure | Intake Restriction | EGR | VGT | DPF |
|--------------------------------------|--|----------------|---------------|--------------------|-----|-----|-----|
| Main relay | Supplies power to the system. | ○ | ○ | ○ | ○ | ○ | ○ |
| Injector | Precisely injects fuel. | ○ | | | | | |
| Suction control valve | Controls the volume of fuel that is supplied to the supply pump. | ○ | ○ | | | | |
| EGR Valve DC Motor | Controls the vacuum that is applied to the EGR valve. | | | | ○ | | |
| VGT E-VRV | Controls the vacuum that is applied to the turbo. | | | | | ○ | |
| Electronic Control Throttle DC Motor | Controls the vacuum that is applied to the intake suction valve. | | | ○ | | | ○ |
| Fan relay | Controls the duration of time in which the current is applied to the electric fan. | | | | | | |

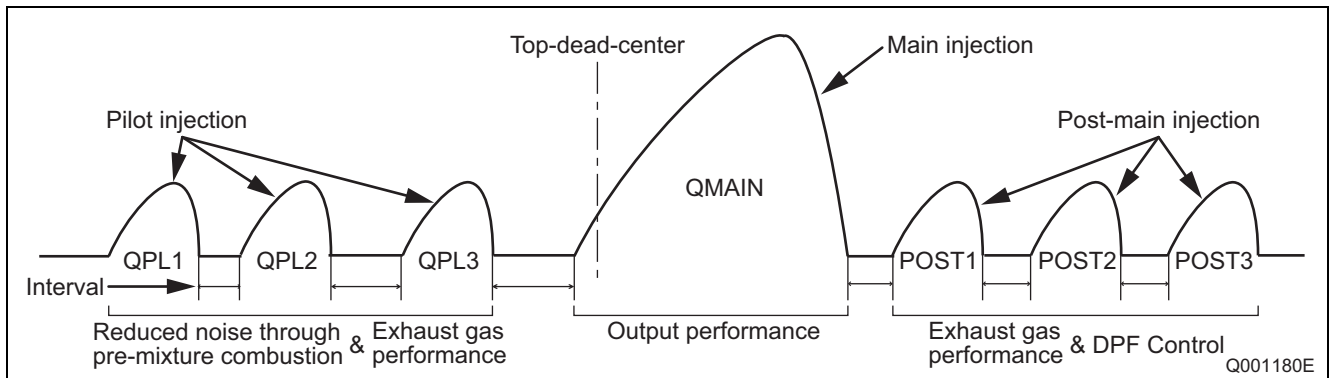
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(3) Control System

| Control Name | Function |
|--------------------------------|--|
| Fuel injection control | Controls the injectors' fuel injection timing and injection quantity by adding corrections based on the signals from the sensors to the basic injection duration, which is calculated in accordance with the conditions of the engine. |
| Rail pressure control | Controls the rail pressure by sending signals to the suction control valve of the supply pump in accordance with the conditions of the engine. |
| VGT control | Controls the boost pressure by calculating the signals that are output to the E-VRV in accordance with the operating conditions. |
| Intake restriction control | Controls the opening of the intake restriction mechanism in accordance with the driving conditions. |
| EGR control | Controls the opening of the EGR valve by calculating the signals that are output in accordance with the operating conditions. |
| Glow plug relay control | Controls the duration of the current that is applied to the glow plug relay in accordance with the water temperature during the starting of the engine. |
| Air conditioner cutoff control | Cuts off the air conditioner during acceleration to improve drivability. |
| Diagnosis | Illuminates a warning light to alert the driver if a failure occurs in the computer. |
| Auto cruise control | Effects feedback control of the actual vehicle speed to match the speed that is set in accordance with the cruise control switch. |
| DSC control | Effects traction control and ABS control in accordance with the driving conditions. |
| DPF Control | Data from the differential pressure sensor, exhaust temperature sensor, airflow sensor, etc, are accumulated in the DPF and used to estimate the PM (Particulate Matter) volume as well as perform proper combustion (PM combustion). |

7.2 Fuel Injection Timing Control

- Multi-Injection Control has changed due to the items attached to the DPF. Post2 and Post3 injections have been added due to the state of the DPF.



8. DIAGNOSTIC TROUBLE CODES (DTC)

8.1 About the Codes Shown in the Table

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

8.2 Diagnostic Trouble Code Details

< NOTE >

- *1 : In the event that the code "DTC0088" is displayed when using a diagnostic tool, there is a possibility that the injectors have exceeded the guarantee limit (engine speed and fuel pressure parameters). Replace all injectors.
- *2 : In the event that the code "DTC0089" is displayed when using a diagnostic tool, there is a possibility that the pressure limiter is open. Replace the rail.
- *3 : In the event that the code "DTC1211" is displayed when using a diagnostic tool, there is a possibility of damage to one of the pump cylinders. However, if the MIL lamp is on, verify that the vehicle is not out of gas. If there is even a small amount of residual fuel, refill the tank and check the MIL lamp again. If the MIL lamp is still on, replace the pump.
- *4 : In the event that the code "DTC1281" is displayed when using a diagnostic tool, there is a possibility that the pump has exceeded the guarantee limit (engine speed and fuel pressure parameters). Replace the pump.
- *5 : In the event that the code "DTC1329" is displayed when using a diagnostic tool, there is a possibility that the pump has exceeded the guarantee limit (engine speed and fuel pressure parameters). Replace the pump.

| DTC Number SAE | Diagnosis Item [Terminal] | Description of Diagnosis 1: Diagnosis condition 2: Failure state | Light ON | Main Malfunction Symptom | Inspection Area |
|-------------------|---|--|-------------|--|---|
| P0563 | Battery voltage high [Battery terminal] | 1: Key ON and starter OFF 2: Out of range | Yes | ECU, sensor(s), actuator damage | Battery, ECU, ECU-battery wiring harness, connector |
| P0562 | Battery voltage low [Battery terminal] | 1: Key ON and starter OFF 2: Out of range | Yes | ECU reset, sensor, poor actuator operation, poor emissions, poor driveability | Battery, ECU, ECU-battery wiring harness, connector |
| P0118 | Coolant temperature sensor high [Coolant temperature sensor terminal] | 1: Key On and battery normal 2: Out of range | Yes | Worsening emissions, decrease in low temperature startability, decrease in driveability | Coolant temperature sensor, ECU, ECU-sensor wiring harness, connector |
| P0117 | Coolant temperature sensor low [Coolant temperature sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Worsening emissions, decrease in low temperature startability, decrease in driveability | Coolant temperature sensor, ECU, ECU-sensor wiring harness, connector |
| P0116 | Abnormal coolant temperature sensor characteristics [Coolant temperature sensor terminal] | When in an expected temperature rise situation, a small change in output detected. | Yes | Worsening emissions, decrease in low temperature startability, decrease in driveability | Coolant temperature sensor, ECU, ECU-sensor wiring harness, connector |

| DTC Number SAE | Diagnosis Item [Terminal] | Description of Diagnosis 1: Diagnosis condition 2: Failure state | Light ON | Main Malfunction Symptom | Inspection Area |
|-------------------|--|--|-------------|---|--|
| P0098 | Intake air temperature sensor high [Intake air temperature sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Worsening emissions, decrease in low temperature startability, decrease in driveability | Intake air temperature sensor, ECU, ECU-sensor wiring harness, connector |
| P0097 | Intake air temperature sensor low [Intake air temperature sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Worsening emissions, decrease in low temperature startability, decrease in driveability | Intake air temperature sensor, ECU, ECU-sensor wiring harness, connector |
| P0096 | Abnormal intake air sensor characteristics [Intake air temperature sensor terminal] | When in an expected temperature rise situation, a small change in output detected. | Yes | Worsening emissions, decrease in low temperature startability, decrease in driveability | Intake air temperature sensor, ECU, ECU-sensor wiring harness, connector |
| P0113 | Ambient temperature sensor high [Ambient temperature sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Worsening emissions, decrease in low temperature startability, decrease in driveability | Ambient temperature sensor, ECU, ECU-sensor wiring harness, connector |
| P0112 | Ambient temperature sensor low [Ambient temperature sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Worsening emissions, decrease in low temperature startability, decrease in driveability | Ambient temperature sensor, ECU, ECU-sensor wiring harness, connector |
| P0111 | Abnormal ambient temperature sensor characteristics [Ambient temperature sensor terminal] | When in an expected temperature rise situation, a small change in output detected. | Yes | Worsening emissions, decrease in low temperature startability, decrease in driveability | Ambient temperature sensor, ECU, ECU-sensor wiring harness, connector |
| P0183 | Fuel temperature sensor high [Fuel temperature sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Worsening emissions | Fuel temperature sensor, ECU, ECU-sensor wiring harness, connector |
| P0182 | Fuel temperature sensor low [Fuel temperature sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Worsening emissions | Fuel temperature sensor, ECU, ECU-sensor wiring harness, connector |
| P0181 | Abnormal fuel temperature sensor characteristics [Fuel temperature sensor terminal] | When in an expected temperature rise situation, a small change in output detected. | No | Worsening emissions | Fuel temperature sensor, ECU, ECU-sensor wiring harness, connector |

