



DENSO



ISUZU ELF 4HK1/4JJ1 Engine

COMMON RAIL SYSTEM (CRS)

SERVICE MANUAL: Operation



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DENSO CORPORATION

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1. APPLICABLE VEHICLE AND PRODUCT INFORMATION

1.1 Outline

- This manual describes the Common Rail System (CRS) equipped with the 4HK1 and 4JJ1 engines used in the ISUZU ELF. For information on items common to all CRSs, refer to the previously published CRS general addition manual, doc ID: 00400076E. {Items common to all CRSs: CRS development process, system control, construction and operation of main components (supply pump, rail, injectors), sensors, and actuators.}

The use of the aforementioned CRS is a model change designed to make the ISUZU ELF sold in all regions (with the exception of North America and Thailand) compliant with Euro 4 and Euro 5 regulations.

1.2 Applicable Vehicle

- The North American ISUZU ELF has undergone a minor change in which a Diesel Particulate Filter (DPF) system is used to comply with exhaust gas regulations for 2009 model vehicles.

Model Name	Engine Model	Engine Displacement	Remarks
ELF	4HK1	5.2 L	
	4JJ1	3.0 L	

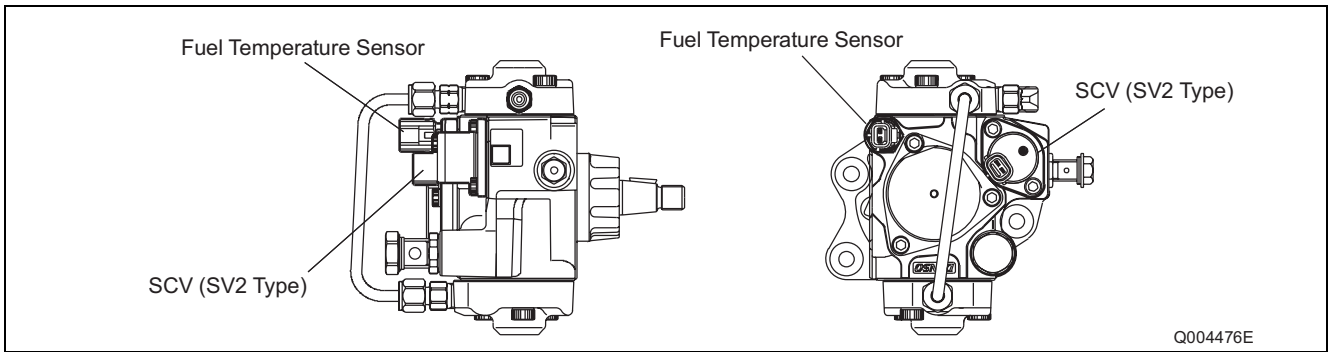
1.3 Applicable Product List

Part Name	DENSO Part Number	Manufacturer Part Number	Remarks
Supply Pump	294000-058#	8973815580	4HK1 Engine
	294000-120#	8973815554	4JJ1 Engine
Injector	095000-639#	8976097912	4HK1 Engine
	095000-803#	8980749090	4JJ1 Engine
Rail	095440-091#	8980118881	
Engine ECU	275800-670#	8980701280	4HK1 Engine
Crankshaft Position Sensor (NE)	949979-031#	8976069430	4HK1 Engine
	949979-012#	8973121081	4JJ1 Engine
Camshaft Position Sensor (TDC)	949979-169#	8980190240	4HK1 Engine
	949979-012#	8973121081	4JJ1 Engine
Manifold Absolute Pressure (MAP) Sensor	079800-797#	8980094180	
Atmospheric Pressure Sensor	079800-911#	8980445200	4JJ1 Engine
Differential Pressure Sensor	104990-101#	8973599852	
	104990-104#	8973603682	
Exhaust Temperature Sensor	265600-125#	8980043290	
	265600-126#	8980043300	

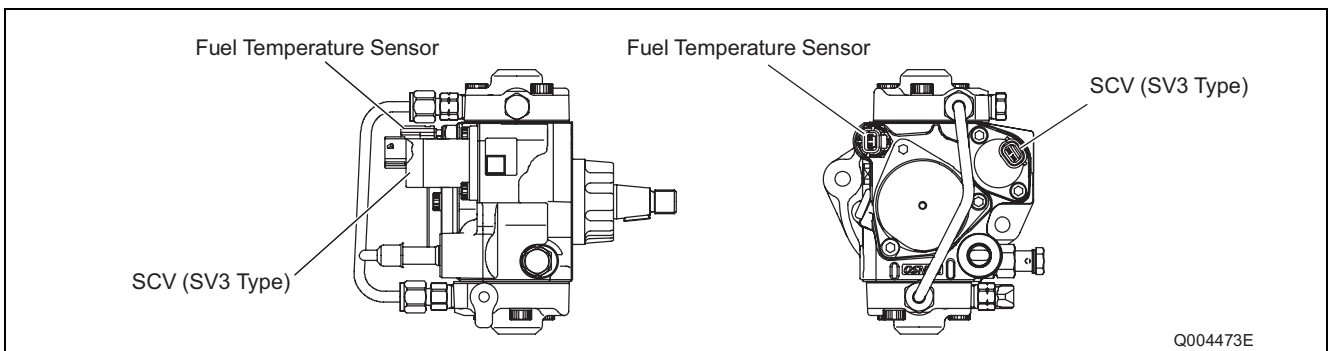
2. SUPPLY PUMP

2.1 Configuration and Operation

- The 4HK1 engine is equipped with an SV2 type Suction Control Valve (SCV), while the 4JJ1 engine is equipped with an SV3 type SCV.

