

DM

DIAGNOSIS MANUAL **COMMON RAIL SYSTEM**

**V3800-CR-TE4, V3800-CR-TIE4,
V3800-CR-TE4C, V3800-CR-TIE4C,
V3800-TIE4, V3800-TIE4C(DOC only)
(OEM ENGINE)**

Kubota

Record of Revisions

For pdf, use search function {Search word} to find all the revised locations.

Last digit of the Code No.	Issue month	Main Revised Point and Corrective Measures {Search word}	Reference Page
1	2015.12	<ul style="list-style-type: none">• Added the information of V3800-TIE4, V3800-TIE4C (DOC only)	—
2	2017.02	<ul style="list-style-type: none">• Correction of fuel temperature sensor information• Correction of Biodiesel fuel information	1-M30, 1-M36, 1-S21 1-S544
3	2017.07	<ul style="list-style-type: none">• Correction of PCV (Pre-stroke Control Valve) connector information• Correction of PRV (Pressure Relief Valve) connector information• Correction of intake throttle valve connector information	1-M45, 1-S379, 1-S382, 1-S476 1-M45, 1-S382, 1-S478, 1-S522 1-S229, 1-S269, 1-S490, 1-S528

I INFORMATION

INFORMATION

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1. SAFETY FIRST

SAFETY FIRST

- This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully.
- It is essential that you read the instructions and safety regulations before you attempt to repair or use this unit.



DANGER

- Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

- Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

- Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



IMPORTANT

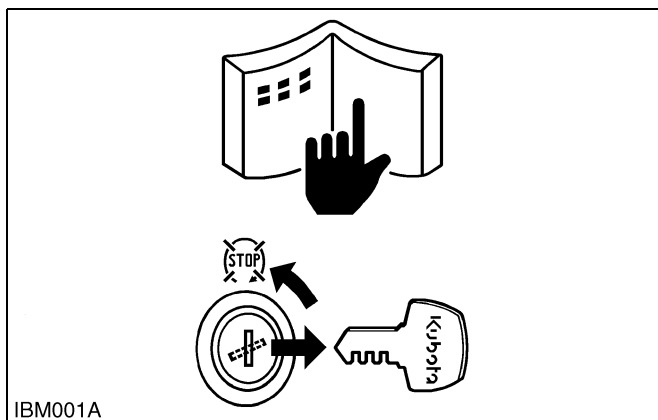
- Indicates that equipment or property damage could result if instructions are not followed.



NOTE

- Gives helpful information.

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BEFORE SERVICING AND REPAIRING

- Read all instructions and safety instructions in this manual and on your machine safety decals.
- Clean the work area and machine.
- Park the machine on a firm and level ground.
- Allow the engine to cool before proceeding.
- Stop the engine, and remove the key.
- Disconnect the battery negative cable.
- Hang a "DO NOT OPERATE" tag in operator station.

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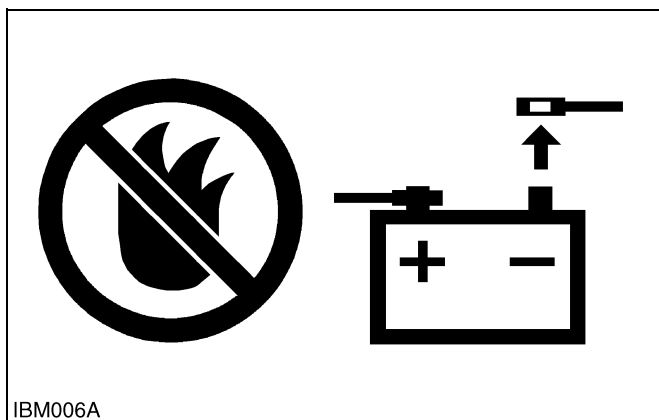
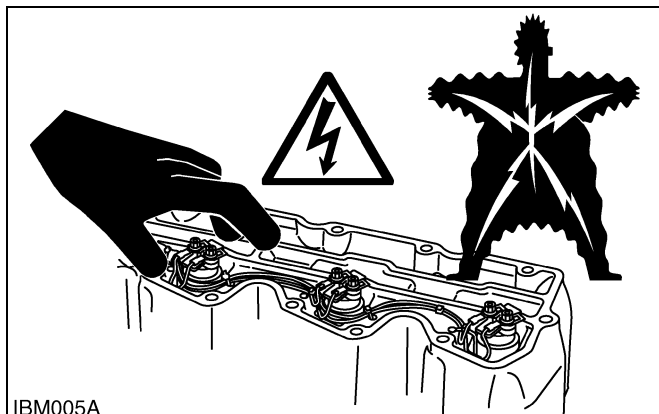
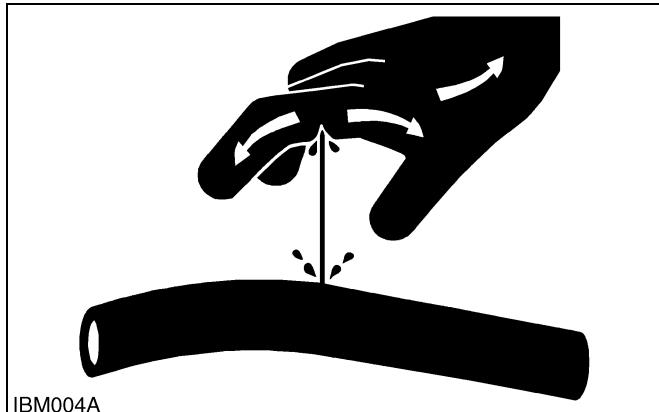
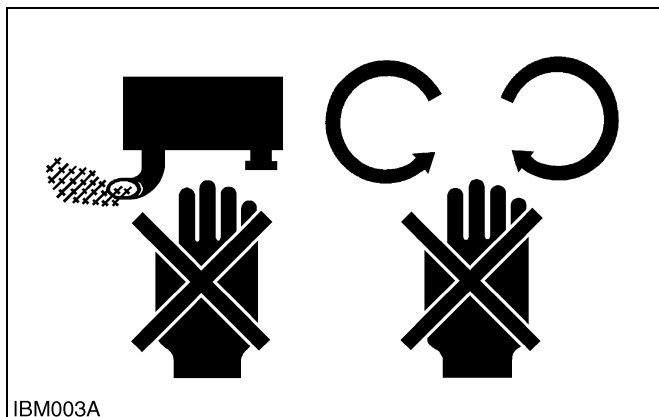
SAFETY STARTING

- Do not start the engine by shorting across starter terminals or bypassing the safety start switch.
- Unauthorized modifications to the engine may impair the function and / or safety and affect engine life.

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SAFETY WORKING

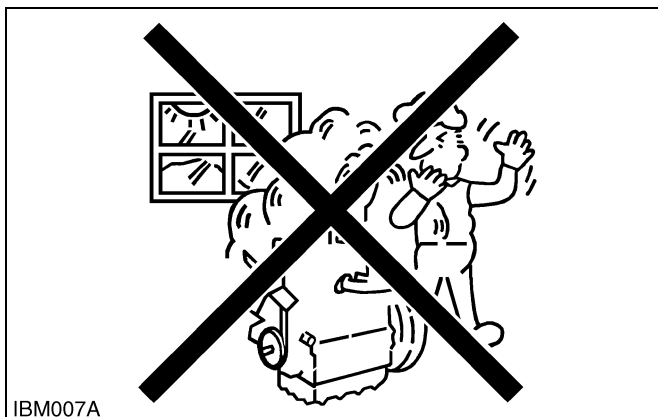
- Do not work on the machine while under the influence of alcohol, medication, or other substances or while fatigued.
- Wear close fitting clothing and safety equipment appropriate to the job.
- Use tools appropriate to the work. Makeshift tools, parts, and procedures are not recommended.
- When servicing is performed together by two or more persons, take care to perform all work safely.
- Do not touch the rotating or hot parts while the engine is running.
- Never remove the radiator cap while the engine is running, or immediately after stopping. Otherwise, hot water will spout out from radiator. Only remove radiator cap when cool enough to touch with bare hands. Slowly loosen the cap to first stop to relieve pressure before removing completely.
- Escaping fluid (fuel or hydraulic oil) under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or fuel lines. Tighten all connections before applying pressure.
- Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.
- Do not open high-pressure fuel system. High-pressure fluid remaining in fuel lines can cause serious injury. Do not disconnect or attempt to repair fuel lines, sensors, or any other components between the high-pressure fuel pump and injectors on engines with high pressure common rail fuel system.
- High voltage exceeding 100 V is generated in the ECU and injector. Pay sufficient caution to electric shock when performing work activities.

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AVOID FIRES

- Fuel is extremely flammable and explosive under certain conditions. Do not smoke or allow flames or sparks in your working area.
- To avoid sparks from an accidental short circuit, always disconnect the battery negative cable first and connect it last.
- Battery gas can explode. Keep sparks and open flame away from the top of battery, especially when charging the battery.
- Make sure that no fuel has been spilled on the engine.

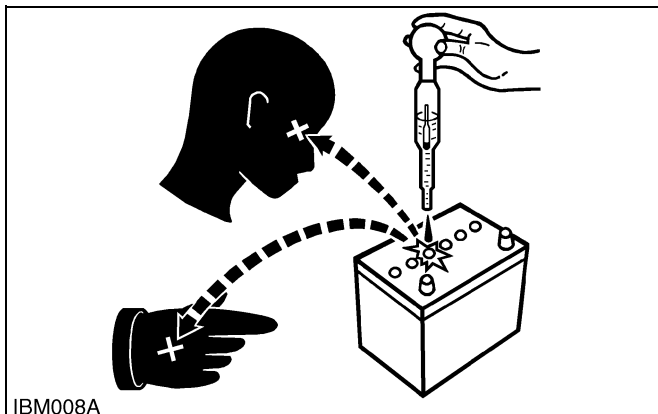
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VENTILATE WORK AREA

- If the engine must be running to do some work, make sure the area is well ventilated. Never run the engine in a closed area. The exhaust gas contains poisonous carbon monoxide.

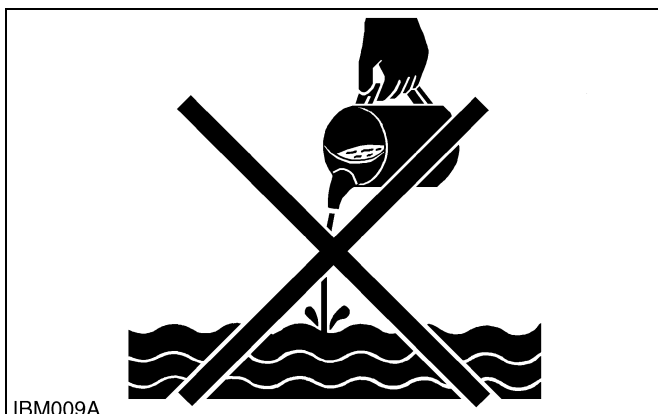
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PREVENT ACID BURNS

- Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, clothing and cause blindness if splashed into eyes. Keep electrolyte away from eyes, hands and clothing. If you spill electrolyte on yourself, flush with water, and get medical attention immediately.

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DISPOSE OF FLUIDS PROPERLY

- Do not pour fluids into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, electrolyte and other harmful waste.

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PREPARE FOR EMERGENCIES

- Keep a first aid kit and fire extinguisher handy at all times.
- Keep emergency numbers for doctors, ambulance service, hospital and fire department near your telephone.

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1 COMMON RAIL SYSTEM

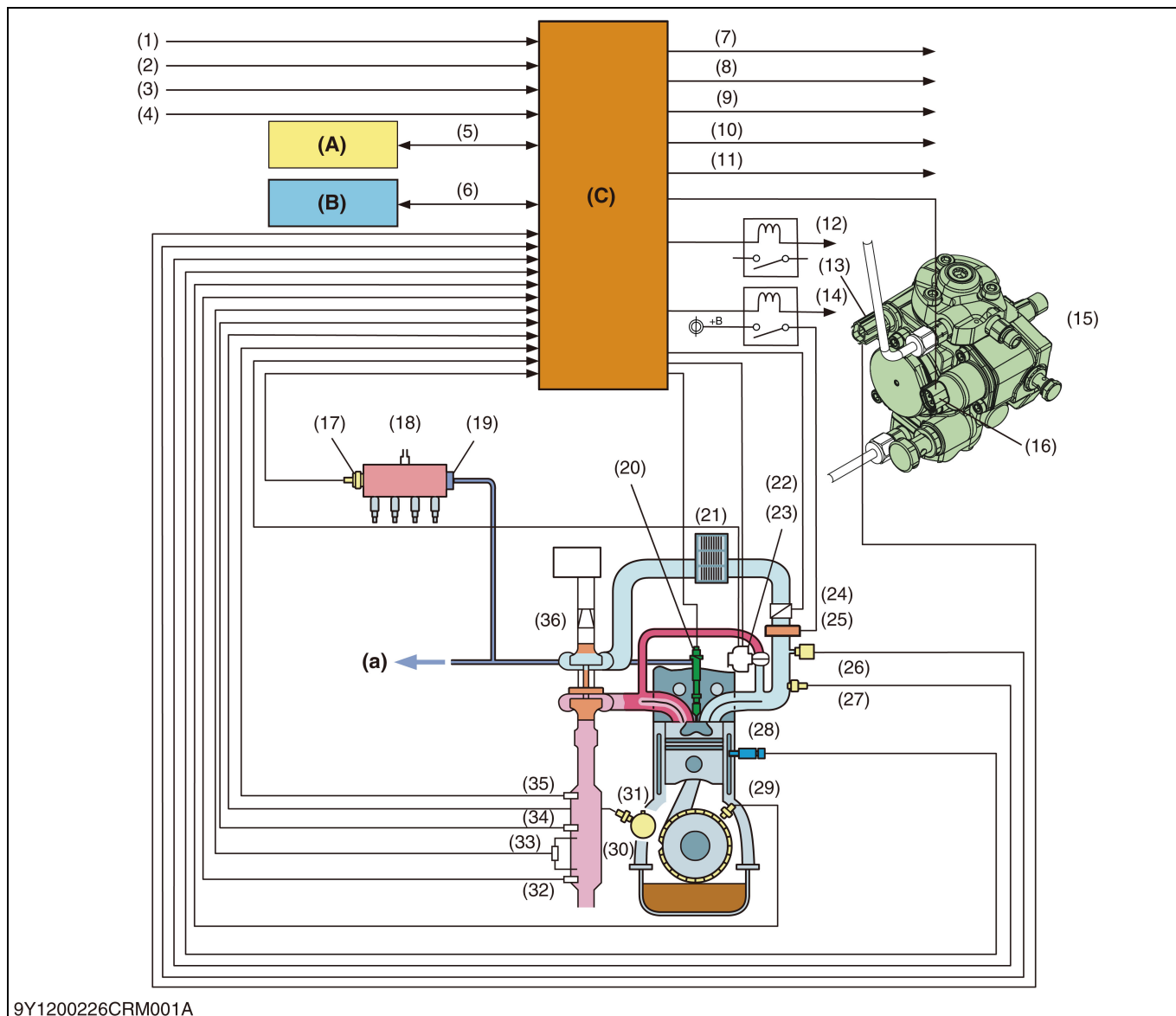
MECHANISM

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1. BASIC SYSTEM INFORMATION

[1] SYSTEM CONFIGURATION (V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)



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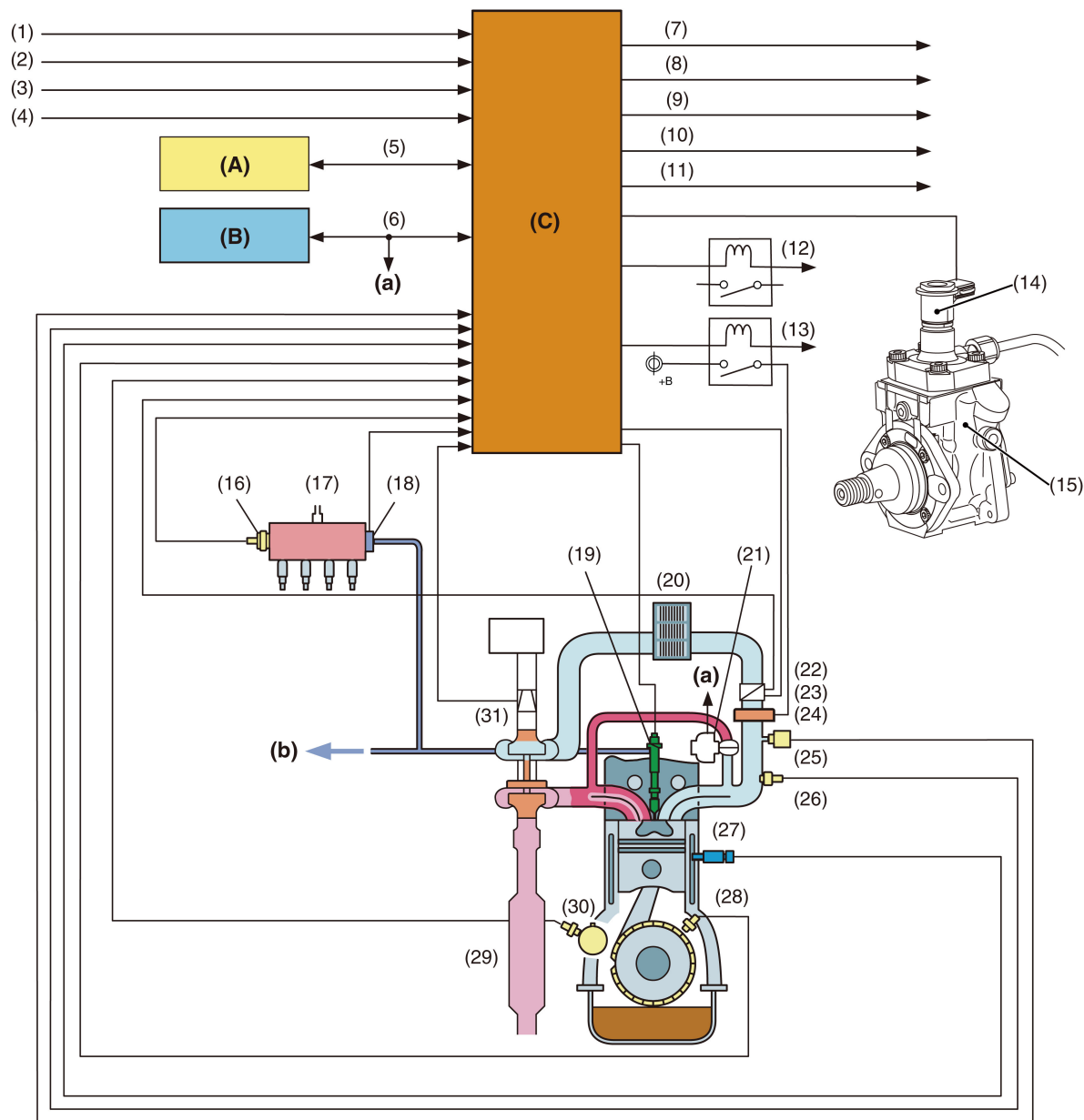
- | | | | |
|---|------------------------------------|--|---|
| (1) Key Switch ON Signal | (11) Glow (Air Heater) Lamp Signal | (26) Boost Pressure Sensor | (34) Exhaust Gas Temperature Sensor1 (T1) (DPF Inlet Exhaust Gas Temperature) |
| (2) Starter Switch Signal | (12) Starter Relay | (27) Intake Air Temperature Sensor | (35) Exhaust Gas Temperature Sensor0 (T0) (DOC Inlet Exhaust Gas Temperature) |
| (3) Emergency Stop Switch | (13) Fuel Temperature Sensor | (28) Coolant Temperature Sensor | (36) Mass Air Flow Sensor |
| (4) Oil Pressure Switch | (14) Glow (Air Heater) Relay | (29) Crankshaft Position Sensor | |
| (5) CAN Communication for OEM Machine | (15) Supply Pump | (30) Diesel Particulate Filter (Hereinafter Referred To As The "DPF") Muffler | |
| (Accelerator Position Signal*, Neutral Switch*, Machine Travel Speed Signal*) | (16) SCV (Suction Control Valve) | (31) Camshaft Position Sensor | |
| (6) CAN Communication for Service | (17) Rail Pressure Sensor | (32) Exhaust Gas Temperature Sensor2 (T2) (DPF Outlet Exhaust Gas Temperature) | |
| (7) Engine Warning Light Signal | (18) Rail | (33) Differential Pressure Sensor (DPF Differential Pressure) (ΔP) | |
| (8) Stop Lamp Signal | (19) Pressure Limiter | | |
| (9) Oil Pressure Warning Lamp Signal | (20) Injector | | |
| (10) Overheat Lamp Signal | (21) Inter cooler | | |
| | (22) EGR DC Motor | | |
| | (23) EGR Lift Sensor | | |
| | (24) Intake Throttle Valve | | |
| | (25) Intake Air Heater | | |
- (A) CAN2 Connector (For OEM Machine)
 (B) CAN1 Connector (For Service)
 (C) Engine ECU
 (a) To Fuel Tank

NOTE

- The signals marked with * are CAN communication.

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[2] SYSTEM CONFIGURATION (V3800-TIE4/-TIE4C)



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■ NOTE

- The signals marked with * are CAN communication.

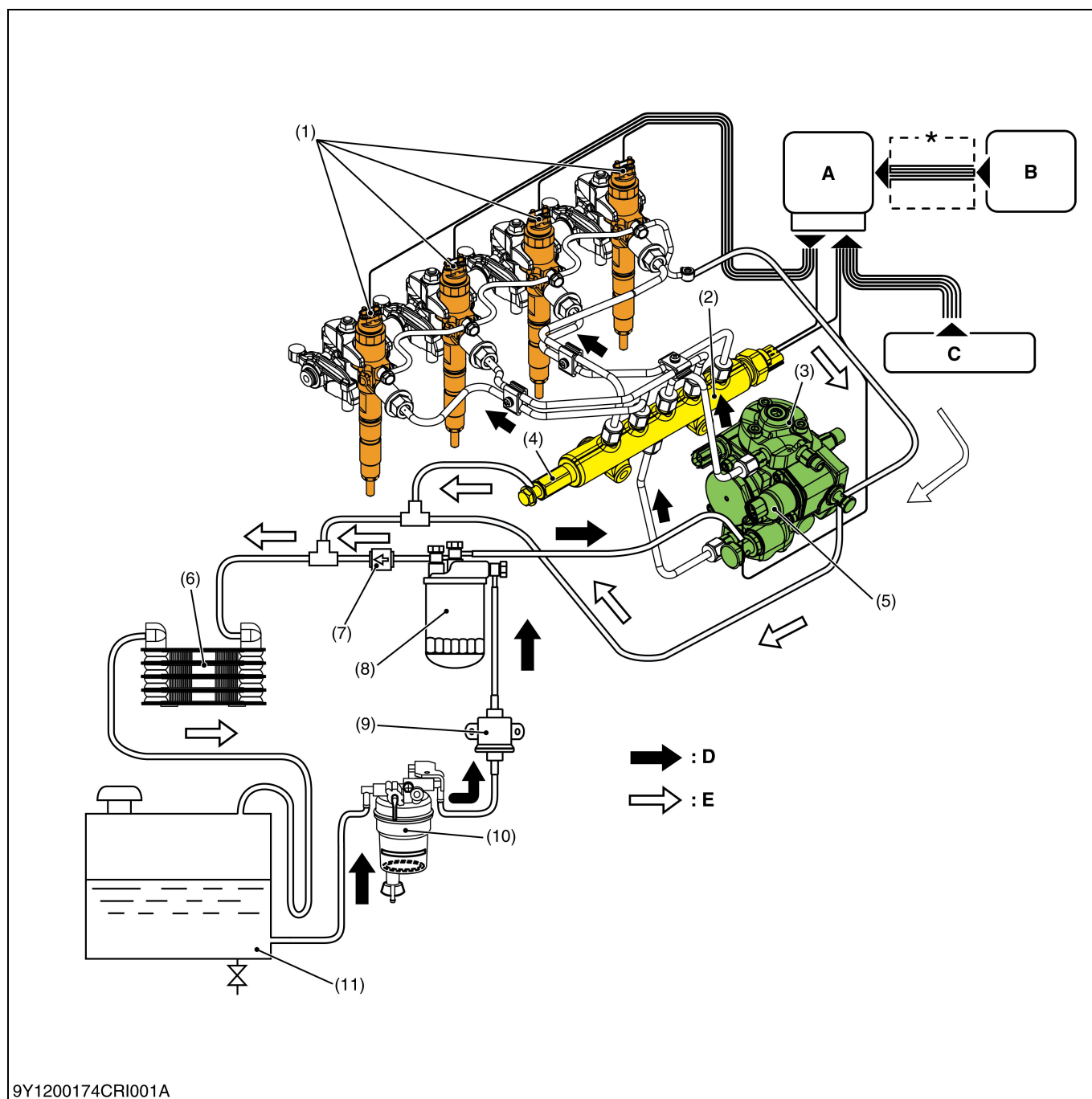
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- | | | | |
|---|--|---|---|
| (1) Key Switch ON Signal | (9) Oil Pressure Warning Lamp Signal | (20) Inter cooler | (A) CAN2 Connector
(For OEM Machine) |
| (2) Starter Switch Signal | (10) Overheat Lamp Signal | (21) EGR Valve
(CAN Communication) | |
| (3) Emergency Stop Switch | (11) Glow (Air Heater) Lamp Signal | (22) Intake Throttle Valve Sensor | (B) CAN1 Connector
(For Service) |
| (4) Oil Pressure Switch | (12) Starter Relay | (23) Intake Throttle Valve Motor | (C) Engine ECU |
| (5) CAN Communication for
OEM Machine | (13) Glow (Air Heater) Relay | (24) Intake Air Heater | (a) To CAN1 Communication |
| (Accelerator Position Signal*,
Neutral Switch*, Machine
Travel Speed Signal*) | (14) PCV
(Pre-stroke Control Valve) | (25) Intake Air Pressure Sensor | (b) To Fuel Tank |
| (6) CAN Communication for
Service | (15) Supply Pump | (26) Intake Air Temperature
Sensor | |
| (7) Engine Warning Light Signal | (16) Rail Pressure Sensor | (27) Coolant Temperature Sensor | |
| (8) Stop Lamp Signal | (17) Rail | (28) Crankshaft Position Sensor | |
| | (18) PRV
(Pressure Relief Valve) | (29) Diesel Oxidation Catalyst
(DOC) Muffler | |
| | (19) Injector | (30) Camshaft Position Sensor | |
| | | (31) Air Flow Sensor | |

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[3] FUEL SYSTEM (V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)



- (1) Injector
- (2) Rail
- (3) Supply Pump
- (4) Pressure Limiter

- (5) SCV (Suction Control Valve)
- (6) Fuel Cooler
- (7) Check Valve
- (8) Fuel Filter
- (9) Fuel Feed Pump
- (10) Water Separator
- (11) Fuel Tank

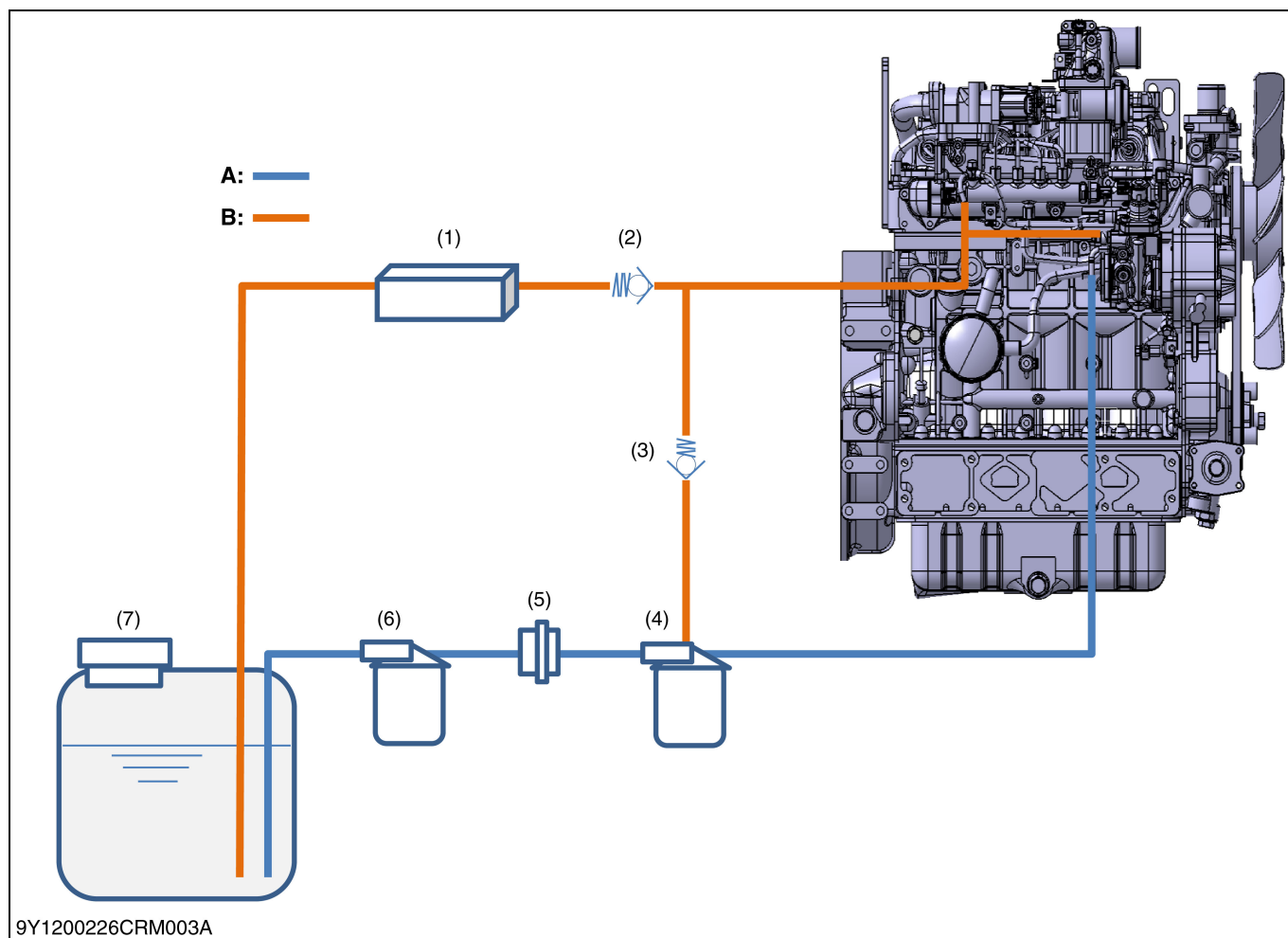
- A: ECU for Engine
- B: ECU for Machine
- C: Sensors
- D: Injected Fuel Flow
- E: Returned Fuel Flow

■ NOTE

- The signals marked with * are CAN communication.

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[4] FUEL SYSTEM (V3800-TIE4/-TIE4C)



(1) Fuel Cooler (Option)
(2) Check Valve with Pressure Regulator

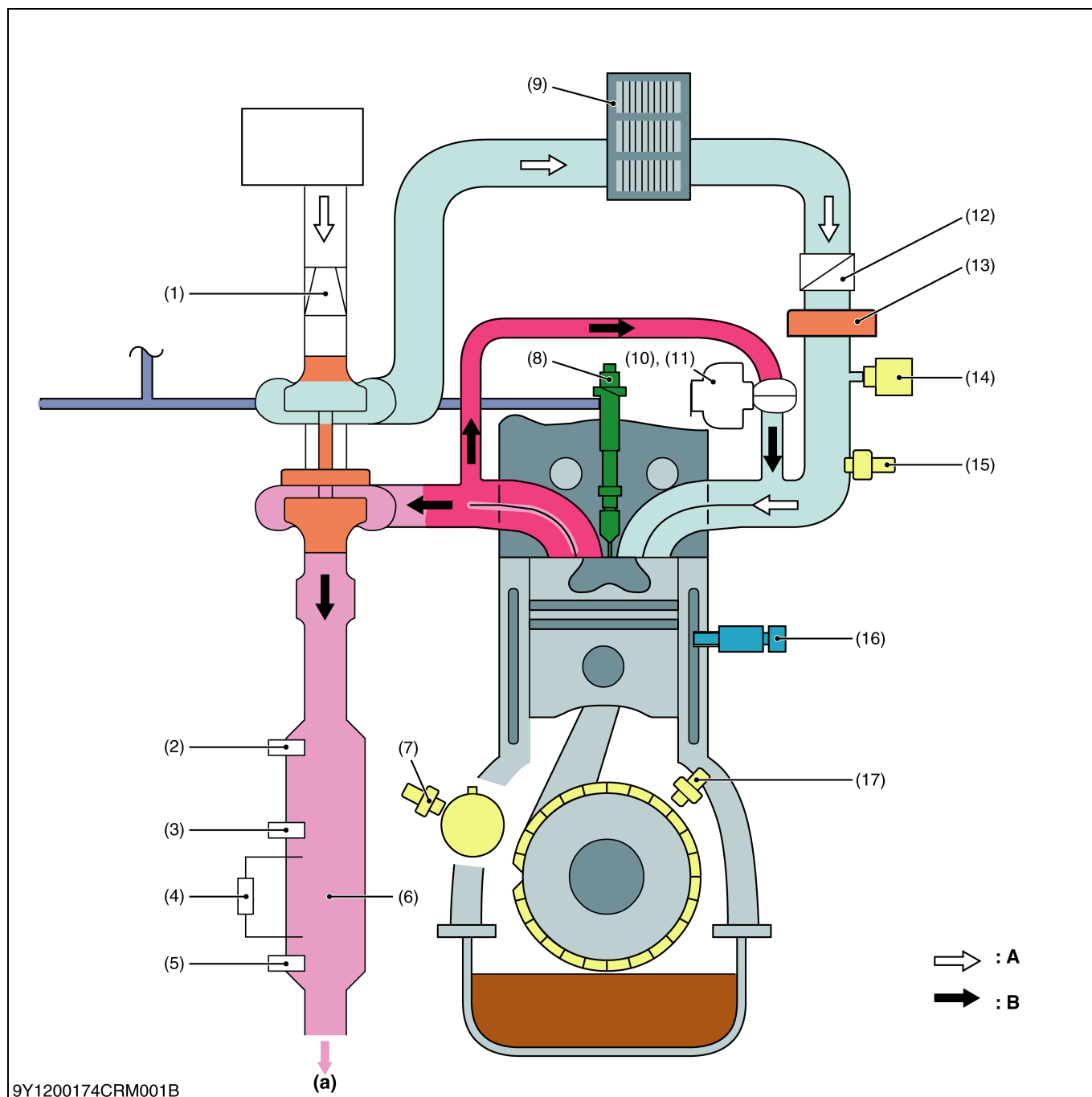
(3) Check Valve
(4) Fuel Filter
(5) Feed Pump

(6) Water Separator
(7) Fuel Tank

A: Fuel Supply
B: Fuel Return

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[5] INTAKE AND EXHAUST SYSTEM (V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)



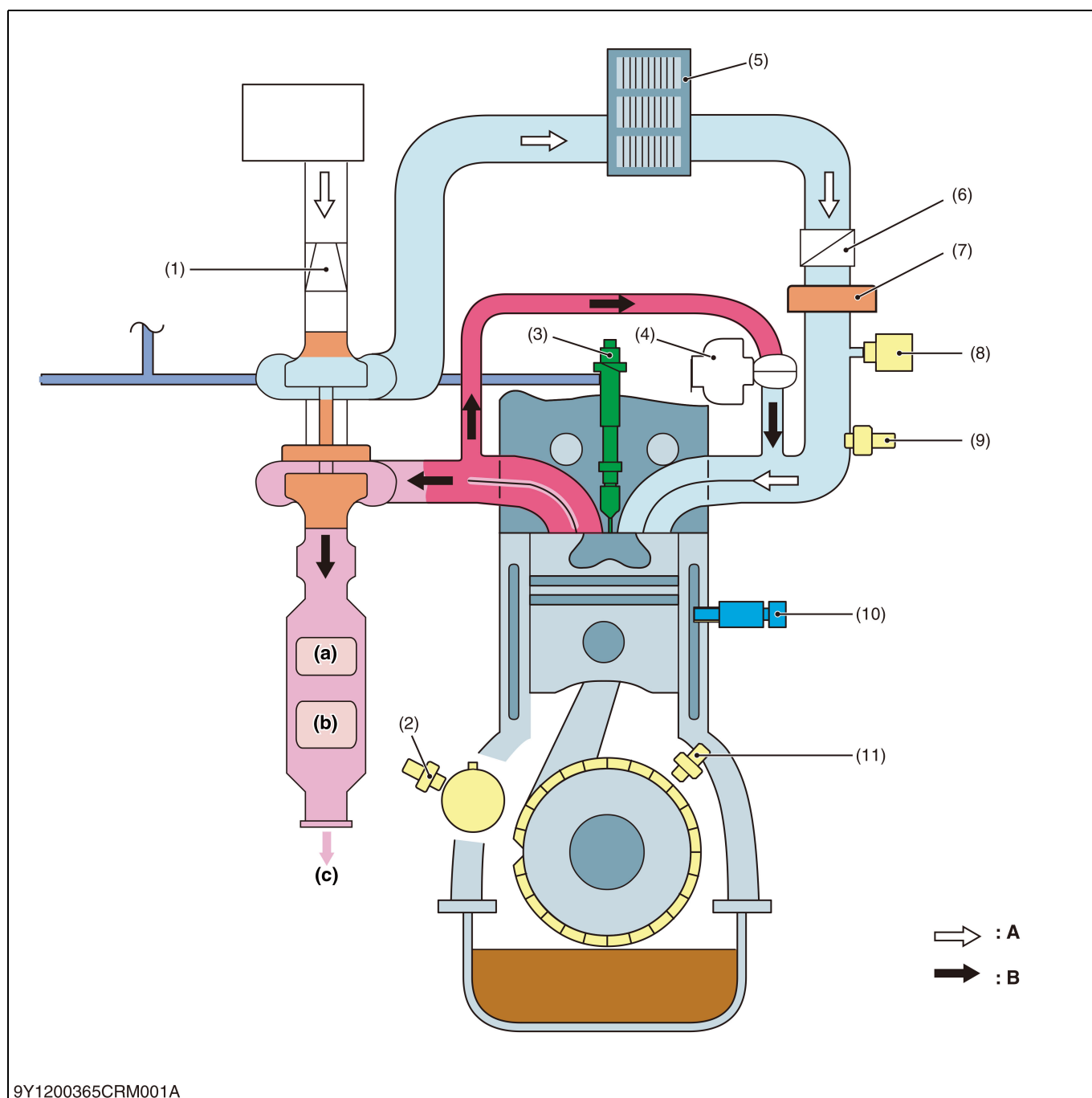
- | | | |
|--|---|------------------------------------|
| (1) Mass Air Flow Sensor | (5) Exhaust Gas Temperature Sensor2 (T2) (DPF Outlet Exhaust Gas Temperature) | (10) EGR DC Motor |
| (2) Exhaust Gas Temperature Sensor0 (T0) (DOC Inlet Exhaust Gas Temperature) | (6) Diesel Particulate Filter (Hereinafter Referred To As The "DPF") Muffler | (11) EGR Lift Sensor |
| (3) Exhaust Gas Temperature Sensor1 (T1) (DPF Inlet Exhaust Gas Temperature) | (7) Camshaft Position Sensor | (12) Intake Throttle Valve |
| (4) Differential Pressure Sensor (DPF Differential Pressure) (ΔP) | (8) Injector | (13) Intake Air Heater |
| | (9) Inter cooler | (14) Boost Pressure Sensor |
| | | (15) Intake Air Temperature Sensor |
| | | (16) Coolant Temperature Sensor |
| | | (17) Crankshaft Position Sensor |

A: Intake Air Flow
B: Exhaust Gas Flow

(a) To Muffler

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[6] INTAKE AND EXHAUST SYSTEM (V3800-TIE4/-TIE4C)



- (1) Camshaft Position Sensor
- (2) Air Flow Sensor
- (3) Injector
- (4) EGR Valve

- (5) Inter Cooler
- (6) Intake Throttle Valve
- (7) Intake Air Heater
- (8) Boost Pressure Sensor

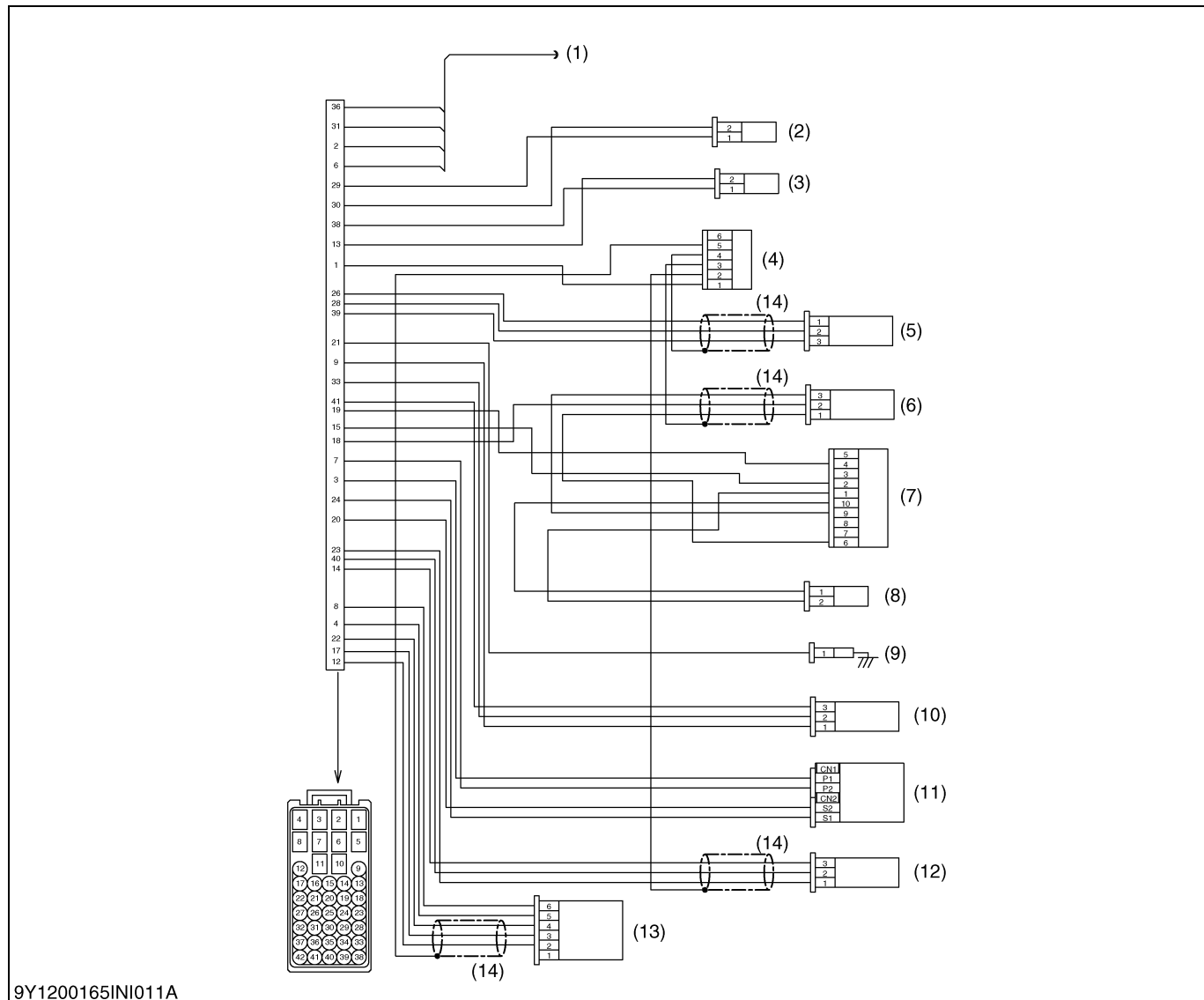
- (9) Intake Air Temperature Sensor
- (10) Coolant Temperature Sensor
- (11) Crankshaft Position Sensor

- A: Intake Air Flow**
- B: Exhaust Gas Flow**
- (a) DOC 1 (Diesel Oxidation Catalyst 1)**
- (b) DOC 2 (Diesel Oxidation Catalyst 2)**
- (c) To Muffler**

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[7] WIRING DIAGRAM

(1) Engine Intermediate Harness (Engine Side Harness) (V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)



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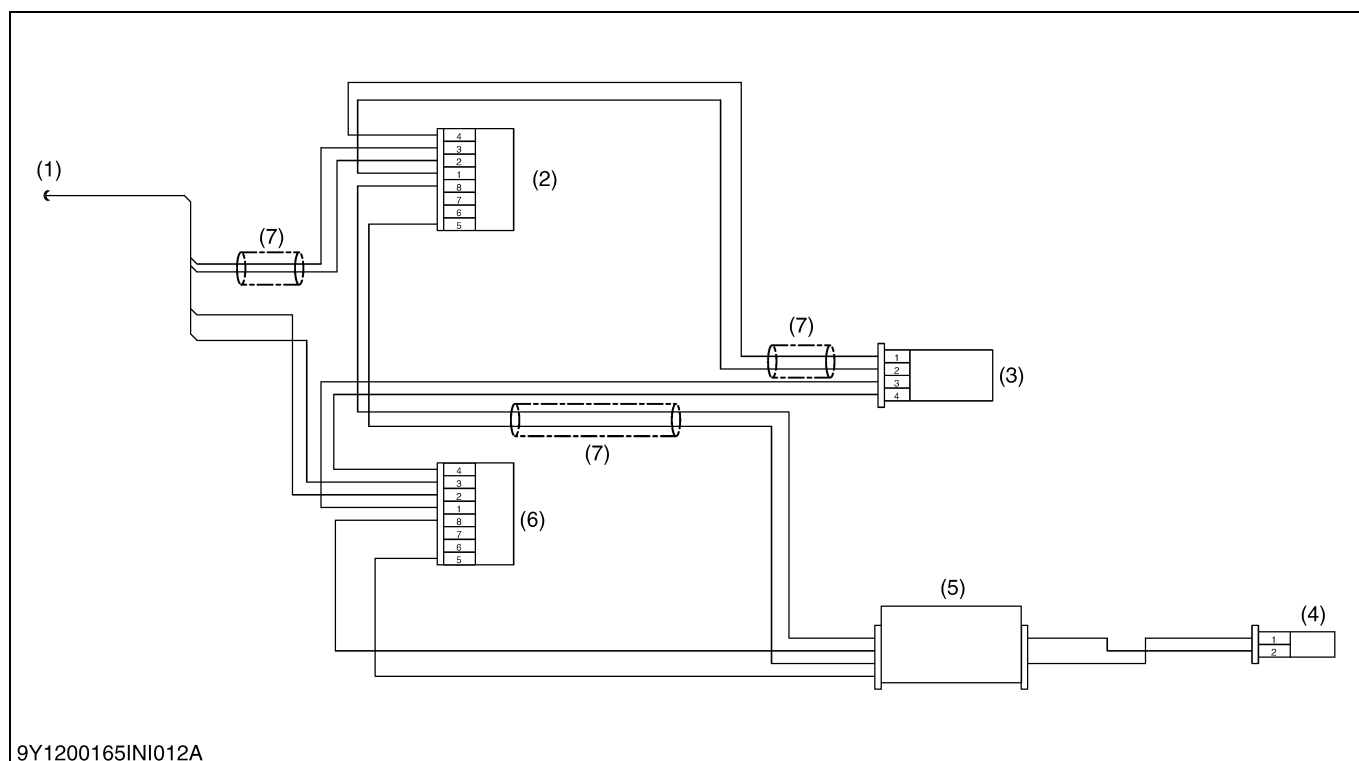
■ NOTE

- The picture shows the pin arrangement of the connector housing viewed from wire side, not mating side.
(To be continued)

(Continued)

(1)	—	CAN and EGR
(2)	CN202	Intake Air Temperature Sensor
(3)	CN203	Coolant Temperature Sensor
(4)	CN215	Engine Joint Connector 1
(5)	CN204	Rail Pressure Sensor
(6)	CN205	Crankshaft Position Sensor
(7)	CN216	Engine Joint Connector 2
(8)	CN206	Resistance Connector (1.1 kΩ)
(9)	CN207	Oil Pressure Switch
(10)	CN208	Boost Pressure Sensor
(11)	CN209 / 210	Supply Pump
(12)	CN211	Camshaft Position Sensor
(13)	CN212	Intake Throttle Valve
(14)	—	Shield Cable

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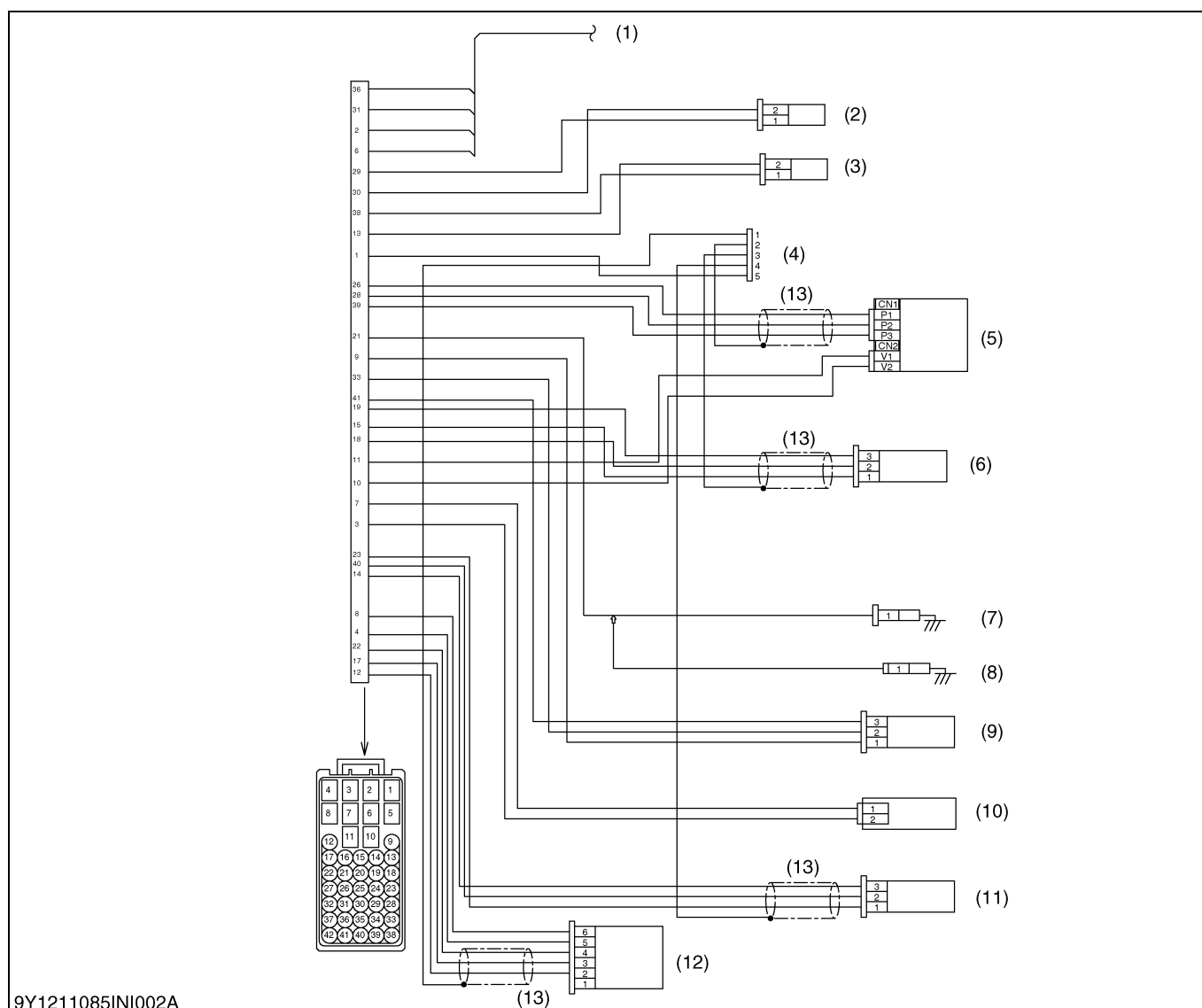
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(1)	—	CAN and EGR
(2)	CN221	Engine Joint Connector 3
(3)	CN223	EGR Valve
(4)	CN226	Resistance Connector (120 Ω)
(5)	CN224/225	Can Tool
(6)	CN222	Engine Joint Connector 4
(7)	—	Shield Cable

NOTE

- The picture shows the pin arrangement of the connector housing viewed from wire side, not mating side.

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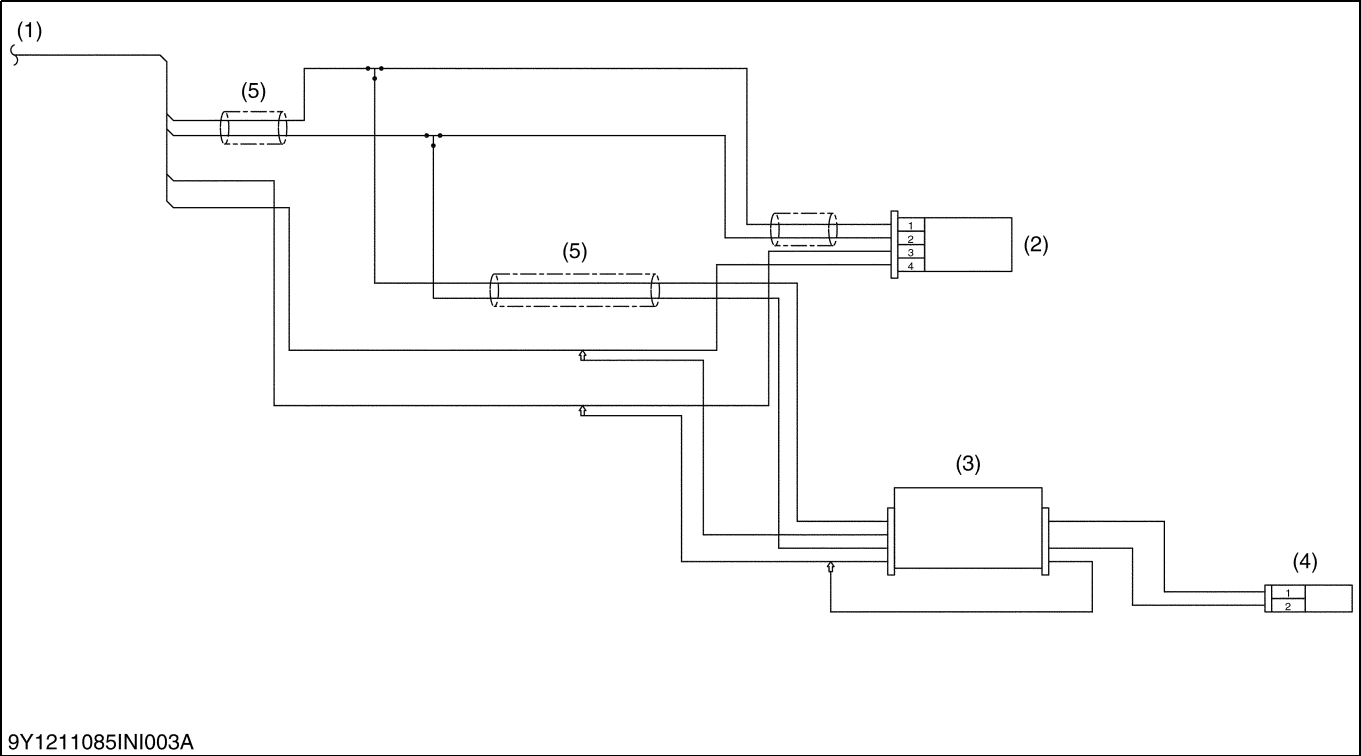
(2) Engine Intermediate Harness (Engine Side Harness) (V3800-TIE4/-TIE4C)

(1)	—	CAN and EGR
(2)	CN201	Intake Air Temperature Sensor
(3)	CN202	Coolant Temperature Sensor
(4)	—	Bonder 12 (ENG)
(5)	CN204	Rail Assembly
(6)	CN206	Crankshaft Position Sensor
(7)	CN207	Oil Pressure Switch 1
(8)	CN208	Oil Pressure Switch 2
(9)	CN209	Boost Pressure Sensor
(10)	CN210	Supply Pump Assembly
(11)	CN211	Camshaft Position Sensor
(12)	CN212	Intake Throttle Valve
(13)	—	Shield Cable

■ NOTE

- The picture shows the pin arrangement of the connector housing viewed from wire side, not mating side.

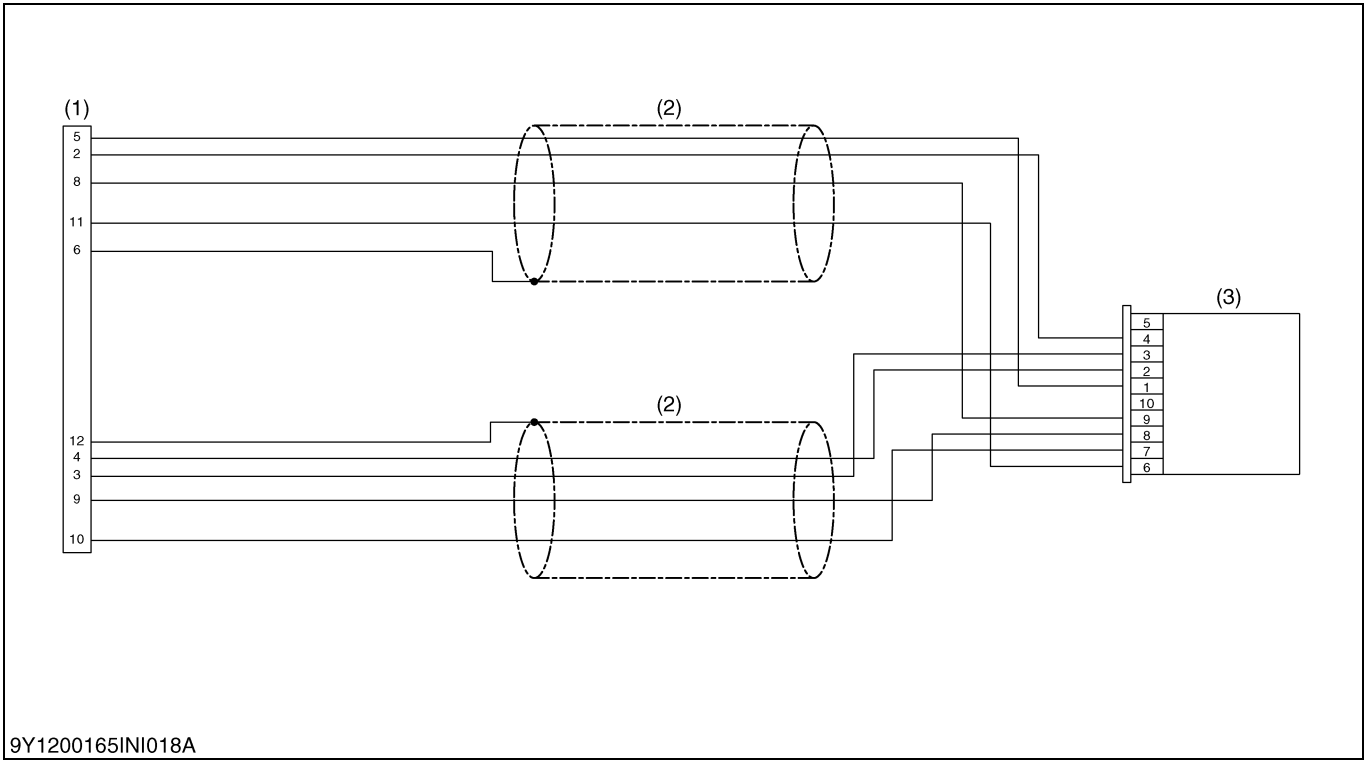
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(1)	–	CAN and EGR
(2)	CN222	EGR Valve
(3)	CN223/224	CAN Tool
(4)	–	Resistance Connector (120 Ω)
(5)	–	Shield Cable

- **NOTE**
- The picture shows the pin arrangement of the connector housing viewed from wire side, not mating side.
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(3) Injector Intermediate Harness (Engine Side Harness)



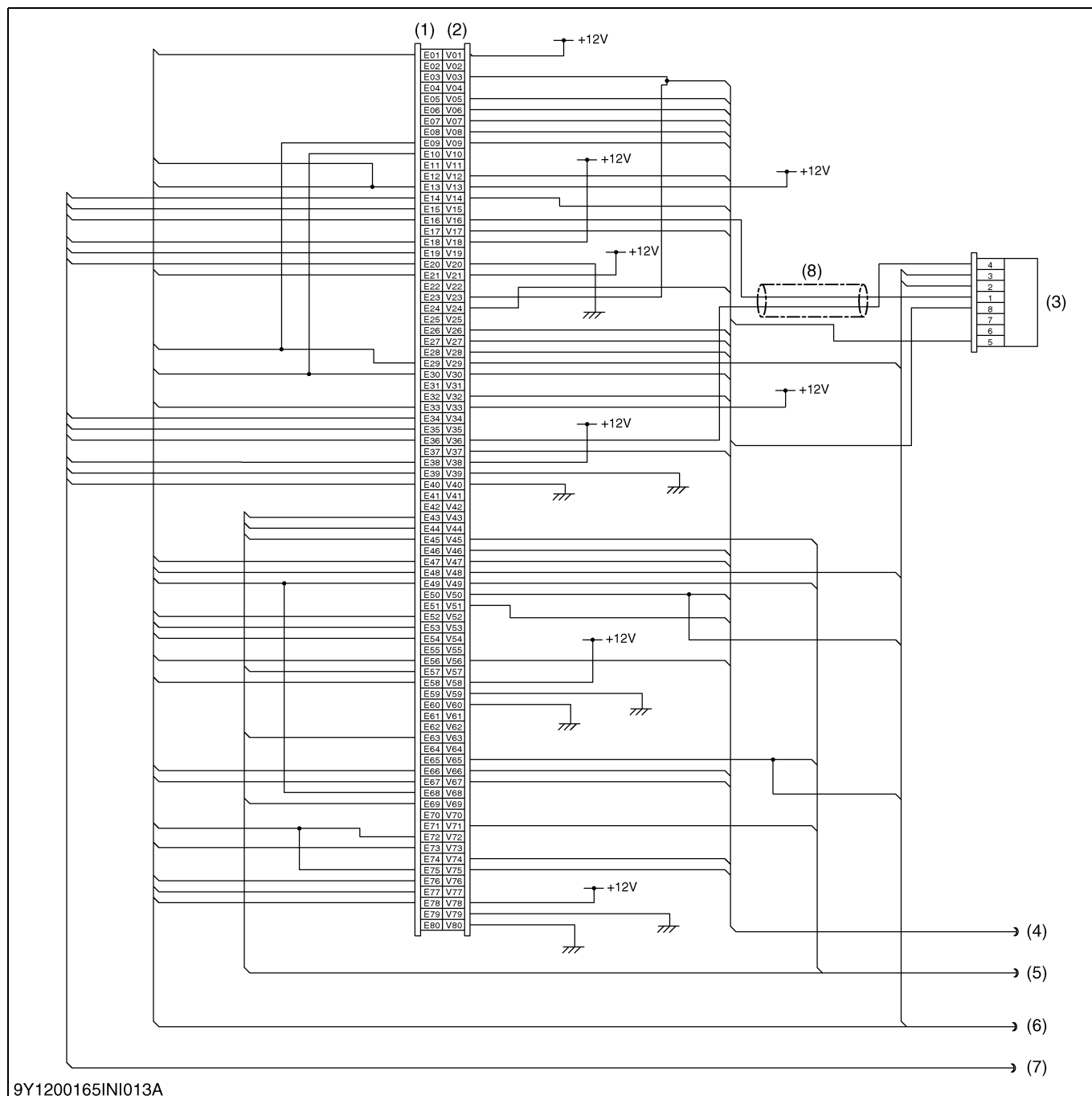
(1)	CN302	Injector Intermediate Connector
(2)	—	Shield Cable
(3)	CN301	Injector

■ NOTE

- The picture shows the pin arrangement of the connector housing viewed from wire side, not mating side.

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(4) ECU Intermediate Harness (OEM Side Harness) (V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)

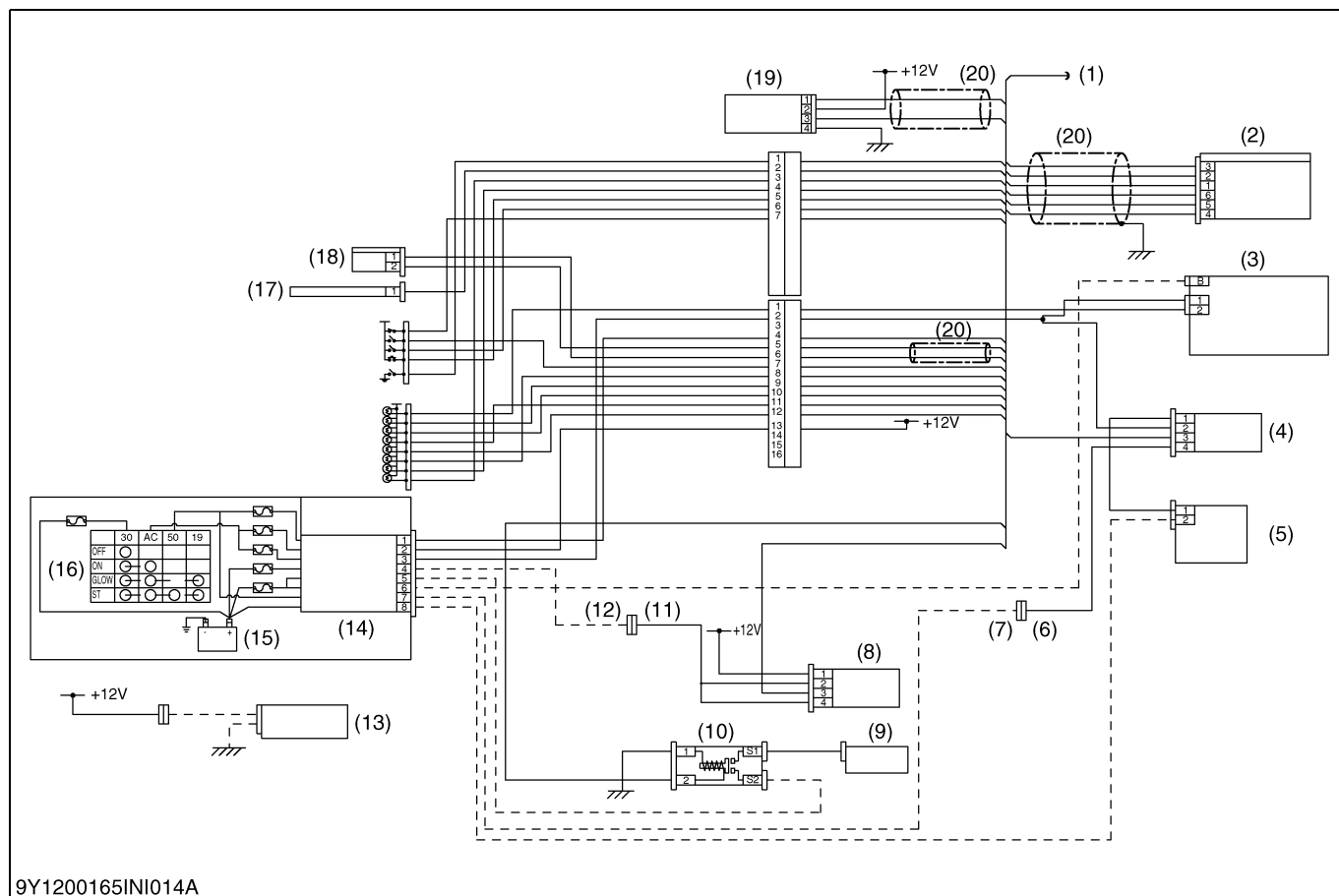


(1)	CN501	ECU (1)
(2)	CN502	ECU (2)
(3)	CN503	ECU Joint Connector 1
(4)	—	Power Unit
(5)	—	Diesel Particulate Filter (hereinafter referred to as the "DPF")
(6)	—	Engine
(7)	—	Injector
(8)	—	Shield Cable

NOTE

- The picture shows the pin arrangement of the connector housing viewed from wire side, not mating side.

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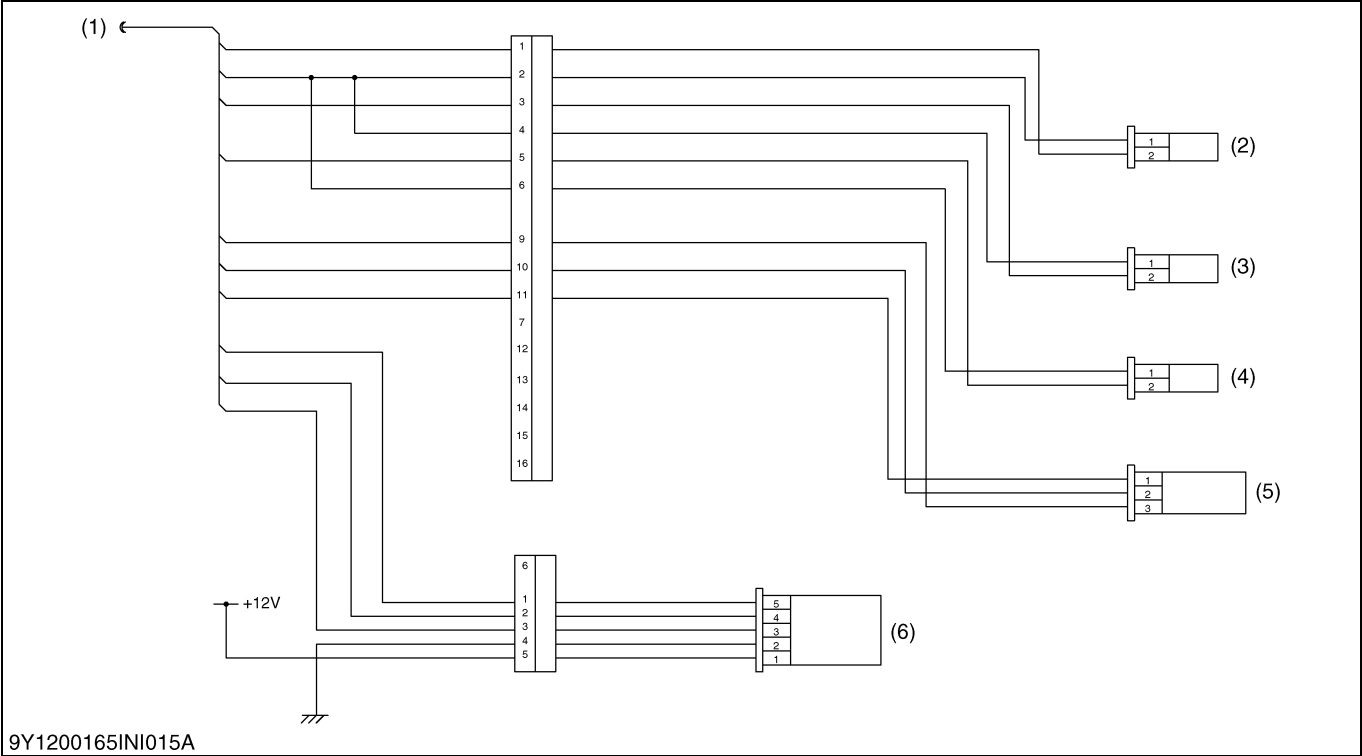


(1)	—	Power Unit
(2)	CN401	Accel Sensor
(3)	CN402	Alternator
(4)	CN403	Starter Relay
(5)	CN404	Starter
(6)	CN405	Connector
(7)	CN406	Connector
(8)	CN413	Main Relay
(9)	—	Intake Air Heater
(10)	CN416	Intake Air Heater Relay
(11)	CN414	Connector
(12)	CN415	Connector
(13)	—	Fuel Feed Pump
(14)	—	Battery Unit
(15)	—	Battery
(16)	—	Key Switch
(17)	—	Speed Sensor
(18)	—	CAN for Machine
(19)	CN407	CAN Tool
(20)	—	Shield Cable

NOTE

- The picture shows the pin arrangement of the connector housing viewed from wire side, not mating side.

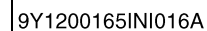
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(1)	–	Diesel Particulate Filter (DPF)
(2)	CN101	Exhaust Gas Temperature Sensor2 (T2)
(3)	CN102	Exhaust Gas Temperature Sensor1 (T1)
(4)	CN103	Exhaust Gas Temperature Sensor0 (T0)
(5)	CN104	DPF Differential Pressure Sensor (ΔP)
(6)	CN105	Mass Air Flow Sensor

- **NOTE**
- The picture shows the pin arrangement of the connector housing viewed from wire side, not mating side.

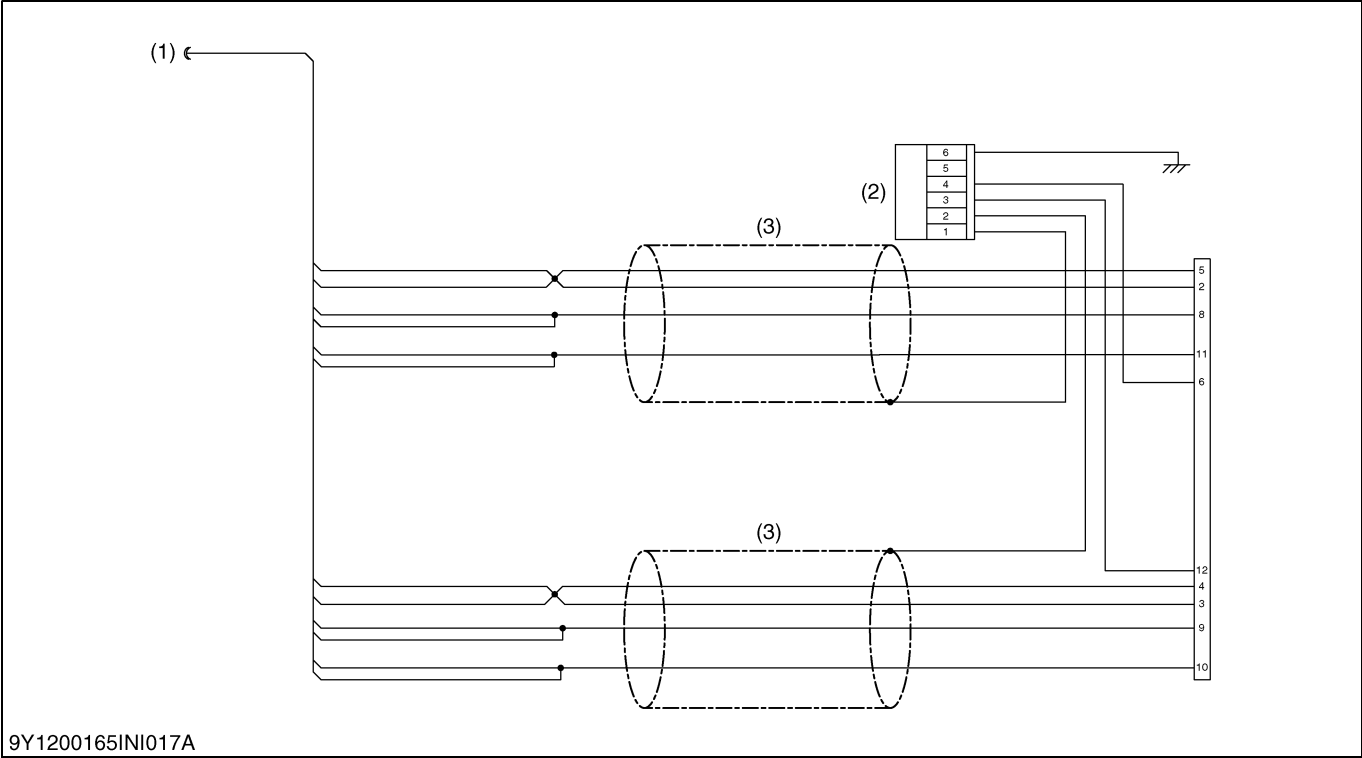
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(1)	–	Engine
(2)	CN217	ECU Joint Connector 2
(3)	–	Shield Cable

- The picture shows the pin arrangement of the connector housing viewed from wire side, not mating side.

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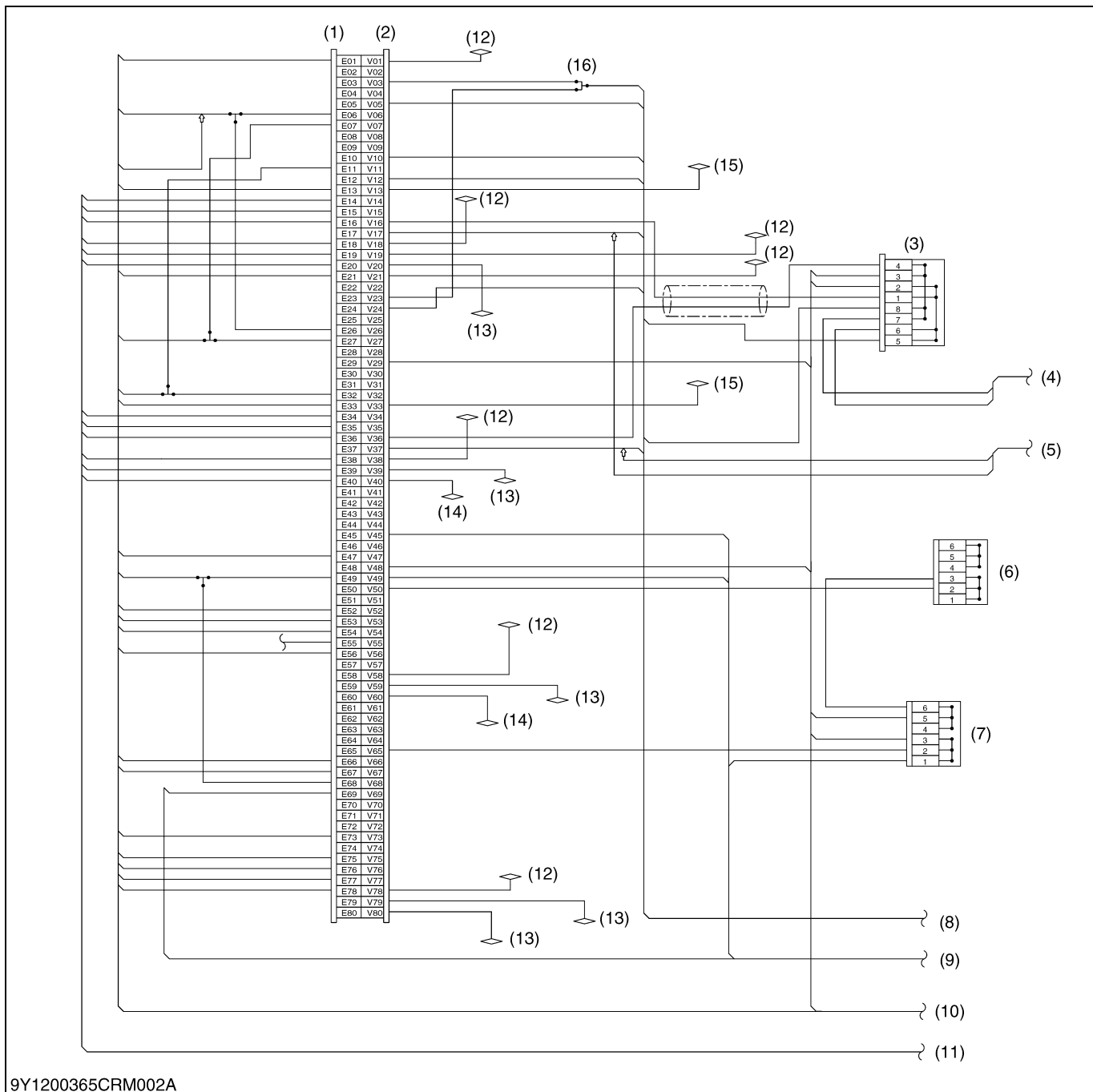


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(1)	–	Injector
(2)	CN304	ECU Joint Connector 3
(3)	–	Shield Cable

- **NOTE**
- The picture shows the pin arrangement of the connector housing viewed from wire side, not mating side.