| DTC Number SAE | Diagnosis Item [Terminal] | Description of Diagnosis 1: Diagnosis condition 2: Failure state | Light ON | Main Malfunction Symptom | Inspection Area |
|-------------------|--|--|-------------|---|--|
| P0193 | Rail pressure sensor high [Rail pressure sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | PC control impossible, poor driveability, worsening emissions | Rail pressure sensor, ECU, ECU-sensor wiring harness, connector |
| P0192 | Rail pressure sensor low [Rail pressure sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | PC control impossible, poor driveability, worsening emissions | Rail pressure sensor, ECU, ECU-sensor wiring harness, connector |
| P0191 | Abnormal rail pressure sensor characteristics [Rail pressure sensor terminal] | When rail pressure sensor output should be changing, sensor output change is small. | Yes | PC control impossible, poor driveability, worsening emissions | Rail pressure sensor, ECU, ECU-sensor wiring harness, connector |
| P0108 | Turbo pressure sensor high [Turbo pressure sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Worsening emissions, decrease in driveability | Turbo pressure sensor, ECU, ECU-sensor wiring harness, connector |
| P0107 | Turbo pressure sensor low [Turbo pressure sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Worsening emissions, decrease in driveability | Turbo pressure sensor, ECU, ECU-sensor wiring harness, connector |
| P0106 | Abnormal turbo pressure sensor characteristics [Turbo pressure sensor terminal] | When turbo pressure sensor output should be changing, sensor output change is small. | Yes | Worsening emissions, decrease in driveability | Turbo pressure sensor, ECU, ECU-sensor wiring harness, connector |
| P2229 | Atmospheric pressure sensor high [Atmospheric pressure sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Worsening emissions, decrease in driveability | Atmospheric pressure sensor (built into the ECU), ECU, ECU-sensor wiring harness, connector |
| P2228 | Atmospheric pressure sensor low [Atmospheric pressure sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Worsening emissions, decrease in driveability | Atmospheric pressure sensor (built into the ECU), ECU, ECU-sensor wiring harness, connector |
| P2227 | Abnormal atmospheric pressure sensor characteristics [Atmospheric pressure sensor terminal] | 1: During engine operation 2: Large difference in standard value and atmospheric pressure | Yes | Worsening emissions, decrease in driveability | Atmospheric pressure sensor (built into the ECU), turbo pressure sensor, ECU, ECU-sensor wiring harness, connector |
| P0123 | Accelerator sensor 1 high [Accelerator sensor 1 (TV01) terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Accelerator control not possible | Accelerator sensor, ECU, ECU-sensor wiring harness, connector |
| P0122 | Accelerator sensor 1 low [Accelerator sensor 1 (TV01) terminal] | 1: Key ON and battery normal 2: Out of range | Yes | No acceleration | Accelerator sensor, ECU, ECU-sensor wiring harness, connector |
| P2135 | Accelerator 1 intermediate malfunction [Accelerator sensor 1, 2 (TV01, 2) terminal] | 1: Key ON and battery normal 2: Voltage difference detected | Yes | Accelerator control not possible | Accelerator sensor, ECU, ECU-sensor wiring harness, connector |

| DTC Number SAE | Diagnosis Item [Terminal] | Description of Diagnosis 1: Diagnosis condition 2: Failure state | Light ON | Main Malfunction Symptom | Inspection Area |
|-------------------|---|--|-------------|---|--|
| P0121 | Accelerator sensor 1 abnormal characteristics [Accelerator sensor 1, 2 (TV01, 2) terminal] | 1: Key ON and battery normal 2: Sensor 1, 2 voltage difference observed | Yes | Accelerator control not possible, no acceleration | Accelerator sensor, ECU, ECU-sensor wiring harness, connector |
| P0223 | Accelerator sensor 2 high [Accelerator sensor 2 (TV02) terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Heavy idle vibration | Accelerator sensor, ECU, ECU-sensor wiring harness, connector |
| P0222 | Accelerator sensor 2 low [Accelerator sensor 2 (TV02) terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Heavy idle vibration | Accelerator sensor, ECU, ECU-sensor wiring harness, connector |
| P0103 | Mass airflow sensor high [Mass airflow sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Output insufficient, worsening emissions | Mass airflow sensor, ECU, ECU-sensor wiring harness, connector |
| P0102 | Mass airflow sensor low [Mass airflow sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Worsening emissions | Mass airflow sensor, ECU, ECU-sensor wiring harness, connector |
| P0101 | Abnormal mass airflow sensor characteristics [Mass airflow sensor terminal] | 1: During engine operation 2: Abnormal flow volume value detected | Yes | Output insufficient, worsening emissions | Mass airflow sensor, intake air temperature sensor, turbo pressure sensor, EGR actuator, ECU, ECU-sensor wiring harness, connector |
| P0406 | EGR lift sensor high [EGR lift sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Output insufficient, worsening emissions | EGR actuator, ECU, ECU-sensor wiring harness, connector |
| P0405 | EGR lift sensor low [EGR lift sensor terminal] | 1: Key ON and battery normal 2: Out of range | Yes | Worsening emissions | EGR actuator, ECU, ECU-sensor wiring harness, connector |
| P0545 | Exhaust temperature sensor U low [Exhaust temperature sensor 1 terminal (before DOC)] | 1: Key ON and battery normal 2: Out of range | Yes | Output insufficient, worsening emissions | Exhaust temperature sensor 1, ECU, ECU-sensor wiring harness, connector |
| P0546 | Abnormal exhaust temperature sensor U characteristics [Exhaust temperature sensor 1 terminal (before DOC)] | 1: Key ON and battery normal 2: Out of range observed | Yes | Output insufficient, worsening emissions | Exhaust temperature sensor 1, 2, 3, ECU, ECU-sensor wiring harness, connector |
| P0548 | Exhaust temperature sensor M low [Exhaust temperature sensor 2 terminal (before DPF)] | 1: Key ON and battery normal 2: Out of range observed | Yes | Output insufficient, worsening emissions | Exhaust temperature sensor 2, ECU, ECU-sensor wiring harness, connector |
| P0549 | Abnormal exhaust temperature sensor M characteristics [Exhaust temperature sensor 2 terminal (before DPF)] | 1: Key ON and battery normal 2: Out of range observed | Yes | Output insufficient, worsening emissions | Exhaust temperature sensor 1, 2, 3, ECU, ECU-sensor wiring harness, connector |

| DTC Number SAE | Diagnosis Item [Terminal] | Description of Diagnosis 1: Diagnosis condition 2: Failure state | Light ON | Main Malfunction Symptom | Inspection Area |
|-------------------|---|--|-------------|--|---|
| P2032 | Exhaust temperature sensor L low [Exhaust temperature sensor 3 terminal (before DPF)] | 1: Key ON and battery normal 2: Out of range observed | Yes | Output insufficient, worsening emissions | Exhaust temperature sensor 3, ECU, ECU-sensor wiring harness, connector |
| P2033 | Abnormal exhaust temperature sensor L characteristics [Exhaust temperature sensor 3 terminal (before DPF)] | 1: Key ON and battery normal 2: Out of range observed | Yes | Output insufficient, worsening emissions | Exhaust temperature sensor 1, 2, 3, ECU, ECU-sensor wiring harness, connector |
| P2455 | Exhaust pressure sensor M high [Exhaust pressure sensor terminal] | 1: Key ON and battery normal 2: Out of range observed | Yes | Output insufficient, worsening emissions | Exhaust pressure sensor, ECU, ECU-sensor wiring harness, connector |
| P2454 | Exhaust pressure sensor M low [Exhaust pressure sensor terminal] | 1: Key ON and battery normal 2: Out of range observed | Yes | Output insufficient, worsening emissions | Exhaust pressure sensor, ECU, ECU-sensor wiring harness, connector |
| P1392 | Glow plug voltage high [Glow plug relay terminal, glow plug terminal] | 1: Key ON and battery normal 2: Out of range observed | No | Dead battery, burnt heater | Glow plug, glow plug relay, ECU, ECU-sensor wiring harness, connector |
| P1391 | Glow plug voltage low [Glow plug relay terminal, glow plug terminal] | 1: Key ON and battery normal 2: Out of range observed | No | Decreased startability | Glow plug, glow plug relay, ECU, ECU-sensor wiring harness, connector |
| P0132 | A/F sensor + voltage high [A/F output terminal (+ side)] | 1: Key ON and battery normal 2: Out of range observed | Yes | Poor DPF recovery, declining output, worsening emissions | A/F sensor, ECU, ECU-sensor wiring harness, connector |
| P0131 | A/F sensor + voltage low [A/F output terminal (+ side)] | 1: Key ON and battery normal 2: Out of range observed | Yes | Poor DPF recovery, declining output, worsening emissions | A/F sensor, ECU, ECU-sensor wiring harness, connector |
| P0152 | A/F sensor - voltage high [A/F output terminal (- side)] | 1: Key ON and battery normal 2: Out of range observed | Yes | Poor DPF recovery, declining output, worsening emissions | A/F sensor, ECU, ECU-sensor wiring harness, connector |
| P0151 | A/F sensor - voltage low [A/F output terminal (- side)] | 1: Key ON and battery normal 2: Out of range observed | Yes | Poor DPF recovery, declining output, worsening emissions | A/F sensor, ECU, ECU-sensor wiring harness, connector |
| P0134 | A/F sensor + - terminal short [A/F output terminal (+ - side)] | 1: Key ON and battery normal 2: Sensor + - terminal voltage difference observed | Yes | Poor DPF recovery, declining output, worsening emissions | A/F sensor, ECU, ECU-sensor wiring harness, connector |
| P0030 | A/F sensor heater abnormality [A/F output terminal] | 1: During engine operation 2: Current condition observed | Yes | Poor DPF recovery, declining output, worsening emissions | A/F sensor, ECU, ECU-sensor wiring harness, connector |