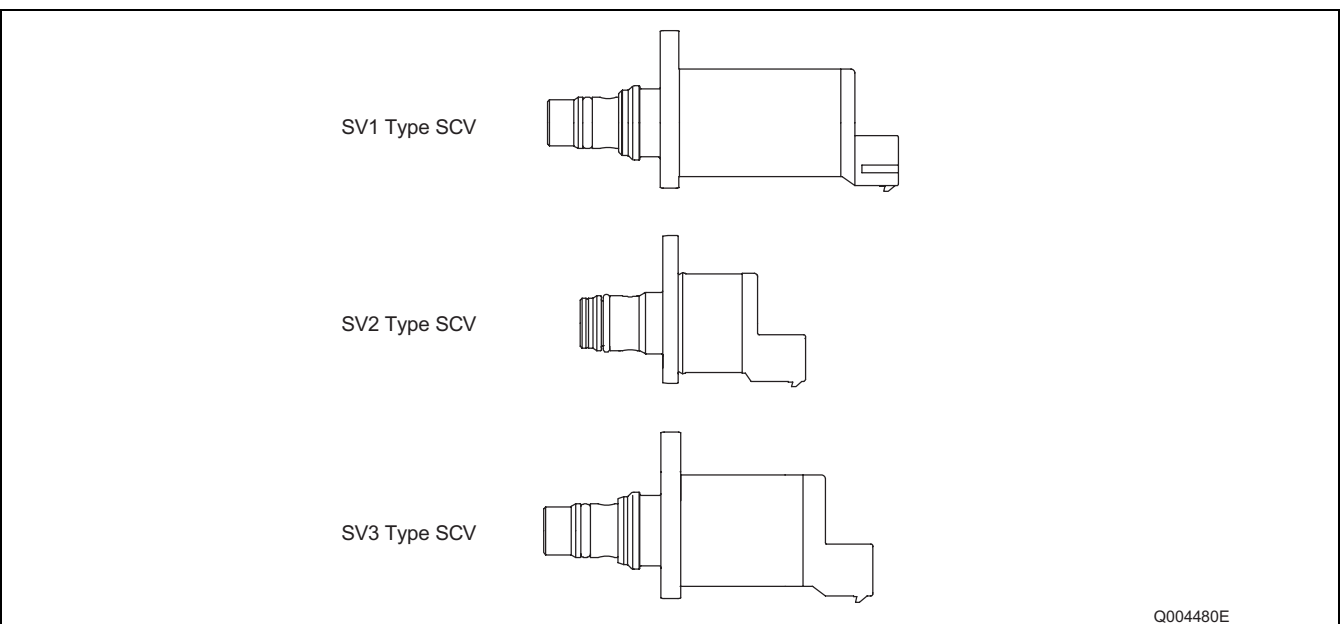


4HK1



4JJ1

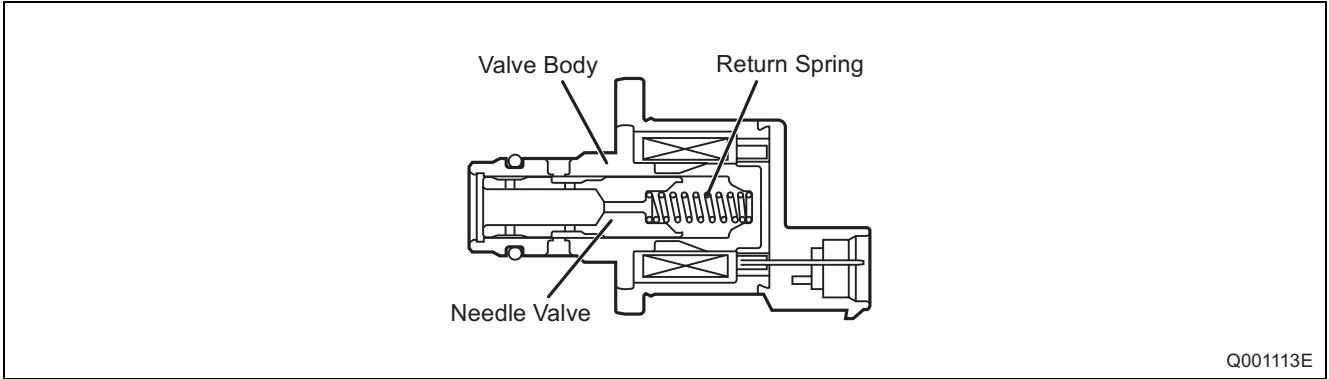
- The SV1 type is a heavy-duty SCV, while the SV2 type is a compact SCV. The SV3 type SCV is a compact version of the SV1 type.



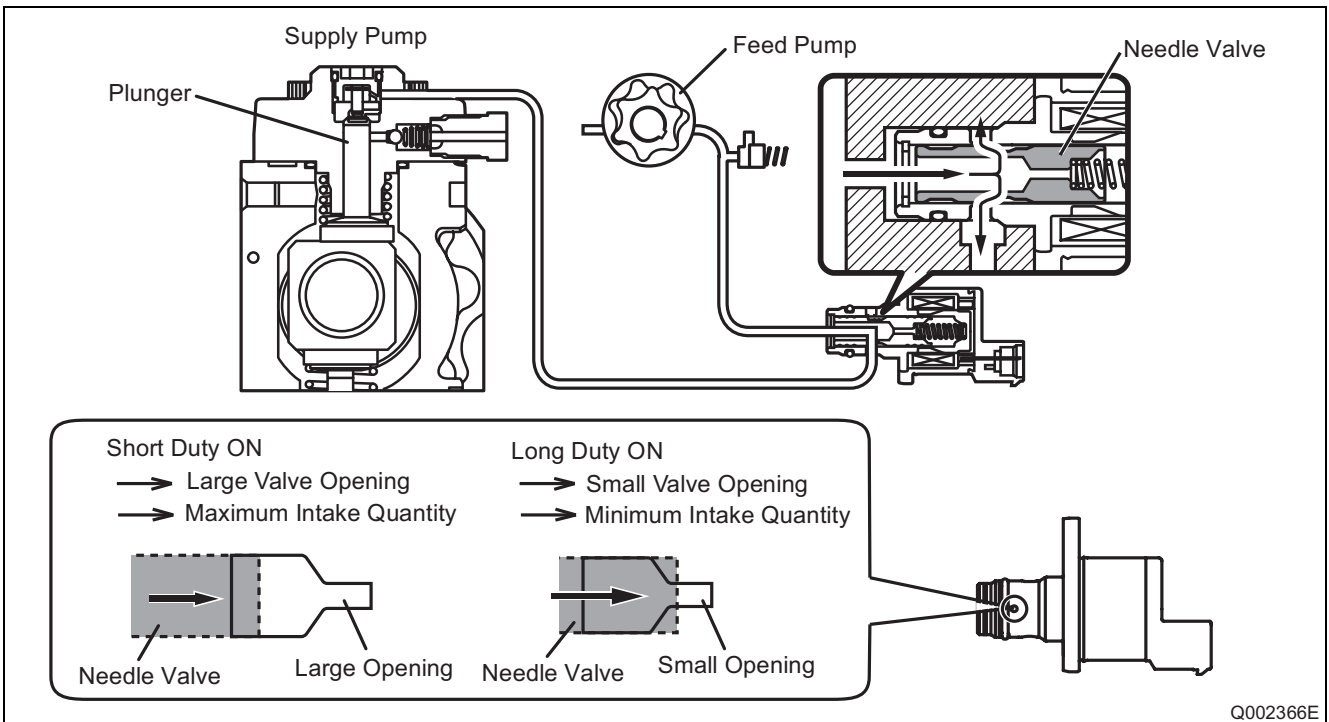
2.2 Suction Control Valve (SCV)

- The SCV is a normally open type identical to the conventional SCV.

(1) SV2 type (4HK1)