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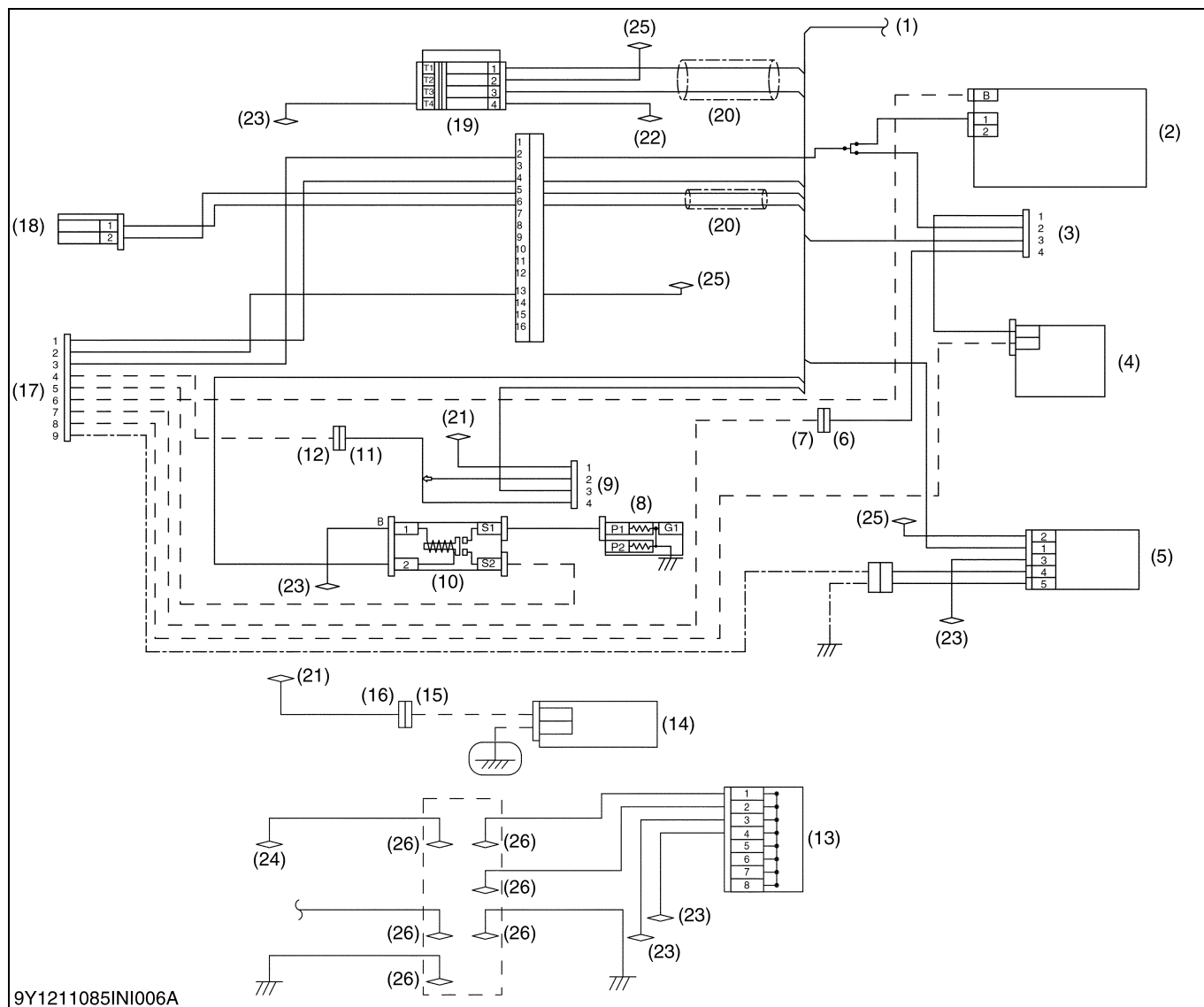
(5) ECU Intermediate Harness (OEM Side Harness) (V3800-TIE4/-TIE4C)**NOTE**

- The picture shows the pin arrangement of the connector housing viewed from wire side, not mating side.
(To be continued)

(Continued)

(1)	CN701	ECU (1)
(2)	CN702	ECU (2)
(3)	CN703	ECU Joint Connector 3
(4)	–	CAN 1
(5)	–	CAN 2
(6)	CN704	ECU Joint Connector 12
(7)	CN705	ECU Joint Connector 9
(8)	–	Power Unit
(9)	–	Mass Air Flow Sensor
(10)	–	Engine
(11)	–	Injector
(12)	–	Bonder 1 (BAT)
(13)	–	Bonder 2A (EARTH)
(14)	–	Bonder 3 (EARTH-SIG)
(15)	–	Bonder 4 (BAT-IG)

9Y1200226CRM0046US0



9Y1211085INI006A

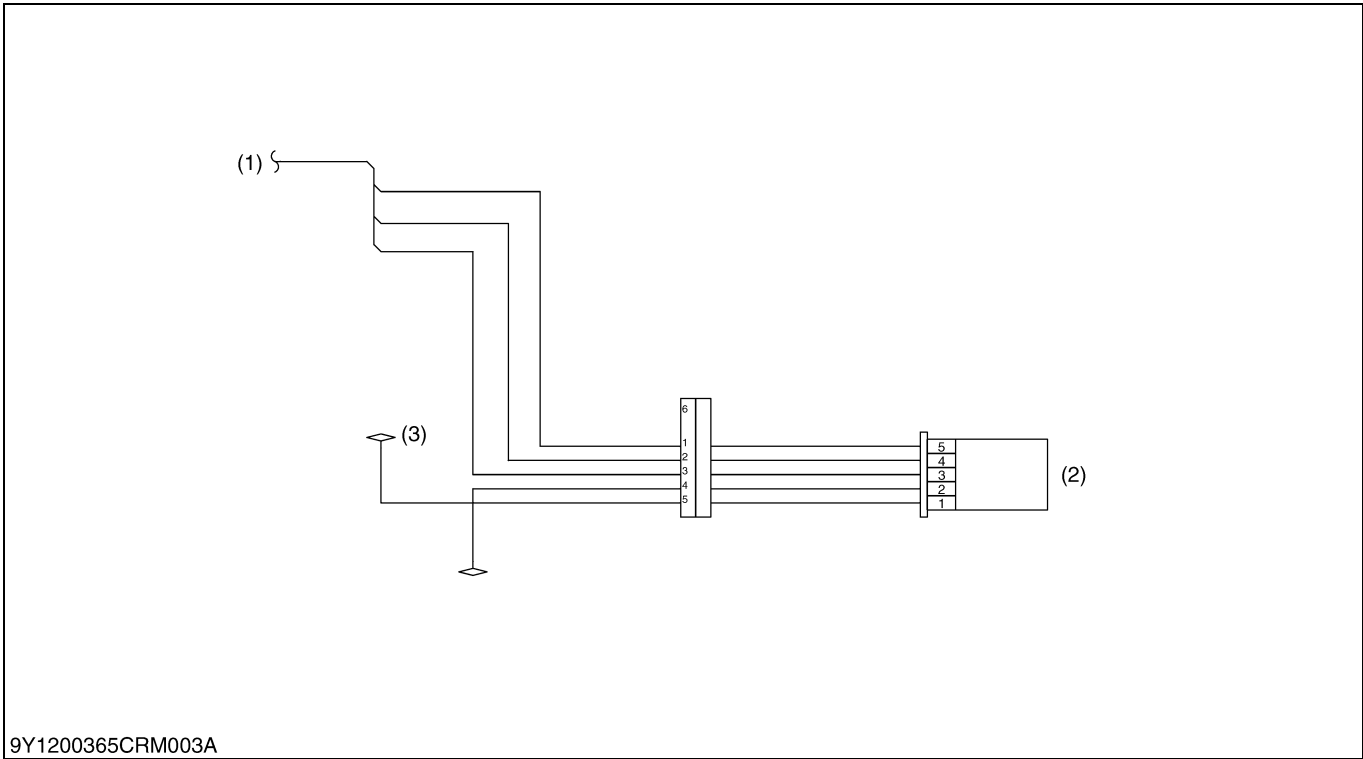
NOTE

- The picture shows the pin arrangement of the connector housing viewed from wire side, not mating side.
(To be continued)

(Continued)

(1)	–	Power Unit
(2)	CN602	Alternator
(3)	CN603	Starter Relay
(4)	CN604	Starter
(5)	CN619	Sedimenter
(6)	CN605	Connector
(7)	CN606	Connector
(8)	–	Intake Air Heater
(9)	CN613	Main Relay
(10)	CN616	Intake Air Heater Relay
(11)	CN614	Connector
(12)	CN615	Connector
(13)	CN620	ECU Joint Connector 13
(14)	–	Fuel Feed Pump
(15)	CN617	Connector
(16)	CN618	Connector
(17)	–	Battery Unit
(18)	–	CAN for Vehicle
(19)	CN607/608	CAN 1 for Service Tool
(20)	–	Shield Cable
(21)	–	Bonder 1 (BAT)
(22)	–	Bonder 2A (EARTH)
(23)	–	Bonder 2B (EARTH)
(24)	–	Bonder 3 (EARTH-SIG)
(25)	–	Bonder 4 (BAT-IG)
(26)	–	Bonder 7 (EARTH)

9Y1200226CRM0053US0



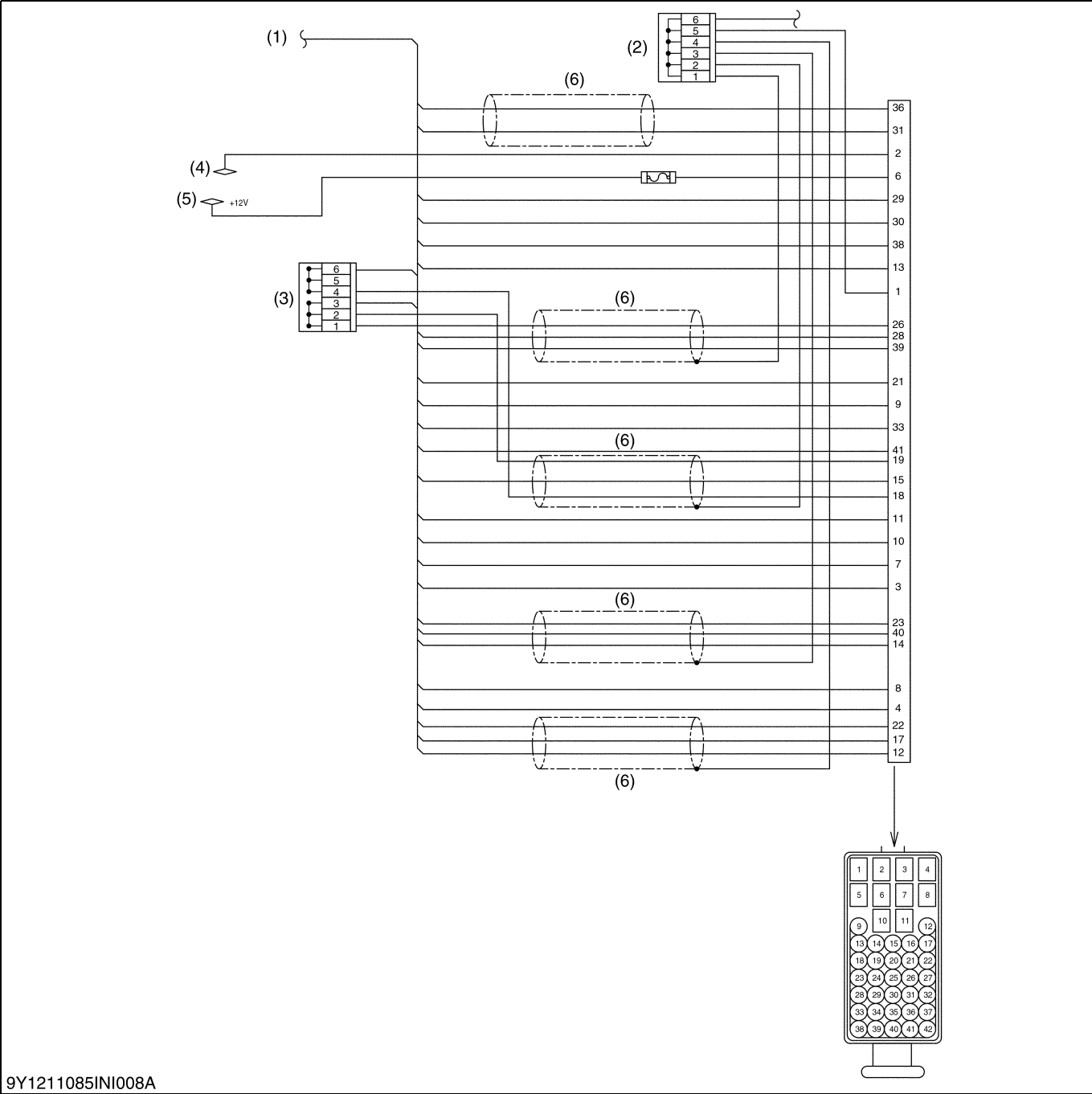
9Y1200365CRM003A

(1)	—	Mass Air Flow Sensor
(2)	CN105	Mass Air Flow Sensor
(3)	—	Bonder 1 (BAT)

■ NOTE

- The picture shows the pin arrangement of the connector housing viewed from wire side, not mating side.

9Y1200226CRM0054US0



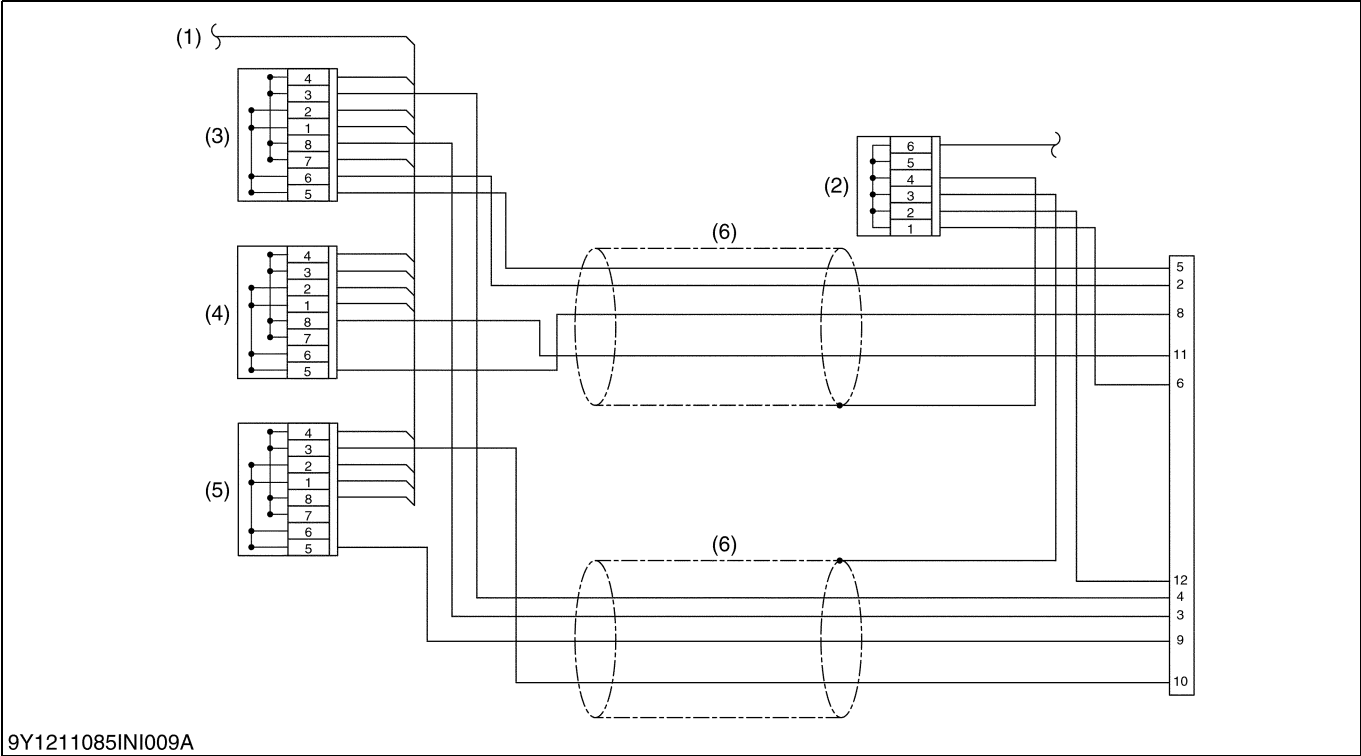
9Y1211085INI008A

(1)	–	Engine
(2)	CN215	ECU Joint Connector 5
(3)	CN216	ECU Joint Connector 8
(4)	–	Bonder 2A (EARTH)
(5)	–	Bonder 1 (BAT)
(6)	–	Shield Cable

NOTE

- The picture shows the pin arrangement of the connector housing viewed from wire side, not mating side.

9Y1200226CRM0055US0



(1)	—	Injector
(2)	CN304	ECU Joint Connector 7
(3)	CN305	ECU Joint Connector 2
(4)	CN306	ECU Joint Connector 11
(5)	CN307	ECU Joint Connector 6
(6)	—	Shield Cable

■ **NOTE**

- The picture shows the pin arrangement of the connector housing viewed from wire side, not mating side.

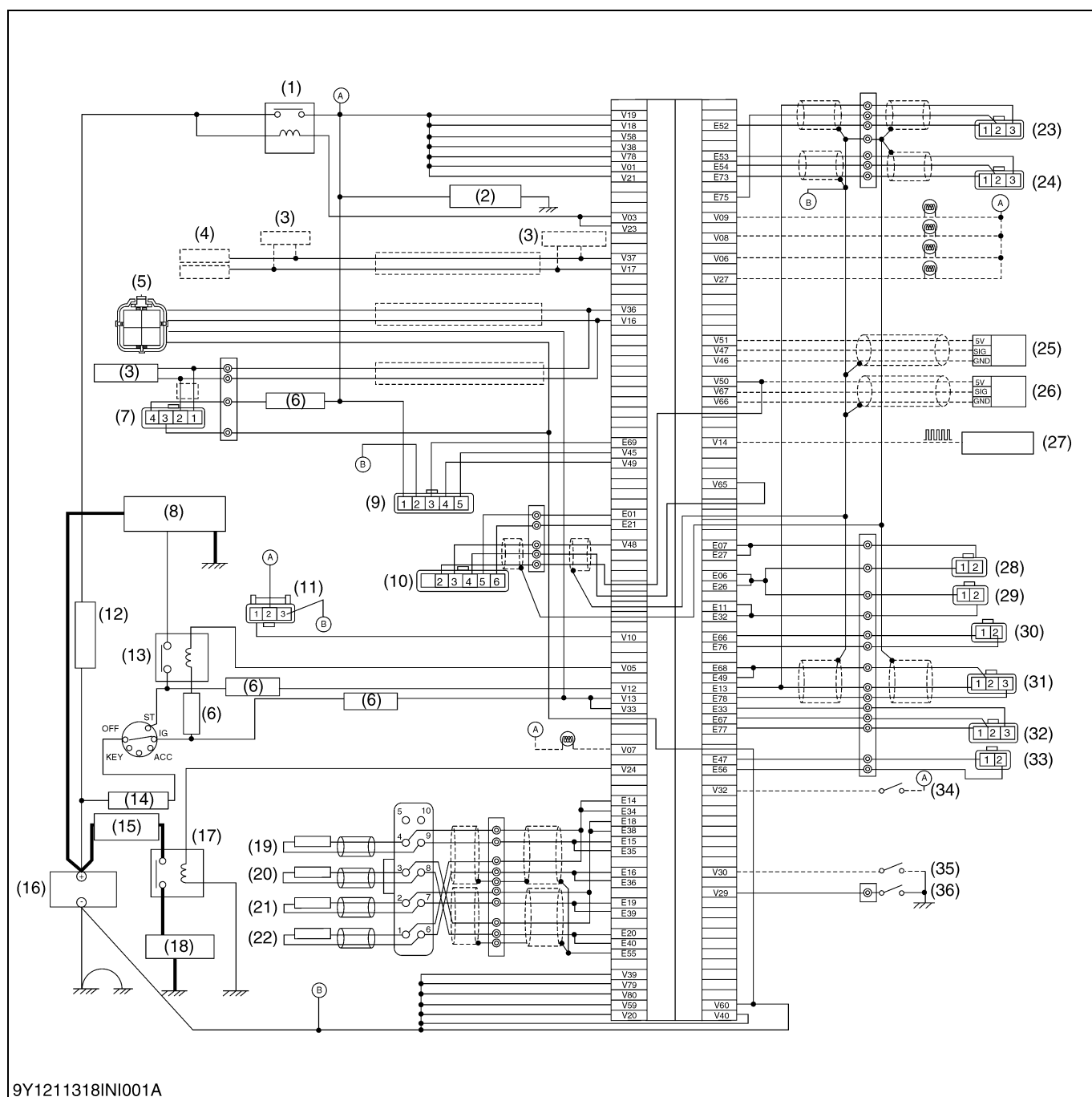
9Y1200226CRM0056US0

9Y1200165INI010A

- | | | | |
|---|---------------------------------|---------------------------------------|--|
| (1) Main Relay | (10) Battery | (21) Machine Speed Sensor | (29) Stop Switch |
| (2) Fuel Feed Pump | (11) Intake Air Heater Relay | (22) DPF Differential Pressure | (30) Parked Regeneration Switch |
| (3) CAN1 Connector
(For Service) | (12) Intake Air Heater | Sensor (ΔP) | (31) Parking Switch |
| (4) CAN2 Connector
(For OEM Machine) | (13) Injector 1 | (23) SCV (Suction Control Valve) | (32) Regeneration Inhibit Switch |
| | (14) Injector 2 | (24) Fuel Temperature Sensor | (33) Neutral Switch |
| | (15) Injector 3 | (25) Coolant Temperature Sensor | (34) DPF Exhaust Gas
Temperature Sensor (T_0) |
| (5) EGR Valve | (16) Injector 4 | (26) Rail Pressure Sensor | |
| (6) Starter | (17) Crankshaft Position Sensor | (27) Boost Pressure Sensor | (35) DPF Exhaust Gas
Temperature Sensor (T_1) |
| (7) Mass Air Flow Sensor | (18) Camshaft Position Sensor | (28) Intake Air Temperature
Sensor | (36) DPF Exhaust Gas
Temperature Sensor (T_2) |
| (8) Intake Throttle Valve | (19) Accel Sensor 1 | | |
| (9) Starter Relay | (20) Accel Sensor 2 | | |

■ **NOTE**

- Terminal names and terminal numbers marked with * have become invalid.

(7) System Wiring Diagram (V3800-TIE4/-TIE4C)

- | | | | |
|----------------------------------|---------------------------------|--|--|
| (1) Main Relay | (11) Sedimenter Switch (Option) | (23) Crankshaft Position Sensor (NE Sensor) | (29) PRV (Pressure Relief Valve) |
| (2) Fuel Feed Pump | (12) FUSE (30 A) | (24) Camshaft Position Sensor (G Sensor) | (30) Coolant Temperature Sensor |
| (3) Resistance Connector (120 Ω) | (13) Starter Relay | (25) Accel Sensor 1 (or via CAN Message) | (31) Rail Pressure Sensor |
| (4) CAN2 Connector (For Vehicle) | (14) FUSE (50 A) | (26) Accel Sensor 2 (or via CAN Message) | (32) Boost Sensor |
| (5) CAN1 Connector (For Service) | (15) FUSE (120 A) | (27) Vehicle Speed Sensor (or via CAN Message) | (33) Intake Air Temperature Sensor |
| (6) FUSE (5 A) | (16) Battery | (28) PCV (Pre-stroke Control Valve) | (34) Stop Switch (or via CAN Message) |
| (7) EGR Valve | (17) Intake Air Heater Relay | | (35) Neutral Switch (or via CAN Message) |
| (8) Starter | (18) Intake Air Heater | | (36) Oil Pressure Switch |
| (9) Air Flow Sensor | (19) Injector 1 | | |
| (10) Intake Throttle Valve | (20) Injector 2 | | |
| | (21) Injector 3 | | |
| | (22) Injector 4 | | |

9Y1200226CRM0047US0

[8] AVAILABLE DATA MONITOR SIGNALS (LEVEL 1)

(1) Monitor Items (V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)

Classification		Signal Name	Unit	Terminal Name	Terminal No.
Input	Pulse / Rotary signal	Engine speed active flag	—	—	—
		Cam speed active flag	—	—	—
		Engine speed	min ⁻¹ (rpm)	NE + / -	E52 / E72
		Machine speed *	km/h	SPD	V14
	Analog signal	Accelerator pedal position	%	—	—
		Accelerator pedal position sensor 1 output voltage *	V	APS1	V47
		Accelerator pedal position sensor 2 output voltage *	V	APS2	V67
		Boost pressure	kPa	—	—
		Boost pressure sensor output voltage	V	PIM	E67
		Fuel temperature	°C	—	—
		Fuel temperature sensor output voltage	V	THF	E48
		Coolant temperature	°C	—	—
		Coolant temperature sensor output voltage	V	THW	E66
		Intake air temperature	°C	—	—
		Intake air temperature sensor output voltage	V	THA	E47
		Atmospheric pressure	kPa	—	—
		Atmospheric pressure sensor output voltage	V	PATM	—
		Battery voltage	V	+BP	V18, V38, V58, V78
	Digital signal	Key switch	—	IG-SW	V13, V33
		Starter switch	—	STA-SW	V12
		Neutral switch *	—	N-SW	V30

■ NOTE

- The signals marked with * are inputs from ECU for machine through CAN. Terminal names and terminal numbers have become invalid.

9Y1200226CRM0034US0

Classification		Signal Name	Unit	Terminal Name	Terminal No.
Output	Basic control signal	Final fuel injection quantity	mm ³ /st	—	—
		Target rail pressure	MPa	—	—
		Actual rail pressure MPa	MPa	—	—
		Rail pressure sensor output voltage	V	PFUEL 1/2	E68 / E49
		Target suction control valve (SCV) current	mA	—	—
		Actual suction control valve (SCV) current	mA	SCV+ / —	E09, E29/E10, E30
		Pump learning condition	—	—	—
		Pump difference learning correction value	mA	—	—
		Pressure feedback integral guard flag	—	—	—
		Engine stop flag	—	—	—
		Low temperature start mode flag	—	—	—
		Registration history (#1 cylinder)	—	—	—
		Registration history (#2 cylinder)	—	—	—
		Registration history (#3 cylinder)	—	—	—
		Registration history (#4 cylinder)	—	—	—
		Number of registrations (#1 cylinder)	—	—	—
		Number of registrations (#2 cylinder)	—	—	—
		Number of registrations (#3 cylinder)	—	—	—
		Number of registrations (#4 cylinder)	—	—	—
	Actuator	Exhaust gas recirculation (EGR) valve target position	%	—	(CAN1)
		Exhaust gas recirculation (EGR) valve actual position	%	—	(CAN1)
		Exhaust gas recirculation (EGR) position sensor output	—	—	(CAN1)
		Glow (air heater) relay	—	GRLY	V24

9Y1200226CRM0035US0

Classification		Signal Name	Unit	Terminal Name	Terminal No.
Output	DPF data	Differential pressure 1 output voltage	V	DPS	E45
		Exhaust gas temperature 0 output voltage	V	IDOC	E44
		Exhaust gas temperature 1 output voltage	V	ODOC	E63
		Exhaust gas temperature 2 output voltage	V	ODPF	E43
		Intake air temperature built-in MAF output voltage	V	IATS	V49
		Intake throttle valve lift output voltage	V	ITS	V48
		Differential pressure 1	kPa	—	—
		Exhaust gas temperature 0	°C	—	—
		Exhaust gas temperature 1	°C	—	—
		Exhaust gas temperature 2	°C	—	—
		Mass air flow for intake throttle	kg/h	—	—
		Intake air temperature built-in MAF	°C	—	—
		Target intake throttle valve opening	%	—	—
		Intake throttle final duty control quantity	%	—	—
		Intake throttle valve lift	%	—	—
		PM sedimentation quantity 1	mg	—	—
		PM sedimentation quantity 2	mg	—	—
		Final fuel injection quantity multiplication quantity	L	—	—
		Target mass air flow	kg/h	—	—
		Pump learning end time	h	—	—
		Hour meter	h	—	—
		DPF auto regeneration last active time	sec	—	—
		Regeneration running time	min	—	—
		Source address of TSC1	—	—	—
		Parking SW	—	—	—
		Neutral SW	—	—	—
		DPF auto regeneration inhibit SW	—	—	—
		DPF manual regeneration force SW	—	—	—
		Oil pressure SW	—	—	—
		Target speed of isochronous control	min ⁻¹ (rpm)	—	—
		DPF regeneration control level	—	—	—
		DPF regeneration control status	—	—	—

9Y1200226CRM0036US0

(2) Monitor Items (V3800-TIE4/-TIE4C)

Classification		Signal Name	Unit	Terminal Name	Terminal No.
Input	Pulse / Rotary signal	Engine speed active flag	—	—	—
		Cam speed active flag	—	—	—
		Engine speed	min ⁻¹ (rpm)	NE + / -	E52 / E75
		Machine speed *	km/h	SPD	V14
	Analog signal	Accelerator pedal position	%	—	—
		Accelerator pedal position sensor 1 output voltage *	V	APS1	V47
		Accelerator pedal position sensor 2 output voltage *	V	APS2	V67
		Boost pressure	kPa	—	—
		Boost pressure sensor output voltage	V	PIM	E67
		Coolant temperature	°C	—	—
		Coolant temperature sensor output voltage	V	THW	E66
		Intake air temperature	°C	—	—
		Intake air temperature sensor output voltage	V	THA	E47
		Atmospheric pressure	kPa	—	—
		Atmospheric pressure sensor output voltage	V	PATM	—
		Battery voltage	V	+BP	V18, V38, V58, V78
	Digital signal	Key switch	—	IG-SW	V13, V33
		Starter switch	—	STA-SW	V12
		Neutral switch *	—	N-SW	V30

■ NOTE

- The signals marked with * are inputs from ECU for machine through CAN. Terminal names and terminal numbers have become invalid.

9Y1200226CRM0057US0

Classification		Signal Name	Unit	Terminal Name	Terminal No.
Output	Basic control signal	Final fuel injection quantity	mm ³ /st	—	—
		Target rail pressure	MPa	—	—
		Actual rail pressure MPa	MPa	—	—
		Rail pressure sensor output voltage	V	PFUEL 1/2	E68 / E49
		Pump angle error learning value (HP5)	CA	—	—
		Pump angle error learning end flag (HP5)	—	—	—
		Final discharge quantity	mm ³ /st	—	—
		Actual discharge quantity	mm ³ /st	—	—
		PCV valve closing timing	CA	—	—
		PCV current carrying start timing	CA	—	—
		PCV current carrying period	μsec	—	—
		Pressure feedback integral guard flag	—	—	—
		Engine stop flag	—	—	—
		Low temperature start mode flag	—	—	—
		Registration history (#1 cylinder)	—	—	—
		Registration history (#2 cylinder)	—	—	—
		Registration history (#3 cylinder)	—	—	—
		Registration history (#4 cylinder)	—	—	—
		Number of registrations (#1 cylinder)	—	—	—
		Number of registrations (#2 cylinder)	—	—	—
		Number of registrations (#3 cylinder)	—	—	—
		Number of registrations (#4 cylinder)	—	—	—
	Actuator	Exhaust gas recirculation (EGR) valve target position	%	—	(CAN1)
		Exhaust gas recirculation (EGR) valve actual position	%	—	(CAN1)
		Exhaust gas recirculation (EGR) position sensor output	—	—	(CAN1)
		Glow (air heater) relay	—	GRLY	V24

9Y1200226CRM0058US0

Classification		Signal Name	Unit	Terminal Name	Terminal No.
Output	DOC data	Intake air temperature built-in MAF output voltage	V	IATS	V49
		Intake throttle valve lift output voltage	V	ITS	V48
		Mass air flow for intake throttle	kg/h	—	—
		Intake air temperature built-in MAF	°C	—	—
		Target intake throttle valve opening	%	—	—
		Intake throttle final duty control quantity	%	—	—
		Intake throttle valve lift	%	—	—
		Target mass air flow	kg/h	—	—
		Pump learning end time	h	—	—
		Hour meter	h	—	—
		Oil pressure SW	—	—	—
		Target speed of isochronous control	min ⁻¹ (rpm)	—	—

9Y1200226CRM0059US0

(3) Normal Value (V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)

Classification		Signal Name	Unit	Engine Stops	During Start-Up	Idling	During Acceleration	During No-load Maximum Speed
Input	Pulse / Rotary signal	Engine speed	min ⁻¹ (rpm)	0	0 → 800 (Ordinary temperature)	Approx. 800 (After warm-up)	Approx. 800 → 2700	Approx. 2700 (After warm-up)
		Engine speed active flag	–	OFF	ON	ON	ON	ON
		Cam speed active flag	–	OFF	ON	ON	ON	ON
		Machine speed	km/h	When the machine stopped: 0				
	Analog signal	Final accelerator pedal position opening	%	0	0	0	0 → 100	100
		Accelerator pedal position sensor 1 output voltage	V	Sensor unused by CAN input				
		Accelerator pedal position sensor 2 output voltage	V					
		Boost pressure	kPa	Approx. 100	Approx. 100	Approx. 100	–	–
		Boost pressure sensor output voltage	V	Approx. 1.0	Approx. 1.0	Approx. 1.0	–	–
		Fuel temperature	°C	Representative value: Approx. 20 °C (68 °F) → Approx. 2.4 V				
		Fuel temperature sensor output voltage	V					
		Coolant temperature	°C	Representative value: Approx. 20 °C (68 °F) → Approx. 2.4 V				
		Coolant temperature sensor voltage output	V					
		Intake air temperature	°C	Representative value: Approx. 20 °C (68 °F) → Approx. 2.4 V				
		Intake air temperature sensor output voltage	V					
		Atmospheric pressure	kPa	Representative value: Approx. 100 kPa → 3.7 V (Depending on the atmospheric pressure)				
		Atmospheric pressure sensor output voltage	V					
		Battery voltage	V	When stopped: Approx. 12.5 V When operating: Approx. 14 V (Depends on the battery charging condition, whether or not there is a load voltage, rotation speed)				
	Digital signal	Key Switch	–	ON	ON	ON	ON	ON
		Start switch	–	OFF	ON	OFF	OFF	OFF
		Neutral switch	–	During neutral: ON				

9Y1200226CRM0037US0

Classification		Signal Name	Unit	Engine Stops	During Start-Up	Idling	During Acceleration	During No-load Maximum Speed	
Output	Basic control signal	Final fuel injection quantity	mm ³ /st	0 (Indication value - 50)	0 → 80 (Ordinary temperature)	Approx. 12 (After warm-up)	Approx. 12→75 (After warm-up)	Approx. 30 (After warm-up)	
		Target rail pressure	MPa	Depends on the rotation speed, load (After warm-up) When idling: Approx. 40 to 50 MPa (410 to 500 kgf/cm ² , 5800 to 7200 psi) During no-load maximum speed: 95.0 to 115 MPa (969 to 1170 kgf/cm ² , 13800 to 16600 psi) During acceleration: 95.0 to 130 MPa (969 to 1320 kgf/cm ² , 13800 to 18800 psi)					
		Actual rail pressure Mpa	MPa	—	Approx. the same as the target value (Follow to the target value)				
		Rail pressure sensor output voltage	V	Depends on the rotation speed, load (After warm-up) When stopped: Approx. 1.0 V When idling: 1.65 to 1.80 V During no-load maximum speed: 2.50 to 2.85 V During acceleration: 2.5 to 3.3 V					
		Target suction control valve (SCV) current	mA	—	1700 to 2000	Approx. 1800	Approx. 1400	Approx. 1600	
		Actual suction control valve (SCV) current	mA	Approx. the same as the target value (Follow to the target value)					
		Pump learning condition	—	Normally 2 or 3* ¹ Indicates the following depending on the learning status: 255 (Default value), 1 (Provisional learning completion), 0 (Actual learning), 2 (Actual learning completion), 3 (Relearning)					
		Pump deviation learning correction value	mA	±200 mA (Guideline * ²)					
		Pressure feedback integral guard flag	—	Normally OFF					
		Engine stop flag	—	ON	OFF	OFF	OFF	OFF	
		Low temperature start mode flag	—	OFF	ON	OFF	OFF	OFF	

■ NOTE

- *1: Very occasionally, it does not shift from 3 to 2. If there is an engine malfunction on the status above, perform the forced-relearning.
- *2: As the following value of A varies depending on pump, the table above is for guideline. If the value of A has a wider gap than the initial learning value, there may be out of the range of the above table.
A net normal value is the value that provided by the forced-learning several times: Compared with A
12 V spec: $A - 100 \leq \text{normal value} \leq A + 50$
The current shall be used as a reference (guideline) only as this value varies depending on the pump used.

Classification		Signal Name	Unit	Engine Stops	During Start-Up	Idling	During Acceleration	During No-load Maximum Speed
Output	Actuator	Exhaust gas recirculation (EGR) valve target position	%	Depends on the rotation speed, load and temperature				
		Exhaust gas recirculation (EGR) valve actual position	%	Approx. the same as the target EGR position (Follow to the target value)				
		Exhaust gas recirculation (EGR) position sensor output	—	16 to 106 (CAN communication data) (Valve lift: 0 to 10 mm)				
		Glow (air heater) relay	—	Only during cold start-up (before-and-after): ON				
	DPF data	Differential pressure 1	kPa	Input range: -1.7 to 34.5 kPa Output range: 0.5 to 4.5 V				
		Differential pressure 1 sensor output voltage	V					
		Exhaust gas temperature 0	°C	Representative value: Approx. 100 °C (212 °F) → Approx. 4.4 V Representative value: Approx. 250 °C (482 °F) → Approx. 2.3 V				
		Exhaust gas temperature 0 sensor output voltage	V					
		Exhaust gas temperature 1	°C	Representative value: Approx. 100 °C (212 °F) → Approx. 4.4 V Representative value: Approx. 250 °C (482 °F) → Approx. 2.3 V				
		Exhaust gas temperature 1 sensor output voltage	V					
		Exhaust gas temperature 2	°C	Representative value: Approx. 100 °C (212 °F) → Approx. 4.4 V Representative value: Approx. 250 °C (482 °F) → Approx. 2.3 V				
		Exhaust gas temperature 2 sensor output voltage	V					
		Intake air temperature built-in MAF	°C	Representative value: Approx. 20 °C (68 °F) → Approx. 3.1 V Representative value: Approx. 80 °C (176 °F) → Approx. 0.9 V				
		Intake air temperature built-in MAF sensor output voltage	V					
		Mass air flow for intake throttle	kg/h	12.96 to 698.4 (1.239 to 4.598 V)				
		Intake throttle valve lift	%	100 (Full open)	100 (Full open)	100 to 0		
		Intake throttle valve lift output voltage	V	Approx. 0.5 V	Approx. 0.5 V	0.5 to 4.375 V		

9Y1200226CRM0038US0

(4) Normal Value (V3800-TIE4/-TIE4C)

Classification		Signal Name	Unit	Engine Stops	During Start-Up	Idling	During Acceleration	During No-load Maximum Speed
In-put	Pulse / Rotary signal	Engine speed	min ⁻¹ (rpm)	0	0 → 800 (Ordinary temperature)	Approx. 800 (After warm-up)	Approx. 800 → 2700	Approx. 2700 (After warm-up)
		Engine speed active flag	–	OFF	ON	ON	ON	ON
		Cam speed active flag	–	OFF	ON	ON	ON	ON
		Machine speed	km/h	When the machine stopped: 0				
	Analog signal	Final accelerator pedal position opening	%	0	0	0	0 → 100	100
		Accelerator pedal position sensor 1 output voltage	V	Sensor unused by CAN input				
		Accelerator pedal position sensor 2 output voltage	V					
		Boost pressure	kPa	Approx. 100	Approx. 100	Approx. 100	–	–
		Boost pressure sensor output voltage	V	Approx. 1.0	Approx. 1.0	Approx. 1.0	–	–
		Coolant temperature	°C	Representative value: Approx. 20 °C (68 °F) → Approx. 2.4 V Representative value: Approx. 80 °C (176 °F) → Approx. 0.5 V				
		Coolant temperature sensor voltage output	V					
		Intake air temperature	°C	Representative value: Approx. 20 °C (68 °F) → Approx. 2.4 V Representative value: Approx. 40 °C (104 °F) → Approx. 1.5 V				
		Intake air temperature sensor output voltage	V					
		Atmospheric pressure	kPa	Representative value: Approx. 100 kPa → 3.7 V (Depending on the atmospheric pressure)				
		Atmospheric pressure sensor output voltage	V					
		Battery voltage	V	When stopped: Approx. 12.5 V When operating: Approx. 14 V (Depends on the battery charging condition, whether or not there is a load voltage, rotation speed)				
	Digital signal	Key Switch	–	ON	ON	ON	ON	ON
		Start switch	–	OFF	ON	OFF	OFF	OFF
		Neutral switch	–	During neutral: ON				

9Y1200226CRM0060US0

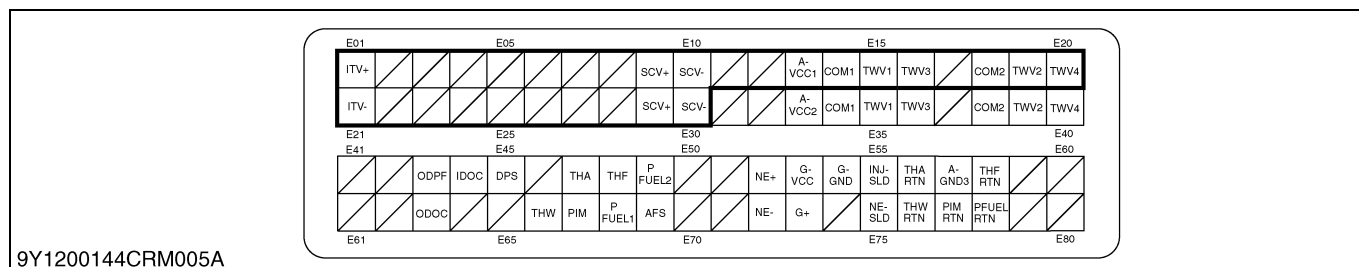
Classification		Signal Name	Unit	Engine Stops	During Start-Up	Idling	During Acceleration	During No-load Maximum Speed	
Output	Basic control signal	Final fuel injection quantity	mm ³ /st	0 (Indication value - 50)	0 → 80 (Ordinary temperature)	Approx. 12 (After warm-up)	Approx. 12→75 (After warm-up)	Approx. 30 (After warm-up)	
		Target rail pressure	MPa	Depends on the rotation speed, load (After warm-up) When idling: Approx. 35 to 60 MPa (360 to 610 kgf/cm ² , 5100 to 8700 psi) During no-load maximum speed: 75.0 to 155 MPa (765 to 1580 kgf/cm ² , 10900 to 22400 psi) During acceleration: Maximum value 155 MPa (1580 kgf/cm ² , 22500 psi)					
		Actual rail pressure MPa	MPa	—	Approx. the same as the target value (Follow to the target value)				
		Rail pressure sensor output voltage	V	Depends on the rotation speed, load (After warm-up) Key switch is ON: Approx. 0.5 V After engine start-up: Approx. 0.9 to 2.9 V					
		Pump angle error learning value (HP5)	CA	-3 to +3					
		Pump angle error learning end flag (HP5)	—	Unlearning: "0" Actual learning completion: "165"					
		PCV valve closing timing	CA	Approx. the same as the PCV current carrying start timing (Follow to the PCV current carrying start timing)					
		Engine stop flag	—	ON	OFF	OFF	OFF	OFF	
		Low temperature start mode flag	—	OFF	ON	OFF	OFF	OFF	

Classification		Signal Name	Unit	Engine Stops	During Start-Up	Idling	During Acceleration	During No-load Maximum Speed
Output	Actuator	Exhaust gas recirculation (EGR) valve target position	%	Depends on the rotation speed, load and temperature				
		Exhaust gas recirculation (EGR) valve actual position	%	Approx. the same as the target EGR position (Follow to the target value)				
		Glow (air heater) relay	–	Only during cold start-up (before-and-after): ON				
	DOC data	Intake air temperature built-in MAF	°C	Representative value: Approx. 0 °C (32 °F) → Approx. 4.0 V Representative value: Approx. 20 °C (69 °F) → Approx. 3.1 V				
		Intake air temperature built-in MAF sensor output voltage	V					
		Mass air flow for intake throttle	kg/h	–		12.96 to 698.4 (1.239 to 4.598 V)		
		Intake throttle valve lift	%	75	102 (Full open)	102 to 0		
		Intake throttle valve lift output voltage	V	Approx. 3.4 V	Approx. 4.4 V	0.5 to 4.375 V		

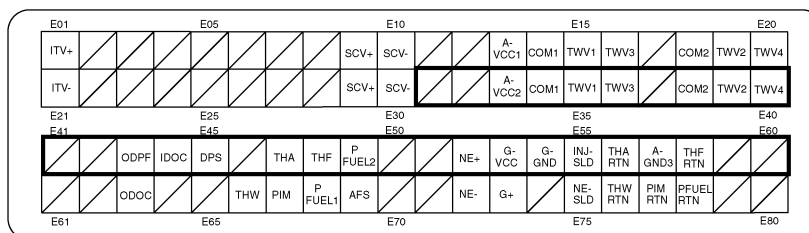
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[9] ECU TERMINAL LAYOUT

(1) ECU Terminal Layout 1 (Engine Side) (V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)

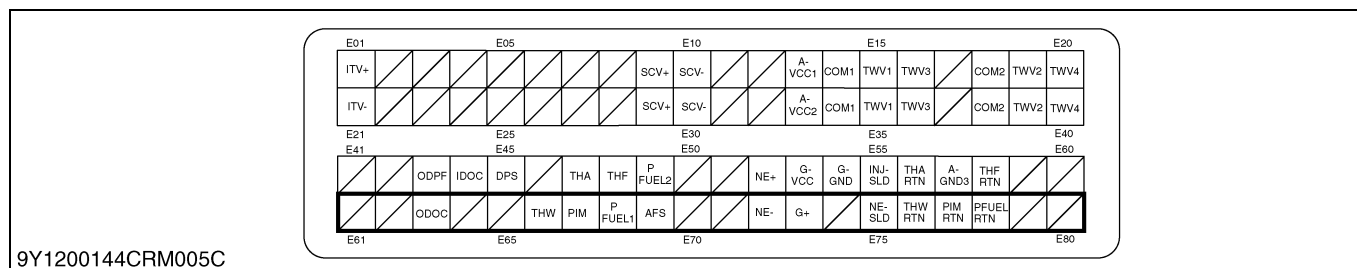


No.	Terminal Name	Signal Name
E01	ITV+	INTAKE THROTTLE VALVE MOTOR (+)
E02	—	—
E03	—	—
E04	—	—
E05	—	—
E06	—	—
E07	—	—
E08	—	—
E09	SCV+	SCV (SUCTION CONTROL VALVE) (+)
E10	SCV-	SCV (SUCTION CONTROL VALVE) (-)
E11	—	—
E12	—	—
E13	A-VCC1	SENSOR (POWER SUPPLY)
E14	COM1	INJECTION COM 1
E15	TWV1	INJECTION DRIVE1 (No.1 CYLINDER)
E16	TWV3	INJECTION DRIVE3 (No.4 CYLINDER)
E17	—	—
E18	COM2	INJECTION COM 2
E19	TWV2	INJECTION DRIVE2 (No.3 CYLINDER)
E20	TWV4	INJECTION DRIVE4 (No.2 CYLINDER)
E21	ITV-	INTAKE THROTTLE VALVE MOTOR (-)
E22	—	—
E23	—	—
E24	—	—
E25	—	—
E26	—	—
E27	—	—
E28	—	—
E29	SCV+	SCV (SUCTION CONTROL VALVE) (+)
E30	SCV-	SCV (SUCTION CONTROL VALVE) (-)



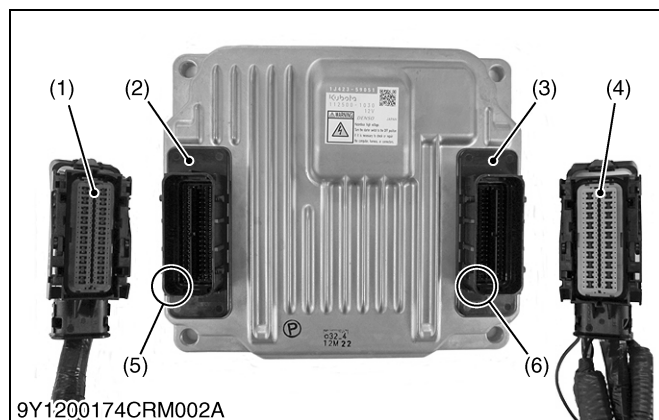
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No.	Terminal Name	Signal Name
E31	—	—
E32	—	—
E33	A-VCC2	SENSOR (POWER SUPPLY)
E34	COM1	INJECTION COM 1
E35	TWV1	INJECTION DRIVE1 (No.1 CYLINDER)
E36	TWV3	INJECTION DRIVE3 (No.4 CYLINDER)
E37	—	—
E38	COM2	INJECTION COM 2
E39	TWV2	INJECTION DRIVE2 (No.3 CYLINDER)
E40	TWV4	INJECTION DRIVE4 (No.2 CYLINDER)
E41	—	—
E42	—	—
E43	ODPF	OUTLET DPF (DPF Exhaust Gas Temperature SENSOR T2)
E44	IDOC	INLET DOC (DPF Exhaust Gas Temperature SENSOR T0)
E45	DPS	DIFFERENTIAL PRESSURE SENSOR
E46	—	—
E47	THA	INTAKE AIR TEMPERATURE SENSOR
E48	THF	FUEL TEMPERATURE SENSOR
E49	PFUEL2	RAIL PRESSURE SENSOR 2
E50	—	—
E51	—	—
E52	NE+	CRANKSHAFT POSITION SENSOR (+)
E53	G-VCC	CAMSHAFT POSITION SENSOR (POWER SUPPLY)
E54	G-GND	CAMSHAFT POSITION SENSOR (GROUND)
E55	INJ-SLD	SHIELD GROUND
E56	THA RTN	INTAKE AIR TEMPERATURE SENSOR RTN
E57	A-GND3	DPF Exhaust Gas Temperature SENSOR T0, T1, T2 GROUND
E58	THF RTN	FUEL TEMPERATURE SENSOR RTN
E59	—	—
E60	—	—



No.	Terminal Name	Signal Name
E61	—	—
E62	—	—
E63	ODOC	OUTLET DOC (DPF EXHAUST GAS TEMPERATURE SENSOR T1)
E64	—	—
E65	—	—
E66	THW	COOLANT TEMPERATURE SENSOR
E67	PIM	BOOST PRESSURE SENSOR
E68	PFUEL1	RAIL PRESSURE SENSOR 1
E69	AFS	MASS AIR FLOW SENSOR
E70	—	—
E71	—	—
E72	NE-	CRANKSHAFT POSITION SENSOR (-)
E73	G+	CAMSHAFT POSITION SENSOR (+)
E74	—	—
E75	NE-SLD	CRANKSHAFT POSITION SENSOR SHIELD GROUND
E76	THW RTN	COOLANT TEMPERATURE SENSOR RTN
E77	PIM RTN	BOOST PRESSURE SENSOR RTN
E78	PFUEL RTN	RAIL PRESSURE SENSOR RTN
E79	—	—
E80	—	—

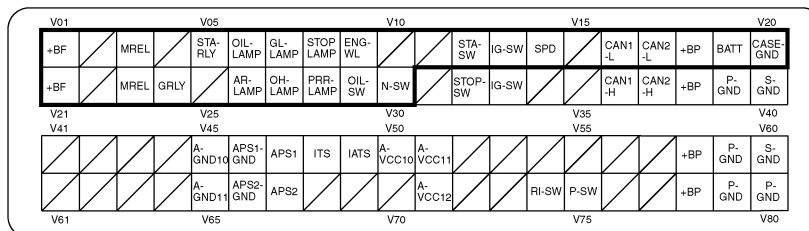
9Y1200226CRM0039US0



- (1) ECU Wiring Harness Connector 1 (Engine Side)
- (2) ECU Connector 1 (Engine Side)
- (3) ECU Connector 2 (Machine Side)
- (4) ECU Wiring Harness Connector 2 (Machine Side)
- (5) E01 Pin Position
- (6) V01 Pin Position

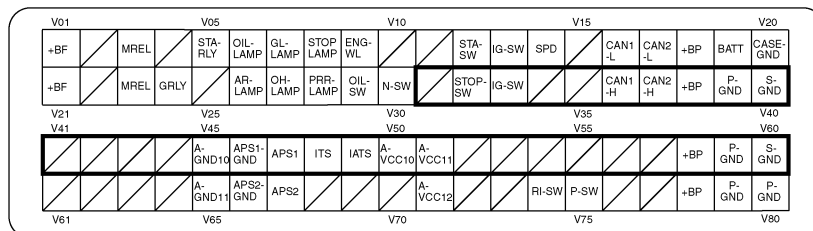
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(2) ECU Terminal Layout 2 (Machine Side) (V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)



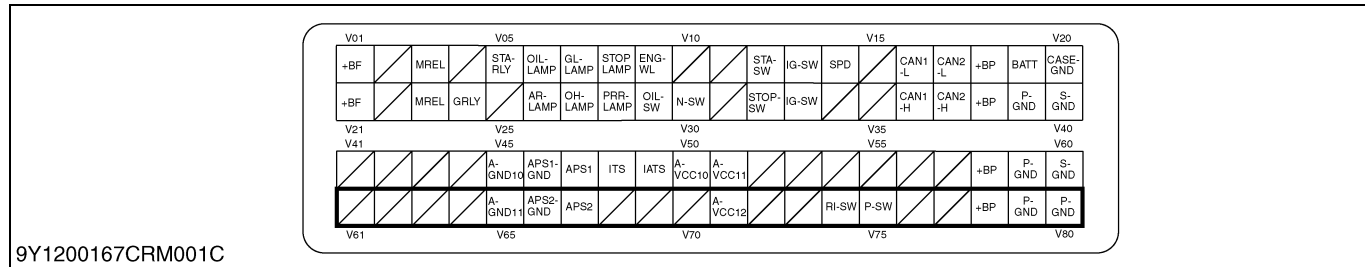
9Y1200167CRM001A

No.	Terminal Name	Signal Name
V01	+BF	BATTERY+ (MAIN RELAY)
V02	—	—
V03	MREL	MAIN RELAY
V04	—	—
V05	STA-RLY	STARTER RELAY
V06	OIL-LAMP	OUTPUT FOR OIL PRESSURE DECREASE LAMP SIGNAL
V07	GL-LAMP	OUTPUT FOR GLOW (AIR HEATER) LAMP SIGNAL
V08	STOP-LAMP	OUTPUT FOR ENGINE STOP LAMP SIGNAL
V09	ENG-WL	OUTPUT FOR ENGINE WARNING LIGHT SIGNAL
V10	—	—
V11	—	—
V12	STA-SW	STARTER SWITCH
V13	IG-SW	KEY SWITCH ON
V14	SPD	MACHINE TRAVEL SPEED SIGNAL
V15	—	—
V16	CAN1-L	CAN1-L (FOR SERVICE)
V17	CAN2-L	CAN2-L (FOR MACHINE)
V18	+BP	BATTERY+ (MAIN RELAY)
V19	BATT	BATTERY+
V20	CASE-GND	CASE GROUND
V21	+BF	BATTERY+ (MAIN RELAY)
V22	—	—
V23	MREL	MAIN RELAY
V24	GRLY	GLOW (AIR HEATER) RELAY
V25	—	—
V26	AR-LAMP	ACTIVE REGENERATION LAMP
V27	OH-LAMP	OUTPUT FOR OVERHEAT LAMP SIGNAL
V28	PRR-LAMP	PARKED REGENERATION REQUEST LAMP
V29	OIL-SW	OIL PRESSURE DECREASE SWITCH
V30	N-SW	NEUTRAL SWITCH



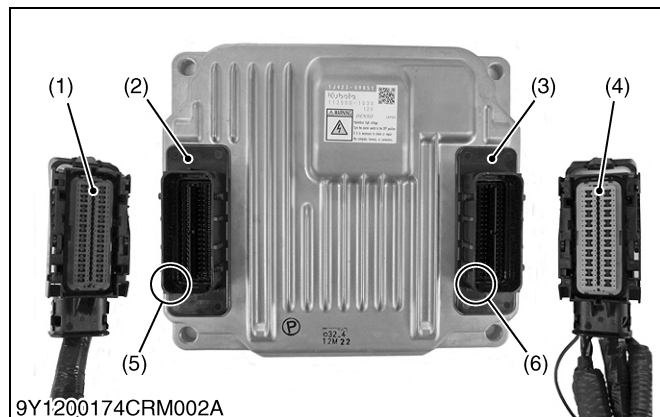
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No.	Terminal Name	Signal Name
V31	—	—
V32	STOP-SW	EMERGENCY STOP SWITCH
V33	IG-SW	KEY SWITCH ON
V34	—	—
V35	—	—
V36	CAN1-H	CAN1-H (FOR SERVICE)
V37	CAN2-H	CAN2-H (FOR MACHINE)
V38	+BP	BATTERY+ (MAIN RELAY)
V39	P-GND	POWER GROUND
V40	S-GND	SIGNAL GROUND
V41	—	—
V42	—	—
V43	—	—
V44	—	—
V45	A-GND10	MASS AIR FOLW SENSOR GROUND
V46	APS1-GND	ACCELERATOR POSITION SENSOR1 (GROUND)
V47	APS1	ACCELERATOR POSITION SENSOR1
V48	ITS	INTAKE THROTTLE POSITION SENSOR
V49	IATS	INTAKE AIR TEMPERATURE SENSOR (IN MASS AIR FLOW SENSOR)
V50	A-VCC10	ACCELERATOR POSITION SENSOR2 (POWER SUPPLY)
V51	A-VCC11	ACCELERATOR POSITION SENSOR1 (POWER SUPPLY)
V52	—	—
V53	—	—
V54	—	—
V55	—	—
V56	—	—
V57	—	—
V58	+BP	BATTERY+ (MAIN RELAY)
V59	P-GND	POWER GROUND
V60	S-GND	SIGNAL GROUND



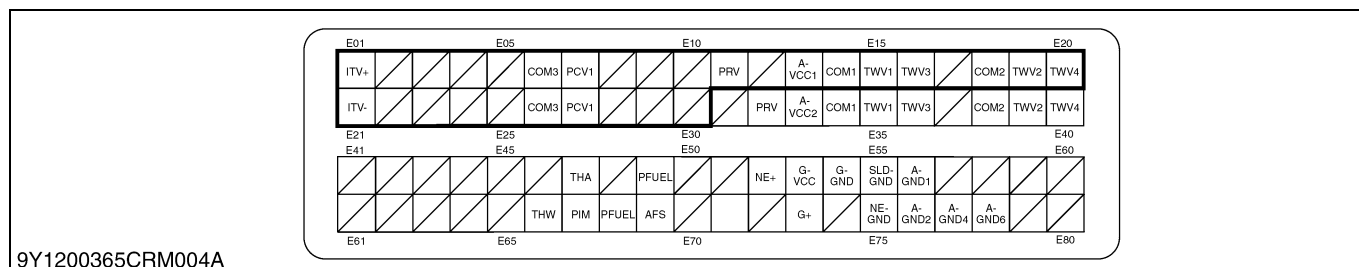
No.	Terminal Name	Signal Name
V61	—	—
V62	—	—
V63	—	—
V64	—	—
V65	A-GND11	DIFFERENTIAL PRESSURE SENSOR GROUND / INTAKE THROTTLE POSITION SENSOR GROUND
V66	APS2-GND	ACCELERATOR POSITION SENSOR2 (GROUND)
V67	APS2	ACCELERATOR POSITION SENSOR2
V68	—	—
V69	—	—
V70	—	—
V71	A-VCC12	DIFFERENTIAL PRESSURE SENSOR (POWER SUPPLY)
V72	—	—
V73	—	—
V74	R1-SW	REGENERATION INHIBIT SWITCH
V75	P-SW	PARKING SWITCH
V76	—	—
V77	—	—
V78	+BP	BATTERY+ (MAIN RELAY)
V79	P-GND	POWER GROUND
V80	P-GND	POWER GROUND

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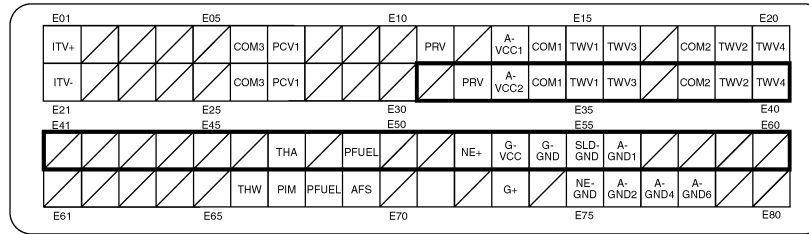


- (1) ECU Wiring Harness Connector 1 (Engine Side)
- (2) ECU Connector 1 (Engine Side)
- (3) ECU Connector 2 (Machine Side)
- (4) ECU Wiring Harness Connector 2 (Machine Side)
- (5) E01 Pin Position
- (6) V01 Pin Position

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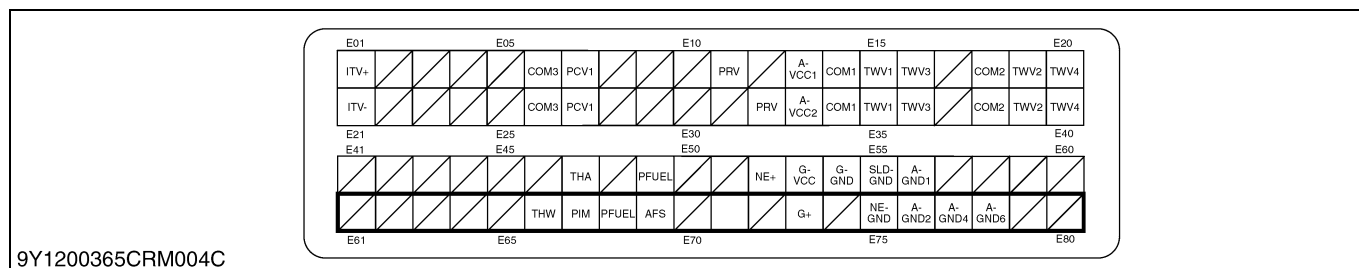
(3) ECU Terminal Layout 1 (Engine Side) (V3800-TIE4/-TIE4C)

No.	Terminal Name	Signal Name
E01	ITV+	INTAKE THROTTLE VALVE MOTOR (+)
E02	—	—
E03	—	—
E04	—	—
E05	—	—
E06	COM3	PCV-PRV COM 3
E07	PCV1	PCV (PRE-STROKE CONTROL VALVE) (-)
E08	—	—
E09	—	—
E10	—	—
E11	PRV	PRV (PRESSURE RELIEF VALVE) (-)
E12	—	—
E13	A-VCC1	A-VCC1 (RAIL PRESSURE SENSOR VCC / CRANKSHAFT POSITION SENSOR VCC)
E14	COM1	INJECTION COM 1
E15	TWV1	INJECTION DRIVE1 (No.1 CYLINDER)
E16	TWV3	INJECTION DRIVE3 (No.4 CYLINDER)
E17	—	—
E18	COM2	INJECTION COM 2
E19	TWV2	INJECTION DRIVE2 (No.3 CYLINDER)
E20	TWV4	INJECTION DRIVE4 (No.2 CYLINDER)
E21	ITV-	INTAKE THROTTLE VALVE MOTOR (-)
E22	—	—
E23	—	—
E24	—	—
E25	—	—
E26	COM3	PCV-PRV COM 3
E27	PCV1	PCV (PRE-STROKE CONTROL VALVE) (-)
E28	—	—
E29	—	—
E30	—	—



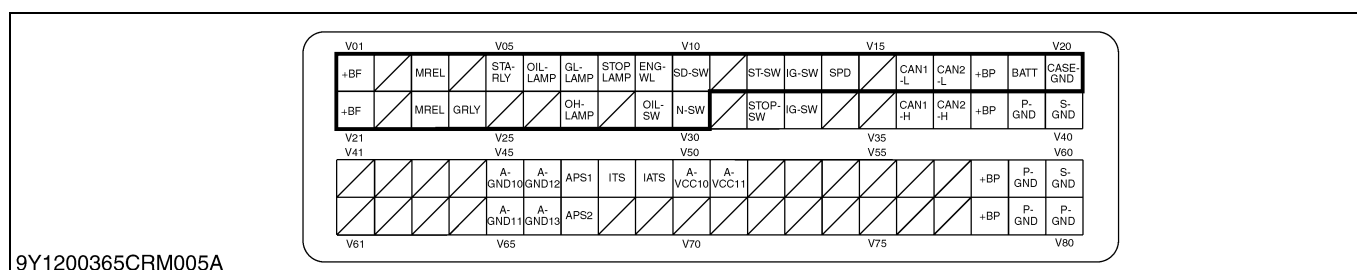
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No.	Terminal Name	Signal Name
E31	—	—
E32	PRV	PRV (PRESSURE RELIEF VALVE) (-)
E33	A-VCC2	A-VCC2 (BOOST SENSOR VCC)
E34	COM1	INJECTION COM 1
E35	TWV1	INJECTION DRIVE1 (No.1 CYLINDER)
E36	TWV3	INJECTION DRIVE3 (No.4 CYLINDER)
E37	—	—
E38	COM2	INJECTION COM 2
E39	TWV2	INJECTION DRIVE2 (No.3 CYLINDER)
E40	TWV4	INJECTION DRIVE4 (No.2 CYLINDER)
E41	—	—
E42	—	—
E43	—	—
E44	—	—
E45	—	—
E46	—	—
E47	THA	INTAKE AIR TEMPERATURE SENSOR
E48	—	—
E49	PFUEL	RAIL PRESSURE SENSOR
E50	—	—
E51	—	—
E52	NE+	CRANKSHAFT POSITION SENSOR (+)
E53	G-VCC	G-VCC (CAMSHAFT POSITION SENSOR VCC)
E54	G-GND	G-GND (CAMSHAFT POSITION SENSOR GROUND)
E55	SLD-GND	SHIELD GROUND
E56	A-GND1	A-GND1 (INTAKE AIR TEMPERATURE SENSOR GROUND)
E57	—	—
E58	—	—
E59	—	—
E60	—	—

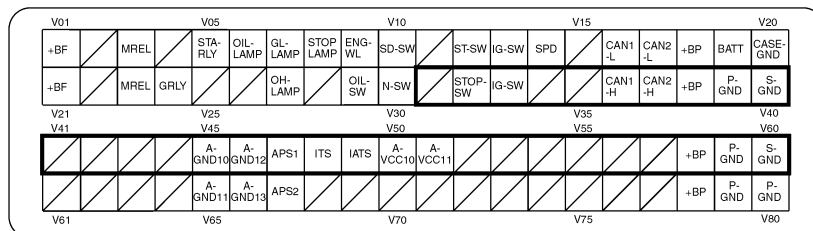


No.	Terminal Name	Signal Name
E61	—	—
E62	—	—
E63	—	—
E64	—	—
E65	—	—
E66	THW	COOLANT TEMPERATURE SENSOR
E67	PIM	BOOST SENSOR
E68	PFUEL	RAIL PRESSURE SENSOR
E69	AFS	AIR MASS FLOW SENSOR
E70	—	—
E71	—	—
E72	—	—
E73	G+	CAMSHAFT POSITION SENSOR (+)
E74	—	—
E75	NE-GND	NE-GND (CRANKSHAFT POSITION SENSOR GROUND)
E76	A-GND2	A-GND2 (COOLANT TEMPERATURE SENSOR GROUND)
E77	A-GND4	A-GND4 (BOOST SENSOR GROUND)
E78	A-GND6	A-GND6 (RAIL PRESSURE SENSOR GROUND)
E79	—	—
E80	—	—

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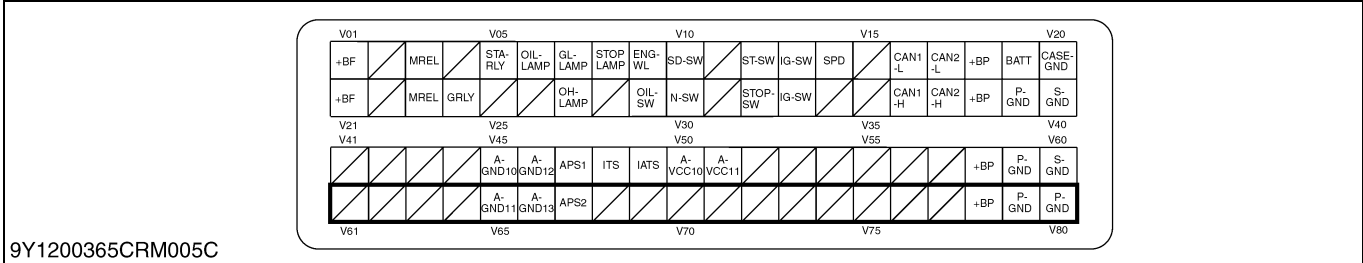
(4) ECU Terminal Layout 2 (Machine Side) (V3800-TIE4/-TIE4C)

No.	Terminal Name	Signal Name
V01	+BF	BATTERY+ (MAIN RELAY)
V02	—	—
V03	MREL	MAIN RELAY
V04	—	—
V05	STA-RLY	STARTER RELAY
V06	OIL-LAMP	OUTPUT FOR LOW OIL PRESSURE LAMP SIGNAL
V07	GL-LAMP	OUTPUT FOR GLOW (AIR HEATER) LAMP SIGNAL
V08	STOP-LAMP	OUTPUT FOR ENGINE STOP LAMP SIGNAL
V09	ENG-WL	OUTPUT FOR ENGINE WARNING LIGHT SIGNAL
V10	SD-SW	SEDIMENTER SW (OPTION)
V11	—	—
V12	ST-SW	STARTER SWITCH
V13	IG-SW	KEY SWITCH ON
V14	SPD	MACHINE TRAVEL SPEED SIGNAL
V15	—	—
V16	CAN1-L	CAN1-L (FOR SERVICE)
V17	CAN2-L	CAN2-L (FOR MACHINE)
V18	+BP	BATTERY (+) (MAIN RELAY)
V19	BATT	BATTERY (+)
V20	CASE-GND	CASE GROUND
V21	+BF	BATTERY (+) (MAIN RELAY)
V22	—	—
V23	MREL	MAIN RELAY
V24	GRLY	GLOW (AIR HEATER) RELAY
V25	—	—
V26	—	—
V27	OH-LAMP	OUTPUT FOR OVERHEAT LAMP SIGNAL
V28	—	—
V29	OIL-SW	LOW OIL PRESSURE SWITCH
V30	N-SW	NEUTRAL SWITCH



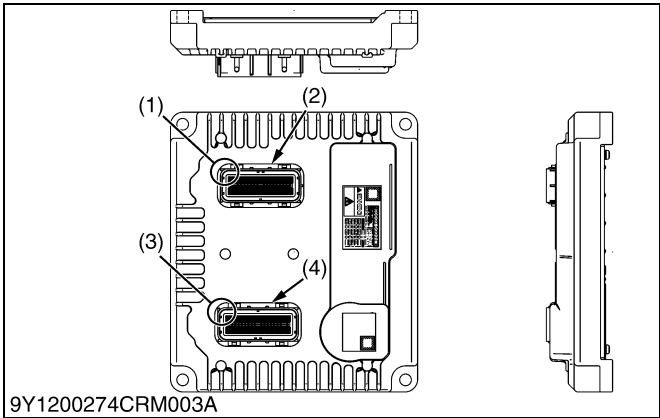
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No.	Terminal Name	Signal Name
V31	—	—
V32	STOP-SW	EMERGENCY STOP SWITCH
V33	IG-SW	KEY SWITCH ON
V34	—	—
V35	—	—
V36	CAN1-H	CAN1-H (FOR SERVICE)
V37	CAN2-H	CAN2-H (FOR MACHINE)
V38	+BP	BATTERY (+) (MAIN RELAY)
V39	P-GND	POWER GROUND
V40	S-GND	SIGNAL GROUND
V41	—	—
V42	—	—
V43	—	—
V44	—	—
V45	A-GND10	A-GND10 (AIR MASS FLOW SENSOR GROUND)
V46	A-GND12	A-GND12 (ACCELERATOR POSITION SENSOR1 GROUND)
V47	APS1	ACCELERATOR POSITION SENSOR1
V48	ITS	INTAKE THROTTLE POSITION SENSOR
V49	IATS	INTAKE AIR TEMPERATURE SENSOR (IN AIR MASS FLOW SENSOR)
V50	A-VCC10	A-VCC10 (ACCELERATOR POSITION SENSOR2 VCC / INTAKE THROTTLE POSITION SENSOR VCC)
V51	A-VCC11	A-VCC11 (ACCELERATOR POSITION SENSOR1 VCC)
V52	—	—
V53	—	—
V54	—	—
V55	—	—
V56	—	—
V57	—	—
V58	+BP	BATTERY (+) (MAIN RELAY)
V59	P-GND	POWER GROUND
V60	S-GND	SIGNAL GROUND



No.	Terminal Name	Signal Name
V61	—	—
V62	—	—
V63	—	—
V64	—	—
V65	A-GND11	A-GND11 (INTAKE THROTTLE POSITION SENSOR GROUND)
V66	A-GND13	A-GND13 (ACCELERATOR POSITION SENSOR2 GROUND)
V67	APS2	ACCELERATOR POSITION SENSOR2
V68	—	—
V69	—	—
V70	—	—
V71	—	—
V72	—	—
V73	—	—
V74	—	—
V75	—	—
V76	—	—
V77	—	—
V78	+BP	BATTERY (+) (MAIN RELAY)
V79	P-GND	POWER GROUND
V80	P-GND	POWER GROUND

9Y1200226CRM0049US0



- (1) E01 Pin Position
(2) ECU Connector 1
(Engine Side)
- (3) V01 Pin Position
(4) ECU Connector 2
(Machine Side)

9Y1200226CRM0050US0

SERVICING

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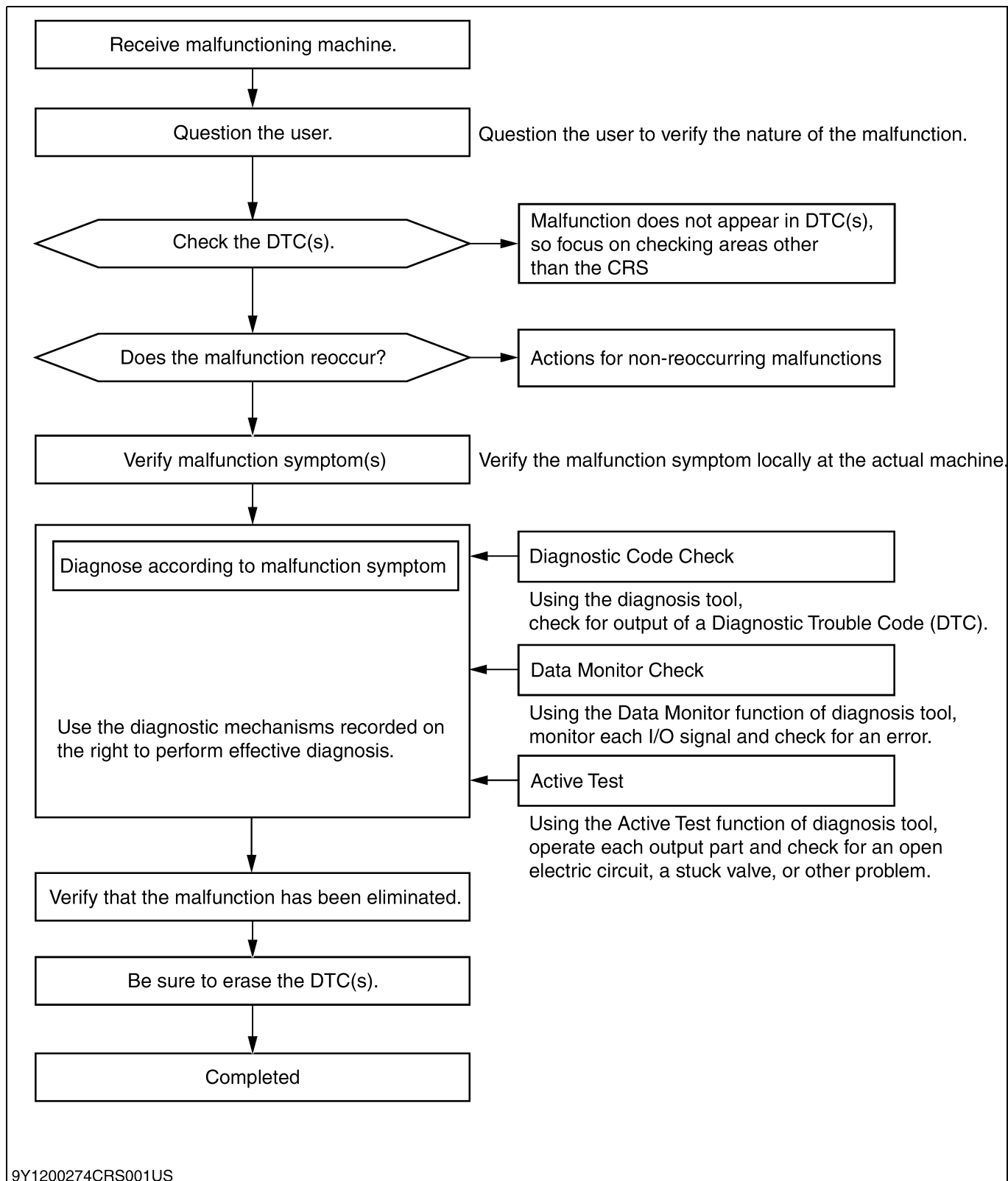
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(21)Camshaft Position Sensor (G Sensor) Abnormality (DTC P0340 / 723-8, P0341 / 723-2)	1-S186
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(23)EGR Actuator Abnormality (DTC P0403 / 523574-3, DTC P0404 / 523574-4, P0409 / 523572-4)	1-S193
(24)Oil Pressure Error (P0524 / 100-1).....	1-S196
(25)Exhaust Gas Temperature Sensor 1 (T1) Abnormality (DTC P0543 / 3242-4, P0544 / 3242-3)	1-S198
(26)Exhaust Gas Temperature Sensor 0 (T0) Abnormality (DTC P0546 / 4765-4, P0547 / 4765-3)	1-S201
(27)Battery Voltage Abnormality (DTC P0562 / 168-4, P0563 / 168-3)	1-S204
(28)QR Data Abnormality (DTC P0602/523538-2, P0602/523538-7)	1-S207
(29)ECU Flash-ROM and CPU Abnormality (DTC P0605 / 628-2, P0606 / 1077-2, P0606/ 523527-2)	1-S208
(30)Injector Charge Voltage Abnormality (DTC P0611 / 523525-1)	1-S210
(31)SCV Drive System Abnormality (DTC P0628 / 1347-4, P0629 / 1347-3).....	1-S212
(32)Sensor Supply Voltage 1 Abnormality (DTC P0642 / 3509-4, P0643 / 3509-3)	1-S216
(33)Sensor Supply Voltage 2 Abnormality (DTC P0652 / 3510-4, P0653 / 3510-3)	1-S218
(34)Main Relay is Locked in Closed Position (DTC P0687 / 1485-2)	1-S220
(35)Pump Seizing (DTC P1274 / 523539-2, P1275 / 523540-2)	1-S223
(36)EEPROM Check Sum Error (DTC P1990 / 523700-13).....	1-S228
(37)Intake Throttle Feedback Error (DTC P2108 / 523580-2)	1-S229
(38)Accelerator Position Sensor 1 Abnormality (DTC P2122 / 91-4, P2123 / 91-3)	1-S231
(39)Accelerator Position Sensor 2 Abnormality (DTC P2127 / 29-4, P2128 / 29-3)	1-S235
(40)Accelerator Position Sensor Error (CAN) (DTC P2131 / 523543-2).....	1-S239
(41)Accelerator Position Sensor Correlation Error (DTC P2135 / 91-2)	1-S241
(42)Common 1 System Injector Drive Circuit Open (DTC P2146 / 523523-2)	1-S242
(43)Common 1 TWV Actuation System Short (DTC P2147 / 523523-4, P2148 / 523523-3)	1-S245
(44)Common 2 System Injector Drive Circuit Open (DTC P2149 / 523524-2)	1-S249
(45)Common 2 TWV Actuation System Short (DTC P2150 / 523524-4, P2151 / 523524-3)	1-S252
(46)Barometric Pressure Sensor Error (DTC P2228 / 108-4, P2229 / 108-3)	1-S256
(47)EGR (DC Motor) Abnormality (DTC P2413 / 523575-7, P2414 / 523576-2, P2415 / 523577-2)	1-S258
(48)Exhaust Gas Temperature Sensor 2 (T2) Abnormality (DTC P242C / 3246-4, P242D / 3246-3)	1-S261
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(67)No Communication with EGR (DTC U0076 / 523578-2)	1-S293
(68)CAN1 Bus Off (DTC U0077 / 523604-2)	1-S295
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(29)ECU Flash-ROM and CPU Abnormality (DTC P0605 / 628-2, P0606 / 1077-2, P0606/ 523527-2)	1-S446
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(43)Lamp Driving Circuit Error (DTC P1A10 / 523621-3, DTC P1A11 / 523622-3, DTC P1A12 / 4115-3).....	1-S483
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(46)Intake Throttle Feedback Error (DTC P2108 / 523580-2)	1-S489
(47)Accelerator Position Sensor 1 Abnormality (DTC P2122 / 91-4, P2123 / 91-3)	1-S491
(48)Accelerator Position Sensor 2 Abnormality (DTC P2127 / 29-4, P2128 / 29-3)	1-S495
(49)Accelerator Position Sensor Error (CAN) (DTC P2131 / 523543-2).....	1-S499
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(57)Open Circuit of Harness or Coil in PRV Line (DTC P2294 / 523613-5)	1-S522
(58)EGR (DC Motor) Abnormality (DTC P2413 / 523575-7, P2414 / 523576-2, P2415 / 523577-2)	1-S524
(59)Intake Throttle Lift Sensor Abnormality (DTC P2621 / 523583-4, P2622 / 523582-3)	1-S527
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(61)Initial Pump-calibration Incomplete (DTC P3019 / 523600-0)	1-S531
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1. GENERAL

[1] OVERALL DIAGNOSTIC PROCEDURE



[2] QUESTIONING

- Use the trouble check sheet to ensure that the customer's explanation is fully understood.
- Accurately judge information concerning the malfunction.

Grasp the situation firmly, using five 5W1H (Who, What, When, Where, Why, How) as a basis.

Ex: Low ambient temperature, starting, normal conditions, proximity to engine, metallic noise, etc.

(Reference)

Do not ask random questions. Ask questions that will aid in narrowing down the possible malfunctioning system while making educated guesses based on the malfunction symptoms.

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Questioning Points

What?	Malfunction symptom
When?	Date, time, frequency of occurrence.
Where?	Field conditions
What were conditions like at the time of malfunction?	Driving conditions, operating conditions, weather.
What happened?	Type of malfunction.

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Trouble Check Sheet for KUBOTA Common Rail System

When the machine is received from the customer, it is necessary to verify the "malfunction symptoms" and the "generated malfunction data" with the customer. This is performed based on the trouble check sheet.

(1) Trouble Check Sheet

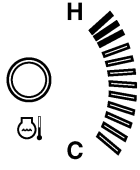
Because:

- The malfunction symptom may not be reproduced at the workshop.
- The customer's complaint does not always match the malfunction.
- If the person performing repairs is not working from the correct malfunction symptoms, man-hours will be wasted.

The question chart can aid the service person in diagnosing, repairing and verifying repair work.

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Trouble Check Sheet				
Machine details				
Customer name				
Customer address				
Machine model		Machine serial number		
Engine serial number		Purchase date		
Repair date		Hourmeter indicator	hours	
Warranty				
Warranty Judgment	<input type="checkbox"/> Yes		<input type="checkbox"/> No	
Defective parts	<input type="checkbox"/> Injector		<input type="checkbox"/> Supply Pump	
	<input type="checkbox"/> Common rail		<input type="checkbox"/> Fuel Filter	
	<input type="checkbox"/> Others ()			
Replace parts details				
Supply Pump	Quantity	Units	Part number	
	Serial number			
Injector	Quantity	Units	Part number	
	Serial number	Cylinder 1 ()		Cylinder 2 ()
		Cylinder 3 ()		Cylinder 4 ()
	Defective injector	<input type="checkbox"/> Injector 1		<input type="checkbox"/> Injector 2
		<input type="checkbox"/> Injector 3		<input type="checkbox"/> Injector 4
Actual part replacement	<input type="checkbox"/> Injector		<input type="checkbox"/> Supply Pump	
	<input type="checkbox"/> Common rail		<input type="checkbox"/> Fuel Filter	
	<input type="checkbox"/> ECU		<input type="checkbox"/> Others ()	
Customer complaint				
<input type="checkbox"/> 1. Engine no start	<input type="checkbox"/> a. No initial combustion		<input type="checkbox"/> b. No complete combustion	
	<input type="checkbox"/> c. No cranking			
<input type="checkbox"/> 2. Difficult to start	<input type="checkbox"/> a. Engine crank slowly			
	<input type="checkbox"/> b. Others ()			
<input type="checkbox"/> 3. Poor idling	<input type="checkbox"/> a. Incorrect first idle		<input type="checkbox"/> b. Noise	
	<input type="checkbox"/> c. Hunting idle from () to () min ⁻¹ (rpm)			
	<input type="checkbox"/> d. High idling () min ⁻¹ (rpm)			
	<input type="checkbox"/> e. Low idling () min ⁻¹ (rpm)			
	<input type="checkbox"/> f. Rough			
	<input type="checkbox"/> g. Others ()			
<input type="checkbox"/> 4. Poor driveability	<input type="checkbox"/> a. Hesitation		<input type="checkbox"/> b. Surging	
	<input type="checkbox"/> c. Knocking		<input type="checkbox"/> d. Lack of power	
	<input type="checkbox"/> e. Others ()			
<input type="checkbox"/> 5. Abnormal smoke	<input type="checkbox"/> a. Black		<input type="checkbox"/> b. White	
	<input type="checkbox"/> c. Others ()			
<input type="checkbox"/> 6. Fuel leakage	<input type="checkbox"/> a. Large quantity		<input type="checkbox"/> b. Blurred	
	Leaking from:	<input type="checkbox"/> Injector		<input type="checkbox"/> Supply Pump
		<input type="checkbox"/> Others ()		
<input type="checkbox"/> 7. Engine not stop				
<input type="checkbox"/> 8. Engine stall				
<input type="checkbox"/> 9. Others				

Condition when problem occurs (Duplicated answers can be possible)		
1. Weather	<input type="checkbox"/> a. Fine	<input type="checkbox"/> b. Cloudy
	<input type="checkbox"/> c. Rainy	<input type="checkbox"/> d. Snow
	<input type="checkbox"/> e. Flood	
	<input type="checkbox"/> f. Others ()	
2. Outdoor temperature	Approx. °C (°F)	
3. Altitude	Approx. m	
4. Engine coolant	<input type="checkbox"/> a. Cold	Write the position of the indicator on coolant temperature gauge.  9Y1200058ENI031A
	<input type="checkbox"/> b. Warming up	
	<input type="checkbox"/> c. After warming up	
	<input type="checkbox"/> d. Any temperature	
	<input type="checkbox"/> e. Others ()	
5. Engine operation	<input type="checkbox"/> a. Starting	<input type="checkbox"/> b. Just after starting
	<input type="checkbox"/> c. Idling	<input type="checkbox"/> d. Racing
	<input type="checkbox"/> e. Acceleration	<input type="checkbox"/> f. Deceleration
	<input type="checkbox"/> g. While at work	
	<input type="checkbox"/> h. Others ()	
6. Problem frequency	<input type="checkbox"/> a. Constant	<input type="checkbox"/> b. Once only
	<input type="checkbox"/> c. Sometime (Time per day/month)	
7. Engine warning light	<input type="checkbox"/> Turn on a light	<input type="checkbox"/> Turn off a light
8. Optional parts	Fill the parts in if you use optional parts or non-genuine parts for electrical, intake/exhaust and fuel system. ()	
Dealer check		
1. Duplicate the problem	<input type="checkbox"/> a. Yes (Duplicate)	<input type="checkbox"/> b. No (Not occur)
2. Diagnosis trouble code	<input type="checkbox"/> a. Abnormal (What is code)	
	<input type="checkbox"/> b. Normal (No code)	
3. Appearance	<input type="checkbox"/> a. Normal	<input type="checkbox"/> b. Cracked
	<input type="checkbox"/> c. Discolored	
	<input type="checkbox"/> d. Others ()	
4. Fuel condition	<input type="checkbox"/> a. Normal	
	<input type="checkbox"/> b. Abnormal ()	

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[3] LIST OF MALFUNCTION SYMPTOM

Malfunctions and corresponding symptoms resulting from the CRS may also be generated from other sources, such as the engine (mechanical parts), the fuel system, etc. When performing CRS troubleshooting, the aim is not to quickly determine that the CRS is the cause of a malfunction. Rather, the cause should be exhaustively considered while verifying the causes listed below.

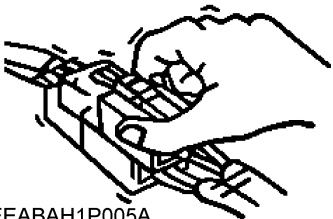
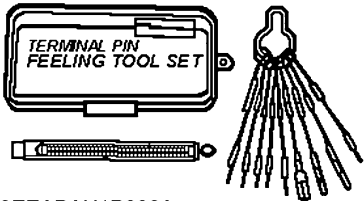
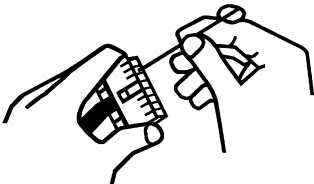
Malfunction symptom	Area of Fault	Cause	Action
Engine overheat	Fuel system	Poor fuel	Switch to the correct fuel (No.2-D diesel fuel).
	Lubrication system	Engine oil deterioration.	Change engine oil.
		Inappropriate engine oil.	Replace with the appropriate engine oil (API Service Classification CF grade or higher).
		Faulty oil pump.	Replace oil pump.
		Insufficient engine oil level	Add engine oil.
Insufficient output	Intake system	Clogged air cleaner element.	Clean or replace air cleaner element.
	Fuel system	Air mixed with the fuel system.	Perform fuel system air bleeding.
		Faulty fuel filter.	Replace fuel filter.
		Poor or inappropriate fuel.	Switch to the correct fuel (No.2-D diesel fuel).
	Engine	Worn cylinder liner and the piston ring of the piston. (Low compression pressure)	Overhaul engine.
	Other	Overheat	Refer to "Engine Overheat" items.
Faulty starting	Intake system	Clogged air cleaner element.	Clean or replace air cleaner element.
	Fuel system	Insufficient fuel.	Add fuel and perform fuel system air bleeding.
		Fuel system clogged.	Clean the fuel system.
		Large amount of intermixing water to the water separator, element clogging and deformation.	Clean or replace.
		Air being introduced through fuel system connection points.	Tighten connections.
		Clogged fuel filter	Replace fuel filter.
		Fuel feed pump operation fault.	Replace fuel feed pump.
		Injection pipe connection loose.	Tighten connecting nut.
	Electrical system	Battery fault	Inspect battery.
		Faulty starter wiring.	Replace starter wiring.
		Loose battery cable.	Tighten battery terminal connections, or replace cables.
		Faulty starter operation.	Replace starter assembly.
		Starting assist device (intake air heater) fault.	Replace starting assist device (intake air heater).
	Lubrication system	Excessive engine oil viscosity.	Replace with oil of appropriate viscosity.
	Engine	Burnt pistons.	Replace piston, piston ring and cylinder block.
		Burnt main bearing.	Replace main bearing and crankshaft.
		Low compression pressure.	Overhaul engine.
	Other	Ring gear damage.	Flywheel / starter replacement.
Idle fault	Engine	Poor valve clearance	Adjust valve clearance.
		Poor valve seat contact.	Break in valve and valve seat, or replace.
		Low coolant temperature.	Perform warm-up operation.
		Large difference in cylinder-to cylinder compression pressure.	Overhaul engine.