| DTC Number SAE | Diagnosis Item [Terminal] | Description of Diagnosis 1: Diagnosis condition 2: Failure state | Light ON | Main Malfunction Symptom | Inspection Area |
|-------------------|--|---|-------------|--|---|
| P0133 | Poor A/F sensor activation [A/F output terminal (+ - side)] | 1: During engine operation 2: Sensor output value observed | Yes | Poor DPF recovery, declining output, worsening emissions | A/F sensor, ECU, ECU-sensor wiring harness, connector |
| P2148 | Injector COM1 TMV actuation system +B short [Injector terminal, Injector common terminal] | 1: During engine operation 2: Abnormal voltage at unenergized terminal | Yes | Poor driveability, worsening emissions or engine stall | Injector, ECU, ECU-sensor wiring harness, connector |
| P2147 | Injector COM1 TMV actuation system ground short [Injector terminal, Injector common terminal] | 1: During engine operation 2: Abnormal voltage at unenergized terminal | Yes | Poor driveability, worsening emissions or engine stall | Injector, ECU, ECU-sensor wiring harness, connector |
| P1378 | Injector low charge [Injector terminal, Injector common terminal] | 1: During engine operation 2: Voltage observed | Yes | Poor driveability, worsening emissions or engine stall | Injector, ECU, ECU-sensor wiring harness, connector |
| P0201 | Injector TMV1 actuation system open circuit [Injector terminal, Injector common terminal] | 1: During engine operation 2: No peak current | Yes | Poor driveability, worsening emissions or engine stall | Injector, ECU, ECU-sensor wiring harness, connector |
| P0203 | Injector TMV2 actuation system open circuit [Injector terminal, Injector common terminal] | 1: During engine operation 2: No peak current | Yes | Poor driveability, worsening emissions or engine stall | Injector, ECU, ECU-sensor wiring harness, connector |
| P0204 | Injector TMV3 actuation system open circuit [Injector terminal, Injector common terminal] | 1: During engine operation 2: No peak current | Yes | Poor driveability, worsening emissions or engine stall | Injector, ECU, ECU-sensor wiring harness, connector |
| P0202 | Injector TMV4 actuation system open circuit [Injector terminal, Injector common terminal] | 1: During engine operation 2: No peak current | Yes | Poor driveability, worsening emissions or engine stall | Injector, ECU, ECU-sensor wiring harness, connector |
| P2146 | Injector common 1 system open circuit [Injector terminal, Injector common terminal] | 1: During engine operation 2: No peak current | Yes | Poor driveability, worsening emissions or engine stall | Injector, ECU, ECU-sensor wiring harness, connector |
| P2149 | Injector common 2 system open circuit [Injector terminal, Injector common terminal] | 1: During engine operation 2: No peak current | Yes | Poor driveability, worsening emissions or engine stall | Injector, ECU, ECU-sensor wiring harness, connector |
| P1379 | Injector overcharge [Injector terminal, Injector common terminal] | 1: During engine operation 2: Condensor voltage surplus | Yes | Poor driveability, worsening emissions or engine stall | Injector, ECU, ECU-sensor wiring harness, connector |
| P0629 | SCV +B short [SCV terminal (+ - side)] | 1: During engine operation 2: High current detected | Yes | Poor pumping | SCV, ECU, ECU-sensor wiring harness, connector |

| DTC Number SAE | Diagnosis Item [Terminal] | Description of Diagnosis 1: Diagnosis condition 2: Failure state | Light ON | Main Malfunction Symptom | Inspection Area |
|-------------------|---|---|-------------|--|--|
| P0628 | SCV actuation system abnormality [SCV terminal (+ - side)] | 1: During engine operation 2: Low current detected | Yes | Poor pumping | SCV, ECU, ECU-sensor wiring harness, connector |
| P0093 | Fuel leak [Rail pressure sensor terminal] | Consumption volume is beyond the predicted scope | Yes | Fuel leak | Rail pressure sensor, injector, pump, rail, pressure limiter, fuel piping, ECU, ECU-sensor wiring harness, connector |
| P0342 | No TDC pulse input [Cylinder recognition sensor terminal] | No TDC pulse input | Yes | Poor startability | Cylinder recognition sensor, Cam angle pulse, ECU, ECU-sensor wiring harness, connector |
| P0341 | TDC sensor pulse number abnormality [Cylinder recognition sensor terminal] | Continuous TDC pulse number excess/deficiency | Yes | Poor startability | Cylinder recognition sensor, Cam angle pulse, ECU, ECU-sensor wiring harness, connector |
| P0337 | No speed pulse input [Crankshaft position sensor terminal] | No speed pulse input | Yes | Start failure, engine vibration, poor speed control | Crankshaft position sensor, crankshaft position pulse, ECU, ECU-sensor wiring harness, connector |
| P0336 | Abnormal speed pulse number [Crankshaft position sensor terminal] | Continuous speed pulse number excess/deficiency | Yes | Start failure, engine vibration, poor speed control | Crankshaft position sensor, crankshaft position pulse, ECU, ECU-sensor wiring harness, connector |
| P0512 | Starter switch battery short [Starter switch terminal, Starter relay terminal] | 1: Key ON and battery normal 2: Starter signal observed | Yes | Dead battery, driveability, poor emissions | Starter relay, starter switch, starter, ECU, ECU-sensor wiring harness, connector |
| P0704 | Clutch switch malfunction [Starter switch terminal, Starter relay terminal] | No clutch signal during clutch input situation | Yes | Heavy idle vibration, worsening emissions, poor driveability | Clutch switch, vehicle speed, ECU, ECU-sensor wiring harness, connector |
| P0234 | Turbo system superfluity abnormality (positive denia-tion) [EVRV terminal, Turbo pressure sensor terminal] | 1: During engine operation 2: Difference between standard value and output | No | Poor driveability, T/C damaged | Turbo pressure sensor, EVRV actuator, T/C acuator, ECU, ECU-sensor wiring harness, connector |
| P0299 | Turbo system underfluity abnormality (negative denia-tion) [EVRV terminal, Turbo pressure sensor terminal] | 1: During engine operation 2: Difference between standard value and output | No | Poor driveability, T/C damaged | Turbo pressure sensor, EVRV actuator, T/C acuator, ECU, ECU-sensor wiring harness, connector |

| DTC Number SAE | Diagnosis Item [Terminal] | Description of Diagnosis 1: Diagnosis condition 2: Failure state | Light ON | Main Malfunction Symptom | Inspection Area |
|-------------------|--|---|-------------|---|--|
| P0402 | EGR system excess abnormality (EGR excessive flow) [EGR lift sensor terminal, EGR DC motor output terminal, Mass airflow sensor terminal] | 1: During engine operation 2: Difference between standard value and output | Yes | Poor driveability, T/C damaged | EGR actuator, mass airflow sensor, ECU, ECU-sensor wiring harness, connector |
| P0401 | EGR system insufficiency abnormality (EGR insufficient flow) [EGR lift sensor terminal, EGR DC motor output terminal, Mass airflow sensor terminal] | 1: During engine operation 2: Difference between standard value and output | Yes | Poor emissions | EGR actuator, mass airflow sensor, ECU, ECU-sensor wiring harness, connector |
| P1196 | Main relay abnormality [Main relay terminal] | 1: Key OFF and battery normal 2: Battery voltage observed | No | Dead battery | Main relay, ECU, ECU-sensor wiring harness, connector |
| P0016 | Speed-TDC phase gap malfunction [Cylinder recognition sensor terminal, Crankshaft position sensor] | Speed-TDC phase relationship observed | Yes | Start failure, engine vibration, poor speed control | Cylinder recognition sensor, Cam angle pulse, crankshaft position sensor, crankshaft position pulse, ECU, ECU-sensor wiring harness, connector |
| P0301 | Injector function (non-injection) 1 [Injector terminal, Injector common terminal] | 1: During engine operation 2: Non-injection condition observed | Yes | Poor driveability, heavy idle vibration | Injector, fuel piping, ECU, ECU-sensor wiring harness, connector |
| P0302 | Injector function (non-injection) 2 [Injector terminal, Injector common terminal] | 1: During engine operation 2: Non-injection condition observed | Yes | Poor driveability, heavy idle vibration | Injector, fuel piping, ECU, ECU-sensor wiring harness, connector |
| P0303 | Injector function (non-injection) 3 [Injector terminal, Injector common terminal] | 1: During engine operation 2: Non-injection condition observed | Yes | Poor driveability, heavy idle vibration | Injector, fuel piping, ECU, ECU-sensor wiring harness, connector |
| P0304 | Injector function (non-injection) 4 [Injector terminal, Injector common terminal] | 1: During engine operation 2: Non-injection condition observed | Yes | Poor driveability, heavy idle vibration | Injector, fuel piping, ECU, ECU-sensor wiring harness, connector |
| P0219 | Engine overrun abnormality [Injector terminal, injector common terminal, Crankshaft position sensor terminal, Accelerator sensor terminal] | Engine speed above prescribed value | No | Excessive speed | Rail pressure sensor, accelerator sensor, crankshaft position sensor, injector, pump, rail, pressure limiter, fuel piping, ECU, ECU-sensor wiring harness, connector |