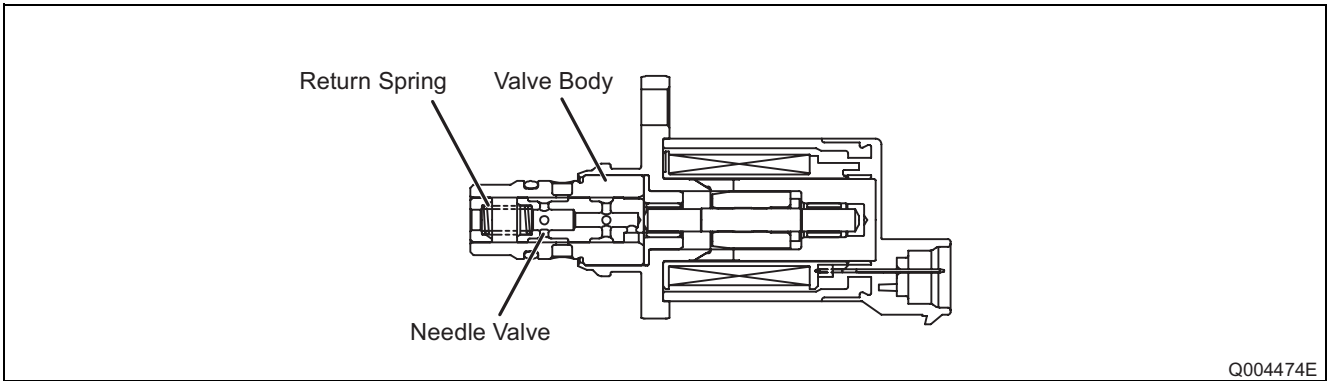


External View



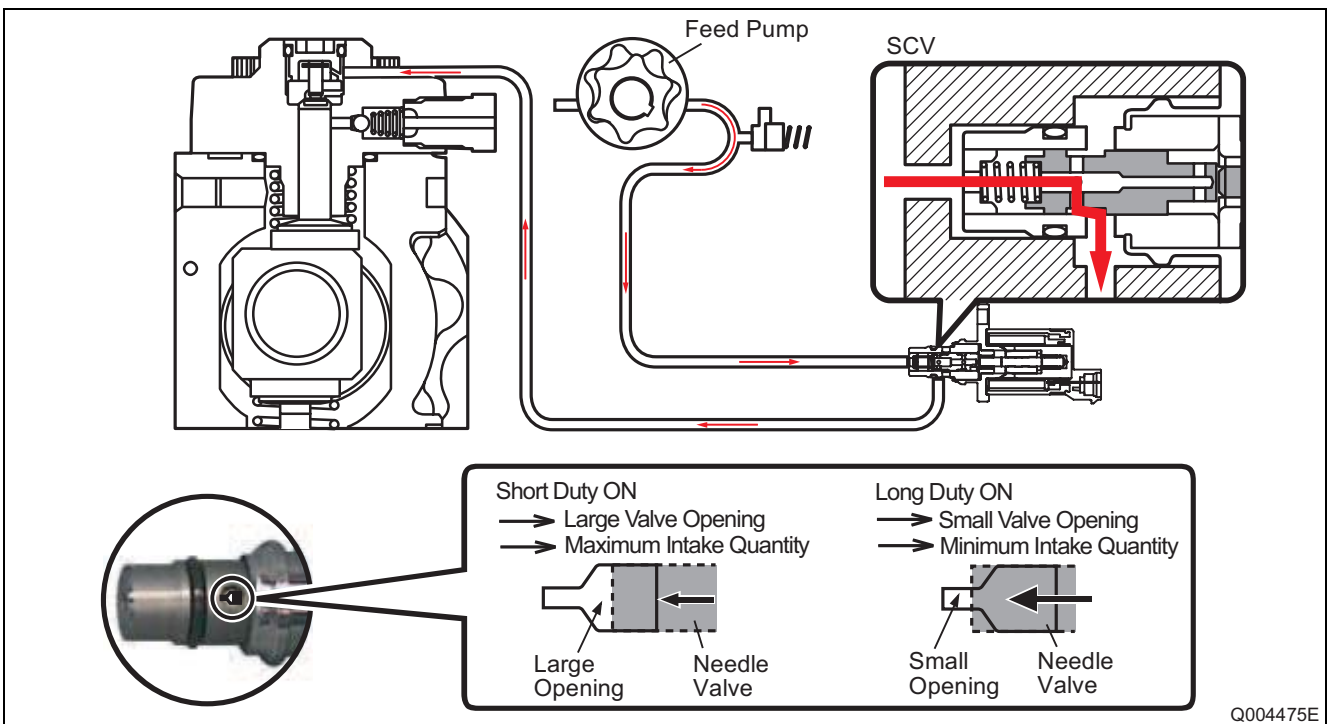
Operational Concept Diagram

(2) SV3 type (4JJ1)



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External View



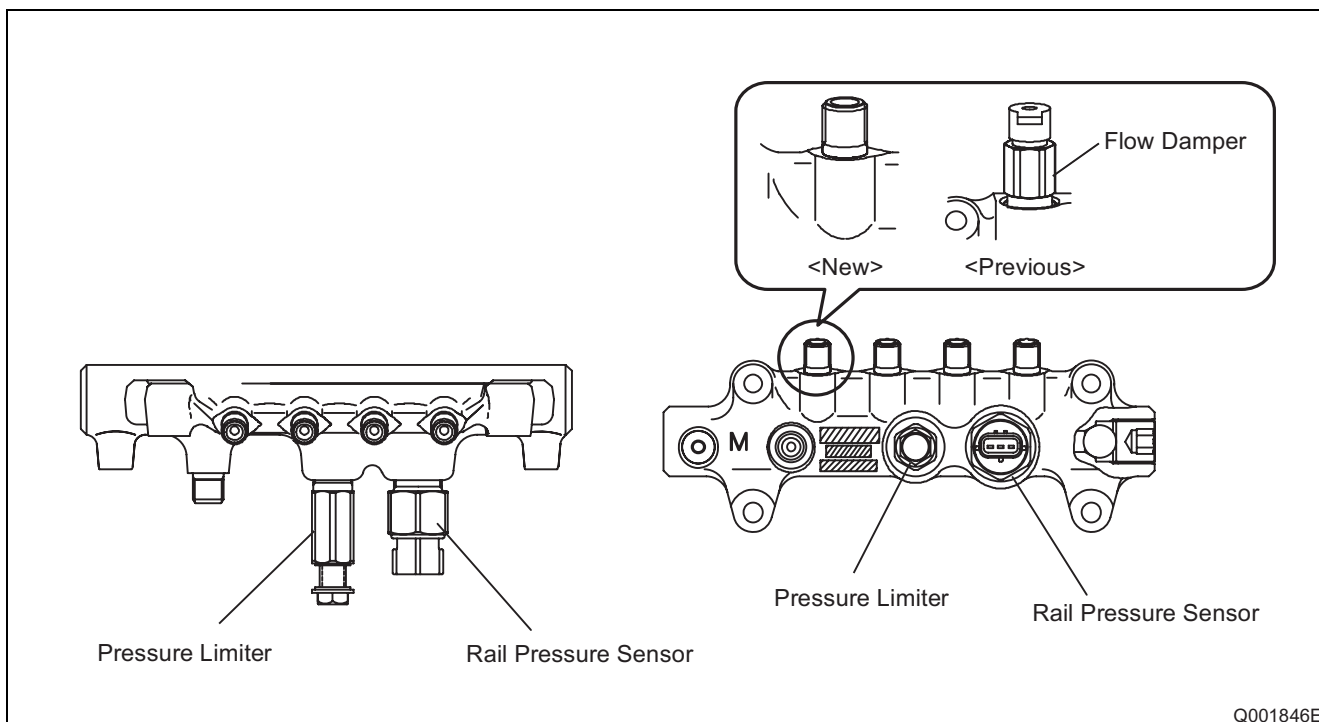
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Operational Concept Diagram

3. RAIL

3.1 Outline

- The flow damper has been discontinued.
- The rail pressure limiter opening pressure has been changed from 200 Mpa to 221 Mpa.

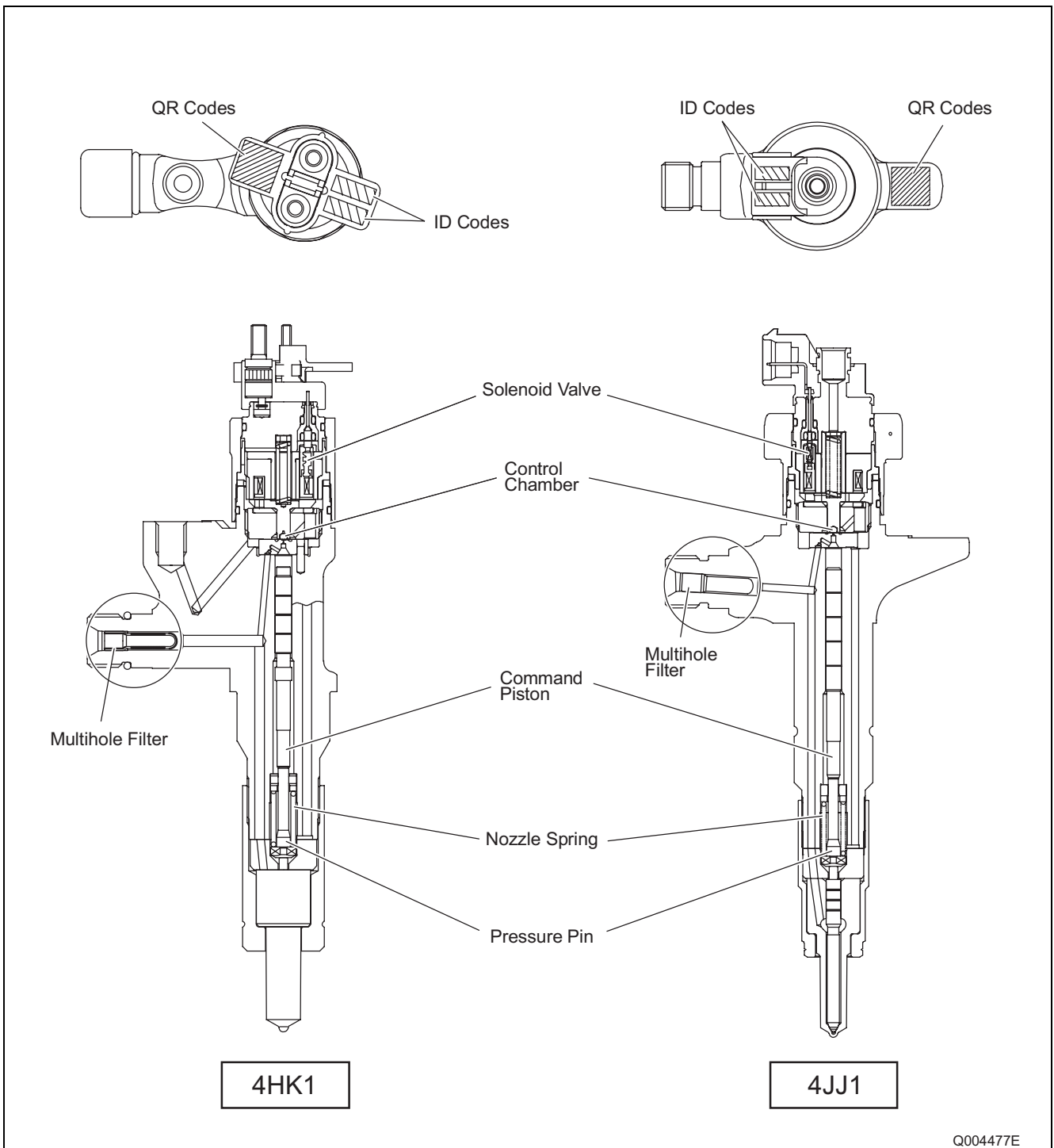


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4. INJECTOR

4.1 Outline

- The CRS detailed herein uses solenoid injectors with QR codes.
- The filter for the injector fuel inlet has been changed from a bar filter to a multihole filter.
- The responsiveness of the injectors used with the 4JJ1 engine has been improved. In addition, a Diamond Like Coating (DLC) applied to the sliding parts of the injector nozzles greatly reduces the likelihood of foreign matter adherence.