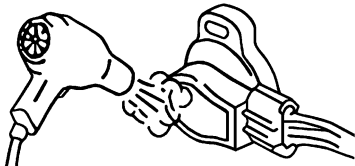
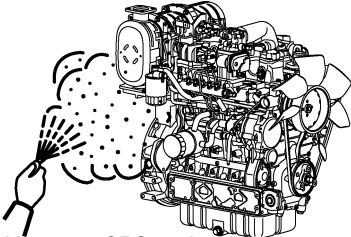
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[4] ACTIONS FOR NON-REOCCURRING MALFUNCTIONS

- In cases where the malfunction does not reoccur, perform the actions below to determine the cause of the malfunction.
- In cases where the malfunction does not reoccur at the dealer, sales company or workshop, perform the work that actually caused the malfunction.
- Check the fuel pipe system [including the fuel feed pump (electromagnetic pump) and tank], intake system and exhaust system.
- If the malfunction does not reoccur, there may be an ECU malfunction. For diagnostic purposes only, temporarily replace the ECU with a unit that functions normally to perform the check procedure. At the same time, be sure to perform difference learning for the supply pump and input QR Code for injectors. If there would be no change, ECU should not be replaced.

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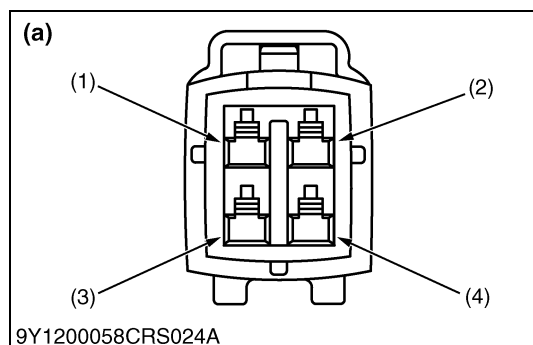
Action	Malfunction symptom		
	Dead battery	Engine will not start	Idle speed abnormal engine stall sluggish poor acceleration
Verify that there is no Diagnostic Trouble Code (DTC) stored in the memory.	—	○	○
Using the trouble check sheet as a base, perform a reoccurrence test in "Reoccurrence" mode. Use this data (engine ECU (PCM) voltage value, etc.) to determine the cause of the malfunction.	○	○	○
<p>Assume that an electrical system wiring harness or connector is the cause of the malfunction and vibrate these components by hand to verify whether or not a malfunction occurs and a DTC is generated.</p>  <p>3EEABAH1P005A</p>	—	○	○
<p>Assume that an electrical system female connector terminal is the cause of the malfunction and verify that the connection points are not defective.</p> <p>Recommended Tools: KOWA Precision Handling Feeling Tool Set (KLM-10- 20) Depending on the terminal, a matching size may not be available.</p>  <p>3EEABAH1P006A</p> <p>Insert the male terminal that matches the shape of the female terminal and check for looseness.</p>  <p>3EEABAH1P007A</p>	—	○	○

Action	Malfunction symptom		
	Dead battery	Engine will not start	Idle speed abnormal engine stall sluggish poor acceleration
Heat the accelerator sensor and other electrical components with a hair dryer. Verify whether or not the voltage value (resistance value) changes. ■ NOTE <ul style="list-style-type: none"> Do not exceed 60 °C (140 °F) (still touchable by hand) when heating. Do not remove the component case and add heat directly to electronic parts.  3EEABAH1P008A	—	—	○
Verify whether or not malfunction symptoms occur under heavy engine loads (headlights, A/C, wiper, etc. switches ON).	○	—	○
If any commercial electrical products have been installed, remove them and verify whether or not the malfunction symptoms occur.	○	○	○
If it is thought that the malfunction occurs in rainy or high temperature weather, spray the machine with water and verify whether or not the malfunction occurs. ■ NOTE <ul style="list-style-type: none"> Do not spray water directly onto the engine. Spray water mist on the entire surface of the radiator to indirectly change the temperature and humidity of the engine compartment. Do not spray water directly on electrical parts.  9Y1200174CRS001A	○	○	○

9Y1200226CRS0615US0

2. DIAGNOSTIC TOOL CONNECTION PROCEDURE

[1] DIAGNOSTIC CONNECTOR POSITIONS



1. Refer to the operator's manual for this machine to check the position for connecting the diagnosis tool.

(1) Terminal IG-SW (V13, V33)

(a) CAN1 Connector

(2) Terminal CAN1-H (V36)

(3) Terminal S-GND (V60)

(4) Terminal CAN1-L (V16)

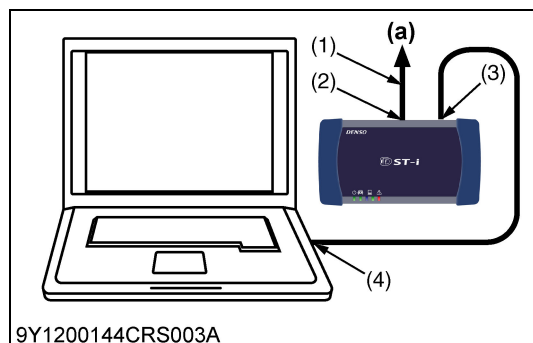
9Y1200226CRS0616US0

[2] DIAGNOSTIC TOOL CONNECTION PROCEDURE

■ IMPORTANT

- At first time usage, it is necessary to do "Communication Setting" with administrator user account.
- Prepare a PC on which the diagnostic software has already been installed.
- When connecting the diagnosis cable, ensure that the key switch on the machine side is OFF.

9Y1200226CRS0617US0



1. Start up a PC on which the diagnostic software has been installed with administrator user account.
2. Connect the machine-side CAN1 connector (a) to the interface connector (To Machine) (2) with the cable (To Machine) (1).
3. Connect the cable (USB) (4) to the USB connector (To PC) (3) and then connect the USB cable to the USB port on PC.
4. Start the diagnostic software.
5. Select "Communication Setting" from "System Setting" in the menu and execute. (Only when performing the initial settings.)

■ NOTE

- The USB port used while the "Communication Setting" process, should always be used.

(1) Cable (To Machine)

(5) DC Jack (Reserved)*

(2) Interface Connector (To Machine)

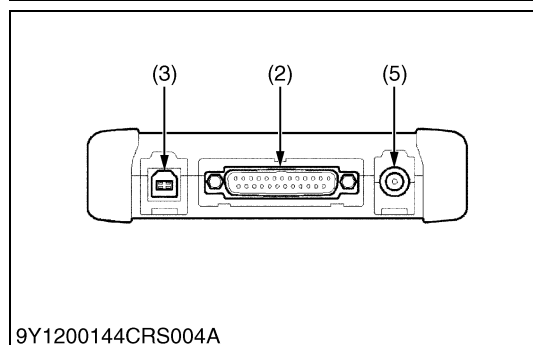
(3) USB Connector (To PC)*

(4) Cable (USB)

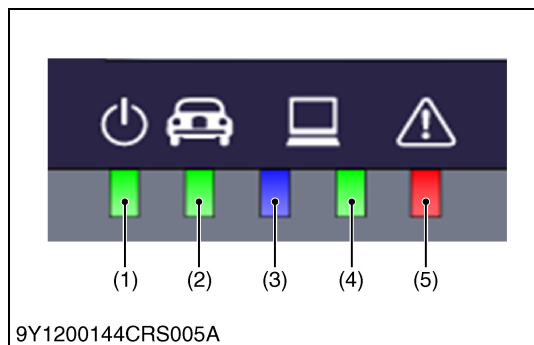
(a) CAN1 Connector

* Rubber cap is attached to USB connector and DC jack each

9Y1200226CRS0618US0



[3] CHECKING THE COMMUNICATION OPERATION OF THE INTERFACE (DST-i)



The communication operation can be checked with the illuminating condition of the five indicators on the DST-i unit.

If a communication error occurs, check the illuminating condition of each indicator and repair or replace the malfunction (including cable open circuits).

- (1) Power Indicator
- (2) Machine Communication Indicator
- (3) PC Communication (Bluetooth) Indicator
- (4) PC Communication (USB) Indicator
- (5) Error Detection Indicator

No.	Type of LED	Color	LED Status	Details
(1)	Power Indicator	Green	Light OFF	Power OFF
			Light ON	Power is supplied from machine cable or USB cable
(2)	Machine Communication Indicator	Green	Light OFF	Stand-by for communication
			Light Flashing (synchronized with communication)	Communication in progress
(3)	PC Communication (Bluetooth) Indicator	Blue	Reserved	Bluetooth communication status (Bluetooth is option)
(4)	PC Communication (USB) Indicator	Green	Light OFF	USB cable has not connected to PC or USB driver has not installed to PC
			Light ON	Stand-by for communication
			Light Flashing	Stand-by for establishment of communication
			Light Flashing (synchronized with communication)	Communication in progress
(5)	Error Detection Indicator	Red	Light OFF	Normal conditions
			Light Flashing	Error occurs

9Y1200226CRS0619US0

DST-i operation Status and Display Specification

■ Light Operation During Normal Conditions

DST-i Status	LED Status			
	Power	Machine	USB	Error
Power OFF	□	□	□	□
Power ON	■	□	□	□
USB stand-by status	■	□	●	□
USB cable has not connected to PC or USB driver has not installed to PC	■	□	□	□
Machine stand-by for communication	■	□	■	□
Machine / USB communication in progress	■	★	★	□

■ Light Operation During Abnormal Operation

DST-i Status	LED Status			
	Power	Machine	USB	Error
System Error	■	●	●	●
	■	■	■	●

□: Light OFF

■: Light ON

●: Light Flashing

★: Light Flashing (Synchronized with communication)


9Y1200226CRS0620US0

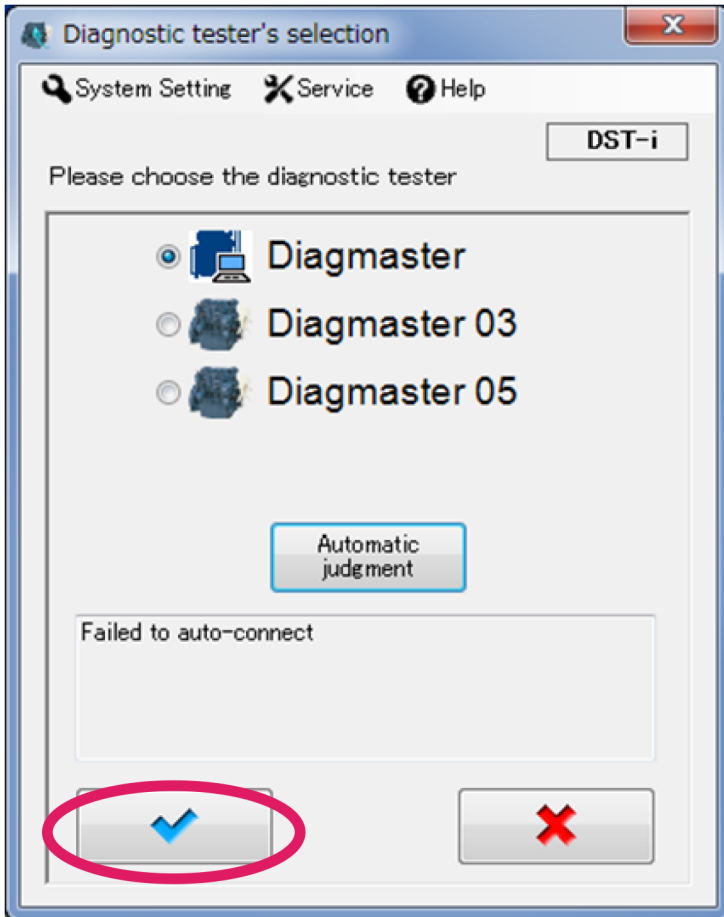
[4] CHECKING THE OPERATION OF THE ECU

(1) Starting Diagmaster

1. Double-click the "Diagmaster Launcher" icon on your computer desktop.



2. Select "Diagmaster" and then click the  button.



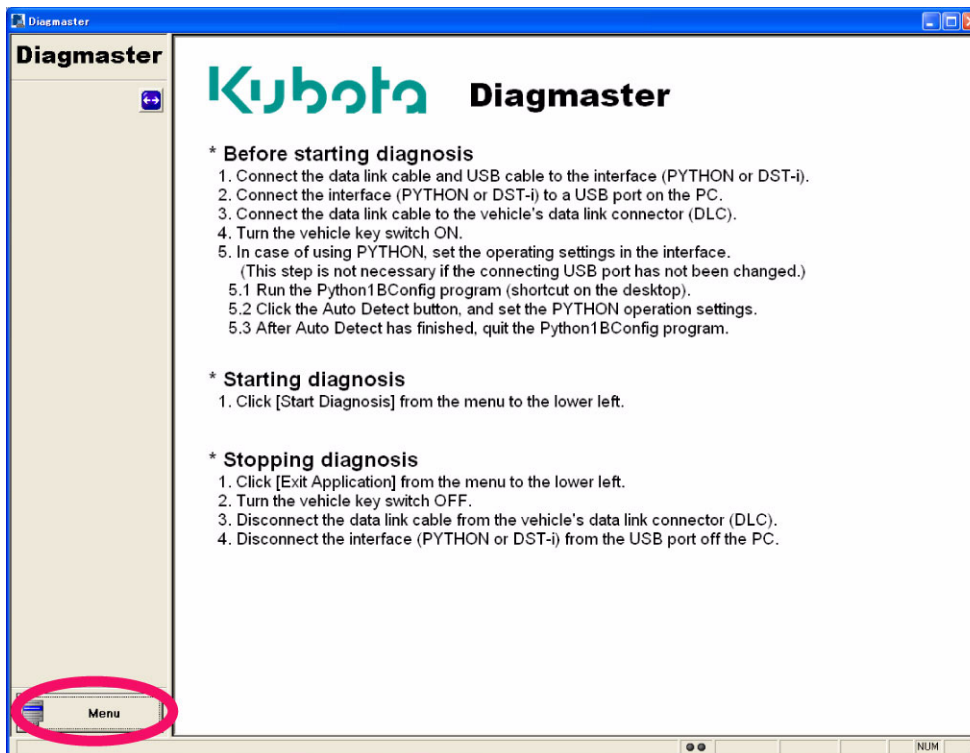
3. Enter your "User ID" and "Password", and then click the  button.



4. The Diagmaster version screen appears.



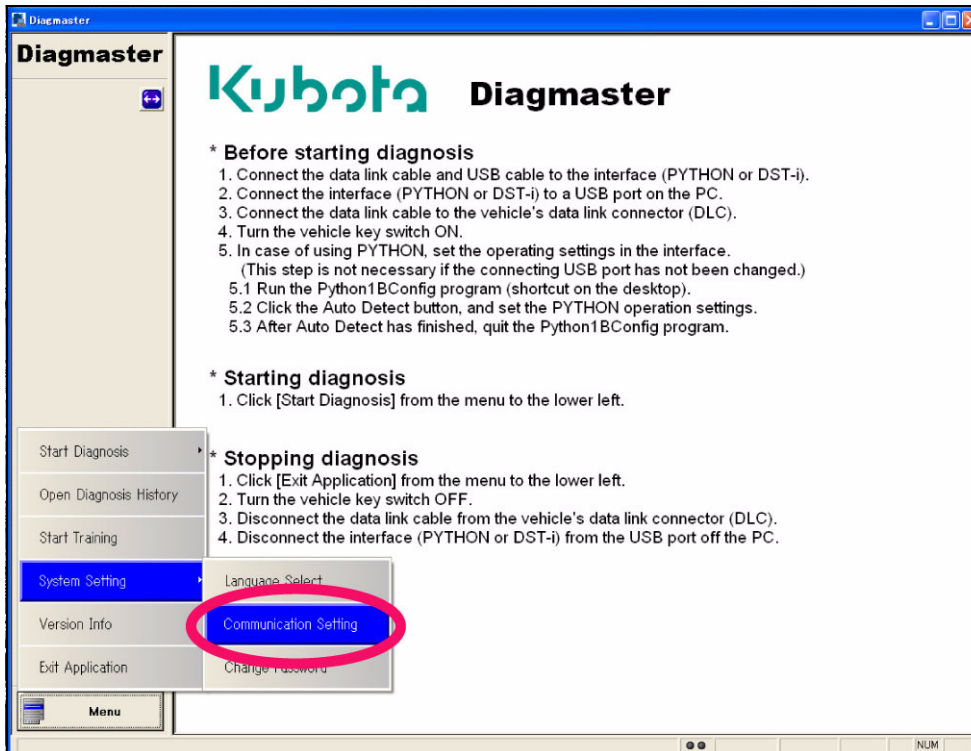
5. The Diagmaster initial screen appears.



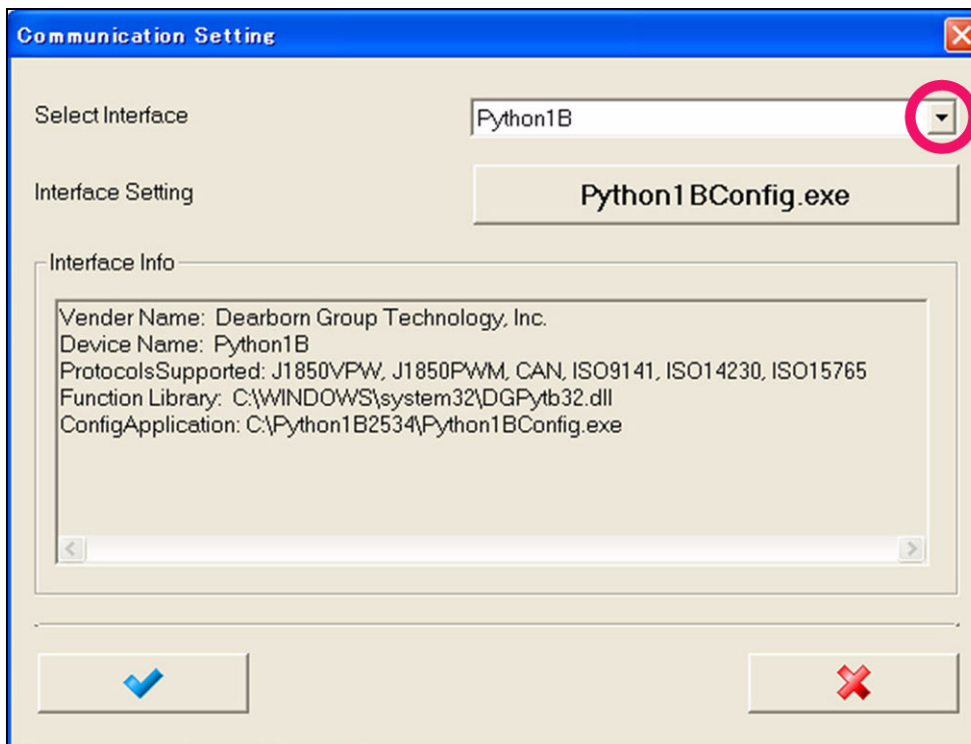
9Y1200226CRS0621US0

(2) DST-i Communication Settings

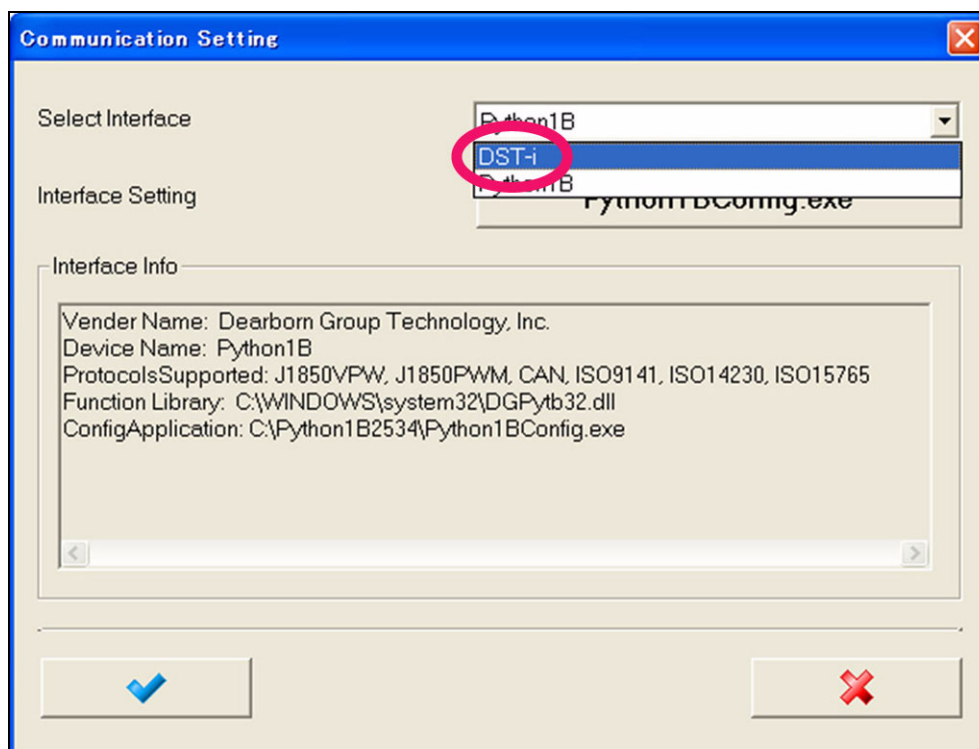
1. From the "Menu", select "System Setting", and then "Communication Setting"



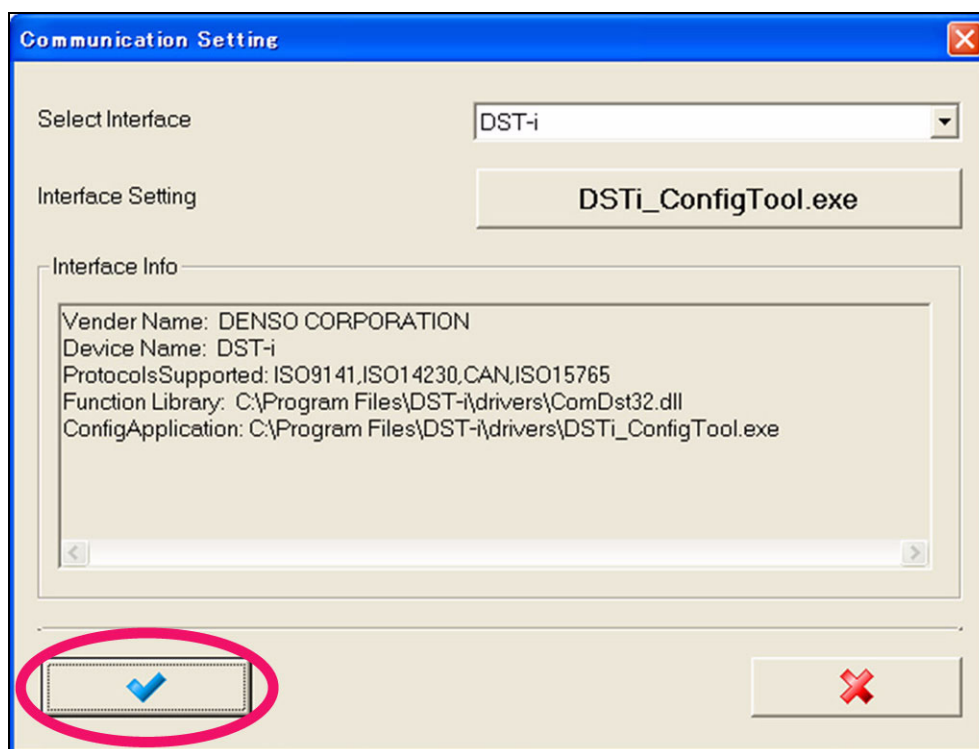
2. Click the interface select button.



3. Select "DST-i", and then click the mouse button.



4. Click the  button.

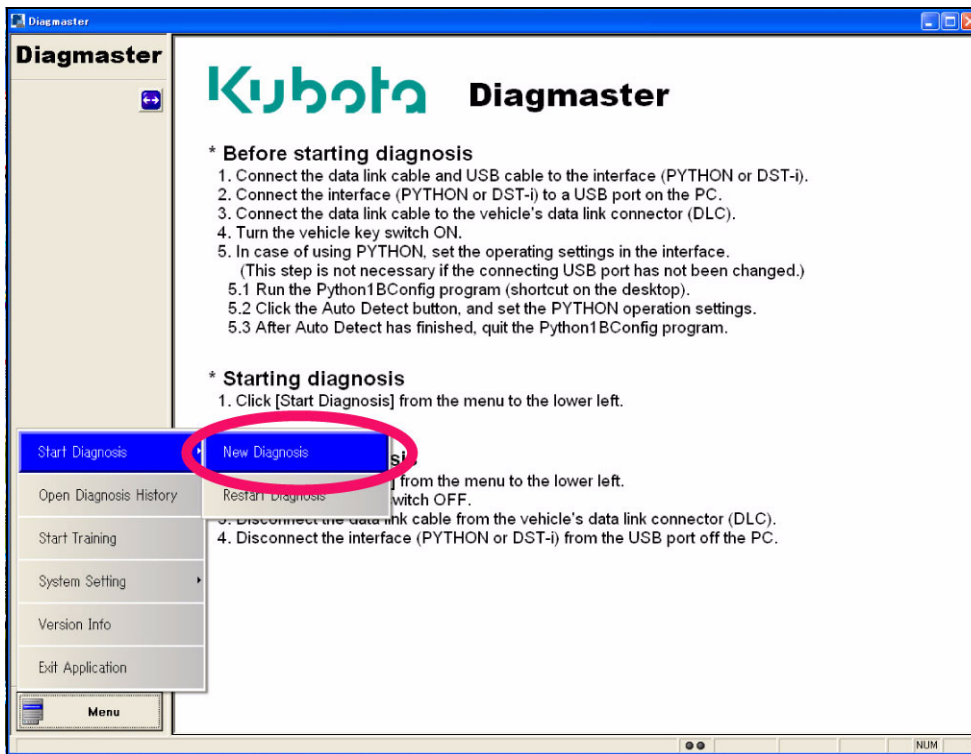


■ **NOTE**

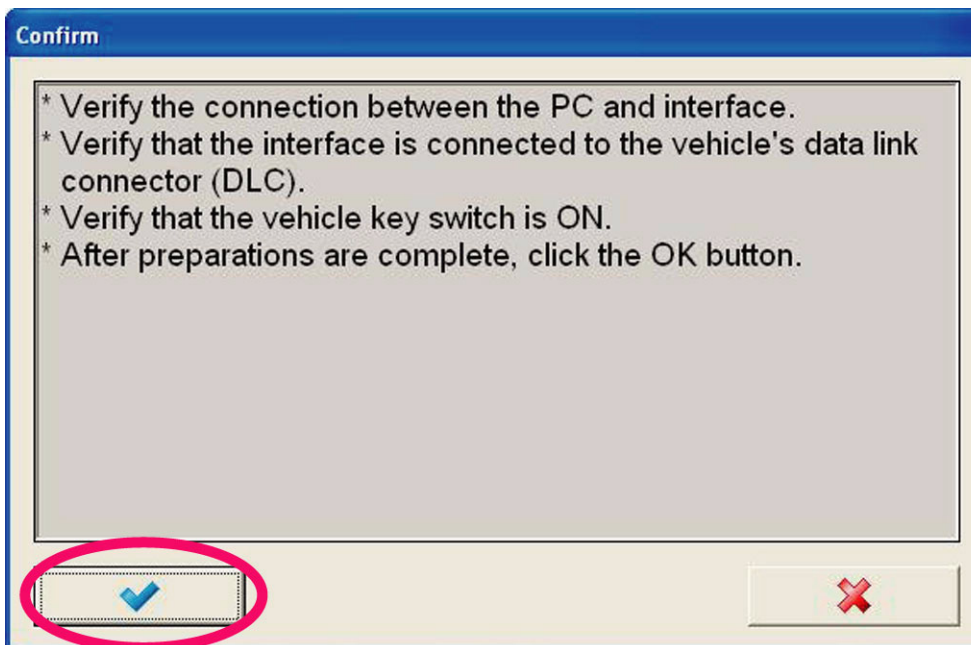
- If you failed in the setting, confirm the connection and start again from procedure 1. to 4..

9Y1200226CRS0622US0

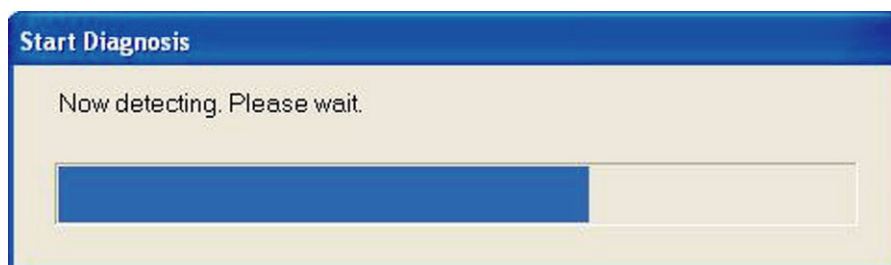
5. From "Menu", select "Start Diagnosis", and then "New Diagnosis".



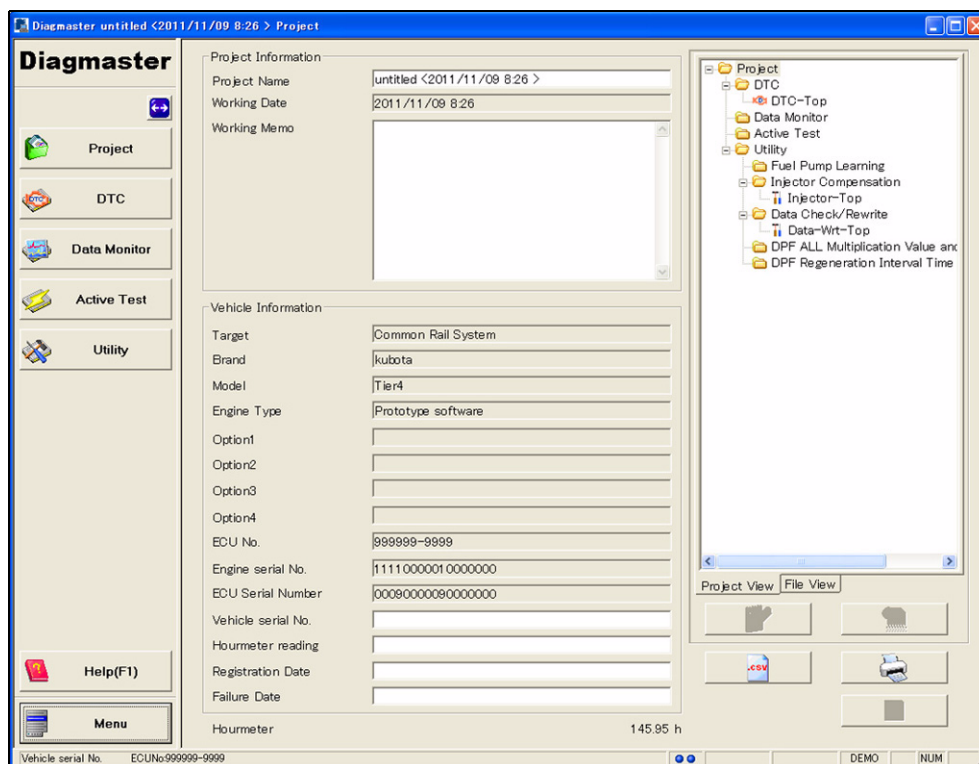
6. Click the  button.



7. The transmitting to ECU progress indicator appears.



8. The "Project" screen appears.



■ NOTE

- If you failed in the setting, confirm the content of procedure 6. and start again from procedure 5. to 8..

9Y1200226CRS0623US0

3. ACTIVE TEST AND SUPPLY PUMP DIFFERENCE LEARNING

The five items below are used (including the supply pump difference learning).

1	"Injector non-injection instruction"	From the active test screen
2	"EGR actuation test"	
3	"Air heater relay actuation test" and "Intake throttle valve actuation test"	
4	"Supply pump difference learning (clear the learning value)" (V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)	From the utility screen
5	"Supply pump learning (clear the learning value)" (V3800-TIE4/-TIE4C)	

9Y1200226CRS0624US0

(Operating conditions → specified tool conditions)

- The conditions below are required for "Injector non-injection instruction", "Supply pump difference learning (clear the learning value)" and "Supply pump learning (clear the learning value)":
 - Machine is stopped
 - Neutral switch is ON

9Y1200226CRS0625US0

[Operation details]

1. "Injector non-injection instruction"

- Stop the injection for each cylinder injector in accordance with the requests from the tool.

Factory specification	Engine vibration and noise are increased when the injection for the corresponding cylinder is stopped. The same results must be attained from all the cylinders.
-----------------------	--

■ **NOTE**

- Do not judge with the corresponding cylinder only: also compare with the symptoms in the other cylinders.**

2. "EGR actuation test"

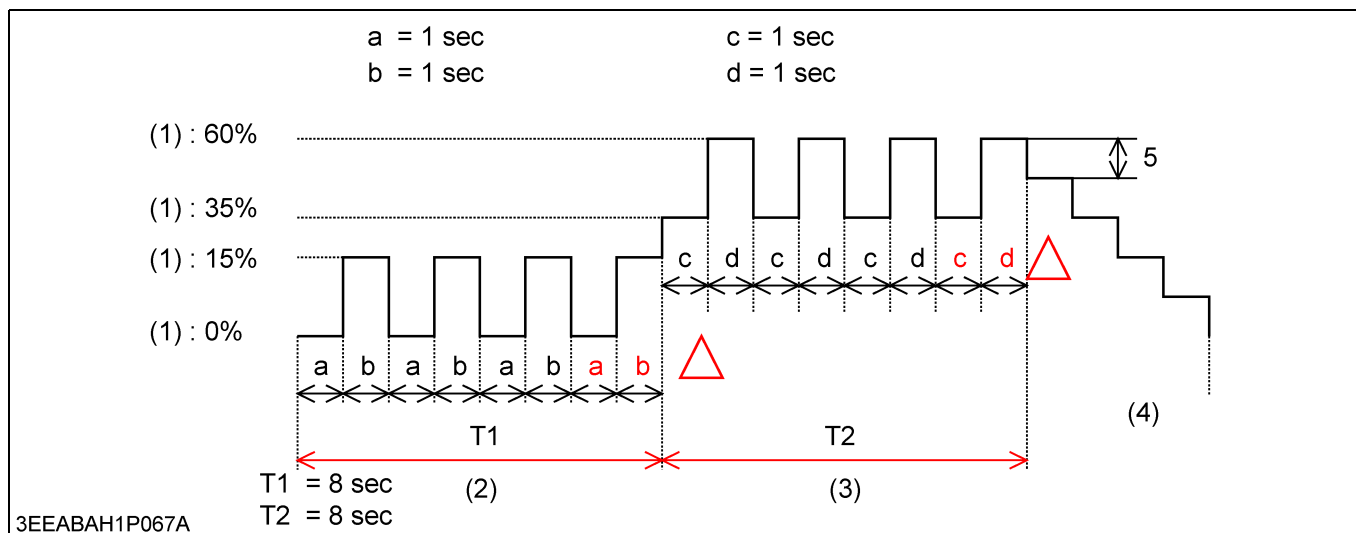
- Operate as shown in the diagram below and in accordance with the requests from the tool.

Factory specification	Low side: When target EGR valve openings of 0 % and 15 % are given alternately, there must not be disparity in the actual EGR valve opening. High side: When target EGR valve openings of 35 % and 60 % are given alternately, there must not be disparity in the actual EGR valve opening.
-----------------------	--

■ **NOTE**

- In some cases the actual opening may be different from the target opening.**
The reason for this is because the learning value is always reflected for 0 lift, after being used for a long time 0 points are shifted.

As such, the factory spec. is a relative evaluation and not an absolute evaluation.



- (1) Opening (2) Operation check on the fully closed valve side (3) Operation check on the fully open valve side (4) Fully open → impact dampening when fully closed

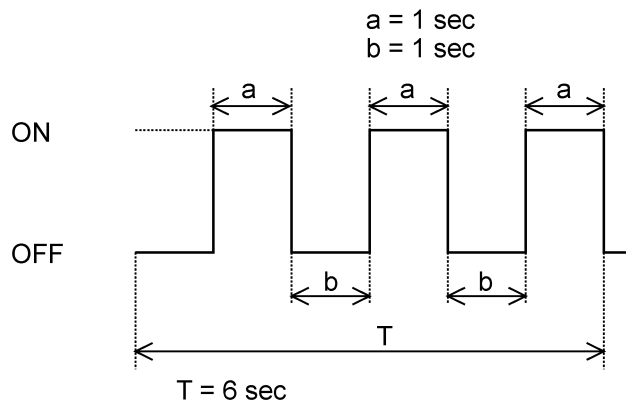
3. "Air heater relay actuation test" and "Intake throttle valve actuation test"

- Operate as shown in the diagram below and in accordance with the requests from the tool.

Factory specification	Operates repeatedly between ON and OFF in accordance with the specified cycle.
-----------------------	--

(To be continued)

(Continued)



3EEABAH1P068A

4. "Supply pump difference learning (clear the learning value) (V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)"

■ **IMPORTANT**

- **Must be performed after replacing the supply pump or ECU.**
- **Clear the learning completion flag in accordance with the requests from the tool. (Initialize)**

Factory specification	A difference learning completion message comes from the tool. In addition, when the "Pump difference learning status" is checked with the monitor function, the status is 2 or 3.
-----------------------	--

■ **NOTE**

- **When the diagnosis related pressure is detected, or when the actual rail pressure can not follow the target pressure properly, perform pump difference learning and see what happens. (As there are some cases that can not complete the relearning (status 2) from status 3.)**
- **This major symptom is extreme air in fuel line or filter clogged etc., and it normally occurred when operating with the extreme vacuum pressure. Perform pump difference learning particularly when the replacement of the filter (too much dirt) has not performed or the engine stalls by air in fuel line etc.**

(The conditions of pump difference learning)

- Condition of the pump difference learning is; After the engine has warmed up (after the thermostat is opened) and the machine is stopped + the neutral switch is ON (neutral status) + the engine is idling (accelerator open position 0 %).

5. "Supply pump learning (clear the learning value)" (V3800-TIE4/-TIE4C)

■ **IMPORTANT**

- **Must be performed after replacing the supply pump or ECU.**
- **Clear the learning completion flag in accordance with the requests from the tool. (Initialize)**

Factory specification	A learning completion message comes from the tool. In addition, when the "Pump learning condition" is checked with the monitor function, the status is 165.
-----------------------	--

■ **NOTE**

- **In the case of engine models with DOC only, select "Supply Pump Learning (HP5)" from the utility screen.**

(The conditions of pump learning)

- Condition of the pump learning is; After the engine has warmed up (after the thermostat is opened) and the machine is stopped + the neutral switch is ON (neutral status) + the engine is idling (accelerator open position 0 %).

9Y1200226CRS0626US0

4. DIAGNOSIS BY MALFUNCTION SYMPTOM

[1] LIST OF MALFUNCTION CAUSES BY SYMPTOM

- Verify the malfunction symptom, and perform diagnosis according to the appropriate number.
- Many diagnostic procedures include check and verification of malfunction symptom while it occurs. Be sure to perform work while verifying the malfunction symptom.

No.	Malfunction Symptom	Detail
1	Engine Warning Light Comes On.	—
2	Engine Does Not Start.	Engine does not crank (starter motor does not rotate).
		Engine stops when the key switch returns to the ON position from the ST position (engine does not rotate under its own power).
3	Takes A Long Time Before Engine Starts.	Takes a long time before engine starts.
		May accompany idle failure.
4	Idle Failure	Idle speed is lower than the standard value or unstable.
		Engine may stall.
5	Engine Noise	Abnormal noises come from inside the engine.
		Engine sound is loud.
6	High Fuel Consumption	Fuel consumption has increased significantly.
7	Poor Acceleration (Insufficient Output)	Acceleration is slower than before when depressing the accelerator pedal.
		Power feels insufficient compared with previously. Large amount of rotation drop.
8	Black Smoke Emitted.	The amount of black smoke in the exhaust gas has increased abnormally compared with previously.
9	White Smoke Emitted.	The amount of white smoke in the exhaust gas has increased abnormally compared with previously.
10	Engine Stalls On Deceleration.	Engine speed drops when releasing the accelerator pedal.
		Engine stalls on deceleration with the accelerator pedal fully closed.
		Engine stalls immediately after the machine stops when decelerating with the accelerator pedal fully closed.

9Y1200226CRS0627US0

Malfunction Cause		Malfunction Cause																
		Control System												Engine				
		Crankshaft position sesor			Camshaft position sensor			Accelerator position sensor			Coolant temperature sensor		Low compression pressure	Engine internal fault	Valve clearance fault	Valve timing fault	Low engine oil viscosity	Insufficient engine oil level
No signal output	Damaged sensor pulsar gear	Air gap size is too large	No signal output	Damaged sensor pulsar gear	Air gap size is too large	No signal output	False signal output	Misadjustment	No signal output	False signal output								
1	Engine Warning Light Comes On	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>		<input type="radio"/> *1	<input type="radio"/> *1		<input type="radio"/> *2		
2	Engine Does Not Start	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>						<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>		
3	Takes A Long Time Before Engine Starts		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>		
4	Idle Failure		<input type="radio"/>	<input type="radio"/>				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>		
5	Engine Noise		<input type="radio"/>	<input type="radio"/>								<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
6	High Fuel Consumption		<input type="radio"/>	<input type="radio"/>								<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
7	Poor Acceleration (Insufficient Output)		<input type="radio"/>	<input type="radio"/>				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
8	Black Smoke Emitted		<input type="radio"/>	<input type="radio"/>									<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
9	White Smoke Emitted		<input type="radio"/>	<input type="radio"/>									<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
10	Engine Stalls On Deceleration		<input type="radio"/>	<input type="radio"/>									<input type="radio"/>	<input type="radio"/>		<input type="radio"/>		

*1: When the engine rotation change is large, it lights.

*2: It lights for a timing positional wrong gear.

9Y1200226CRS0628US0

Malfunction Cause		Malfunction Cause																	
		Control System									Engine Electrical System				Intake System				
		Boost pressure sensor		Rail pressure sensor		Fuel temperature sensor (V3800-CR-TE4/-TIE4/-TE4C/TIE4C)		SCV or PCV malfunction	Main relay malfunction	EGR valve fault	Battery		Charging system malfunction	Air cleaner clogging	Starter relay malfunction	Intake system components	Glow (intake air heater) system		Turbocharge malfunction
											No signal output	False signal output				No signal output	False signal output	No signal output	
1	Engine Warning Light Comes On	○	○	○		○		○	○		○		○			○ *1	○		
2	Engine Does Not Start			○	○			○	○		○	○	○		○		○	○	
3	Takes A Long Time Before Engine Starts			○	○			○				○		○			○	○	
4	Idle Failure			○	○			○											
5	Engine Noise			○	○			○								○			○
6	High Fuel Consumption			○	○			○					○			○			○
7	Poor Acceleration (Insufficient Output)	○	○	○	○			○					○			○			○
8	Black Smoke Emitted			○	○			○		○			○			○			○
9	White Smoke Emitted		○	○	○			○		○			○			○	○		○
10	Engine Stalls On Deceleration							○					○						

*1: When pressure doesn't hang to the boost pressure sensor, it is likely to light.

9Y1200226CRS0629US0

Malfunction Cause		Malfunction Cause																
		Fuel System								Cooling System			Others					
		Supply pump learning failure	Fuel quality	Blockage, leak, malfunction	Injectors	Supply pump malfunction	Clogged fuel filter	Faulty fuel pressure limiter or PRV	Blockage	Leak	SCV or PCV malfunction	Cooling system failure (radiator, hoses, thermostat, cooling fan, etc.)	Damaged fan belt or misadjusted belt tension	Improper concentration of antifreeze	Power transmission malfunction (including clutch slipping) *1	Large dragging (including brake) *1	Loose fit parts	Defective CAN communication
1	Engine Warning Light Comes On			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			<input type="radio"/>							
2	Engine Does Not Start		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>						<input type="radio"/>			
3	Takes A Long Time Before Engine Starts		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>						<input type="radio"/>			
4	Idle Failure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>						<input type="radio"/>			
5	Engine Noise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							<input type="radio"/>			<input type="radio"/>	<input type="radio"/>		
6	High Fuel Consumption	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>	<input type="radio"/>			
7	Poor Acceleration (Insufficient Output)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					<input type="radio"/>	<input type="radio"/>			<input type="radio"/>
8	Black Smoke Emitted	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>									
9	White Smoke Emitted	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>									
10	Engine Stalls On Deceleration		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>									

*1: It emphatically searches for the machine side.

9Y1200226CRS0630US0

[2] DIAGNOSIS BY MALFUNCTION SYMPTOM

(1) Engine Warning Light Comes On

1. Turn the key switch ON and check that the fuel feed pump is operating. If it is not operating, check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE - 5. Check the Fuel Feed Pump". (Refer to page 1-S547)
2. Connect diagnosis tool and read DTC. Refer to pertinent DTC diagnosis guidelines and implement diagnosis.

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(2) Engine Does Not Start

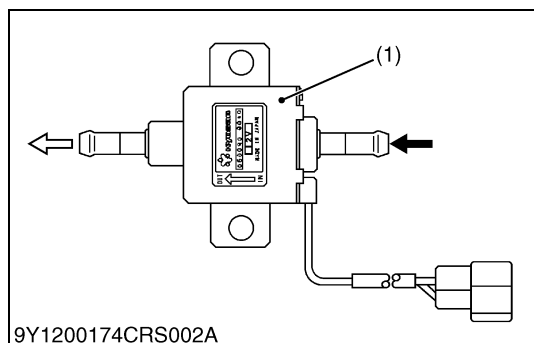
Possible causes:

1. Fuel feed pump operation fault.
2. Starting assist device (intake air heater)
 - Applicable only when the temperature is low: -10°C (14°F) or less
 - Refer to the workshop manual for the machine and check the air heater, relay and related wiring harness.

***Refer to the previous "List of malfunction causes by symptom" for the subsequent details.**

3. Engine fault
 - Low compression pressure.
 - Engine internal fault
 - Valve timing fault
4. Control system
 - Damage to the pulsar gear of the crankshaft position sensor
 - Air gap of the crankshaft position sensor is large
 - Damage to the pulsar gear of the camshaft position sensor
 - SCV, PCV or PRV operation fault
 - Main relay malfunction
5. Engine electrical system
 - Battery fault
 - Charging system malfunction
 - Starter relay malfunction
6. Intake system
 - Glow (intake air heater) relay fault
 - Intake air heater fault
7. Fuel system
 - Fuel quality
 - Fuel filter clogging
 - Fuel pressure limiter fault
 - Fuel line clogging, leak
8. CRS (including the wiring harness)
 - Power supply system
 - Output system (supply pump, injector and common rail)
 - Input system (sensors and switches)
 - ECU
9. Others
 - Large amount of drag (including the brakes, etc.)

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9Y1200174CRS002A

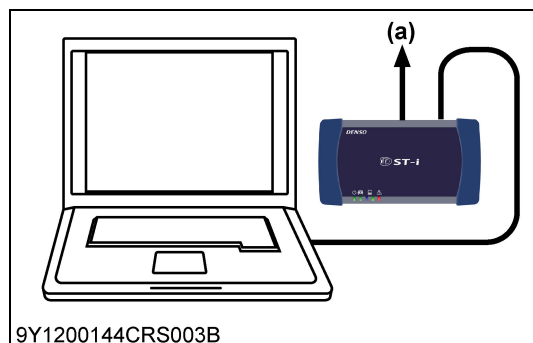
1. Check the Fuel Feed Pump Operation

1. Turn the key switch ON and check that the fuel feed pump is operating.

Factory specification	Operates when the key switch is turned ON.
OK	Go to "2. Check the DTC".
NG	Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE - 5. Check the Fuel Feed Pump". (Refer to page 1-S547)

(1) Fuel Feed Pump

9Y1200226CRS0633US0



2. Check the DTC

1. Turn the key switch ON and check the DTC.

Factory specification	No DTC is output.
-----------------------	-------------------

Communication error

OK	Go to "3. Check the Starting Assist Device".
NG	Go to "6. Check the ECU Power Supply and Grounding".

DTC presently existing

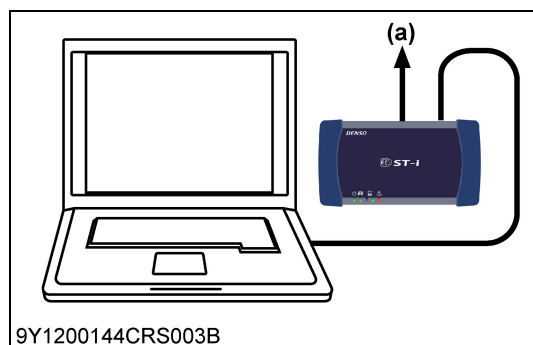
OK	Go to "3. Check the Starting Assist Device".
NG	Check in accordance with the troubleshooting procedures for each DTC.

Past DTC only

OK	Go to "3. Check the Starting Assist Device".
NG	Reproduce defect by referring to the freeze frame data, etc.

(a) CAN1 Connector

9Y1200226CRS0634US0



3. Check the Starting Assist Device

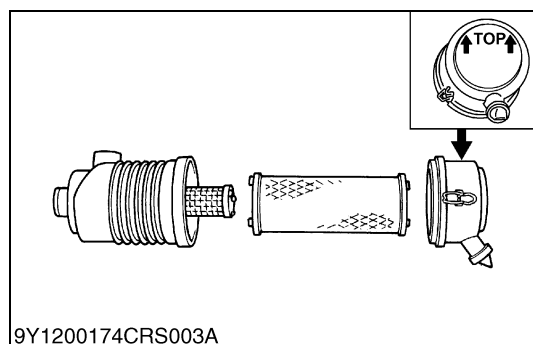
1. Refer to the workshop manual for the machine and check the air heater, relay and related wiring harness.
2. In case the engine can not start when it is new or after the maintenance, make sure to connect the injector harness connector of the head cover position.
3. If the starter relay is used, neutral condition is required depending on the model. Use the monitor function to check whether the neutral switch (signal) is ON.
4. Perform an active test for models that have relay control in the ECU on the engine side.

Factory specification	Operates repeatedly between ON and OFF in accordance with the specified cycle.
-----------------------	--

OK	Go to "4. Check the Intake System".
NG	Checking and repair of starting assist device (intake air heater).

(a) CAN1 Connector

9Y1200226CRS0635US0

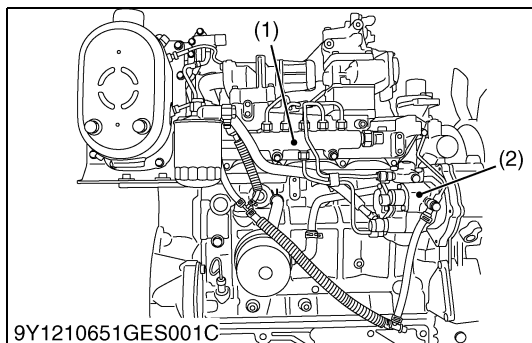


4. Check the Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

OK	Go to "5. Check the Fuel System".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

9Y1200226CRS0636US0



5. Check the Fuel System

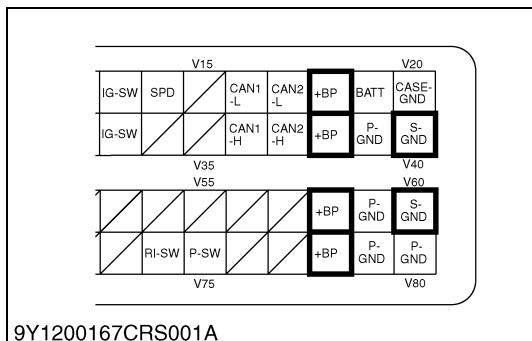
1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "6. Check the ECU Power Supply and Grounding".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

(1) Rail

(2) Supply Pump

9Y1200226CRS0637US0



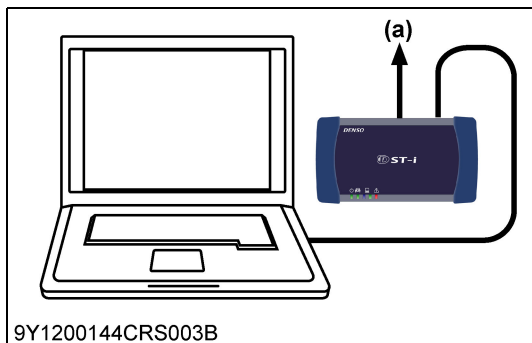
6. Check the ECU Power Supply and Grounding

1. Turn the key switch ON and measure the voltage between the ECU +BP terminals (V18 / V38 / V58 / V78) and ground (body / battery terminal) and ECU S-GND terminal (V40 / V60) and ground (body / battery terminal).

Factory specification	+BP terminal - ground: 10 V or higher S-GND terminal - ground: 0.5 V or lower
-----------------------	--

OK	Go to "7. Check the Crankshaft Position Sensor and Camshaft Position Sensor Signal".
NG	Diagnose by referring to "6.[3] ELECTRIC SYSTEM INSPECTION PROCEDURE - (3) Checking The Power And Ground System (Main Relay ECU Circuit)". (Refer to page 1-S553)

9Y1200226CRS0638US0



7. Check the Crankshaft Position Sensor and Camshaft Position Sensor Signals

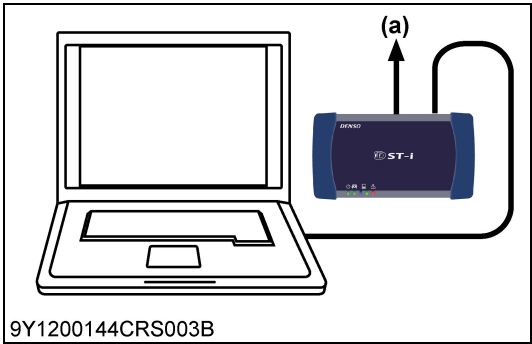
1. Set the key switch to START position and crank the engine. Check the "Engine speed active flag" and "Cam speed active flag" using the diagnosis tool data monitor function.

Factory specification	Both sides ON and constant
-----------------------	----------------------------

OK	Normal.
NG	Go to "8. Supply Pump Difference Learning and Checking the Monitor".
Both flags are unsatisfactory.	Cause of the engine starting failure has been determined. Determine the malfunction area by referring to sections in P0335, P0336 (Refer to page 1-S181) and P0340, P0341 (Refer to page 1-S186) in "5.[2] DIAGNOSIS BY DTC".
Only one side of the flag is unsatisfactory.	Care should be taken as this does not cause engine starting failure. Since the sensor signal is abnormal, determine the malfunction area by referring to sections in P0335, P0336 (Refer to page 1-S181) and P0340, P0341 (Refer to page 1-S186) in "5.[2] DIAGNOSIS BY DTC" as was the case in the above.

(a) CAN1 Connector

9Y1200226CRS0639US0



8. Supply Pump Difference Learning and Checking the Monitor

- 1. Perform difference learning for the supply pump in accordance with "3. ACTIVE TEST AND SUPPLY PUMP DIFFERENCE LEARNING". (Refer to page 1-S16)
- 2. In accordance with the previous "List of malfunction causes by symptom", use the diagnosis tool for a monitor check of the mode flags during start-up, such as the coolant temperature, rail pressure and battery voltage. (Refer to page 1-S19)

OK	Go to "9. Check the Engine".
NG	Repair the malfunction.

(a) CAN1 Connector

9Y1200226CRS0640US0

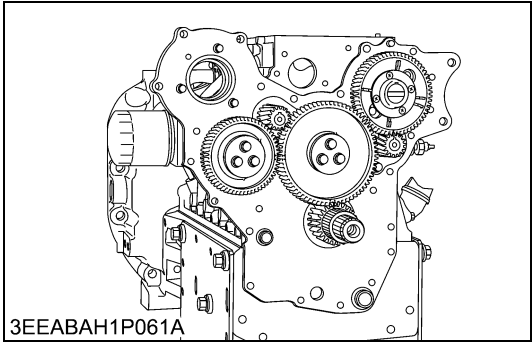
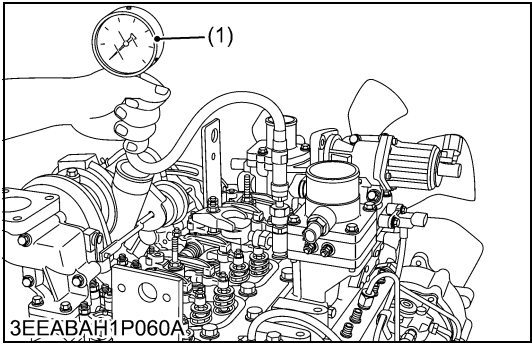
9. Check the Engine

- 1. Check the compression pressure, valve timing and the inside of the engine.

OK	Normal.
NG	Repair the malfunction.

(1) Compression Tester

9Y1200226CRS0641US0



(3) Takes A Long Time Before Engine Starts

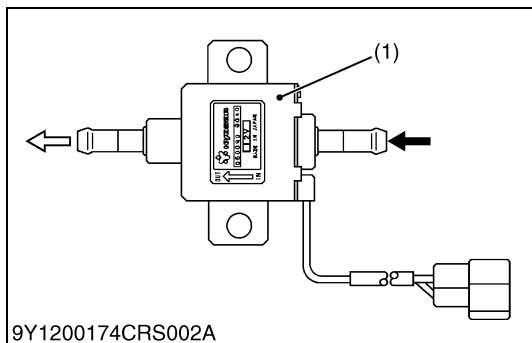
Possible causes:

1. Fuel feed pump operation fault.

***Refer to the previous "List of malfunction causes by symptom" for the subsequent details.**

2. Engine fault
 - Low compression pressure.
 - Engine internal fault
 - Valve timing fault
3. Control system
 - Damage to the pulsar gear of the crankshaft position sensor
 - Air gap of the crankshaft position sensor is large
 - Damage to the pulsar gear of the camshaft position sensor
 - SCV, PCV or PRV operation fault
4. Engine electrical system
 - Battery fault
5. Intake system
 - Glow (intake air heater) relay fault
 - Intake air heater fault
6. Fuel system
 - Fuel quality
 - Fuel filter clogging
 - Fuel pressure limiter fault
 - Fuel line clogging, leak
7. CRS (Including the wiring harness)
 - Output system (Supply pump, injector and common rail)
 - Input system (Sensors and switches)
 - ECU
8. Others
 - Large amount of drag (Including the brakes, etc.)

9Y1200226CRS0642US0



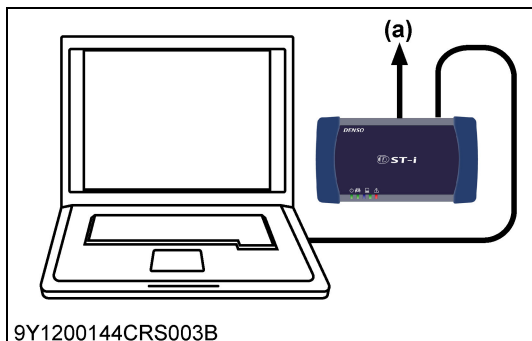
1. Check the Fuel Feed Pump Operation

1. Turn the key switch ON and check that the fuel feed pump is operating.

Factory specification	Operates when the key switch is turned ON.
OK	Go to "2. Check the DTC".
NG	Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE - 5. Check the Fuel Feed Pump". (Refer to page 1-S547)

(1) Fuel Feed Pump

9Y1200226CRS0643US0



2. Check the DTC

1. Turn the key switch ON and check the DTC.

Factory specification	No DTC is output.
-----------------------	-------------------

DTC presently existing

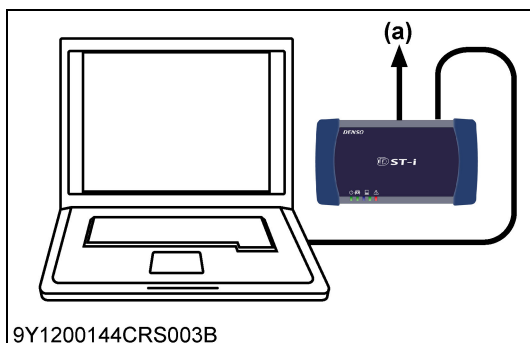
OK	Go to "3. Check the Starting Assist Device".
NG	Check in accordance with the troubleshooting procedures for each DTC.

Past DTC only

OK	Go to "3. Check the Starting Assist Device".
NG	Reproduce defect by referring to the freeze frame data, etc.

(a) CAN1 Connector

9Y1200226CRS0644US0



3. Check the Starting Assist Device

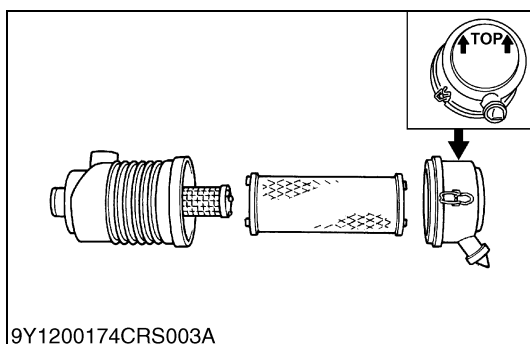
1. Refer to the workshop manual for the machine and check the air heater, relay and related wiring harness.
2. In case the engine can not start when it is new or after the maintenance, make sure to connect the injector harness connector of the head cover position.
3. If the starter relay is used, neutral condition is required depending on the model. Use the monitor function to check whether the neutral switch (signal) is ON.
4. Perform an active test for models that have relay control in the ECU on the engine side.

Factory specification	Operates repeatedly between ON and OFF in accordance with the specified cycle.
-----------------------	--

OK	Go to "4. Check the Intake System".
NG	Checking and repair of starting assist device (intake air heater).

(a) CAN1 Connector

9Y1200226CRS0645US0

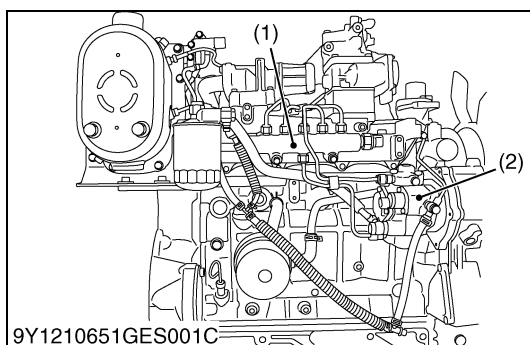


4. Check the Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

OK	Go to "5. Check the Fuel System".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

9Y1200226CRS0646US0



5. Check the Fuel System

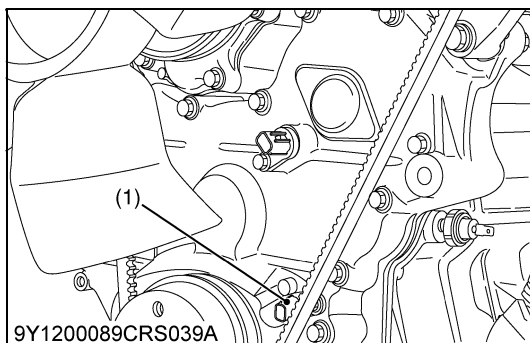
1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "6. Check the Crankshaft Position Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

(1) Rail

(2) Supply Pump

9Y1200226CRS0647US0



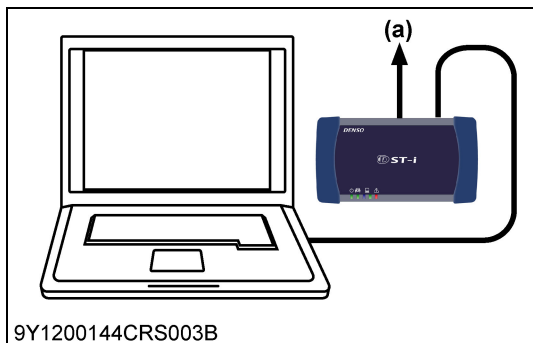
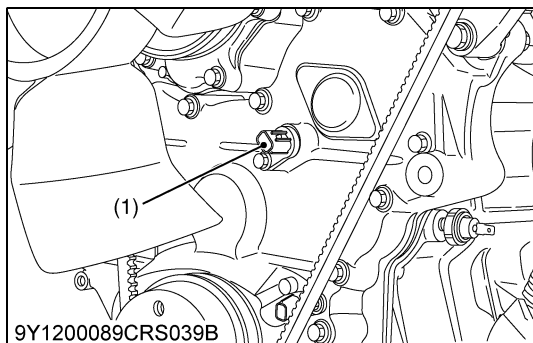
6. Check the Crankshaft Position Sensor

1. Refer to DTC P0335 and P0336, and implement checking of the crankshaft position sensor.

OK	Go to "7. Check the Camshaft Position Sensor".
NG	Repair and replacement of the crankshaft position sensor-related parts.

(1) Crankshaft Position Sensor
(NE Sensor)

9Y1200226CRS0648US0



7. Check the Camshaft Position Sensor

1. Refer to DTC P0340 and P0341, and implement checking of the camshaft position sensor.

OK	Go to "8. Check the Rail Pressure Sensor and Supply Pump".
NG	Repair and replacement of camshaft position sensor-related parts.

- (1) Camshaft Position Sensor
(G Sensor)

9Y1200226CRS0649US0

8. Check the Data Related to Pressure Control

1. Measure the "Target rail pressure" and "Actual rail pressure" when accelerator is operated as indicated below using the diagnosis tool data monitor function.

(V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)

Factory specification	<p>The "Actual rail pressure" always follow to the "Target rail pressure".</p> <ol style="list-style-type: none"> 1. When idling: 40 to 50 MPa (410 to 500 kgf/cm², 5800 to 7200 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 95.0 to 130 MPa (969 to 1320 kgf/cm², 13800 to 18800 psi) 3. No-load maximum speed: 95.0 to 115 MPa (969 to 1170 kgf/cm², 13800 to 16600 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.
-----------------------	---

OK	Go to "9. Check the Injector (Including the Pipes, etc.)"
NG	<p>(Check the trouble related to pressure) Refer to the pressure system items (P0087, P0088, P0089 and P0093 (Refer to page 1-S131)) and SCV abnormality items (P0628 and P0629 (Refer to 1-S212)) in "5.[2] DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts.</p> <p>■ NOTE</p> <ul style="list-style-type: none"> • Some diagnosis items above may be mentioned twice.

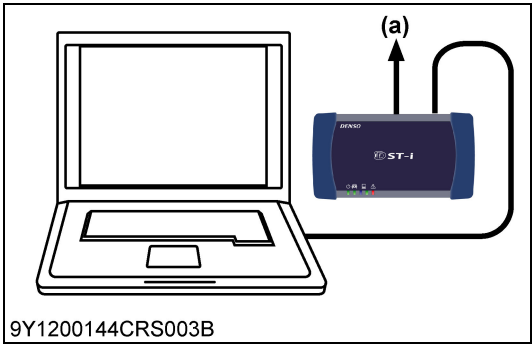
(V3800-TIE4/-TIE4C)

Factory specification	<p>The "Actual rail pressure" always follow to the "Target rail pressure"</p> <ol style="list-style-type: none"> 1. When idling: 35 to 60 MPa (360 to 610 kgf/cm², 5100 to 8700 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 155 MPa (1580 kgf/cm², 22500 psi) 3. No-load maximum speed: 75.0 to 155 MPa (765 to 1580 kgf/cm², 10900 to 22400 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.
-----------------------	--

OK	Go to "9. Check the Injector (Including the Pipes, etc.)"
NG	<p>(Check the trouble related to pressure) Refer to the pressure system items (P0088, P0093 and P0191 (Refer to page 1-S374)) and PCV / PRV abnormality items (P0089, P1A06, P1A0D and P2293 (Refer to page 1-S378)) in "5. DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts.</p> <p>■ NOTE</p> <ul style="list-style-type: none"> • Some diagnosis items above may be mentioned twice.

(a) CAN1 Connector

9Y1200226CRS0650US0



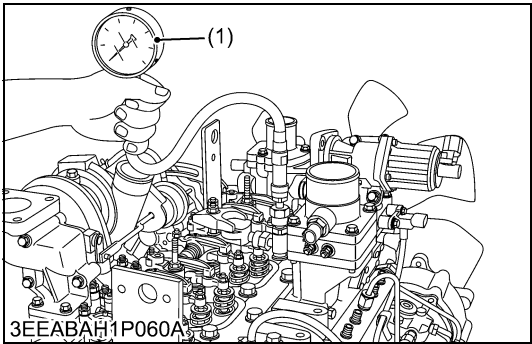
9. Check the Injector (Including the Pipes, etc.)

1. Perform the diagnosis tool active test (stopping the injector injection by cylinder) and check the injector performance.

Factory specification	Engine vibration and noise are increased and the rotation rate is reduced when the injection for the corresponding cylinder is stopped. The same results must be attained from all the cylinders.
OK	Go to "10. Check the Engine".
NG	Check and repair faulty parts including the high pressure line of the defective cylinder.

(a) CAN1 Connector

9Y1200226CRS0651US0



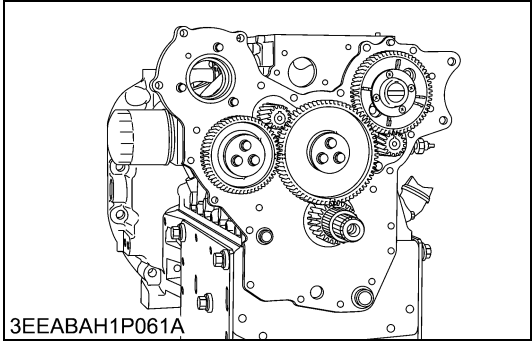
10. Check the Engine

1. Check the compression pressure, valve timing and the inside of the engine.

OK	Normal.
NG	Repair the malfunction.

(1) Compression Tester

9Y1200226CRS0652US0



(4) Idle Failure

Possible causes:

1. Fuel feed pump operation fault.

***Refer to the previous "List of malfunction causes by symptom" for the subsequent details.**

2. Engine fault

- Low compression pressure.
- Engine internal fault
- Valve timing fault

3. Control system

- Damage to the pulsar gear of the crankshaft position sensor
- Air gap of the crankshaft position sensor is large
- SCV, PCV or PRV operation fault

4. Fuel system

- Supply pump learning has not been performed
- Fuel quality
- Fuel filter clogging
- Fuel pressure limiter fault
- Fuel line clogging, leak

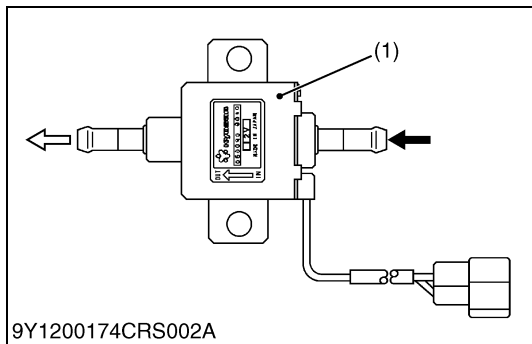
5. CRS (including the wiring harness)

- Output system (supply pump, injector and common rail)
- Input system (sensors and switches)
- ECU

6. Others

- Large amount of drag (including the brakes, etc.)

9Y1200226CRS0653US0



9Y1200174CRS002A

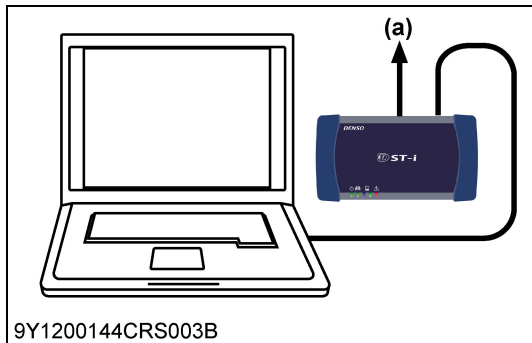
1. Check the Fuel Feed Pump Operation

1. Turn the key switch ON and check that the fuel feed pump is operating.

Factory specification	Operates when the key switch is turned ON.
OK	Go to "2. Check the DTC".
NG	Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE - 5. Check the Fuel Feed Pump". (Refer to page 1-S547)

(1) Fuel Feed Pump

9Y1200226CRS0654US0



9Y1200144CRS003B

2. Check the DTC

1. Turn the key switch ON and check the DTC.

Factory specification	No DTC is output.
-----------------------	-------------------

DTC presently existing

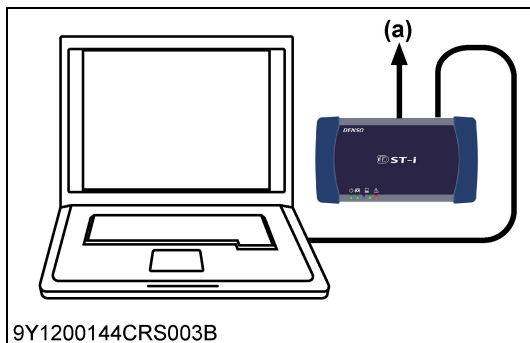
OK	Go to "3. Check the Injector (Including the Pipes, etc.)".
NG	Check in accordance with the troubleshooting procedures for each DTC.

Past DTC only

OK	Go to "3. Check the Injector (Including the Pipes, etc.)".
NG	Reproduce defect by referring to the freeze frame data, etc.

(a) CAN1 Connector

9Y1200226CRS0655US0



3. Check the Injector (Including the Pipes, etc.)

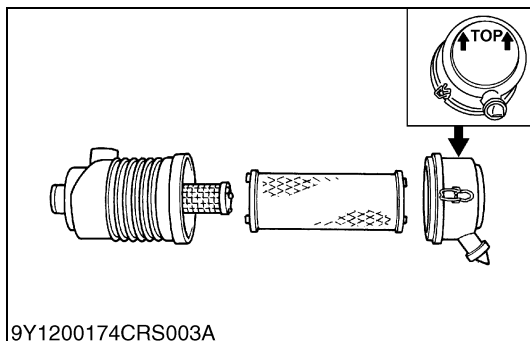
1. Perform the diagnosis tool active test (stopping the injector injection by cylinder) and check the injector performance.

Factory specification	Engine vibration and noise are increased and the rotation rate is reduced when the injection for the corresponding cylinder is stopped. The same results must be attained from all the cylinders.
-----------------------	--

OK	Go to "4. Check the Intake System".
NG	Check and repair faulty parts including the high pressure line of the defective cylinder.

(a) CAN1 Connector

9Y1200226CRS0656US0

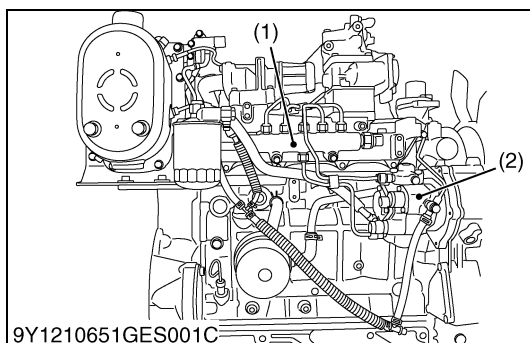


4. Check the Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

OK	Go to "5. Check the Fuel System".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

9Y1200226CRS0657US0



5. Check the Fuel System

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "6. Check the Accelerator Position Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

(1) Rail

(2) Supply Pump

9Y1200226CRS0658US0

6. Check the Accelerator Position Sensor



CAUTION

- When checking, pay attention to the angle of mounting instead of the output signal quality.

1. Inspect in accordance with the operator's manual.

OK	Go to "7. Check the Crankshaft Position Sensor".
NG	Replacement of accelerator position sensor.

9Y1200226CRS0659US0

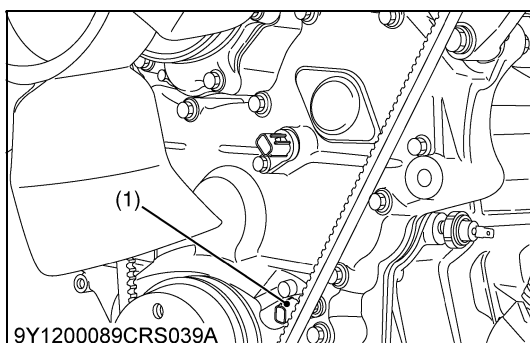
7. Check the Crankshaft Position Sensor

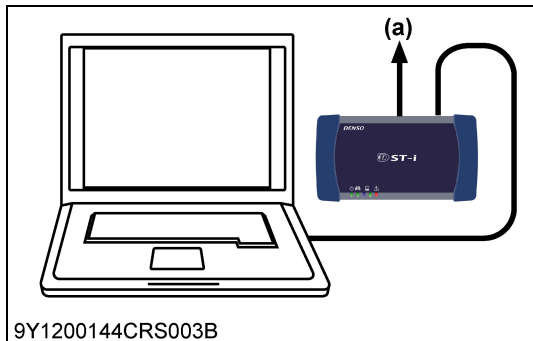
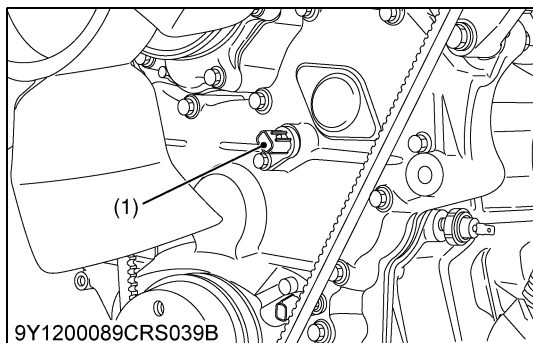
1. Refer to DTC P0335 and P0336, and implement checking of the crankshaft position sensor.

OK	Go to "8. Check the Camshaft Position Sensor".
NG	Repair and replacement of the crankshaft position sensor-related parts.

- (1) Crankshaft Position Sensor (NE Sensor)

9Y1200226CRS0660US0





8. Check the Camshaft Position Sensor

1. Refer to DTC P0340 and P0341, and implement checking of the camshaft position sensor.

OK	Go to "9. Check the Rail Pressure Sensor and Supply Pump".
NG	Repair and replacement of camshaft position sensor-related parts.

- (1) Camshaft Position Sensor
(G Sensor)

9Y1200226CRS0661US0

9. Check the Data Related to Pressure Control

1. Measure the "Target rail pressure" and "Actual rail pressure" when accelerator is operated as indicated below using the diagnosis tool data monitor function.

(V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)

Factory specification	<p>The "Actual rail pressure" always follow to the "Target rail pressure".</p> <ol style="list-style-type: none"> 1. When idling: 40 to 50 MPa (410 to 500 kgf/cm², 5800 to 7200 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 95.0 to 130 MPa (969 to 1320 kgf/cm², 13800 to 18800 psi) 3. No-load maximum speed: 95.0 to 115 MPa (969 to 1170 kgf/cm², 13800 to 16600 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.
-----------------------	---

OK	Go to "10. Check the Engine"
NG	<p>(Check the trouble related to pressure) Refer to the pressure system items (P0087, P0088, P0089 and P0093 (Refer to page 1-S131)) and SCV abnormality items (P0628 and P0629 (Refer to 1-S212)) in "5.[2] DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts.</p> <p>■ NOTE</p> <ul style="list-style-type: none"> • Some diagnosis items above may be mentioned twice.

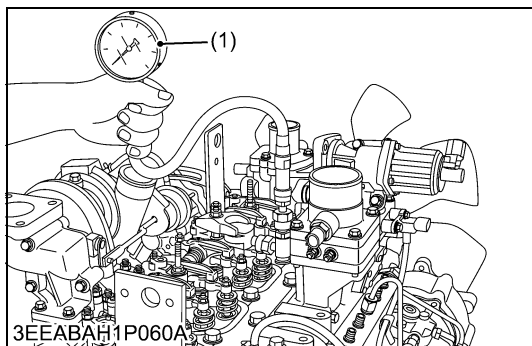
(V3800-TIE4/-TIE4C)

Factory specification	<p>The "Actual rail pressure" always follow to the "Target rail pressure"</p> <ol style="list-style-type: none"> 1. When idling: 35 to 60 MPa (360 to 610 kgf/cm², 5100 to 8700 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 155 MPa (1580 kgf/cm², 22500 psi) 3. No-load maximum speed: 75.0 to 155 MPa (765 to 1580 kgf/cm², 10900 to 22400 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.
-----------------------	--

OK	Go to "10. Check the Engine"
NG	<p>(Check the trouble related to pressure) Refer to the pressure system items (P0088, P0093 and P0191 (Refer to page 1-S374)) and PCV / PRV abnormality items (P0089, P1A06, P1A0D and P2293 (Refer to page 1-S378)) in "5. DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts.</p> <p>■ NOTE</p> <ul style="list-style-type: none"> • Some diagnosis items above may be mentioned twice.

(a) CAN1 Connector

9Y1200226CRS0662US0



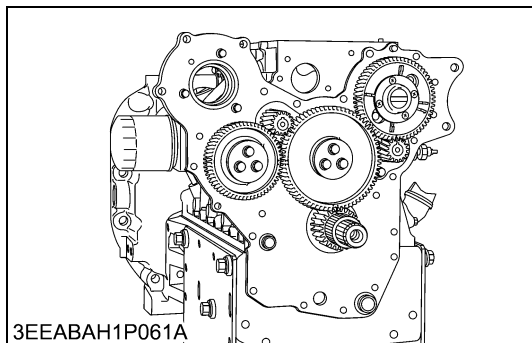
10. Check the Engine

1. Check the compression pressure, valve timing and the inside of the engine.

OK	Normal.
NG	Repair the malfunction.

(1) Compression Tester

9Y1200226CRS0663US0



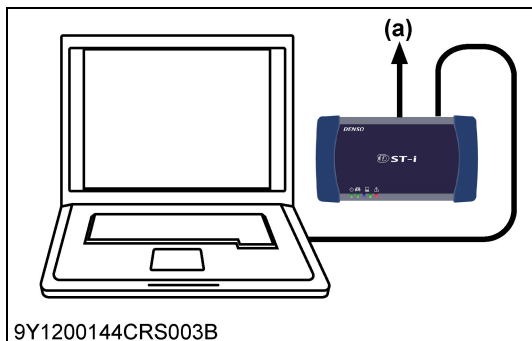
(5) Engine Noise

Possible causes:

*Refer to the previous "List of malfunction causes by symptom" for the subsequent details.

1. Engine fault
 - Low compression pressure.
 - Engine internal fault
 - Valve clearance fault
 - Valve timing fault
2. Control system
 - Damage to the pulsar gear of the crankshaft position sensor
 - Air gap of the crankshaft position sensor is large
 - SCV, PCV or PRV operation fault
3. Intake system
 - Leak from the intake system parts
4. Fuel system
 - Supply pump learning has not been performed
 - Fuel quality
5. Cooling system
 - Fan belt damage or tension misadjustment
6. CRS (including related fuel line)
 - Output system (supply pump, injector and common rail)
 - Input system (sensors)
 - ECU
7. Others
 - Large amount of drag (including the brakes, etc.)
 - Loose parts (including part interference sound)

9Y1200226CRS0664US0



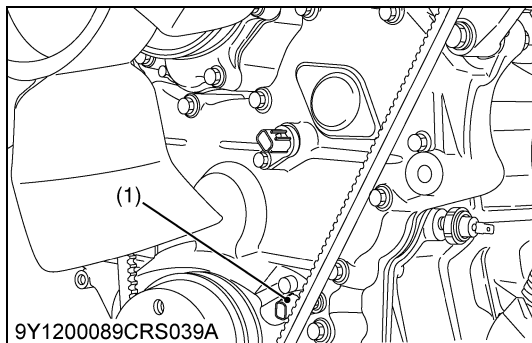
1. Check the DTC

1. Turn the key switch ON and check the DTC.

Factory specification	No DTC is output.
OK	Go to "2. Check the Crankshaft Position Sensor"
NG	Check in accordance with the troubleshooting procedures for each DTC.

(a) CAN1 Connector

9Y1200226CRS0665US0



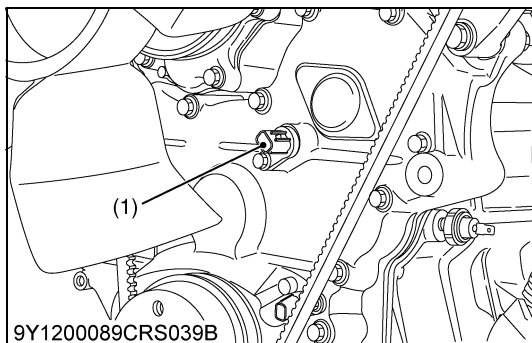
2. Check the Crankshaft Position Sensor

1. Refer to DTC P0335 and P0336, and implement checking of the crankshaft position sensor.

OK	Go to "3. Check the Camshaft Position Sensor".
NG	Repair and replacement of the crankshaft position sensor-related parts.

- (1) Crankshaft Position Sensor
(NE Sensor)

9Y1200226CRS0666US0



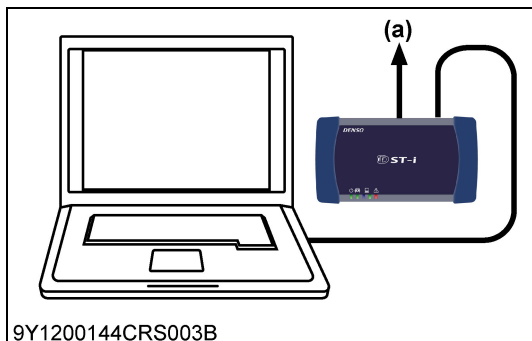
3. Check the Camshaft Position Sensor

1. Refer to DTC P0340 and P0341, and implement checking of the camshaft position sensor.

OK	Go to "4. Check the Injector (Including the Pipes, etc.)".
NG	Repair and replacement of camshaft position sensor-related parts.

- (1) Camshaft Position Sensor
(G Sensor)

9Y1200226CRS0667US0



4. Check the Injector (Including the Pipes, etc.)

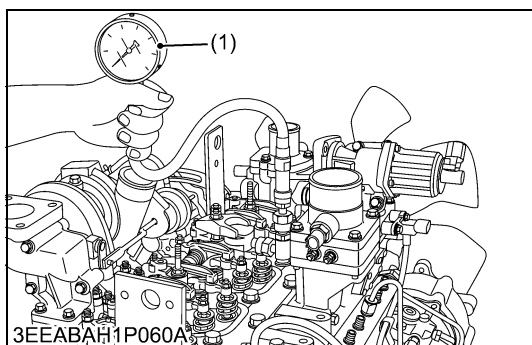
1. Perform the diagnosis tool active test (stopping the injector injection by cylinder) and check the injector performance.

Factory specification	<ol style="list-style-type: none"> 1. Engine vibration and noise are increased and the rotation speed is reduced when the injection for the corresponding cylinder is stopped. 2. The same results must be attained from all the cylinders.
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OK	Go to "5. Check the Engine and Machine Body".
NG	Check and repair faulty parts including the high pressure line of the defective cylinder.

- (a) CAN1 Connector

9Y1200226CRS0668US0



5. Check the Engine and Machine Body

1. Check the compression pressure, valve clearance, valve timing and the inside of the engine.

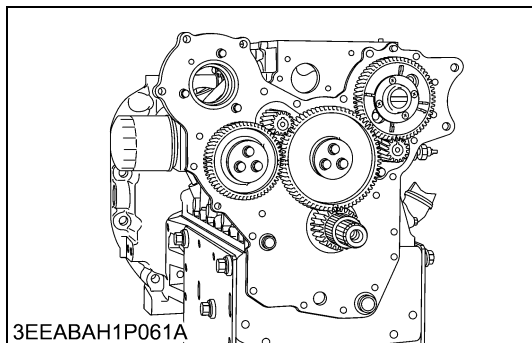
OK	Normal.
NG	Repair the malfunction.