| DTC Number SAE | Diagnosis Item [Terminal] | Description of Diagnosis 1: Diagnosis condition 2: Failure state | Light ON | Main Malfunction Symptom | Inspection Area |
|-------------------|---|--|-------------|--|--|
| P0088*1 | Rail high pressure abnormality [Rail pressure sensor terminal] | 1: During engine operation 2: High pressure condition observed | Yes | Poor driveability, poor emissions, fuel leak | Rail pressure sensor, injector, pump, rail, pressure limiter, fuel piping, ECU, ECU-sensor wiring harness, connector |
| P0089*2 | Pressure limiter opening malfunction [Rail pressure sensor terminal] | 1: During engine operation 2: Pressure limiter opening condition observed | No | — | Rail pressure sensor, injector, pump, rail, pressure limiter, fuel piping, ECU, ECU-sensor wiring harness, connector |
| P0607 | CPU abnormality (monitoring IC abnormality) [Battery terminal, etc.] | — | No | — | Battery, ECU, ECU-battery wiring harness, connector |
| P0606 | CPU abnormality (main IC abnormality) [Battery terminal, etc.] | — | Yes | Engine stall | Battery, ECU, ECU-battery wiring harness, connector |
| P0605 | ECU Flash-ROM abnormality [Battery terminal, etc.] | — | Yes | — | Battery, ECU, ECU-battery wiring harness, connector |
| P0500 | CAN communication vehicle speed malfunction [CAN communication line] | When there is a CAN communication ABS ID abnormality | Yes | Insufficient output, poor driveability, poor emissions | DSC and ABS unit, ECU, ECU-unit wiring harness, connector |
| P0504 | Cruise brake switch invalid [Brake switch terminal] | 1: Key ON and battery normal 2: Brake switch output observed | No | Cruise cannot be suspended, cruise cannot be operated | Brake switch, ECU, ECU-unit wiring harness, connector |
| P0564 | Cruise command switch abnormality [Command switch terminal] | 1: During engine operation 2: Command switch output observed | No | Cruise cannot be operated, vehicle speed control impossible | Brake switch, ECU, ECU-unit wiring harness, connector |
| P1211*3 | Single pump abnormality diagnosis [Rail pressure sensor terminal] | 1: During engine operation 2: Pump injection volume abnormality observed | Yes | Insufficient output, poor emissions, poor driveability | Rail pressure sensor, injector, pump, rail, pressure limiter, fuel piping, ECU, ECU-sensor wiring harness, connector |
| P1281*4 | Pump protective fill plug [Rail pressure sensor terminal] | 1: During engine operation 2: High pressure condition observed | Yes | Insufficient output, poor driveability, poor emissions, engine stall | Rail pressure sensor, injector, pump, rail, pressure limiter, fuel piping, ECU, ECU-sensor wiring harness, connector |
| P1329*5 | Pump exchange fill plug [Rail pressure sensor terminal] | 1: During engine operation 2: High pressure condition observed | Yes | Insufficient output, poor driveability, poor emissions, engine stall | Rail pressure sensor, injector, pump, rail, pressure limiter, fuel piping, ECU, ECU-sensor wiring harness, connector |

| DTC Number SAE | Diagnosis Item [Terminal] | Description of Diagnosis 1: Diagnosis condition 2: Failure state | Light ON | Main Malfunction Symptom | Inspection Area |
|-------------------|--|--|-------------|---|--|
| P2622 | Electronic control throttle high [Electronic control throttle sensor terminal] | 1: Key ON and battery normal 2: Out of range observed | Yes | Insufficient output, poor driveability, poor emissions | Electronic control throttle, ECU, ECU-sensor wiring harness, connector |
| P2621 | Electronic control throttle low [Electronic control throttle sensor terminal] | 1: Key ON and battery normal 2: Out of range observed | Yes | Insufficient output, poor driveability, poor emissions | Electronic control throttle, ECU, ECU-sensor wiring harness, connector |
| P1589 | Electronic control throttle valve stuck [Electronic control throttle sensor terminal, Electronic control throttle DC motor output terminal] | 1: During engine operation 2: Difference between standard value and output observed | Yes | Insufficient output, poor driveability, poor emissions | Electronic control throttle, ECU, ECU-sensor wiring harness, connector |
| P2101 | Electronic control throttle DC motor overcurrent abnormality [Electronic control throttle DC motor output terminal] | 1: Key ON and battery normal 2: Current value observed | Yes | Insufficient output, poor driveability, poor emissions | Electronic control throttle, ECU, ECU-sensor wiring harness, connector |
| P1588 | Electronic control throttle spring breakage [Electronic control throttle sensor terminal, Electronic control throttle DC motor output terminal] | Spring reactivity observed | Yes | Engine stall due to throttle closure, difficulty starting | Electronic control throttle, ECU, ECU-sensor wiring harness, connector |
| P0404 | EGR DC motor temperature abnormality [EGR lift sensor terminal, EGR DC motor output terminal] | DC motor estimated temperature is above the regular value | Yes | Insufficient output, poor driveability, poor emissions | EGR actuator, ECU, ECU-sensor wiring harness, connector |
| P0400 | EGR DC motor feedback abnormality [EGR lift sensor terminal, EGR DC motor output terminal] | Actual lift does not operate beyond the regular position | Yes | Insufficient output, poor driveability, poor emissions | EGR actuator, ECU, ECU-sensor wiring harness, connector |
| P0403 | EGR DC motor condition abnormality [EGR lift sensor terminal, EGR DC motor output terminal] | 1: Key ON and battery normal 2: Current value observed | Yes | Insufficient output, poor driveability, poor emissions | EGR actuator, ECU, ECU-sensor wiring harness, connector |
| P252F | Oil dilution [Turbo pressure sensor, crankshaft position sensor, Injector terminal] | Oil quantity abnormality observed | No | Engine failure, poor driveability, poor emissions | Engine oil quantity |

| DTC Number SAE | Diagnosis Item [Terminal] | Description of Diagnosis 1: Diagnosis condition 2: Failure state | Light ON | Main Malfunction Symptom | Inspection Area |
|-------------------|--|--|-------------|--|---|
| P0850 | Neutral switch abnormality [Neutral switch terminal, CAN communication line] | No neutral signal during a neutral switch input situa- tion | Yes | Heavy idle vibra- tion, improper shift CH recognition, worsening emis- sions, poor drive- ability | Neutral switch, vehicle speed sensor, ECU, ECU- sensor wiring harness, con- nector |
| P0045 | VNT EVRV abnormality [EVVRV terminal] | 1: During engine operation 2: Voltage is below the normal value | Yes | Insufficient output, poor driveability, T/C damaged | EGR actuator, ECU, ECU- sensor wiring harness, con- nector |
| P0072 | Engine compartment tem- perature sensor low [Differential pressure sensor temperature sensor terminal] | 1: Key ON and battery nor- mal 2: Out of range observed | Yes | Poor recovery, declining output, worsening emis- sions | Engine compartment tem- perature sensor, ECU, ECU- sensor wiring harness, con- nector |
| P0073 | Engine compartment tem- perature sensor high [Differential pressure sensor temperature sensor terminal] | 1: Key ON and battery nor- mal 2: Out of range observed | Yes | Poor recovery, declining output, worsening emis- sions | Engine compartment tem- perature sensor, ECU, ECU- sensor wiring harness, con- nector |
| P0071 | Abnormal Engine compart- ment temperature sensor characteristics [Differential pressure sensor temperature sensor terminal, Ambient temperature sensor terminal] | 1: During engine operation 2: Difference between stan- dard value and output observed | No | Poor recovery, declining output, worsening emis- sions | Engine compartment tem- perature sensor, ambient temperature sensor, ECU, ECU-sensor wiring harness, connector |
| P2456 | Differential pressure sensor intermediate malfunction [Differential pressure sensor terminal, mass airflow sen- sor terminal, Atmospheric pressure sensor terminal, exhaust temperature sensor terminal] | 1: During engine operation 2: Difference between stan- dard value and output observed | No | Poor recovery, declining output, worsening emis- sions | Differential pressure sensor, mass airflow sensor, atmo- spheric pressure sensor, exhaust temperature sensor, ECU, ECU-sensor wiring harness, connector |
| P2002 | Differential pressure sensor upstream piping malfunction [Differential pressure sensor terminal, mass airflow sen- sor terminal, Atmospheric pressure sensor terminal, exhaust temperature sensor terminal] | 1: During engine operation 2: Difference between stan- dard value and output observed | Yes | Poor recovery, declining output, worsening emis- sions | Differential pressure sensor, mass airflow sensor, atmo- spheric pressure sensor, exhaust temperature sensor, differential pressure sensor piping, DPF cracking, ECU, ECU-sensor wiring harness, connector |

| DTC Number SAE | Diagnosis Item [Terminal] | Description of Diagnosis 1: Diagnosis condition 2: Failure state | Light ON | Main Malfunction Symptom | Inspection Area |
|-------------------|---|---|-------------|--|--|
| P2453 | Differential pressure sensor gain abnormality [Differential pressure sensor terminal, mass airflow sensor terminal, Atmospheric pressure sensor terminal, exhaust temperature sensor terminal] | 1: During engine operation 2: Difference between standard value and output observed | No | Poor recovery, declining output, worsening emissions | Differential pressure sensor, mass airflow sensor, atmospheric pressure sensor, exhaust temperature sensor, Differential pressure sensor piping, ECU, ECU-sensor wiring harness, connector |
| P2452 | Differential pressure sensor offset abnormality [Differential pressure sensor terminal] | 1: Key OFF and battery normal 2: Difference between standard value and output observed | No | Poor recovery, declining output, worsening emissions | Differential pressure sensor, mass airflow sensor, atmospheric pressure sensor, exhaust temperature sensor, Differential pressure sensor piping, ECU, ECU-sensor wiring harness, connector |
| B1600 | Immobilizer abnormality. No reception of signal from the transporter [Immobilizer actuation output terminal] | — | No | Starting not possible | Key, ECU, ECU-sensor wiring harness, connector |
| B1602 | Immobilizer abnormality. Signal format error from the transporter [Immobilizer actuation output terminal] | — | No | Starting not possible | Key, ECU, ECU-sensor wiring harness, connector |
| B1601 | Immobilizer abnormality. Signal code disunity from the transporter [Immobilizer actuation output terminal] | — | No | Starting not possible | Key, ECU, ECU-sensor wiring harness, connector |
| B1213 | Immobilizer abnormality. Programmed key does not satisfy the minimum specified number [Immobilizer actuation output terminal] | — | No | Starting not possible | Key, ECU, ECU-sensor wiring harness, connector |
| B1681 | Immobilizer abnormality-diagnostic reception Time Out [Immobilizer actuation output terminal] | — | No | Starting not possible | Key, ECU, ECU-sensor wiring harness, connector |
| B2103 | Immobilizer abnormality-diagnosis, abnormal value reception [Immobilizer actuation output terminal] | — | No | Starting not possible | Key, ECU, ECU-sensor wiring harness, connector |