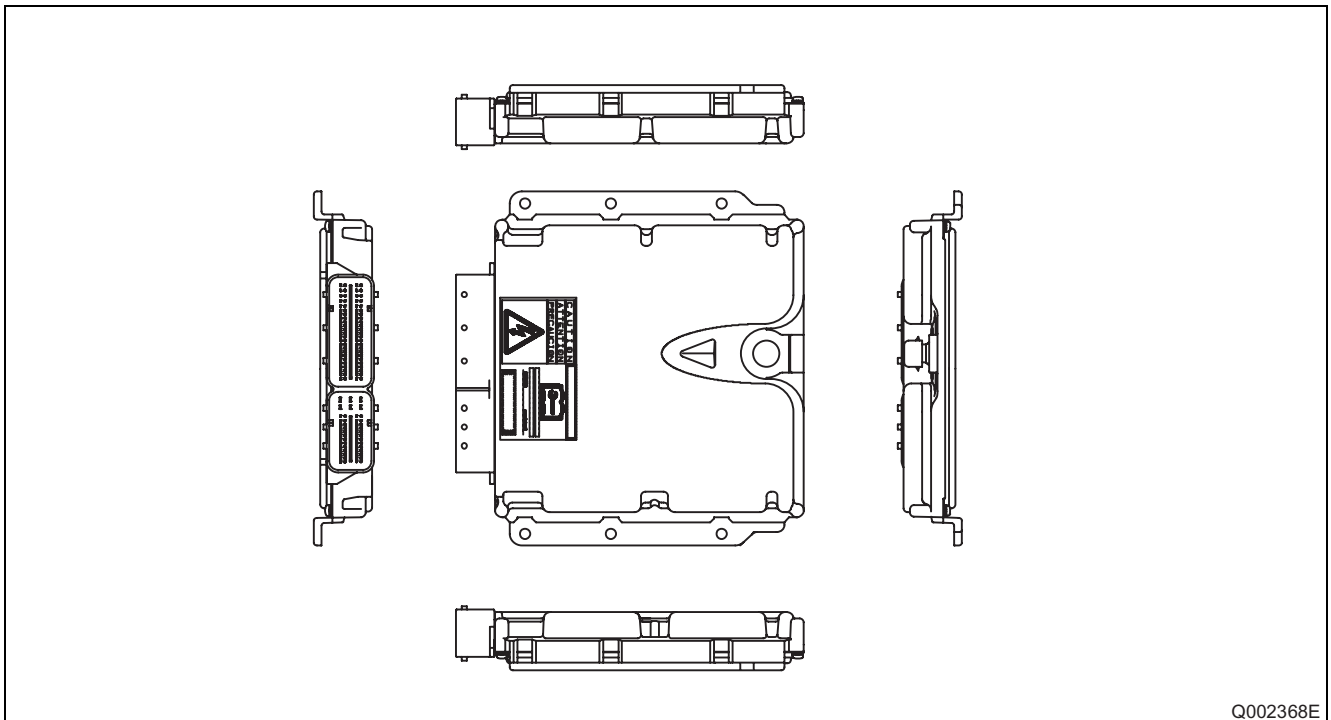


5. CONTROL SYSTEM

5.1 Engine ECU

- The engine ECU shown below is equipped with the 4HK1 engine. The 4JJ1 engine is equipped with a non-DENSO engine ECU.

The figure below is an external view of the engine ECU. For the connector pin layout and external wiring diagram: Refer to [ATTACHED MATERIALS] on P1-17.