2. Check for loose parts in the engine and on the machine body (including part interference sound).
3. Check for a large amount of drag (including the brakes, etc.).

OK	Normal.
NG	Repair the malfunction.

- (1) Compression Tester

9Y1200226CRS0669US0



(6) High fuel consumption

Possible causes:

Reduced engine performance is detected and the fuel consumption is higher for this reason.

1. The engine performance is reduced and the fuel consumption is higher for this reason

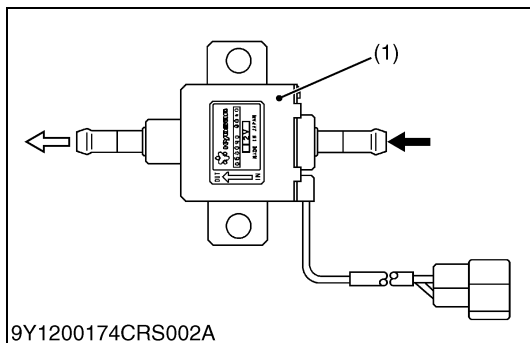
Reduced engine performance is not detected but the fuel consumption is higher.

1. Usage habits of the user or use of non-standard parts
 - Not the standard specification
 - Tires, wheels
 - Intake / exhaust system parts
 - Used for a long time under poor fuel consumption conditions
 - Engine used for a long time under a high load
 - Long idling time
 - Frequently used under driving conditions with a large injection quantity
 - Low mileage for each drive (frequently used before the engine has warmed up)
 - Faulty maintenance
 - Engine oil (dirt)
 - Air filter, fuel filter (dirt, clogging)
 - Radiator clogging
2. Powertrain malfunctions not involving the engine
 - Large driving resistance
 - Large resistance for actuation
 - Tire air pressure
 - Brake drag
 - Clutch slipping
3. Fuel feed pump operation fault.

***Refer to the previous "List of malfunction causes by symptom" for the subsequent details.**

4. Engine fault
 - Low compression pressure.
 - Engine internal fault
 - Valve clearance fault
 - Valve timing fault
 - Engine oil viscosity fault
5. Control system
 - Damage to the pulsar gear of the crankshaft position sensor
 - Air gap of the crankshaft position sensor is large
 - SCV, PCV or PRV operation fault
6. Intake system
 - Air cleaner clogging
 - Leak from the intake system parts
 - Turbocharger operation fault
7. Fuel system
 - Supply pump learning has not been performed
 - Fuel quality
 - Fuel pressure limiter fault
 - Fuel line clogging, leak
8. CRS (including related parts)
 - Output system (supply pump and injector)
 - Input system (sensors) *A cause for larger injection quantity

9Y1200226CRS0670US0



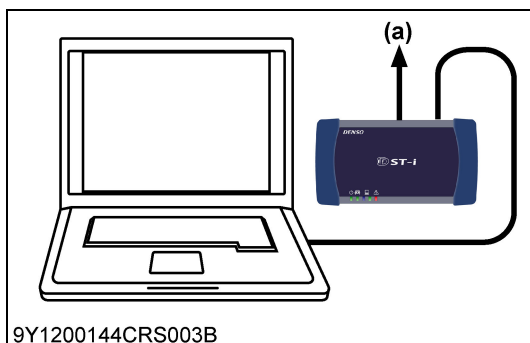
1. Check the Fuel Feed Pump Operation

1. Turn the key switch ON and check that the fuel feed pump is operating.

Factory specification	Operates when the key switch is turned ON.
OK	Go to "2. Check the DTC".
NG	Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE - 5. Check the Fuel Feed Pump". (Refer to page 1-S547)

(1) Fuel Feed Pump

9Y1200226CRS0671US0



2. Check the DTC

1. Turn the key switch ON and check the DTC.

Factory specification	No DTC is output.
OK	Go to "3. Comparison of Fuel Economy".
NG	Check in accordance with the troubleshooting procedures for each DTC.

(a) CAN1 Connector

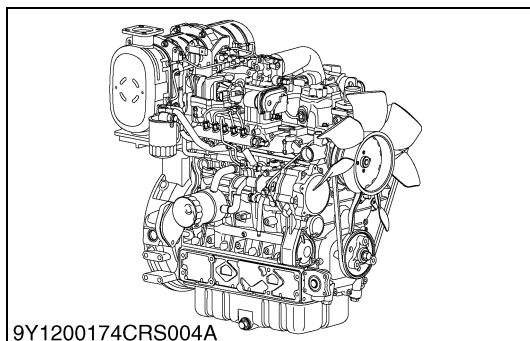
9Y1200226CRS0672US0

3. Comparison of Fuel Economy

1. Compare with a normal device working under the same operating conditions and measure the amount of consumed fuel (amount left in the tank).

OK	Use a specific example to explain and make the user understand that under some operating conditions the fuel consumption will increase and that the machine is not malfunctioning.
NG	Go to "4. Check the Engine and Machine Condition".

9Y1200226CRS0673US0



4. Check the Engine and Machine Condition

1. Check for the usage habits of the user or use of non-standard parts.
 - Use of non-standard parts such as tires, wheels and intake / exhaust system parts
 - Used under poor fuel consumption conditions
 - Engine used for a long time under a high load
 - Long idling time
 - Faulty maintenance
 - Engine oil level and dirt
 - Air filter, fuel filter dirt and clogging
 - Radiator clogging

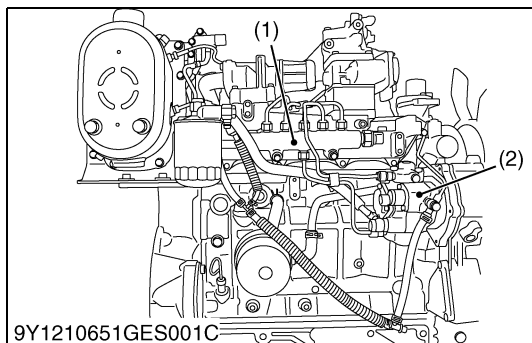
OK	Go to "Check for malfunctions in the powertrain".
NG	Give guidance to the user.

2. Check for malfunctions in the powertrain.

- Check the driving resistance
 - Is a large resistance required for actuation?
 - Is the tire air pressure correct?
 - Is there brake drag?

OK	Go to "5. Check the Fuel System".
NG	Adjust or repair the malfunction.

9Y1200226CRS0674US0



5. Check the Fuel System

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

(Reference)

Pay attention particularly to the following two points:

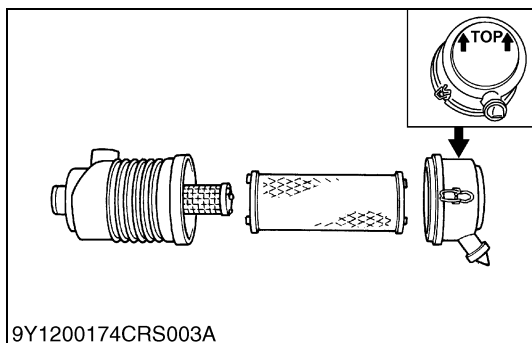
- Service fuel (for summer / winter seasons, and cold region)
- Fuel leak from the fuel line

OK	Go to "6. Check the Intake System".
NG	Repair or replace the malfunctioning component.

(1) Rail

(2) Supply Pump

9Y1200226CRS0675US0



6. Check the Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

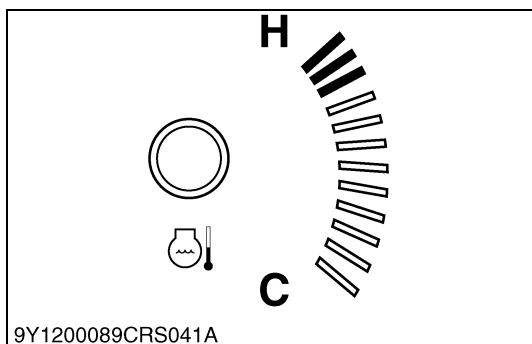
(Reference)

Pay attention particularly to the following point:

- Intake air leak

OK	Go to "7. Check the Coolant Temperature Increase Rate".
NG	Repair or replace the malfunctioning component.

9Y1200226CRS0676US0

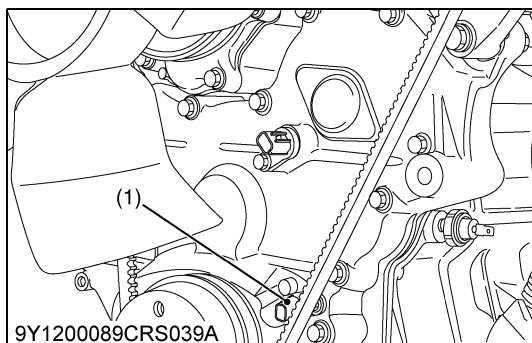


7. Check the Coolant Temperature Increase Rate

1. Check the speed of the coolant temperature increase on the coolant temperature gauge in the instrument panel (compared with a normal device).

OK	Go to "8. Check the Crankshaft Position Sensor".
NG	Check and repair the cooling system.

9Y1200226CRS0677US0



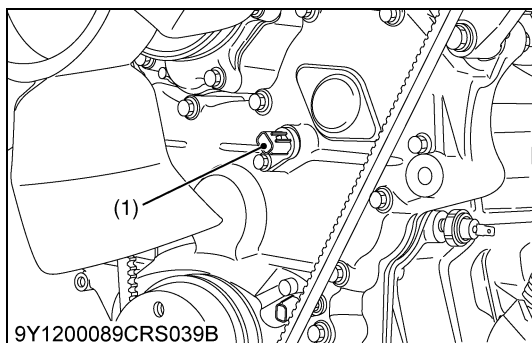
8. Check the Crankshaft Position Sensor

1. Refer to DTC P0335 and P0336, and implement checking of the crankshaft position sensor.

OK	Go to "9. Check the Camshaft Position Sensor".
NG	Repair and replacement of the crankshaft position sensor-related parts.

(1) Crankshaft Position Sensor
(NE Sensor)

9Y1200226CRS0678US0



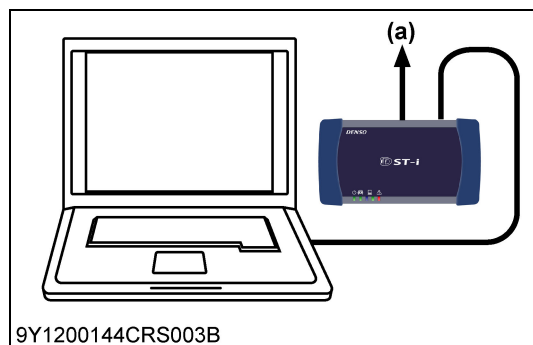
9. Check the Camshaft Position Sensor

1. Refer to DTC P0340 and P0341, and implement checking of the camshaft position sensor.

OK	Go to "10. Check the Rail Pressure Sensor And Supply Pump".
NG	Repair and replacement of camshaft position sensor-related parts.

(1) Camshaft Position Sensor
(G Sensor)

9Y1200226CRS0679US0



10. Check the Data Related to Pressure Control

1. Measure the "Target rail pressure" and "Actual rail pressure" when accelerator is operated as indicated below using the diagnosis tool data monitor function.

(V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)

Factory specification	<p>The "Actual rail pressure" always follow to the "Target rail pressure".</p> <ol style="list-style-type: none"> 1. When idling: 40 to 50 MPa (410 to 500 kgf/cm², 5800 to 7200 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 95.0 to 130 MPa (969 to 1320 kgf/cm², 13800 to 18800 psi) 3. No-load maximum speed: 95.0 to 115 MPa (969 to 1170 kgf/cm², 13800 to 16600 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.
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OK	Go to "11. Check the Injector (Including the Pipes, etc.)"
NG	<p>(Check the trouble related to pressure) Refer to the pressure system items (P0087, P0088, P0089 and P0093 (Refer to page 1-S131)) and SCV abnormality items (P0628 and P0629 (Refer to 1-S212)) in "5.[2] DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts.</p> <p>■ NOTE</p> <ul style="list-style-type: none"> • Some diagnosis items above may be mentioned twice.

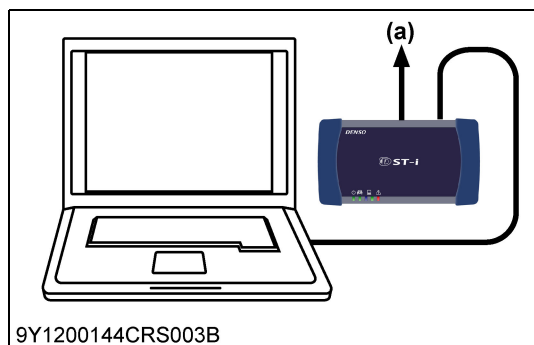
(V3800-TIE4/-TIE4C)

Factory specification	<p>The "Actual rail pressure" always follow to the "Target rail pressure"</p> <ol style="list-style-type: none"> 1. When idling: 35 to 60 MPa (360 to 610 kgf/cm², 5100 to 8700 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 155 MPa (1580 kgf/cm², 22500 psi) 3. No-load maximum speed: 75.0 to 155 MPa (765 to 1580 kgf/cm², 10900 to 22400 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.
-----------------------	--

OK	Go to "11. Check the Injector (Including the Pipes, etc.)"
NG	<p>(Check the trouble related to pressure) Refer to the pressure system items (P0088, P0093 and P0191 (Refer to page 1-S374)) and PCV / PRV abnormality items (P0089, P1A06, P1A0D and P2293 (Refer to page 1-S378)) in "5. DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts.</p> <p>■ NOTE</p> <ul style="list-style-type: none"> • Some diagnosis items above may be mentioned twice.

(a) CAN1 Connector

9Y1200226CRS0680US0



11. Check the Injector (Including the Pipes, etc.)

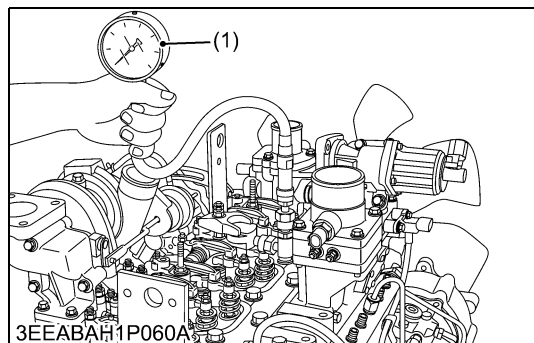
1. Perform the diagnosis tool active test (stopping the injector injection by cylinder) and check the injector performance.

Factory specification	Engine vibration and noise are increased and the rotation speed is reduced when the injection for the corresponding cylinder is stopped. The same results must be attained from all the cylinders.
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OK	Go to "12. Check the Engine".
NG	Check and repair faulty parts including the high pressure line of the defective cylinder.

(a) CAN1 Connector

9Y1200226CRS0681US0



12. Check the Engine

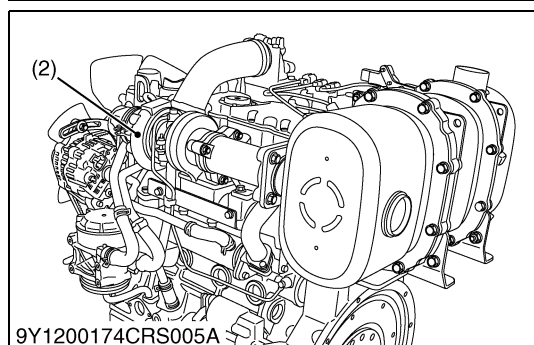
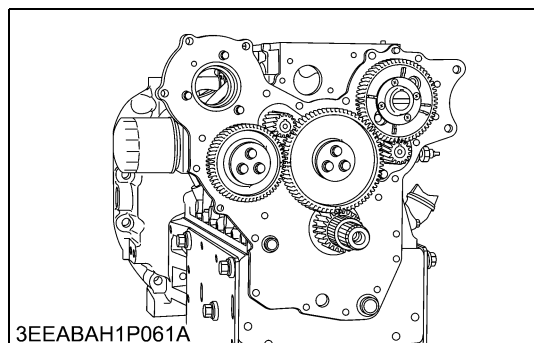
1. Check the compression pressure, valve clearance, valve timing, the inside of the engine and engine oil viscosity.
2. Check the timing gear.
3. Check the turbocharger.

OK	Normal.
NG	Repair or replace the related parts.

(1) Compression Tester

(2) Turbocharger

9Y1200226CRS0682US0



(7) Poor Acceleration (Insufficient Output)

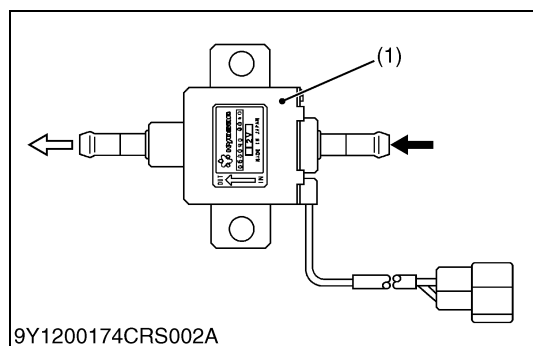
Possible causes:

1. Fuel feed pump operation fault.
2. Large driving resistance due to problems in the machine itself that do not involve the engine
 - Large resistance for actuation
 - Tire air pressure
 - Power transmission fault
 - Brake drag

***Refer to the previous "List of malfunction causes by symptom" for the subsequent details.**

3. Engine fault
 - Low compression pressure.
 - Engine internal fault
 - Valve clearance fault
 - Valve timing fault
 - Engine oil viscosity fault
4. Control system
 - Damage to the pulsar gear of the crankshaft position sensor
 - Air gap of the crankshaft position sensor is large
 - Accelerator position sensor misadjustment
 - SCV, PCV or PRV operation fault
5. Intake system
 - Air cleaner clogging
 - Leak from the intake system parts
 - Turbocharger operation fault
6. Fuel system
 - Supply pump learning has not been performed
 - Fuel quality
 - Fuel pressure limiter fault
 - Fuel line clogging, leak
7. CRS (including related parts)
 - Output system (supply pump, injector and common rail)
 - Input system (sensors) *A cause for larger injection quantity
 - ECU
8. Others
 - Power transmission fault
 - Large amount of drag (including the brakes, etc.)
 - Defective CAN communication

9Y1200226CRS0683US0



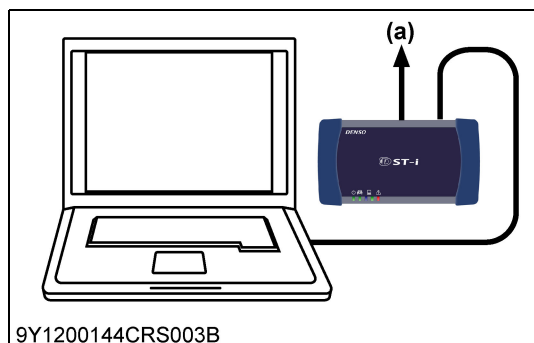
1. Check the Fuel Feed Pump Operation

1. Turn the key switch ON and check that the fuel feed pump is operating.

Factory specification	Operates when the key switch is turned ON.
OK	Go to "2. Check the DTC".
NG	Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE - 5. Check the Fuel Feed Pump". (Refer to page 1-S547)

(1) Fuel Feed Pump

9Y1200226CRS0684US0



2. Check the DTC

1. Turn the key switch ON and check the DTC.

Factory specification	No DTC is output.
-----------------------	-------------------

DTC presently existing

OK	Go to "3. Check the Accelerator Position Sensor".
NG	Check in accordance with the troubleshooting procedures for each DTC.

Past DTC only

OK	Go to "3. Check the Accelerator Position Sensor".
NG	Reproduce defect by referring to the freeze frame data, etc.

(a) CAN1 Connector

9Y1200226CRS0685US0

3. Check the Accelerator Position Sensor

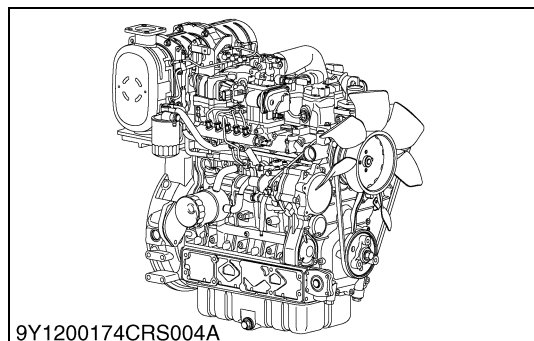


CAUTION

- When checking, pay attention to the angle of mounting instead of the output signal quality.
1. Inspect in accordance with the operator's manual.

OK	Go to "4. Check the Idle Condition".
NG	Replacement of accelerator position sensor.

9Y1200226CRS0686US0



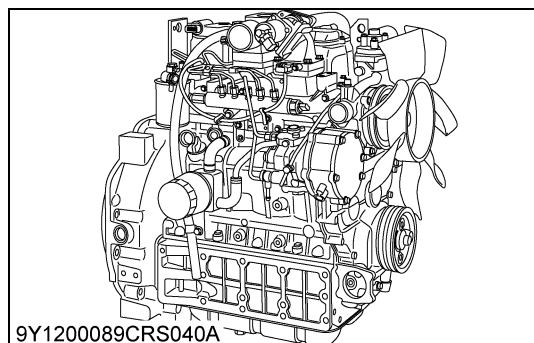
4. Check the Idle Condition

1. Check if idling is normal.

Factory specification	Stable at specified speed.
-----------------------	----------------------------

OK	Go to "5. Malfunction Verification - 1".
NG	Refer to "(4) Idle Failure", and implement checking and repair.(Refer to page 1-S31)

9Y1200226CRS0687US0



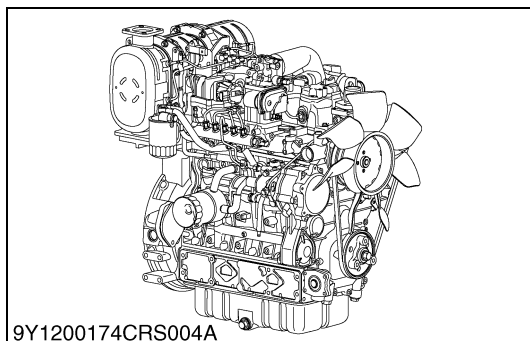
5. Malfunction Verification - 1

1. Reproduce running conditions (engine speed, machine speed, gear shift, etc.) as pointed out by the driver. Compare with another machine of the same model and check whether poor acceleration and power shortage can be sensed.

Factory specification	No malfunction should be detected.
-----------------------	------------------------------------

OK	Explain to the driver that the machine is in a normal condition. (Reference) <ul style="list-style-type: none"> • Give appropriate advice to the driver about matters concerning anything noticed that is related to his driving manner (such as selection of shift, etc.).
NG	Go to "6. Malfunction Verification - 2".

9Y1200226CRS0688US0

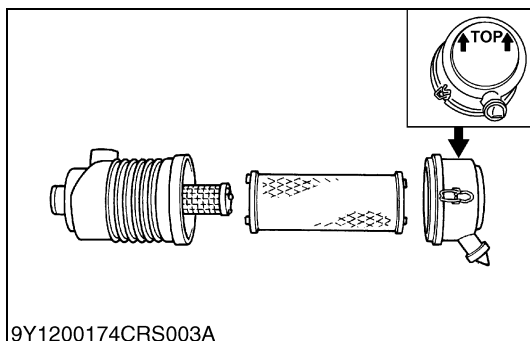


6. Malfunction Verification - 2

- Check for a large driving resistance due to problems in the machine itself that do not involve the engine.
 - Large resistance for actuation
 - Tire air pressure
 - Power transmission fault
 - Brake drag

OK	Go to "7. Check the Intake System".
NG	Repair or adjust the malfunction.

9Y1200226CRS0689US0

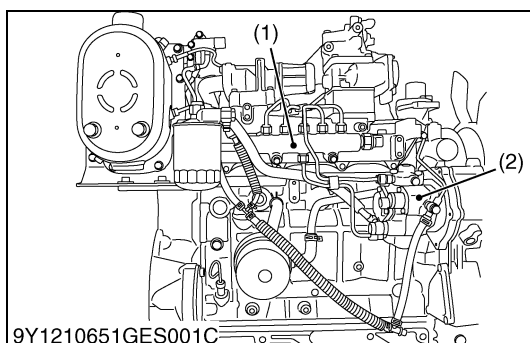


7. Check the Intake System

- Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

OK	Go to "8. Check the Fuel System".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

9Y1200226CRS0690US0



8. Check the Fuel System

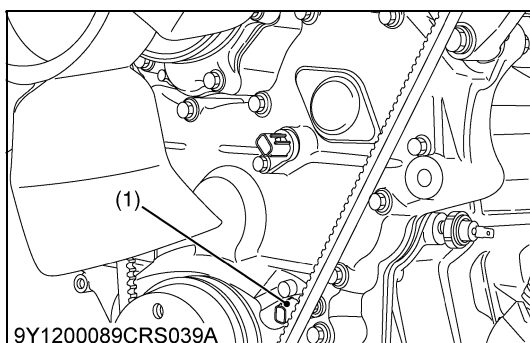
- Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "9. Check the Crankshaft Position Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

(1) Rail

(2) Supply Pump

9Y1200226CRS0691US0



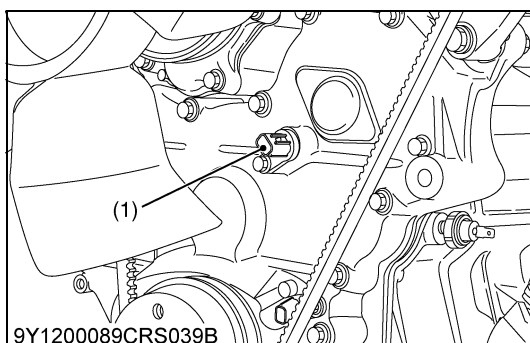
9. Check the Crankshaft Position Sensor

- Refer to DTC P0335 and P0336, and implement checking of the crankshaft position sensor.

OK	Go to "10. Check the Camshaft Position Sensor".
NG	Repair and replacement of the crankshaft position sensor-related parts.

(1) Crankshaft Position Sensor
(NE Sensor)

9Y1200226CRS0692US0



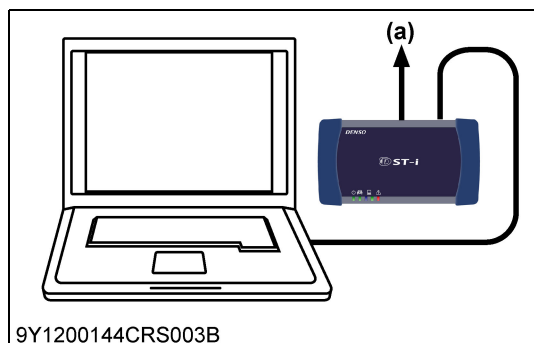
10. Check the Camshaft Position Sensor

- Refer to DTC P0340 and P0341, and implement checking of the camshaft position sensor.

OK	Go to "11. Check the Rail Pressure Sensor and Supply Pump".
NG	Repair and replacement of camshaft position sensor-related parts.

(1) Camshaft Position Sensor
(G Sensor)

9Y1200226CRS0693US0



11. Check the Data Related to Pressure Control

1. Measure the "Target rail pressure" and "Actual rail pressure" when accelerator is operated as indicated below using the diagnosis tool data monitor function.

(V3800-CR-TE4/-TIE4/-TE4C)

Factory specification	<p>The "Actual rail pressure" always follow to the "Target rail pressure".</p> <ol style="list-style-type: none"> 1. When idling: 40 to 50 MPa (410 to 500 kgf/cm², 5800 to 7200 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 95.0 to 130 MPa (969 to 1320 kgf/cm², 13800 to 18800 psi) 3. No-load maximum speed: 95.0 to 115 MPa (969 to 1170 kgf/cm², 13800 to 16600 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.
-----------------------	---

OK	Go to "12. Check the Injector (Including the Pipes, etc.)"
NG	<p>(Check the trouble related to pressure) Refer to the pressure system items (P0087, P0088, P0089 and P0093 (Refer to page 1-S131)) and SCV abnormality items (P0628 and P0629 (Refer to 1-S212)) in "5.[2] DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts.</p> <p>■ NOTE</p> <ul style="list-style-type: none"> • Some diagnosis items above may be mentioned twice.

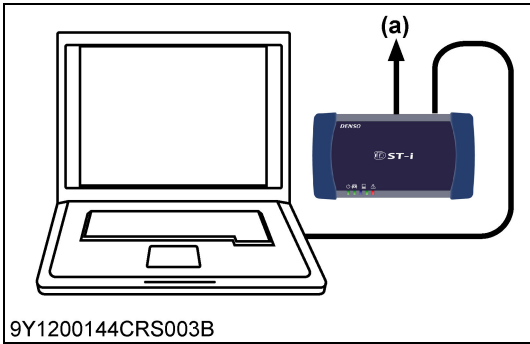
(V3800-TIE4/-TIE4C)

Factory specification	<p>The "Actual rail pressure" always follow to the "Target rail pressure"</p> <ol style="list-style-type: none"> 1. When idling: 35 to 60 MPa (360 to 610 kgf/cm², 5100 to 8700 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 155 MPa (1580 kgf/cm², 22500 psi) 3. No-load maximum speed: 75.0 to 155 MPa (765 to 1580 kgf/cm², 10900 to 22400 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.
-----------------------	--

OK	Go to "12. Check the Injector (Including the Pipes, etc.)"
NG	<p>(Check the trouble related to pressure) Refer to the pressure system items (P0088, P0093 and P0191 (Refer to page 1-S374)) and PCV / PRV abnormality items (P0089, P1A06, P1A0D and P2293 (Refer to page 1-S378)) in "5. DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts.</p> <p>■ NOTE</p> <ul style="list-style-type: none"> • Some diagnosis items above may be mentioned twice.

(a) CAN1 Connector

9Y1200226CRS0694US0



12. Check the Injector (Including the Pipes, etc.)

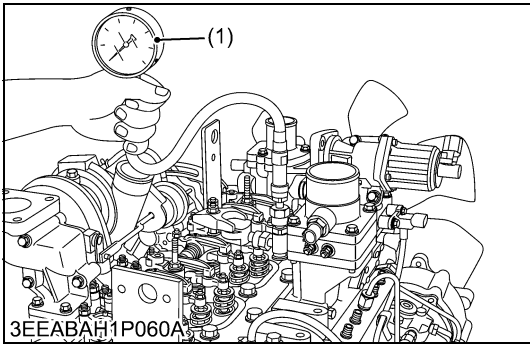
1. Perform the diagnosis tool active test (stopping the injector injection by cylinder) and check the injector performance.

Factory specification	1. Engine vibration and noise are increased and the rotation speed is reduced when the injection for the corresponding cylinder is stopped. 2. The same results must be attained from all the cylinders.
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OK	Go to "13. Check the Engine"
NG	Check and repair faulty parts including the high pressure line of the defective cylinder.

(a) CAN1 Connector

9Y1200226CRS0695US0



13. Check the Engine

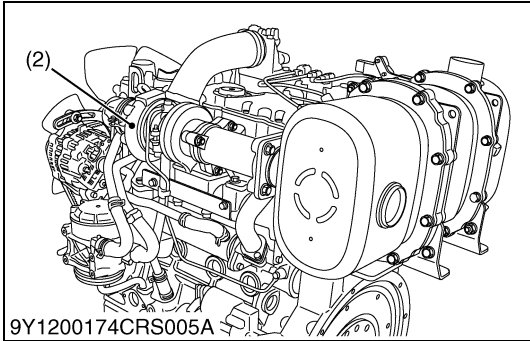
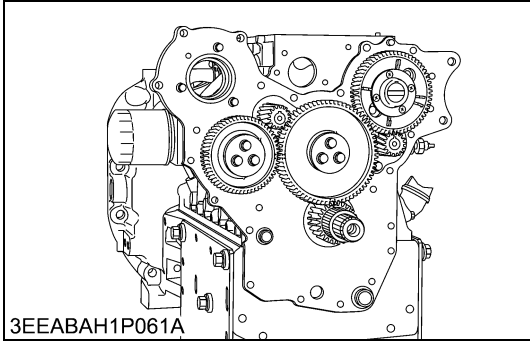
1. Check the compression pressure, valve clearance, valve timing, the inside of the engine and engine oil viscosity.
2. Check the timing gear.
3. Check the turbocharger.

OK	Normal.
NG	Repair or replace the related parts.

(1) Compression Tester

(2) Turbocharger

9Y1200226CRS0696US0



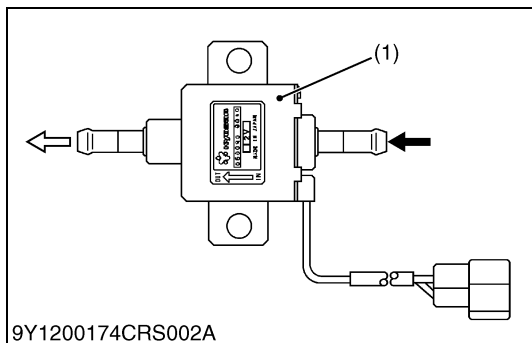
(8) Abnormal Black Smoke Emitted

Possible causes:

1. Fuel feed pump operation fault.

***Refer to the previous "List of malfunction causes by symptom" for the subsequent details.**

2. Engine fault
 - Low compression pressure.
 - Engine internal fault
 - Valve clearance fault
 - Valve timing fault
 - Engine oil viscosity fault
3. Control system
 - Damage to the pulsar gear of the crankshaft position sensor
 - Air gap of the crankshaft position sensor is large
 - SCV, PCV or PRV operation fault
 - EGR valve fault
4. Intake system
 - Air cleaner clogging
 - Leak from the intake system parts
 - Turbocharger operation fault
5. Fuel system
 - Supply pump learning has not been performed
 - Fuel quality
 - Fuel pressure limiter fault
 - Fuel line clogging, leak
6. CRS (including the wiring harness)
 - Output system (supply pump, injector and common rail)
 - Input system (sensors and switches)
 - ECU



9Y1200174CRS002A

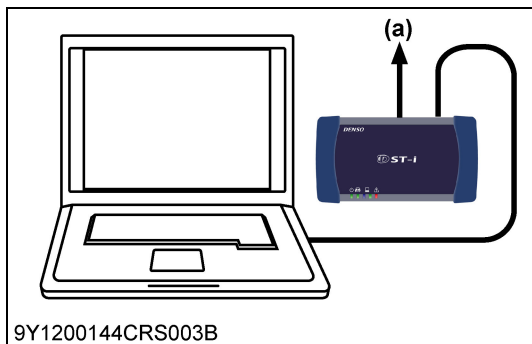
1. Check the Fuel Feed Pump Operation

1. Turn the key switch ON and check that the fuel feed pump is operating.

Factory specification	Operates when the key switch is turned ON.
OK	Go to "2. Check the DTC".
NG	Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE - 5. Check the Fuel Feed Pump". (Refer to page 1-S547)

(1) Fuel Feed Pump

9Y1200226CRS0697US0



9Y1200144CRS003B

2. Check the DTC

1. Turn the key switch ON and check the DTC.

Factory specification	No DTC is output.
-----------------------	-------------------

DTC presently existing

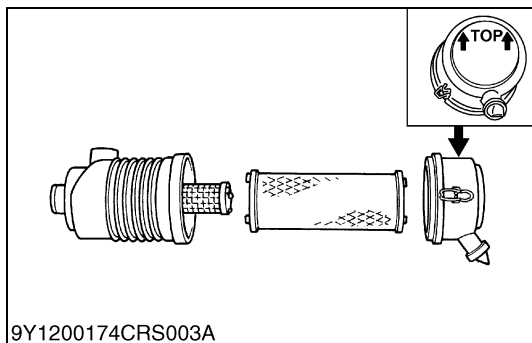
OK	Go to "3. Check the Intake System".
NG	Check in accordance with the troubleshooting procedures for each DTC.

Past DTC only

OK	Go to "3. Check the Intake System".
NG	Reproduce defect by referring to the freeze frame data, etc.

(a) CAN1 Connector

9Y1200226CRS0699US0

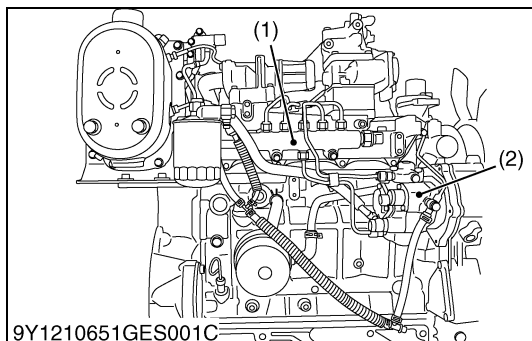


3. Check the Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

OK	Go to "4. Check the Fuel System".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

9Y1200226CRS0700US0



4. Check the Fuel System

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "5. Check the Accelerator Position Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

(1) Rail

(2) Supply Pump

9Y1200226CRS0701US0

5. Check the Accelerator Position Sensor



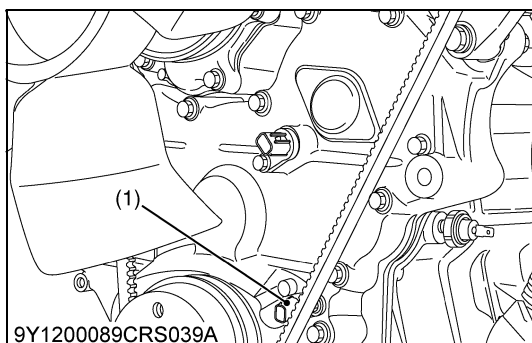
CAUTION

- When checking, pay attention to the angle of mounting instead of the output signal quality.

1. Inspect in accordance with the operator's manual.

OK	Go to "6. Check the Crankshaft Position Sensor".
NG	Replacement of accelerator position sensor.

9Y1200226CRS0702US0



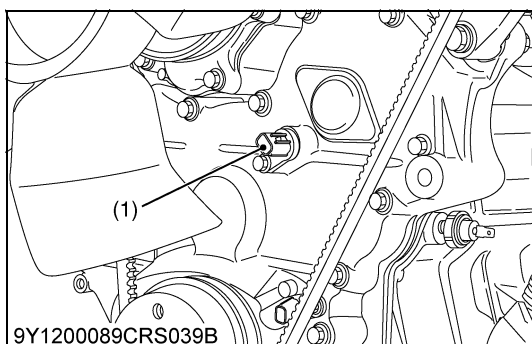
6. Check the Crankshaft Position Sensor

1. Refer to DTC P0335 and P0336, and implement checking of the crankshaft position sensor.

OK	Go to "7. Check the Camshaft Position Sensor".
NG	Repair and replacement of the crankshaft position sensor-related parts.

(1) Crankshaft Position Sensor
(NE Sensor)

9Y1200226CRS0703US0



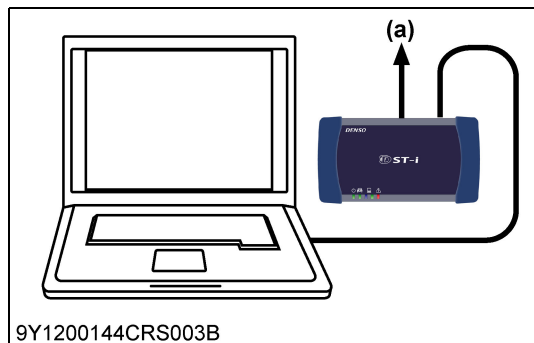
7. Check the Camshaft Position Sensor

1. Refer to DTC P0340 and P0341, and implement checking of the camshaft position sensor.

OK	Go to "8. Check the EGR Valve".
NG	Repair and replacement of camshaft position sensor-related parts.

(1) Camshaft Position Sensor
(G Sensor)

9Y1200226CRS0704US0



8. Check the EGR Valve

Refer to "5.[2] DIAGNOSTIC PROCEDURE BY DTC" for the detailed EGR-related check. A simplified version is shown below. (Refer to page 1-S124)



CAUTION

- Check that the EGR valve does not open before the engine has warmed up [coolant temperature: 65 °C (149 °F)].
1. Use the monitor function to check whether the actual opening meets the target opening.

Factory specification	Refer to "1.[5].(2) Normal Value". (Refer to page 1-M33) In addition, for the check procedures refer to "5.[2] DIAGNOSTIC PROCEDURE BY DTC". (Refer to page 1-S124)
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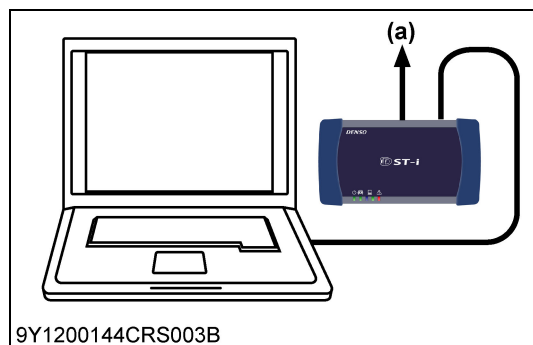
2. Perform an active test (EGR actuation test).

Factory specification	(Low side) When target EGR valve openings of 0 % and 15 % are given alternately, there must not be disparity in the actual EGR valve opening. (High side) When target EGR valve openings of 35 % and 60 % are given alternately, there must not be disparity in the actual EGR valve opening.
-----------------------	--

OK	Go to "9. Check the Rail Pressure Sensor and Supply Pump".
NG	Replace the EGR valve.

(a) CAN1 Connector

9Y1200226CRS0705US0



9. Check the Data Related to Pressure Control

1. Measure the "Target rail pressure" and "Actual rail pressure" when accelerator is operated as indicated below using the diagnosis tool data monitor function.

(V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure".
	1. When idling: 40 to 50 MPa (410 to 500 kgf/cm ² , 5800 to 7200 psi)
	2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 95.0 to 130 MPa (969 to 1320 kgf/cm ² , 13800 to 18800 psi)
	3. No-load maximum speed: 95.0 to 115 MPa (969 to 1170 kgf/cm ² , 13800 to 16600 psi)
	4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.

OK	Go to "10. Check the Injector (Including the Pipes, etc.)".
NG	<p>(Check the trouble related to pressure) Refer to the pressure system items (P0087, P0088, P0089 and P0093 (Refer to page 1-S131)) and SCV abnormality items (P0628 and P0629 (Refer to 1-S212)) in "5.[2] DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts.</p> <p>■ NOTE</p> <ul style="list-style-type: none"> • Some diagnosis items above may be mentioned twice.

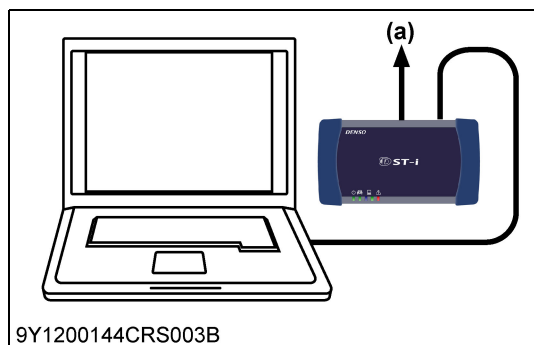
(V3800-TIE4/-TIE4C)

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure"
	1. When idling: 35 to 60 MPa (360 to 610 kgf/cm ² , 5100 to 8700 psi)
	2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 155 MPa (1580 kgf/cm ² , 22500 psi)
	3. No-load maximum speed: 75.0 to 155 MPa (765 to 1580 kgf/cm ² , 10900 to 22400 psi)
	4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.

OK	Go to "10. Check the Injector (Including the Pipes, etc.)".
NG	<p>(Check the trouble related to pressure) Refer to the pressure system items (P0088, P0093 and P0191 (Refer to page 1-S374)) and PCV / PRV abnormality items (P0089, P1A06, P1A0D and P2293 (Refer to page 1-S378)) in "5. DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts.</p> <p>■ NOTE</p> <ul style="list-style-type: none"> • Some diagnosis items above may be mentioned twice.

(a) CAN1 Connector

9Y1200226CRS0706US0



10. Check the Injector (Including the Pipes, etc.)

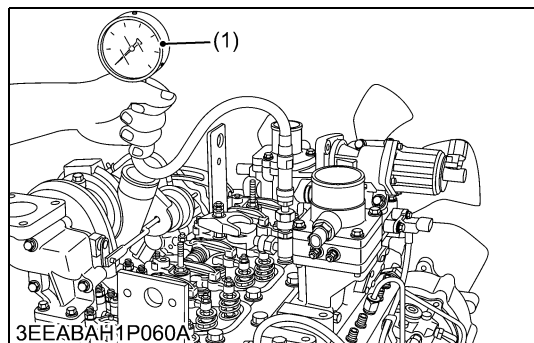
1. Perform the diagnosis tool active test (stopping the injector injection by cylinder) and check the injector performance.

Factory specification	<ol style="list-style-type: none"> 1. Engine vibration and noise are increased and the rotation speed is reduced when the injection for the corresponding cylinder is stopped. 2. The same results must be attained from all the cylinders.
-----------------------	---

OK	Go to "11. Check the Engine".
NG	Check and repair faulty parts including the high pressure line of the defective cylinder.

(a) CAN1 Connector

9Y1200226CRS0707US0



11. Check the Engine

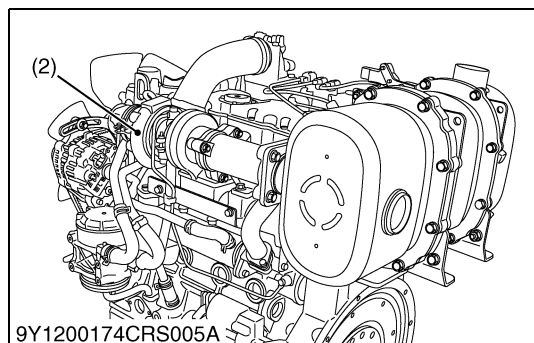
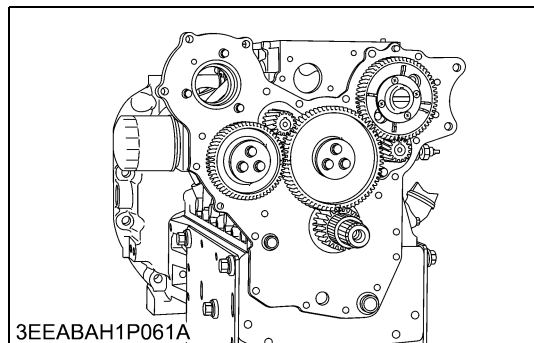
1. Check the compression pressure, valve clearance, valve timing, the inside of the engine and engine oil viscosity.
2. Check the timing gear.
3. Check the turbocharger.

OK	Normal.
NG	Repair or replace the related parts.

(1) Compression Tester

(2) Turbocharger

9Y1200226CRS0708US0

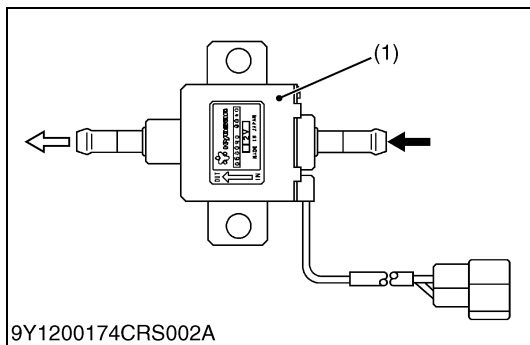


(9) Abnormal White Smoke Emitted

Possible causes:

1. Fuel feed pump operation fault.
 2. Starting assist device fault (air heater and glow (air heater) relay do not operate)
- *Refer to the previous "List of malfunction causes by symptom" for the subsequent details.**
3. Engine fault
 - Low compression pressure.
 - Engine internal fault
 - Valve clearance fault
 - Valve timing fault
 4. Control system
 - Damage to the pulsar gear of the crankshaft position sensor
 - Air gap of the crankshaft position sensor is large
 - SCV, PCV or PRV operation fault
 - EGR valve fault
 5. Intake system
 - Air cleaner clogging
 - Leak from the intake system parts
 - Glow (intake air heater) relay fault
 - Turbocharger operation fault
 6. Fuel system
 - Supply pump learning has not been performed
 - Fuel quality
 - Fuel filter clogging
 - Fuel pressure limiter fault
 - Fuel line clogging, leak
 7. CRS (including the wiring harness)
 - Output system (supply pump, injector and common rail)
 - Input system (sensors and switches)
 - ECU

9Y1200226CRS0709US0



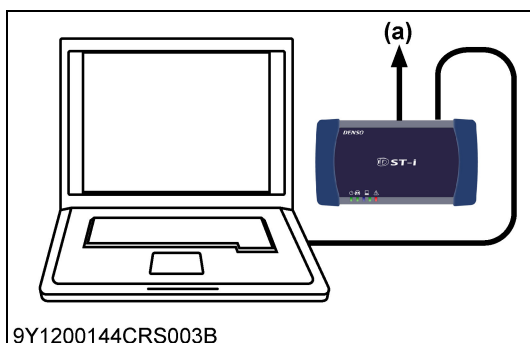
1. Check the Fuel Feed Pump Operation

1. Turn the key switch ON and check that the fuel feed pump is operating.

Factory specification	Operates when the key switch is turned ON.
OK	Go to "2. Check the DTC".
NG	Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE - 5. Check the Fuel Feed Pump". (Refer to page 1-S547)

(1) Fuel Feed Pump

9Y1200226CRS0710US0



2. Check the DTC

1. Turn the key switch ON and check the DTC.

Factory specification	No DTC is output.
-----------------------	-------------------

DTC presently existing

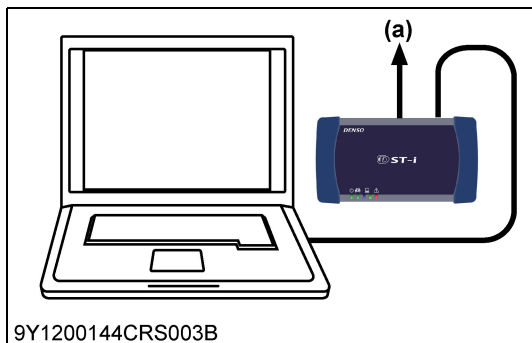
OK	Go to "3. Check the Starting Assist Device".
NG	Check in accordance with the troubleshooting procedures for each DTC.

Past DTC only

OK	Go to "3. Check the Starting Assist Device".
NG	Reproduce defect by referring to the freeze frame data, etc.

(a) CAN1 Connector

9Y1200226CRS0711US0



3. Check the Starting Assist Device

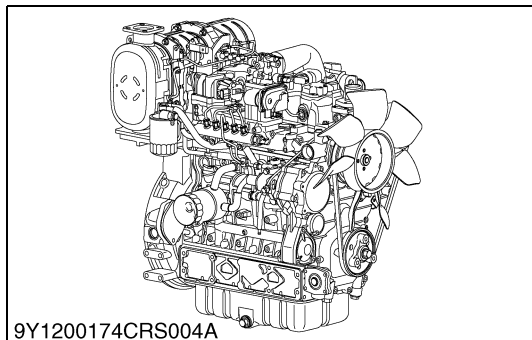
1. Refer to the workshop manual for the machine and check the air heater, relay and related wiring harness.
2. Perform an active test for models that have relay control in the ECU on the engine side.

Factory specification	Operates repeatedly between ON and OFF in accordance with the specified cycle.
-----------------------	--

OK	Go to "4. Check the Idle Condition".
NG	Checking and repair of starting assist device (intake air heater).

(a) **CAN1 Connector**

9Y1200226CRS0712US0



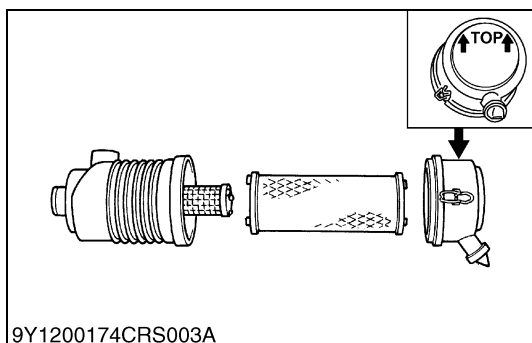
4. Check the Idle Condition

1. Check if idling is normal.

Factory specification	Stable at specified speed.
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OK	Go to "5. Check the Intake System".
NG	Refer to "(4) Idle Failure", and implement checking and repair.(Refer to page 1-S31)

9Y1200226CRS0713US0

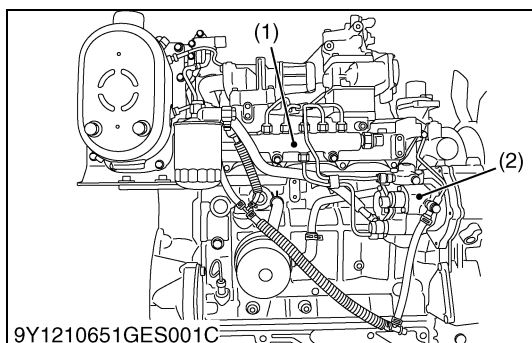


5. Check the Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

OK	Go to "6. Check the Fuel System".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

9Y1200226CRS0714US0



6. Check the Fuel System

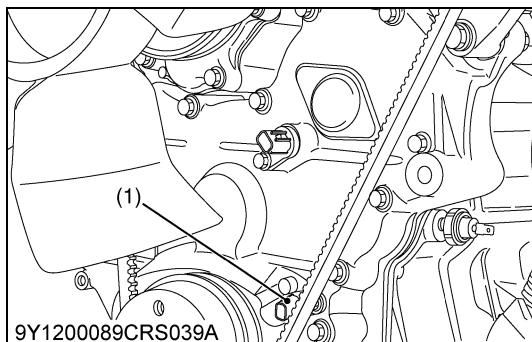
1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "7. Check the Crankshaft Position Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

(1) Rail

(2) Supply Pump

9Y1200226CRS0715US0



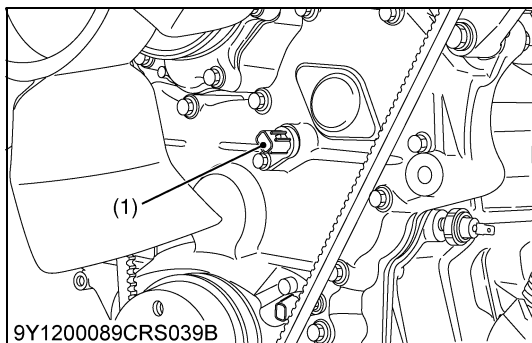
7. Check the Crankshaft Position Sensor

1. Refer to DTC P0335 and P0336, and implement checking of the crankshaft position sensor.

OK	Go to "8. Check the Camshaft Position Sensor".
NG	Repair and replacement of the crankshaft position sensor-related parts.

(1) Crankshaft Position Sensor
(NE Sensor)

9Y1200226CRS0716US0



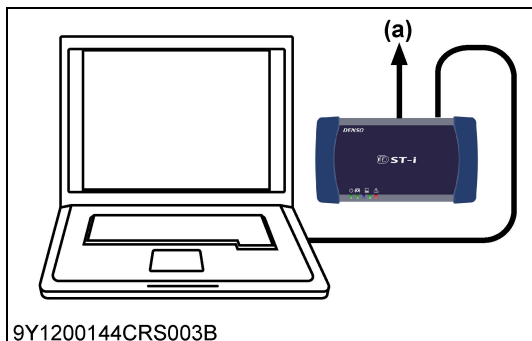
8. Check the Camshaft Position Sensor

1. Refer to DTC P0340 and P0341, and implement checking of the camshaft position sensor.

OK	Go to "9. Check the EGR Valve".
NG	Repair and replacement of camshaft position sensor-related parts.

- (1) Camshaft Position Sensor
(G Sensor)

9Y1200226CRS0717US0



9. Check the EGR Valve

Refer to "5.[2] DIAGNOSTIC PROCEDURE BY DTC" for the detailed EGR-related check. A simplified version is shown below. (Refer to page 1-S124)



CAUTION

- Check that the EGR valve does not open before the engine has warmed up [coolant temperature: 65 °C (149 °F)].

1. Use the monitor function to check whether the actual opening meets the target opening.

Factory specification	Refer to "1.[5].(2) Normal Value". (Refer to page 1-M33) In addition, for the check procedures refer to "5.[2] DIAGNOSTIC PROCEDURE BY DTC". (Refer to page 1-S124)
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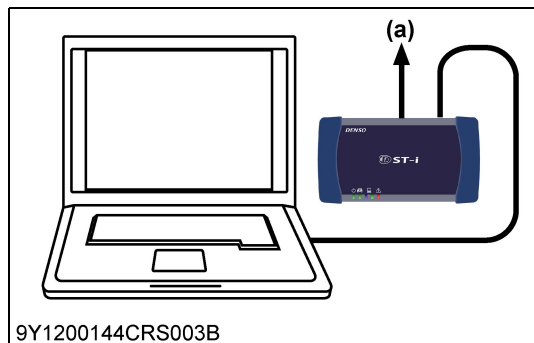
2. Perform an active test (EGR actuation test).

Factory specification	(Low side) When target EGR valve openings of 0 % and 15 % are given alternately, there must not be disparity in the actual EGR valve opening. (High side) When target EGR valve openings of 35 % and 60 % are given alternately, there must not be disparity in the actual EGR valve opening.
-----------------------	--

OK	Go to "10. Check the Rail Pressure Sensor and Supply Pump".
NG	Replace the EGR valve.

- (a) CAN1 Connector

9Y1200226CRS0718US0



10. Check the Data Related to Pressure Control

1. Measure the "Target rail pressure" and "Actual rail pressure" when accelerator is operated as indicated below using the diagnosis tool data monitor function.

(V3800-CR-TE4/-TIE4/-TE4C)

Factory specification	<p>The "Actual rail pressure" always follow to the "Target rail pressure".</p> <ol style="list-style-type: none"> 1. When idling: 40 to 50 MPa (410 to 500 kgf/cm², 5800 to 7200 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 95.0 to 130 MPa (969 to 1320 kgf/cm², 13800 to 18800 psi) 3. No-load maximum speed: 95.0 to 115 MPa (969 to 1170 kgf/cm², 13800 to 16600 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.
-----------------------	---

OK	Go to "11. Check the Injector (Including the Pipes, etc.)"
NG	<p>(Check the trouble related to pressure) Refer to the pressure system items (P0087, P0088, P0089 and P0093 (Refer to page 1-S131)) and SCV abnormality items (P0628 and P0629 (Refer to 1-S212)) in "5.[2] DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts.</p> <p>■ NOTE</p> <ul style="list-style-type: none"> • Some diagnosis items above may be mentioned twice.

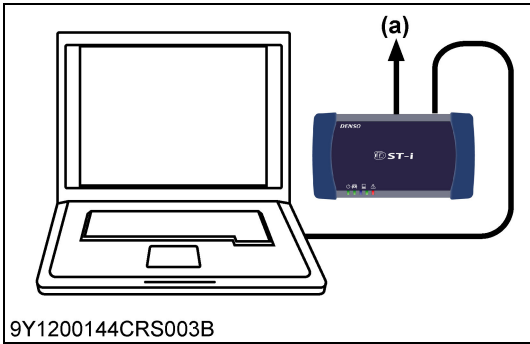
(V3800-TIE4/-TIE4C)

Factory specification	<p>The "Actual rail pressure" always follow to the "Target rail pressure"</p> <ol style="list-style-type: none"> 1. When idling: 35 to 60 MPa (360 to 610 kgf/cm², 5100 to 8700 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 155 MPa (1580 kgf/cm², 22500 psi) 3. No-load maximum speed: 75.0 to 155 MPa (765 to 1580 kgf/cm², 10900 to 22400 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.
-----------------------	--

OK	Go to "11. Check the Injector (Including the Pipes, etc.)"
NG	<p>(Check the trouble related to pressure) Refer to the pressure system items (P0088, P0093 and P0191 (Refer to page 1-S374)) and PCV / PRV abnormality items (P0089, P1A06, P1A0D and P2293 (Refer to page 1-S378)) in "5. DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts.</p> <p>■ NOTE</p> <ul style="list-style-type: none"> • Some diagnosis items above may be mentioned twice.

(a) CAN1 Connector

9Y1200226CRS0719US0



11. Check the Injector (Including the Pipes, etc.)

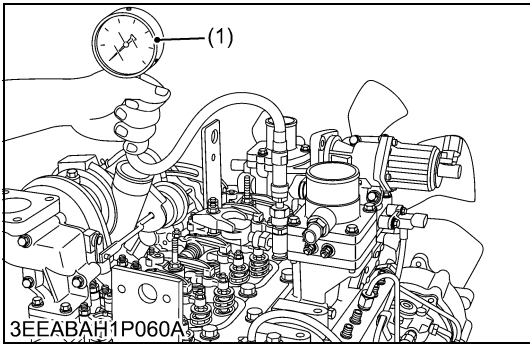
1. Perform the diagnosis tool active test (stopping the injector injection by cylinder) and check the injector performance.

Factory specification	Engine vibration and noise are increased and the rotation speed is reduced when the injection for the corresponding cylinder is stopped. The same results must be attained from all the cylinders.
-----------------------	---

OK	Go to "12. Check the Engine".
NG	Check and repair faulty parts including the high pressure line of the defective cylinder.

(a) CAN1 Connector

9Y1200226CRS0720US0



12. Check the Engine

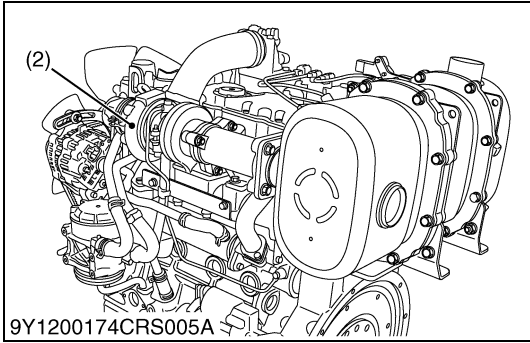
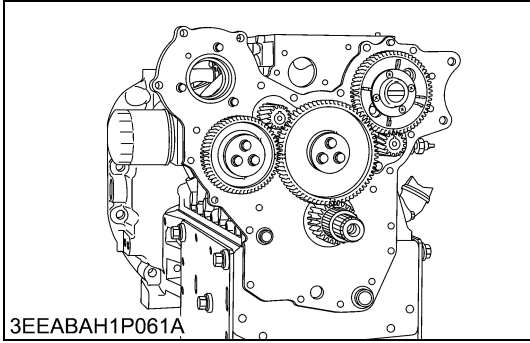
1. Check the compression pressure, valve clearance, valve timing and the inside of the engine.
2. Check the timing gear.
3. Check the turbocharger.

OK	Normal.
NG	Check and repair faulty parts including the high pressure line of the defective cylinder.

(1) Compression Tester

(2) Turbocharger

9Y1200226CRS0721US0



(10) Engine Stalls On Deceleration

Possible causes:

1. Fuel feed pump operation fault.

***Refer to the previous "List of malfunction causes by symptom" for the subsequent details.**

2. Engine fault

- Low compression pressure.
- Engine internal fault
- Valve timing fault

3. Control system

- Damage to the pulsar gear of the crankshaft position sensor
- Air gap of the crankshaft position sensor is large
- SCV, PCV or PRV operation fault

4. Intake system

- Air cleaner clogging

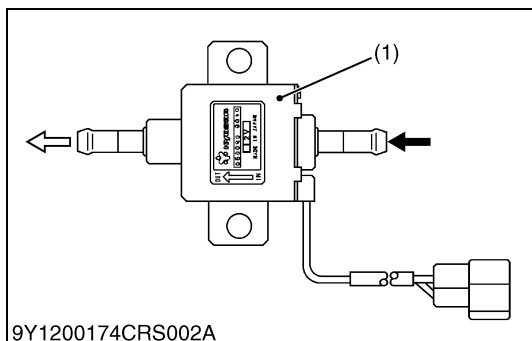
5. Fuel system

- Fuel quality
- Fuel filter clogging
- Fuel line clogging, leak

6. CRS (including the wiring harness)

- Output system (supply pump, injector and common rail)
- Input system (sensors and switches)
- ECU

9Y1200226CRS0722US0



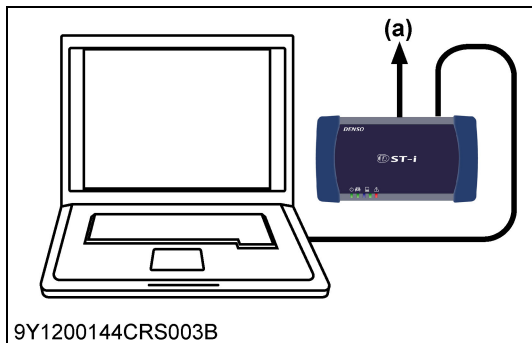
1. Check the Fuel Feed Pump Operation

1. Turn the key switch ON and check that the fuel feed pump is operating.

Factory specification	Operates when the key switch is turned ON.
OK	Go to "2. Check the DTC".
NG	Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE - 5. Check the Fuel Feed Pump". (Refer to page 1-S547)

(1) Fuel Feed Pump

9Y1200226CRS0723US0



2. Check the DTC

1. Turn the key switch ON and check the DTC.

Factory specification	No DTC is output.
-----------------------	-------------------

DTC presently existing

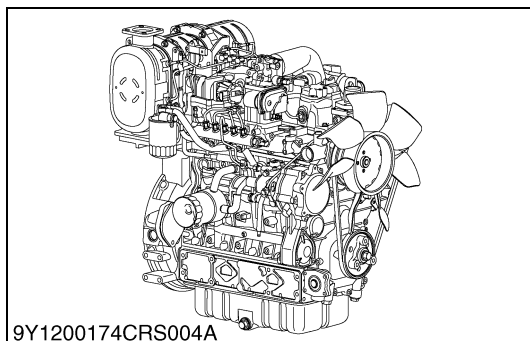
OK	Go to "3. Check the idle condition".
NG	Check in accordance with the troubleshooting procedures for each DTC.

Past DTC only

OK	Go to "3. Check the idle condition".
NG	Reproduce defect by referring to the freeze frame data, etc.

(a) CAN1 Connector

9Y1200226CRS0724US0



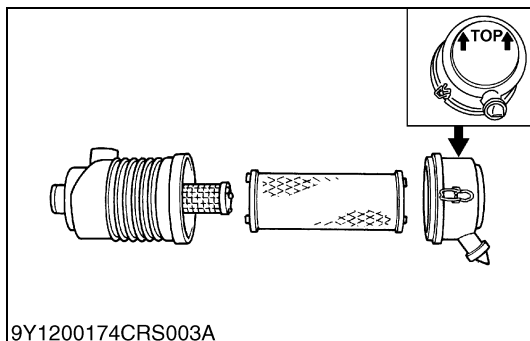
3. Check the Idle Condition

1. Check if idling is normal.

Factory specification	Stable at specified speed.
-----------------------	----------------------------

OK	Go to "4. Check the Intake System".
NG	Refer to "(4) Idle Failure", and implement checking and repair. (Refer to page 1-S31)

9Y1200226CRS0725US0

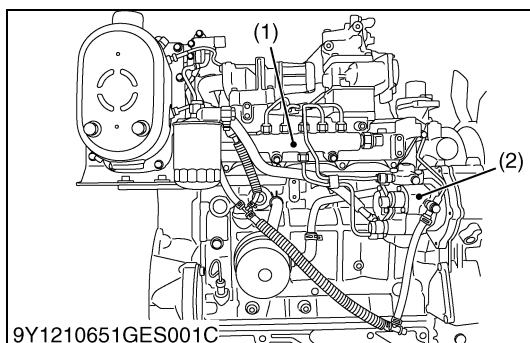


4. Check the Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

OK	Go to "5. Check the Fuel System".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

9Y1200226CRS0726US0



5. Check the Fuel System

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "6. Check the Accelerator Position Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

(1) Rail

(2) Supply Pump

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6. Check the Accelerator Position Sensor



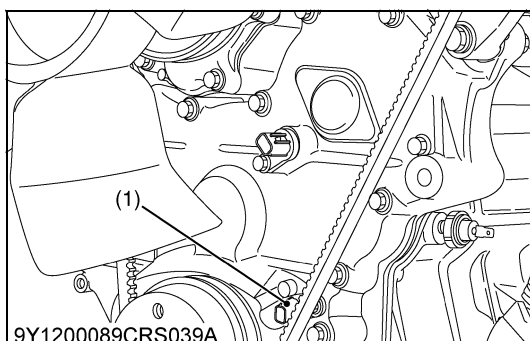
CAUTION

- When checking, pay attention to the angle of mounting instead of the output signal quality.

1. Inspect in accordance with the operator's manual.

OK	Go to "7. Check the Crankshaft Position Sensor".
NG	Replacement of accelerator position sensor.

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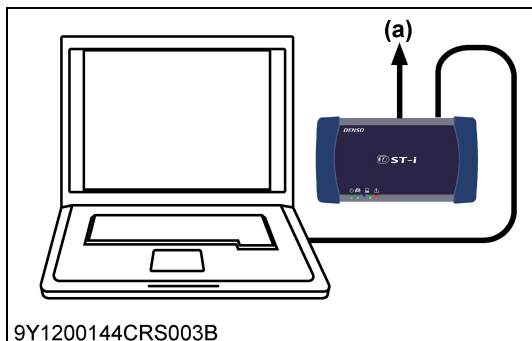
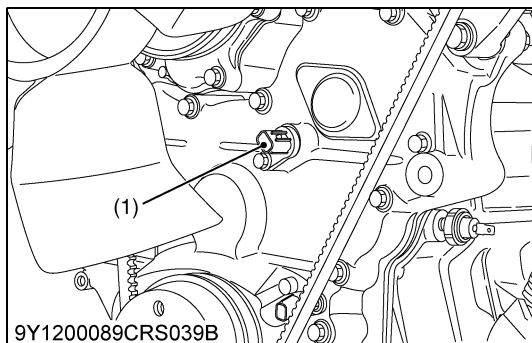
7. Check the Crankshaft Position Sensor

1. Refer to DTC P0335 and P0336, and implement checking of the crankshaft position sensor.

OK	Go to "8. Check the Camshaft Position Sensor".
NG	Repair and replacement of the crankshaft position sensor-related parts.

- (1) Crankshaft Position Sensor (NE Sensor)

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8. Check the Camshaft Position Sensor

1. Refer to DTC P0340 and P0341, and implement checking of the camshaft position sensor.

OK	Go to "9. Check the Rail Pressure Sensor and Supply Pump".
NG	Repair and replacement of camshaft position sensor-related parts.

- (1) Camshaft Position Sensor
(G Sensor)

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9. Check the Data Related to Pressure Control

1. Measure the "Target rail pressure" and "Actual rail pressure" when accelerator is operated as indicated below using the diagnosis tool data monitor function.

(V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)

Factory specification	<p>The "Actual rail pressure" always follow to the "Target rail pressure".</p> <ol style="list-style-type: none"> 1. When idling: 40 to 50 MPa (410 to 500 kgf/cm², 5800 to 7200 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 95.0 to 130 MPa (969 to 1320 kgf/cm², 13800 to 18800 psi) 3. No-load maximum speed: 95.0 to 115 MPa (969 to 1170 kgf/cm², 13800 to 16600 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.
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OK	Go to "10. Check the Injector (Including the Pipes, etc.)".
NG	<p>(Check the trouble related to pressure)</p> <p>Refer to the pressure system items (P0087, P0088, P0089 and P0093 (Refer to page 1-S131)) and SCV abnormality items (P0628 and P0629 (Refer to 1-S212)) in "5.[2] DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts.</p> <p>■ NOTE</p> <ul style="list-style-type: none"> • Some diagnosis items above may be mentioned twice.

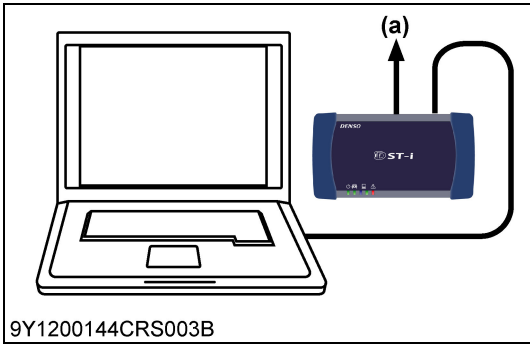
(V3800-TIE4/-TIE4C)

Factory specification	<p>The "Actual rail pressure" always follow to the "Target rail pressure"</p> <ol style="list-style-type: none"> 1. When idling: 35 to 60 MPa (360 to 610 kgf/cm², 5100 to 8700 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 155 MPa (1580 kgf/cm², 22500 psi) 3. No-load maximum speed: 75.0 to 155 MPa (765 to 1580 kgf/cm², 10900 to 22400 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.
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OK	Go to "10. Check the Injector (Including the Pipes, etc.)".
NG	<p>(Check the trouble related to pressure)</p> <p>Refer to the pressure system items (P0088, P0093 and P0191 (Refer to page 1-S374)) and PCV / PRV abnormality items (P0089, P1A06, P1A0D and P2293 (Refer to page 1-S378)) in "5. DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts.</p> <p>■ NOTE</p> <ul style="list-style-type: none"> • Some diagnosis items above may be mentioned twice.

(a) CAN1 Connector

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10. Check the Injector (Including the Pipes, etc.)

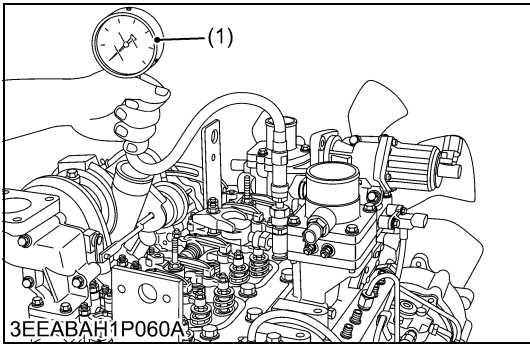
1. Perform the diagnosis tool active test (stopping the injector injection by cylinder) and check the injector performance.

Factory specification	1. Engine vibration and noise are increased and the rotation speed is reduced when the injection for the corresponding cylinder is stopped. 2. The same results must be attained from all the cylinders.
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OK	Go to "11. Check the Engine".
NG	Check and repair faulty parts including the high pressure line of the defective cylinder.

(a) CAN1 Connector

9Y1200226CRS0732US0



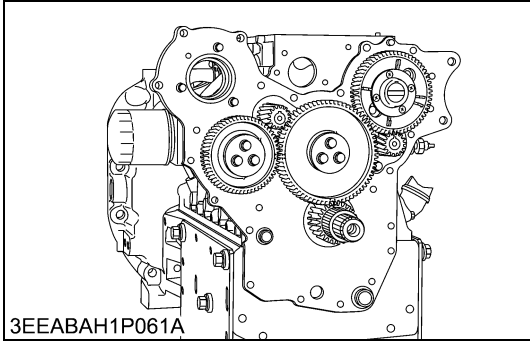
11. Check the Engine

1. Check the compression pressure, valve clearance, valve timing and the inside of the engine.
2. Check the timing gear.

OK	Normal.
NG	Repair the malfunction.

(1) Compression Tester

9Y1200226CRS0733US0



5. DIAGNOSTIC PROCEDURE BY DTC

[1] DTC LIST (V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)

Name		NE-G phase shift
ISO 14229 P-Code		P0016
J1939-73	SPN	636
	FMI	7
SPN Name SAE J1939 Table C1		Engine Position Sensor
DTC Name		NE-G phase shift
Management Unit for Detected Part		NEGUM
Detection item		<ul style="list-style-type: none"> Large phase shift between NE (crankshaft position sensor) pulse and G (camshaft position sensor) pulse
DTC Set Preconditions		<ul style="list-style-type: none"> Engine is operating above low idle speed Battery voltage is normal Sensor supply voltage VCC# is normal NE signal is normal G signal is normal Coolant temperature is 10 °C (50 °F) or higher
DTC set parameter		(Approximate) <ul style="list-style-type: none"> Phase difference between NE pulse and G pulse is within ± 0.26 rad ($\pm 15^\circ$)
Time to action or number of error detection		<ul style="list-style-type: none"> 10 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		(Invalid G signal) <ul style="list-style-type: none"> Engine hesitates at start-up
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter =zero
Delay time for recovery		<ul style="list-style-type: none"> Delay time varies with engine speed in proportional relation. If it is set 30 sec at 800 min^{-1} (rpm), it is shorten to 15 sec at 1600 min^{-1} (rpm) operation.
Remark		<ul style="list-style-type: none"> NE: Crankshaft position sensor G: Camshaft position sensor

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Name		Intake air temperature built-in MAF sensor abnormality	
ISO 14229 P-Code		P0072	P0073
J1939-73	SPN	171	171
	FMI	4	3
SPN Name SAE J1939 Table C1		Ambient Air Temperature	Ambient Air Temperature
DTC Name		Intake air temperature built-in MAF sensor: Low	Intake air temperature built-in MAF sensor: High
Management Unit for Detected Part		THAIL	THAIH
Detection item		<ul style="list-style-type: none"> Ground short circuit of sensor / harness 	<ul style="list-style-type: none"> Open circuit or +B short circuit of sensor / harness.
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal 	<ul style="list-style-type: none"> Battery voltage is normal
DTC set parameter		<ul style="list-style-type: none"> Intake air temperature built-in MAF sensor voltage: 0.1 V or less 	<ul style="list-style-type: none"> Intake air temperature built-in MAF sensor voltage: 4.9 V or more
Time to action or number of error detection		<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> 25 °C (77 °F) [default value] 	<ul style="list-style-type: none"> 25 °C (77 °F) [default value]
Behaviour During Malfunction		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> Immediately 	<ul style="list-style-type: none"> Immediately
Remark			

9Y1200226CRS0735US0

Name		Pressure limiter emergency open
ISO 14229 P-Code		P0087
J1939-73	SPN	633
	FMI	7
SPN Name SAE J1939 Table C1		Engine Fuel Actuator 1 Control Command
DTC Name		Pressure limiter emergency open
Management Unit for Detected Part		PLACT
Detection item		<ul style="list-style-type: none"> Pressure limiter emergency open
DTC Set Preconditions		<ul style="list-style-type: none"> Rail pressure sensor is normal Sensor supply voltage VCC# is normal
DTC set parameter		<ul style="list-style-type: none"> Combination of below A and B <p>A: Fuel leak (P0093) is detected</p> <p>B: Condition (1) or (2) is fulfilled;</p> <p>(1) Rail pressure exceeds 191 MPa (1950 kgf/cm², 27700 psi)</p> <p>(2) Within 1 sec, after the rail pressure goes below 191 MPa (1950 kgf/cm², 27700 psi) [Before the pressure decrease, the rail pressure is above 191 MPa (1950 kgf/cm², 27700 psi)]</p>
Time to action or number of error detection		<ul style="list-style-type: none"> 1 time or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> To minimize PM emission to Diesel Particulate Filter (hereinafter referred to as the "DPF") Engine speed may go down due to lack of fuel pressure, regardless limp home de-rating

9Y1200226CRS0736US0

Name		High rail pressure
ISO 14229 P-Code		P0088
J1939-73	SPN	157
	FMI	0
SPN Name SAE J1939 Table C1		Engine Injector Metering Rail 1 Pressure
DTC Name		High rail pressure
Management Unit for Detected Part		PCEX
Detection item		<ul style="list-style-type: none"> Actual pressure exceeds the command pressure
DTC Set Preconditions		<ul style="list-style-type: none"> Rail pressure sensor is normal Sensor supply voltage VCC# is normal
DTC set parameter		<ul style="list-style-type: none"> Actual pressure ≥ 197 MPa (2010 kgf/cm², 28600 psi)
Time to action or number of error detection		<ul style="list-style-type: none"> 1 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> 30 sec.
Remark		<ul style="list-style-type: none"> To minimize PM emission to DPF

9Y1200226CRS0737US0

Name		SCV stuck
ISO 14229 P-Code		P0089
J1939-73	SPN	1347
	FMI	7
SPN Name SAE J1939 Table C1		Engine Fuel Feed Pump Pressurizing Assembly #1
DTC Name		SCV stuck
Management Unit for Detected Part		SCVS
Detection item		<ul style="list-style-type: none"> • SCV stuck at open position (Actual rail pressure continuously exceeds the command rail pressure)
DTC Set Preconditions		<ul style="list-style-type: none"> • Supply pump is normal and pump calibration has been executed • Engine is operating (Q: 4 mm³/st or higher) • Injector is normal • Battery voltage is normal • Sensor supply voltage VCC# is normal • Rail pressure sensor is normal
DTC set parameter		<ul style="list-style-type: none"> • Discharge request of supply pump goes below 0 mm³/st and the actual rail pressure is 10 MPa (100 kgf/cm², 1400 psi) higher than command pressure • Above state continues for 26 seconds or more
Time to action or number of error detection		<ul style="list-style-type: none"> • 1 time or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 50 % of normal condition • Speed limitation (Accelerator limitation: 50 %) • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output • Worsening exhaust gas performance • Engine stops in some case
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> • To minimize PM emission to DPF

9Y1200226CRS0738US0

Name		Fuel leak (in high pressured fuel system)
ISO 14229 P-Code		P0093
J1939-73	SPN	1239
	FMI	1
SPN Name SAE J1939 Table C1		Engine Fuel Leakage 1
DTC Name		Fuel leak (in high pressured fuel system)
Management Unit for Detected Part		FLEAK
Detection item		<ul style="list-style-type: none"> Fuel leak from high pressured fuel system (Fuel consumption is calculated from the difference of fuel pressure of before and after the injection, and the error will be detected when excess fuel consumption is found)
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC# is normal Rail pressure sensor is normal Supply pump (SCV) is normal Injector and injector drive circuit are normal NE signal is active [Engine is operating (700 min^{-1} (rpm) or higher)] No DTC of P0087, P0088, P0089
DTC set parameter		(a): the flow volume which is calculated from the difference of rail pressure (decrease) (b): total volume of injection and leakage Fuel leak is judged with following conditions: <ul style="list-style-type: none"> In case, engine speed is more than 1200 min^{-1} (rpm): When the difference of (a) and (b) is $120 \text{ mm}^3/\text{st}$ or above, (a) is higher than (b), and fuel leak is not from opening pressure limiter In case, engine speed is 1200 min^{-1} (rpm) or less: When the difference of (a) and (b) is $400 \text{ mm}^3/\text{st}$ or above, (a) is higher than (b), and fuel leak is not from opening pressure limiter
Time to action or number of error detection		<ul style="list-style-type: none"> 1 time or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance Engine stops in some case
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> To minimize PM emission to DPF

9Y1200226CRS0739US0

Name		Intake air volume: Low
ISO 14229 P-Code		P0101
J1939-73	SPN	132
	FMI	1
SPN Name SAE J1939 Table C1		Engine Inlet Air Mass Flow Rate
DTC Name		Intake air volume: Low
Management Unit for Detected Part		GA
Detection item		<ul style="list-style-type: none"> • Engine inlet air mass flow rate lacking (Disconnect turbo blower intake hose)
DTC Set Preconditions		<ul style="list-style-type: none"> • Engine is operating [1000 min^{-1} (rpm) or higher] • Coolant temperature is $15 \text{ }^{\circ}\text{C}$ ($59 \text{ }^{\circ}\text{F}$) or higher (Coolant temperature sensor is normal) • MAF sensor is normal • EGR valve is normal • Intake throttle valve is normal • Battery voltage is normal
DTC set parameter		<ul style="list-style-type: none"> • Engine Inlet Air Mass Flow Rate: less than half of target value
Time to action or number of error detection		<ul style="list-style-type: none"> • 10.0 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—
Remark		

9Y1200226CRS0740US0

Name		MAF sensor abnormality	
ISO 14229 P-Code		P0102	P0103
J1939-73	SPN	132	132
	FMI	4	3
SPN Name SAE J1939 Table C1		Engine Inlet Air Mass Flow Rate	Engine Inlet Air Mass Flow Rate
DTC Name		MAF sensor: Low	MAF sensor: High
Management Unit for Detected Part		MAFL	MAFH
Detection item		<ul style="list-style-type: none"> Open circuit or ground short circuit of sensor / harness. 	<ul style="list-style-type: none"> +B short circuit of sensor / harness
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Starter Switch signal (ECU: V12 terminal) is not activated Sensor supply voltage is normal 	<ul style="list-style-type: none"> Battery voltage is normal $700 \text{ min}^{-1} (\text{rpm}) \leq \text{engine speed} \leq 2800 \text{ min}^{-1} (\text{rpm})$ Target intake mass air flow is 460 or less and it continues for 3 secs. Sensor supply voltage is normal
DTC set parameter		<ul style="list-style-type: none"> Mass air flow sensor voltage: 0.1 V or less 	<ul style="list-style-type: none"> Mass air flow sensor voltage: 4.9 V or more in certain operation condition
Time to action or number of error detection		<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Sensor output: 0.7 times of target value at normal condition [default value] Output limitation: Approximately 75 % of normal condition EGR stop Intake throttle 100 % open 	<ul style="list-style-type: none"> Sensor output: 0.7 times of target value at normal condition [default value] Output limitation: Approximately 75 % of normal condition EGR stop Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> Engine is not stopped forcibly by ECU. However KUBOTA strongly recommends operator to stop engine as soon as possible. 	<ul style="list-style-type: none"> Engine is not stopped forcibly by ECU. However KUBOTA strongly recommends operator to stop engine as soon as possible.