| DTC Number SAE | Diagnosis Item [Terminal] | Description of Diagnosis 1: Diagnosis condition 2: Failure state | Light ON | Main Malfunction Symptom | Inspection Area |
|-------------------|---|--|-------------|---|--|
| B2431 | Immobilizer abnormality-programming error [Immobilizer actuation output terminal] | — | No | Starting not possible | Key, ECU, ECU-sensor wiring harness, connector |
| P1260 | Immobilizer abnormality-DTC at EPATS [Immobilizer actuation output terminal] | — | No | Starting not possible | Key, ECU, ECU-sensor wiring harness, connector |
| B1342 | Immobilizer abnormality-ECU defective [Immobilizer actuation output terminal] | — | No | Starting not possible | Key, ECU, ECU-sensor wiring harness, connector |
| P1675 | QR data failure to write malfunction | Configuration abnormality | Yes | Worsening emissions, insufficient output, decrease in driveability | ECU, wiring harness noise, etc |
| P1676 | QR data malfunction | Configuration abnormality | Yes | Worsening emissions, insufficient output, decrease in driveability | ECU, wiring harness noise, etc |
| P1676 | QR correction information input malfunction | Configuration abnormality | Yes | Worsening emissions, insufficient output, decrease in driveability | ECU, wiring harness noise, etc |
| P0154 | Atmospheric observation malfunction [A/F output terminal, A/F heater terminal, atmospheric pressure sensor, Injector terminal, injector common terminal] | Gap in A/F sensor characteristics observed | Yes | DPF recovery not possible/DPF melting, insufficient output, worsening emissions | A/F sensor, atmospheric pressure sensor, injector, ECU, ECU-sensor wiring harness, connector |
| P253F | Oil dilution 2 [Turbo pressure sensor, Crankshaft position sensor, Injector terminal] | Oil quantity abnormality observe | No | Speed increase, insufficient output, poor driveability, poor emissions | Engine oil quantity |
| P1303 | EGR DC motor EGR initial rise abnormality [EGR lift sensor terminal, EGR DC motor output terminal] | EGR valve voltage change observed | Yes | Insufficient output, poor driveability, poor emissions | EGR actuator, ECU, ECU-sensor wiring harness, connector |

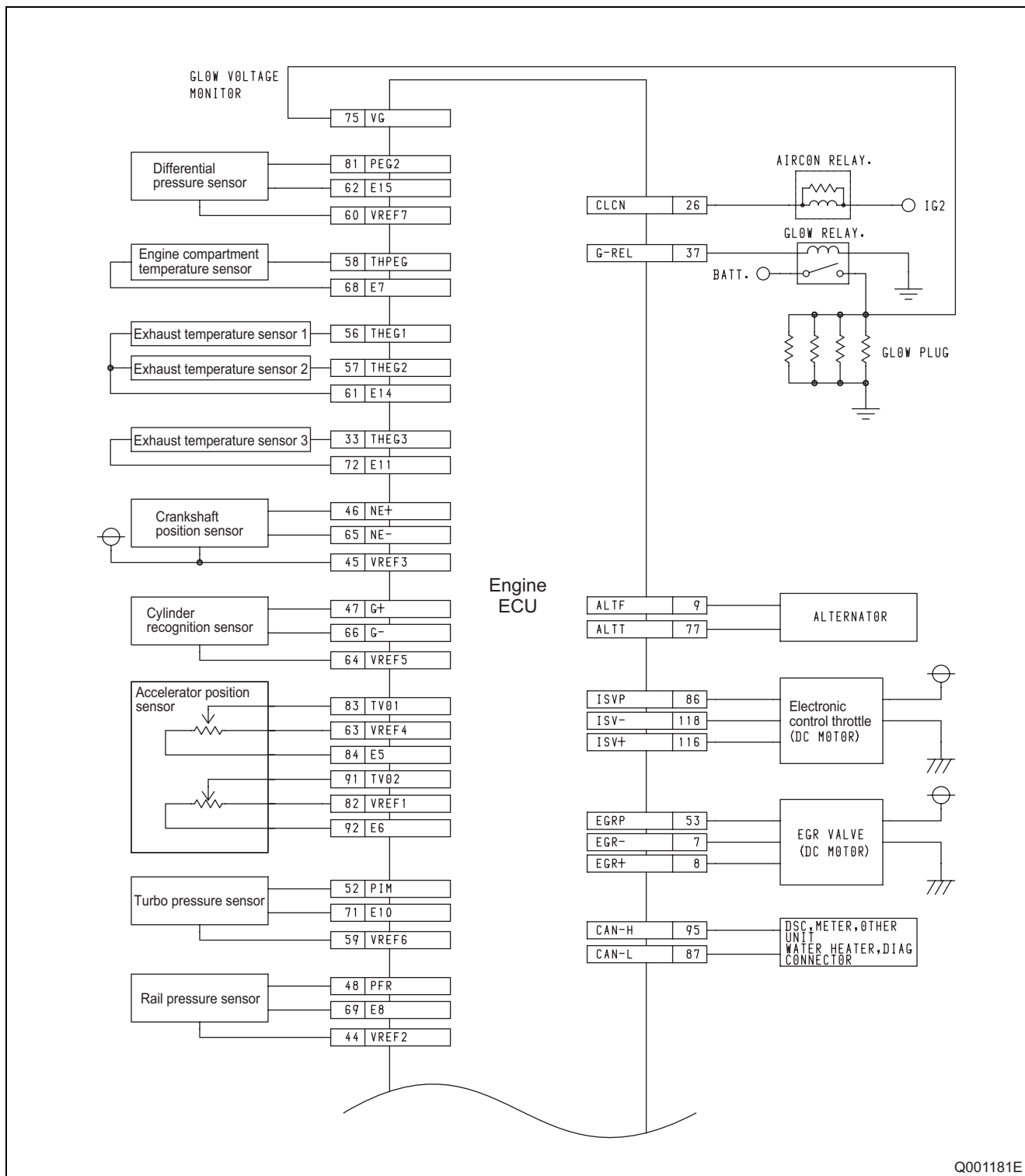
| DTC Number SAE | Diagnosis Item [Terminal] | Description of Diagnosis 1: Diagnosis condition 2: Failure state | Light ON | Main Malfunction Symptom | Inspection Area |
|-------------------|--|--|-------------|--|---|
| P2458 | DPF PM accumulation abnormality 1 [Differential pressure sensor, Mass airflow sensor, Turbo pressure sensor, Coolant temperature sensor, Intake air temperature sensor, Atmospheric pressure sensor, Exhaust temperature sensor, Crankshaft position sensor, Engine compartment temperature sensor, Rail pressure sensor, Injector terminal, A/F sensor terminal] | Accumulation quantity abnormality observed | No | Poor recovery, declining output due to EGR quantity, worsening emissions | Differential pressure sensor, mass airflow sensor, turbo pressure sensor, coolant temperature sensor, intake air temperature sensor, atmospheric pressure sensor, exhaust temperature sensor, crankshaft position sensor, engine compartment temperature sensor, rail pressure sensor, injector, A/F sensor, differential pressure sensor piping, DPF cracking, ECU, ECU-sensor wiring harness, connector |
| P242F | DPF PM accumulation abnormality 2 [Differential pressure sensor, Mass airflow sensor, Turbo pressure sensor, Coolant temperature sensor, Intake air temperature sensor, Atmospheric pressure sensor, Exhaust temperature sensor, Crankshaft position sensor, Engine compartment temperature sensor, Rail pressure sensor, Injector terminal, A/F sensor terminal] | Accumulation quantity abnormality observed | Yes | Poor recovery, declining output due to EGR quantity, worsening emissions | Differential pressure sensor, mass airflow sensor, turbo pressure sensor, coolant temperature sensor, intake air temperature sensor, atmospheric pressure sensor, exhaust temperature sensor, crankshaft position sensor, engine compartment temperature sensor, rail pressure sensor, injector, A/F sensor, differential pressure sensor piping, DPF cracking, ECU, ECU-sensor wiring harness, connector |
| P242F | DPF PM accumulation abnormality 3 [Differential pressure sensor, Mass airflow sensor, Turbo pressure sensor, Coolant temperature sensor, Intake air temperature sensor, Atmospheric pressure sensor, Exhaust temperature sensor, Crankshaft position sensor, Engine compartment temperature sensor, Rail pressure sensor, Injector terminal, A/F sensor terminal] | Accumulation quantity abnormality observed | Yes | Poor recovery, declining output due to EGR quantity, worsening emissions | Differential pressure sensor, mass airflow sensor, turbo pressure sensor, coolant temperature sensor, intake air temperature sensor, atmospheric pressure sensor, exhaust temperature sensor, crankshaft position sensor, engine compartment temperature sensor, rail pressure sensor, injector, A/F sensor, differential pressure sensor piping, DPF cracking, ECU, ECU-sensor wiring harness, connector |