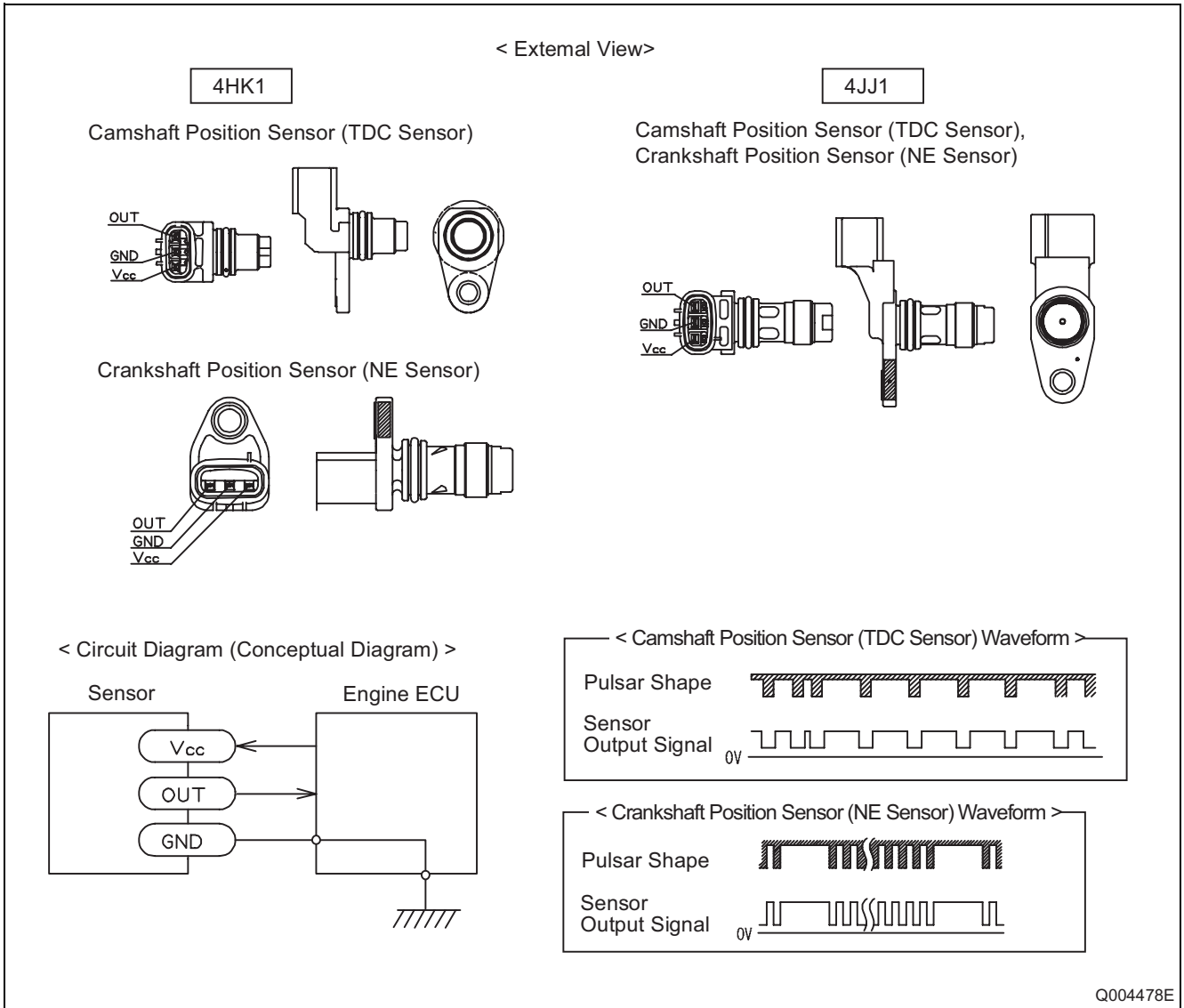


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5.2 Sensors

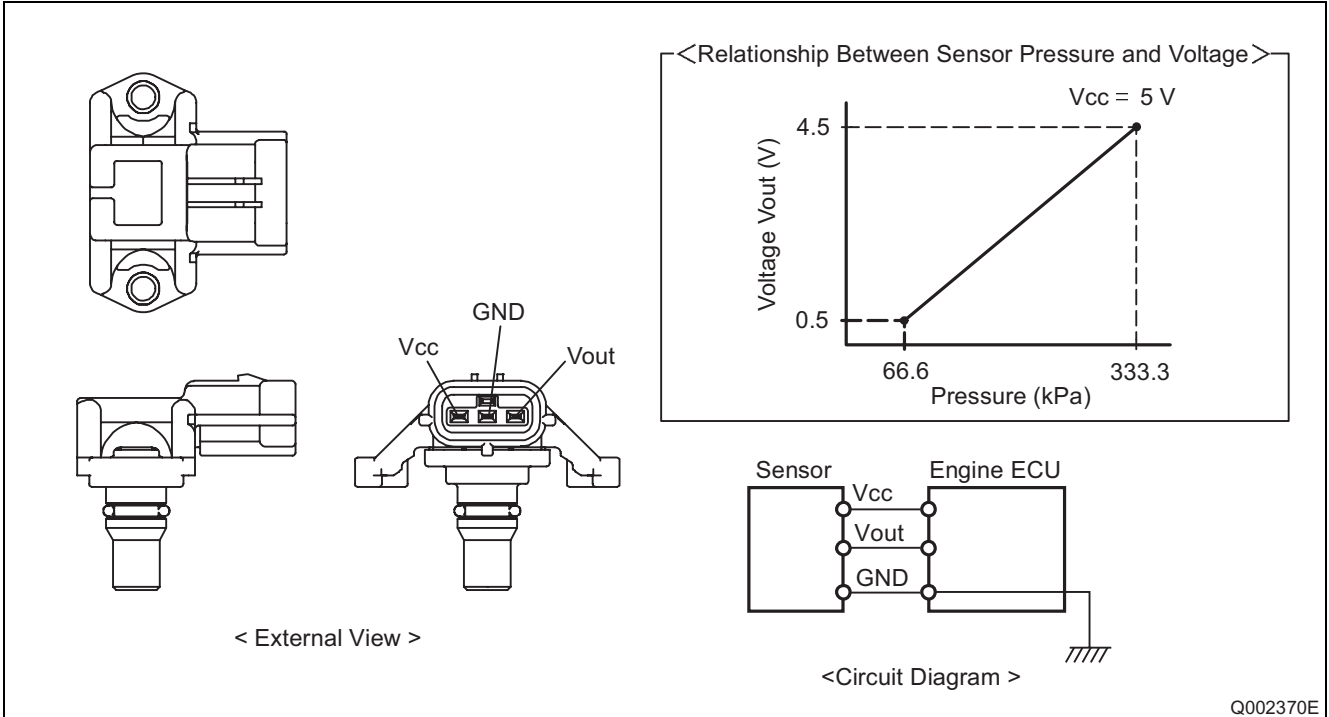
(1) Crankshaft position sensor (NE sensor) and camshaft position sensor (TDC sensor)

- Both the crankshaft position sensor (NE sensor) and camshaft position sensor (TDC sensor) are Magnetic Resistance Element (MRE) type sensors.



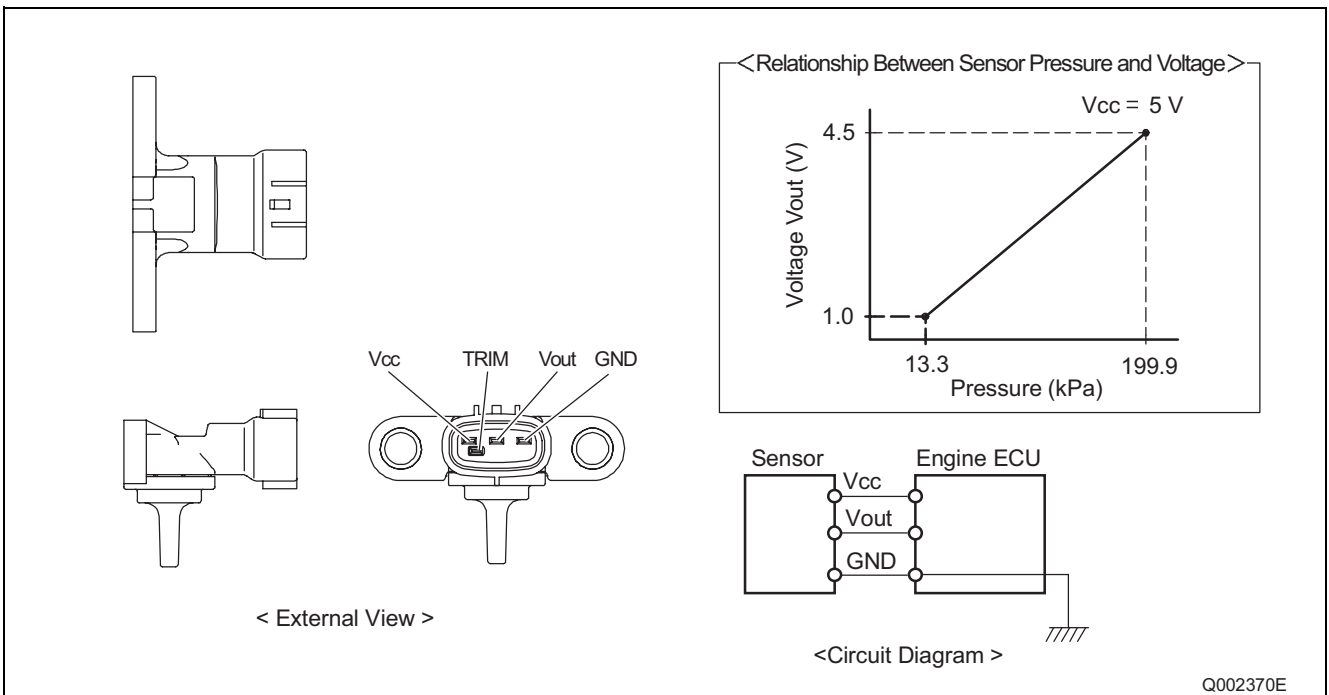
(2) Manifold Absolute Pressure (MAP) sensor

- The MAP sensor is identical in construction and operation to the conventional type MAP sensor. Air pressure within the intake manifold is detected using the "Piezoelectric Resistance Effect". The Piezoelectric resistance effect is the change in electrical resistance that occurs when the voltage applied to the silicon element inside the MAP sensor changes.



(3) Atmospheric pressure sensor

- The 4JJ1 is equipped with the atmospheric pressure sensor. The atmospheric pressure sensor is a semiconductor type pressure sensor that utilizes a characteristic in which the electrical resistance changes when the pressure applied to a silicon crystal in the sensor changes.



6. EXHAUST GAS CONTROL SYSTEM

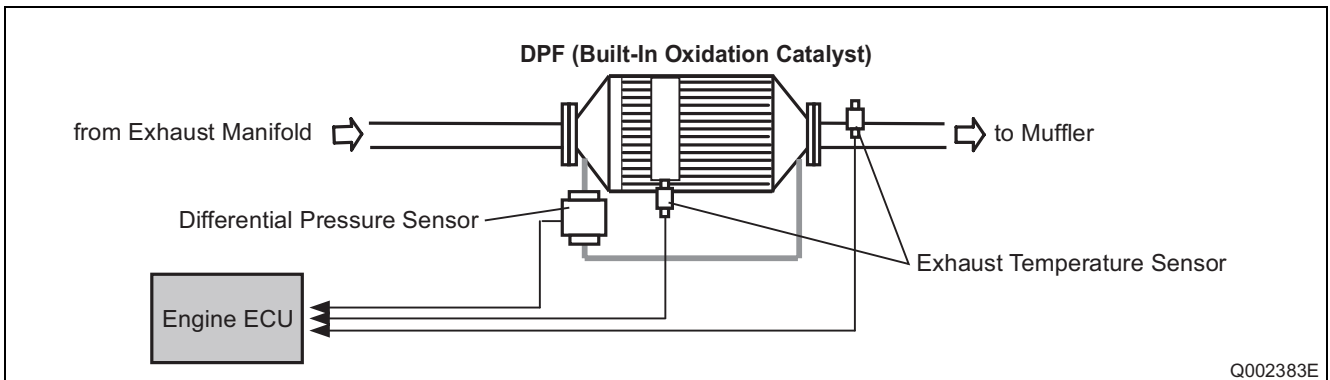
6.1 Outline

- A Diesel Particulate Filter (DPF) system is equipped in the ISUZU ELF to comply with North American exhaust gas regulations for 2007 model vehicles.