9Y1200226CRS0741US0

Name		Intake air temperature: high (Inter cooler model only)
ISO 14229 P-Code		P0111
J1939-73	SPN	172
	FMI	0
SPN Name SAE J1939 Table C1		Air Inlet Temperature
DTC Name		Intake air temperature: high Inter cooler model only
Management Unit for Detected Part		THAABH
Detection item		• Intake air temperature too high
DTC Set Preconditions		• Battery voltage is normal • Key switch is ON
DTC set parameter		• Intake air temperature higher than ambient temperature +60 °C (+140 °F)
Time to action or number of error detection		• 10 sec. or more
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		• None
Engine Warning Light		• ON
Recovery from error		• Key switch turn OFF
Delay time for recovery		—
Remark		• Inter cooler model only

9Y1200226CRS0742US0

Name		Intake air temperature error	
ISO 14229 P-Code		P0112	P0113
J1939-73	SPN	172	172
	FMI	4	3
SPN Name SAE J1939 Table C1		Engine Air Inlet Temperature	Engine Air Inlet Temperature
DTC Name		Intake air temperature error: Low	Intake air temperature error: High
Management Unit for Detected Part		THAL	THAH
Detection item		<ul style="list-style-type: none"> Ground short circuit of sensor / harness 	<ul style="list-style-type: none"> Open circuit or +B short circuit of sensor / harness
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal 	<ul style="list-style-type: none"> Battery voltage is normal
DTC set parameter		<ul style="list-style-type: none"> Voltage of intake air temperature sensor is 0.05 V or less 	<ul style="list-style-type: none"> Voltage of intake air temperature sensor is 4.9 V or above
Time to action or number of error detection		<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> During start-up = -20 °C (-4 °F) [default value] Under other conditions = 40 °C (104 °F) [default value] 	<ul style="list-style-type: none"> During start-up = -20 °C (-4 °F) [default value] Under other conditions = 40 °C (104 °F) [default value]
Behaviour During Malfunction		<ul style="list-style-type: none"> Amount of white smoke increases at low temperatures 	<ul style="list-style-type: none"> Amount of white smoke increases at low temperatures
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> 30 sec. 	<ul style="list-style-type: none"> 30 sec.
Remark			

9Y1200226CRS0743US0

Name		Coolant temperature sensor abnormality	
ISO 14229 P-Code		P0117	P0118
J1939-73	SPN	110	110
	FMI	4	3
SPN Name SAE J1939 Table C1		Engine Coolant Temperature	Engine Coolant Temperature
DTC Name		Coolant temperature sensor: Low	Coolant temperature sensor: High
Management Unit for Detected Part		THWL	THWH
Detection item		<ul style="list-style-type: none"> Ground short circuit of sensor / harness 	<ul style="list-style-type: none"> Open circuit or +B short circuit of sensor / harness
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal 	<ul style="list-style-type: none"> Battery voltage is normal
DTC set parameter		<ul style="list-style-type: none"> Voltage of coolant temperature sensor is 0.1 V or less 	<ul style="list-style-type: none"> Voltage of coolant temperature sensor is 4.9 V or above
Time to action or number of error detection		<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> During start-up = -25 °C (-13 °F) [default value] Under other conditions = 80 °C (176 °F) [default value] Output limitation: Approximately 75 % of normal condition EGR stop Intake throttle 100 % open 	<ul style="list-style-type: none"> During start-up = -25 °C (-13 °F) [default value] Under other conditions = 80 °C (176 °F) [default value] Output limitation: Approximately 75 % of normal condition EGR stop Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> Amount of white smoke increases at low temperatures Insufficient output Worsening exhaust gas performance 	<ul style="list-style-type: none"> Amount of white smoke increases at low temperatures Insufficient output Worsening exhaust gas performance
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS0744US0

Name		Fuel high temperature
ISO 14229 P-Code		P0181
J1939-73	SPN	174
	FMI	0
SPN Name SAE J1939 Table C1		Fuel Temperature
DTC Name		Fuel high temperature
Management Unit for Detected Part		THFABH
Detection item		<ul style="list-style-type: none"> Fuel temperature high
DTC Set Preconditions		<ul style="list-style-type: none"> Passed 300 sec after cranking Engine speed is 800 min⁻¹ (rpm) or more Fuel temperature sensor is normal
DTC set parameter		<ul style="list-style-type: none"> Fuel temperature higher than 90 °C (194 °F)
Time to action or number of error detection		<ul style="list-style-type: none"> 10 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> 30 sec.
Remark		

9Y1200226CRS0745US0

Name		Fuel temperature sensor abnormality	
ISO 14229 P-Code		P0182	P0183
J1939-73	SPN	174	174
	FMI	4	3
SPN Name SAE J1939 Table C1		Engine Fuel Temperature 1	Engine Fuel Temperature 1
DTC Name		Fuel temperature sensor: Low	Fuel temperature sensor: High
Management Unit for Detected Part		THFL	THFH
Detection item		<ul style="list-style-type: none"> Ground short circuit of sensor / harness 	<ul style="list-style-type: none"> Open circuit or +B short circuit of sensor / harness
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal 	<ul style="list-style-type: none"> Battery voltage is normal
DTC set parameter		<ul style="list-style-type: none"> Voltage of temperature sensor in supply pump is 0.1 V or less 	<ul style="list-style-type: none"> Voltage of temperature sensor in supply pump is 4.9 V or above
Time to action or number of error detection		<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> During start-up = -20 °C (-4 °F) [default value] Under other conditions = 45 °C (113 °F) [default value] Output limitation: Approximately 75 % of normal condition 	<ul style="list-style-type: none"> During start-up = -20 °C (-4 °F) [default value] Under other conditions = 45 °C (113 °F) [default value] Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> 30 sec. 	<ul style="list-style-type: none"> 30 sec.
Remark			

9Y1200226CRS0746US0

Name		Rail pressure sensor abnormality	
ISO 14229 P-Code		P0192	P0193
J1939-73	SPN	157	157
	FMI	4	3
SPN Name SAE J1939 Table C1		Engine Injector Metering Rail 1 Pressure	Engine Injector Metering Rail 1 Pressure
DTC Name		Rail pressure sensor: Low	Rail pressure sensor: High
Management Unit for Detected Part		PCL	PCH
Detection item		<ul style="list-style-type: none"> Ground short circuit of sensor / harness Failure of sensor 	<ul style="list-style-type: none"> Open circuit or +B short circuit of sensor / harness. Failure of sensor
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC# is normal 	<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC# is normal
DTC set parameter		<ul style="list-style-type: none"> Voltage of rail pressure sensor is 0.7 V or less 	<ul style="list-style-type: none"> Voltage of rail pressure sensor is 4.9 V or above
Time to action or number of error detection		<ul style="list-style-type: none"> Transient 	<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop Intake throttle 100 % open Engine forcibly stopped 60 sec. later 	<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop Intake throttle 100 % open Engine forcibly stopped 60 sec. later
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance Worsening running noise Increase in white smoke Engine stops 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance Worsening running noise Increase in white smoke Engine stops
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> To minimize PM emission to DPF 	<ul style="list-style-type: none"> To minimize PM emission to DPF

9Y1200226CRS0747US0

Name		Injector charge voltage: High
ISO 14229 P-Code		P0200
J1939-73	SPN	523535
	FMI	0
SPN Name SAE J1939 Table C1		proprietary
DTC Name		Injector charge voltage: High
Management Unit for Detected Part		OCHG
Detection item		<ul style="list-style-type: none"> • Injector charge voltage: High
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • CPU is normal
DTC set parameter		<ul style="list-style-type: none"> • Injector charge voltage: High
Time to action or number of error detection		<ul style="list-style-type: none"> • 10 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open • Engine forcibly stopped 60 sec. later
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output • Worsening exhaust gas performance • Engine stops
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—
Remark		

9Y1200226CRS0748US0

Name		Open circuit of harness/coil	
ISO 14229 P-Code		P0201	P0202
J1939-73	SPN	651	653
	FMI	3	3
SPN Name SAE J1939 Table C1		Engine Injector Cylinder #01	Engine Injector Cylinder #03
DTC Name		Open circuit of harness/coil in 1st cylinder injector	Open circuit of harness/coil in 3rd cylinder injector
Management Unit for Detected Part		NCTWV1	NCTWV2
Detection item		<ul style="list-style-type: none"> • Open circuit of harness • Open circuit of injector coil 	<ul style="list-style-type: none"> • Open circuit of harness • Open circuit of injector coil
DTC Set Preconditions		<ul style="list-style-type: none"> • Engine is operating • Battery voltage is normal • During injection • CPU is normal 	<ul style="list-style-type: none"> • Engine is operating • Battery voltage is normal • During injection • CPU is normal
DTC set parameter		<ul style="list-style-type: none"> • Open circuit of harness or open circuit of injector coil 	<ul style="list-style-type: none"> • Open circuit of harness or open circuit of injector coil
Time to action or number of error detection		<ul style="list-style-type: none"> • 8 times or more 	<ul style="list-style-type: none"> • 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open 	<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output • Large vibration • Worsening exhaust gas performance 	<ul style="list-style-type: none"> • Insufficient output • Large vibration • Worsening exhaust gas performance
Engine Warning Light		<ul style="list-style-type: none"> • ON 	<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF 	<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> • Injectors which have no DTC are operated • To minimize PM emission to DPF 	<ul style="list-style-type: none"> • Injectors which have no DTC are operated • To minimize PM emission to DPF

9Y1200226CRS0749US0

Name		Open circuit of harness/coil	
ISO 14229 P-Code		P0203	P0204
J1939-73	SPN	654	652
	FMI	3	3
SPN Name SAE J1939 Table C1		Engine Injector Cylinder #04	Engine Injector Cylinder #02
DTC Name		Open circuit of harness/coil in 4th cylinder injector	Open circuit of harness/coil in 2nd cylinder injector
Management Unit for Detected Part		NCTWV3	NCTWV4
Detection item		<ul style="list-style-type: none"> • Open circuit of harness • Open circuit of injector coil 	<ul style="list-style-type: none"> • Open circuit of harness • Open circuit of injector coil
DTC Set Preconditions		<ul style="list-style-type: none"> • Engine is operating • Battery voltage is normal • During injection • CPU is normal 	<ul style="list-style-type: none"> • Engine is operating • Battery voltage is normal • During injection • CPU is normal
DTC set parameter		<ul style="list-style-type: none"> • Open circuit of harness or open circuit of injector coil 	<ul style="list-style-type: none"> • Open circuit of harness or open circuit of injector coil
Time to action or number of error detection		<ul style="list-style-type: none"> • 8 times or more 	<ul style="list-style-type: none"> • 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open 	<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output • Large vibration • Worsening exhaust gas performance 	<ul style="list-style-type: none"> • Insufficient output • Large vibration • Worsening exhaust gas performance
Engine Warning Light		<ul style="list-style-type: none"> • ON 	<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF 	<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> • Injectors which have no DTC are operated • To minimize PM emission to DPF 	<ul style="list-style-type: none"> • Injectors which have no DTC are operated • To minimize PM emission to DPF

9Y1200226CRS0750US0

Name		Engine overheat	Engine overrun
ISO 14229 P-Code		P0217	P0219
J1939-73	SPN	110	190
	FMI	0	0
SPN Name SAE J1939 Table C1		Engine Coolant Temperature	Engine Speed
DTC Name		Engine overheat	Engine overrun
Management Unit for Detected Part		THWOT	NEOR
Detection item		• Overheat of engine coolant temperature	• Engine speed exceeds threshold speed
DTC Set Preconditions		• Coolant temperature sensor is normal	• Key switch is ON
DTC set parameter		• Engine coolant temperature $\geq 120\text{ }^{\circ}\text{C}$ (248 $^{\circ}\text{F}$)	• Engine speed $\geq 3500\text{ min}^{-1}$ (rpm)
Time to action or number of error detection		• 5 sec. or more	• 3 revolutions or more
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open	• Stop injection ($Q = 0\text{ mm}^3/\text{st}$)
Behaviour During Malfunction		• Insufficient output • Overheat	• Overrun
Engine Warning Light		• ON	• ON
Recovery from error		• Diagnostic counter = zero	• Diagnostic counter = zero
Delay time for recovery		• 30 sec.	• Immediately
Remark			

9Y1200226CRS0751US0

Name		Boost pressure sensor abnormality	
ISO 14229 P-Code		P0237	P0238
J1939-73	SPN	102	102
	FMI	4	3
SPN Name SAE J1939 Table C1		Engine Intake Manifold #1 Pressure	Engine Intake Manifold #1 Pressure
DTC Name		Boost pressure sensor: Low	Boost pressure sensor: High
Management Unit for Detected Part		PIML	PIMH
Detection item		<ul style="list-style-type: none"> Ground short circuit of sensor / harness Failure of sensor 	<ul style="list-style-type: none"> Open circuit or +B short circuit of sensor / harness Failure of sensor
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC# is normal 	<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC# is normal
DTC set parameter		<ul style="list-style-type: none"> Voltage of boost pressure sensor is 0.2 V or below 	<ul style="list-style-type: none"> Voltage of boost pressure sensor is 4.9 V or above
Time to action or number of error detection		<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> 65kPa (0.66 kgf/cm², 9.4 psi) [default value] 	<ul style="list-style-type: none"> 65 kPa (0.66 kgf/cm², 9.4 psi) [default value]
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output 	<ul style="list-style-type: none"> Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> Default value is changed in consideration with high altitude usage 	<ul style="list-style-type: none"> Default value is changed in consideration with high altitude usage

9Y1200226CRS0752US0

Name		Crankshaft position sensor (NE sensor) abnormality	
ISO 14229 P-Code		P0335	P0336
J1939-73	SPN	636	636
	FMI	8	2
SPN Name SAE J1939 Table C1		Engine Position Sensor	Engine Position Sensor
DTC Name		No input of NE sensor (Crankshaft position sensor) pulse	NE sensor (Crankshaft position sensor) pulse number error
Management Unit for Detected Part		NENOP	NEPUM
Detection item		<ul style="list-style-type: none"> • Open circuit or short circuit of sensor / harness • Failure of sensor 	<ul style="list-style-type: none"> • Open circuit or short circuit of sensor / harness • Failure of sensor
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • Sensor supply voltage VCC# is normal • Engine is not stalled 	<ul style="list-style-type: none"> • Battery voltage is normal • Sensor supply voltage VCC# is normal • 350 min⁻¹ (rpm) or higher
DTC set parameter		<ul style="list-style-type: none"> • No recognition of Ne sensor pulse 	<ul style="list-style-type: none"> • Pulse count per rotation is not 56 teeth
Time to action or number of error detection		<ul style="list-style-type: none"> • 10 times or more 	<ul style="list-style-type: none"> • 10 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition 	<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		(Running only with G signal) <ul style="list-style-type: none"> • Faulty starting • Vibration is slightly large • Insufficient output 	(Running only with G signal) <ul style="list-style-type: none"> • Faulty starting • Vibration is slightly large • Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> • ON 	<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Diagnostic counter = zero 	<ul style="list-style-type: none"> • Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> • Delay time varies with engine speed in proportional relation • If it is set 30 sec. at 800 min⁻¹ (rpm), it is shorten to 15 sec. at 1600 min⁻¹ (rpm) operation 	<ul style="list-style-type: none"> • Delay time varies with engine speed in proportional relation • If it is set 30 sec. at 800 min⁻¹ (rpm), it is shorten to 15 sec. at 1600 min⁻¹ (rpm) operation
Remark			

9Y1200226CRS0753US0

Name		Camshaft position sensor (G sensor) abnormality	
ISO 14229 P-Code		P0340	P0341
J1939-73	SPN	723	723
	FMI	8	2
SPN Name SAE J1939 Table C1		Engine Speed 2	Engine Speed 2
DTC Name		No input of G sensor (Camshaft position sensor) pulse	G sensor (Camshaft position sensor) pulse number error
Management Unit for Detected Part		GNOP	GPUM
Detection item		<ul style="list-style-type: none"> • Open circuit or short circuit of sensor / harness • Failure of sensor 	<ul style="list-style-type: none"> • Open circuit or short circuit of sensor / harness • Failure of sensor
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • Sensor supply voltage VCC# is normal • Engine is not stalled 	<ul style="list-style-type: none"> • Battery voltage is normal • Sensor supply voltage VCC# is normal • Engine speed is 350 min⁻¹ (rpm) or higher
DTC set parameter		<ul style="list-style-type: none"> • No recognition of G sensor pulse 	<ul style="list-style-type: none"> • Pulse count per rotation is not 5 teeth
Time to action or number of error detection		<ul style="list-style-type: none"> • 10 times or more 	<ul style="list-style-type: none"> • 10 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • None
Behaviour During Malfunction		(Invalid G signal) <ul style="list-style-type: none"> • Engine hesitates at start-up 	(Invalid G signal) <ul style="list-style-type: none"> • Engine hesitates at start-up
Engine Warning Light		<ul style="list-style-type: none"> • ON 	<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Diagnostic counter = zero 	<ul style="list-style-type: none"> • Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> • Delay time varies with engine speed in proportional relation • If it is set 30 sec. at 800 min⁻¹ (rpm), it is shorten to 15 sec. at 1600 min⁻¹ (rpm) operation 	<ul style="list-style-type: none"> • Delay time varies with engine speed in proportional relation • If it is set 30 sec. at 800 min⁻¹ (rpm), it is shorten to 15 sec. at 1600 min⁻¹ (rpm) operation
Remark			

9Y1200226CRS0754US0

Name		Air heater relay driving circuit abnormality	
ISO 14229 P-Code		P0380	P0380
J1939-73	SPN	523544	523544
	FMI	3	4
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		+B short of air heater relay driving circuit	Ground short of air heater relay driving circuit
Management Unit for Detected Part		GRELBT	GRELGD
Detection item		<ul style="list-style-type: none"> +B short of air heater relay driving circuit 	<ul style="list-style-type: none"> Ground short or open circuit of air heater relay driving circuit
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal During air heater relay drive command is activated 	<ul style="list-style-type: none"> Battery voltage is normal Other than during air heater relay drive command is activated
DTC set parameter		<ul style="list-style-type: none"> +B short circuit of harness 	<ul style="list-style-type: none"> Open circuit of harness, Ground short circuit
Time to action or number of error detection		<ul style="list-style-type: none"> 1 sec. or more 	<ul style="list-style-type: none"> 1 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Behaviour During Malfunction		(At low temperature) <ul style="list-style-type: none"> Faulty starting Increase in white smoke 	(At low temperature) <ul style="list-style-type: none"> Faulty starting Increase in white smoke
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS0755US0

Name		EGR actuator abnormality		
ISO 14229 P-Code		P0403	P0404	P0409
J1939-73	SPN	523574	523574	523572
	FMI	3	4	4
SPN Name SAE J1939 Table C1		proprietary	proprietary	proprietary
DTC Name		EGR actuator open circuit	EGR actuator coil short	EGR position sensor failure
Management Unit for Detected Part		DCMEGROPC	DCMEGROCC	LEGRC
Detection item		• EGR actuator open circuit	• EGR actuator coil short	• EGR position sensor failure
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal No DTC of U0077 "CAN1 Bus off" EGR control line is normal 	<ul style="list-style-type: none"> Battery voltage is normal No DTC of U0077 "CAN1 Bus off" EGR control line is normal 	<ul style="list-style-type: none"> Battery voltage is normal No DTC of U0077 "CAN1 Bus off" EGR control line is normal
DTC set parameter		• EGR actuator open error signal received via CAN	• EGR actuator coil short error signal received via CAN	• EGR position sensor error signal received via CAN
Time to action or number of error detection		• 2.8 sec or more	• 2.8 sec. or more	• 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance
Engine Warning Light		• ON	• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		—	—	—
Remark				

9Y1200226CRS0756US0

Name		Oil pressure error
ISO 14229 P-Code		P0524
J1939-73	SPN	100
	FMI	1
SPN Name SAE J1939 Table C1		Engine Oil Pressure
DTC Name		Oil pressure error
Management Unit for Detected Part		POILDN
Detection item		<ul style="list-style-type: none"> Oil pressure switch
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Key switch turn ON Starter Switch signal (ECU: V12 terminal) is not activated 10 sec or more after engine start [700 min^{-1} (rpm) or higher]
DTC set parameter		<ul style="list-style-type: none"> Oil pressure switch ON: continues one sec or more
Time to action or number of error detection		<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> None
Behaviour During Malfunction		<ul style="list-style-type: none"> Engine stops
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—
Remark		

9Y1200226CRS0757US0

Name		Exhaust gas temperature sensor 1 (T1) abnormality	
ISO 14229 P-Code		P0543	P0544
J1939-73	SPN	3242	3242
	FMI	4	3
SPN Name SAE J1939 Table C1		After treatment 1 Diesel Particulate Filter Intake Gas Temperature	After treatment 1 Diesel Particulate Filter Intake Gas Temperature
DTC Name		Exhaust gas temperature sensor 1: Low	Exhaust gas temperature sensor 1: High
Management Unit for Detected Part		THAEX1L	THAEX1H
Detection item		<ul style="list-style-type: none"> Ground short circuit of sensor / harness 	<ul style="list-style-type: none"> Open circuit or +B short circuit of sensor / harness.
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal 	<ul style="list-style-type: none"> Battery voltage is normal Coolant temperature is 65 °C (149 °F) or more: continues longer than 10 min. after engine starting 100 °C (212 °F) ≤ T0 ≤ 800 °C (1472 °F): continues longer than 10 sec. or 100 °C (212 °F) ≤ T2 ≤ 800 °C (1472 °F): continues longer than 10sec.
DTC set parameter		<ul style="list-style-type: none"> Diesel Particulate Filter (hereinafter referred to as the "DPF") inlet temperature sensor (T1) voltage: 0.08 V or less 	<ul style="list-style-type: none"> DPF inlet temperature sensor (T1) voltage: 4.92 V or more
Time to action or number of error detection		<ul style="list-style-type: none"> 5 sec. or more 	<ul style="list-style-type: none"> 120 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> 0 °C (32 °F) [default value] Output limitation: Approximately 75 % of normal condition 	<ul style="list-style-type: none"> 0 °C (32 °F) [default value] Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS0758US0

Name		Exhaust gas temperature sensor 0 (T0) abnormality	
ISO 14229 P-Code		P0546	P0547
J1939-73	SPN	4765	4765
	FMI	4	3
SPN Name SAE J1939 Table C1		After treatment 1 Diesel Oxidation Catalyst Intake Gas Temperature	After treatment 1 Diesel Oxidation Catalyst Intake Gas Temperature
DTC Name		Exhaust gas temperature sensor 0: Low	Exhaust gas temperature sensor 0: High
Management Unit for Detected Part		THAEX0L	THAEX0H
Detection item		<ul style="list-style-type: none"> Ground short circuit of sensor / harness 	<ul style="list-style-type: none"> Open circuit or +B short circuit of sensor / harness.
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal 	<ul style="list-style-type: none"> Battery voltage is normal Coolant temperature is 65 °C (149 °F) or more: continues longer than 5 min. after engine starting 100 °C (212 °F) ≤ T1 ≤ 800 °C (1472 °F): continues longer than 10 sec. or 100 °C (212 °F) ≤ T2 ≤ 800 °C (1472 °F): continues longer than 10 sec.
DTC set parameter		<ul style="list-style-type: none"> DOC inlet temperature sensor (T0) voltage: 0.08 V or less 	<ul style="list-style-type: none"> DOC inlet temperature sensor (T0) voltage: 4.92 V or more
Time to action or number of error detection		<ul style="list-style-type: none"> 5 sec. or more 	<ul style="list-style-type: none"> 120 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> 0 °C (32 °F) [default value] Output limitation: Approximately 75 % of normal condition 	<ul style="list-style-type: none"> 0 °C (32 °F) [default value] Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS0759US0

Name		Battery voltage abnormality	
ISO 14229 P-Code		P0562	P0563
J1939-73	SPN	168	168
	FMI	4	3
SPN Name SAE J1939 Table C1		Battery Potential / Power Input 1	Battery Potential / Power Input 1
DTC Name		Battery voltage: Low	Battery voltage: High
Management Unit for Detected Part		VBBL	VBBH
Detection item		<ul style="list-style-type: none"> • Open circuit, short circuit or damage of harness • Failure of battery 	<ul style="list-style-type: none"> • Open circuit, short circuit or damage of harness • Failure of battery
DTC Set Preconditions		<ul style="list-style-type: none"> • Key switch is ON • Starter Switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> • Key switch is ON • Starter Switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> • ECU recognition of battery voltage is below 8 V in 12 V system • Not monitored during cranking 	<ul style="list-style-type: none"> • ECU recognition of battery voltage is above 16 V in 12 V system
Time to action or number of error detection		<ul style="list-style-type: none"> • 1 sec. or more 	<ul style="list-style-type: none"> • 1 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open 	<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> • Faulty starting • Insufficient output • Worsening exhaust gas performance • Engine stops in some case 	<ul style="list-style-type: none"> • Faulty starting • Insufficient output • Worsening exhaust gas performance
Engine Warning Light		<ul style="list-style-type: none"> • ON 	<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Diagnostic counter = zero 	<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		<ul style="list-style-type: none"> • 30 sec. 	—
Remark			

9Y1200226CRS0760US0

Name		QR data abnormality	
ISO 14229 P-Code		P0602	P0602
J1939-73	SPN	523538	523538
	FMI	2	7
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		QR data error	No QR data
Management Unit for Detected Part		QRERR	QRNOT
Detection item		<ul style="list-style-type: none"> QR data read error from EEPROM 	<ul style="list-style-type: none"> Area of QR data on EEPROM is vacant
DTC Set Preconditions		<ul style="list-style-type: none"> Key switch is ON 	<ul style="list-style-type: none"> Key switch is ON
DTC set parameter		<ul style="list-style-type: none"> QR correction data exceeds threshold value Multiple check error (QR correction data for each injector has been stored in three locations. When this data is read and compared, an error is determined if there is difference in all three values.) 	<ul style="list-style-type: none"> When QR correction data fails to write to the EEPROM (When the initial ECU value is "0", an error that QR data is not written to the disc at the time of vehicle shipment is detected.)
Time to action or number of error detection		<ul style="list-style-type: none"> Transient 	<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Nozzle calibration is not executed Output limitation: Approximately 75 % of normal condition 	<ul style="list-style-type: none"> Nozzle correction factor = 0 [default value] Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output 	<ul style="list-style-type: none"> Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> To cover each injector dispersion 	

9Y1200226CRS0761US0

Name		ECU FLASH ROM and CPU abnormality		
ISO 14229 P-Code		P0605	P0606	P0606
J1939-73	SPN	628	1077	523527
	FMI	2	2	2
SPN Name SAE J1939 Table C1		Program Memory	Engine Fuel Injection Pump Controller	
DTC Name		ECU FLASH ROM error	ECU CPU (Main IC) error	ECU CPU (Monitoring IC) error
Management Unit for Detected Part		FROM	MCPU	SCPU
Detection item		• FLASH ROM error	• Failure of CPU	• Failure of monitoring IC of CPU
DTC Set Preconditions		• Key switch is ON	• Key switch is ON • Battery voltage is 10 V or more • Starter Switch signal (ECU: V12 terminal) is not activated	• Key switch is ON • Battery voltage is 10 V or more • Starter Switch signal (ECU: V12 terminal) is not activated
DTC set parameter		• 3 times or more consecutive inconsistencies in checksum	• CPU abnormality counter ≥ 5 times (RUN pulse abnormality occurs 5 times or more)	• Abnormality continues for 2000 msec or more after the ECU is turned ON • RUN pulse abnormality • Above conditions occur continuously for 700 msec or more
Time to action or number of error detection		• 1 time or more	• 1 time or more	• 1 time or more
Limp Home Action by engine ECU (system action)		• Engine stopped without delay	• Engine Stop	• Engine Stop
Behaviour During Malfunction		• Engine stops	• Engine stops	• Engine stops
Engine Warning Light		• ON	• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		—	—	—
Remark				

9Y1200226CRS0762US0

Name		Injector charge voltage abnormality
ISO 14229 P-Code		P0611
J1939-73	SPN	523525
	FMI	1
SPN Name SAE J1939 Table C1		proprietary
DTC Name		Injector charge voltage: Low
Management Unit for Detected Part		LCHG
Detection item		<ul style="list-style-type: none"> • Injector charge voltage: Low • Failure of charge circuit of ECU
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • CPU is normal
DTC set parameter		<ul style="list-style-type: none"> • Injector charge voltage: Low • Failure of charge circuit of ECU
Time to action or number of error detection		<ul style="list-style-type: none"> • Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output • Worsening exhaust gas performance • Engine stops in some case
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> • To minimize PM emission to DPF

9Y1200226CRS0763US0

Name		SCV drive system abnormality	
ISO 14229 P-Code		P0628	P0629
J1939-73	SPN	1347	1347
	FMI	4	3
SPN Name SAE J1939 Table C1		Engine Fuel Feed Pump Pressurizing Assembly #1	Engine Fuel Feed Pump Pressurizing Assembly #1
DTC Name		SCV drive system error	+B short circuit of SCV
Management Unit for Detected Part		DRSCV	BSSCV
Detection item		<ul style="list-style-type: none"> Open circuit or ground short circuit of SCV 	<ul style="list-style-type: none"> +B short circuit of SCV
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Key switch is ON Starter Switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> Battery voltage is normal Key switch is ON Starter Switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> Open circuit or ground short of SCV 	<ul style="list-style-type: none"> +B short circuit of SCV
Time to action or number of error detection		<ul style="list-style-type: none"> 2.6 sec. or more 	<ul style="list-style-type: none"> 2.6 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop Intake throttle 100 % open Engine forcibly stopped 60 sec later 	<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop Intake throttle 100 % open Engine forcibly stopped 60 sec later
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			<ul style="list-style-type: none"> Engine speed may go down due to low fuel pressure regardless limp home de-rating Engine may stop automatically before stopped forcibly by ECU

9Y1200226CRS0764US0

Name		Sensor supply voltage 1 abnormality	
ISO 14229 P-Code		P0642	P0643
J1939-73	SPN	3509	3509
	FMI	4	3
SPN Name SAE J1939 Table C1		Sensor supply voltage 1	Sensor supply voltage 1
DTC Name		Sensor supply voltage 1: Low	Sensor supply voltage 1: High
Management Unit for Detected Part		VCC1L	VCC1H
Detection item		<ul style="list-style-type: none"> • Sensor supply voltage 1 error or recognition error 	<ul style="list-style-type: none"> • Sensor supply voltage 1 error or recognition error
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • Key switch turn ON • Starter Switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> • Battery voltage is normal • Key switch turn ON • Starter Switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> • Voltage to sensor is below 4.375 V 	<ul style="list-style-type: none"> • Voltage to sensor is above 5.625 V
Time to action or number of error detection		<ul style="list-style-type: none"> • Transient 	<ul style="list-style-type: none"> • Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 50 % of normal condition • Speed limitation (Accelerator limitation: 50 %) • EGR stop • Intake throttle 100 % open 	<ul style="list-style-type: none"> • Output limitation: Approximately 50 % of normal condition • Speed limitation (Accelerator limitation: 50 %) • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> • Faulty starting • Insufficient output • Worsening exhaust gas performance • Engine stops in some case 	<ul style="list-style-type: none"> • Faulty starting • Insufficient output • Worsening exhaust gas performance • Engine stops in some case
Engine Warning Light		<ul style="list-style-type: none"> • ON 	<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF 	<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> • Emission related 	<ul style="list-style-type: none"> • Emission related

9Y1200226CRS0765US0

Name		Sensor supply voltage 2 abnormality	
ISO 14229 P-Code		P0652	P0653
J1939-73	SPN	3510	3510
	FMI	4	3
SPN Name SAE J1939 Table C1		Sensor supply voltage 2	Sensor supply voltage 2
DTC Name		Sensor supply voltage 2: Low	Sensor supply voltage 2: High
Management Unit for Detected Part		VCC2L	VCC2H
Detection item		<ul style="list-style-type: none"> Sensor supply voltage 2 error or recognition error 	<ul style="list-style-type: none"> Sensor supply voltage 2 error or recognition error
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Key switch turn ON Starter Switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> Battery voltage is normal Key switch turn ON Starter Switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> Voltage to sensor is below 4.375 V 	<ul style="list-style-type: none"> Voltage to sensor is above 5.625 V
Time to action or number of error detection		<ul style="list-style-type: none"> Transient 	<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition 	<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		<ul style="list-style-type: none"> Faulty starting Insufficient output Worsening exhaust gas performance 	<ul style="list-style-type: none"> Faulty starting Insufficient output Worsening exhaust gas performance
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> Emission related 	<ul style="list-style-type: none"> Emission related

9Y1200226CRS0766US0

Name		Main relay is locked in closed position
ISO 14229 P-Code		P0687
J1939-73	SPN	1485
	FMI	2
SPN Name SAE J1939 Table C1		ECM Main Relay
DTC Name		Main relay is locked in closed position
Management Unit for Detected Part		MRYCS
Detection item		<ul style="list-style-type: none"> • Failure of main relay
DTC Set Preconditions		<ul style="list-style-type: none"> • Key switch is OFF • Engine stops
DTC set parameter		<ul style="list-style-type: none"> • Main relay stays active longer than 1 sec. without command
Time to action or number of error detection		<ul style="list-style-type: none"> • 2 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • None
Behaviour During Malfunction		<ul style="list-style-type: none"> • Dead battery
Engine Warning Light		<ul style="list-style-type: none"> • OFF
Recovery from error		<ul style="list-style-type: none"> • Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> • 5.3 sec.
Remark		

9Y1200226CRS0767US0

Name		Pump seizing
ISO 14229 P-Code		P1274
J1939-73	SPN	523539
	FMI	2
SPN Name SAE J1939 Table C1		proprietary
DTC Name		Pump seizing 1
Management Unit for Detected Part		PMPPR
Detection item		<ul style="list-style-type: none"> High pressure 1 error
DTC Set Preconditions		<ul style="list-style-type: none"> Sensor supply voltage VCC# is normal Rail pressure sensor is normal
DTC set parameter		(Approximate parameter) <ul style="list-style-type: none"> Rail pressure of 230 MPa (2350 kgf/cm², 33400 psi) or more continues 1 second under the condition of above 800 min⁻¹ (rpm) Rail pressure of 220 MPa (2250 kgf/cm², 31900 psi) or more continues 1 second under the condition of below 800 min⁻¹ (rpm) [Threshold changes depending on the engine speed. 700 min⁻¹ (rpm) should be used as a reference]
Time to action or number of error detection		<ul style="list-style-type: none"> 1 time or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> To minimize PM emission to DPF To avoid extremely high pressure in injection system

9Y1200226CRS0768US0

Name		Pump seizing
ISO 14229 P-Code		P1275
J1939-73	SPN	523540
	FMI	2
SPN Name SAE J1939 Table C1		proprietary
DTC Name		Pump seizing 2
Management Unit for Detected Part		PMPEX
Detection item		<ul style="list-style-type: none"> High pressure 2 error
DTC Set Preconditions		<ul style="list-style-type: none"> Sensor supply voltage VCC# is normal Rail pressure sensor is normal
DTC set parameter		<p>(Approximate parameter)</p> <ul style="list-style-type: none"> Rail pressure of above 197 MPa (2010 kgf/cm², 28600 psi), and below 230 MPa (2350 kgf/cm², 33400 psi) continues total time for 35 seconds under condition of above 800 min⁻¹ (rpm) [Threshold changes depending on the engine speed. 2000 min⁻¹ (rpm) should be used as a reference] Or, rail pressure of above 220 MPa (2250 kgf/cm², 31900 psi) continues total time for 1.7 second under condition of below 800 min⁻¹ (rpm) [Threshold changes depending on the engine speed. 700 min⁻¹ (rpm) should be used as a reference]
Time to action or number of error detection		<ul style="list-style-type: none"> 1 time or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> To minimize PM emission to DPF To avoid extremely high pressure in injection system

9Y1200226CRS0769US0

Name		EEPROM check sum error	Intake throttle feedback error
ISO 14229 P-Code		P1990	P2108
J1939-73	SPN	523700	523580
	FMI	13	2
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		EEPROM check sum error	Intake throttle feedback error
Management Unit for Detected Part		EEPKB	DCMIFB
Detection item		• KBT-EEPROM check sum error	• Intake throttle feedback error
DTC Set Preconditions		• Battery voltage is normal	• Battery voltage is normal
DTC set parameter		• EEPROM check sum error	(Approximate parameter) • Deviation of throttle position is not corrected in 20 times
Time to action or number of error detection		• Transient	• 5 sec. or more
Limp Home Action by engine ECU (system action)		• None	• Output limitation: Approximately 75 % of normal condition • Intake throttle 100 % open
Behaviour During Malfunction		• None	• None
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS0770US0

Name		Accelerator position sensor 1 abnormality	
ISO 14229 P-Code		P2122	P2123
J1939-73	SPN	91	91
	FMI	4	3
SPN Name SAE J1939 Table C1		Accelerator Pedal Position 1	Accelerator Pedal Position 1
DTC Name		Accelerator position sensor 1: Low	Accelerator position sensor 1: High
Management Unit for Detected Part		ACCP1L	ACCP1H
Detection item		<ul style="list-style-type: none"> Ground short circuit or open circuit of sensor / harness 	<ul style="list-style-type: none"> Battery short circuit out of sensor / harness
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC2 is normal 	<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC2 is normal
DTC set parameter		<ul style="list-style-type: none"> Voltage of accelerator position sensor 1 is 0.3 V or less 	<ul style="list-style-type: none"> Voltage of accelerator position sensor 1 is 4.8 V or less
Time to action or number of error detection		<ul style="list-style-type: none"> Transient 	<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Forced Idle (Accelerator = 0 %) 	<ul style="list-style-type: none"> Forced Idle (Accelerator = 0 %)
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output 	<ul style="list-style-type: none"> Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> 3 sec. 	<ul style="list-style-type: none"> 3 sec.
Remark			

9Y1200226CRS0771US0

Name		Accelerator position sensor 2 abnormality	
ISO 14229 P-Code		P2127	P2128
J1939-73	SPN	29	29
	FMI	4	3
SPN Name SAE J1939 Table C1		Accelerator Pedal Position 2	Accelerator Pedal Position 2
DTC Name		Accelerator position sensor 2: Low	Accelerator position sensor 2: High
Management Unit for Detected Part		ACCP2L	ACCP2H
Detection item		<ul style="list-style-type: none"> Ground short circuit or open circuit of sensor / harness 	<ul style="list-style-type: none"> Battery short circuit out of sensor / harness
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC1 is normal 	<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC1 is normal
DTC set parameter		<ul style="list-style-type: none"> Voltage of accelerator position sensor 2 is 0.3 V or less 	<ul style="list-style-type: none"> Voltage of accelerator position sensor 2 is 4.8 V or less
Time to action or number of error detection		<ul style="list-style-type: none"> Transient 	<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Forced Idle (Accelerator = 0 %) 	<ul style="list-style-type: none"> Forced Idle (Accelerator = 0 %)
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output 	<ul style="list-style-type: none"> Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> 3 sec. 	<ul style="list-style-type: none"> 3 sec.
Remark			

9Y1200226CRS0772US0

Name		Accelerator position sensor error (CAN)	Accelerator position sensor correlation error
ISO 14229 P-Code		P2131	P2135
J1939-73	SPN	523543	91
	FMI	2	2
SPN Name SAE J1939 Table C1		proprietary	Accel Pedal Sensor 1
DTC Name		Accelerator position sensor error (CAN)	Accelerator position sensor correlation error
Management Unit for Detected Part		ACCPCAN	ACCPP
Detection item		<ul style="list-style-type: none"> Accelerator position sensor signal error (sensor / harness open circuit, ground short circuit etc) 	<ul style="list-style-type: none"> Deviation from designed correlation in two sensors
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Key switch turn ON Starter Switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> Battery voltage is normal Accelerator position sensor1 is normal Accelerator position sensor2 is normal
DTC set parameter		<ul style="list-style-type: none"> Accelerator position sensor error signal received by CAN 	<ul style="list-style-type: none"> Deviation from designed correlation in two sensors It depends on engine application
Time to action or number of error detection		<ul style="list-style-type: none"> Transient 	<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Not applicable 	<ul style="list-style-type: none"> Forced Idle (Accelerator = 0 %)
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output 	<ul style="list-style-type: none"> Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero (CAN signal recovers) 	<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> Immediately 	<ul style="list-style-type: none"> 3 sec.
Remark			

9Y1200226CRS0773US0

Name		Common 1 system injector drive circuit open
ISO 14229 P-Code		P2146
J1939-73	SPN	523523
	FMI	2
SPN Name SAE J1939 Table C1		proprietary
DTC Name		Injector drive circuit open in No.1 and 4 Cylinder simultaneously
Management Unit for Detected Part		NCCOM1
Detection item		<ul style="list-style-type: none"> • Wiring harness open circuit
DTC Set Preconditions		<ul style="list-style-type: none"> • Engine is operating • Battery voltage is normal • During injection • CPU is normal
DTC set parameter		<ul style="list-style-type: none"> • When wiring harness open circuit
Time to action or number of error detection		<ul style="list-style-type: none"> • 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output • Large vibration • Worsening exhaust gas performance • Engine stops in some case
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> • Injectors which have no DTC are operated • To minimize PM emission to DPF

9Y1200226CRS0774US0

Name		Common 1 TWV actuation system short	
ISO 14229 P-Code		P2147	P2148
J1939-73	SPN	523523	523523
	FMI	4	3
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		1 & 4 cylinder injector short to ground at power supply side, or all cylinder injector short to ground	1 & 4 cylinder injector short to +B at power supply side, or all cylinder injector short to +B
Management Unit for Detected Part		GSTWV1	BSTWV1
Detection item		<ul style="list-style-type: none"> Wiring harness short to ground 	<ul style="list-style-type: none"> Wiring harness short to +B
DTC Set Preconditions		<ul style="list-style-type: none"> Engine is operating Battery voltage is normal 	<ul style="list-style-type: none"> Engine is operating Battery voltage is normal
DTC set parameter		<ul style="list-style-type: none"> When wiring harness short to ground occurs 	<ul style="list-style-type: none"> When wiring harness short to +B occurs
Time to action or number of error detection		<ul style="list-style-type: none"> 8 times or more 	<ul style="list-style-type: none"> 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Injectors which have DTC stop injection Output limitation: Approximately 75 % of normal condition EGR stop Intake throttle 100 % open 	<ul style="list-style-type: none"> Injectors which have error stop injection Output limitation: Approximately 75 % of normal condition EGR stop Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Large vibration Worsening exhaust gas performance Engine stops in some case 	<ul style="list-style-type: none"> Insufficient output Large vibration Worsening exhaust gas performance Engine stops in some case
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> Injectors which have no DTC are operated To minimize PM emission to DPF 	<ul style="list-style-type: none"> Injectors which have no DTC are operated To minimize PM emission to DPF

9Y1200226CRS0775US0

Name		Common 2 system injector drive circuit open
ISO 14229 P-Code		P2149
J1939-73	SPN	523524
	FMI	2
SPN Name SAE J1939 Table C1		proprietary
DTC Name		Injector drive circuit open in No.2 and 3 Cylinder simultaneously
Management Unit for Detected Part		NCCOM2
Detection item		<ul style="list-style-type: none"> • Wiring harness open circuit
DTC Set Preconditions		<ul style="list-style-type: none"> • Engine is operating • Battery voltage is normal • During injection • CPU is normal
DTC set parameter		<ul style="list-style-type: none"> • When wiring harness open circuit
Time to action or number of error detection		<ul style="list-style-type: none"> • 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output • Large vibration • Worsening exhaust gas performance • Engine stops in some case
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> • Injectors which have no DTC are operated • To minimize PM emission to DPF

9Y1200226CRS0776US0

Name		Common 2 TWV actuation system short	
ISO 14229 P-Code		P2150	P2151
J1939-73	SPN	523524	523524
	FMI	4	3
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		2 & 3 cylinder injector short to ground at power supply side, or all cylinder injector short to ground	2 & 3 cylinder injector short to +B at power supply side, or all cylinder injector short to +B
Management Unit for Detected Part		GSTWV2	BSTWV2
Detection item		<ul style="list-style-type: none"> Wiring harness short to ground 	<ul style="list-style-type: none"> Wiring harness short to +B
DTC Set Preconditions		<ul style="list-style-type: none"> Engine is operating Battery voltage is normal 	<ul style="list-style-type: none"> Engine is operating Battery voltage is normal
DTC set parameter		<ul style="list-style-type: none"> When wiring harness short to ground occurs 	<ul style="list-style-type: none"> When wiring harness short to +B occurs
Time to action or number of error detection		<ul style="list-style-type: none"> 8 times or more 	<ul style="list-style-type: none"> 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Injectors which have error stop injection Output limitation: Approximately 75 % of normal condition EGR stop Intake throttle 100 % open 	<ul style="list-style-type: none"> Injectors which have error stop injection Output limitation Approximately 75 % of normal condition EGR stop Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Large vibration Worsening exhaust gas performance Engine stops in some case 	<ul style="list-style-type: none"> Insufficient output Large vibration Worsening exhaust gas performance Engine stops in some case
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> Injectors which have no DTC are operated To minimize PM emission to DPF 	<ul style="list-style-type: none"> Injectors which have no DTC are operated To minimize PM emission to DPF

9Y1200226CRS0777US0

Name		Barometric pressure sensor error	
ISO 14229 P-Code		P2228	P2229
J1939-73	SPN	108	108
	FMI	4	3
SPN Name SAE J1939 Table C1		Barometric Pressure	Barometric Pressure
DTC Name		Barometric pressure sensor error (Low side)	Barometric pressure sensor error (High side)
Management Unit for Detected Part		PATML	PATMH
Detection item		<ul style="list-style-type: none"> Sensor / ECU internal circuit short to ground 	<ul style="list-style-type: none"> Sensor / ECU internal circuit short to +B
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal 	<ul style="list-style-type: none"> Battery voltage is normal
DTC set parameter		<ul style="list-style-type: none"> Barometric pressure sensor voltage: 1.6 V or less 	<ul style="list-style-type: none"> Barometric pressure sensor voltage: 4.4 V or more
Time to action or number of error detection		<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> 65 kPa (0.66 kgf/cm², 9.4 psi) [default value] 	<ul style="list-style-type: none"> 65 kPa (0.66 kgf/cm², 9.4 psi) [default value]
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output 	<ul style="list-style-type: none"> Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> Immediately 	<ul style="list-style-type: none"> Immediately
Remark		<ul style="list-style-type: none"> Default value is changed in consideration with high altitude usage 	<ul style="list-style-type: none"> Default value is changed in consideration with high altitude usage

9Y1200226CRS0778US0

Name		EGR (DC motor) abnormality		
ISO 14229 P-Code		P2413	P2414	P2415
J1939-73	SPN	523575	523576	523577
	FMI	7	2	2
SPN Name SAE J1939 Table C1		proprietary	proprietary	proprietary
DTC Name		EGR actuator valve stuck	EGR (DC motor) overheat	EGR (DC motor) temperature sensor failure
Management Unit for Detected Part		EGRVSC	EGRAMBTMPC	EGRTHC
Detection item		<ul style="list-style-type: none"> EGR actuator valve stuck 	<ul style="list-style-type: none"> EGR (DC motor) overheat 	<ul style="list-style-type: none"> EGR (DC motor) temperature sensor failure
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal No DTC of U0077 "CAN1 Bus off" EGR control line is normal 	<ul style="list-style-type: none"> Battery voltage is normal No DTC of U0077 "CAN1 Bus off" EGR control line is normal 	<ul style="list-style-type: none"> Battery voltage is normal No DTC of U0077 "CAN1 Bus off" EGR control line is normal
DTC set parameter		<ul style="list-style-type: none"> EGR actuator valve stuck error signal received via CAN 	<ul style="list-style-type: none"> EGR (DC motor) temperature error signal (thermistor: 125 °C (257 °F) or more) received via CAN 	<ul style="list-style-type: none"> EGR (DC motor) temperature sensor error signal received via CAN
Time to action or number of error detection		<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—	—
Remark				

9Y1200226CRS0779US0

Name		Exhaust gas temperature sensor 2 (T2) abnormality	
ISO 14229 P-Code		P242C	P242D
J1939-73	SPN	3246	3246
	FMI	4	3
SPN Name SAE J1939 Table C1		After treatment 1 Diesel Particulate Filter Outlet Gas Temperature	After treatment 1 Diesel Particulate Filter Outlet Gas Temperature
DTC Name		Exhaust gas temperature sensor 2: Low	Exhaust gas temperature sensor 2: High
Management Unit for Detected Part		THAEX2L	THAEX2H
Detection item		<ul style="list-style-type: none"> Ground short circuit of sensor / harness 	<ul style="list-style-type: none"> Open circuit or +B short circuit of sensor / harness.
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal 	<ul style="list-style-type: none"> Battery voltage is normal Coolant temperature is 65 °C (149 °F) or more: continues longer than 10 min. after engine starting 100 °C (212 °F) ≤ T0 ≤ 800 °C (1472 °F): continues longer than 10 sec. or 100 °C (212 °F) ≤ T1 ≤ 800 °C (1472 °F): continues longer than 10 sec.
DTC set parameter		<ul style="list-style-type: none"> DPF outlet temperature sensor (T2) voltage: 0.08 V or less 	<ul style="list-style-type: none"> DPF outlet temperature sensor (T2) voltage: 4.92 V or more
Time to action or number of error detection		<ul style="list-style-type: none"> 5 sec. or more 	<ul style="list-style-type: none"> 120 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> 0 °C (32 °F) [default value] Output limitation: Approximately 75 % of normal condition 	<ul style="list-style-type: none"> 0 °C (32 °F) [default value] Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS0780US0

Name		Differential pressure sensor 1 abnormality	
ISO 14229 P-Code		P2454	P2455
J1939-73	SPN	3251	3251
	FMI	4	3
SPN Name SAE J1939 Table C1		After treatment 1 Diesel Particulate Filter Differential Pressure	After treatment 1 Diesel Particulate Filter Differential Pressure
DTC Name		Differential pressure sensor 1: Low	Differential pressure sensor 1: High
Management Unit for Detected Part		PEX1L	PEX1H
Detection item		<ul style="list-style-type: none"> Ground short circuit of sensor / harness 	<ul style="list-style-type: none"> Open circuit or +B short circuit of sensor / harness.
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC# is normal Starter Switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC# is normal Starter Switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> DPF differential pressure sensor voltage: 0.21 V or less 	<ul style="list-style-type: none"> DPF differential pressure sensor voltage: 4.7 V or more
Time to action or number of error detection		<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> 0 kPa (0.0 kgf/cm², 0.0 psi) [default value] Output limitation: Approximately 75 % of normal condition 	<ul style="list-style-type: none"> 0 kPa (0.0 kgf/cm², 0.0 psi) [default value] Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS0781US0

Name		Intake throttle lift sensor abnormality	
ISO 14229 P-Code		P2621	P2622
J1939-73	SPN	523582	523582
	FMI	4	3
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		Intake throttle lift sensor: Low	Intake throttle lift sensor: High
Management Unit for Detected Part		ITHRPREL	ITHRPREH
Detection item		• Intake throttle lift sensor low	• Intake throttle lift sensor high
DTC Set Preconditions		• Battery voltage is normal • Sensor supply voltage VCC# is normal	• Battery voltage is normal • Sensor supply voltage VCC# is normal
DTC set parameter		• Intake throttle lift sensor voltage: 0.1 V or less	• Intake throttle lift sensor voltage: 4.89 V or more
Time to action or number of error detection		• 2.8 sec or more	• 2.8 sec. or more
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition • Intake throttle 100 % open	• Output limitation: Approximately 75 % of normal condition • Intake throttle 100 % open
Behaviour During Malfunction		• None	• None
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS0782US0

Name		Emission deterioration
ISO 14229 P-Code		P3001
J1939-73	SPN	3252
	FMI	0
SPN Name SAE J1939 Table C1		After treatment 1 Exhaust Gas Temperature 2 Preliminary FMI
DTC Name		Emission deterioration
Management Unit for Detected Part		DOCDTHEX
Detection item		<ul style="list-style-type: none"> • DOC is heated up due to unburned fuel
DTC Set Preconditions		<ul style="list-style-type: none"> • Other than during regeneration mode • Coolant temperature is 65 °C (149 °F) or more: continues longer than 5 min after engine starting
DTC set parameter		<ul style="list-style-type: none"> • $T1 - T0 \geq 250 \text{ }^{\circ}\text{C}$ (482 °F)
Time to action or number of error detection		<ul style="list-style-type: none"> • 60 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 50 % of normal condition • Speed limitation (Accelerator limitation: 50 %) • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> • To minimize PM emission to DPF

9Y1200226CRS0783US0

Name		Exhaust gas temperature sensor 0: Emergency high	Exhaust gas temperature sensor 1: Emergency high
ISO 14229 P-Code		P3002	P3003
J1939-73	SPN	4765	3242
	FMI	0	0
SPN Name SAE J1939 Table C1		After treatment 1 Exhaust Gas Temperature 1 Preliminary FMI	After treatment 1 Exhaust Gas Temperature 2 Preliminary FMI
DTC Name		Emergency Exhaust gas temperature sensor 0: High	Emergency Exhaust gas temperature sensor 1: High
Management Unit for Detected Part		EXTEMPT0	EXTEMPT1
Detection item		• DOC inlet temperature (T0) high	• DPF inlet temperature (T1) high
DTC Set Preconditions		<ul style="list-style-type: none"> Exhaust gas temperature sensor T0,T1 and T2 are normal Battery voltage is normal 	<ul style="list-style-type: none"> Exhaust gas temperature sensor T0,T1 and T2 are normal Battery voltage is normal
DTC set parameter		• DOC inlet temperature (T0): 700 °C (1292 °F) or more	• DPF inlet temperature (T1): 715 °C (1319 °F) or more
Time to action or number of error detection		• 2.0 sec. or more	• 9.0 min. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Stop injection (Q = 0 mm³/st) Engine stop Inhibit starter relay activation until exhaust gas temperature reduces down to 300 °C (572 °F) 	<ul style="list-style-type: none"> Stop injection (Q = 0 mm³/st) Engine stop Inhibit starter relay activation until exhaust gas temperature reduces down to 300 °C (572 °F)
Behaviour During Malfunction		<ul style="list-style-type: none"> Engine stops Inhibited cranking until down to 300 °C (572 °F) 	<ul style="list-style-type: none"> Engine stops Inhibited cranking until down to 300 °C (572 °F)
Engine Warning Light		• ON	• ON
Recovery from error		• Under 300 °C (572 °F) & key switch turn OFF	• Under 300 °C (572 °F) & key switch turn OFF
Delay time for recovery		–	–
Remark		• In case engine ECU is not involved to drive starter, starter activation should be inhibited by other way until exhaust gas temperature reduces down to 300 °C (572 °F)	• In case engine ECU is not involved to drive starter, starter activation should be inhibited by other way until exhaust gas temperature reduces down to 300 °C (572 °F)

9Y1200226CRS0784US0

Name		Exhaust gas temperature sensor 2: Emergency high
ISO 14229 P-Code		P3004
J1939-73	SPN	3246
	FMI	0
SPN Name SAE J1939 Table C1		After treatment 1 Exhaust Gas Temperature 3 Preliminary FMI
DTC Name		Emergency Exhaust gas temperature sensor 2: High
Management Unit for Detected Part		EXTEMPT2
Detection item		<ul style="list-style-type: none"> DPF outlet temperature (T2) high
DTC Set Preconditions		<ul style="list-style-type: none"> Exhaust gas temperature sensor T0,T1 and T2 are normal Battery voltage is normal
DTC set parameter		<ul style="list-style-type: none"> DPF outlet temperature (T2): 820 °C (1508 °F) or more
Time to action or number of error detection		<ul style="list-style-type: none"> 2.0 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Stop injection (Q = 0 mm³/st) Engine stop EGR stop Intake throttle 0 % open (Close) Inhibit starter relay activation until exhaust gas temperature reduces down to 300 °C (572 °F)
Behaviour During Malfunction		<ul style="list-style-type: none"> Engine stops Inhibit cranking until down to 300 °C (572 °F)
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Under 300 °C (572 °F) & key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> In case engine ECU is not involved to drive starter, starter activation should be inhibited by other way until exhaust gas temperature reduces down to 300 °C (572 °F)

9Y1200226CRS0785US0

Name		Excessive PM3
ISO 14229 P-Code		P3006
J1939-73	SPN	3701
	FMI	15
SPN Name SAE J1939 Table C1		Diesel Particulate Filter Status
DTC Name		Excessive PM3
Management Unit for Detected Part		DPFPMEX2
Detection item		• PM accumulation level3
DTC Set Preconditions		• Battery voltage is normal
DTC set parameter		• PM accumulation more than trigger level • Regeneration level = 3
Time to action or number of error detection		• Transient
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 50 % of normal condition
Behaviour During Malfunction		• Insufficient output
Engine Warning Light		• ON
Recovery from error		• Diagnostic counter = zero
Delay time for recovery		• Immediately
Remark		• To minimize PM out put

9Y1200226CRS0786US0

Name		Excessive PM4	Excessive PM5
ISO 14229 P-Code		P3007	P3008
J1939-73	SPN	3701	3701
	FMI	16	0
SPN Name SAE J1939 Table C1		Diesel Particulate Filter Status	Diesel Particulate Filter Status
DTC Name		Excessive PM4	Excessive PM5
Management Unit for Detected Part		DPFPMEX3	DPFPMEX4
Detection item		• PM accumulation level4	• PM accumulation level5
DTC Set Preconditions		• Battery voltage is normal	• Battery voltage is normal
DTC set parameter		• PM accumulation more than trigger level • Regeneration level = 4	• PM accumulation more than trigger level • Regeneration level = 5
Time to action or number of error detection		• Transient	• Transient
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 50 % of normal condition	• Output limitation: Approximately 50 % of normal condition
Behaviour During Malfunction		• Insufficient output	• Insufficient output
Engine Warning Light		• ON	• ON
Recovery from error		• Diagnostic counter = zero	• Key switch turn OFF
Delay time for recovery		• Immediately	—
Remark		• To minimize PM out put	• To minimize PM out put • Engine is not stopped forcibly by ECU However KUBOTA strongly recommends operator to stop engine as soon as possible.

9Y1200226CRS0787US0

Name		Boost pressure low
ISO 14229 P-Code		P3011
J1939-73	SPN	132
	FMI	15
SPN Name SAE J1939 Table C1		Engine Inlet Air Mass Flow Rate
DTC Name		Boost pressure low
Management Unit for Detected Part		GA2
Detection item		<ul style="list-style-type: none"> • Disconnect the hose between the turbo blower out and intake flange
DTC Set Preconditions		<ul style="list-style-type: none"> • Other than during regeneration mode • Engine speed is 1600 min⁻¹ (rpm) or more • Target intake air flow value is 950 mg/cyl or more • MAF sensor is normal • EGR valve is normal • Intake throttle valve is normal • Boost pressure sensor is normal • Barometric pressure sensor is normal • Coolant temperature sensor is normal
DTC set parameter		<ul style="list-style-type: none"> • Boost pressure sensor output is below target level in high air flow operating condition
Time to action or number of error detection		<ul style="list-style-type: none"> • 10 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 50 % of normal condition • Speed limitation (Accelerator limitation: 50 %) • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> • Engine power is restricted by boost pressure signal accordingly • To minimize PM emission to DPF

9Y1200226CRS0788US0

Name		Low coolant temperature in parked regeneration	Parked regeneration time out
ISO 14229 P-Code		P3012	P3013
J1939-73	SPN	523589	523590
	FMI	17	16
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		Low coolant temperature in parked regeneration	Parked regeneration time out
Management Unit for Detected Part		ST5TIMEUP	MNRGNTIMEUP
Detection item		<ul style="list-style-type: none"> During regeneration mode, engine warm-up condition is not satisfied (coolant temperature is low) 	<ul style="list-style-type: none"> Time out error: regeneration incomplete due to low temperature of DPF
DTC Set Preconditions		<ul style="list-style-type: none"> During parked active regeneration mode 	<ul style="list-style-type: none"> During parked active regeneration mode Coolant temperature is 65 °C (149 °F) or more
DTC set parameter		<ul style="list-style-type: none"> Engine coolant temperature stays below 65 °C (149 °F) for 1500 seconds or more under parked regeneration process. 	<ul style="list-style-type: none"> Regeneration process is not completed within 2700 sec
Time to action or number of error detection		<ul style="list-style-type: none"> Transient 	<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Behaviour During Malfunction		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero (Leaving from parked active regeneration status) 	<ul style="list-style-type: none"> Diagnostic counter = zero (Leaving from parked active regeneration status)
Delay time for recovery		<ul style="list-style-type: none"> Immediately 	<ul style="list-style-type: none"> Immediately
Remark			

9Y1200226CRS0789US0

Name		All exhaust gas temperature sensor failure	Initial pump-calibration incomplete
ISO 14229 P-Code		P3018	P3019
J1939-73	SPN	523599	523600
	FMI	0	0
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		All exhaust gas temperature sensor failure	Initial pump-calibration incomplete
Management Unit for Detected Part		THAEXALL	IPMPSTDYNOT
Detection item		<ul style="list-style-type: none"> All exhaust gas temperature sensor failure simultaneously 	<ul style="list-style-type: none"> Pump-calibration history
DTC Set Preconditions		<ul style="list-style-type: none"> Engine speed is 1400 min⁻¹ (rpm) or more Quantity of injection is 30 mm³/st or more Coolant temperature is 65 °C (149 °F) or more: continues longer than 300 sec. Intake air temperature is 0 °C (32 °F) or more Passed 100sec after cranking 	<ul style="list-style-type: none"> Battery voltage is normal
DTC set parameter		<ul style="list-style-type: none"> All exhaust gas temperature sensor failure (sensor low) simultaneously 	<ul style="list-style-type: none"> Initial pump calibration incomplete
Time to action or number of error detection		<ul style="list-style-type: none"> 100 sec. or more 	<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition 	<ul style="list-style-type: none"> None
Behaviour During Malfunction		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> Immediately 	<ul style="list-style-type: none"> Immediately
Remark			

9Y1200226CRS0790US0

Name		High exhaust gas temperature after emergency high temperature DTC	High frequency of regeneration
ISO 14229 P-Code		P3023	P3024
J1939-73	SPN	523601	523602
	FMI	0	0
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		High exhaust gas temperature after emergency high temperature DTC	High frequency of regeneration
Management Unit for Detected Part		STAINHIBIT	RGNINTWRN
Detection item		<ul style="list-style-type: none"> Exhaust gas temperature sensor 0, 1, 2 output 	<ul style="list-style-type: none"> Time interval from the end time to the start time of the regeneration
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal 	<ul style="list-style-type: none"> Battery voltage is normal Key switch is ON
DTC set parameter		<ul style="list-style-type: none"> All exhaust gas temperature (T0, T1 and T2) reduces down to 300 °C (572°F) 	<ul style="list-style-type: none"> Regeneration time interval within 30 min. occurs three times continuously
Time to action or number of error detection		<ul style="list-style-type: none"> Transient 	<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Engine stop Inhibit starter relay activation until all exhaust gas temperature (T0, T1 and T2) reduces down to 300 °C (572 °F) 	<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Worsening exhaust gas performance (NOx)
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		<ul style="list-style-type: none"> Immediately 	—
Remark			

9Y1200226CRS0791US0

Name		Over heat pre-caution	CAN2 Bus off
ISO 14229 P-Code		P3025	U0075
J1939-73	SPN	523603	523547
	FMI	15	2
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		Over heat pre-caution	CAN2 Bus off
Management Unit for Detected Part		THWOT2	CANB2
Detection item		<ul style="list-style-type: none"> Coolant temperature 	<ul style="list-style-type: none"> CAN2 +B / GND short circuit or high traffic error
DTC Set Preconditions		<ul style="list-style-type: none"> Coolant temperature sensor is normal 	<ul style="list-style-type: none"> Battery voltage is normal Key switch is ON
DTC set parameter		<ul style="list-style-type: none"> Engine coolant temperature $\geq 110\text{ }^{\circ}\text{C}$ (230 $^{\circ}\text{F}$) 	<ul style="list-style-type: none"> CAN2 Bus off
Time to action or number of error detection		<ul style="list-style-type: none"> Transient 	<ul style="list-style-type: none"> 2 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Forced Idle (Accelerator = 0 %)
Behaviour During Malfunction		<ul style="list-style-type: none"> Worsening exhaust gas performance (NOx) 	<ul style="list-style-type: none"> Insufficient output Transmitted data is invalid
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		<ul style="list-style-type: none"> Immediately 	—
Remark			

9Y1200226CRS0792US0

Name		No communication with EGR	CAN1 Bus off
ISO 14229 P-Code		U0076	U0077
J1939-73	SPN	523578	523604
	FMI	2	2
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		No communication with EGR	CAN1 Bus off
Management Unit for Detected Part		CANOPENEGR	CANB1
Detection item		<ul style="list-style-type: none"> No communication with EGR 	<ul style="list-style-type: none"> CAN1 +B / GND short circuit or high traffic error
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Starter Switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> Battery voltage is normal Key switch is ON
DTC set parameter		<ul style="list-style-type: none"> Interruption of CAN 	<ul style="list-style-type: none"> CAN1 Bus off
Time to action or number of error detection		<ul style="list-style-type: none"> 1.3 sec. or more 	<ul style="list-style-type: none"> 2 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas performance 	<ul style="list-style-type: none"> Insufficient output Transmitted data is invalid
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS0793US0

Name		CAN2 frame error		
ISO 14229 P-Code		U0081	U0082	U0083
J1939-73	SPN	523548	523591	523592
	FMI	2	2	2
SPN Name SAE J1939 Table C1		proprietary	proprietary	proprietary
DTC Name		CAN-KBT frame error	CAN CCVS (Parking SW and Vehicle Speed) frame error	CAN CM1 (Regen. SW) frame error
Management Unit for Detected Part		CANOPENGENU	CANOPENCCVS	CANOPENCM1
Detection item		• CAN-KBT original frame open circuit error	• CAN_CCVS communication stopping	• CAN_CM1 communication stopping
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Key switch turn OFF to ON Starter Switch signal (ECU: V12 terminal) is not activated No error of "CAN2 Bus off" 	<ul style="list-style-type: none"> Battery voltage is normal Starter Switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> Battery voltage is normal Starter Switch signal (ECU: V12 terminal) is not activated
DTC set parameter		• CAN2 KBT frame open circuit error	• CAN CCVS frame time out error	• CAN CM1 frame time out Error
Time to action or number of error detection		• Transient	• 0.5 sec. or more	• 2.0 sec. or more
Limp Home Action by engine ECU (system action)		• Forced Idle (Accelerator = 0 %)	• Parking SW = OFF, Vehicle speed = 0 [default value]	• Regeneration inhibit = ON, Parked regeneration SW = OFF [default value]
Behaviour During Malfunction		• Insufficient output	• None	• None
Engine Warning Light		• ON	• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		—	—	—
Remark				

9Y1200226CRS0794US0

Name		CAN2 frame error		
ISO 14229 P-Code		U0084	U0085	U0086
J1939-73	SPN	523593	523594	523595
	FMI	2	2	2
SPN Name SAE J1939 Table C1		proprietary	proprietary	proprietary
DTC Name		CAN DDC1 (Transmission) frame error	CAN ETC2 (Neutral SW) frame error	CAN ETC5 (Neutral SW) frame error
Management Unit for Detected Part		CANOPENDDC	CANOPENETC2	CANOPENETC5
Detection item		• CAN_DDC1 communication stopping	• CAN_ETC2 communication stopping	• CAN_ETC5 communication stopping
DTC Set Preconditions		• Battery voltage is normal • Starter Switch signal (ECU: V12 terminal) is not activated	• Battery voltage is normal • Starter Switch signal (ECU: V12 terminal) is not activated	• Battery voltage is normal • Starter Switch signal (ECU: V12 terminal) is not activated
DTC set parameter		• CAN DDC1 frame time out Error	• CAN ETC2 frame time out error	• CAN ETC5 frame time out error
Time to action or number of error detection		• 0.5 sec. or more	• 0.5 sec. or more	• 0.5 sec. or more
Limp Home Action by engine ECU (system action)		• Accelerator non-linear processing flag = 0 [default value] • Accelerator non-linear processing invalid	• Neutral SW = OFF [default value]	• Neutral SW = OFF [default value]
Behaviour During Malfunction		• None	• None	• None
Engine Warning Light		• ON	• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		—	—	—
Remark				

9Y1200226CRS0795US0

Name		CAN2 frame error	
ISO 14229 P-Code		U0087	U0089
J1939-73	SPN	523596	523598
	FMI	2	2
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		CAN TSC1 frame error	CAN EBC1 frame error
Management Unit for Detected Part		CANOPENTSC1TM	CANOPENABS
Detection item		• CAN_TSC1 communication stopping	• CAN_EBC1 communication stopping
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Starter Switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> Battery voltage is normal Starter Switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> No request to "TSC1 buffer" continues 3 times after over-ride control request (other than 0x00) 	<ul style="list-style-type: none"> CAN EBC1 frame time out error
Time to action or number of error detection		<ul style="list-style-type: none"> 60 msec. or more 	<ul style="list-style-type: none"> 0.5 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Override control mode = Normal mode [default value] 	<ul style="list-style-type: none"> Non shutdown [default value] Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> Immediately 	<ul style="list-style-type: none"> Immediately
Remark			

9Y1200226CRS0796US0

■ NOTE

- If any DTC occurred, automatic active regeneration is inhibited.
- In case, "Excessive PM3", "Excessive PM4" and "High frequency of regeneration", parked active regeneration function is allowed.

9Y1200226CRS0797US0

[2] DIAGNOSTIC PROCEDURE BY DTC (V3800-CR-TE4/-TIE4/-TE4C/-TIE4C)

If a DTC output indicates a malfunction, locate the malfunction by following the diagnostic procedure in the following pages.

Follow the instructions of the diagnostic procedure when required to refer to other items.

In this manual, the diagnostic procedures are listed according to the Diagnostic Trouble Code (DTC) numbers as shown. (In exceptional cases, some procedures are given in different positions.)

ISO 14229 P-Code	J1939-73		Name	Reference Page
	SPN	FMI		
P0016	636	7	NE-G phase shift	1-S127
P0072	171	4	Intake air temperature built-in MAF sensor abnormality	1-S128
P0073	171	3		
P0087	633	7	Pressure limiter emergency open	1-S131
P0088	157	0	High rail pressure	1-S136
P0089	1347	7	SCV stuck	1-S141
P0093	1239	1	Fuel leak (in high pressured fuel system)	1-S146
P0101	132	1	Intake air volume: Low	1-S151
P0102	132	4	MAF sensor abnormality	1-S152
P0103	132	3		
P0111	172	0	Intake air temperature: high (Inter cooler model only)	1-S154
P0112	172	4	Intake air temperature error	1-S155
P0113	172	3		
P0117	110	4	Coolant temperature sensor abnormality	1-S158
P0118	110	3		
P0181	174	0	Fuel high temperature	1-S161
P0182	174	4	Fuel temperature sensor abnormality	1-S162
P0183	174	3		
P0192	157	4	Rail pressure sensor abnormality	1-S165
P0193	157	3		
P0200	523535	0	Injector charge voltage: High	1-S169
P0201	651	3	Open circuit of harness/coil	1-S171
P0202	653	3		
P0203	654	3		
P0204	652	3		
P0217	110	0	Engine overheat	1-S174
P0219	190	0	Engine overrun	1-S176
P0237	102	4	Boost pressure sensor abnormality	1-S177
P0238	102	3		
P0335	636	8	Crankshaft position sensor (NE sensor) abnormality	1-S181
P0336	636	2		
P0340	723	8	Camshaft position sensor (G sensor) abnormality	1-S186
P0341	723	2		
P0380	523544	3	Air heater relay driving circuit abnormality	1-S190
P0380	523544	4		

ISO 14229 P-Code	J1939-73		Name	Reference Page
	SPN	FMI		
P0403	523574	3	EGR actuator abnormality	1-S193
P0404	523574	4		
P0409	523572	4		
P0524	100	1	Oil pressure error	1-S196
P0543	3242	4	Exhaust gas temperature sensor 1 (T1) abnormality	1-S198
P0544	3242	3		
P0546	4765	4	Exhaust gas temperature sensor 0 (T0) abnormality	1-S201
P0547	4765	3		
P0562	168	4	Battery voltage abnormality	1-S204
P0563	168	3		
P0602	523538	2	QR data abnormality	1-S207
P0602	523538	7		
P0605	628	2	ECU FLASH ROM and CPU abnormality	1-S208
P0606	1077	2		
P0606	523527	2		
P0611	523525	1	Injector charge voltage abnormality	1-S210
P0628	1347	4	SCV drive system abnormality	1-S212
P0629	1347	3		
P0642	3509	4	Sensor supply voltage 1 abnormality	1-S216
P0643	3509	3		
P0652	3510	4	Sensor supply voltage 2 abnormality	1-S218
P0653	3510	3		
P0687	1485	2	Main relay is locked in closed position	1-S220
P1274	523539	2	Pump seizing	1-S223
P1275	523540	2		
P1990	523700	13	EEPROM check sum error	1-S228
P2108	523580	2	Intake throttle feedback error	1-S229
P2122	91	4	Accelerator position sensor 1 abnormality	1-S231
P2123	91	3		
P2127	29	4	Accelerator position sensor 2 abnormality	1-S235
P2128	29	3		
P2131	523543	2	Accelerator position sensor error (CAN)	1-S239
P2135	91	2	Accelerator position sensor correlation error	1-S241
P2146	523523	2	Common 1 system injector drive circuit open	1-S242
P2147	523523	4	Common 1 TWV actuation system short	1-S245
P2148	523523	3		
P2149	523524	2	Common 2 system injector drive circuit open	1-S249
P2150	523524	4	Common 2 TWV actuation system short	1-S252
P2151	523524	3		
P2228	108	4	Barometric pressure sensor error	1-S256
P2229	108	3		

ISO 14229 P-Code	J1939-73		Name	Reference Page
	SPN	FMI		
P2413	523575	7	EGR (DC motor) abnormality	1-S258
P2414	523576	2		
P2415	523577	2		
P242C	3246	4	Exhaust gas temperature sensor 2 (T2) abnormality	1-S261
P242D	3246	3		
P2454	3251	4	Differential pressure sensor 1 abnormality	1-S264
P2455	3251	3		
P2621	523582	4	Intake throttle lift sensor abnormality	1-S268
P2622	523582	3		
P3001	3252	0	Emission deterioration	1-S270
P3002	4765	0	Exhaust gas temperature sensor 0: Emergency high	1-S272
P3003	3242	0	Exhaust gas temperature sensor 1: Emergency high	1-S274
P3004	3246	0	Exhaust gas temperature sensor 2: Emergency high	1-S276
P3006	3701	15	Excessive PM3	1-S278
P3007	3701	16	Excessive PM4	1-S279
P3008	3701	0	Excessive PM5	1-S280
P3011	132	15	Boost pressure low	1-S281
P3012	523589	17	Low coolant temperature in parked regeneration	1-S283
P3013	523590	16	Parked regeneration time out	1-S284
P3018	523599	0	All exhaust gas temperature sensor failure	1-S286
P3019	523600	0	Initial pump-calibration incomplete	1-S287
P3023	523601	0	High exhaust gas temperature after emergency high temperature DTC	1-S288
P3024	523602	0	High frequency of regeneration	1-S289
P3025	523603	15	Over heat pre-caution	1-S290
U0075	523547	2	CAN2 Bus off	1-S291
U0076	523578	2	No communication with EGR	1-S293
U0077	523604	2	CAN1 Bus off	1-S295
U0081	523548	2	CAN2 frame error	1-S296
U0082	523591	2		
U0083	523592	2		
U0084	523594	2		
U0085	523593	2		
U0086	523595	2		
U0087	523596	2		
U0089	523598	2		

9Y1200226CRS0798US0

(1) NE - G Phase Shift (DTC P0016 / 636-7)

Behaviour during malfunction: (Invalid G signal)

- Engine hesitates at start-up

Detection item:

- Large phase shift between NE (crankshaft position sensor) pulse and G (camshaft position sensor) pulse

DTC set preconditions:

- Engine is operating above low idle speed
- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- NE signal is normal
- G signal is normal
- Coolant temperature is 10 °C (50 °F) or higher

DTC set parameter: (Approximate)

- Phase difference between NE pulse and G pulse within ± 0.26 rad ($\pm 15^\circ$)

Engine warning light:

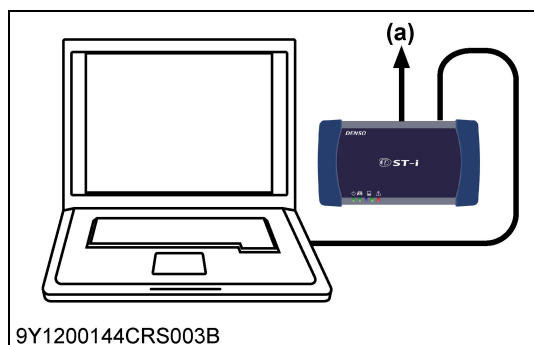
- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Diagnostic counter = zero



9Y1200226CRS0799US0

1. Check the Crankshaft Position Sensor and Camshaft Position Sensor Signals

1. Run the engine and check the values of the "Engine speed active flag" and "Cam speed active flag" with the data monitor function.

Factory specification	Constantly ON
OK	Check the DTC (speed signal phase shift) again.
	OK Normal.
	NG Check each pulsar for damage and deviation, and correct.
NG	Refer to "Crankshaft Position Sensor (NE sensor) Abnormality" (page 1-S181) and "Camshaft Position Sensor (G sensor) Abnormality" (page 1-S186).

■ NOTE

(Crankshaft position sensor side)

- The NE pulsar has deviated.
- A large magnetic substance has adhered to the pulsar, hardened and rotates together with it, or the teeth have been ground down.

(Camshaft position sensor side)

- The G pulsar plate is disconnected.
- The cam gear unit is disconnected, etc. (large side clearance).
- A large magnetic substance has adhered to the pulsar, hardened and rotates together with it, or the teeth have been ground down.

(a) CAN1 Connector

9Y1200226CRS0800US0

(2) Intake Air Temperature Built-in MAF Sensor: Abnormality (DTC P0072 / 171-4, DTC P0073 / 171-3)

P0072 / 171-4: Intake air temperature built-in MAF sensor abnormality (Low side)

Behaviour during malfunction:

- None

Detection item:

- Ground short circuit of sensor / harness

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Intake air temperature built-in MAF sensor voltage: 0.1 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- 25 °C (77 °F) [default value]

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS0801US0

P0073 / 171-3: Intake air temperature built-in MAF sensor abnormality (High side)

Behaviour during malfunction:

- None

Detection item:

- Sensor / Harness short to +B

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Intake air temperature built-in MAF sensor voltage: 4.9 V or more

Engine warning light:

- ON

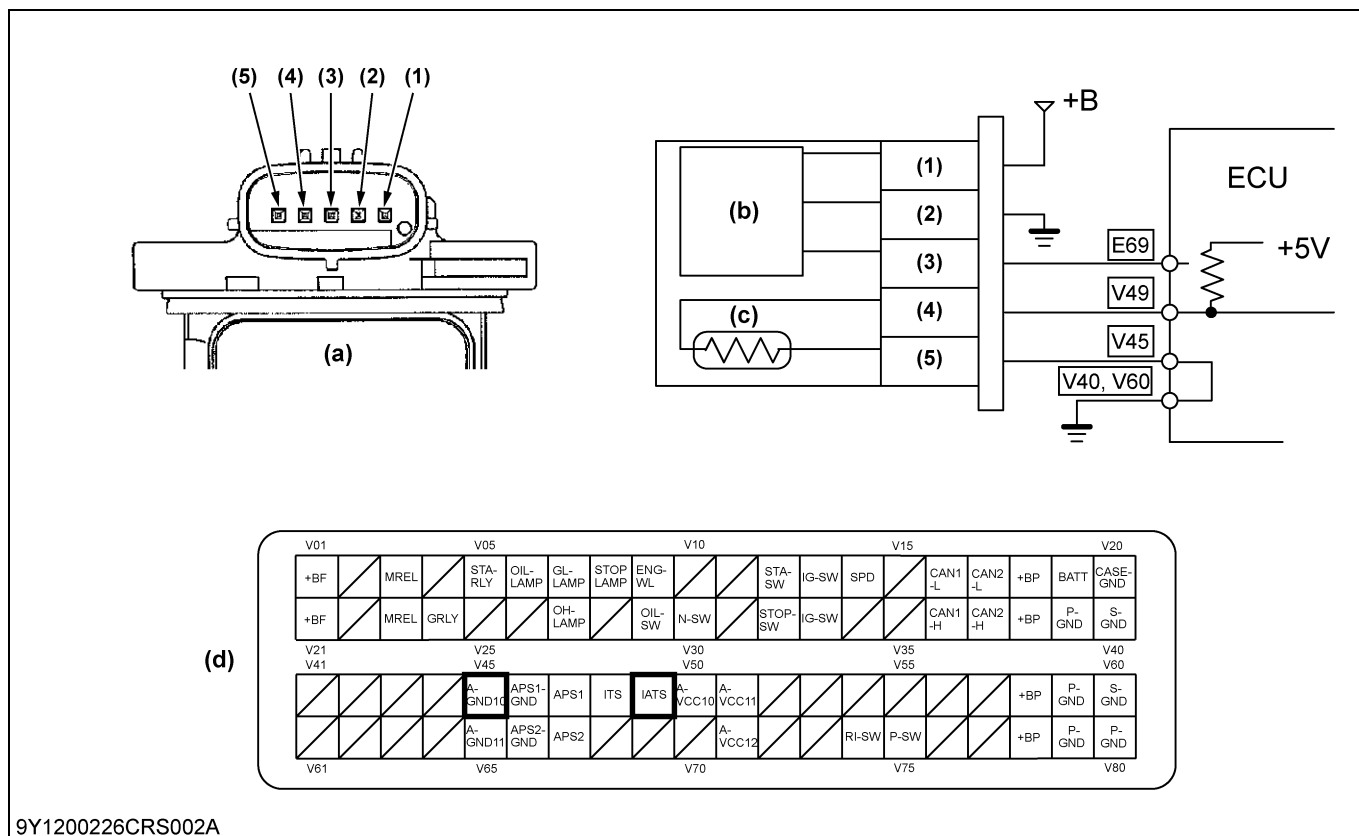
Limp home action by engine ECU (system action):

- 25 °C (77 °F) [default value]

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS0802US0



9Y1200226CRS002A

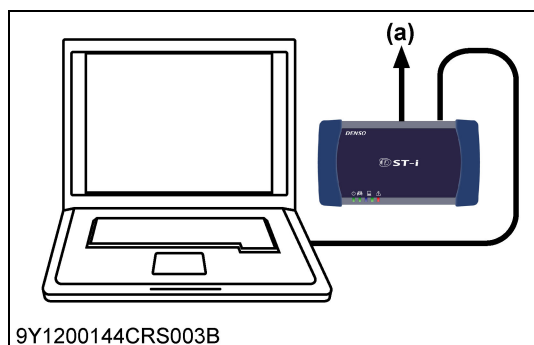
- (1) Terminal Power (+12 V)
 (2) Terminal Ground
 (3) Terminal AFS

- (4) Terminal IATS
 (5) Terminal A-GND 10

- (a) Terminal Layout
 (b) Mass Air Flow (MAF) Sensor

- (c) Intake Air Temperature (Built-in MAF)
 (d) ECU Connector 1 (Engine Side)

9Y1200226CRS0803US0



9Y1200144CRS003B

1. Check the Intake Air Temperature Sensor Signals

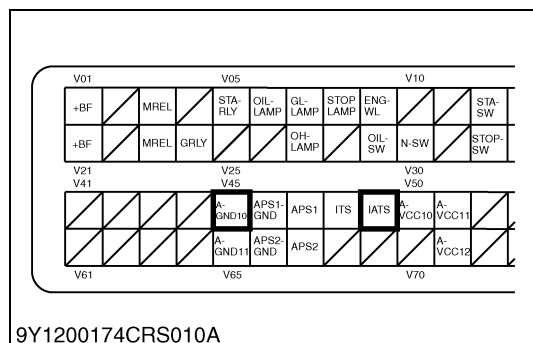
- Place the key switch in the ON position, and check the "Intake air temperature" and "Intake air temperature sensor output voltage" on the diagnosis tool data monitor.

Factory specification		
Actual intake air temperature	Intake air temperature	Output voltage
20 °C (68 °F)	20 °C (68 °F)	Approx. 3.1 V
40 °C (104 °F)	40 °C (104 °F)	Approx. 2.2 V
60 °C (140 °F)	60 °C (140 °F)	Approx. 1.4 V
80 °C (176 °F)	80 °C (176 °F)	Approx. 0.9 V

OK	Clear the DTC and check whether it is output again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Resistance Between Terminals".	

- (a) CAN1 Connector

9Y1200226CRS0804US0



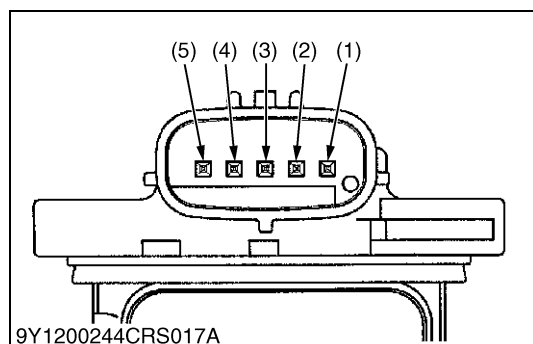
2. Measure the Resistance Between Terminals

- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals V45 and V49 of the connector.

Factory specification	
Temperature	Resistance
20 °C (68 °F)	Approx. 2.43 kΩ
40 °C (104 °F)	Approx. 1.15 kΩ
60 °C (140 °F)	Approx. 0.587 kΩ
80 °C (176 °F)	Approx. 0.321 kΩ

OK	Go to "4. Measure the ECU Terminal Voltage".
NG	Go to "3. Check the sensor".

9Y1200226CRS0805US0



3. Check the Sensor

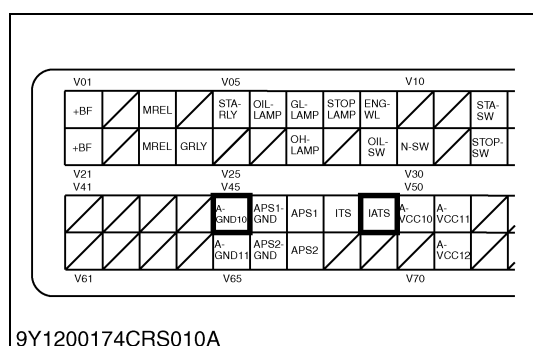
- Turn the key switch OFF, remove the connector from the sensor side and measure the resistance between the terminals on the sensor side.

Factory specification	
Temperature	Resistance
20 °C (68 °F)	Approx. 2.43 kΩ
40 °C (104 °F)	Approx. 1.15 kΩ
60 °C (140 °F)	Approx. 0.587 kΩ
80 °C (176 °F)	Approx. 0.321 kΩ

OK	Wiring harness open circuit or connector fault → Check and repair.
NG	Intake air temperature sensor fault → Replace the mass air flow sensor.

- (1) Terminal Power (+12 V)
- (2) Terminal Ground
- (3) Terminal AFS
- (4) Terminal IATS
- (5) Terminal A-GND 10

9Y1200226CRS0806US0



4. Measure the ECU Terminal Voltage

- Plug the ECU wiring harness connector into socket again, unplug the sensor connector, and measure the voltage between ECU terminals V45 and V49 at the ECU side.

Factory specification	Approx. 5 V
OK	The ECU connector is faulty or its wiring harness is shorted.
NG	Confirm by using other sensors that there is no ground short malfunction before replacing the ECU.

9Y1200226CRS0807US0

(3) Pressure Limiter Emergency Open (DTC P0087 / 633-7)

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas performance

Detection item:

- Open circuit or +B short circuit of sensor / harness.