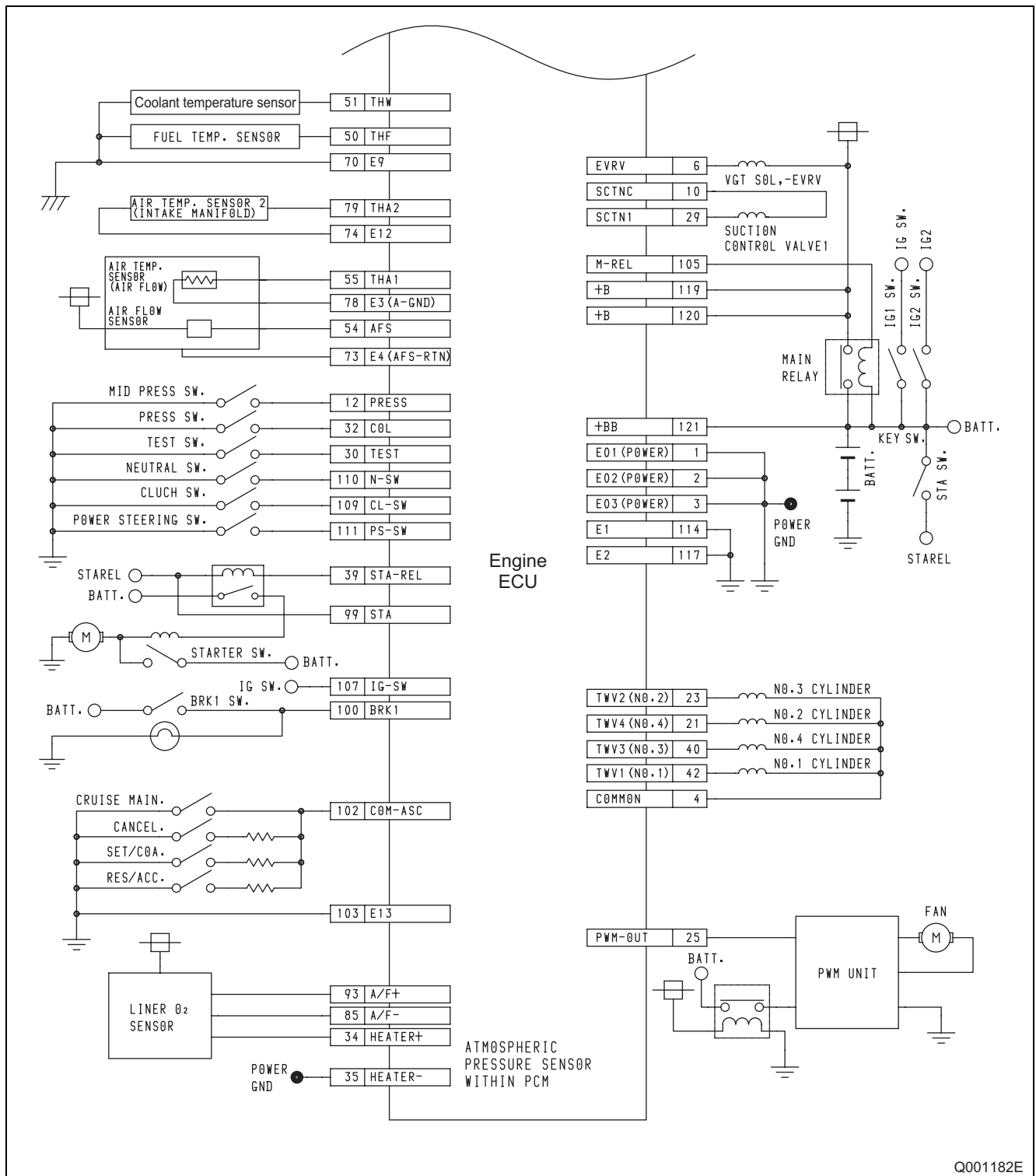
| DTC Number SAE | Diagnosis Item [Terminal] | Description of Diagnosis 1: Diagnosis condition 2: Failure state | Light ON | Main Malfunction Symptom | Inspection Area |
|-------------------|--|--|-------------|---|---|
| P242F | DPF PM accumulation abnormality 4 [Differential pressure sensor, Mass airflow sensor, Turbo pressure sensor, Coolant temperature sensor, Intake air temperature sensor, Atmospheric pressure sensor, Exhaust temperature sensor, Crankshaft position sensor, Engine compartment temperature sensor, Rail pressure sensor, Injector terminal, A/F sensor terminal] | Accumulation quantity abnormality observed | Yes | Poor recovery, declining output, worsening emissions | Differential pressure sensor, mass airflow sensor, turbo pressure sensor, coolant temperature sensor, intake air temperature sensor, atmospheric pressure sensor, exhaust temperature sensor, crankshaft position sensor, engine compartment temperature sensor, rail pressure sensor, injector, A/F sensor, differential pressure sensor piping, DPF cracking, ECU, ECU-sensor wiring harness, connector |
| P2428 | DPF temperature rise abnormality [Differential pressure sensor, Mass airflow sensor, Turbo pressure sensor, Coolant temperature sensor, Intake air temperature sensor, Atmospheric pressure sensor, Exhaust temperature sensor, Crankshaft position sensor, Engine compartment temperature sensor, Rail pressure sensor, Injector terminal, A/F sensor terminal] | Abnormal exhaust temperature rise observed after the DPF | No | Poor recovery, declining output, worsening emissions | Differential pressure sensor, mass airflow sensor, turbo pressure sensor, coolant temperature sensor, intake air temperature sensor, atmospheric pressure sensor, exhaust temperature sensor, crankshaft position sensor, engine compartment temperature sensor, rail pressure sensor, injector, A/F sensor, differential pressure sensor piping, DPF cracking, ECU, ECU-sensor wiring harness, connector |
| P0601 | DPF related EEPROM abnormality | — | Yes | Poor recovery, declining output, worsening emissions | ECU, wiring harness noise, etc. |
| U0073 | CAN communication bus off abnormality [CAN communication line] | Communication abnormality observed | No | Vehicle speed, DSC, ABS, combustion system heater, meter does not operate | ECU, ECU-unit wiring harness, connector |
| U0121 | CAN communication DSC abnormality [CAN communication line] | Communication abnormality observed | Yes | DSC, vehicle speed does not operate | DSC and ABS unit, ECU, ECU-unit wiring harness, connector |
| U0166 | CAN communication FFH abnormality [CAN communication line] | Communication abnormality observed | No | Combustion system heater does not operate | Combustion system heater unit, ECU, ECU-unit wiring harness, connector |

| DTC Number SAE | Diagnosis Item [Terminal] | Description of Diagnosis 1: Diagnosis condition 2: Failure state | Light ON | Main Malfunction Symptom | Inspection Area |
|-------------------|---|--|-------------|---|--|
| U0121 | CAN communication ABS abnormality [CAN communication line] | Communication abnormality observed | Yes | ABS, vehicle speed does not operate | DSC and ABS unit, ECU, ECU-unit wiring harness, connector |
| U0155 | CAN communication HEC abnormality [CAN communication line] | Communication abnormality observed | Yes | Meter unit does not operate | Meter unit, ECU, ECU-unit wiring harness, connector |
| P0602 | CAN communication abnormality-VID read malfunction [CAN communication line] | Communication abnormality observed | Yes | — | ECU, ECU-unit wiring harness, connector |
| P0610 | CAN communication abnormality-VID checksum abnormality [CAN communication line] | Communication abnormality observed | Yes | — | ECU, ECU-unit wiring harness, connector |
| P0104 | Abnormal mass airflow sensor characteristics [Mass airflow sensor terminal] | 1: During engine operation 2: Abnormal flow volume value detected | No | Output insufficient, worsening emissions | Mass airflow sensor, intake air temperature sensor, turbo pressure sensor, EGR actuator, ECU, ECU-sensor wiring harness, connector |
| P0140 | Atmospheric observation malfunction [A/F output terminal, A/F heater terminal, atmospheric pressure sensor, Injector terminal, injector common terminal] | Gap in A/F sensor characteristics observed | No | DPF recovery not possible/DPF melting, insufficient output, worsening emissions | A/F sensor, atmospheric pressure sensor, injector, ECU, ECU-sensor wiring harness, connector |

9. EXTERNAL WIRING DIAGRAM

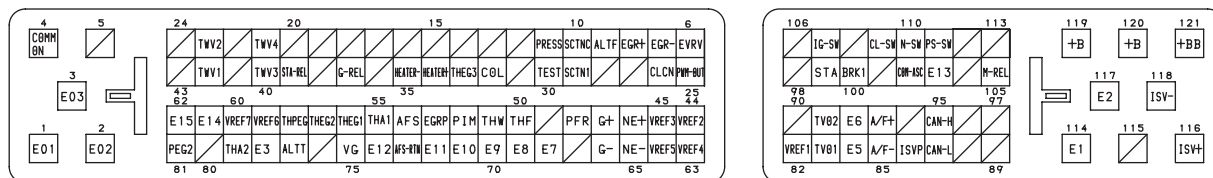
9.1 Engine ECU External Wiring Diagram (Model Name: MAZDA 5)