The DPF is a non-DENSO product. The exhaust gas temperature sensor and differential pressure sensor are made by DENSO.

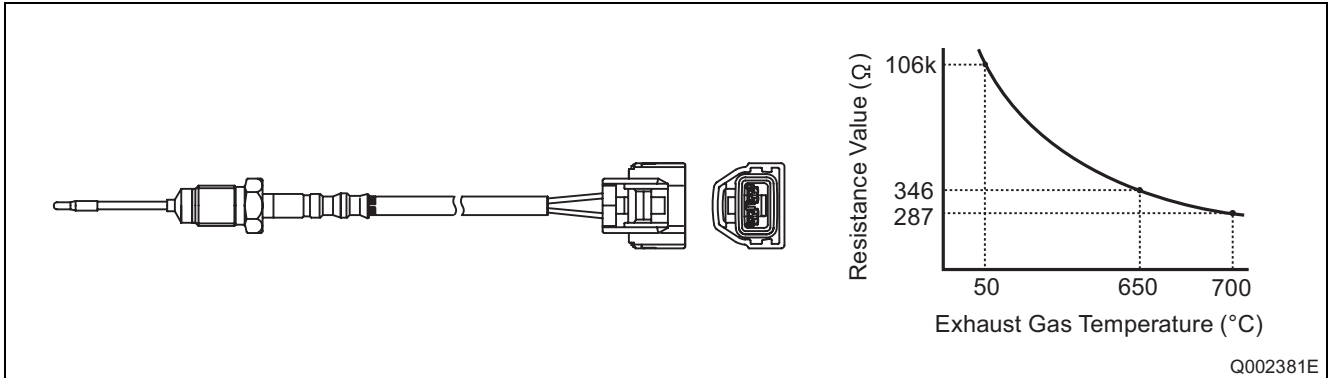
6.2 DPF System

- The ISUZU ELF uses a conventional DPF system.



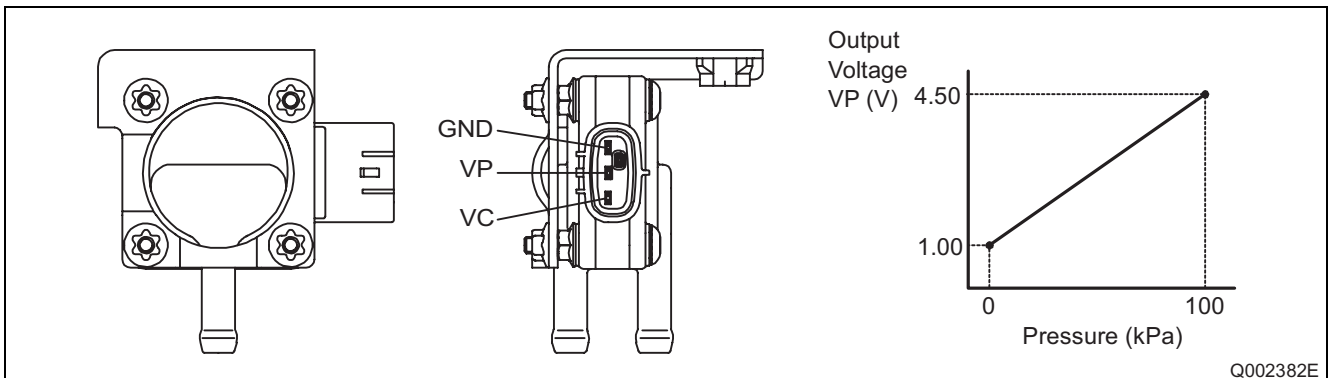
(1) Exhaust gas temperature sensor

- The exhaust gas temperature sensor used in the ISUZU ELF is identical in construction and operation to the conventional type exhaust gas temperature sensor.



(2) Differential pressure sensor

- The differential pressure sensor used in the ISUZU ELF is identical in construction and operation to the conventional type differential pressure sensor.



7. ENGINE ECU DIAGNOSTIC TROUBLE CODES (DTC)

7.1 DTC Table

- The DTC table below is for the 4HK1 engine. The 4JJ1 engine is equipped with a non-DENSO engine ECU.

SAE Code	Detection Item	Remarks
P0016	Crankshaft Position Sensor, Camshaft Position Sensor Correlation Related Error	
P0027	Exhaust Brake Valve Stuck	
	Exhaust Throttle Valve Stuck	
P003A	Variable Geometry Turbo (VGT) Module Opening Command Too Wide	
P0045	VGT Module Motor Circuit Short/Position Control Abnormality/Power Supply Voltage	
P0079	Exhaust Throttle Short to GND	
P0080	Exhaust Throttle Short to BATT	
P0087	Rail Pressure Limiter Operation	
P0088	Abnormal Rail Pressure Level 1	
	Abnormal Rail Pressure Level 2	
P0089	Suction Control Valve (SCV) Stuck	
P0091	SCV (+) Output Open/Short to GND	
	SCV (-) Output Open/Short to GND	
	SCV Coil Open	
P0092	SCV (+) Output Short to BATT	
	SCV (-) Output Short to BATT	
P0093	Fuel Leak or Rail Pressure Sensor Performance Abnormality	
P0097	Intake Air Temperature Sensor 2 Signal Low Voltage Abnormality	
P0098	Intake Air Temperature Sensor 2 Signal High Voltage Abnormality	
P0101	Exhaust Gas Recirculation (EGR) System Abnormality	
P0102	Mass Air Flow (MAF) Meter Signal Low Voltage Abnormality	
P0103	MAF Meter Signal High Voltage Abnormality	
P0112	Intake Air Temperature Sensor Signal Low Voltage Abnormality	
P0113	Intake Air Temperature Sensor Signal High Voltage Abnormality	
P0116	Coolant Temperature Sensor Performance	
P0117	Coolant Temperature Sensor Signal Low Voltage Abnormality	
P0118	Coolant Temperature Sensor Signal High Voltage Abnormality	
P0126	Safe Driving Coolant Temperature Increase	
P0128	Coolant Temperature Below Thermostat Regulating Temperature	
P0181	Fuel Temperature Sensor Stuck in Middle Range	
P0182	Fuel Temperature Sensor Signal Low Voltage Abnormality	

SAE Code	Detection Item	Remarks
P0183	Fuel Temperature Sensor Signal High Voltage Abnormality	
P0191	Rail Pressure Sensor Stuck	
	Rail Pressure Sensor Characteristics Abnormality (When Key is ON)	
	Rail Pressure Sensor Characteristics Abnormality (When Key is OFF)	
P0192	Rail Pressure Sensor Signal Low Voltage Abnormality	
P0193	Rail Pressure Sensor Signal High Voltage Abnormality	
P0201	Two-Way Valve (TWV) 1 Output Open Load Injector #1 Coil Open	
P0202	TWV 4 Output Open Load Injector #6 Coil Open	
P0203	TWV 2 Output Open Load Injector #5 Coil Open	
P0204	TWV 3 Output Open Load Injector #3 Coil Open	
P0219	Engine Overspeed Abnormality	
P0234	Turbo/Super Charger Engine Overboost Abnormality	
P0237	Manifold Absolute Pressure (MAP) Sensor Signal Low Voltage Abnormality	
P0238	MAP Sensor Signal High Voltage Abnormality	
P0261	TWV 1 Load Short (Injector #1)	
P0264	TWV 4 Load Short (Injector #6)	
P0267	TWV 2 Load Short (Injector #5)	
P0270	TWV 3 Load Short (Injector #3)	
P0299	Underboost Abnormality	
P02E2	Electronic Control Throttle DC Motor Open Malfunction	
P02E3	Electronic Control Throttle DC Motor +B/GND Short Malfunction	
P02E7	Electronic Control Throttle Stuck Closed	
	Electronic Control Throttle Stuck Open	
	Electronic Control Throttle Open Learning Abnormality	
	Electronic Control Throttle Close Learning Abnormality	
P02E8	Electronic Control Throttle Position Low-Side Abnormality	
P02E9	Electronic Control Throttle Position High-Side Abnormality	
P0300	Engine Misfire (Multiple Cylinders)	
P0301	Engine Misfire (Cylinder #1)	
P0302	Engine Misfire (Cylinder #2)	
P0303	Engine Misfire (Cylinder #3)	
P0304	Engine Misfire (Cylinder #4)	
P0335	No Crankshaft Position Sensor Pulse Input	
P0336	Crankshaft Position Sensor Performance	
P0340	No Camshaft Position Sensor Input	