DTC set preconditions:

- Rail pressure sensor is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Combination of below A and B
 - A: Fuel leak (P0093) is detected
 - B: Condition (1) or (2) is fulfilled;
 - (1) Rail pressure exceeds 191 MPa (1950 kgf/cm², 27700 psi)
 - (2) Within 1 sec, after the rail pressure goes below 191 MPa (1950 kgf/cm², 27700 psi)
- [Before the pressure decrease, the rail pressure is above 191 MPa (1950 kgf/cm², 27700 psi)]

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0808US0

Diagnostic Procedure for Pressure System DTCs

Checking of fault conditions and actions taken

If DTCs of non-pressure system are detected (*Refer to the pressure system DTCs given below.)

First locate the non-pressure system problem indicated by DTCs, and repair the affected parts. After the repair has been carried out, check for an output of pressure system DTCs. If so, begin the diagnosis of the affected pressure system.

If only pressure system DTCs are detected (*Refer to the pressure system DTCs given below.)

Diagnose the affected pressure system indicated by DTCs.

If a DTC currently exists

Begin diagnosis without returning the key switch to the OFF position. However, carefully make satisfactory / unsatisfactory judgments as the injection amount and rail pressure are limited by system actions.

If only a past DTC exists

Log the freeze-frame data, clear the DTCs, and stop the engine. Then, try to reproduce the problem using the freeze-frame data and the trouble check sheet.

Pressure system DTCs*[High pressure abnormality]**

1. P0088: High rail pressure

[Low pressure abnormality]

1. P0087: Pressure limiter emergency open
2. P0093: Fuel leak

[Abnormal pressure]

1. P0089: SCV stuck
2. P1274: Pump seizing 1
3. P1275: Pump seizing 2

■ IMPORTANT

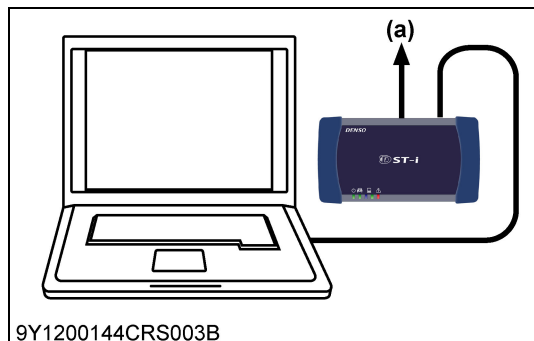
- Multiple pressure system DTCs may be output simultaneously. Also, both abnormal high pressure and abnormal low pressure may be reported simultaneously under certain malfunction conditions.

9Y1200226CRS0809US0

NOTE

- If the pressure limiter is opened, it will be kept open until the engine stops running. Therefore, the rail pressure is kept at 40 to 60 MPa (410 to 610 kgf/cm², 5800 to 8700 psi) regardless of its target rail pressure. This point must be considered when measuring the rail pressure. However, when the engine is stopped and the rail pressure reduces enough, the pressure limiter is closed and the rail pressure will start to increase again.
- Even when the problem indicated by this DTC cannot be reproduced, the high pressure will have occurred for certain reasons. Therefore, the cause of the high pressure must be identified.

9Y1200226CRS0810US0



1. Check the Data Related to the Rail Pressure

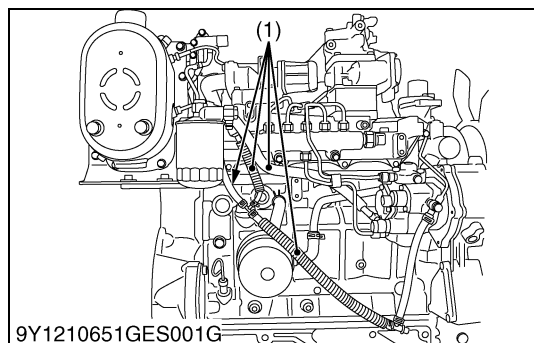
- Connect the diagnosis tool to the CAN1 connector, and select the "Actual rail pressure" and "Target rail pressure" on the data monitor.
- Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure"
	<ol style="list-style-type: none"> When idling: 40 to 50 MPa (410 to 500 kgf/cm², 5800 to 7200 psi) Accelerator opening 0 → 100 % (During acceleration): Maximum value 95.0 to 130 MPa (969 to 1320 kgf/cm², 13800 to 18800 psi) No-load maximum speed: 95.0 to 115 MPa (969 to 1170 kgf/cm², 13800 to 16600 psi) The numerical value is stable under normal operating and the target value corresponds with actual pressure value.

OK	Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.
NG	Go to "2. Check the Fuel System for the Existence of Air".

(a) CAN1 Connector

9Y1200226CRS0811US0



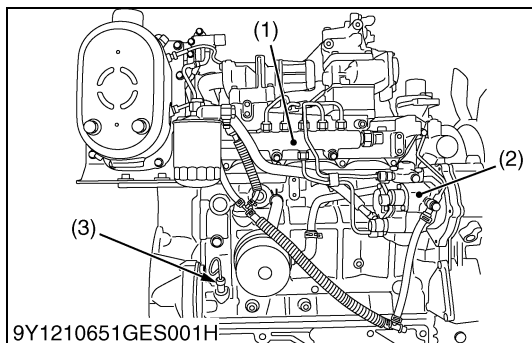
2. Check the Fuel System for the Existence of Air

- Check each joint of the fuel system for the existence of air. To detect the existence of air effectively, replace the fuel hose with a transparent one.

OK	Go to "3. Check the Fuel System".
NG	Locate the position of the fuel leakage in the piping and repair it.

(1) Fuel Hose

9Y1200226CRS0812US0



3. Check the Fuel System

⚠ CAUTION

- Visually check there is no leak in the high pressure fuel pipe system.
- A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.

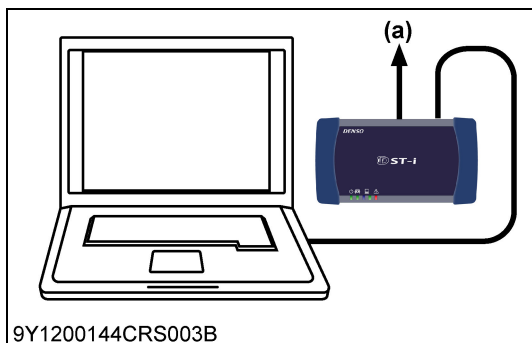
1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "4. Check the Rail Pressure Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

- (1) Rail
(2) Supply Pump

- (3) Dipstick

9Y1200226CRS0813US0



4. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)

1. Check the rail pressure sensor.

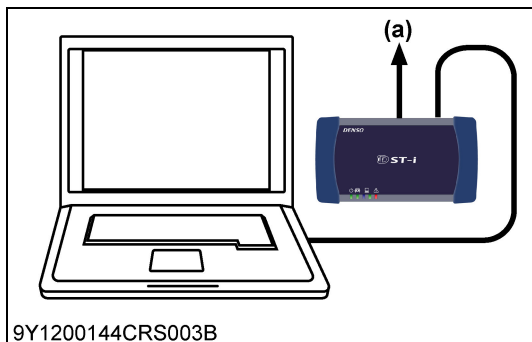
■ NOTE

- Closely check sensor signals for a noise component and an abnormality that exists for a short time.

OK	Go to "5. Check the DTC Again".
NG	Replace the rail assembly or its related parts. (Follow the diagnostic procedure of items P0192 and P0193.) (Refer to page 1-S165)

- (a) CAN1 Connector

9Y1200226CRS0814US0



5. Check the DTC Again

1. Clear the past malfunction data, and make sure that the same DTC is output again in the reproduction test.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

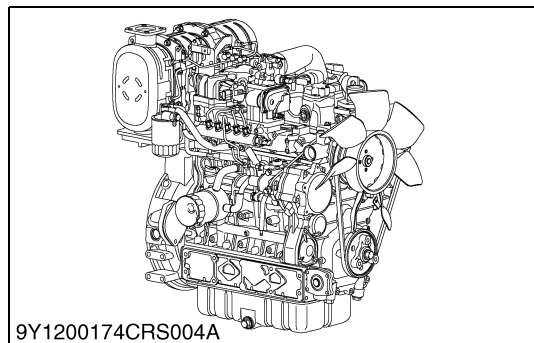
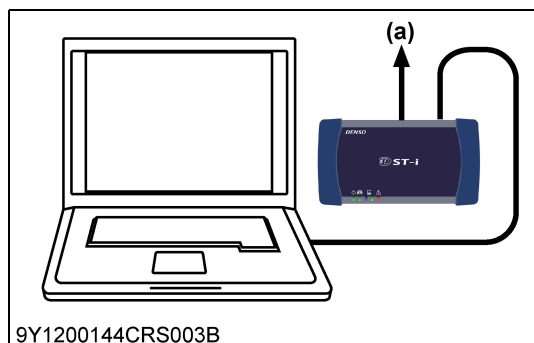
■ NOTE

- Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.

OK	Normal.
NG	Go to "6. Check the SCV-related Data".

- (a) CAN1 Connector

9Y1200226CRS0815US0



6. Check the SCV-related Data

1. Check the "Target rail pressure", "Actual rail pressure", "Target SCV current", "Actual SCV current", "Pump deviation learning status", "Pump deviation learning correction value" and "Pressure feedback integral guard execution flag" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	<ol style="list-style-type: none"> 1. The "Actual SCV current value" always follow to the "Target SCV current value". <ul style="list-style-type: none"> • When idling: Approx. 1800 mA • Accelerator opening: 0→100 % (During acceleration): Approx. 1400 mA minimum • During no-load maximum speed: Approx. 1600 mA • The numerical value is stable under normal operating and the target value corresponds with actual pressure value.
	<p>* The current shall be used as a reference only as this value varies depending on the pump used.</p> <ol style="list-style-type: none"> 2. The "Pressure feedback integral guard executing flag" must be OFF. 3. The "Pump deviation learning correction value" must be within ± 200 mA. <p>■ NOTE</p> <ul style="list-style-type: none"> • As the following value of A varies depending on pump, the table above is for guideline. If the value of A has a wider shift than the initial learning value, there may be out of the range of the above table. A net normal value is the value that provided by the forced-learning several times.: Compared with A 12 V spec.: $A-100 \leq \text{normal value} \leq A+50$ <p>Therefore, if the value is out of the range above, perform the forced-learning.</p>

■ NOTE

- "Pump difference learning status"

It must be "2" (Learning completed) or "3" (During relearning). If not, keep idling the engine after warming up and when the learning status becomes "2" or "3", make the judgment. Occasionally, it does not shift from 3 to 2. Perform pump difference learning to take into account the above status, then compare with the status before learning.

OK	After confirming that an intermittent malfunction (such as power supply system or noise generation) does not occur in relation to the ECU, replace the ECU.
NG	Replace the SCV or supply pump unit (under warranty).

(a) CAN1 Connector

9Y1200226CRS0816US0

(4) High Rail Pressure (DTC P0088 / 157-0)

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas performance

Detection item:

- Actual pressure exceeds the command pressure

DTC set preconditions:

- Rail pressure sensor is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Actual pressure ≥ 197 MPa (2010 kgf/cm², 28600 psi)

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS0817US0

Diagnostic Procedure for Pressure System DTCs

Checking of fault conditions and actions taken

If DTCs of non-pressure system are detected (*Refer to the pressure system DTCs given below.)

First locate the non-pressure system problem indicated by DTCs, and repair the affected parts. After the repair has been carried out, check for an output of pressure system DTCs. If so, begin the diagnosis of the affected pressure system.

If only pressure system DTCs are detected (*Refer to the pressure system DTCs given below.)

Diagnose the affected pressure system indicated by DTCs.

If a DTC currently exists

Begin diagnosis without returning the key switch to the OFF position. However, carefully make satisfactory / unsatisfactory judgments as the injection amount and rail pressure are limited by system actions.

If only a past DTC exists

Log the freeze-frame data, clear the DTCs, and stop the engine. Then, try to reproduce the problem using the freeze-frame data and the trouble check sheet.

Pressure system DTCs*[High pressure abnormality]**

1. P0088: High rail pressure

[Low pressure abnormality]

1. P0087: Pressure limiter emergency open
2. P0093: Fuel leak

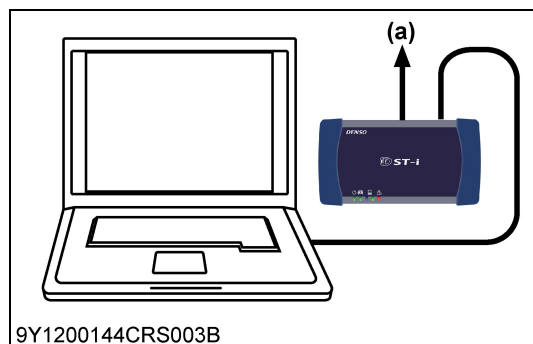
[Abnormal pressure]

1. P0089: SCV stuck
2. P1274: Pump seizing 1
3. P1275: Pump seizing 2

■ IMPORTANT

- Multiple pressure system DTCs may be output simultaneously. Also, both abnormal high pressure and abnormal low pressure may be reported simultaneously under certain malfunction conditions.

9Y1200226CRS0818US0



1. Check the Data Related to the Rail Pressure

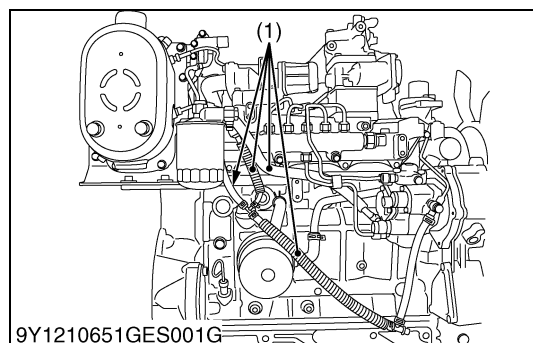
1. Connect the diagnosis tool to the CAN1 connector, and select the "Actual rail pressure" and "Target rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure"
	1. When idling: 40 to 50 MPa (410 to 500 kgf/cm ² , 5800 to 7200 psi)
	2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 95.0 to 130 MPa (969 to 1320 kgf/cm ² , 13800 to 18800 psi)
	3. No-load maximum speed: 95.0 to 115 MPa (969 to 1170 kgf/cm ² , 13800 to 16600 psi)
	4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.

OK	Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.
NG	Go to "2. Check the Fuel System for the Existence of Air".

(a) CAN1 Connector

9Y1200226CRS0819US0



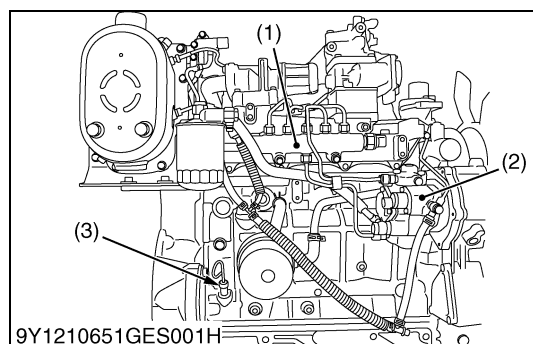
2. Check the Fuel System for the Existence of Air

1. Check each joint of the fuel system for the existence of air.
To detect the existence of air effectively, replace the fuel hose with a transparent one.

OK	Go to "3. Check the Fuel System".
NG	Locate the position of the fuel leakage in the piping and repair it.

(1) Fuel Hose

9Y1200226CRS0820US0



3. Check the Fuel System



CAUTION

- Visually check there is no leak in the high pressure fuel pipe system.
- A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.

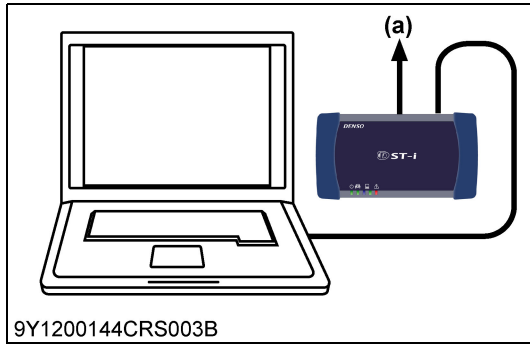
1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "4. Check the Rail Pressure Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

- (1) Rail
(2) Supply Pump

- (3) Dipstick

9Y1200226CRS0821US0



4. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)

1. Check the rail pressure sensor.

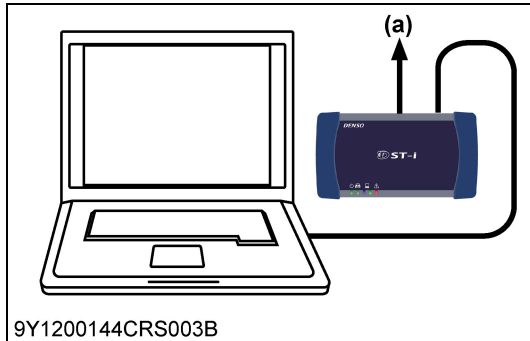
■ NOTE

- Closely check sensor signals for a noise component and an abnormality that exists for a short time.

OK	Go to "5. Check the DTC Again".
NG	Replace the rail assembly or its related parts. (Follow the diagnostic procedure of items P0192 and P0193.) (Refer to page 1-S165)

(a) CAN1 Connector

9Y1200226CRS0822US0



5. Check the DTC Again

1. Clear the past malfunction data, and make sure that the same DTC is output again in the reproduction test.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

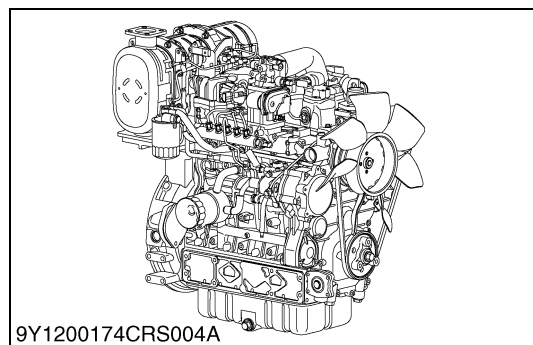
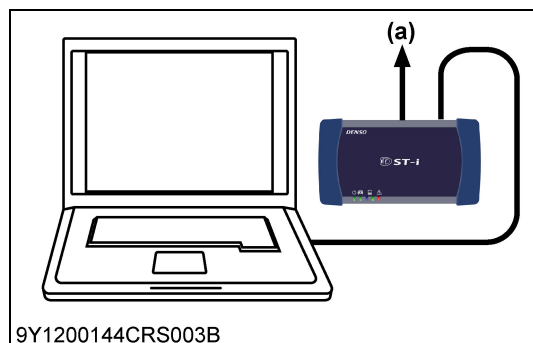
■ NOTE

- Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.

OK	Normal.
NG	Go to "6. Check the SCV-related Data".

(a) CAN1 Connector

9Y1200226CRS0823US0



6. Check the SCV-related Data

1. Check the "Target rail pressure", "Actual rail pressure", "Target SCV current", "Actual SCV current", "Pump deviation learning status", "Pump deviation learning correction value" and "Pressure feedback integral guard execution flag" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	<ol style="list-style-type: none"> 1. The "Actual SCV current value" always follow to the "Target SCV current value". <ul style="list-style-type: none"> • When idling: Approx. 1800 mA • Accelerator opening: 0→100 % (During acceleration): Approx. 1400 mA minimum • During no-load maximum speed: Approx. 1600 mA • The numerical value is stable under normal operating and the target value corresponds with actual pressure value. * The current shall be used as a reference only as this value varies depending on the pump used. 2. The "Pressure feedback integral guard executing flag" must be OFF. 3. The "Pump deviation learning correction value" must be within ± 200 mA. <p>■ NOTE</p> <ul style="list-style-type: none"> • As the following value of A varies depending on pump, the table above is for guideline. If the value of A has a wider shift than the initial learning value, there may be out of the range of the above table. A net normal value is the value that provided by the forced-learning several times.: Compared with A 12 V spec.: $A - 100 \leq \text{normal value} \leq A + 50$ <p>Therefore, if the value is out of the range above, perform the forced-learning.</p>
-----------------------	---

■ NOTE

- "Pump difference learning status"

It must be "2" (Learning completed) or "3" (During relearning). If not, keep idling the engine after warming up and when the learning status becomes "2" or "3", make the judgment. Occasionally, it does not shift from 3 to 2. Perform pump difference learning to take into account the above status, then compare with the status before learning.

OK	After confirming that an intermittent malfunction (such as power supply system or noise generation) does not occur in relation to the ECU, replace the ECU.
NG	Replace the SCV or supply pump unit (under warranty).

(a) CAN1 Connector

9Y1200226CRS0824US0

(5) SCV Stuck (DTC P0089 / 1347-7)

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas performance
- Engine stops in some case

Detection item:

- SCV stuck at open position (Actual rail pressure continuously exceeds the command rail pressure)

DTC set preconditions:

- Supply pump is normal and pump calibration has been executed
- Engine is operating (Q: 4 mm³/st or higher)
- Injector is normal
- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- Rail pressure sensor is normal

DTC set parameter:

- Discharge request of supply pump goes below 0 mm³/st and the actual rail pressure is 10 MPa (100 kgf/cm², 1400 psi) higher than command pressure
- Above state continues for 26 seconds or more

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0825US0

Diagnostic Procedure for Pressure System DTCs

Checking of fault conditions and actions taken

If DTCs of non-pressure system are detected (*Refer to the pressure system DTCs given below.)

First locate the non-pressure system problem indicated by DTCs, and repair the affected parts. After the repair has been carried out, check for an output of pressure system DTCs. If so, begin the diagnosis of the affected pressure system.

If only pressure system DTCs are detected (*Refer to the pressure system DTCs given below.)

Diagnose the affected pressure system indicated by DTCs.

If a DTC currently exists

Begin diagnosis without returning the key switch to the OFF position. However, carefully make satisfactory / unsatisfactory judgments as the injection amount and rail pressure are limited by system actions.

If only a past DTC exists

Log the freeze-frame data, clear the DTCs, and stop the engine. Then, try to reproduce the problem using the freeze-frame data and the trouble check sheet.

Pressure system DTCs*[High pressure abnormality]**

1. P0088: High rail pressure

[Low pressure abnormality]

1. P0087: Pressure limiter emergency open
2. P0093: Fuel leak

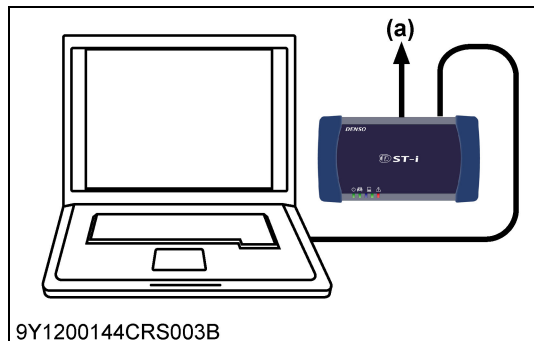
[Abnormal pressure]

1. P0089: SCV stuck
2. P1274: Pump seizing 1
3. P1275: Pump seizing 2

■ IMPORTANT

- Multiple pressure system DTCs may be output simultaneously. Also, both abnormal high pressure and abnormal low pressure may be reported simultaneously under certain malfunction conditions.

9Y1200226CRS0826US0



1. Check the Data Related to the Rail Pressure

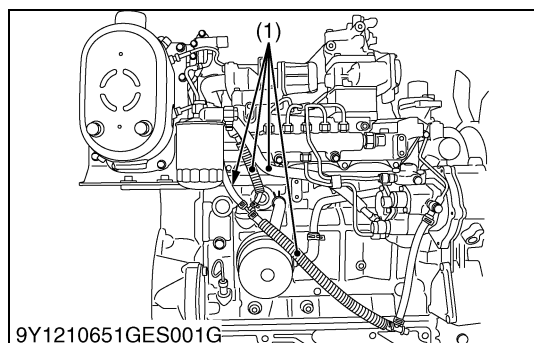
1. Connect the diagnosis tool to the CAN1 connector, and select the "Actual rail pressure" and "Target rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure"
	1. When idling: 40 to 50 MPa (410 to 500 kgf/cm ² , 5800 to 7200 psi)
	2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 95.0 to 130 MPa (969 to 1320 kgf/cm ² , 13800 to 18800 psi)
	3. No-load maximum speed: 95.0 to 115 MPa (969 to 1170 kgf/cm ² , 13800 to 16600 psi)
	4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.

OK	Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.
NG	Go to "2. Check the Fuel System for the Existence of Air".

(a) CAN1 Connector

9Y1200226CRS0827US0



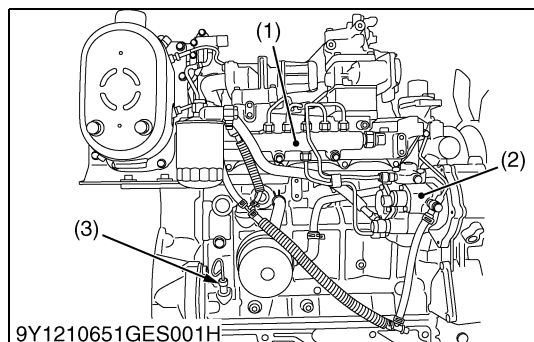
2. Check the Fuel System for the Existence of Air

1. Check each joint of the fuel system for the existence of air.
To detect the existence of air effectively, replace the fuel hose with a transparent one.

OK	Go to "3. Check the Fuel System".
NG	Rotate the fuel feed pump sufficiently and bleed the air. Locate the position of the fuel leakage in the piping and repair it.

(1) Fuel Hose

9Y1200226CRS0828US0



3. Check the Fuel System



CAUTION

- Visually check there is no leak in the high pressure fuel pipe system.
- A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.

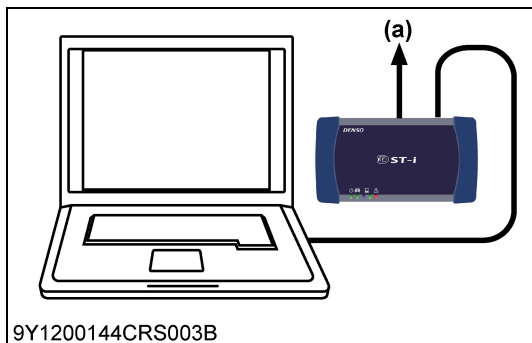
1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "4. Check the Rail Pressure Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

- (1) Rail
(2) Supply Pump

- (3) Dipstick

9Y1200226CRS0829US0



4. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)

1. Check the rail pressure sensor.

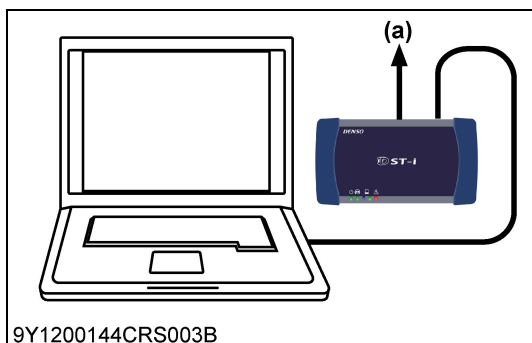
■ NOTE

- Closely check sensor signals for a noise component and an abnormality that exists for a short time.

OK	Go to "5. Check the DTC Again".
NG	Replace the rail assembly or its related parts. (Follow the diagnostic procedure of items P0192 and P0193.) (Refer to page 1-S165)

(a) CAN1 Connector

9Y1200226CRS0830US0



5. Check the DTC Again

1. Clear the past malfunction data, and make sure that the same DTC is output again in the reproduction test.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

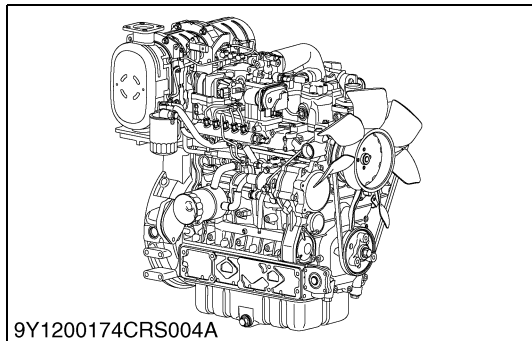
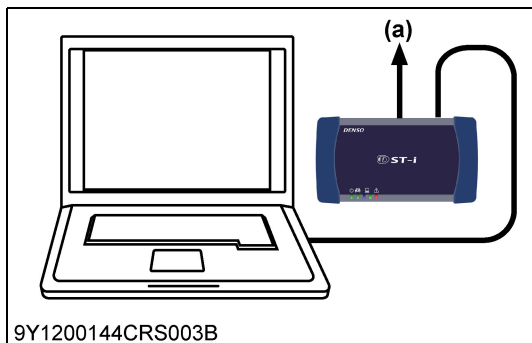
■ NOTE

- Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.

OK	Normal.
NG	Go to "6. Check the SCV-related Data".

(a) CAN1 Connector

9Y1200226CRS0831US0



6. Check the SCV-related Data

⚠ CAUTION

• "Pump difference learning status"

It must be "2" (Learning completed) or "3" (During relearning). For cases other than those above, perform pump difference learning and judge after status 2 or 3 is entered. Occasionally, it does not shift from 3 to 2. Perform pump difference learning to take into account the above status, then compare with the status before learning.

1. Check the "Target rail pressure", "Actual rail pressure", "Target SCV current", "Actual SCV current", "Pump deviation learning status", "Pump deviation learning correction value" and "Pressure feedback integral guard execution flag" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	<ol style="list-style-type: none"> 1. The "Actual SCV current value" always follow to the "Target SCV current value". <ul style="list-style-type: none"> • When idling: Approx. 1800 mA • Accelerator opening: 0→100 % (During acceleration): Approx. 1400 mA minimum • During no-load maximum speed: Approx. 1600 mA • The numerical value is stable under normal operating and the target value corresponds with actual pressure value. <p>* The current shall be used as a reference only as this value varies depending on the pump used.</p>
	<ol style="list-style-type: none"> 2. The "Pressure feedback integral guard executing flag" must be OFF. 3. The "Pump deviation learning correction value" must be within ± 200 mA. <p>■ NOTE</p> <ul style="list-style-type: none"> • As the following value of A varies depending on pump, the table above is for guideline. If the value of A has a wider shift than the initial learning value, there may be out of the range of the above table. A net normal value is the value that provided by the forced-learning several times.: Compared with A 12 V spec.: $A-100 \leq \text{normal value} \leq A+50$ <p>Therefore, if the value is out of the range above, perform the forced-learning.</p>

3. Perform repeated sudden accelerations and decelerations, and check that the target rail pressure and actual rail pressure converge to approximately the same value.

Factory specification	Converge to within 10 MPa (100 kgf/cm ² , 1400 psi) within 20 seconds or less.
-----------------------	---

4. In addition, suddenly release the accelerator while driving at maximum speed to test the temporary non-injection condition without applying the brake (engine brake only) and check that the target rail pressure and actual rail pressure converge to approximately the same value.

Factory specification	Converge to within 10 MPa (100 kgf/cm ² , 1400 psi) within 20 seconds or less.
-----------------------	---

OK	After confirming that an intermittent malfunction (such as power supply system or noise generation) does not occur in relation to the ECU, replace the ECU.
NG	Replace the SCV or supply pump unit (under warranty).

(a) CAN1 Connector

9Y1200226CRS0832US0

(6) Fuel Leak (in High Pressured Fuel System) (DTC P0093 / 1239-1)

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas performance
- Engine stops in some case

Detection item:

- Fuel leak from high pressured fuel system (Fuel consumption is calculated from the difference of fuel pressure of before and after the injection, and the error will be detected when excess fuel consumption is found)

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- Rail pressure sensor is normal
- Supply pump (SCV) is normal
- Injector and injector drive circuit are normal
- NE signal is active [Engine is operating (700 min^{-1} (rpm) or higher)]
- No DTC of P0087, P0088, P0089

DTC set parameter:

(a): the flow volume which is calculated from the difference of rail pressure (decrease)

(b): total volume of injection and leakage

Fuel leak is judged with following conditions:

- In case, engine speed is more than 1200 min^{-1} (rpm):
When the difference of (a) and (b) is $120 \text{ mm}^3/\text{st}$ or above, (a) is higher than (b), and fuel leak is not from opening pressure limiter
- In case, engine speed is 1200 min^{-1} (rpm) or less:
When the difference of (a) and (b) is $400 \text{ mm}^3/\text{st}$ or above, (a) is higher than (b), and fuel leak is not from opening pressure limiter

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0833US0

Diagnostic Procedure for Pressure System DTCs

Checking of fault conditions and actions taken

If DTCs of non-pressure system are detected (*Refer to the pressure system DTCs given below.)

First locate the non-pressure system problem indicated by DTCs, and repair the affected parts. After the repair has been carried out, check for an output of pressure system DTCs. If so, begin the diagnosis of the affected pressure system.

If only pressure system DTCs are detected (*Refer to the pressure system DTCs given below.)

Diagnose the affected pressure system indicated by DTCs.

If a DTC currently exists

Begin diagnosis without returning the key switch to the OFF position. However, carefully make satisfactory / unsatisfactory judgments as the injection amount and rail pressure are limited by system actions.

If only a past DTC exists

Log the freeze-frame data, clear the DTCs, and stop the engine. Then, try to reproduce the problem using the freeze-frame data and the trouble check sheet.

Pressure system DTCs*[High pressure abnormality]**

1. P0088: High rail pressure

[Low pressure abnormality]

1. P0087: Pressure limiter emergency open
2. P0093: Fuel leak

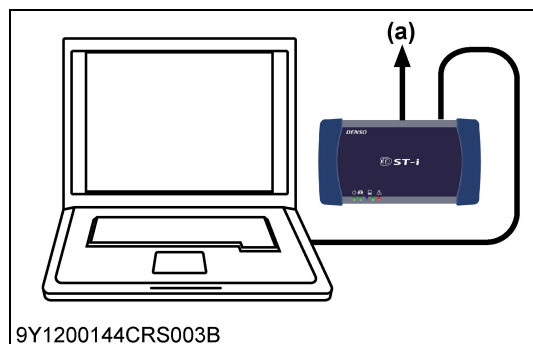
[Abnormal pressure]

1. P0089: SCV stuck
2. P1274: Pump seizing 1
3. P1275: Pump seizing 2

■ IMPORTANT

- Multiple pressure system DTCs may be output simultaneously. Also, both abnormal high pressure and abnormal low pressure may be reported simultaneously under certain malfunction conditions.

9Y1200226CRS0834US0



1. Check the Data Related to the Rail Pressure

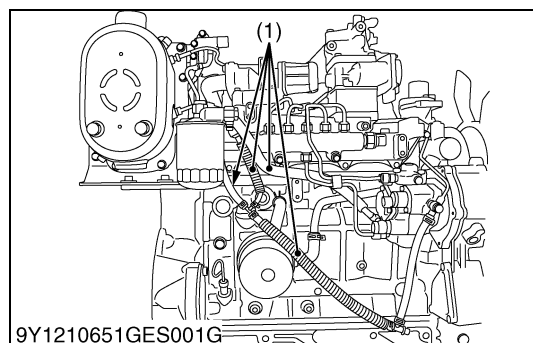
1. Connect the diagnosis tool to the CAN1 connector, and select the "Actual rail pressure" and "Target rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure"
	1. When idling: 40 to 50 MPa (410 to 500 kgf/cm ² , 5800 to 7200 psi)
	2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 95.0 to 130 MPa (969 to 1320 kgf/cm ² , 13800 to 18800 psi)
	3. No-load maximum speed: 95.0 to 115 MPa (969 to 1170 kgf/cm ² , 13800 to 16600 psi)
	4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.

OK	Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.
NG	Go to "2. Check the Fuel System for the Existence of Air".

(a) CAN1 Connector

9Y1200226CRS0835US0



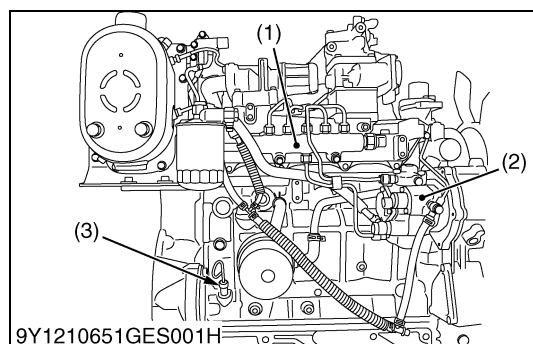
2. Check the Fuel System for the Existence of Air

1. Check each joint of the fuel system for the existence of air.
To detect the existence of air effectively, replace the fuel hose with a transparent one.

OK	Go to "3. Check the Fuel System".
NG	Rotate the fuel feed pump sufficiently and bleed the air. Locate the position of the fuel leakage in the piping and repair it.

(1) Fuel Hose

9Y1200226CRS0836US0



3. Check the Fuel System



CAUTION

- Visually check there is no leak in the high pressure fuel pipe system.
- A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.

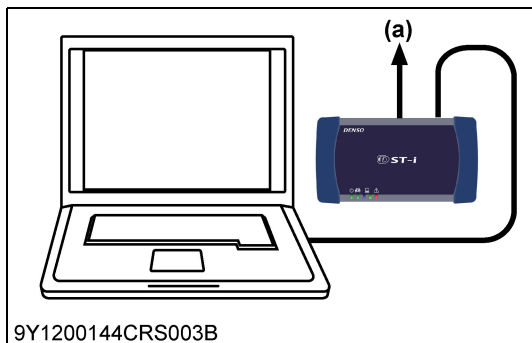
1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "4. Check the Rail Pressure Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

- (1) Rail
(2) Supply Pump

- (3) Dipstick

9Y1200226CRS0837US0



4. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)

1. Check the rail pressure sensor.

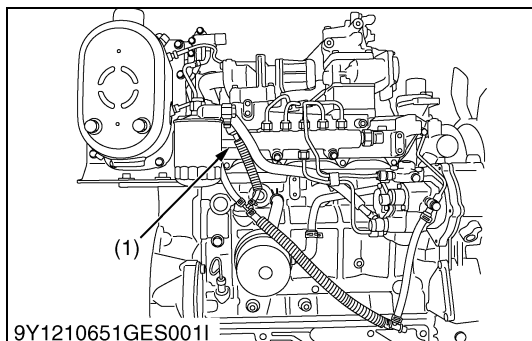
■ NOTE

- Closely check sensor signals for a noise component and an abnormality that exists for a short time.

OK	Go to "5. Check the Pressure Limiter for a Fuel Leakage".
NG	Replace the rail assembly or its related parts. (Follow the diagnostic procedure of items P0192 and P0193.) (Refer to page 1-S165)

(a) CAN1 Connector

9Y1200226CRS0838US0



5. Check the Pressure Limiter for a Fuel Leakage

1. Check the temperature of the pressure limiter return pipe by touching it.

Factory specification	Almost the same as the ambient temperature.
-----------------------	---

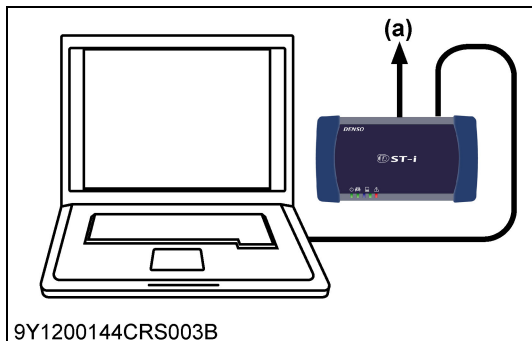
(Reference)

- If the fuel leaks from the pressure limiter, the high temperature and high pressure fuel flows through the return pipe and the pipe becomes very hot.

OK	Go to "6. Check for a Fuel Leakage".
NG	Replace the rail assembly.

(1) Pressure Limiter

9Y1200226CRS0839US0



6. Check for a Fuel Leakage

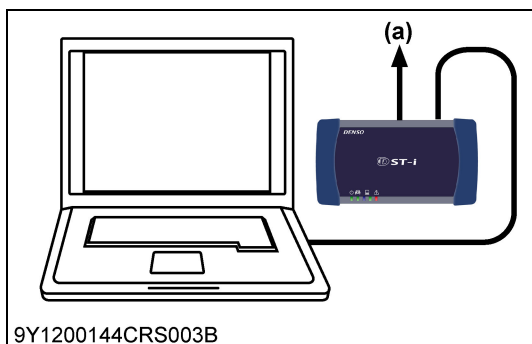
1. Increase the rail pressure by operating the accelerator pedal or accelerator lever, and check for a fuel leakage.

Factory specification	No fuel leaks.
-----------------------	----------------

OK	Go to "7. Check the DTC Again".
NG	Locate the leakage position and repair it.

(a) CAN1 Connector

9Y1200226CRS0840US0



7. Check the DTC Again

1. Clear the past malfunction data, and make sure that the same DTC is output again in the reproduction test.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

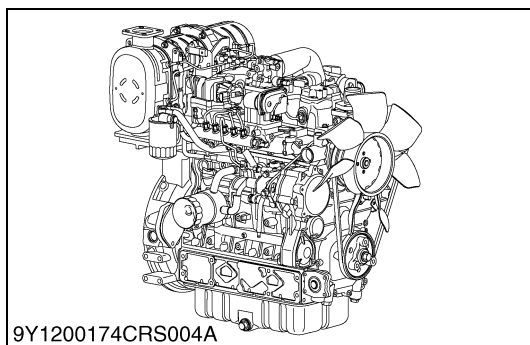
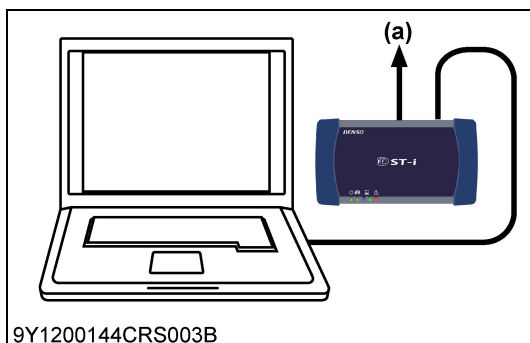
■ NOTE

- Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.

OK	Normal.
NG	Go to "8. Check the SCV-related Data".

(a) CAN1 Connector

9Y1200226CRS0841US0



8. Check the SCV-related Data

1. Check the "Target rail pressure", "Actual rail pressure", "Target SCV current", "Actual SCV current", "Pump deviation learning status", "Pump deviation learning correction value" and "Pressure feedback integral guard execution flag" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	<ol style="list-style-type: none"> 1. The "Actual SCV current value" always follow to the "Target SCV current value". <ul style="list-style-type: none"> • When idling: Approx. 1800 mA • Accelerator opening: 0→100 % (During acceleration): Approx. 1400 mA minimum • During no-load maximum speed: Approx. 1600 mA • The numerical value is stable under normal operating and the target value corresponds with actual pressure value. * The current shall be used as a reference only as this value varies depending on the pump used. 2. The "Pressure feedback integral guard executing flag" must be OFF. 3. The "Pump deviation learning correction value" must be within ± 200 mA. <p>■ NOTE</p> <ul style="list-style-type: none"> • As the following value of A varies depending on pump, the table above is for guideline. If the value of A has a wider shift than the initial learning value, there may be out of the range of the above table. A net normal value is the value that provided by the forced-learning several times.: Compared with A 12 V spec.: $A-100 \leq \text{normal value} \leq A+50$ <p>Therefore, if the value is out of the range above, perform the forced-learning.</p>
-----------------------	---

■ NOTE

- "Pump difference learning status"

It must be "2" (Learning completed) or "3" (During relearning). For cases other than those above, perform pump difference learning and judge after status 2 or 3 is entered. Occasionally, it does not shift from 3 to 2. Perform pump difference learning to take into account the above status, then compare with the status before learning.

OK	After confirming that an intermittent malfunction (such as power supply system or noise generation) does not occur in relation to the ECU, replace the ECU.
NG	Replace the SCV or supply pump unit (under warranty).

(a) CAN1 Connector

9Y1200226CRS0842US0

(7) Intake Air Volume: Low (DTC P0101 / 132-1)

Behaviour during malfunction:

- Insufficient output

Detection item:

- Engine inlet air mass flow rate lacking (Disconnect turbo blower intake hose)

DTC set preconditions:

- Engine is operating [1000 min^{-1} (rpm) or higher]
- Coolant temperature is 15°C (59°F) or higher (Coolant temperature sensor is normal)
- MAF sensor is normal
- EGR valve is normal
- Intake throttle valve is normal
- Battery voltage is normal

DTC set parameter:

- Engine Inlet Air Mass Flow Rate: less than half of target value

Engine warning light:

- ON

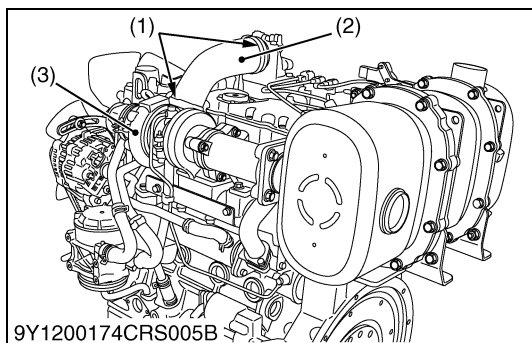
Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0843US0



1. Check the Air Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

■ NOTE

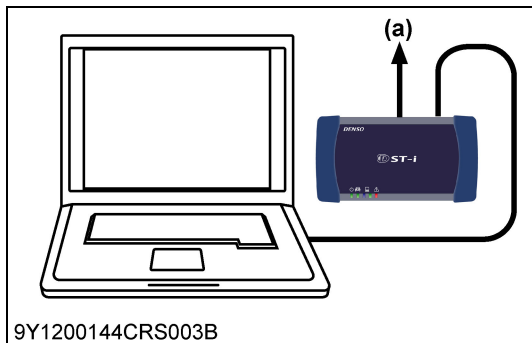
- Check if the suction hose of the turbo blower does not come off. If the hose comes off, install it.
- Check the clogging condition of the air cleaner. If it is very dirty, replace the new one.

OK	Go to "2. DTC Judgment".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

- (1) Hose Clamp
(2) Hose

- (3) Turbocharger

9Y1200226CRS0844US0



2. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Operate the engine for 2 to 3 minutes with the engine in the idle status.
3. Check whether the DTC is output or not.

Factory specification	Either DTC is output.
OK	Normal.
NG	Replace the MAF Sensor or replace the ECU.

- (a) CAN1 Connector

9Y1200226CRS0845US0

(8) MAF Sensor Abnormality (DTC P0102 / 132-4, P0103 / 132-3)

P0102 / 132-4: MAF sensor abnormality (Low side)

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas performance

Detection item:

- Open circuit or ground short circuit of sensor / harness.

DTC set preconditions:

- Battery voltage is normal
- Starter Switch signal (ECU: V12 terminal) is not activated
- Sensor supply voltage is normal

DTC set parameter:

- Mass air flow sensor voltage: 0.1 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Sensor output: 0.7 times of target value at normal condition [default value]
- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0846US0

P0103 / 132-3: MAF sensor abnormality (High side)

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas performance

Detection item:

- +B short circuit of sensor / harness

DTC set preconditions:

- Battery voltage is normal
- $700 \text{ min}^{-1} (\text{rpm}) \leq \text{engine speed} \leq 2800 \text{ min}^{-1} (\text{rpm})$
- Target intake mass air flow is 460 or less and it continues for 3 secs
- Sensor supply voltage is normal

DTC set parameter:

- Mass air flow sensor voltage: 4.9 V or more in certain operation condition

Engine warning light:

- ON

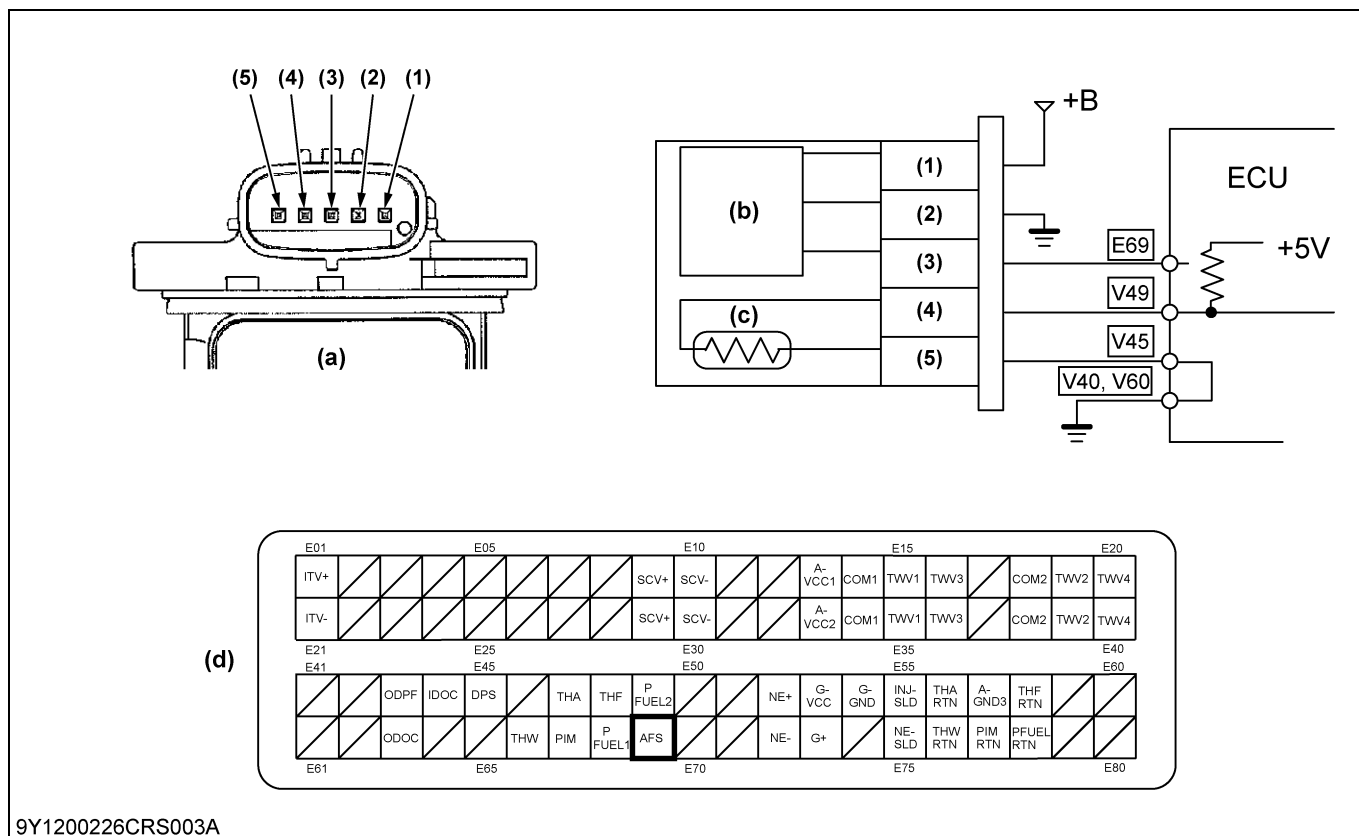
Limp home action by engine ECU (system action):

- Sensor output: 0.7 times of target value at normal condition [default value]
- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0847US0

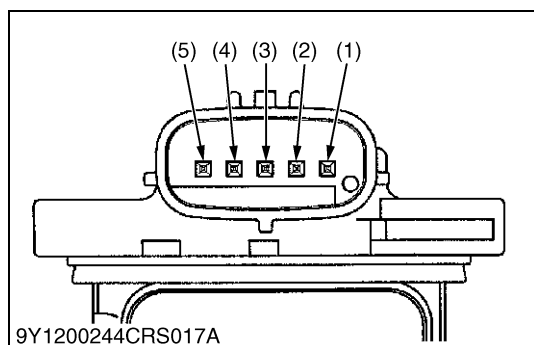


9Y1200226CRS003A

- (1) Terminal Power (+12 V)
 (2) Terminal Ground
 (3) Terminal AFS
 (4) Terminal IATS
 (5) Terminal A-GND10

- (a) Terminal Layout
 (b) Mass Air Flow (MAF) Sensor
 (c) Intake Air Temperature Sensor (Built-in MAF)
 (d) ECU Connector 1 (Engine Side)

9Y1200226CRS0848US0



9Y1200244CRS017A

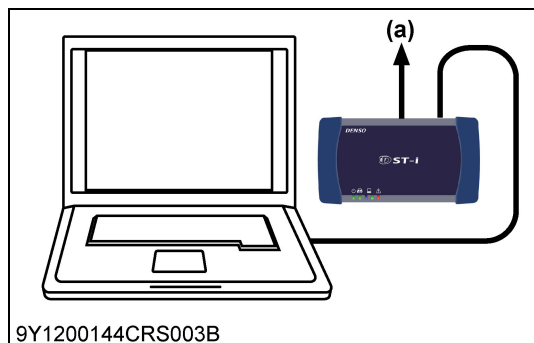
1. Measure the Sensor Terminal Voltage

- Move the key switch from the OFF to the ON position, and measure the voltage between sensor terminals 1 and 2.

Factory specification	Approx. 10 to 16 V
OK	Go to "2. DTC Judgment".
NG	Repair or replace the wiring harness, or replace the sensor

- (1) Terminal Power (+12 V)
 (2) Terminal Ground
 (3) Terminal AFS
 (4) Terminal IATS
 (5) Terminal A-GND10

9Y1200226CRS0849US0



9Y1200144CRS003B

2. DTC Judgment

- Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
- Operate the engine for 2 to 3 minutes with the engine in the idle status.
- Check whether the DTC is output or not.

Factory specification	Either DTC is output.
OK	Normal.
NG	Replace the MAF Sensor or replace the ECU.

- (a) CAN1 Connector

9Y1200226CRS0850US0

(9) Intake Air Temperature: High (Inter Cooler Model Only) (DTC P0111 / 172-0)

Behaviour during malfunction:

- None

Detection item:

- Intake air temperature too high

DTC set preconditions:

- Battery voltage is normal
- Key switch is ON

DTC set parameter:

- Intake air temperature higher than ambient temperature +60 °C (+140 °F)

Engine warning light:

- ON

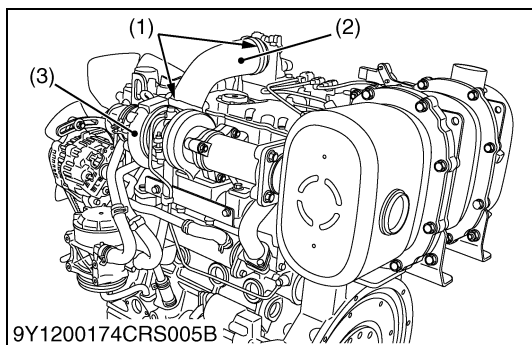
Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0851US0



9Y1200174CRS005B

1. Check the Air Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

■ NOTE

- Check the clogging condition of the inter cooler. (Check whether the inter cooler functions properly. If the inter cooler has an electric fan, check whether it operates properly.)
- Check whether the connection pipe of the inter cooler does not come off.

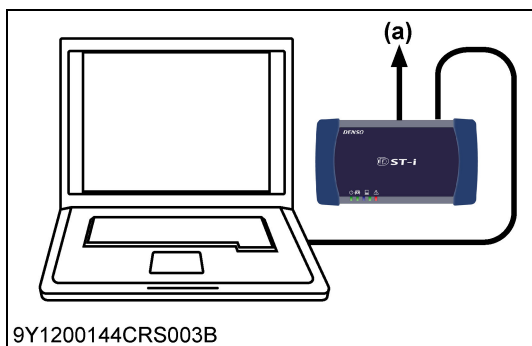
OK	Go to "2. Check the Intake Air Temperature (Refer to items P0072 and P0073)".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

(1) Hose Clamp

(3) Turbocharger

(2) Hose

9Y1200226CRS0852US0



9Y1200144CRS003B

2. Check the Intake Air Temperature Sensor (*Refer to Items P0072 and P0073)

1. Check the intake air temperature sensor. (Refer to page 1-S128)

OK	Normal.
NG	Replace the intake air temperature sensor or its related parts. (Follow the diagnostic procedure of items P0072 and P0073.) (Refer to page 1-S128)

(a) CAN1 Connector

9Y1200226CRS0853US0

(10) Intake Air Temperature Error (DTC P0112 / 172-4, P0113 / 172-3)

P0112 / 172-4: Intake air temperature error (Low side)

Behaviour during malfunction:

- Amount of white smoke increases at low temperatures

Detection item:

- Ground short circuit of sensor / harness

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Voltage of intake air temperature sensor is 0.05 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- During start-up = -20 °C (-4 °F) [default value]
- Under other conditions = 40 °C (104 °F) [default value]

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS0854US0

P0113 / 172-3: Intake air temperature error (High side)

Behaviour during malfunction:

- Amount of white smoke increases at low temperatures

Detection item:

- Open circuit or +B short circuit of sensor / harness

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Voltage of intake air temperature sensor is 4.9 V or above

Engine warning light:

- ON

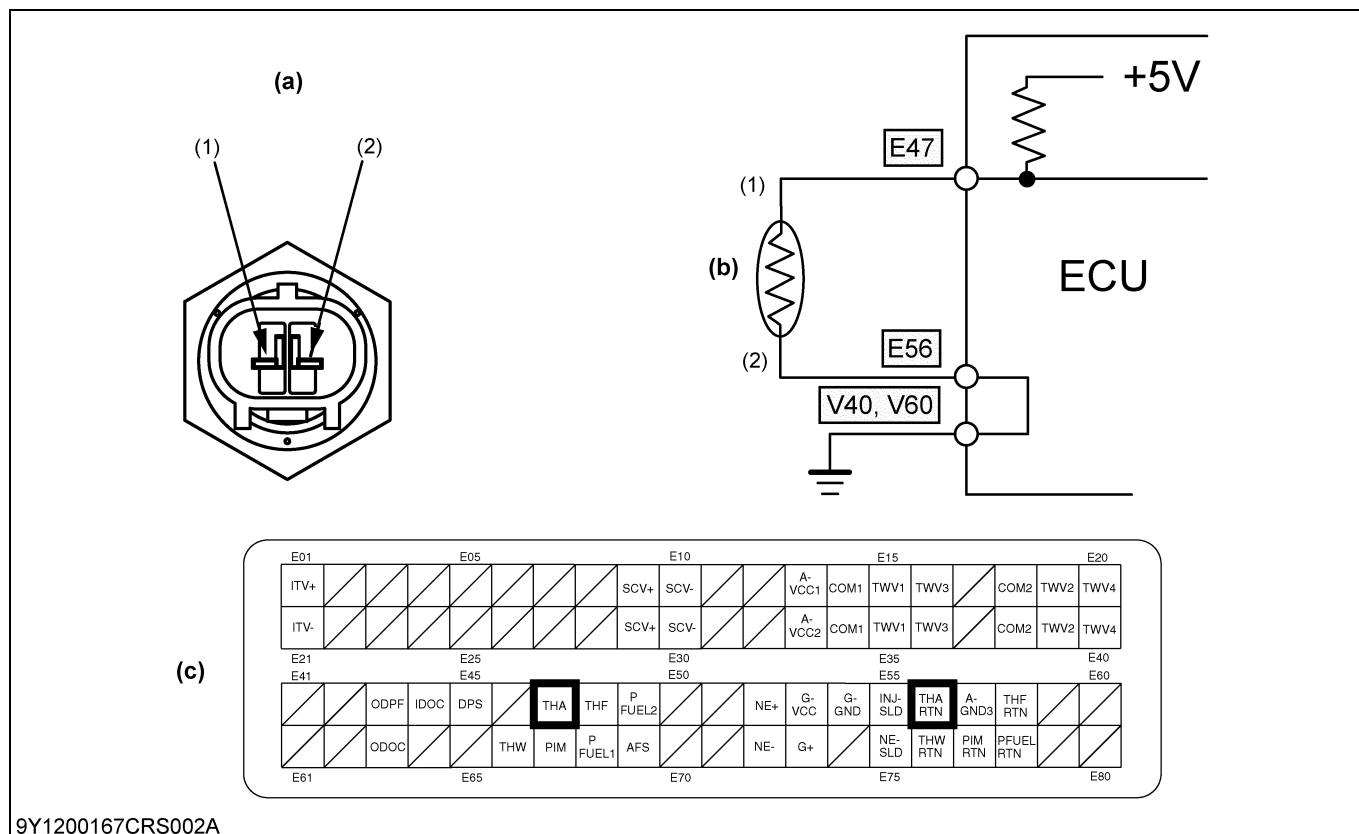
Limp home action by engine ECU (system action):

- During start-up = -20 °C (-4 °F) [default value]
- Under other conditions = 40 °C (104 °F) [default value]

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS0855US0



9Y1200167CRS002A

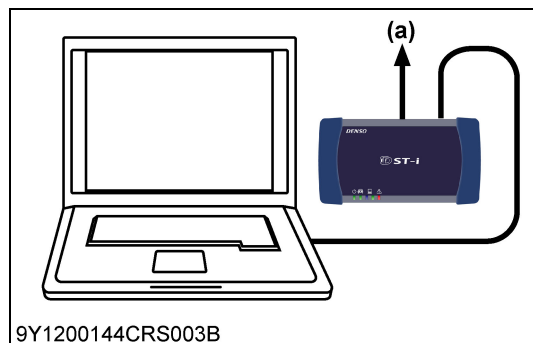
(1) Terminal THA

(2) Terminal THA RTN

(a) Terminal Layout
(b) Intake Air Temperature Sensor

(c) ECU Connector 1 (Engine Side)

9Y1200226CRS0856US0



9Y1200144CRS003B

1. Check the Intake Air Temperature Sensor Signals

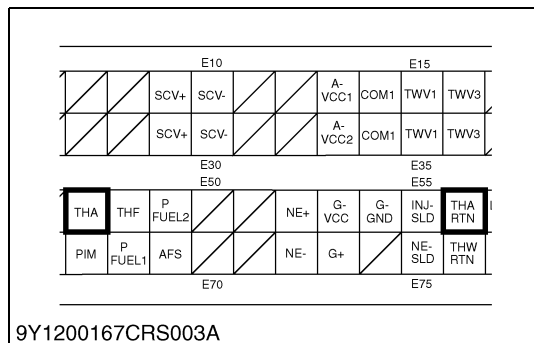
- Place the key switch in the ON position, and check the "Intake air temperature" and "Intake air temperature sensor output voltage" on the diagnosis tool data monitor.

Factory specification		
Actual intake air temperature	Intake air temperature	Output voltage
20 °C (68 °F)	20 °C (68 °F)	Approx. 2.4 V
40 °C (104 °F)	40 °C (104 °F)	Approx. 1.5 V
60 °C (140 °F)	60 °C (140 °F)	Approx. 0.9 V
80 °C (176 °F)	80 °C (176 °F)	Approx. 0.5 V

OK	Clear the DTC and check whether it is output again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Resistance Between Terminals".	

(a) CAN1 Connector

9Y1200226CRS0857US0



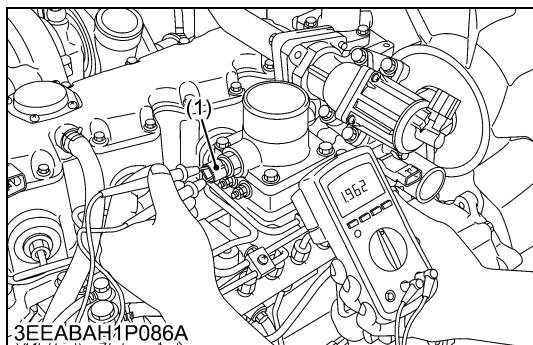
2. Measure the Resistance Between Terminals

- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals E47 and E56 of the connector.

Factory specification	
Temperature	Resistance
20 °C (68 °F)	Approx. 2.4 kΩ
60 °C (140 °F)	Approx. 0.58 kΩ
100 °C (212 °F)	Approx. 0.18 kΩ

OK	Go to "4. Measure the ECU Terminal Voltage".
NG	Go to "3. Check the Sensor".

9Y1200226CRS0858US0



3. Check the Sensor

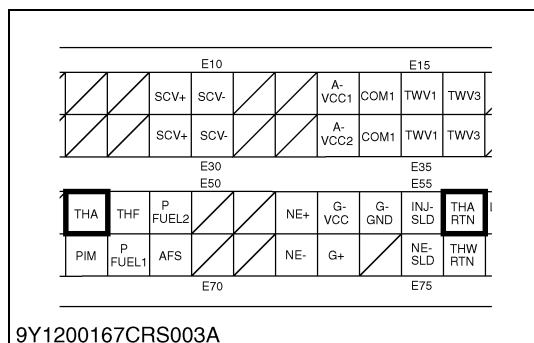
- Turn the key switch OFF, remove the connector from the sensor side and measure the resistance between the terminals on the sensor side.

Factory specification	
Temperature	Resistance
20 °C (68 °F)	Approx. 2.4 kΩ
60 °C (140 °F)	Approx. 0.58 kΩ
100 °C (212 °F)	Approx. 0.18 kΩ

OK	Wiring harness open circuit or connector fault → Check and repair.
NG	Intake air temperature sensor fault → Replace the intake air temperature sensor.

(1) Intake Air Temperature Sensor

9Y1200226CRS0859US0



4. Measure the ECU Terminal Voltage

- Plug the ECU wiring harness connector into socket again, unplug the sensor connector, and measure the voltage between ECU terminals E47 and E56 at the ECU side.

Factory specification	Approx. 5 V
OK	The ECU connector is faulty or its wiring harness is shorted.
NG	Confirm by using other sensors that there is no ground short malfunction before replacing the ECU.

9Y1200226CRS0860US0

(11) Coolant Temperature Sensor Abnormality (DTC P0117 / 110-4, P0118 / 110-3)

P0117 / 110-4: Coolant temperature sensor abnormality (Low side)

Behaviour during malfunction:

- Amount of white smoke increases at low temperatures
- Insufficient output
- Worsening exhaust gas performance

Detection item:

- Ground short circuit of sensor / harness

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Voltage of coolant temperature sensor is 0.1 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- During start-up = -25 °C (-13 °F) [default value]
- Under other conditions = 80 °C (176 °F) [default value]
- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0861US0

P0118 / 110-3: Coolant temperature sensor abnormality (High side)

Behaviour during malfunction:

- Amount of white smoke increases at low temperatures
- Insufficient output
- Worsening exhaust gas performance

Detection item:

- Open circuit or +B short circuit of sensor / harness

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Voltage of coolant temperature sensor is 4.9 V or above

Engine warning light:

- ON

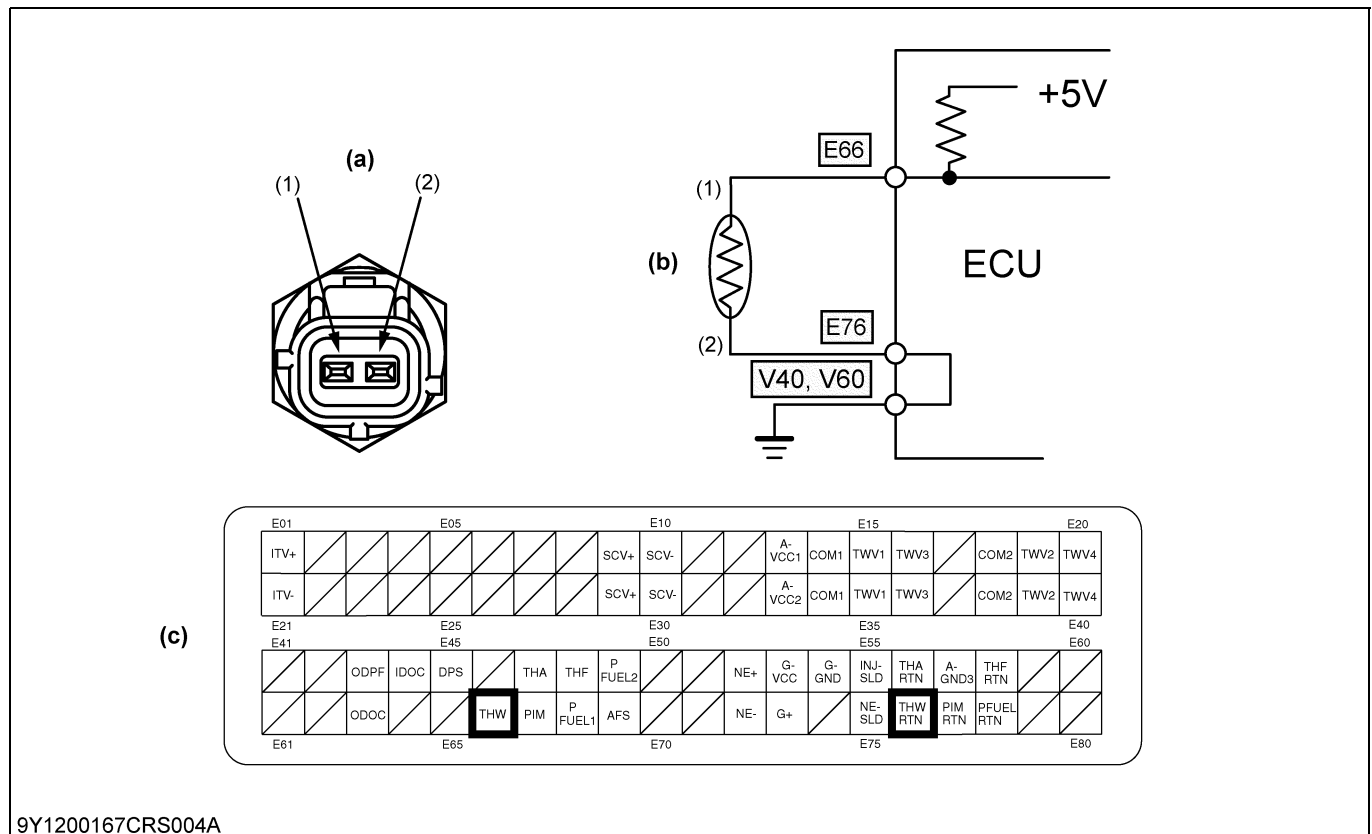
Limp home action by engine ECU (system action):

- During start-up = -25 °C (-13 °F) [default value]
- Under other conditions = 80 °C (176 °F) [default value]
- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0862US0



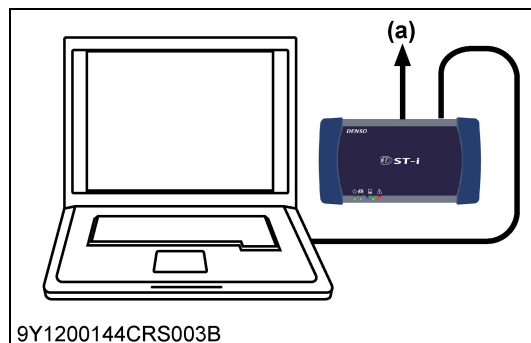
(1) Terminal THW

(2) Terminal THW RTN

(a) Terminal Layout
(b) Coolant Temperature Sensor

(c) **ECU Connector 1
(Engine Side)**


9Y1200226CRS0863US0



1. Check the Coolant Temperature Sensor Signals

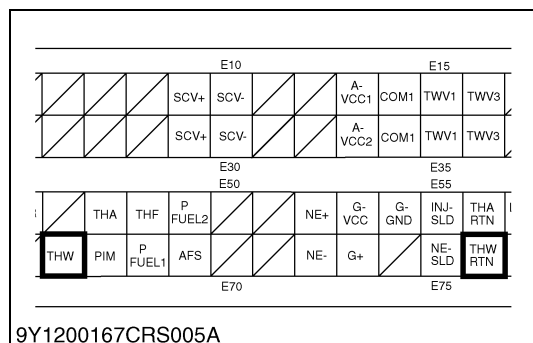
1. Place the key switch in the ON position, and check the "Coolant temperature" and "Coolant temperature sensor output voltage" on the diagnosis tool data monitor.

Factory specification		
Actual coolant temperature	Coolant temperature	Output voltage
20 °C (68 °F)	20 °C (68 °F)	Approx. 2.4 V
40 °C (104 °F)	40 °C (104 °F)	Approx. 1.5 V
60 °C (140 °F)	60 °C (140 °F)	Approx. 0.9 V
80 °C (176 °F)	80 °C (176 °F)	Approx. 0.5 V
100 °C (212 °F)	100 °C (212 °F)	Approx. 0.3 V

OK	Clear the DTC and check whether it is output again or not. 	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Resistance Between Terminals".	

(a) CAN1 Connector

9Y1200226CRS0864US0



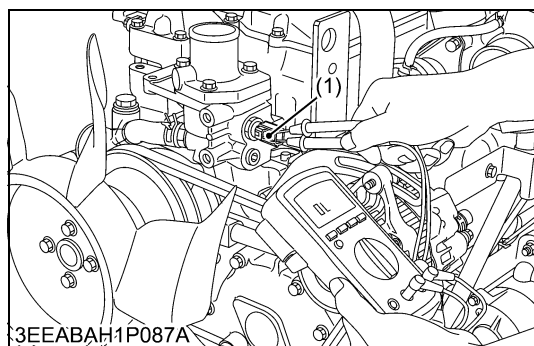
2. Measure the Resistance Between Terminals

- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals E66 and E76 of the connector.

Factory specification	
Temperature	Resistance
20 °C (68 °F)	Approx. 2.5 kΩ
40 °C (104 °F)	Approx. 1.2 kΩ
60 °C (140 °F)	Approx. 0.58 kΩ
80 °C (176 °F)	Approx. 0.32 kΩ
100 °C (212 °F)	Approx. 0.18 kΩ

OK	Go to "4. Measure the ECU Terminal Voltage".
NG	Go to "3. Check the sensor".

9Y1200226CRS0865US0



3. Check the Sensor

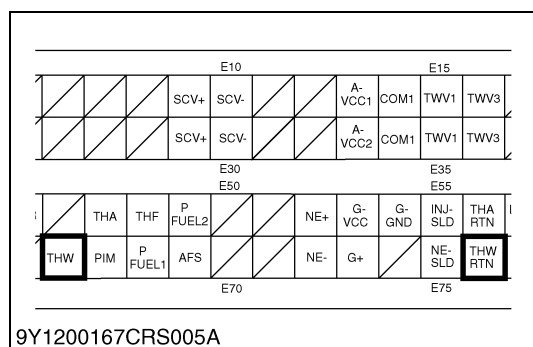
- Turn the key switch OFF, remove the connector from the sensor side and measure the resistance between the terminals on the sensor side.

Factory specification	
Temperature	Resistance
20 °C (68 °F)	Approx. 2.5 kΩ
40 °C (104 °F)	Approx. 1.2 kΩ
60 °C (140 °F)	Approx. 0.58 kΩ
80 °C (176 °F)	Approx. 0.32 kΩ
100 °C (212 °F)	Approx. 0.18 kΩ

OK	Wiring harness open circuit or connector fault → Check and repair.
NG	Coolant temperature sensor fault → Replace the coolant temperature sensor.

(1) Coolant Temperature Sensor

9Y1200226CRS0866US0



4. Measure the ECU Terminal Voltage

- Plug the ECU wiring harness connector into socket again, unplug the sensor connector, and measure the voltage between ECU terminals E66 and E76 at the ECU side.

Factory specification	Approx. 5 V
OK	The ECU connector is faulty or its wiring harness is shorted.
NG	Confirm by using other sensors that there is no ground short malfunction before replacing the ECU.

9Y1200226CRS0867US0

(12) Fuel High Temperature (DTC P0181 / 174-0)

Behaviour during malfunction:

- None

Detection item:

- Fuel temperature high

DTC set preconditions:

- Passed 300 sec after cranking
- Engine speed is 800 min⁻¹ (rpm) or more
- Fuel temperature sensor is normal

DTC set parameter:

- Fuel temperature higher than 90 °C (194 °F)

Engine warning light:

- ON

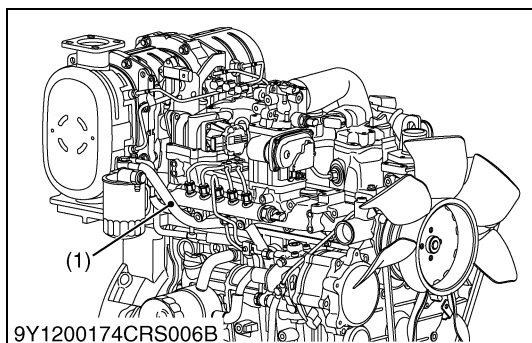
Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS0868US0



1. Check the Fuel System

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

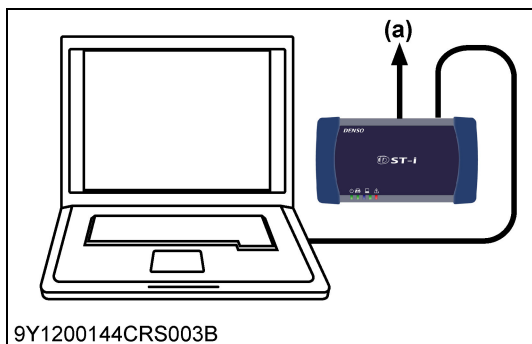
■ NOTE

- If the machine has a fuel cooler, check whether the fuel cooler is installed to the proper position.
- Check whether the cooling performance does not decrease due to dust.
- Check whether the fuel pipe is appropriate.
- Check the clogging condition of the fuel filter. If it is very dirty, replace the new one.

OK	Go to "2. Check the Fuel Temperature sensor (Refer to items P0182 and P0183)".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

(1) Fuel Hose

9Y1200226CRS0869US0



2. Check the Fuel Temperature Sensor (*Refer to Items P0182 and P0183)

1. Check the fuel temperature sensor. (Refer to page 1-S162)

OK	Normal.
NG	Replace the fuel temperature sensor or supply pump unit (under warranty). (Or its related parts. Follow the diagnostic procedure of items P0182 and P0183.) (Refer to page 1-S162)

(a) CAN1 Connector

9Y1200226CRS0870US0

(13) Fuel Temperature Sensor Abnormality (DTC P0182 / 174-4, P0183 / 174-3)

P0182 / 174-4: Fuel temperature sensor abnormality (Low side)

Behaviour during malfunction:

- None

Detection item:

- Ground short circuit of sensor / harness

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Voltage of temperature sensor in supply pump is 0.1 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- During start-up = -20 °C (-4 °F) [default value]
- Under other conditions = 45 °C (113 °F) [default value]
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS0871US0

P0183 / 174-3: Fuel temperature sensor abnormality (High side)

Behaviour during malfunction:

- None

Detection item:

- Open circuit or +B short circuit of sensor / harness

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Voltage of temperature sensor in supply pump is 4.9 V or above

Engine warning light:

- ON

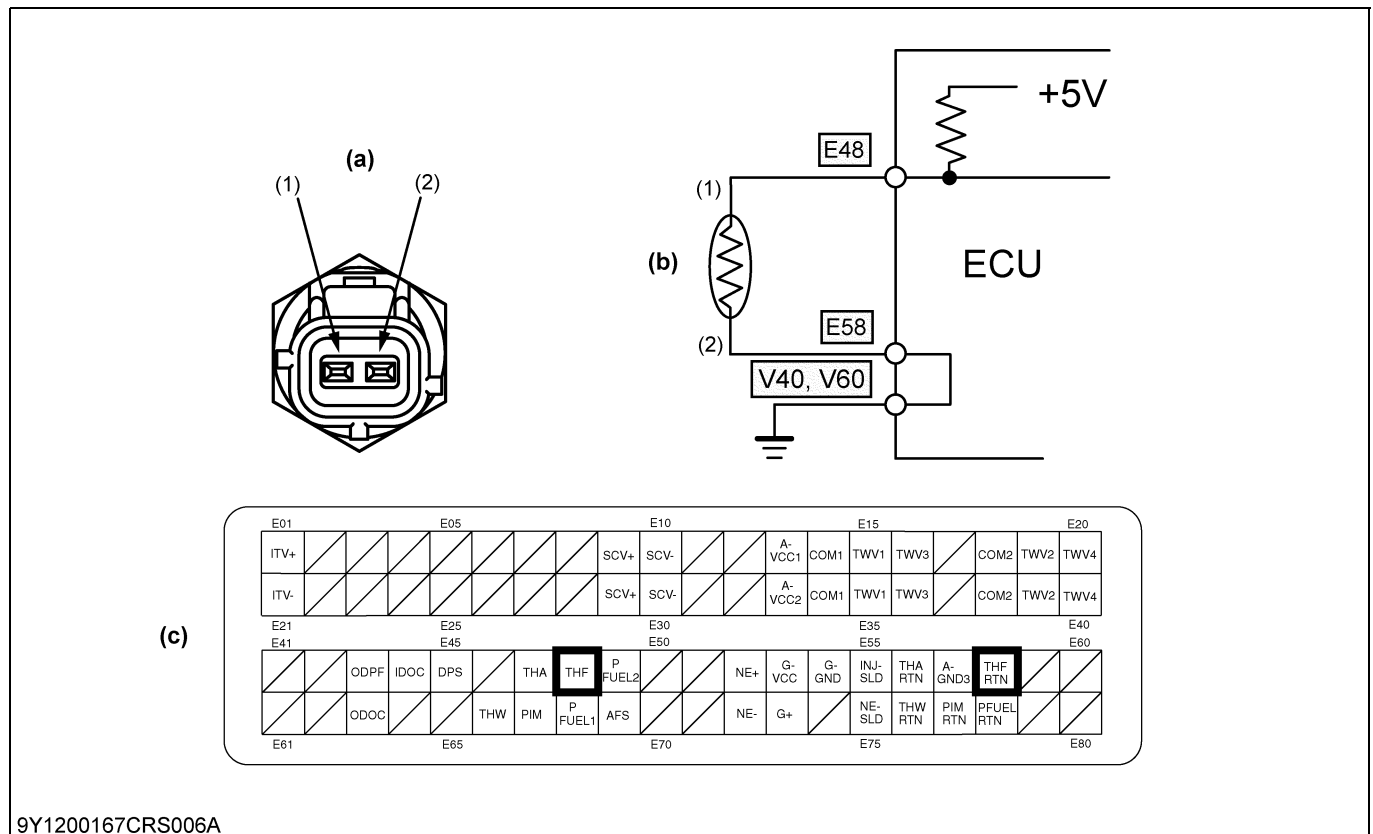
Limp home action by engine ECU (system action):

- During start-up = -20 °C (-4 °F) [default value]
- Under other conditions = 45 °C (113 °F) [default value]
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS0872US0



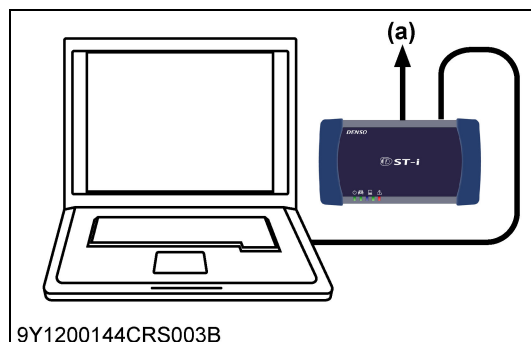
(1) Terminal THF

(2) Terminal THF RTN

(a) Terminal Layout
(b) Fuel Temperature Sensor

(c) **ECU Connector 1
(Engine Side)**

9Y1200226CRS0873US0




9Y1200144CRS003B

1. Check the Fuel Temperature Sensor Signals

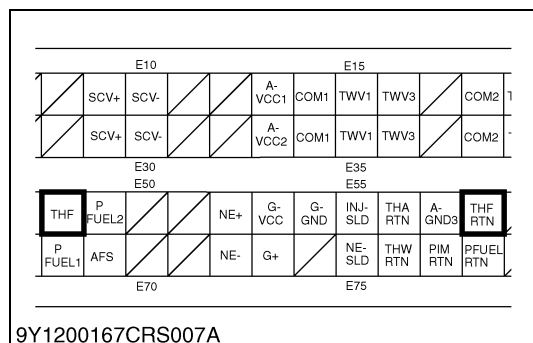
1. Place the key switch in the ON position, and check the "Fuel temperature" and "Fuel temperature sensor output voltage" on the diagnosis tool data monitor.

Factory specification		
Actual fuel temperature	Fuel temperature	Output voltage
20 °C (68 °F)	20 °C (68 °F)	Approx. 2.4 V
40 °C (104 °F)	40 °C (104 °F)	Approx. 1.5 V
60 °C (140 °F)	60 °C (140 °F)	Approx. 0.9 V
80 °C (176 °F)	80 °C (176 °F)	Approx. 0.5 V

OK	Clear the DTC and check whether it is output again or not. 	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Resistance Between Terminals".	

(a) CAN1 Connector

9Y1200226CRS0874US0



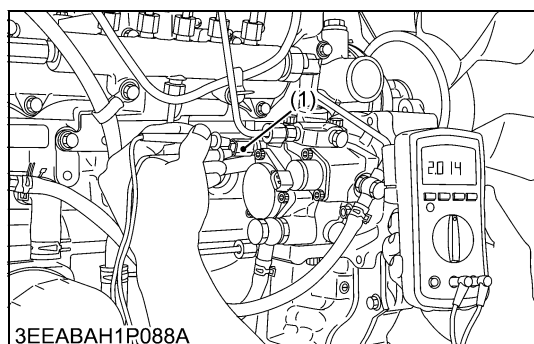
2. Measure the Resistance Between Terminals

- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals E48 and E58 of the connector.

Factory specification	
Temperature	Resistance
20 °C (68 °F)	Approx. 2.5 kΩ
40 °C (104 °F)	Approx. 1.2 kΩ
60 °C (140 °F)	Approx. 0.58 kΩ
80 °C (176 °F)	Approx. 0.32 kΩ

OK	Go to "4. Measure the ECU Terminal Voltage".
NG	Go to "3. Check the Sensor".

9Y1200226CRS0875US0



3. Check the Sensor

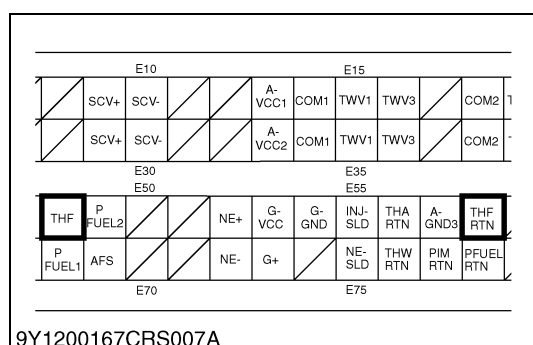
- Turn the key switch OFF, remove the connector from the sensor side and measure the resistance between the terminals on the sensor side.

Factory specification	
Temperature	Resistance
20 °C (68 °F)	Approx. 2.5 kΩ
40 °C (104 °F)	Approx. 1.2 kΩ
60 °C (140 °F)	Approx. 0.58 kΩ
80 °C (176 °F)	Approx. 0.32 kΩ

OK	Wiring harness open circuit or connector fault → Check and repair.
NG	Fuel temperature sensor fault → Replace the fuel temperature sensor or supply pump unit.