(1) Connector Diagram

Connector Pin Layout



Q001136E

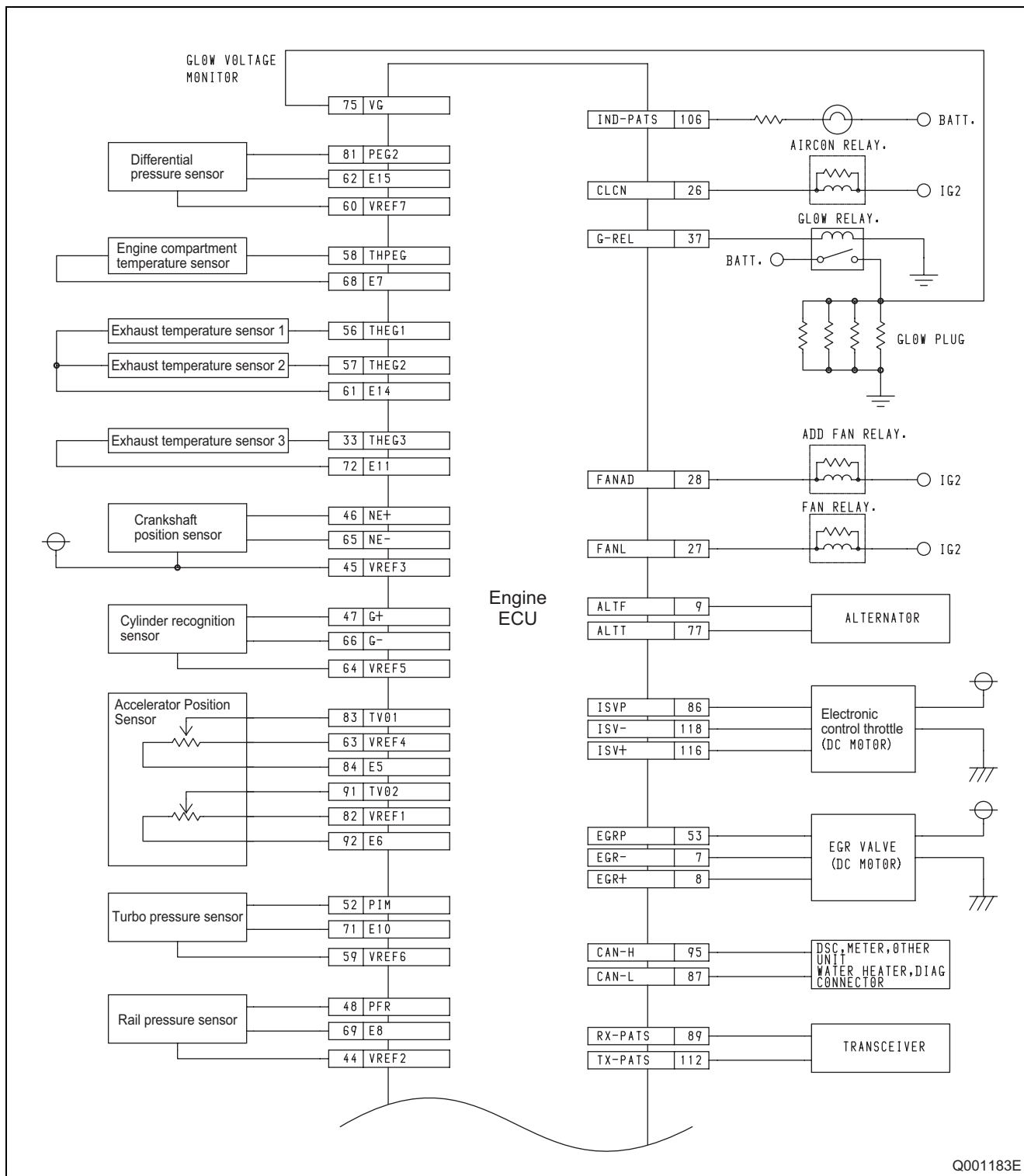
Terminal Connections (1)

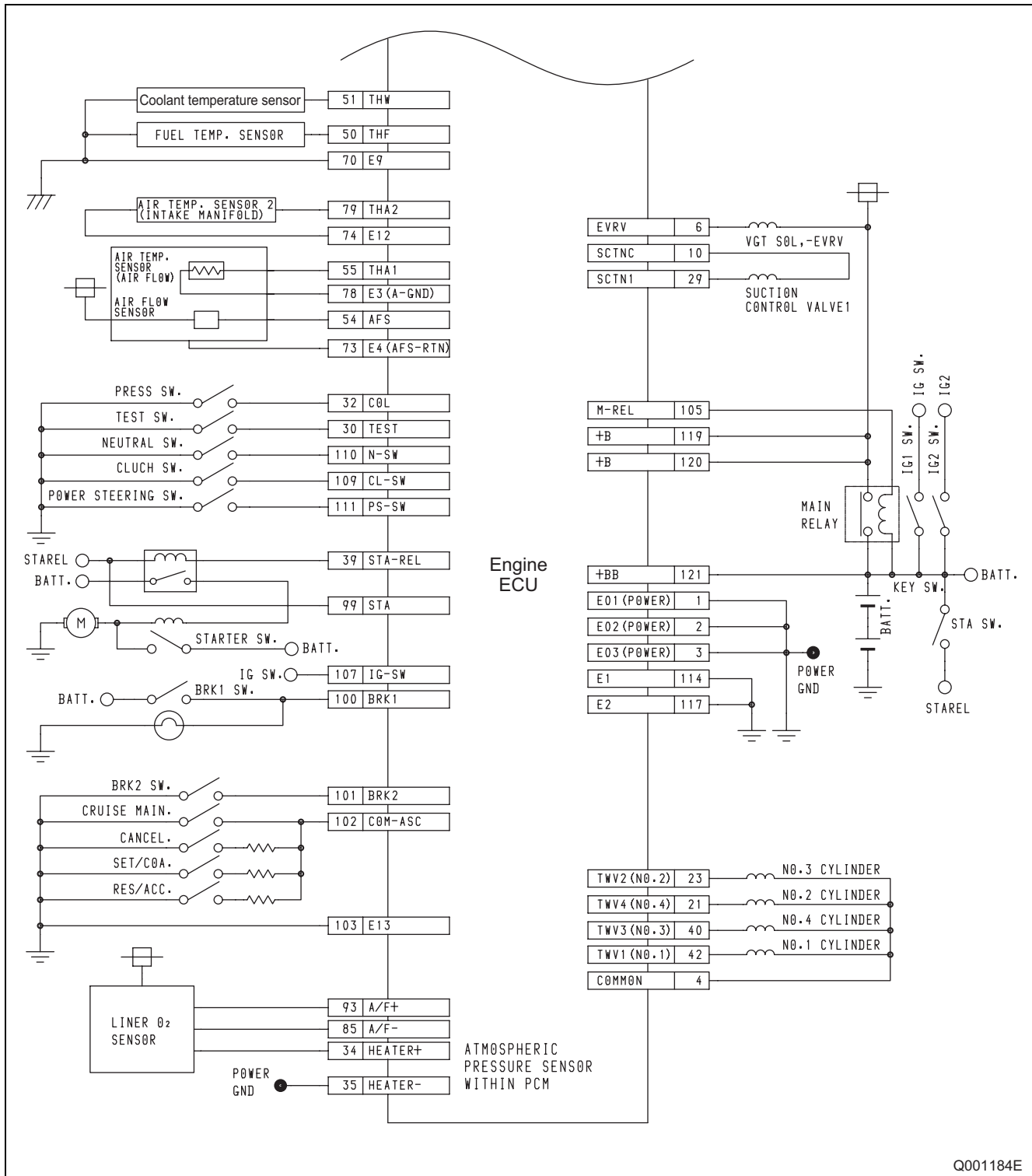
| No. | Pin Symbol | Signal Name | No. | Pin Symbol | Signal Name |
|-----|------------|--|-----|------------|---|
| 1 | E01 | Power GND | 26 | CLCN | Air Conditioner Relay Actuation Output |
| 2 | E02 | Power GND | 27 | — | |
| 3 | E03 | Power GND | 28 | — | |
| 4 | COMMON | Injection Common | 29 | SCTN1 | Suction Control Solenoid Actuation Output 1 |
| 5 | — | | 30 | TEST | Test Switch Input |
| 6 | EV RV | VGT Solenoid (E-VRV) Actuation Output | 31 | — | |
| 7 | EGR- | EGR-DC Motor Actuation (-) | 32 | COL | Air Conditioning Switch Input |
| 8 | EGR+ | EGR-DC Motor Actuation (+) | 33 | THEG3 | Exhaust Temperature Sensor 3 |
| 9 | ALTF | Alternator Field Coil Excitation | 34 | HEATER+ | A/F Heater Actuation (+) |
| 10 | SCTNC | Suction Control Solenoid Actuation Output Common | 35 | HEATER- | A/F Heater Actuation (-) |
| 11 | — | | 36 | — | |
| 12 | PRESS | Press Switch Input | 37 | G-REL | Glow Plug Relay Actuation Output |
| 13 | — | | 38 | — | |
| 14 | — | | 39 | STA-REL | Starter Permission Relay Actuation Output |
| 15 | — | | 40 | TWV3 | Injection Drive 3 |
| 16 | — | | 41 | — | |
| 17 | — | | 42 | TWV1 | Injection Drive 1 |
| 18 | — | | 43 | — | |
| 19 | — | | 44 | VREF2 | Sensor 5V Power Supply |
| 20 | — | | 45 | VREF3 | Sensor 5V Power Supply |
| 21 | TWV4 | Injection Drive 4 | 46 | NE+ | Crankshaft Position Sensor Input (+) |
| 22 | — | | 47 | G+ | Cylinder Recognition Sensor Input (+) |
| 23 | TWV2 | Injection Drive 2 | 48 | PFR | Rail Pressure Sensor Input |
| 24 | — | | 49 | — | |
| 25 | PWM-OUT | PWM Electric Fan Actuation Output | 50 | THF | Fuel Temperature Sensor Input |