SAE Code	Detection Item	Remarks
P0341	Camshaft Position Sensor Performance	
P0381	Glow Indication Lamp Control Circuit High Side	
	Glow Indication Lamp Control Circuit Low Side	
P0401	EGR Valve Stuck	
P0402	EGR System Abnormality 3	
P0403	EGR DC Motor Circuit Malfunction (EBM2)	
	EGR Duty Error	
P0404	EGR in Open Position	
P0405	EGR Gas Position Sensor Circuit Low	
P0406	EGR Gas Position Sensor Circuit High	
P040B	EGR Gas Temperature Sensor Characteristics	
P040C	EGR Gas Temperature Sensor Low Voltage Abnormality	
P040D	EGR Gas Temperature Sensor High Voltage Abnormality	
P041B	EGR Gas Temperature Sensor 2 Characteristics	
P041C	EGR Gas Temperature Sensor 2 Low Voltage Abnormality	
P041D	EGR Gas Temperature Sensor 2 High Voltage Abnormality	
P042E	EGR Closed Position Performance	
P0500	Vehicle Speed Sensor Circuit Abnormality	
P0506	Idle Control Target Speed Low	
P0507	Idle Control Target Speed High	
P0512	Starter Switch Abnormality	
P0522	Oil Pressure Sensor Low-Side Abnormality	
P0523	Oil Pressure Sensor High-Side Abnormality	
P0545	Low Exhaust Gas Temperature Abnormality Before OC	
P0546	High Exhaust Gas Temperature Abnormality Before OC	
P0562	Ignition 1 Low Voltage Abnormality	
P0563	Ignition 1 High Voltage Abnormality	
P0567	Cruise Resume/Accelerator Position Signal Malfunction	
P0568	Cruise Set/Coast Set Signal Malfunction	
P0571	Cruise/Brake Switch Circuit Malfunction	
P0606	Engine ECU Main CPU Abnormality	
P062F	Electronically Erasable and Programmable Read Only Memory (EEPROM) Write Error	
P0642	Analog Sensor Voltage Output #1 Low Voltage Abnormality	
P0643	Analog Sensor Voltage Output #1 High Voltage Abnormality	
P064C	Glow Plug Control Module (GPCM) Circuit	
	GPCM Internal Abnormality	
	GPCM EEPROM Abnormality	

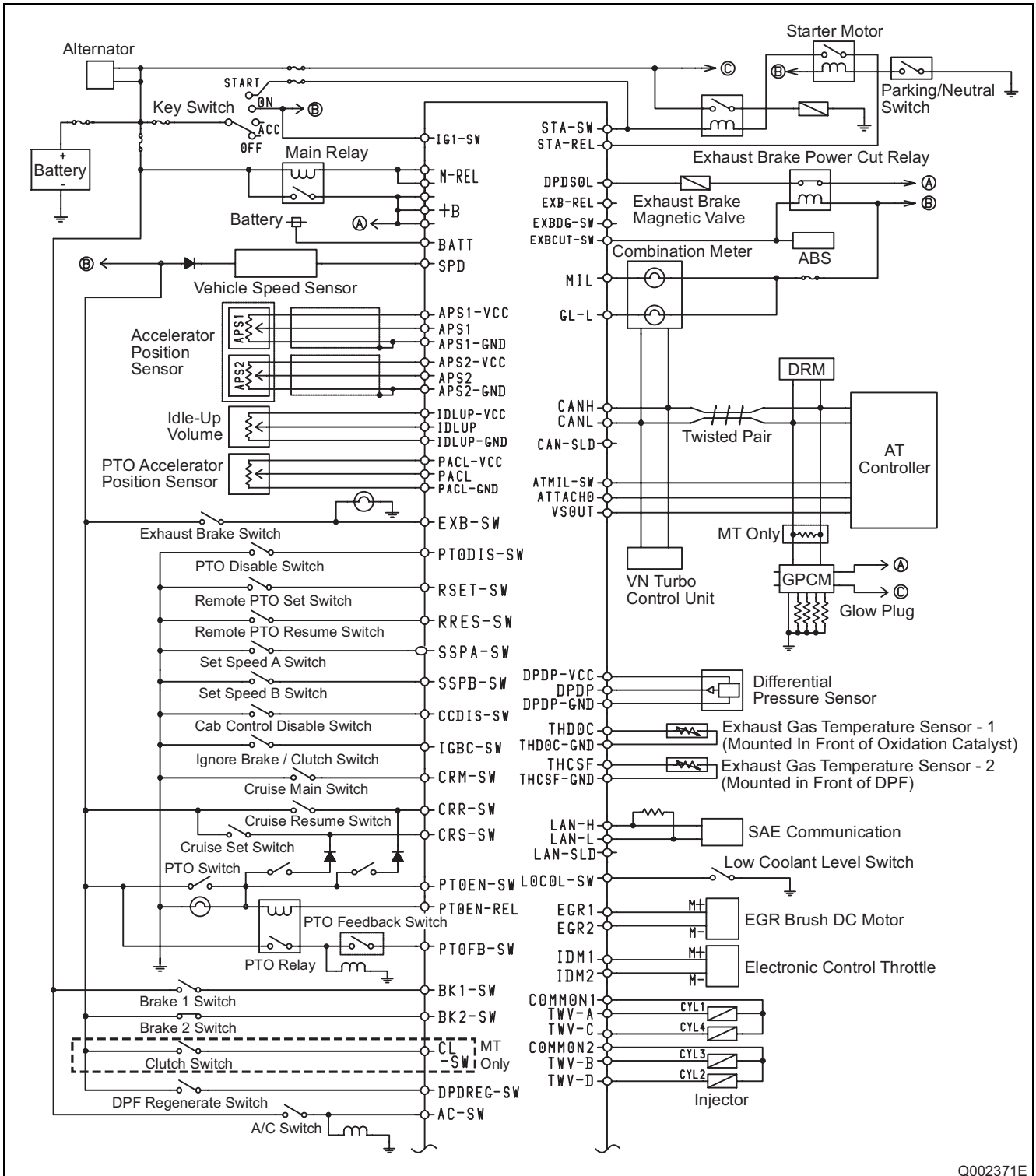
SAE Code	Detection Item	Remarks
P0650	Malfunction Indicator Lamp (MIL) Control Circuit High Side	
	MIL Control Circuit Low Side	
P0652	Analog Sensor Voltage Output #2 Low Voltage Abnormality	
P0653	Analog Sensor Voltage Output #2 High Voltage Abnormality	
P0671	Cylinder 1 Glow Plug Circuit	
P0672	Cylinder 2 Glow Plug Circuit	
P0673	Cylinder 3 Glow Plug Circuit	
P0674	Cylinder 4 Glow Plug Circuit	
P0687	Main Relay Abnormality	
P0700	Transmission Control Module (TCM) MIL Illuminate Request	
P0802	TCM MIL Illuminate Request Circuit	
P1085	Rail Pressure Abnormality (Pump Reliability)	
P1093	Rail Pressure Insufficient at High Load	
P1125	Accelerator Pedal Position Sensor Circuit Intermittent	
P1259	Single-Side Pumping	
P1293	Capacity Charge-Up Abnormal Condition Flag 1	
	Capacity Charge-Up Abnormal Condition Flag 2	
P1471	Diesel Particulate Filter (DPF) Regeneration Deficiency	DPF
P160B	Q Data/QR Data Cross Check Error	DPF
P2002	DPF Deterioration 2	DPF
P2032	Exhaust Gas Low Temperature Abnormality Before DPF	DPF
P2033	Exhaust Gas High Temperature Abnormality Before DPF	DPF
P2080	Exhaust Gas Temperature Sensor High Temperature Abnormality Before Oxidation Catalyst (OC)	DPF
	Exhaust Gas Temperature Sensor Low Temperature Abnormality Before OC	DPF
P2084	Exhaust Gas Temperature Sensor High Temperature Abnormality Before DPF	DPF
P20E2	Exhaust Gas Temperature Sensor Abnormality	
P2122	Accelerator Position Sensor 1 Circuit Low Voltage Abnormality	
P2123	Accelerator Position Sensor 1 Circuit High Voltage Abnormality	
P2127	Accelerator Position Sensor 2 Circuit Low Voltage Abnormality	
P2128	Accelerator Position Sensor 2 Circuit High Voltage Abnormality	
P2138	Accelerator Position Sensor 1, 2 Correlation Abnormality	
P2146	COM 1 Output Open Load	
	TWV 1 or 3 Output Open Load	
P2147	COM 1 Output Short to GND	
	TWV 1 or 3 (or 5) Output Short to GND	
P2148	COM 1 Output Short to BATT	
	TWV 1 or 3 (or 5) Output Short to BATT	