(1) Fuel Temperature Sensor

9Y1200226CRS0876US0



4. Measure the ECU Terminal Voltage

- Plug the ECU wiring harness connector into socket again, unplug the sensor connector, and measure the voltage between ECU terminals E48 and E58 at the ECU side.

Factory specification	Approx. 5 V
OK	The ECU connector is faulty or its wiring harness is shorted.
NG	Confirm by using other sensors that there is no ground short malfunction before replacing the ECU.

9Y1200226CRS0877US0

(14) Rail Pressure Sensor Abnormality (DTC P0192 / 157-4, P0193 / 157-3)**P0192 / 157-4: Rail pressure sensor abnormality (Low side)****Behaviour during malfunction:**

- Insufficient output
- Worsening exhaust gas performance
- Worsening running noise
- Increase in white smoke
- Engine stops

Detection item:

- Ground short circuit of sensor / harness
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Voltage of rail pressure sensor is 0.7 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Intake throttle 100 % open
- Engine forcibly stopped 60 sec. later

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0878US0

P0193 / 157-3: Rail pressure sensor abnormality (High side)**Behaviour during malfunction:**

- Insufficient output
- Worsening exhaust gas performance
- Worsening running noise
- Increase in white smoke
- Engine stops

Detection item:

- Open circuit or +B short circuit of sensor / harness.
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Voltage of rail pressure sensor is 4.9 V or above

Engine warning light:

- ON

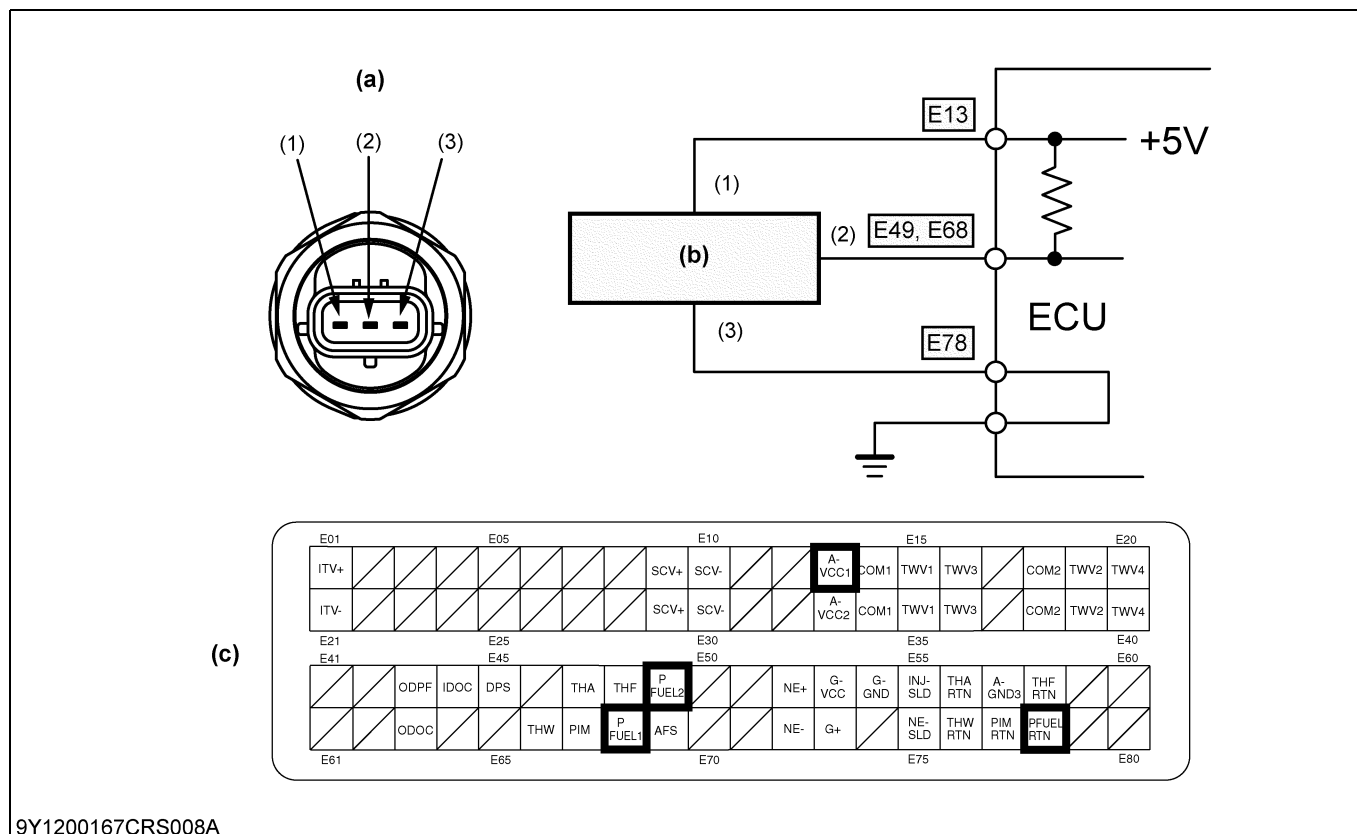
Limp home action by engine ECU (system action):

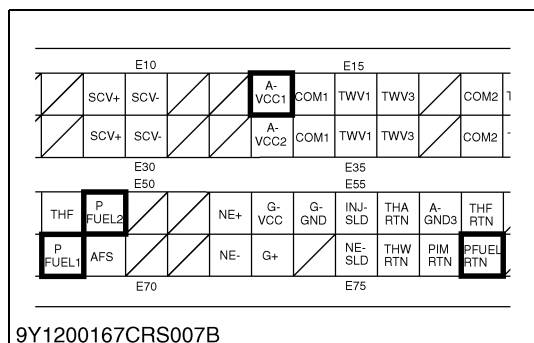
- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Intake throttle 100 % open
- Engine forcibly stopped 60 sec. later

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0879US0





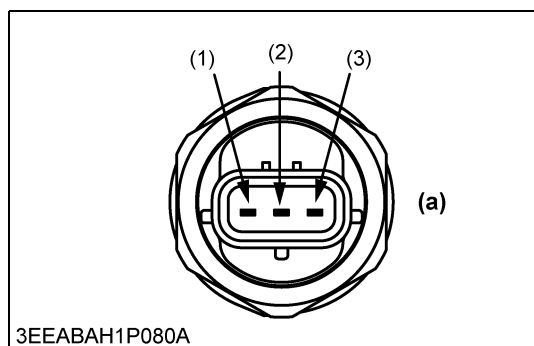
2. Measure the ECU Terminal Voltage

1. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals E68 and E78 and between terminals E49 and E78.
2. Next, start the engine, change the depressed amount of the accelerator pedal, and check the same items again.

Factory specification	Depends on the rotation speed, load (After warm-up) <ol style="list-style-type: none"> 1. When stopped: Approx. 1.0 V 2. When idling: 1.65 to 1.80 V 3. During no-load maximum speed: 2.50 to 2.85 V 4. During acceleration: 2.5 to 3.3 V
-----------------------	---

OK	Check the harness connectors and ECU pins.	
	OK	Faulty ECU → Replace.
	NG	Repair or replace the wiring harness, or replace the ECU.
NG	Go to "3. Measure the voltage between rail pressure sensor terminals - 1".	

9Y1200226CRS0882US0



3. Measure the Voltage Between Rail Pressure Sensor Terminals - 1

1. Place the key switch in the ON position, and measure the voltage between terminals (2) and (3) of the rail pressure sensor at the wiring harness side.
2. Next, start the engine, change the depressed amount of the accelerator pedal, and check the same items again.

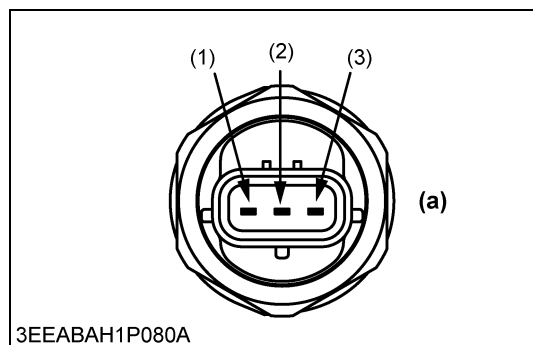
Factory specification	Depends on the rotation speed, load (After warm-up) <ol style="list-style-type: none"> 1. When stopped: Approx. 1.0 V 2. When idling: 1.65 to 1.80 V 3. During no-load maximum speed: 2.50 to 2.85 V 4. During acceleration: 2.5 to 3.3 V
-----------------------	---

OK	Check the wiring harness (between ECU terminals E49 / E68 and sensor terminal (2)). → Repair the faulty area.
NG	Go to "4. Measure the voltage between rail pressure sensor terminals - 2".

- (1) Terminal A-VCC1
- (2) Terminal PFUEL
- (3) Terminal PFUEL RTN

(a) Terminal Layout

9Y1200226CRS0883US0



4. Measure the Voltage Between Rail Pressure Sensor Terminals - 2

1. Set the key switch to the OFF position, and unplug the rail pressure sensor connector from the socket.
2. Place the key switch in the ON position, and measure the voltage between terminals (1) and (3) of the rail pressure sensor connector (at the wiring harness side).

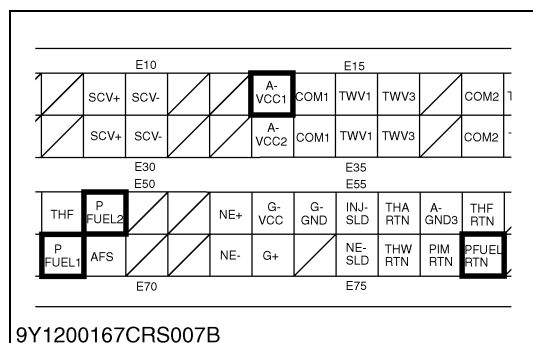
Factory specification	Approx. 5 V
-----------------------	-------------

OK	Check the wiring harness connector and sensor pins.	
	OK	Faulty rail pressure sensor → Replace.
	NG	1. Repair or replace the wiring harness. 2. Replace the rail assembly.
NG	Go to "5. Measure the ECU Terminal Voltage".	

- (1) Terminal A-VCC1
(2) Terminal PFUEL
(3) Terminal PFUEL RTN

(a) Terminal Layout

9Y1200226CRS0884US0



5. Measure the ECU Terminal Voltage

1. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals E13 and E78.

Factory specification	Approx. 5 V
-----------------------	-------------

OK	Check the harness connectors and ECU pins.	
	OK	Faulty ECU → Replace.
	NG	Repair or replace the wiring harness, or replace the ECU.
NG	Check the wiring harness (between ECU terminal E13 and sensor terminal (1) and between ECU terminal E78 and sensor terminal (3)). → Repair the faulty area.	

9Y1200226CRS0885US0

(15) Injector Charge Voltage: High (DTC P0200 / 523535-0)

■ NOTE

- This DTC is detected when the charge voltage in the injector actuation circuit is too high.

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas performance
- Engine stops

Detection item:

- Injector charge voltage: High

DTC set preconditions:

- Battery voltage is normal
- CPU is normal

DTC set parameter:

- Injector charge voltage: High

Engine warning light:

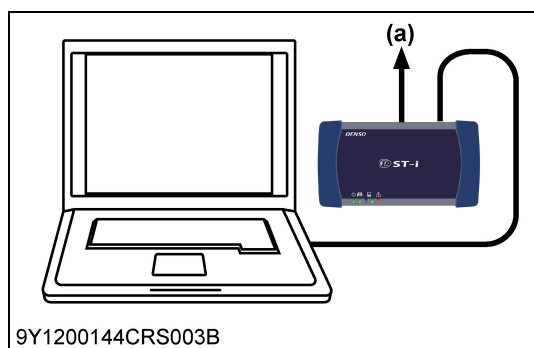
- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open
- Engine forcibly stopped 60 sec. later

Recovery from error:

- Key switch turn OFF

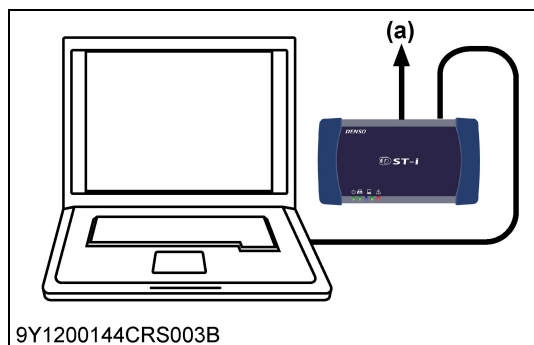


1. Checking Whether the DTC is Detected Again

1. Turn the key switch OFF and then ON again.
2. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
3. Check whether or not the same DTC (P0200) is detected.

Factory specification	DTC is not detected.
OK	It could be a temporary malfunction caused by obstructions to the radio waves, so as long as it recovers to normal operation there is no problem.
NG	Go to "2. Replacing the Injector and Checking Whether the DTC Is Detected Again".

(a) CAN1 Connector



2. Replacing the Injector and Checking Whether the DTC Is Detected Again

1. Replace the injector.
2. Turn the key switch OFF and then ON again.
3. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
4. Check whether or not the same DTC (P0200) is detected.

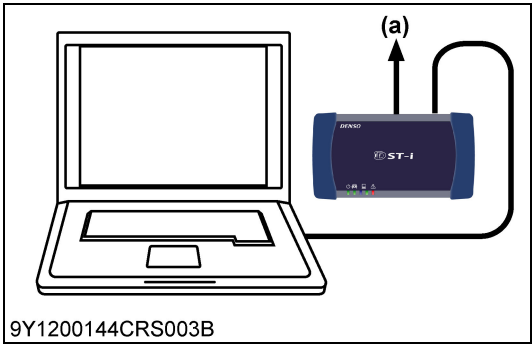
Factory specification	DTC is not detected.
OK	Injector fault → Replace the injector.
NG	Go to "3. Replacing the ECU and Checking Whether the DTC Is Detected Again".

(a) CAN1 Connector

9Y1200226CRS0886US0

9Y1200226CRS0887US0

9Y1200226CRS0888US0



3. Replacing the ECU and Checking Whether the DTC Is Detected Again

- 1. Replace the ECU.
- 2. Turn the key switch OFF and then ON again.
- 3. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
- 4. Check whether or not the same DTC (P0200) is detected.

Factory specification	DTC is not detected.
-----------------------	----------------------

OK	ECU fault → Replace the ECU.
----	------------------------------

(a) CAN1 Connector

9Y1200226CRS0889US0

(16) Open Circuit of Harness/Coil (DTC P0201 / 651-3, P0202 / 653-3, P0203 / 654-3, P0204 / 652-3)

P0201 / 651-3: Engine No. 1 cylinder injector (TWV1) wiring harness open circuit, coil open circuit

P0202 / 653-3: Engine No. 3 cylinder injector (TWV2) wiring harness open circuit, coil open circuit

P0203 / 654-3: Engine No. 4 cylinder injector (TWV3) wiring harness open circuit, coil open circuit

P0204 / 652-3: Engine No. 2 cylinder injector (TWV4) wiring harness open circuit, coil open circuit

Behaviour during malfunction:

- Insufficient output
- Large vibration
- Worsening exhaust gas performance

Detection item:

- Open circuit of harness
- Open circuit of injector coil

DTC set preconditions:

- Engine is operating
- Battery voltage is normal
- During injection
- CPU is normal

DTC set parameter:

- Open circuit of harness or open circuit of injector coil

Engine warning light:

- ON

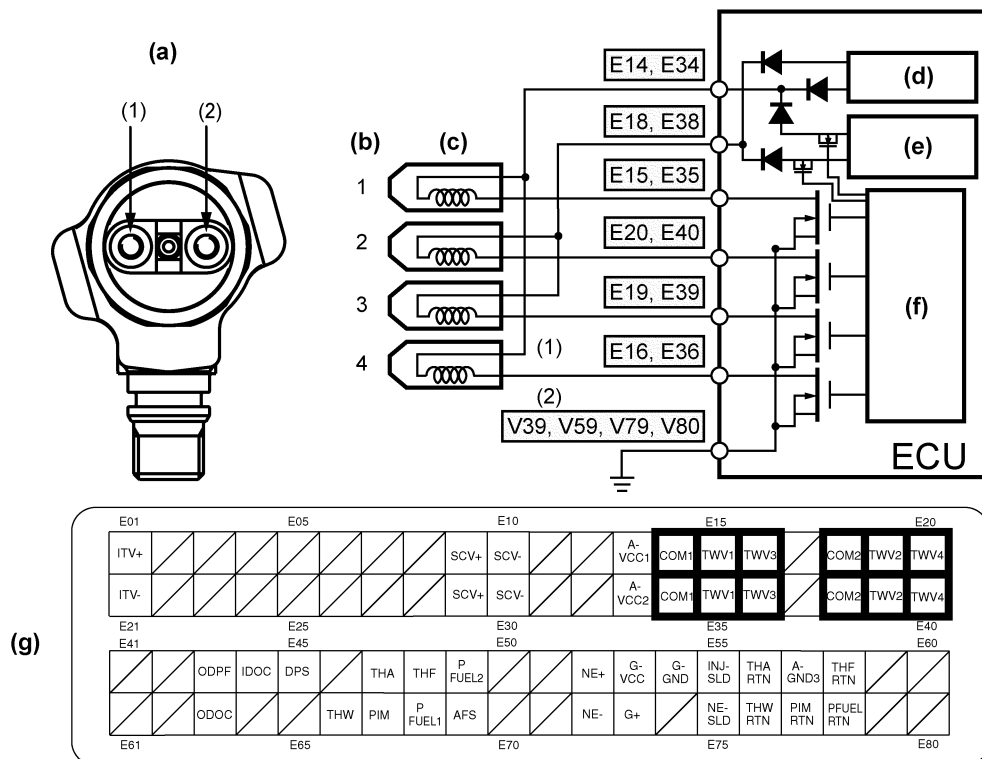
Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0890US0



9Y1200167CRS009A

- (1) Terminal COMMON
(2) Terminal TWV

- (a) Terminal Layout
(b) Engine Cylinder No.
(c) Injectors

- (d) Constant Amperage Circuit
(e) High Voltage Generation Circuit
(f) Control Circuit
(g) ECU Connector 1 (Engine Side)

9Y1200226CRS0891US0

1. Measure the Resistance Between ECU Terminals

- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance each terminal of the connector.

Engine cylinder / TWV number	Measurement terminal
No. 1 cylinder / TWV1	E14, E34 ↔ E15, E35
No. 3 cylinder / TWV2	E18, E38 ↔ E19, E39
No. 4 cylinder / TWV3	E14, E34 ↔ E16, E36
No. 2 cylinder / TWV4	E18, E38 ↔ E20, E40

Factory specification	1.5 Ω or lower
OK	Go to "2. Check the DTC".
NG	Go to "4. Measure the Resistance Between Injector Terminals".

9Y1200226CRS0892US0

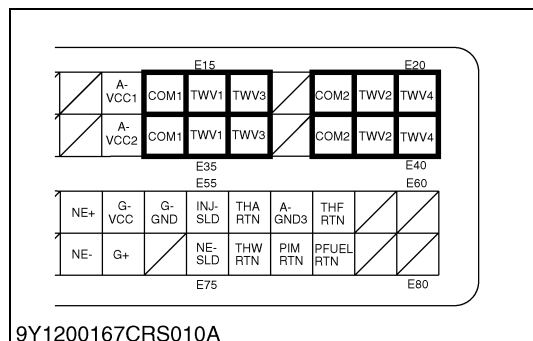
2. Check the DTC

- Plug the ECU connector into socket, and start the engine.
- Clear the DTCs that occurred previously, and check the currently existing trouble.

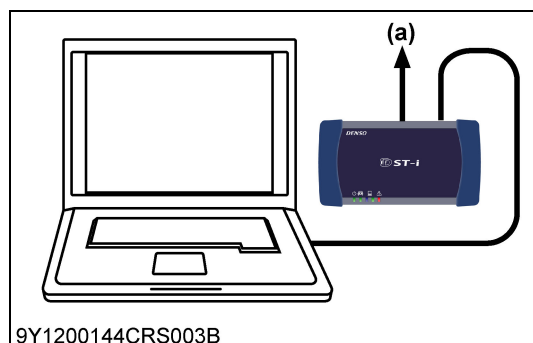
Factory specification	No DTC is output.
OK	Go to "3. Check the Connector and Wiring Harnesses for Poor Contact".
NG	Faulty ECU → Replace.

- (a) CAN1 Connector

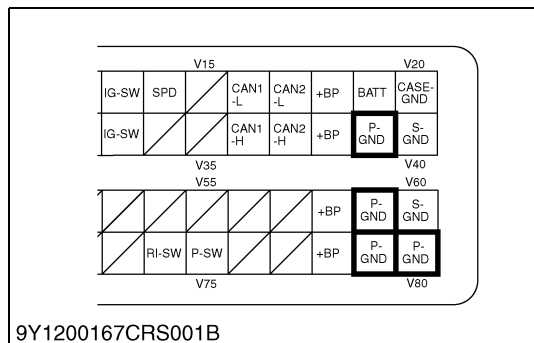
9Y1200226CRS0893US0



9Y1200167CRS010A



9Y1200144CRS003B



3. Check the Connector and Wiring Harnesses for Poor Contact

- Set the key switch to the OFF position, and check the wiring harness connectors and ECU pins for incorrect connection, deformation, poor contact or other defects.

Factory specification	Must be free from faulty connection, deformation, poor contact or other defects.
-----------------------	--

NOTE

- Intermediate connector and wiring harness in head cover should be checked, they are possible cause.

OK	Check the wiring harness and connector of P- GND terminal (ECU terminals V39, V59, V79 and V80). → Repair.
NG	Check the injector wiring harnesses and connectors. → Repair.

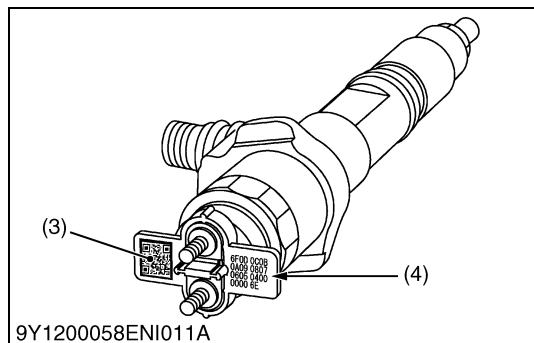
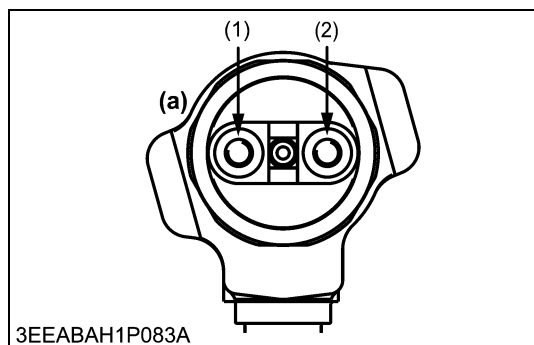
9Y1200226CRS0894US0

4. Measure the Resistance Between Injector Terminals

- Unplug the injector cable connector of the cylinder indicated by the DTC, and measure the resistance between injector terminals (1) and (2).

Factory specification	0.35 to 0.55 Ω
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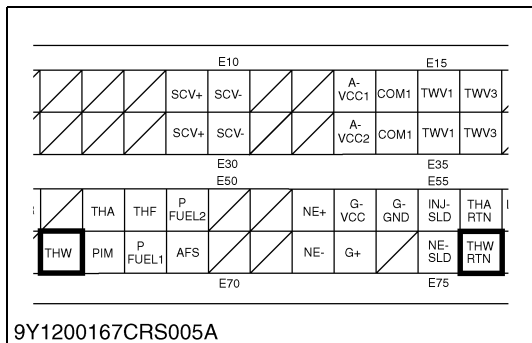
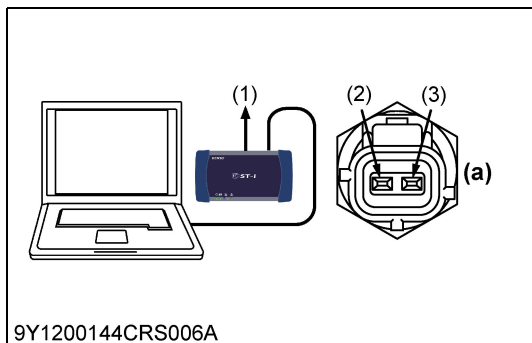
OK	Check the wiring harnesses and connectors for a poor contact. → Repair.
NG	Faulty injector → Replace (Using the diagnosis tool, write the ID (QR) code of replaced injector in the ECU.)



- Terminal COMMON
- Terminal TWV
- QR Code
- ID Code

(a) Injector

9Y1200226CRS0895US0



1. Check the Coolant Temperature Sensor Characteristics for An Error

1. Refer to DTC P0117, P0118, and check the ECU, wiring harness and sensor for an error.

OK	Check the cooling system. → Repair the faulty area. If the cooling system is operating normally, ask the user about malfunction occurrence based on the freeze-frame data to determine whether or not the system was used improperly.
NG	Check and repair or replace the faulty parts.

- (1) CAN1 Connector
- (2) Terminal THW
- (3) Terminal THW RTN

(a) Terminal Layout

9Y1200226CRS0898US0

(18) Engine Overrun (DTC P0219 / 190-0)

Behaviour during malfunction:

- Overrun

Detection item:

- Engine speed exceeds threshold speed

DTC set preconditions:

- Key switch is ON

DTC set parameter:

- Engine speed $\geq 3500 \text{ min}^{-1}$ (rpm)

Engine warning light:

- ON

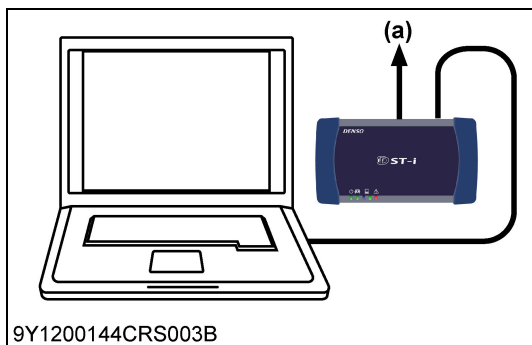
Limp home action by engine ECU (system action):

- Stop injection ($Q = 0 \text{ mm}^3/\text{st}$)

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS0899US0



1. Checking Whether the DTC Is Detected Again

1. Turn the key switch OFF and then ON again.
2. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
3. Check whether or not the same DTC (P0219) is detected.

Factory specification	DTC is not detected.
OK	Go to "2. Checking with the User".
NG	It could be a temporary malfunction caused by obstructions to the radio waves, so as long as it recovers to normal operation there is no problem.

(a) CAN1 Connector

9Y1200226CRS0900US0

2. Checking with the User

1. The following actions may have caused the overrun.
 - Towing heavy objects
 - Drag phenomenon when driving downhill
 - Mistaken operation when making a sudden shift change

Question the user in detail about the items above and give guidance.

9Y1200226CRS0901US0

(19) Boost Pressure Sensor Abnormality (DTC P0237 / 102-4, P0238 / 102-3)**P0237 / 102-4: Boost temperature sensor abnormality (Low side)****Behaviour during malfunction:**

- Insufficient output

Detection item:

- Ground short circuit of sensor / harness
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Voltage of boost pressure sensor is 0.2 V or below

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- 65 kPa (0.66 kgf/cm², 9.4 psi) [default value]

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0902US0

P0238 / 102-3: Boost temperature sensor abnormality (High side)**Behaviour during malfunction:**

- Insufficient output

Detection item:

- Open circuit or +B short circuit of sensor / harness
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Voltage of boost pressure sensor is 4.9 V or above

Engine warning light:

- ON

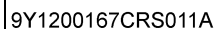
Limp home action by engine ECU (system action):

- 65 kPa (0.66 kgf/cm², 9.4 psi) [default value]

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0903US0



- 9Y1200226CRS0904US0

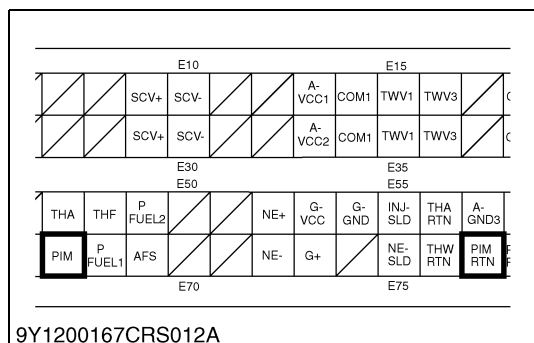


1. Place the key switch in the OFF position, attach the diagnosis tool to the CAN1 connector, and return the key switch to the ON position again. Then, check the "Boost pressure" and "Boost pressure sensor output voltage" on the diagnosis tool data monitor.
2. Next, start the engine, change the depressed amount of the accelerator pedal, and check the same items again.

■ **NOTE**

- Reference value (Factory specification) has complete linearity.

9Y1200226CRS0905US0



2. Measure the ECU Terminal Voltage

1. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals E67 and E77.
2. Next, start the engine, change the depressed amount of the accelerator pedal, and check the same items again.

Factory specification	
Engine state	Output voltage
Key switch ON	Approx. 1.0 V
After engine start-up	1.0 to 2.2 V

OK	Check the harness connectors and ECU pins.
	OK Faulty ECU → Replace.
	NG Repair or replace the wiring harness, or replace the ECU.
NG	Go to "3. Measure the Voltage Between Boost Pressure Sensor Terminals".

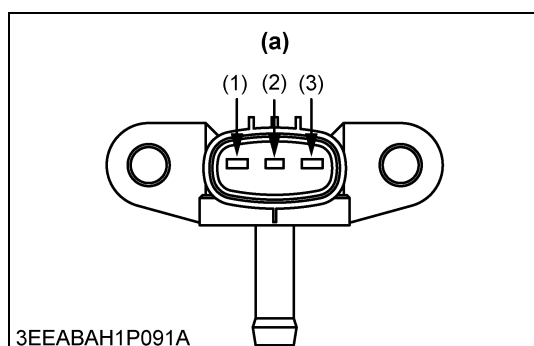
9Y1200226CRS0906US0

3. Measure the Voltage Between Boost Pressure Sensor Terminals

1. Place the key switch in the ON position, and measure the voltage between terminals (2) and (3) of the boost pressure sensor at the wiring harness side.
2. Next, start the engine, change the depressed amount of the accelerator pedal, and check the same items again.

Factory specification	
Engine state	Output voltage
Key switch ON	Approx. 1.0 V
After engine start-up	1.0 to 2.2 V

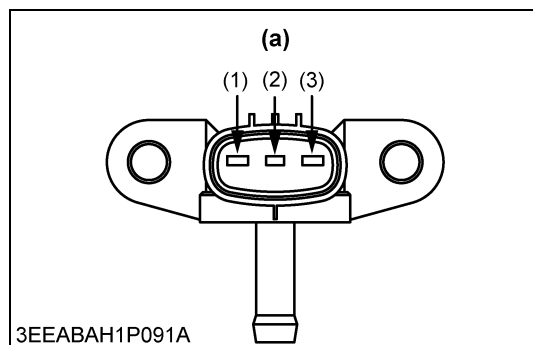
OK	Check the wiring harness (between ECU terminal E67 and sensor terminal (2)). → Repair the faulty area.
NG	Go to "4. Measure the Voltage Between Boost Pressure Sensor Terminals".



- (1) Terminal A-VCC2
- (2) Terminal PIM
- (3) Terminal PIM RTN

(a) Terminal Layout

9Y1200226CRS0907US0



4. Measure the Voltage Between Boost Pressure Sensor Terminals

1. Set the key switch to the OFF position, and unplug the boost pressure sensor connector from the socket.
2. Place the key switch in the ON position, and measure the voltage between terminals (1) and (3) of the boost pressure sensor connector (at the wiring harness side).

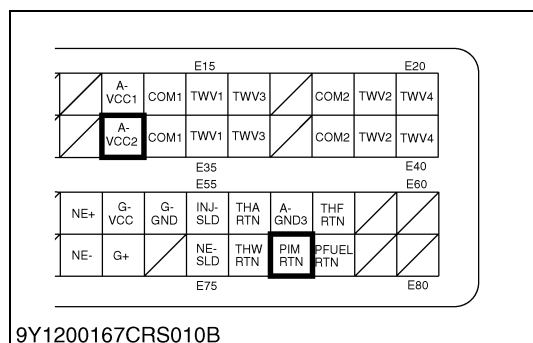
Factory specification	Approx. 5 V
-----------------------	-------------

OK	Check the wiring harness connector and sensor pins.	
	OK	Faulty boost pressure sensor → Replace.
	NG	1. Repair or replace the wiring harness. 2. Replace the boost pressure sensor.
NG	Go to "5. Measure the ECU Terminal Voltage".	

- (1) Terminal A-VCC2
(2) Terminal PIM
(3) Terminal PIM RTN

(a) Terminal Layout

9Y1200226CRS0908US0



5. Measure the ECU Terminal Voltage

1. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals E33 and E77.

Factory specification	Approx. 5 V
-----------------------	-------------

OK	Check the harness connectors and ECU pins.	
	OK	Faulty ECU → Replace.
	NG	Repair or replace the wiring harness, or replace the ECU.
NG	Check the wiring harness (between ECU terminal E33 and sensor terminal (1) and between ECU terminal E77 and sensor terminal (3)). → Repair the faulty area.	

■ NOTE

- Check the hose between intake manifold and sensor, When it is damaged, the boost pressure can not reach the sensor.

9Y1200226CRS0909US0

(20) Crankshaft Position Sensor (NE Sensor) Abnormality (DTC P0335 / 636-8, P0336 / 636-2)

P0335 / 636-8: No input of NE sensor pulse

Behaviour during malfunction (Running only with G signal):

- Faulty starting
- Vibration is slightly large
- Insufficient output

Detection item:

- Open circuit or short circuit of sensor / harness
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- Engine is not stalled

DTC set parameter:

- No recognition of Ne sensor pulse

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition

■ NOTE

- Engine will stop if both NE and G fail

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS0910US0

P0336 / 636-2: NE sensor pulse number error

Behaviour during malfunction (Running only with G signal):

- Faulty starting
- Vibration is slightly large
- Insufficient output

Detection item:

- Open circuit or short circuit of sensor / harness
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- 350 min⁻¹ (rpm) or higher

DTC set parameter:

- Pulse count per rotation is not 56 teeth

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition

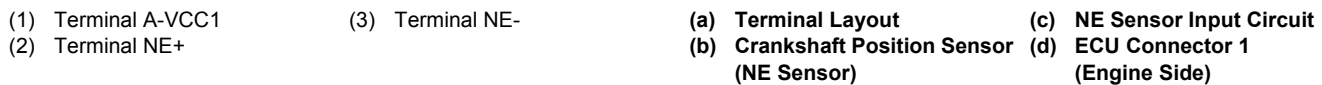
■ NOTE

- Engine will stop if both NE and G fail


Recovery from error:

- Diagnostic counter = zero

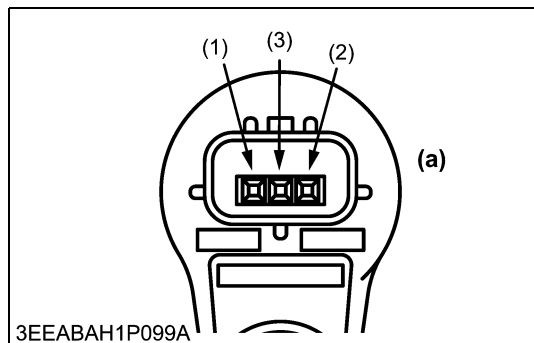
9Y1200226CRS0911US0



1. Rotate the engine, and check the "Engine speed active flag" value on the diagnosis tool data monitor.

Factory specification	Always ON	
OK	It should be confirmed two or more times while changing the accelerator. 	
	OK	Normal.
	NG	Go to "2. Check the Voltage Between Crankshaft Position Sensor Terminals".
NG	Go to "2. Check the Voltage Between Crankshaft Position Sensor Terminals".	

9Y1200226CRS0913US0



2. Check the Voltage Between Crankshaft Position Sensor Terminals

1. Place the key switch in the OFF position, and unplug the crankshaft position sensor connector from the socket.
2. Place the key switch in the ON position, and measure the voltage between A-VCC1 terminal and NE- terminal at the wiring harness side.

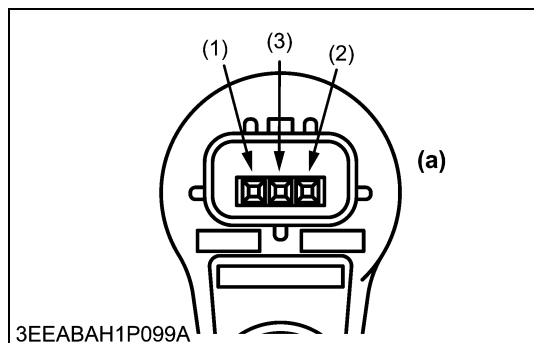
Factory specification	Approx. 5 V
-----------------------	-------------

OK	Go to "3. Check the Connectors".
NG	Go to "5. Measure the ECU Terminal Voltage".

- (1) Terminal A-VCC1
(2) Terminal NE+
(3) Terminal NE-

(a) Terminal Layout

9Y1200226CRS0914US0



3. Check the Connectors

1. Check the sensor and wiring harness connectors for incorrect connection, inappropriate fitting, poor contact or other faulty areas.

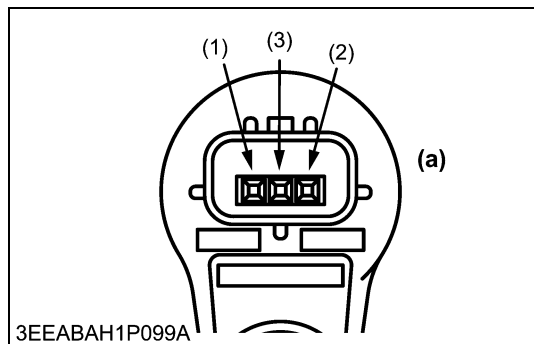
Factory specification	Must be free from incorrect connection, inappropriate fitting, poor contact.
-----------------------	--

OK	Go to "4. Check the Wiring Harness".
NG	Repair or replace.

- (1) Terminal A-VCC1
(2) Terminal NE+
(3) Terminal NE-

(a) Terminal Layout

9Y1200226CRS0915US0



4. Check the Wiring Harness

1. Check the wiring harness between NE+ terminal of sensor and ECU for a short or an open circuit.

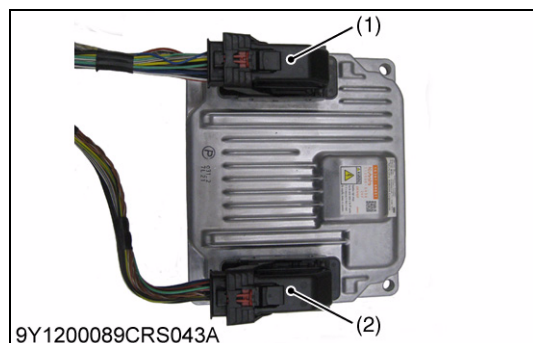
Factory specification	Must be free from shorts and open circuit.
-----------------------	--

OK	The sensor has abnormality. → Replace.
NG	Repair.

- (1) Terminal A-VCC1
(2) Terminal NE+
(3) Terminal NE-

(a) Terminal Layout

9Y1200226CRS0916US0



5. Measure the ECU Terminal Voltage

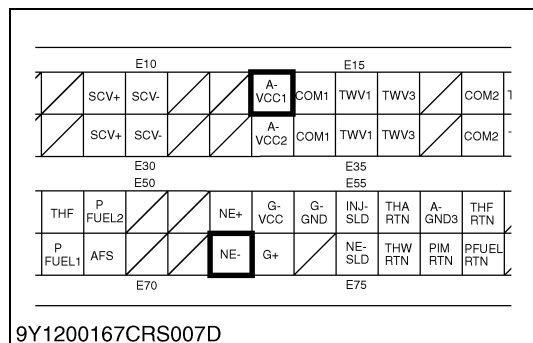
1. Place the key switch in the OFF position, and unplug the ECU wiring harness connector 1 (1) from the socket.
2. Place the key switch in the ON position, and measure the voltage between ECU terminals E13 and E72.

Factory specification	Approx. 5 V
-----------------------	-------------

OK	Go to "6. Check the connectors".
NG	Replace the ECU.

- (1) ECU Wiring Harness Connector 1 (Engine Side) (2) ECU Wiring Harness Connector 2 (Machine Side)

9Y1200226CRS0917US0



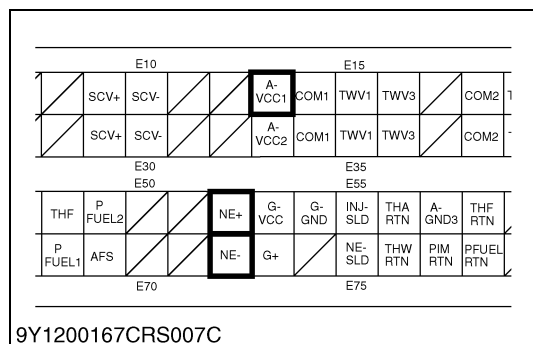
6. Check the Connectors

1. Check ECU terminals E13, E52 and E72 (at the ECU side) and the connectors (at the wiring harness side) for incorrect connection, inappropriate fitting, poor contact.

Factory specification	Must be free from incorrect connection, inappropriate fitting, poor contact.
-----------------------	--

OK	Go to "7. Check the wiring harness".
NG	Repair or replace.

9Y1200226CRS0918US0



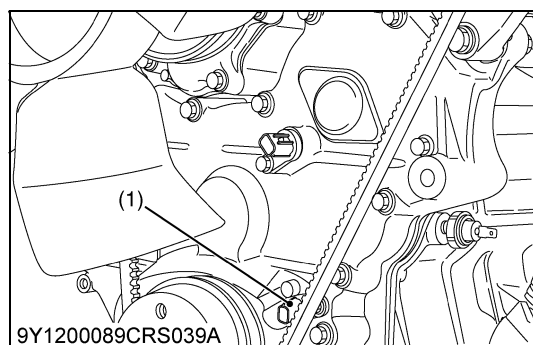
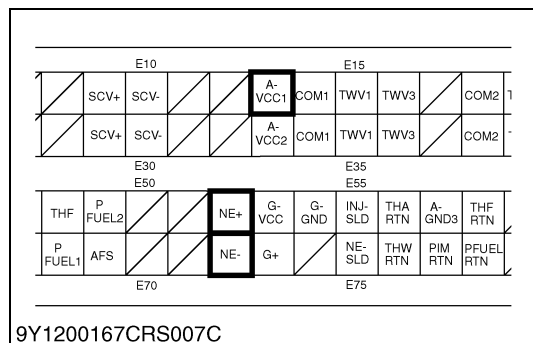
7. Check the Wiring Harness

1. Check the wiring harness being connected to ECU terminals E13, E52 and E72 for a short or an open circuit.

Factory specification	Must be free from shorts and open circuit.
-----------------------	--

OK	Go to "8. Check the Sensor".
NG	Repair.

9Y1200226CRS0919US0



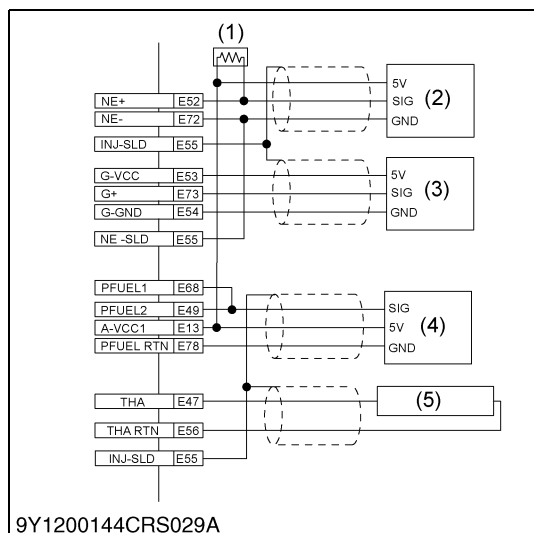
8. Check the Sensor

1. Disconnect the sensor and check the following items.
 - Is there a large amount of magnetic foreign material adhering to the sensor surface?
 - Are there interference marks of the pulsar and the sensor?
 - Are there any pulsar gear abnormalities?

OK	Replace the ECU and test.
NG	Replace the sensor.

- (1) Crankshaft Position Sensor (NE Sensor)

9Y1200226CRS0920US0



9. Check NE sensor pull-up resistor

- Remove the pull-up resistor (1 kΩ) which is connected to harness, then check next item.
 - Check if there is improper connection of 1 kΩ resistive element and connector.
 - Check if there is damage of 1 kΩ resistive element. (measure the resistance of resistive element with tester.)

OK	Replace the ECU and test.
NG	Replace 1 kΩ resistive element, or improve improper connection.

- | | |
|--------------------------------|-----------------------------------|
| (1) Resistor 1 kΩ 1/4 W | (4) Rail Pressure Sensor |
| (2) Crankshaft Position Sensor | (5) Intake Air Temperature Sensor |
| (3) Camshaft Position Sensor | |

9Y1200226CRS0921US0

(21) Camshaft Position Sensor (G Sensor) Abnormality (DTC P0340 / 723-8, P0341 / 723-2)

P0340 / 723-8: No input of G sensor pulse

Behaviour during malfunction (Invalid G signal):

- Engine hesitates at start-up

Detection item:

- Open circuit or short circuit of sensor / harness
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- Engine is not stalled

DTC set parameter:

- No recognition of G sensor pulse

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- None

■ NOTE

- Engine will stop if both NE and G fail

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS0922US0

P0341 / 723-2: G sensor pulse number error

Behaviour during malfunction (Invalid G signal):

- Engine hesitates at start-up

Detection item:

- Open circuit or short circuit of sensor / harness
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- Engine speed is 350 min⁻¹ (rpm) or higher

DTC set parameter:

- Pulse count per rotation is not 5 teeth

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- None

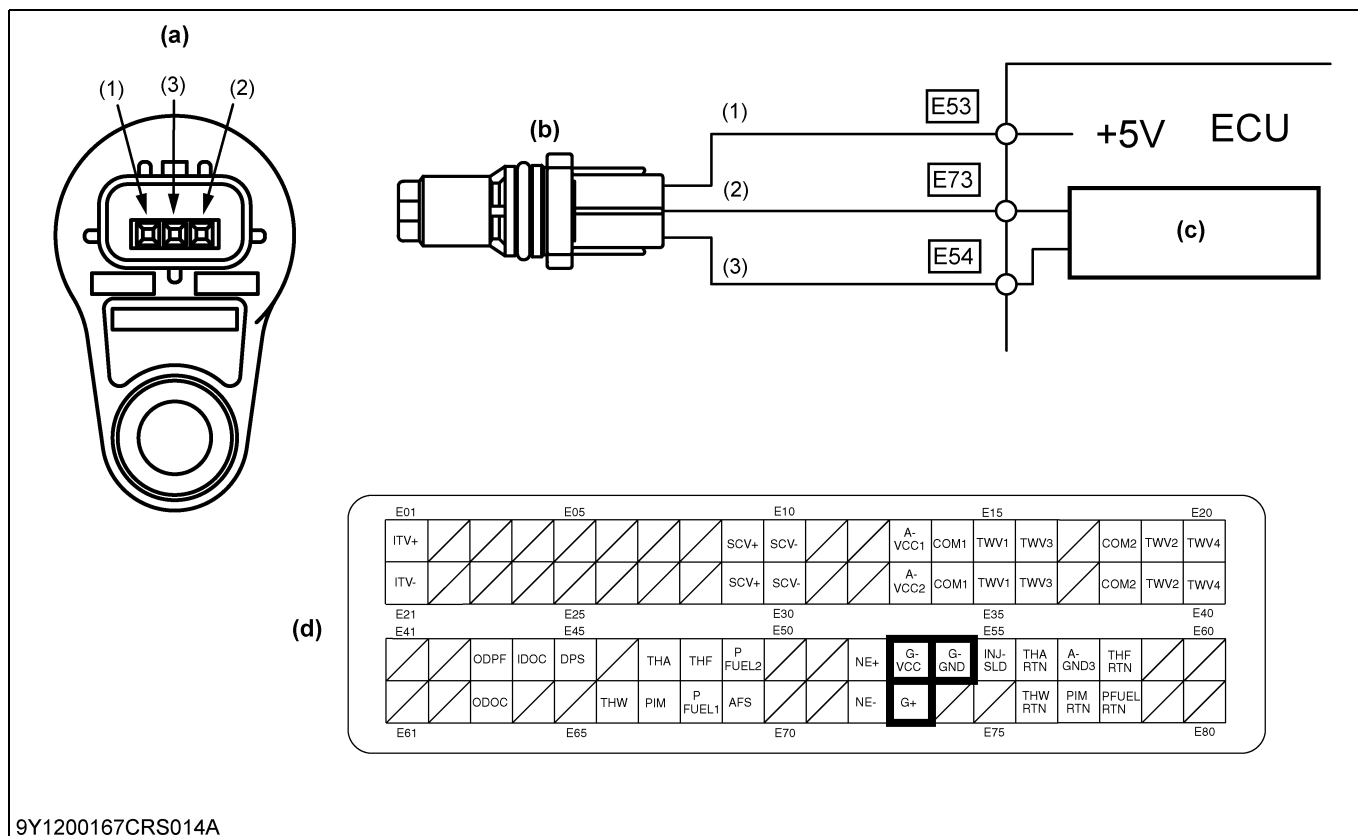
■ NOTE

- Engine will stop if both NE and G fail

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS0923US0



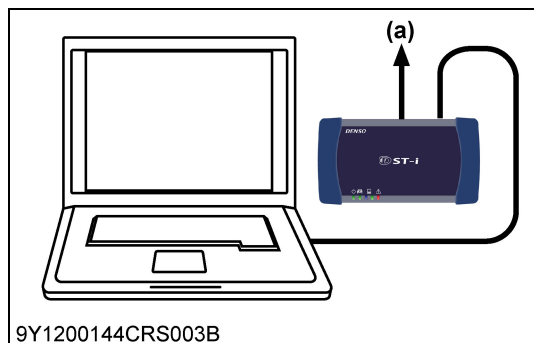
(1) Terminal G-VCC
(2) Terminal G+

(3) Terminal G-GND

(a) Terminal Layout
(b) Camshaft Position Sensor
(G Sensor)

(c) G Sensor Input Circuit
(d) ECU Connector 1
(Engine Side)

9Y1200226CRS0924US0



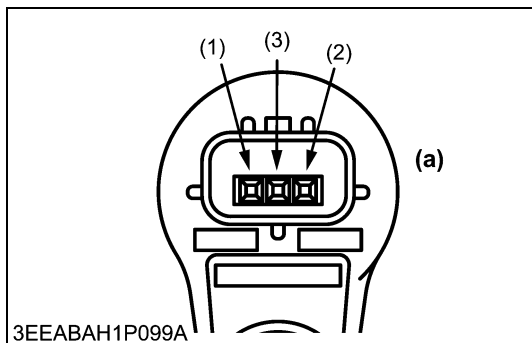
1. Check the Camshaft Position Sensor Signals

1. Rotate the engine, and check the "Cam speed active flag" value on the diagnosis tool data monitor.

Factory specification	Always ON
OK	It should be confirmed two or more times while changing the accelerator.
	OK Normal.
	NG Go to "2. Check the Voltage Between Camshaft Position Sensor Terminals".
NG	Go to "2. Check the Voltage Between Camshaft Position Sensor Terminals".

(a) CAN1 Connector

9Y1200226CRS0925US0



2. Check the Voltage Between Camshaft Position Sensor Terminals

1. Place the key switch in the OFF position, and unplug the camshaft position sensor connector from the socket.
2. Place the key switch in the ON position, and measure the voltage between G-VCC and G-GND terminals at the wiring harness side.

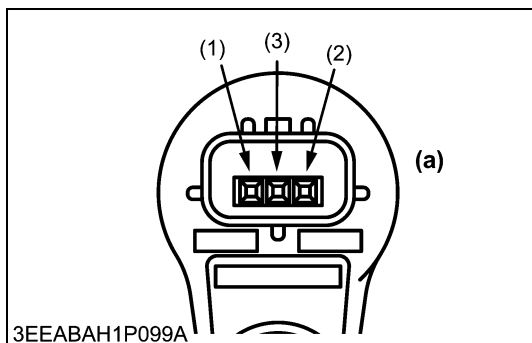
Factory specification	Approx. 5 V
-----------------------	-------------

OK	Go to "3. Check the Connectors".
NG	Go to "5. Measure the ECU Terminal Voltage".

- (1) Terminal G-VCC
(2) Terminal G+
(3) Terminal G-GND

(a) Terminal Layout

9Y1200226CRS0926US0



3. Check the Connectors

1. Check the sensor and wiring harness connectors for incorrect connection, inappropriate fitting, poor contact or other faulty areas.

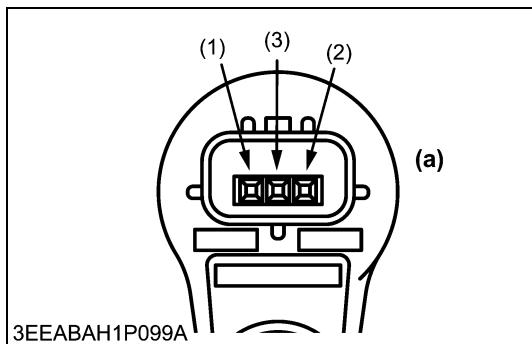
Factory specification	Must be free from incorrect connection, inappropriate fitting, poor contact.
-----------------------	--

OK	Go to "4. Check the Wiring Harness".
NG	Repair or replace.

- (1) Terminal G-VCC
(2) Terminal G+
(3) Terminal G-GND

(a) Terminal Layout

9Y1200226CRS0927US0



4. Check the Wiring Harness

1. Check the wiring harness between G+ terminal of sensor and ECU for a short or an open circuit.

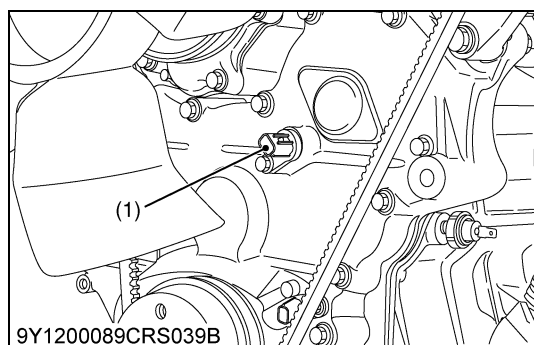
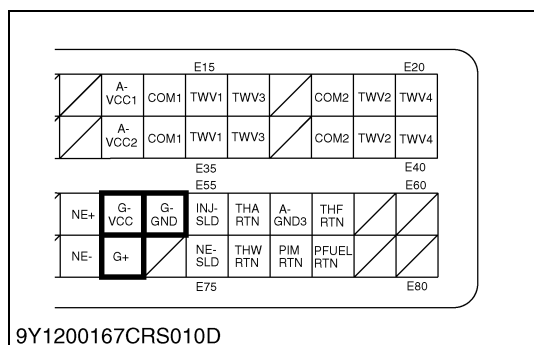
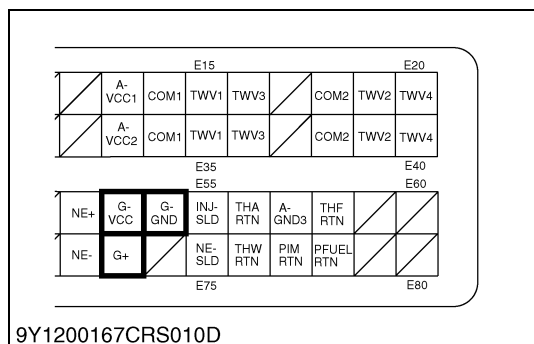
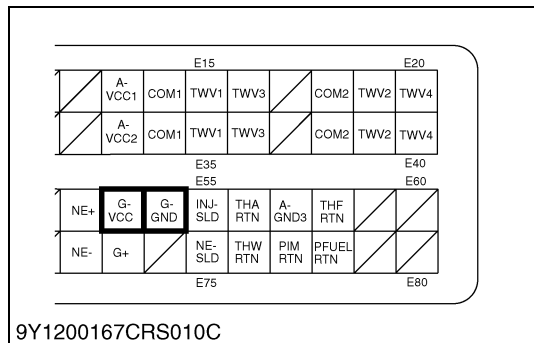
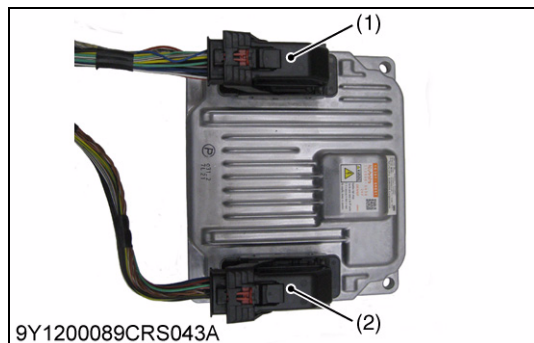
Factory specification	Must be free from shorts and open circuit.
-----------------------	--

OK	The sensor has abnormality. → Replace.
NG	Repair.

- (1) Terminal G-VCC
(2) Terminal G+
(3) Terminal G-GND

(a) Terminal Layout

9Y1200226CRS0928US0



5. Measure the ECU Terminal Voltage

- Place the key switch in the OFF position, and unplug the ECU wiring harness connector 1 (1) from the socket.
- Place the key switch in the ON position, and measure the voltage between ECU terminals E53 and E54.

Factory specification	Approx. 5 V
-----------------------	-------------

OK	Go to "6. Check the Connectors".
NG	Replace the ECU.

- (1) ECU Wiring Harness Connector 1 (Engine Side) (1) ECU Wiring Harness Connector 2 (Machine Side)

9Y1200226CRS0929US0

6. Check the Connectors

- Check ECU terminals E53, E73 and, E54 (at the ECU side) and the connectors (at the wiring harness side) for incorrect connection, inappropriate fitting, poor contact.

Factory specification	Must be free from incorrect connection, inappropriate fitting, poor contact.
-----------------------	--

OK	Go to "7. Check the Wiring Harness".
NG	Repair or replace.

9Y1200226CRS0930US0

7. Check the Wiring Harness

- Check the wiring harness being connected to ECU terminals E53, E73 and E54 for a short or an open circuit.

Factory specification	Must be free from shorts and open circuit.
-----------------------	--

OK	Go to "8. Check the Sensor".
NG	Repair.

9Y1200226CRS0931US0

8. Check the Sensor

- Disconnect the sensor and check the following items.
 - Is there a large amount of magnetic foreign material adhering to the sensor surface?
 - Are there interference marks of the pulsar and the sensor?
 - Are there any pulsar gear abnormalities?

OK	Replace the ECU and test.
NG	Replace the sensor.

- (1) Camshaft Position Sensor (G Sensor)

9Y1200226CRS0932US0

(22) Air Heater Relay Driving Circuit Abnormality (DTC P0380 / 523544-3 / 523544-4)

■ NOTE

- This item is a check related to the air heater (pre) relay control. Even if it is normal, air heating may not work. If this happens, look for the malfunction in accordance with the following procedure.

P0380 / 523544-3: +B short of air heater relay driving circuit

Behaviour during malfunction (At low temperature):

- Faulty starting
- Increase in white smoke

Detection item:

- +B short of air heater relay driving circuit

DTC set preconditions:

- Battery voltage is normal
- During air heater relay drive command is activated

DTC set parameter:

- +B short circuit of harness

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- None

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0933US0

P0380 / 523544-4: Ground short of air heater relay driving circuit

Behaviour during malfunction (At low temperature):

- Faulty starting
- Increase in white smoke

Detection item:

- Ground short or open circuit of air heater relay driving circuit

DTC set preconditions:

- Battery voltage is normal
- Other than during air heater relay drive command is activated

DTC set parameter:

- Open circuit of harness, Ground short circuit

Engine warning light:

- ON

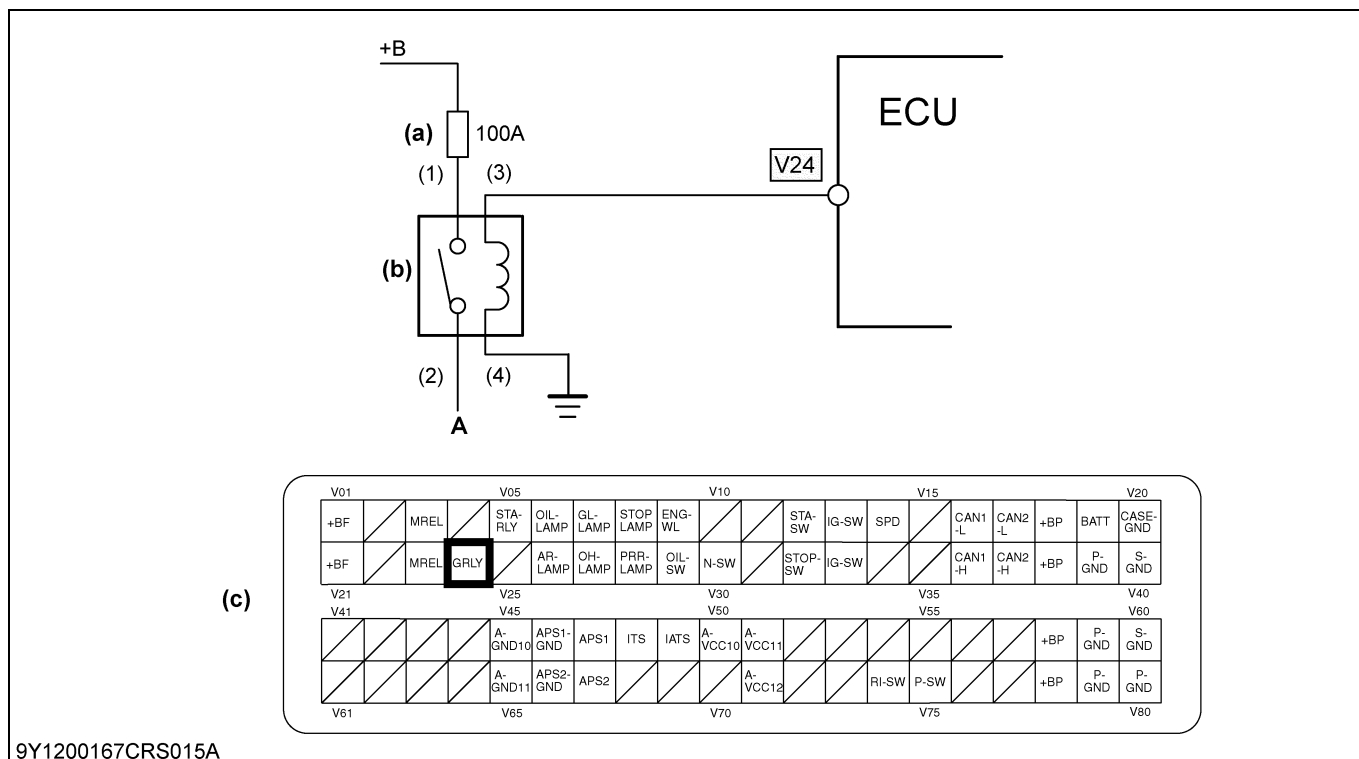
Limp home action by engine ECU (system action):

- None

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0934US0



9Y1200167CRS015A

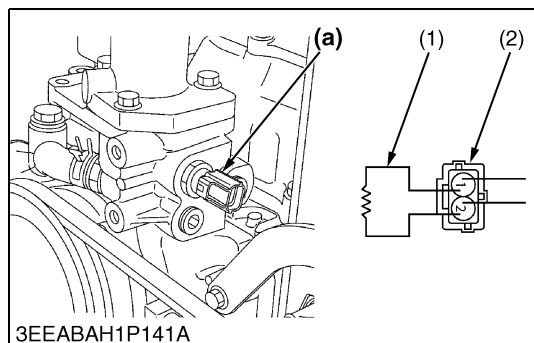
- (1) Terminal +B
 (2) Terminal MAHR
 (3) Terminal GRLY

- (4) Terminal GND

- (a) Fuse
 (b) Air heater relay
 (c) ECU Connector 2
 (Machine Side)

A: To Main Air Heater Relay

9Y1200226CRS0935US0



1. Check the GLRY Signal

- Run the engine until the coolant temperature is 10 °C (50 °F) or higher.
- Check the "Glow relay" data with the data monitor.

Factory specification	OFF
-----------------------	-----

- After disconnecting the connector (2) of coolant temperature sensor and connect the dummy resistor (1) as shown in the left figure, and turn the key switch ON.

Dummy Resistor: 15 to 25 kΩ [Comparable to Approx. -30 to -20 °C (Approx. -22 to -5 °F)]

- Check the "Glow relay" data with the data monitor.

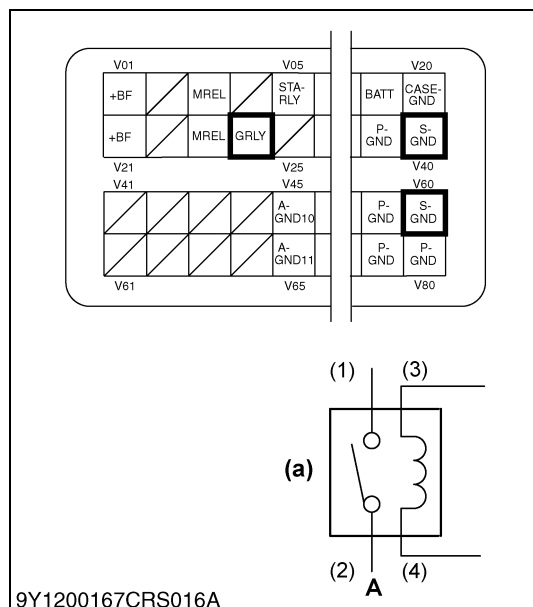
Factory specification	ON
-----------------------	----

OK	Normal.
NG	Go to "2. Check the Wiring Harness / Connector".

- (1) Dummy Resistor
 (2) Connector

(a) Coolant Temperature Sensor

9Y1200226CRS0936US0



2. Check the Wiring Harness / Connector

1. Remove the connector from the ECU side and check the state of the continuity between terminal V24 and (3).
2. Next, check the state of the continuity between terminal V40 / V60 and (4).

Factory specification	Both have continuity
-----------------------	----------------------

3. Check the connector for poor connection, engagement and contact.

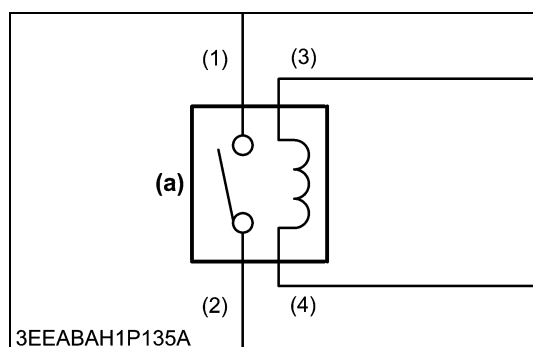
Factory specification	No poor connection, engagement or contact.
-----------------------	--

OK	Go to "3. Check the Relay".
NG	Repair or replace the faulty areas.

- (1) Terminal +B
- (2) Terminal MAHR
- (3) Terminal GRLY
- (4) Terminal GND

- (a) **Air Heater Relay**
A: To Main Air Heater Relay

9Y1200226CRS0937US0



3. Check the Relay

1. After disconnecting the connector of coolant temperature sensor and connect the dummy resistor (5) as shown in the left figure, and turn the key switch ON.
Dummy Resistor: 15 to 25 kΩ [Comparable to Approx. -30 to -20 °C (Approx. -22 to -5 °F)]
2. Measure the voltage between (3) and (4).

Factory specification	When relay is ON: Battery voltage value When relay is OFF: Approx. 0 V
-----------------------	---

3. Check the state of the continuity between (1) and (2).

Factory specification	When relay is ON: Continuity When relay is OFF: No continuity
-----------------------	--

4. Measure the resistance in the relay unit (between (3) and (4)).

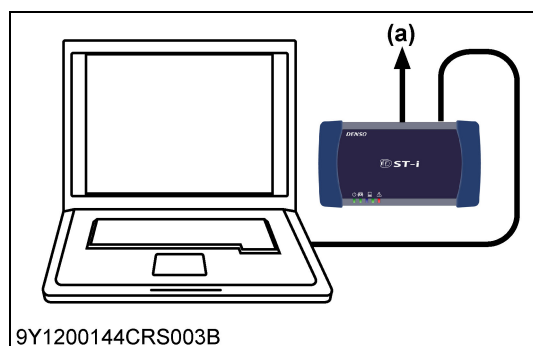
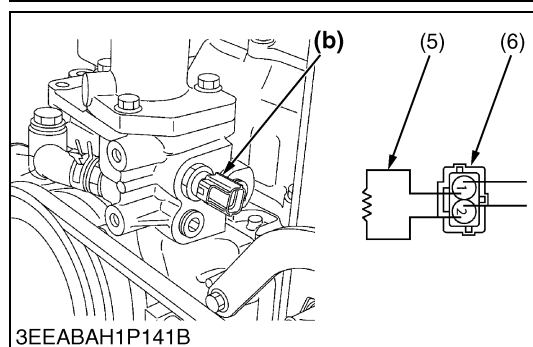
Factory specification	Coil resistance value of relay to use
-----------------------	---------------------------------------

OK	Go to "4. ECU replacement check".
NG	Relay fault → Replace.

- (1) Terminal +B
- (2) Terminal MAHR
- (3) Terminal GRLY
- (4) Terminal GND
- (5) Dummy Resistor
- (6) Connector

- (a) **Air Heater Relay**
(b) **Coolant Temperature Sensor**

9Y1200226CRS0938US0



4. ECU Replacement Check

1. Replace the ECU and perform the previous "Check the GRLY signal".

OK	ECU fault → Replace the ECU.
-----------	------------------------------

- (a) **CAN1 Connector**

9Y1200226CRS0939US0

(23) EGR Actuator Abnormality (DTC P0403 / 523574-3, DTC P0404 / 523574-4, P0409 / 523572-4)

P0403 / 523574-3: EGR actuator open circuit

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas performance

Detection item:

- EGR actuator open circuit

DTC set preconditions:

- Battery voltage is normal
- No DTC of U0077 "CAN1 Bus off"
- EGR control line is normal

DTC set parameter:

- EGR actuator open error signal received via CAN

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0940US0

P0404 / 523574-4: EGR actuator coil short

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas performance

Detection item:

- EGR actuator coil short

DTC set preconditions:

- Battery voltage is normal
- No DTC of U0077 "CAN1 Bus off"
- EGR control line is normal

DTC set parameter:

- EGR actuator coil short error signal received via CAN

Engine warning light:

- ON

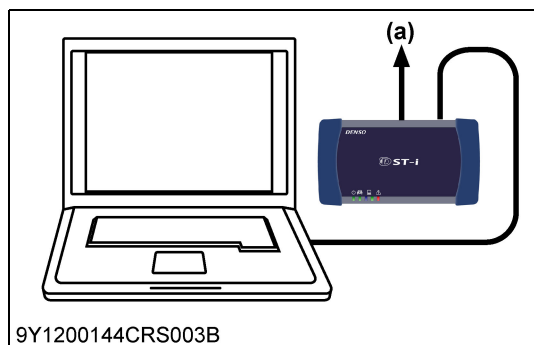
Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0941US0

**1. DTC Judgment**

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Place the key switch in the ON position, check whether the DTC is output or not.
3. Check the DTC again after starting up the engine with the coolant temperature over 65 °C (149 °F).

Factory specification	DTC must not be output.
-----------------------	-------------------------

OK	Normal.
NG	Replace the EGR assembly.

(a) **CAN1 Connector**

9Y1200226CRS0944US0

(24) Oil Pressure Error (P0524 / 100-1)

Behaviour during malfunction:

- Engine stops

Detection item:

- Oil pressure switch

DTC set preconditions:

- Battery voltage is normal
- Key switch turn ON
- Starter Switch signal (ECU: V12 terminal) is not activated
- 10 sec or more after engine start [700 min⁻¹ (rpm) or higher]

DTC set parameter:

- Oil pressure switch ON: continues one sec or more

Engine warning light:

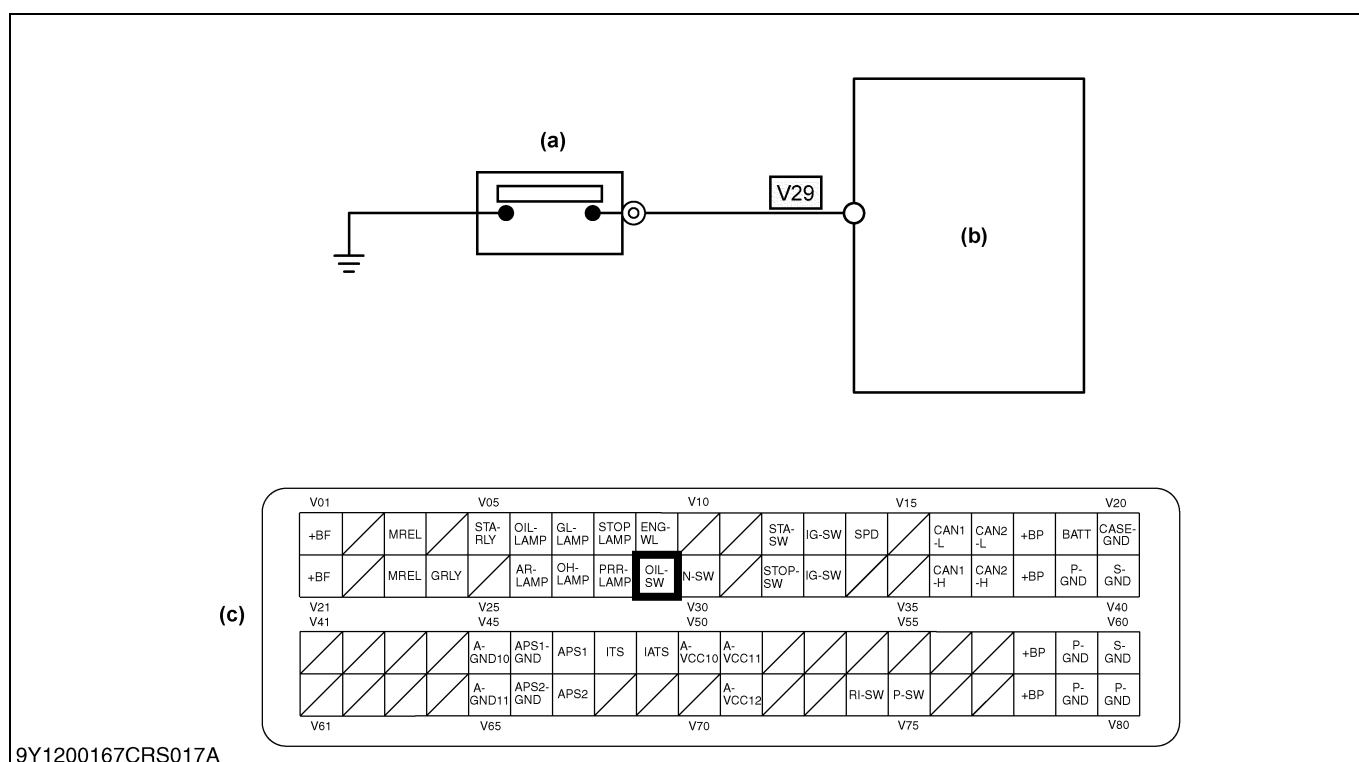
- ON

Limp home action by engine ECU (system action):

- None

Recovery from error:

- Key switch turn OFF

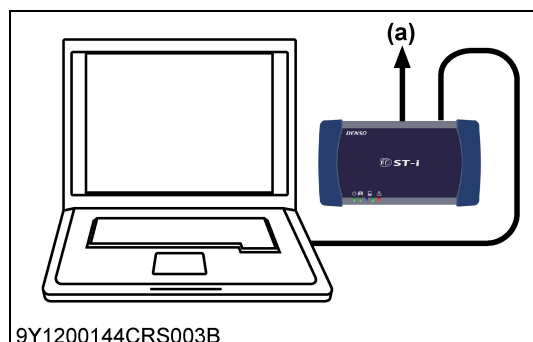


(a) Oil Pressure Switch

(b) Engine ECU

(c) **ECU Connector 2
(Machine Side)**

9Y1200226CRS0945US0



9Y1200144CRS003B

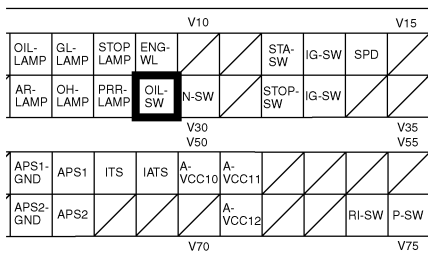
1. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Place the key switch in the ON position, check whether the DTC (P0524) is output or not.

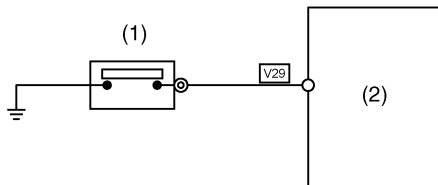
Factory specification	DTC (P0524) must not be output.
OK	Normal.
NG	Go to "2. Check the Wiring Related to the Oil Pressure Switch".

(a) CAN1 Connector

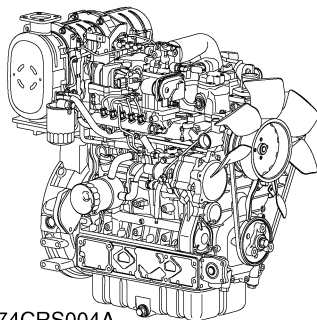
9Y1200226CRS0946US0



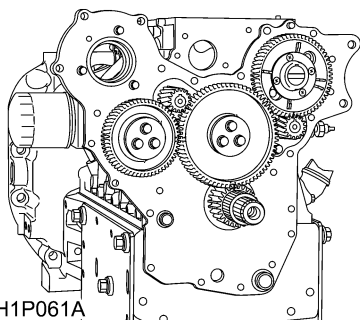
9Y1200167CRS018A



9Y1200144CRS025A



9Y1200174CRS004A



3EEABAH1P061A

2. Check the Wiring Related to the Oil Pressure Switch

1. Check the connector and the wiring harness being connected to ECU terminal V29 for a short or an open circuit.

■ IMPORTANT

- Refer to "6.[3] ELECTRIC SYSTEM INSPECTION PROCEDURE - (1) Basics of Checking Electrical / Electronic Circuit System". (Refer to page 1-S549)

OK	Go to "3. Check the Oil Pressure Switch".
NG	Repair or replace the faulty areas.

9Y1200226CRS0947US0

3. Check the Oil Pressure Switch

1. Replace the oil pressure switch and reconfirms it with the service tool.
If the oil pressure can be measured, perform the oil pressure measurement.

Factory specification	Operating pressure of the oil pressure switch: 0.5 kgf/cm ²
-----------------------	--

OK	Oil pressure switch fault → Replace
NG	Go to "4. Check the Oil and Oil Filter".

(1) 1 Oil Pressure Switch

(2) Engine ECU

9Y1200226CRS0948US0

4. Check the Oil and Oil Filter

1. Replace specified oil and the oil filter and reconfirms it with the service tool.

OK	Deterioration of the oil and oil filter → Change
NG	Go to "5. Check the Engine"

9Y1200226CRS0949US0

5. Check the Engine

1. Check the inside of the engine (oil passage).

OK	Normal.
NG	Repair the malfunction.

9Y1200226CRS0950US0

(25) Exhaust Gas Temperature Sensor 1 (T1) Abnormality (DTC P0543 / 3242-4, P0544 / 3242-3)

P0543 / 3242-4: Exhaust gas temperature sensor 1 (T1) abnormality (Low side)

Behaviour during malfunction:

- None

Detection item:

- Ground short circuit of sensor / harness

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Diesel Particulate Filter (hereinafter referred to as the "DPF") inlet temperature sensor (T1) voltage: 0.08 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- 0 °C (32 °F) [default value]
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0951US0

P0544 / 3242-3: Exhaust gas temperature sensor 1 (T1) abnormality (High side)

Behaviour during malfunction:

- None

Detection item:

- Open circuit or +B short circuit of sensor / harness.

DTC set preconditions:

- Battery voltage is normal
- Coolant temperature is 65 °C (149 °F) or more: continues longer than 10 min. after engine starting
- 100 °C (212 °F) ≤ T0 ≤ 800 °C (1472 °F): continues longer than 10 sec. or 100 °C (212 °F) ≤ T2 ≤ 800 °C (1472 °F): continues longer than 10 sec.

DTC set parameter:

- DPF inlet temperature sensor (T1) voltage: 4.92 V or more

Engine warning light:

- ON

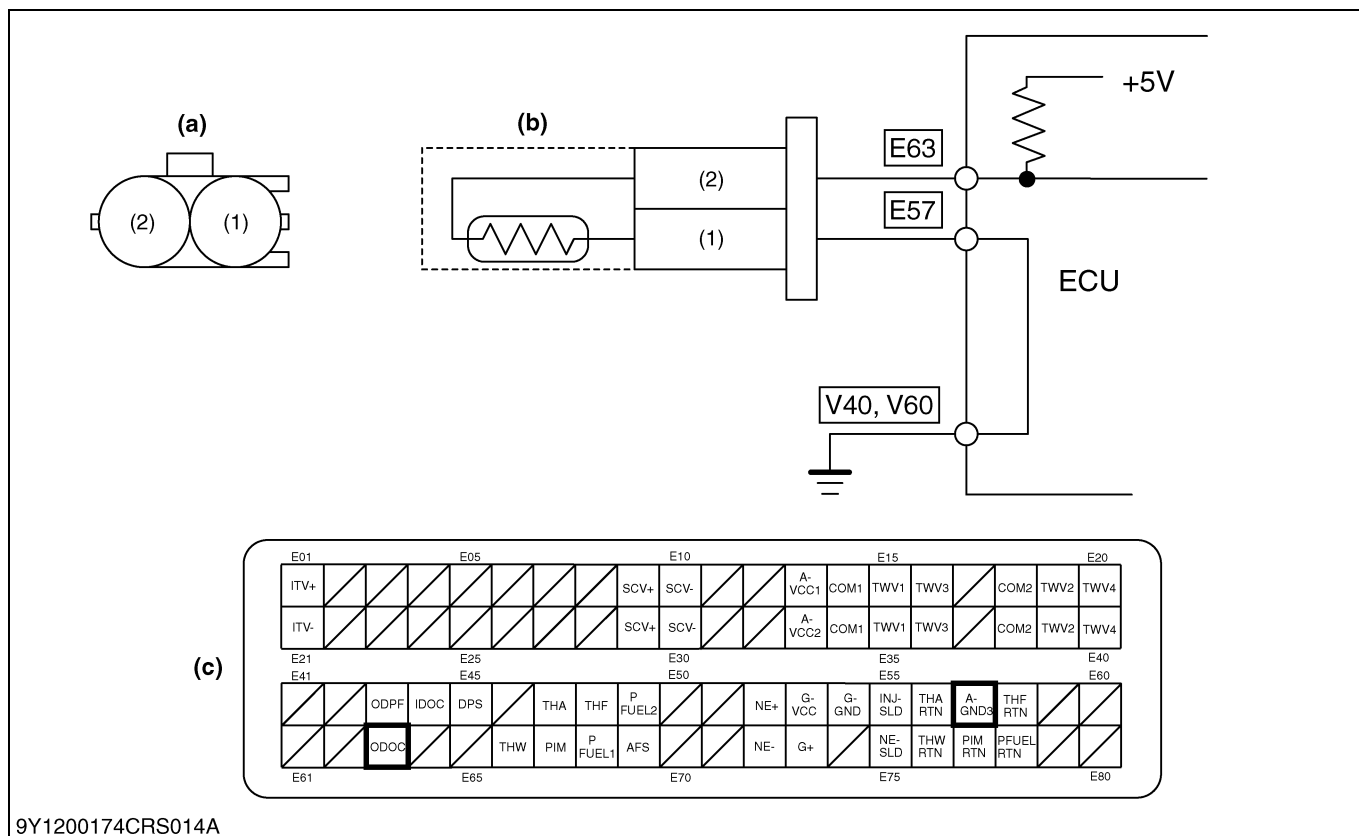
Limp home action by engine ECU (system action):

- 0 °C (32 °F) [default value]
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0952US0



9Y1200174CRS014A

(1) Terminal A-GND3

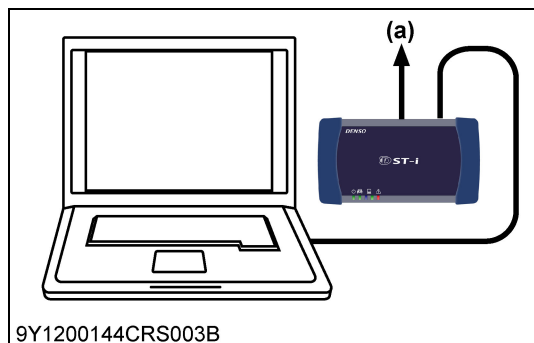
(2) Terminal ODOC

(a) Terminal Layout

(b) Exhaust Gas Temperature Sensor 1 (T1)

(c) ECU Connector 1 (Engine Side)

9Y1200226CRS0953US0



9Y1200144CRS003B

1. Check the Exhaust Gas Temperature Sensor Signals

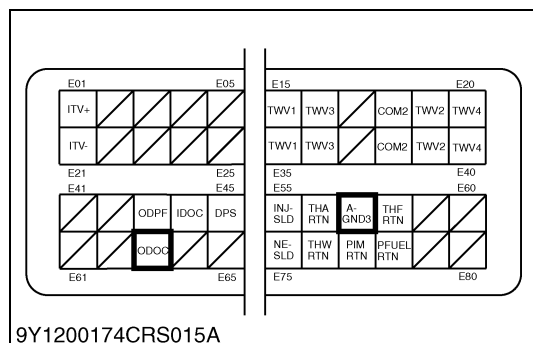
- Place the key switch in the ON position, and check the "Exhaust gas temperature" and "Exhaust gas temperature sensor output voltage" on the diagnosis tool data monitor.

Factory specification		
Actual exhaust gas temperature	Exhaust gas temperature	Output voltage
100 °C (212 °F)	100 °C (212 °F)	Approx. 4.4 V
150 °C (302 °F)	150 °C (302 °F)	Approx. 3.7 V
200 °C (392 °F)	200 °C (392 °F)	Approx. 3.0 V
250 °C (482 °F)	250 °C (482 °F)	Approx. 2.3 V

OK	Clear the DTC and check whether it is output again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Resistance Between Terminals".	