Terminal Connections (2)

| No. | Pin Symbol | Signal Name | No. | Pin Symbol | Signal Name |
|-----|--------------|--|-----|------------|--|
| 51 | THW | Coolant Temperature Sensor Input | 87 | CAN-L | CAN Communication Line (L) |
| 52 | PIM | Turbo Pressure Sensor Input | 88 | — | |
| 53 | EGRP | EGR Position Sensor | 89 | — | |
| 54 | AFS | Mass Air Flow Sensor Input | 90 | — | |
| 55 | THA1 | Intake Air Temperature Sensor Input 1 | 91 | TVO2 | Accelerator Sensor Input 2 |
| 56 | THEG1 | Exhaust Temperature Sensor 1 | 92 | E6 | Sensor System Ground |
| 57 | THEG2 | Exhaust Temperature Sensor 2 | 93 | A/F+ | A/F Sensor Input (+) |
| 58 | THPEG | Engine compartment Temperature Compensation Sensor | 94 | — | |
| 59 | VREF6 | Sensor 5V Power Supply | 95 | CAN-H | CAN Communication Line (H) |
| 60 | VREF7 | Sensor 5V Power Supply | 96 | — | |
| 61 | E14 | Sensor System Ground | 97 | — | |
| 62 | E15 | Sensor System Ground | 98 | — | |
| 63 | VREF4 | Sensor 5V Power Supply | 99 | STA | Starter Switch Input |
| 64 | VREF5 | Sensor 5V Power Supply | 100 | BRK1 | Brake Switch Input 1 |
| 65 | NE- | Crankshaft Position Sensor Input (-) | 101 | — | |
| 66 | G- | Cylinder Recognition Sensor Input (-) | 102 | COM-ASC | Cruise Control Switch |
| 67 | — | | 103 | E13 | Sensor System Ground |
| 68 | E7 | Sensor System Ground | 104 | — | |
| 69 | E8 | Sensor System Ground | 105 | M-REL | Main Relay Actuation Output |
| 70 | E9 | Sensor System Ground | 106 | — | |
| 71 | E10 | Sensor System Ground | 107 | IG-SW | Ignition SW |
| 72 | E11 | Sensor System Ground | 108 | — | |
| 73 | E4 (AFS-RTN) | Mass Air Flow Sensor Special Use Ground | 109 | CL-SW | Clutch Switch Input |
| 74 | E12 | Sensor System Ground | 110 | N-SW | Neutral Switch Input |
| 75 | VG | Glow Plug Voltage Monitor | 111 | PS-SW | Power Switch |
| 76 | — | | 112 | — | |
| 77 | ALTT | Alternator Power Generation Detector | 113 | — | |
| 78 | E3 | Sensor System Ground | 114 | E1 | Signal Ground |
| 79 | THA2 | Intake Air Temperature Sensor Input 2 | 115 | — | |
| 80 | — | | 116 | ISV+ | Electronic Control Throttle DC Motor Actuation (+) |
| 81 | PEG2 | Exhaust Pressure Sensor Input 2 | 117 | E2 | Signal Ground |
| 82 | VREF1 | Sensor 5V Power Supply | 118 | ISV- | Electronic Control Throttle DC Motor Actuation (-) |
| 83 | TVO1 | Accelerator Sensor Input 1 | 119 | +B | +B Power Supply (M-REL Downstream) |
| 84 | E5 | Sensor System Ground | 120 | +B | +B Power Supply (M-REL Downstream) |
| 85 | A/F- | A/F Sensor Input (-) | 121 | +BB | Battery Power Supply |
| 86 | ISVP | Electronic Control Throttle Position Sensor Input | — | — | |

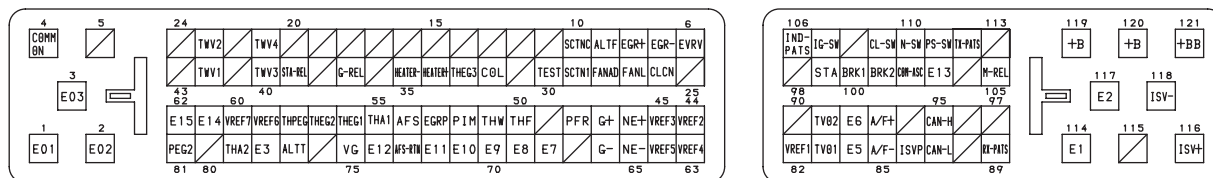
9.2 Engine ECU External Wiring Diagram (Model Name: MAZDA 6)





(1) Connector Diagram

Connector Pin Layout



Q001137E

Terminal Connections (1)

| No. | Pin Symbol | Signal Name | No. | Pin Symbol | Signal Name |
|-----|------------|--|-----|------------|---|
| 1 | E01 | Power GND | 26 | CLCN | Air Conditioner Relay Actuation Output |
| 2 | E02 | Power GND | 27 | FANL | Fan Relay (Low) Actuation Output |
| 3 | E03 | Power GND | 28 | FANAD | ADD Fan Relay Actuation Output |
| 4 | COMMON | Injection Common | 29 | SCTNC | Suction Control Solenoid Actuation Output 1 |
| 5 | — | | 30 | TEST | Test Switch Input |
| 6 | EVRV | VGT Solenoid (E-VRV) Actuation Output | 31 | — | |
| 7 | EGR- | EGR-DC Motor Actuation (-) | 32 | COL | Air Conditioning Switch Input |
| 8 | EGR+ | EGR-DC Motor Actuation (+) | 33 | THEG3 | Exhaust Temperature Sensor 3 |
| 9 | ALTF | Alternator Field Coil Excitation | 34 | HEATER+ | A/F Heater Actuation (+) |
| 10 | SCTNC | Suction Control Solenoid Actuation Output Common | 35 | HEATER- | A/F Heater Actuation (-) |
| 11 | — | | 36 | — | |
| 12 | — | | 37 | G-REL | Glow Plug Relay Actuation Output |
| 13 | — | | 38 | — | |
| 14 | — | | 39 | STA-REL | Starter Permission Relay Actuation Output |
| 15 | — | | 40 | TWV3 | Injection Drive 3 |
| 16 | — | | 41 | — | |
| 17 | — | | 42 | TWV1 | Injection Drive 1 |
| 18 | — | | 43 | — | |
| 19 | — | | 44 | VREF2 | Sensor 5V Power Supply |
| 20 | — | | 45 | VREF3 | Sensor 5V Power Supply |
| 21 | TWV4 | Injection Drive 4 | 46 | NE+ | Crankshaft Position Sensor Input (+) |
| 22 | — | | 47 | G+ | Cylinder recognition Sensor Input (+) |
| 23 | TWV2 | Injection Drive 2 | 48 | PFR | Rail Pressure Sensor Input |
| 24 | — | | 49 | — | |
| 25 | — | | 50 | THF | Fuel Temperature Sensor Input |

Terminal Connections (2)

| No. | Pin Symbol | Signal Name | No. | Pin Symbol | Signal Name |
|-----|--------------|--|-----|------------|--|
| 51 | THW | Coolant Temperature Sensor Input | 87 | CAN-L | CAN Communication Line (L) |
| 52 | PIM | Turbo Pressure Sensor Input | 88 | — | |
| 53 | EGRP | EGR Position Sensor | 89 | RX-PATS | PATS Communication (Receiving) |
| 54 | AFS | Mass Air Flow Sensor Input | 90 | — | |
| 55 | THA1 | Intake Air Temperature Sensor Input 1 | 91 | TVO2 | Accelerator Sensor Input 2 |
| 56 | THEG1 | Exhaust Temperature Sensor 1 | 92 | E6 | Sensor System Ground |
| 57 | THEG2 | Exhaust Temperature Sensor 2 | 93 | A/F+ | A/F Sensor Input (+) |
| 58 | THPEG | Engine compartment Temperature Compensation Sensor | 94 | — | |
| 59 | VREF6 | Sensor 5V Power Supply | 95 | CAN-H | CAN Communication Line (H) |
| 60 | VREF7 | Sensor 5V Power Supply | 96 | — | |
| 61 | E14 | Sensor System Ground | 97 | — | |
| 62 | E15 | Sensor System Ground | 98 | — | |
| 63 | VREF4 | Sensor 5V Power Supply | 99 | STA | Starter Switch Input |
| 64 | VREF5 | Sensor 5V Power Supply | 100 | BRK1 | Brake Switch Input 1 |
| 65 | NE- | Crankshaft Position Sensor Input (-) | 101 | BRK2 | Brake Switch Input 2 |
| 66 | G- | Cylinder recognition Sensor Input (-) | 102 | COM-ASC | Cruise Control Switch |
| 67 | — | | 103 | E13 | Sensor System Ground |
| 68 | E7 | Sensor System Ground | 104 | — | |
| 69 | E8 | Sensor System Ground | 105 | M-REL | Main Relay Actuation Output |
| 70 | E9 | Sensor System Ground | 106 | IND-PATS | Antitheft Indicator |
| 71 | E10 | Sensor System Ground | 107 | IG-SW | Ignition SW |
| 72 | E11 | Sensor System Ground | 108 | — | |
| 73 | E4 (AFS-RTN) | Mass Air Flow Sensor Special Use Ground | 109 | CL-SW | Clutch Switch Input |
| 74 | E12 | Sensor System Ground | 110 | N-SW | Neutral Switch Input |
| 75 | VG | Glow Plug Voltage Monitor | 111 | PS-SW | Power Switch |
| 76 | — | | 112 | TX-PATS | PATS Communication (Sending) |
| 77 | ALTT | Alternator Power Generation Detector | 113 | — | |
| 78 | E3 | Sensor System Ground | 114 | E1 | Signal Ground |
| 79 | THA2 | Intake Air Temperature Sensor Input 2 | 115 | — | |
| 80 | — | | 116 | ISV+ | Electronic Control Throttle DC Motor Actuation (+) |
| 81 | PEG2 | Exhaust Pressure Sensor Input 2 | 117 | E2 | Signal Ground |
| 82 | VREF1 | Sensor 5V Power Supply | 118 | ISV- | Electronic Control Throttle DC Motor Actuation (-) |
| 83 | TVO1 | Accelerator Sensor Input 1 | 119 | +B | +B Power Supply (M-REL Downstream) |
| 84 | E5 | Sensor System Ground | 120 | +B | +B Power Supply (M-REL Downstream) |
| 85 | A/F- | A/F Sensor Input (-) | 121 | +BB | Battery Power Supply |
| 86 | ISVP | Electronic Control Throttle Position Sensor Input | — | — | |

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