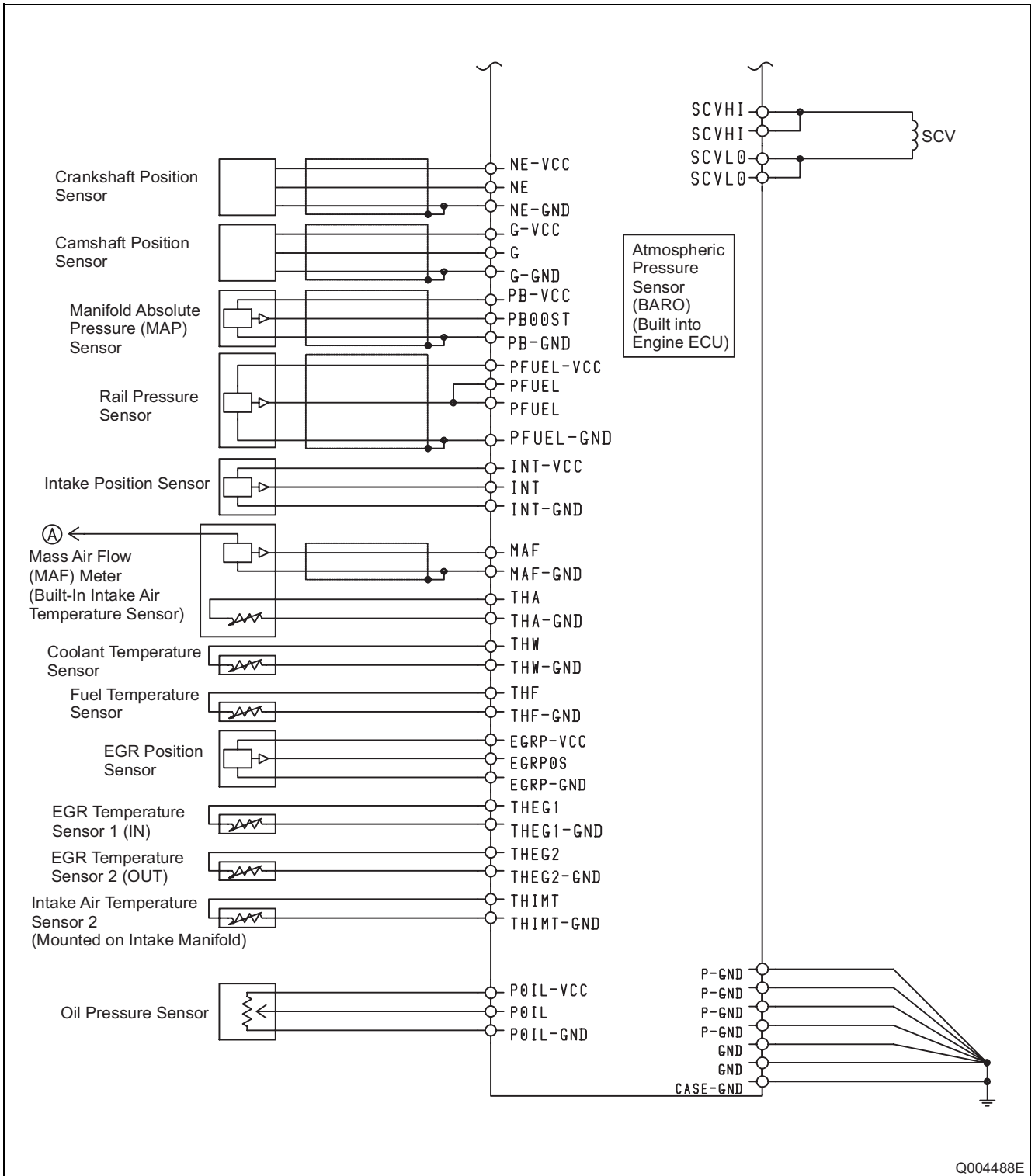
SAE Code	Detection Item	Remarks
P2149	COM 2 Output Open Load TWV 2 or 4 Output Open Load	
P2150	COM 2 Output Short to GND TWV 2 or 4 (or 6) Output Short to GND	
P2151	COM 2 Output Short to BATT TWV 2 or 4 (or 6) Output Short to BATT	
P2199	Intake Air Temperature Abnormality	
P2227	Atmospheric Pressure (BARO) Sensor Performance	
P2228	Atmospheric Pressure Sensor Signal Low Voltage Abnormality	
P2229	Atmospheric Pressure Sensor Signal High Voltage Abnormality	
P244B	DPF Particulate Matter (PM) Over-Trapping	DPF
P244C	DPF Deterioration	DPF
P2453	DPF Exhaust Pressure Characteristics Abnormality	DPF
	DPF Exhaust Pressure Characteristics	
P2454	Exhaust Gas Pressure Sensor Low-Side Abnormality	
P2455	Exhaust Gas Pressure Sensor High-Side Abnormality	
P2457	EGR Cooler Abnormality	
P2463	DPF Over-Accumulation	DPF
P254D	Power Take Off (PTO) Accelerator Pedal Sensor Signal High Voltage Abnormality	
P2564	Variable Geometry Turbo (VGT) Hall IC Sensor Low	
P2565	VGT Hall IC Sensor High	
P256C	Idle Air Control Valve Control Circuit Low Voltage	
P256D	Idle Air Control Valve Control Circuit High Voltage	
P268A	QR-Code Data Programming Abnormality	
U0073	CAN Bus Abnormality	
U0101	TCM CAN Communication Abnormality AT/MT	
U0106	Glow Plug Control Module (GPCM) Failure	
U010C	VGT Module Failure	
U0294	Driving Record Module (DRM) Abnormality	

8. ATTACHED MATERIALS

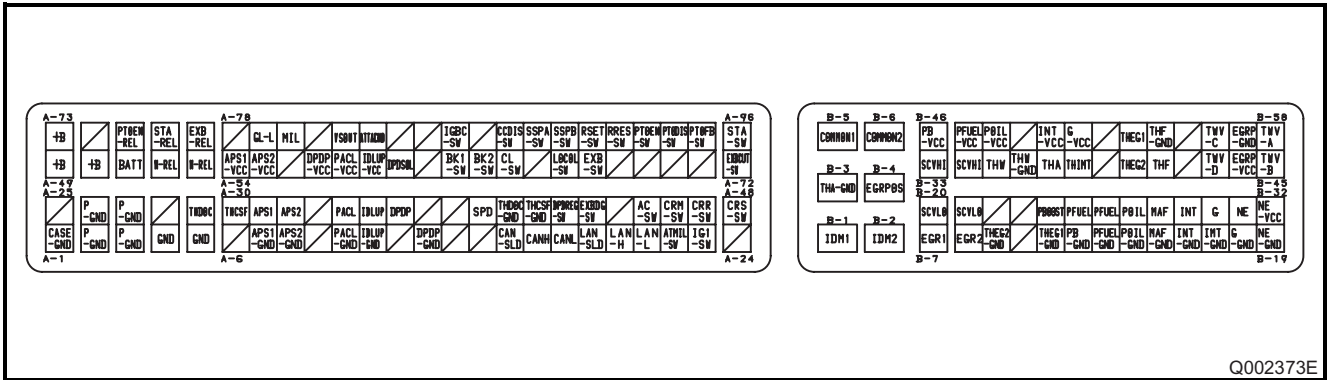
8.1 Engine ECU External Wiring Diagrams

- The wiring diagram below is for the 4HK1 engine. The 4JJ1 engine is equipped with a non-DENSO engine ECU.





8.2 ECU Connector Terminal Layout



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