(a) CAN1 Connector

9Y1200226CRS0954US0



2. Measure the Resistance Between Terminals

- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals E57 and E63 of the connector.

Factory specification	
Temperature	Resistance
100 °C (212 °F)	Approx. 18.3 kΩ
150 °C (302 °F)	Approx. 7.88 kΩ
200 °C (392 °F)	Approx. 4.00 kΩ
250 °C (482 °F)	Approx. 2.30 kΩ

OK	Go to "4. Measure the ECU Terminal Voltage".
NG	Go to "3. Check the Sensor".

9Y1200226CRS0955US0

3. Check the Sensor

- Turn the key switch OFF, remove the connector from the sensor side and measure the resistance between the terminals on the sensor side.

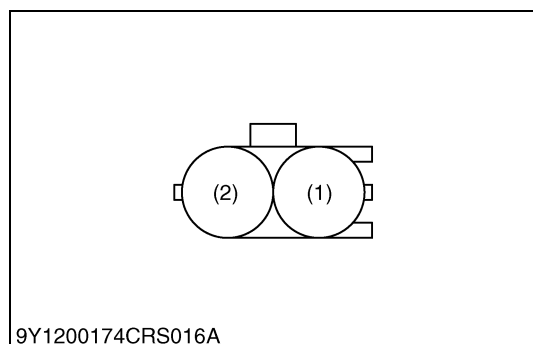
Factory specification	
Temperature	Resistance
100 °C (212 °F)	Approx. 18.3 kΩ
150 °C (302 °F)	Approx. 7.88 kΩ
200 °C (392 °F)	Approx. 4.00 kΩ
250 °C (482 °F)	Approx. 2.30 kΩ

OK	Wiring harness open circuit or connector fault → Check and repair.
NG	Exhaust gas temperature sensor fault → Replace the exhaust gas temperature sensor 1 (T1).

(1) Terminal A-GND3

(2) Terminal ODOC

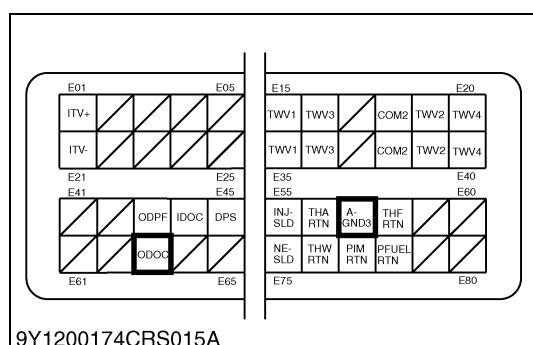
9Y1200226CRS0956US0



4. Measure the ECU Terminal Voltage

- Plug the ECU wiring harness connector into socket again, unplug the sensor connector, and measure the voltage between ECU terminals E57 and E63 at the ECU side.

Factory specification	Approx. 5 V
OK	The ECU connector is faulty or its wiring harness is shorted.
NG	Confirm by using other sensors that there is no ground short malfunction before replacing the ECU.



9Y1200226CRS0957US0

(26) Exhaust Gas Temperature Sensor 0 (T0) Abnormality (DTC P0546 / 4765-4, P0547 / 4765-3)

P0546 / 4765-4: Exhaust gas temperature sensor 0 (T0) abnormality (Low side)

Behaviour during malfunction:

- None

Detection item:

- Ground short circuit of sensor / harness

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- DOC inlet temperature sensor (T0) voltage: 0.08 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- 0 °C (32 °F) [default value]
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0958US0

P0547 / 4765-3: Exhaust gas temperature sensor 0 (T0) abnormality (Low side)

Behaviour during malfunction:

- None

Detection item:

- Open circuit or +B short circuit of sensor / harness.

DTC set preconditions:

- Battery voltage is normal
- Coolant temperature is 65 °C (149 °F) or more: continues longer than 5 min. after engine starting
- 100 °C (212 °F) ≤ T1 ≤ 800 °C (1472 °F): continues longer than 10 sec. or 100 °C (212 °F) ≤ T2 ≤ 800 °C (1472 °F): continues longer than 10 sec.

DTC set parameter:

- DOC inlet temperature sensor (T0) voltage: 4.92 V or more

Engine warning light:

- ON

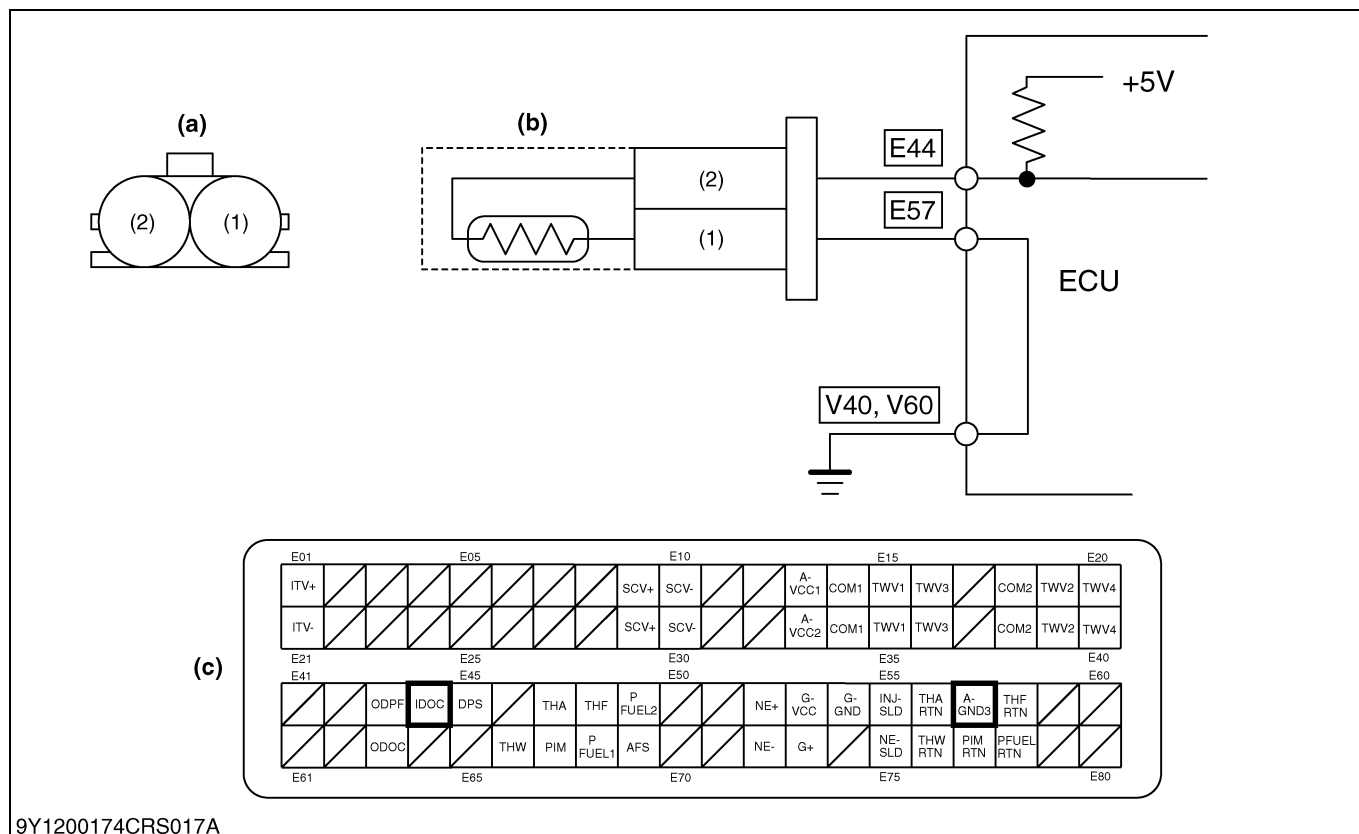
Limp home action by engine ECU (system action):

- 0 °C (32 °F) [default value]
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0959US0



9Y1200174CRS017A

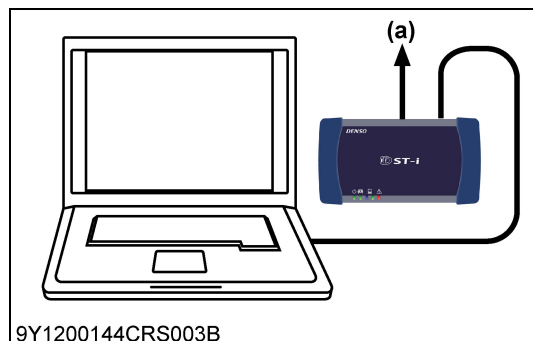
(1) Terminal A-GND3

(2) Terminal IDOC

(a) Terminal Layout
(b) Exhaust Gas Temperature Sensor 0 (T0)

(c) ECU Connector 1
(Engine Side)

9Y1200226CRS0960US0



9Y1200144CRS003B

1. Check the Exhaust Gas Temperature Sensor Signals

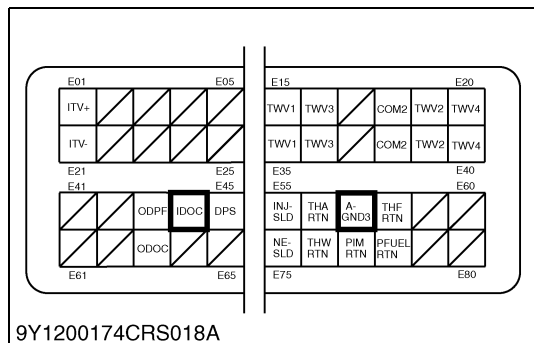
- Place the key switch in the ON position, and check the "Exhaust gas temperature" and "Exhaust gas temperature sensor output voltage" on the diagnosis tool data monitor.

Factory specification		
Actual exhaust gas temperature	Exhaust gas temperature	Output voltage
100 °C (212 °F)	100 °C (212 °F)	Approx. 4.4 V
150 °C (302 °F)	150 °C (302 °F)	Approx. 3.7 V
200 °C (392 °F)	200 °C (392 °F)	Approx. 3.0 V
250 °C (482 °F)	250 °C (482 °F)	Approx. 2.3 V

OK	Clear the DTC and check whether it is output again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Resistance Between Terminals".	

(a) CAN1 Connector

9Y1200226CRS0961US0



2. Measure the Resistance Between Terminals

- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals E44 and E57 of the connector.

Factory specification	
Temperature	Resistance
100 °C (212 °F)	Approx. 18.3 kΩ
150 °C (302 °F)	Approx. 7.88 kΩ
200 °C (392 °F)	Approx. 4.00 kΩ
250 °C (482 °F)	Approx. 2.30 kΩ

OK	Go to "4. Measure the ECU Terminal Voltage".
NG	Go to "3. Check the Sensor".

9Y1200226CRS0962US0

3. Check the Sensor

- Turn the key switch OFF, remove the connector from the sensor side and measure the resistance between the terminals on the sensor side.

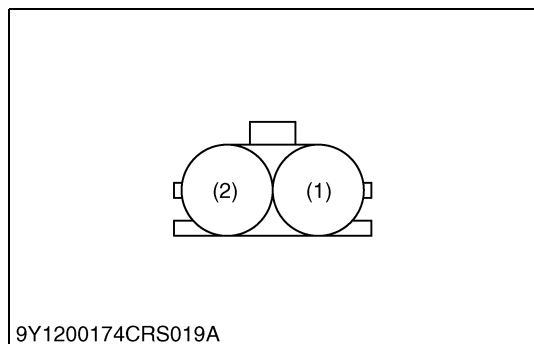
Factory specification	
Temperature	Resistance
100 °C (212 °F)	Approx. 18.3 kΩ
150 °C (302 °F)	Approx. 7.88 kΩ
200 °C (392 °F)	Approx. 4.00 kΩ
250 °C (482 °F)	Approx. 2.30 kΩ

OK	Wiring harness open circuit or connector fault → Check and repair.
NG	Exhaust gas temperature sensor fault → Replace the exhaust gas temperature sensor 0 (T0).

(1) Terminal A-GND3

(2) Terminal IDOC

9Y1200226CRS0963US0

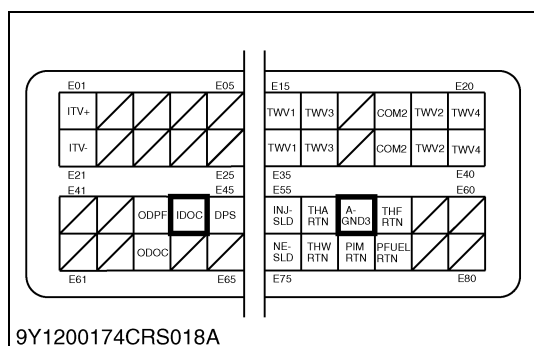


4. Measure the ECU Terminal Voltage

- Plug the ECU wiring harness connector into socket again, unplug the sensor connector, and measure the voltage between ECU terminals E44 and E57 at the ECU side.

Factory specification	Approx. 5 V
OK	The ECU connector is faulty or its wiring harness is shorted.
NG	Confirm by using other sensors that there is no ground short malfunction before replacing the ECU.

9Y1200226CRS0964US0



(27) Battery Voltage Abnormality (DTC P0562 / 168-4, P0563 / 168-3)

P0562 / 168-4: Battery voltage abnormality (Low side)

Behaviour during malfunction:

- Faulty starting
- Insufficient output
- Worsening exhaust gas performance
- Engine stops in some case

Detection item:

- Open circuit, short circuit or damage of harness
- Failure of battery

DTC set preconditions:

- Key switch is ON
- Starter Switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- ECU recognition of battery voltage is below 8 V in 12 V system
- Not monitored during cranking

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS0965US0

P0563 / 168-3: Battery voltage abnormality (High side)

Behaviour during malfunction:

- Faulty starting
- Insufficient output
- Worsening exhaust gas performance

Detection item:

- Open circuit, short circuit or damage of harness
- Failure of battery

DTC set preconditions:

- Key switch is ON
- Starter Switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- ECU recognition of battery voltage is above 16 V in 12 V system

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0966US0



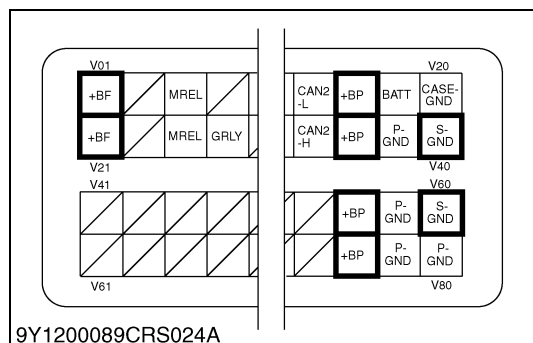
1. Place the key switch in the OFF position, attach the diagnosis tool to the CAN1 connector, and return the key switch to the ON position again. Then, check the "Battery voltage" status on the data monitor.
2. Change the engine operation status, and check the "Battery voltage".

NOTE

- Try to change the engine speed as the generated voltage changes accordingly.

(a) CAN1 Connector

9Y1200226CRS0968US0



2. Check the ECU Terminal Voltage (Part 1)

1. Change the engine operation status, and measure the voltage between ECU terminals V18 / V38 / V58 / V78 and V40 / V60 and between terminals V01 / V02 and V40 / V60.

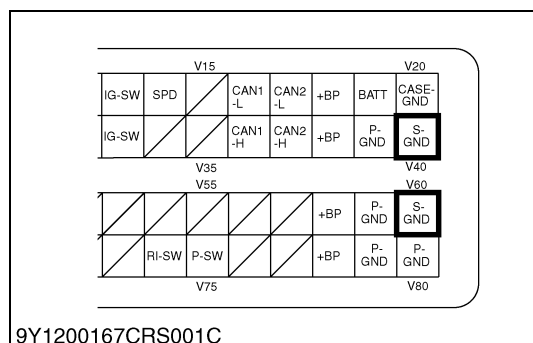
Factory specification	8 V or higher, 15 V or lower (except intense cold temperature)
-----------------------	---

NOTE

- Try to change the engine speed as the generated voltage changes accordingly.

OK	Check the harness connectors and ECU pins.	
	OK	Faulty ECU → Replace.
	NG	Repair or replace the wiring harness, or replace the ECU.
NG	Go to "3. Check the ECU Terminal Voltage (Part 2)".	

9Y1200226CRS0969US0



3. Check the ECU Terminal Voltage (Part 2)

1. Change the engine operation status, and measure the voltage between ECU terminal V40 / V60 and chassis ground terminal.

Factory specification	Always 0.5 V or lower
-----------------------	-----------------------

NOTE

- Try to change the engine speed as the generated voltage changes accordingly.

OK	1. Check the charging system, the battery itself, wiring harness and cables. → Repair the faulty area. 2. Locate the cause of excessively high or low voltage.
NG	Check the wiring harness between ECU terminal and the body ground terminal. → Repair the defects.

9Y1200226CRS0970US0

(28) QR Data Abnormality (DTC P0602/523538-2, P0602/523538-7)**P0602 / 523538-2: QR data error****Behaviour during malfunction:**

- Insufficient output

Detection item:

- QR data read error from EEPROM

DTC set preconditions:

- Key switch is ON

DTC set parameter:

- QR correction data exceeds threshold value
- Multiple check error (QR correction data for each injector has been stored in three locations. When this data is read and compared, an error is determined if there is difference in all three values.)

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Nozzle calibration is not executed
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0971US0

P0602 / 523538-7: No QR data**Behaviour during malfunction:**

- Insufficient output

Detection item:

- Area of QR data on EEPROM is vacant.

DTC set preconditions:

- Key switch is ON

DTC set parameter:

- When QR correction data fails to write to the EEPROM (When the initial ECU value is "0", an error that QR data is not written to the disc at the time of vehicle shipment is detected.)

Engine warning light:

- ON

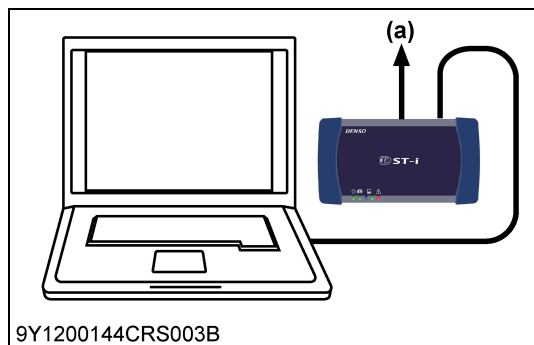
Limp home action by engine ECU (system action):

- Nozzle correction factor = 0 [default value]
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0972US0

**1. Write the QR Codes and Read the DTC Again**

1. Using the diagnosis tool, write the correct QR codes in the ECU.
2. Clear the DTC and check whether the same DTC is output again or not.

Factory specification	OK
OK	An electromagnetic interference (EMI) may have caused the temporary malfunction. There is no problem if the system has recovered.
NG	Faulty Engine ECU.

(a) **CAN1 Connector**

9Y1200226CRS0973US0

(29) ECU Flash-ROM and CPU Abnormality (DTC P0605 / 628-2, P0606 / 1077-2, P0606/ 523527-2)

P0605 / 628-2: ECU Flash-ROM error

Behaviour during malfunction:

- Engine stops

Detection item:

- FLASH ROM error

DTC set preconditions:

- Key switch is ON

DTC set parameter:

- 3 times or more consecutive inconsistencies in checksum

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Engine stopped without delay

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0974US0

P0606 / 1077-2: ECU CPU (Main IC) error

Behaviour during malfunction:

- Engine stops

Detection item:

- Failure of CPU

DTC set preconditions:

- Key switch is ON
- Battery voltage is 10 V or more
- Starter Switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- CPU abnormality counter ≥ 5 times (RUN pulse abnormality occurs 5 times or more)

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Engine Stop

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0975US0

P0606 / 523527-2: ECU CPU (Monitoring IC) error

Behaviour during malfunction:

- Engine stops

Detection item:

- Failure of monitoring IC of CPU

DTC set preconditions:

- Key switch is ON
- Battery voltage is 10 V or more
- Starter Switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Abnormality continues for 2000 msec or more after the ECU is turned ON
- RUN pulse abnormality
- Above conditions occur continuously for 700 msec or more

Engine warning light:

- ON

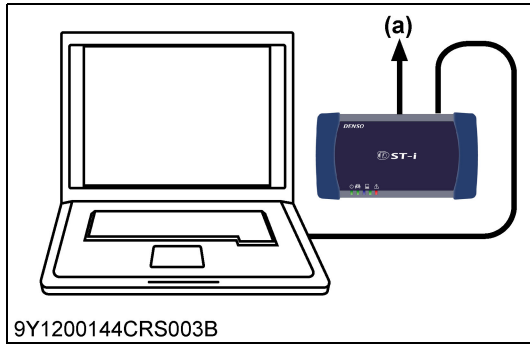
Limp home action by engine ECU (system action):

- Engine Stop

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0976US0

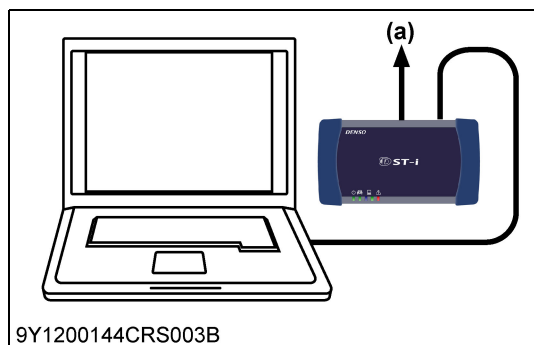
**1. Check the DTC**

1. Place the key switch in the OFF position, attach the diagnosis tool to the CAN1 connector, and return the key switch to the ON position again.
2. Clear the DTC, and check whether the same DTC (P0605 or P0606) is output again or not.

Factory specification	No DTC is output.
OK	An electromagnetic interference (EMI) may have caused the temporary malfunction. There is no problem if the system has recovered.
NG	Faulty Engine ECU → Replace.

(a) CAN1 Connector

9Y1200226CRS0977US0

**1. Checking Whether the DTC Is Detected Again**

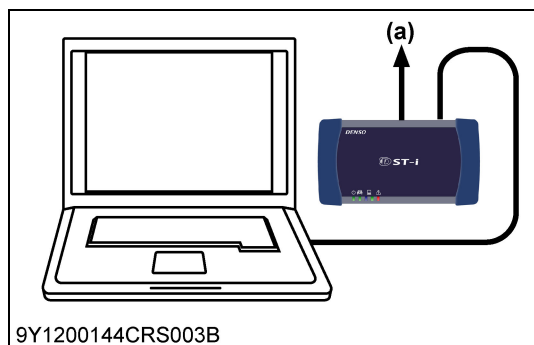
1. Turn the key switch OFF and then ON again.
2. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
3. Check whether or not the same DTC (P0611) is detected.

Factory specification	DTC is not detected.
-----------------------	----------------------

OK	It could be a temporary malfunction caused by obstructions to the radio waves, so as long as it recovers to normal operation there is no problem.
NG	Go to "2. Replacing the Injector and Checking Whether the DTC Is Detected Again".

(a) CAN1 Connector

9Y1200226CRS0980US0

**2. Replacing the Injector and Checking Whether the DTC Is Detected Again**

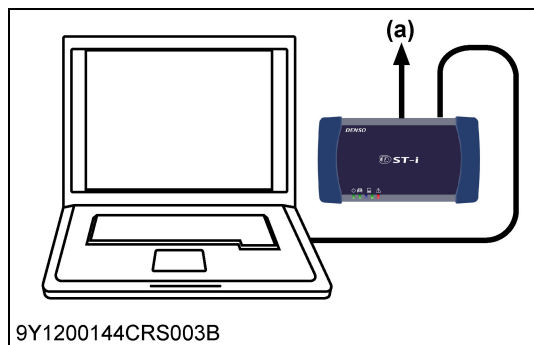
1. Replace the injector.
2. Turn the key switch OFF and then ON again.
3. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
4. Check whether or not the same DTC (P0611) is detected.

Factory specification	DTC is not detected.
-----------------------	----------------------

OK	Injector fault → Replace the injector.
NG	Go to "3. Replacing the ECU and Checking Whether the DTC Is Detected Again".

(a) CAN1 Connector

9Y1200226CRS0981US0

**3. Replacing the ECU and Checking Whether the DTC Is Detected Again**

1. Replace the ECU.
2. Turn the key switch OFF and then ON again.
3. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
4. Check whether or not the same DTC (P0611) is detected.

Factory specification	DTC is not detected.
-----------------------	----------------------

OK	ECU fault → Replace the ECU.
-----------	------------------------------

(a) CAN1 Connector

9Y1200226CRS0982US0

(31) SCV Drive System Abnormality (DTC P0628 / 1347-4, P0629 / 1347-3)**P0628 / 1347-4: SCV drive system error****Behaviour during malfunction:**

- Insufficient output
- Worsening exhaust gas performance

Detection item:

- Open circuit or ground short circuit of SCV

DTC set preconditions:

- Battery voltage is normal
- Key switch is ON
- Starter Switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Open circuit or ground short of SCV

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Intake throttle 100 % open
- Engine forcibly stopped 60 sec later

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0983US0

P0629 / 1347-3: +B short circuit of SCV**Behaviour during malfunction:**

- Insufficient output
- Worsening exhaust gas performance

Detection item:

- +B short circuit of SCV

DTC set preconditions:

- Battery voltage is normal
- Key switch is ON
- Starter Switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- +B short circuit of SCV

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Intake throttle 100 % open
- Engine forcibly stopped 60 sec later

Recovery from error:

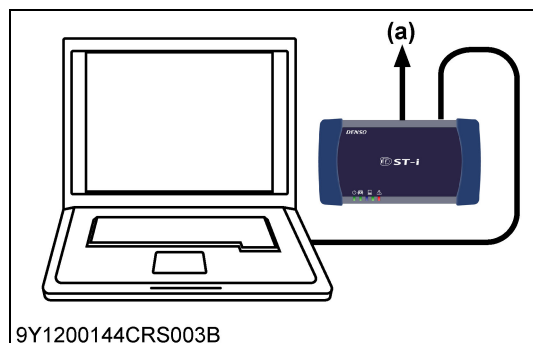
- Key switch turn OFF

9Y1200226CRS0984US0



(c) ECU Connector 1
(Engine Side)

9Y1200226CRS0985US0



1. Check the SCV Current

- Place the key switch in the ON position, and check the "Target SCV current" and "Actual SCV current" on the diagnosis tool data monitor.

Factory specification

- The "Actual SCV current value" always follow to the "Target SCV current value".
 - When idling: Approx. 1800 mA
 - Accelerator opening: 0→100 %
(During acceleration): Approx. 1400 mA minimum
 - During no-load maximum speed: Approx. 1600 mA

The numerical value is stable under normal operating and the target value corresponds with actual pressure value.

*** The current shall be used as a reference only as this value varies depending on the pump used.**

- The "Pressure feedback integral guard executing flag" must be OFF.
- The "Pump deviation learning correction value" must be within ± 200 mA.

NOTE

- As the following value of A varies depending on pump, the table above is for guideline. If the value of A has a wider shift than the initial learning value, there may be out of the range of the above table. A net normal value is the value that provided by the forced-learning several times.: Compared with A 12 V spec.: $A-100 \leq \text{normal value} \leq A+50$
Therefore, if the value is out of the range above, perform the forced-learning.

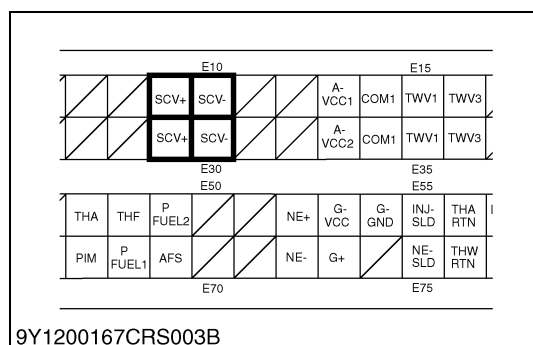
OK	Clear the DTC and check whether it is output again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Resistance Between Terminals".	

(a) CAN1 Connector

9Y1200226CRS0986US0

2. Measure the Resistance Between Terminals

- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals E9 / E29 and E10 / E30 of the connector.

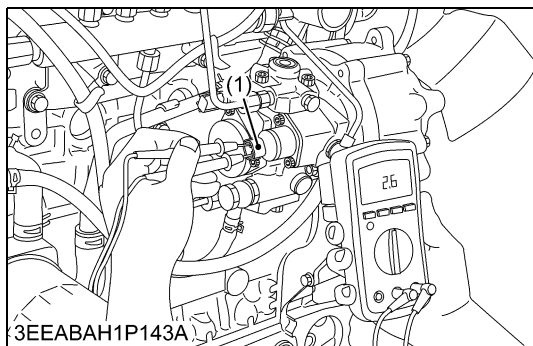


Factory specification

Item	Temperature	Resistance
Resistance	20 °C (68 °F)	Approx. 2.1 Ω
Insulation resistance (between terminal valves)	20 °C (68 °F)	100 M Ω or higher

OK	Go to "4. Measure the ECU Terminal Voltage".
NG	Go to "3. Check the SCV".

9Y1200226CRS0987US0



3. Check the SCV

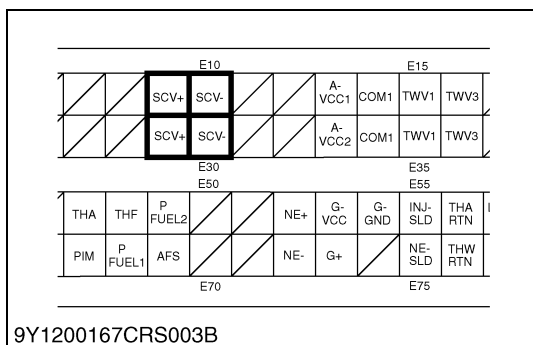
1. Turn the key switch OFF, remove the connector from the SCV side and measure the resistance between the terminals on the SCV side.

Factory specification		
Item	Temperature	Resistance
Resistance	20 °C (68 °F)	Approx. 2.1 Ω
Insulation resistance (between terminal valves)	20 °C (68 °F)	100 MΩ or higher

OK	Wiring harness open circuit or connector fault → Check and repair.
NG	SCV fault → Replace the SCV or supply pump unit (under warranty).

(1) SCV (Suction Control Valve)

9Y1200226CRS0988US0



9Y1200167CRS003B

4. Measure the ECU Terminal Voltage

1. Unplug the ECU wiring harness connector 1 from socket, and measure the voltage between ECU terminals E9 / E29 and E10 / E30 and the ground (at the wiring harness side).

Factory specification	Both must be approx. 0 V.
-----------------------	---------------------------

OK	Normal.
NG	Repair the wiring harness.

9Y1200226CRS0989US0

(32) Sensor Supply Voltage 1 Abnormality (DTC P0642 / 3509-4, P0643 / 3509-3)

P0642 / 3509-4: Sensor supply voltage 1 abnormality (Low side)

Behaviour during malfunction:

- Faulty starting
- Insufficient output
- Worsening exhaust gas performance
- Engine stops in some case

Detection item:

- Sensor supply voltage 1 error or recognition error

DTC set preconditions:

- Battery voltage is normal
- Key switch turn ON
- Starter Switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Voltage to sensor is below 4.375 V

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0990US0

P0643 / 3509-3: Sensor supply voltage 1 abnormality (High side)

Behaviour during malfunction:

- Faulty starting
- Insufficient output
- Worsening exhaust gas performance
- Engine stops in some case

Detection item:

- Sensor supply voltage 1 error or recognition error

DTC set preconditions:

- Battery voltage is normal
- Key switch turn ON
- Starter Switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Voltage to sensor is above 5.625 V

Engine warning light:

- ON

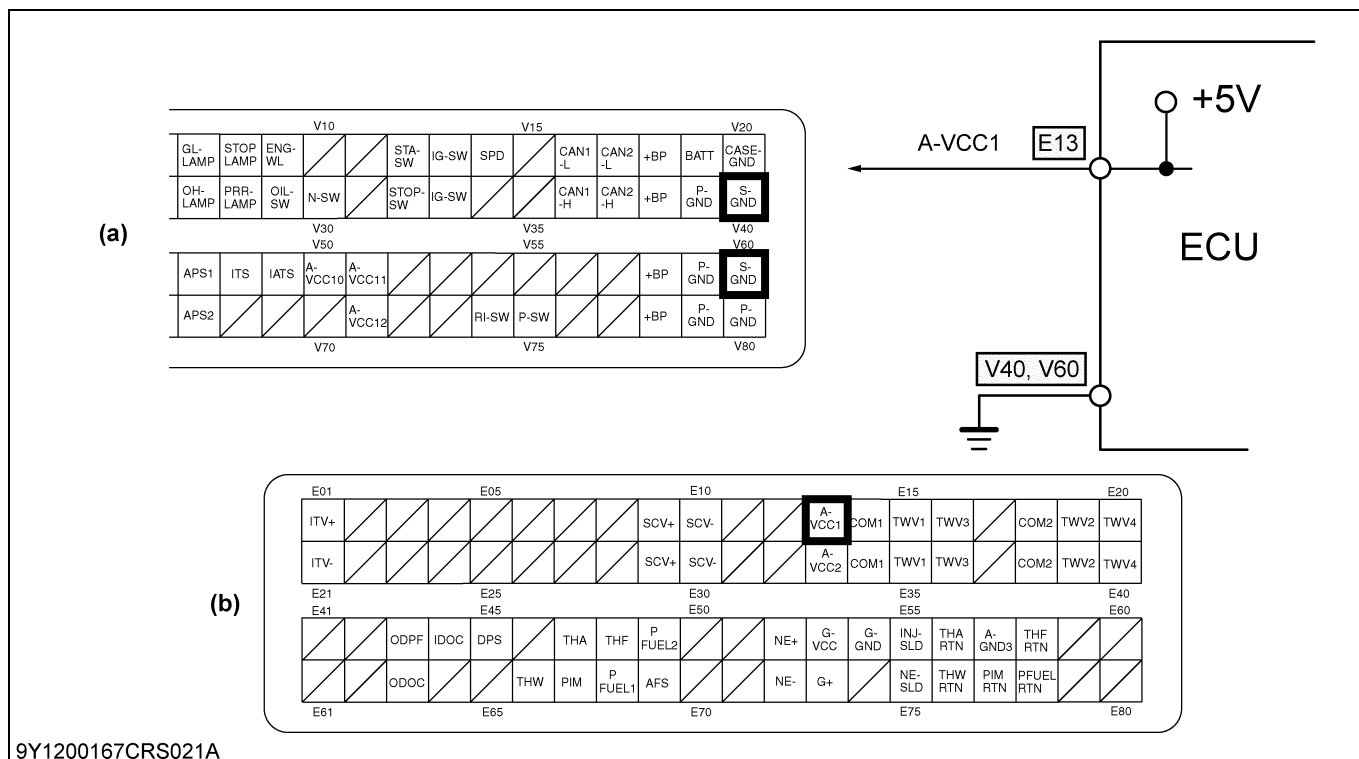
Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

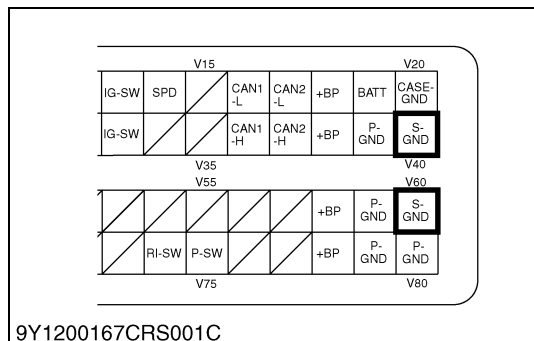
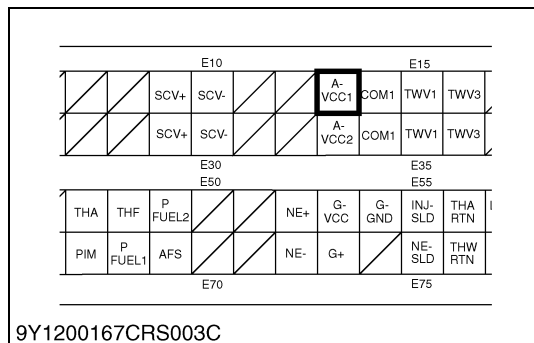
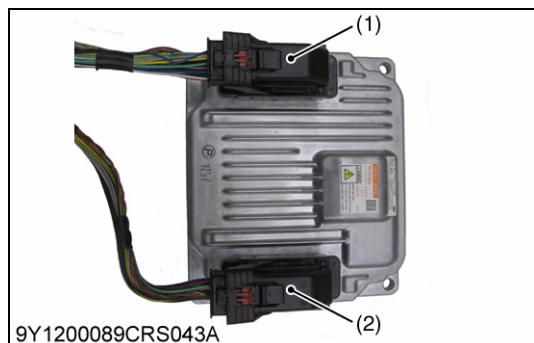
9Y1200226CRS0991US0



9Y1200167CRS021A

(a) ECU Connector 2
(Machine Side)(b) ECU Connector 1
(Engine Side)

9Y1200226CRS0992US0



1. Measure the ECU Terminal Voltage

- Place the key switch in the OFF position, and unplug the ECU wiring harness connector 1 (1) from the socket.
- Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals E13 and V40 / V60.

Factory specification	Approx. 5 V
OK	Check the wiring harness (ECU terminal E13) for a short. → Repair the faulty area.
NG	Check the harness connectors and ECU pins.
OK	Faulty ECU → Replace.
NG	Repair or replace the wiring harness, or replace the ECU.

- (1) ECU Wiring Harness Connector 1 (Engine Side) (2) ECU Wiring Harness Connector 2 (Machine Side)

9Y1200226CRS0993US0

(33) Sensor Supply Voltage 2 Abnormality (DTC P0652 / 3510-4, P0653 / 3510-3)

P0652 / 3510-4: Sensor supply voltage 2 abnormality (Low side)

Behaviour during malfunction:

- Faulty starting
- Insufficient output
- Worsening exhaust gas performance

Detection item:

- Sensor supply voltage 2 error or recognition error

DTC set preconditions:

- Battery voltage is normal
- Key switch turn ON
- Starter Switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Voltage to sensor is below 4.375 V

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Key switch turn OFF

9Y1200226CRS0994US0

P0653 / 3510-3: Sensor supply voltage 2 abnormality (High side)

Behaviour during malfunction:

- Faulty starting
- Insufficient output
- Worsening exhaust gas performance

Detection item:

- Sensor supply voltage 2 error or recognition error

DTC set preconditions:

- Battery voltage is normal
- Key switch turn ON
- Starter Switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Voltage to sensor is above 5.625 V

Engine warning light:

- ON

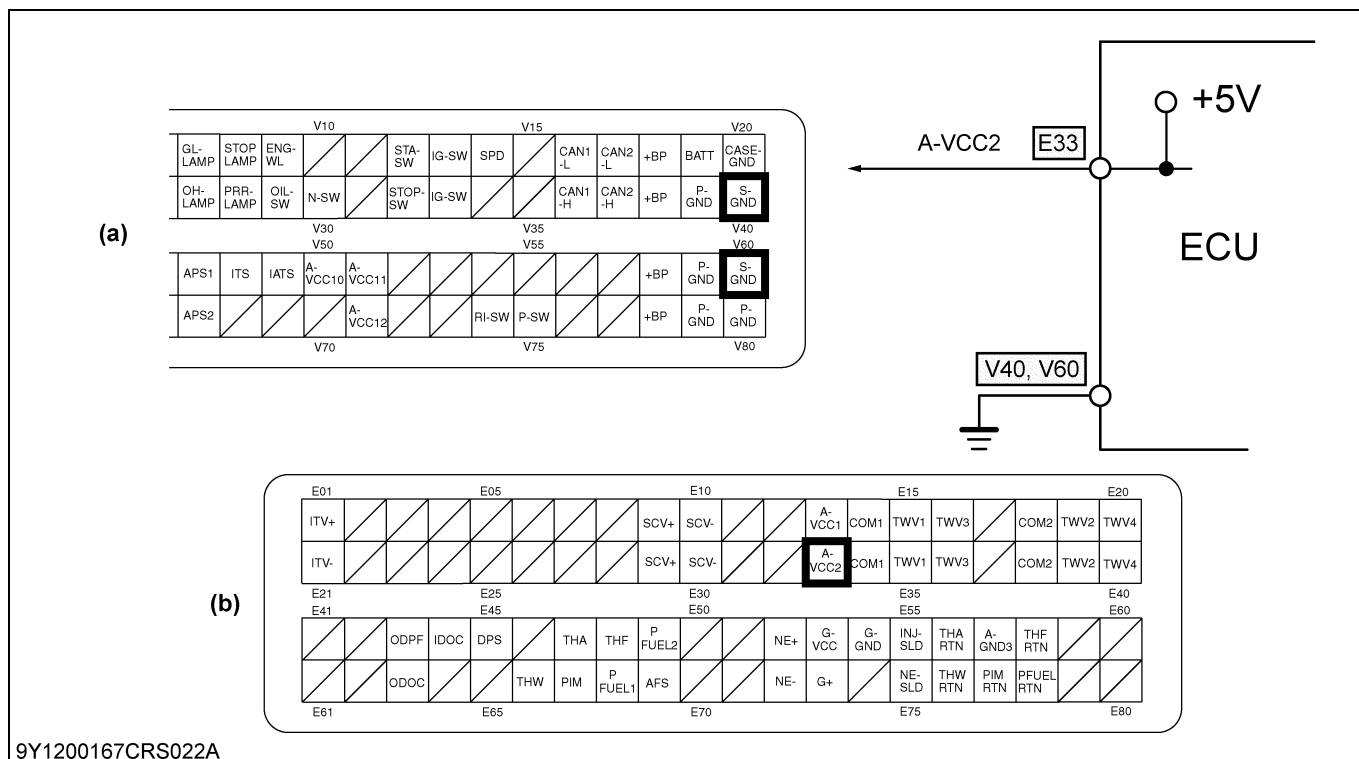
Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition

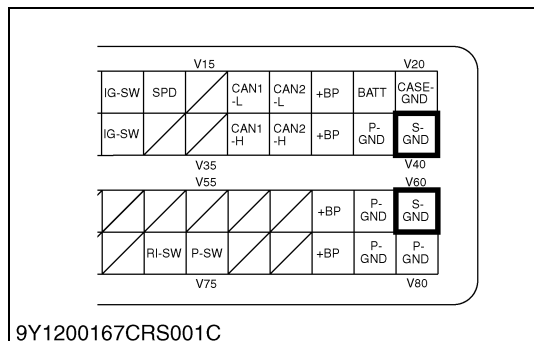
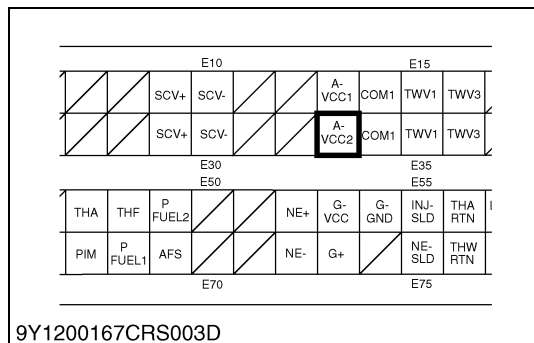
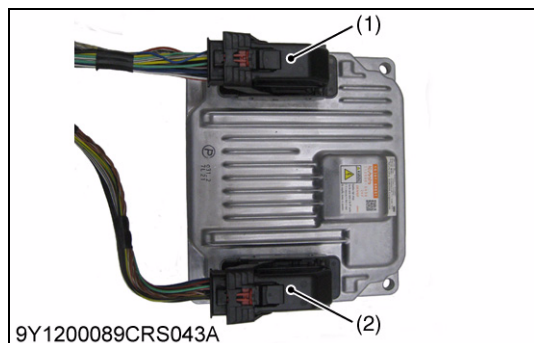
Recovery from error:

- Key switch turn OFF

9Y1200226CRS0995US0

(a) ECU Connector 2
(Machine Side)(b) ECU Connector 1
(Engine Side)

9Y1200226CRS0996US0

**1. Measure the ECU Terminal Voltage**

- Place the key switch in the OFF position, and unplug the ECU wiring harness connector 1 (1) from the socket.
- Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals E33 and V40 / V60.

Factory specification	Approx. 5 V
OK	Check the wiring harness (ECU terminal E33) for a short. → Repair the faulty area.
NG	Check the harness connectors and ECU pins.
OK	Faulty ECU → Replace.
NG	Repair or replace the wiring harness, or replace the ECU.

- (1) ECU Wiring Harness Connector 1 (Engine Side) (2) ECU Wiring Harness Connector 2 (Machine Side)

9Y1200226CRS0997US0

(34) Main Relay is Locked in Closed Position (DTC P0687 / 1485-2)

Behaviour during malfunction:

- Dead battery

Detection item:

- Failure of main relay

DTC set preconditions:

- Key switch is OFF
- Engine stops

DTC set parameter:

- Main relay stays active longer than 1 sec. without command

Engine warning light:

- OFF

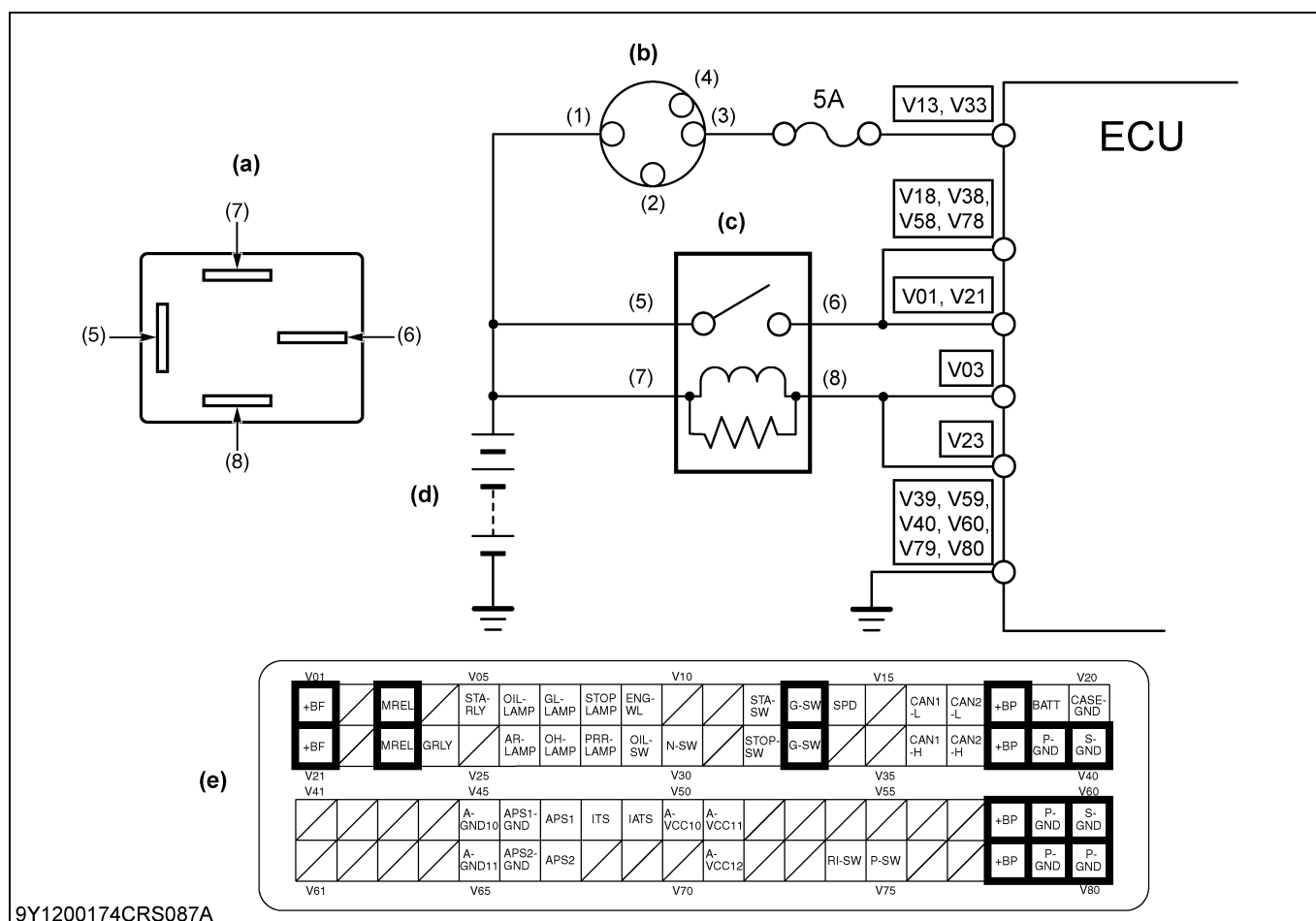
Limp home action by engine ECU (system action):

- None

Recovery from error:

- Diagnostic counter = zero

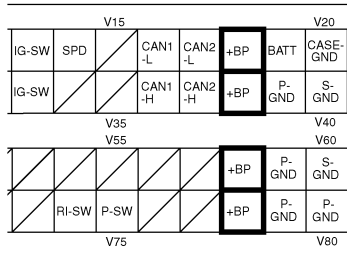
9Y1200226CRS0998US0



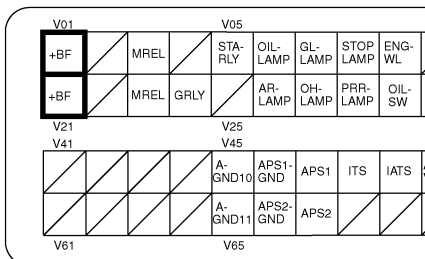
9Y1200174CRS087A

- | | | | |
|---------------------|----------------|--------------------------------|---------------------|
| (1) Input Terminal | (5) Terminal 1 | (a) Main Relay Terminal Layout | (d) Battery |
| (2) ACC | (6) Terminal 2 | (b) Key Switch | (e) ECU Connector 2 |
| (3) Output Terminal | (7) Terminal 3 | (c) Main Relay | (Machine Side) |
| (4) START | (8) Terminal 4 | | |

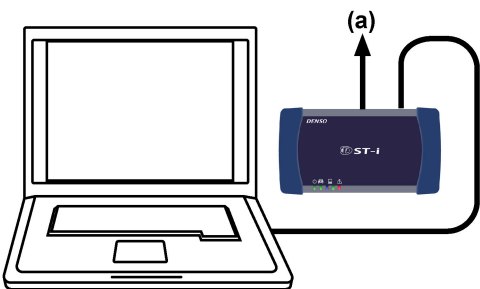
9Y1200226CRS0999US0



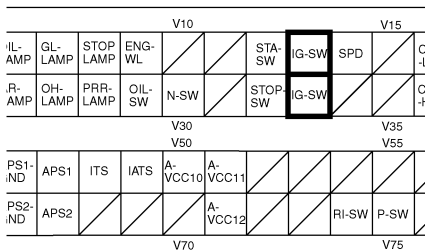
9Y1200167CRS001D



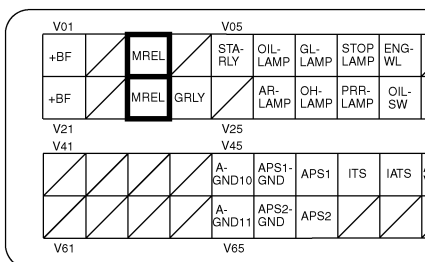
9Y1200167CRS024A



9Y1200144CRS003B



9Y1200167CRS025A



9Y1200167CRS024B

1. Measure the ECU Terminal Voltage

- Place the key switch in the OFF position, and measure the voltage between ECU terminals V18 / V38 / V58 / V78 and V01 / V21 and the chassis ground.

Factory specification	0 V
-----------------------	-----

OK	Clear the DTC and check whether it is detected again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Check the Key Switch Signal".	

9Y1200226CRS1000US0

2. Check the Key Switch Signal

- Place the key switch in the OFF position, attach the diagnosis tool to the CAN1 connector, and return the key switch to the ON position again.
- Using the data monitor function of diagnosis tool, check the "Key switch" data when the key switch is placed in the OFF position.

Factory specification	OFF
-----------------------	-----

OK	Go to "4. Check the ECU Terminal Voltage".
NG	Go to "3. Check the IG-SW Signal".

(a) CAN1 Connector

9Y1200226CRS1001US0

3. Check the IG-SW Signal

- Place the key switch in the OFF position, and measure the voltage at ECU terminal V13 / V33.

Factory specification	0 V
-----------------------	-----

OK	Go to "4. Check the ECU Terminal Voltage".
NG	1. Check the wiring harness and the key switch. → Repair. 2. Locate the cause of constant voltage supply to the wiring harness.

9Y1200226CRS1002US0

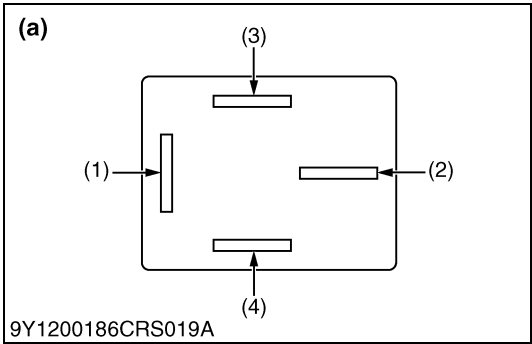
4. Check the ECU Terminal Voltage

- Keep the key switch in the OFF position, and measure the voltage at ECU main relay terminals V03 and V23.

Factory specification	10 V or higher
-----------------------	----------------

OK	Go to "5. Measure the Resistance Between Relay Terminals (for Confirmation)".
NG	1. Check the wiring harness between relay and ECU and connectors. → Repair. 2. Locate the cause of constant shorted wiring harness to the ground.

9Y1200226CRS1003US0



5. Measure the Resistance Between Relay Terminals (for Confirmation)

1. Remove the main relay, and measure the resistance between each relay terminal.

Example of main relay terminal layout

Factory specification	Between terminals (3) and (4): Coil resistance value of relay to use Between terminals (1) and (2): Infinity
-----------------------	--

NG	Faulty main relay → Replace.
----	------------------------------

- (1) Terminal 1 (Contact Terminal)

(2) Terminal 2 (Contact Terminal)

(3) Terminal 3 (Coil Operating Terminal)

(4) Terminal 4 (Coil Operating Terminal)
- (a) Terminal Layout

9Y1200226CRS1004US0

(35) Pump Seizing (DTC P1274 / 523539-2, P1275 / 523540-2)

P1274 / 523539-2: Pump seizing 1

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas performance

Detection item:

- High pressure 1 error

DTC set preconditions:

- Sensor supply voltage VCC# is normal
- Rail pressure sensor is normal

DTC set parameter (Approximate parameter):

- Rail pressure of 230 MPa (2350 kgf/cm², 33400 psi) or more continues 1 second under the condition of above 800 min⁻¹ (rpm)
- Rail pressure of 220 MPa (2250 kgf/cm², 31900 psi) or more continues 1 second under the condition of below 800 min⁻¹ (rpm) [Threshold changes depending on the engine speed. 700 min⁻¹ (rpm) should be used as a reference]

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1005US0

P1275 / 523540-2: Pump seizing 2

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas performance

Detection item:

- High pressure 2 error

DTC set preconditions:

- Sensor supply voltage VCC# is normal
- Rail pressure sensor is normal

DTC set parameter (Approximate parameter):

- Rail pressure of above 197 MPa (2010 kgf/cm², 28600 psi), and below 230 MPa (2350 kgf/cm², 33400 psi) continues total time for 35 seconds under condition of above 800 min⁻¹ (rpm) [Threshold changes depending on the engine speed. 2000 min⁻¹ (rpm) should be used as a reference]
- Or, rail pressure of above 220 MPa (2250 kgf/cm², 31900 psi) continues total time for 1.7 second under condition of below 800 min⁻¹ (rpm) [Threshold changes depending on the engine speed. 700 min⁻¹ (rpm) should be used as a reference]

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1006US0

Diagnostic Procedure for Pressure System DTCs

Checking of fault conditions and actions taken

If DTCs of non-pressure system are detected (*Refer to the pressure system DTCs given below.)

First locate the non-pressure system problem indicated by DTCs, and repair the affected parts. After the repair has been carried out, check for an output of pressure system DTCs. If so, begin the diagnosis of the affected pressure system.

If only pressure system DTCs are detected (*Refer to the pressure system DTCs given below.)

Diagnose the affected pressure system indicated by DTCs.

If a DTC currently exists

Begin diagnosis without returning the key switch to the OFF position. However, carefully make satisfactory / unsatisfactory judgments as the injection amount and rail pressure are limited by system actions.

If only a past DTC exists

Log the freeze-frame data, clear the DTCs, and stop the engine. Then, try to reproduce the problem using the freeze-frame data and the trouble check sheet.

Pressure system DTCs*[High pressure abnormality]**

1. P0088: High rail pressure

[Low pressure abnormality]

1. P0087: Pressure limiter emergency open
2. P0093: Fuel leak

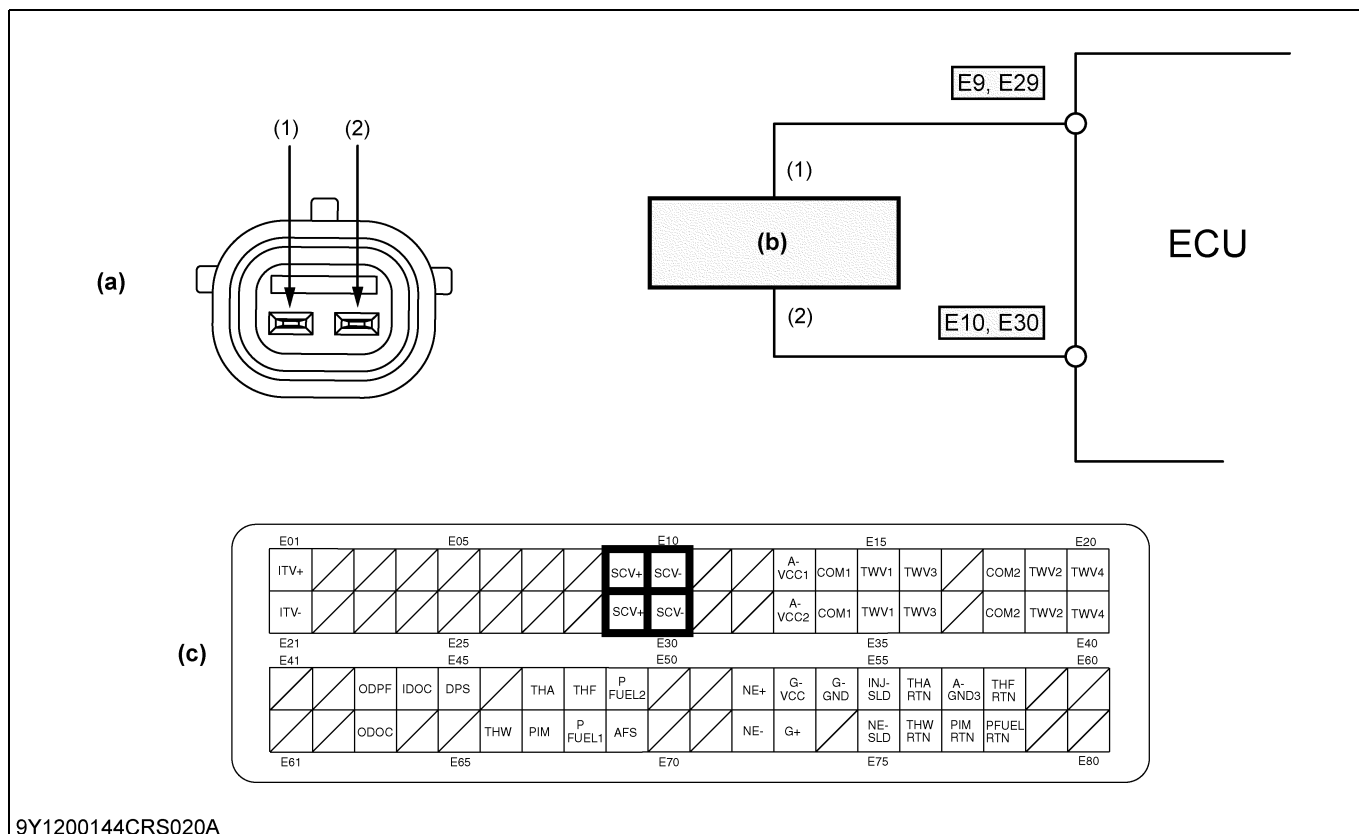
[Abnormal pressure]

1. P0089: SCV stuck
2. P1274: Pump seizing 1
3. P1275: Pump seizing 2

■ IMPORTANT

- Multiple pressure system DTCs may be output simultaneously. Also, both abnormal high pressure and abnormal low pressure may be reported simultaneously under certain malfunction conditions.

9Y1200226CRS1007US0



9Y1200144CRS020A

(1) Terminal SCV+

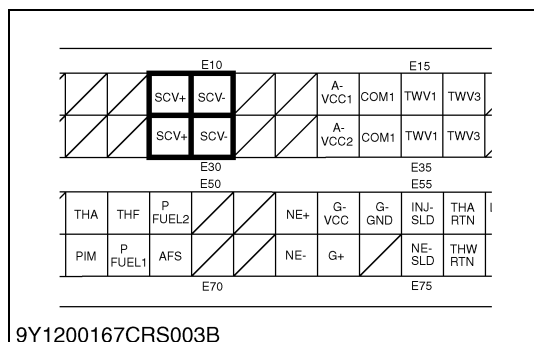
(2) Terminal SCV-

(a) Terminal Layout

(b) SCV (Suction Control Valve)

(c) ECU Connector 1
(Engine Side)

9Y1200226CRS1008US0



9Y1200167CRS003B

1. Measure the Resistance Between SCV Terminals

- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals E9 / E29 and E10 / E30 of the connector.

Factory specification		
Item	Temperature	Resistance
Resistance	20 °C (68 °F)	Approx. 2.1 Ω
Insulation resistance (between terminal and valve)	20 °C (68 °F)	100 MΩ or higher

OK	Go to "3. Check the Fuel System for the Existence of Air".
NG	Go to "2. Measure the Resistance Between Terminals of SCV Unit".

9Y1200226CRS1009US0

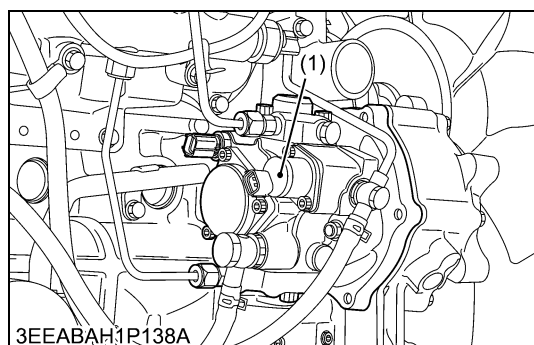
2. Measure the Resistance Between Terminals of SCV Unit

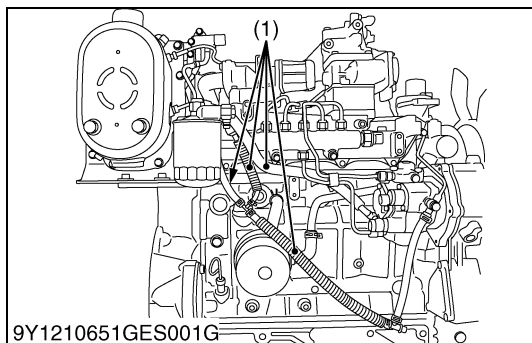
- Refer to the SCV unit inspection procedures.
(Refer to page 1-S215)

OK	Wiring harness open circuit or connector fault → Check and repair.
NG	Faulty SCV → Replace the SCV or supply pump unit (under warranty).

(1) SCV (Suction Control Valve)

9Y1200226CRS1010US0





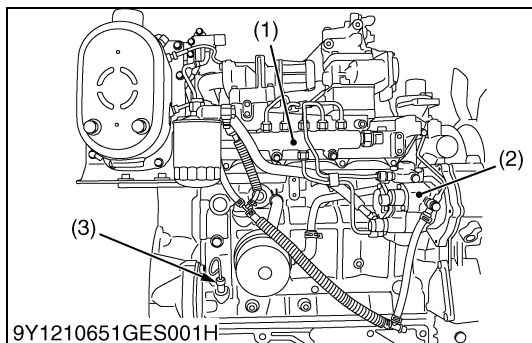
3. Check the Fuel System for the Existence of Air

1. Check each joint of the fuel system for the existence of air.
To detect the existence of air effectively, replace the fuel hose with a transparent one.

OK	Go to "4. Check the Fuel System".
NG	1. Rotate the fuel feed pump sufficiently and bleed the air. 2. Locate the position of the fuel leakage in the piping and repair it.

(1) Fuel Hose

9Y1200226CRS1011US0



4. Check the Fuel System

CAUTION

- Visually check there is no leak in the high pressure fuel pipe system.
- A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.

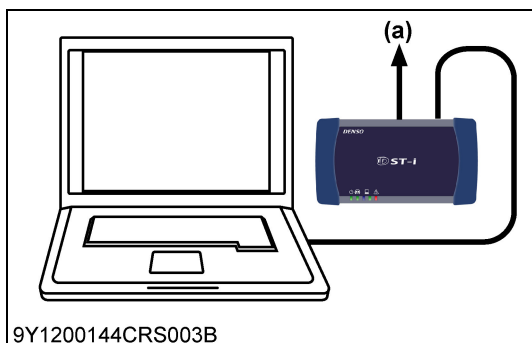
1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	5. Check the data related to the rail pressure
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

(1) Rail
(2) Supply Pump

(3) Dipstick

9Y1200226CRS1012US0



5. Check the Data Related to the Rail Pressure

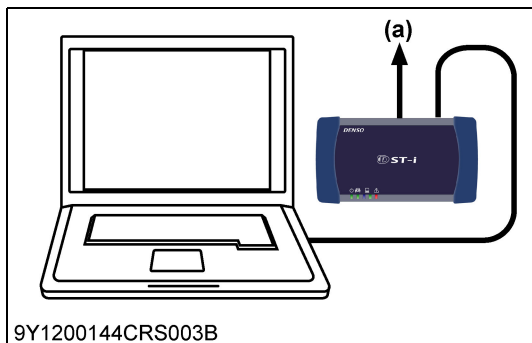
1. Connect the diagnosis tool to the CAN1 connector, and select the "Actual rail pressure" and "Target rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure"
	<ol style="list-style-type: none"> 1. When idling: 40 to 50 MPa (410 to 500 kgf/cm², 5800 to 7200 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 95.0 to 130 MPa (969 to 1320 kgf/cm², 13800 to 18800 psi) 3. No-load maximum speed: 95.0 to 115 MPa (969 to 1170 kgf/cm², 13800 to 16600 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.

OK	Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.
NG	Go to "6. Check the Rail Pressure Sensor".

(a) CAN1 Connector

9Y1200226CRS1013US0



6. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)

1. Check the rail pressure sensor.

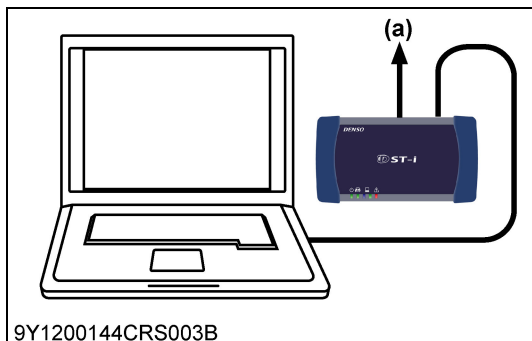
■ NOTE

- Closely check sensor signals for a noise component and an abnormality that exists for a short time.

OK	Go to "7. Check the SCV-related Data".
NG	Replace the rail assembly or its related parts. (Follow the diagnostic procedure of items P0192 and P0193.) (Refer to page 1-S165)

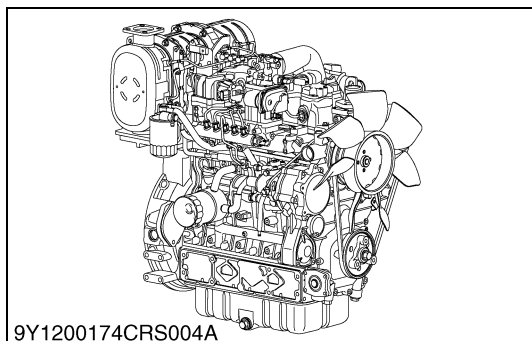
(a) CAN1 Connector

9Y1200226CRS1014US0



7. Check the SCV-related data

1. Check the "Target rail pressure", "Actual rail pressure", "Target SCV current", "Actual SCV current", "Pump deviation learning status", "Pump deviation learning correction value" and "Pressure feedback integral guard execution flag" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.



Factory specification	<ol style="list-style-type: none"> 1. The "Actual SCV current value" always follow to the "Target SCV current value". <ul style="list-style-type: none"> • When idling: Approx. 1800 mA • Accelerator opening: 0→100 % (During acceleration): Approx. 1400 mA minimum • During no-load maximum speed: Approx. 1600 mA • The numerical value is stable under normal operating and the target value corresponds with actual pressure value.
	<p>* The current shall be used as a reference only as this value varies depending on the pump used.</p> <ol style="list-style-type: none"> 2. The "Pressure feedback integral guard executing flag" must be OFF. 3. The "Pump deviation learning correction value" must be within ± 200 mA.
	<h3>■ NOTE</h3> <ul style="list-style-type: none"> • As the following value of A varies depending on pump, the table above is for guideline. If the value of A has a wider shift than the initial learning value, there may be out of the range of the above table. A net normal value is the value that provided by the forced-learning several times.: Compared with A 12 V spec.: $A - 100 \leq \text{normal value} \leq A + 50$ <p>Therefore, if the value is out of the range above, perform the forced-learning.</p>

■ NOTE

- "Pump difference learning status"

It must be "2" (Learning completed) or "3" (During relearning). If not, keep idling the engine after warming up and when the learning status becomes "2" or "3", make the judgment. Occasionally, it does not shift from 3 to 2. Perform pump difference learning to take into account the above status, then compare with the status before learning.

OK	After confirming that an intermittent malfunction (such as power supply system or noise generation) does not occur in relation to the ECU, replace the ECU.
NG	Replace the SCV or supply pump unit (under warranty).

(a) CAN1 Connector

9Y1200226CRS1015US0

(36) EEPROM Check Sum Error (DTC P1990 / 523700-13)

P1990 / 523700-13: EEPROM check sum error

Behaviour during malfunction:

- None

Detection item:

- KBT-EEPROM check sum error

DTC set preconditions:

- Battery voltage is normal

DTC set conditions (Guideline):

- EEPROM check sum error

Engine warning light:

- ON

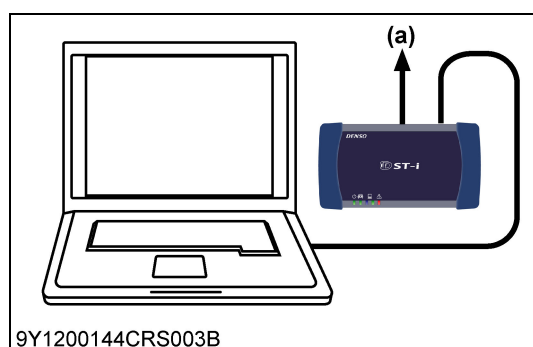
Limp home action by engine ECU (system action):

- None

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1016US0



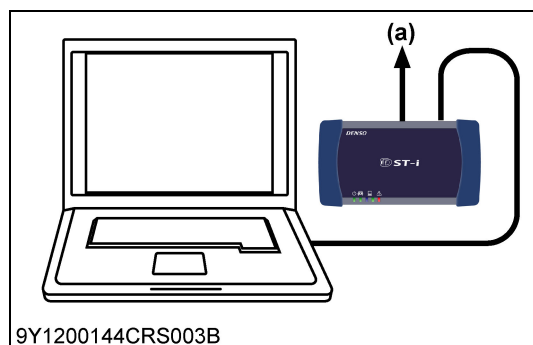
1. Check the DTC

1. Place the key switch in the OFF position, attach the diagnosis tool to the CAN1 connector, and return the key switch to the ON position again.
2. Clear the DTC, and check whether the same DTC is output again or not.

Factory specification	No DTC is output.
OK	An electromagnetic interference (EMI) may have caused the temporary malfunction. There is no problem if the system has recovered.
NG	Go to "2. Write the Trim Data and Read the DTC Again".

(a) CAN1 Connector

9Y1200226CRS1017US0



2. Write the Trim Data and Read the DTC Again

1. Using the diagnosis tool, write the correct trim data in the ECU.
2. Clear the DTC and check whether the same DTC is output again or not.

Factory specification	No DTC is output.
OK	An electromagnetic interference (EMI) may have caused the temporary malfunction. There is no problem if the system has recovered.
NG	Faulty Engine ECU → Replace.

(a) CAN1 Connector

9Y1200226CRS1018US0

(37) Intake Throttle Feedback Error (DTC P2108 / 523580-2)

Behaviour during malfunction:

- None

Detection item:

- Intake throttle feedback error

DTC set preconditions:

- Battery voltage is normal

DTC set parameter (Approximate parameter):

- Deviation of throttle position is not corrected in 20 times

Engine warning light:

- ON

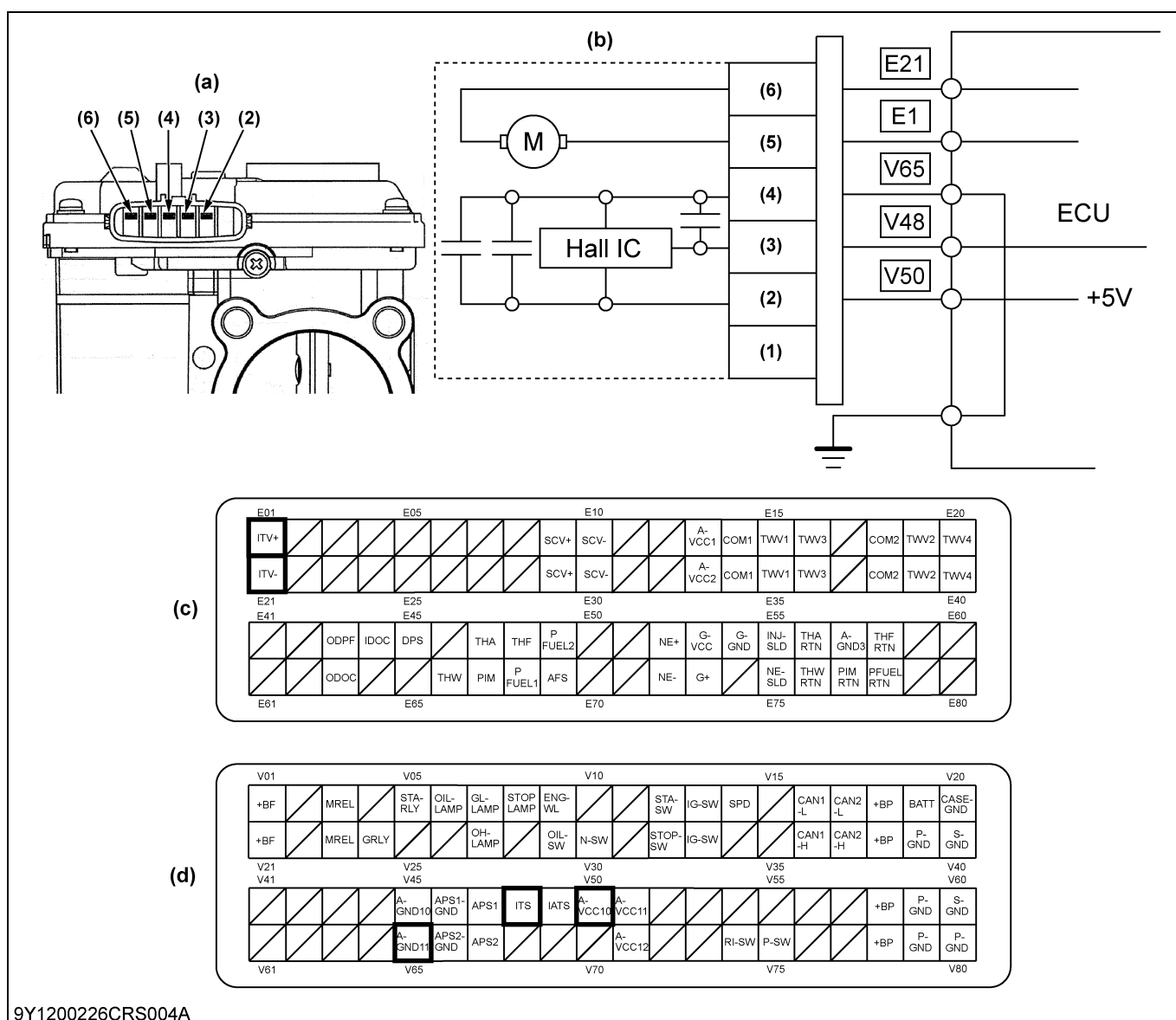
Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1019US0



9Y1200226CRS004A

- (1) No Connection
 (2) Terminal A-VCC10 (+5 V)
 (3) Terminal ITS (Output)

- (4) Terminal A-GND11 (Ground)
 (5) Terminal ITV-
 (6) Terminal ITV+

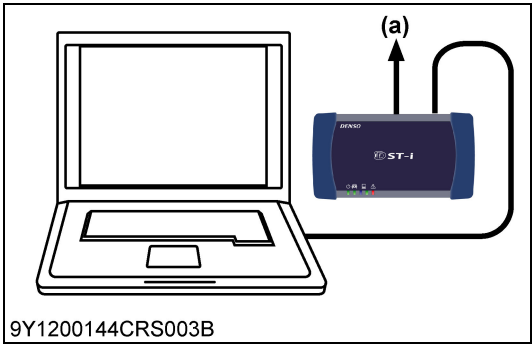
(a) Terminal Layout

(b) Intake Throttle Valve

(c) ECU Connector 1 (Engine Side)

(d) ECU Connector 2 (Machine Side)

9Y1200226CRS1020US0



1. Check the Intake Throttle Signal

- 1. After operating the engine, perform an active test.
Monitor the "Actual intake throttle valve opening" and "Intake throttle opening output voltage", and check the values.
*** For details, refer to the active test section.**
- 2. Clear the DTC and check whether it is output again or not.

Factory specification	No DTC is output.
OK	Normal.
NG	Replace the intake throttle assembly.

(a) CAN1 Connector

9Y1200226CRS1021US0

(38) Accelerator Position Sensor 1 Abnormality (DTC P2122 / 91-4, P2123 / 91-3)

P2122 / 91-4: Accelerator position sensor 1 abnormality (Low side)

Behaviour during malfunction:

- Insufficient output

Detection item:

- Sensor / wiring harness open circuit, ground short

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage (A-VCC11) is normal

DTC set parameter:

- Accelerator position sensor voltage 1 is 0.3 V or lower

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Accelerator opening limit: ACCPF \leq 25 %

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS1022US0

P2123 / 91-3: Accelerator position sensor 1 abnormality (High side)

Behaviour during malfunction:

- Insufficient output

Detection item:

- Sensor / wiring harness power supply short

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage (A-VCC11) is normal

DTC set parameter:

- Accelerator position sensor voltage 1 is 4.8 V or higher

Engine warning light:

- ON

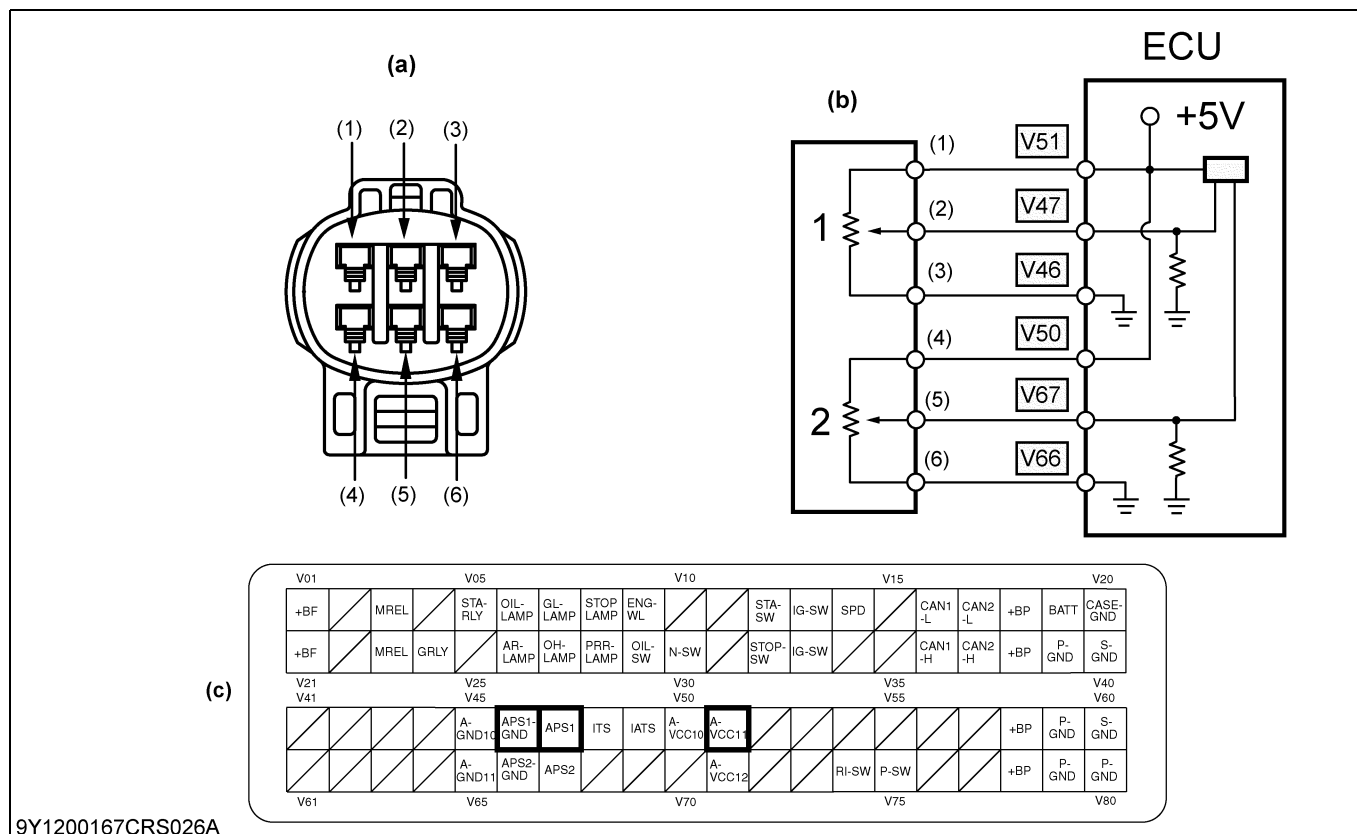
Limp home action by engine ECU (system action):

- Accelerator opening limit: ACCPF \leq 25 %

Recovery from error:

- Diagnostic counter = zero

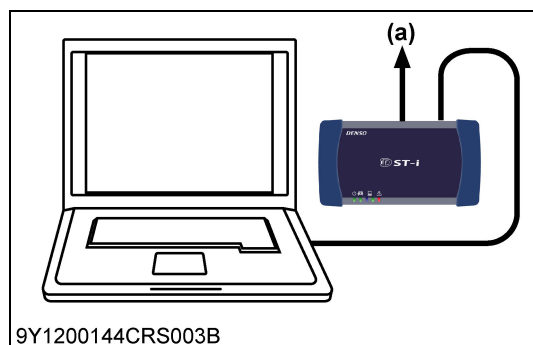
9Y1200226CRS1023US0



- | | |
|-----------------------|-----------------------|
| (1) Terminal A-VCC11 | (4) Terminal A-VCC10 |
| (2) Terminal APS1 | (5) Terminal APS2 |
| (3) Terminal APS1 GND | (6) Terminal APS2 GND |

- (a) Terminal Layout (c) ECU Connector 2
(b) Accelerator Position Sensor (Machine Side)

9Y1200226CRS1024US0




1. Check the Accelerator Position Sensor Signals

1. Place the key switch in the ON position, and check the "Accelerator position" and "Accelerator position sensor 1 output voltage" on the diagnosis tool data monitor.

Factory specification		
Actual accelerator pedal position	Accelerator pedal position	Output voltage
Fully close	0 %	1.35 V or lower (1.1) (): Follow the OEM adjusted value
Fully open	100 %	4.0 V or higher (4.2) (): Follow the OEM adjusted value

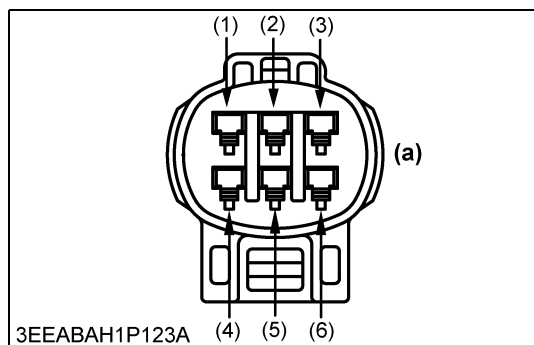
NOTE

- "Full close" and "Full open" are with the accelerator position sensor, not with the accelerator pedal or hand accelerator.

OK	Clear the DTC and check whether it is detected again or not. 	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Voltage Between Sensor Terminals".	

- (a) CAN1 Connector**

9Y1200226CRS1025US0



2. Measure the Voltage Between Sensor Terminals

1. Place the key switch in the OFF position, unplug the accelerator position sensor connector from the socket, and return the key switch to the ON position again.
2. Measure the voltage between terminals (1) and (3) of accelerator position sensor connector (at the machine wiring harness side).

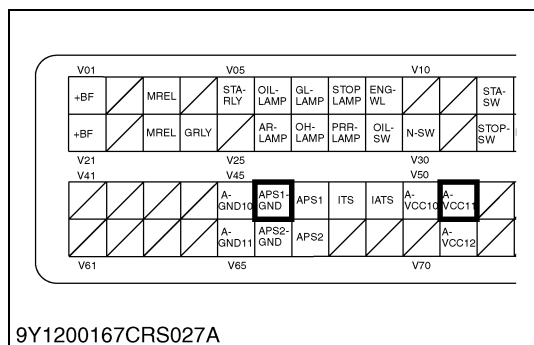
Factory specification	4.5 to 5.5 V
-----------------------	--------------

OK	Go to "4. Measure the ECU Terminal Voltage".
NG	Go to "3. Measure the Terminal Voltage".

- (1) Terminal A-VCC11
- (2) Terminal APS1
- (3) Terminal APS1 GND
- (4) Terminal A-VCC10
- (5) Terminal APS2
- (6) Terminal APS2 GND

(a) Terminal Layout

9Y1200226CRS1026US0



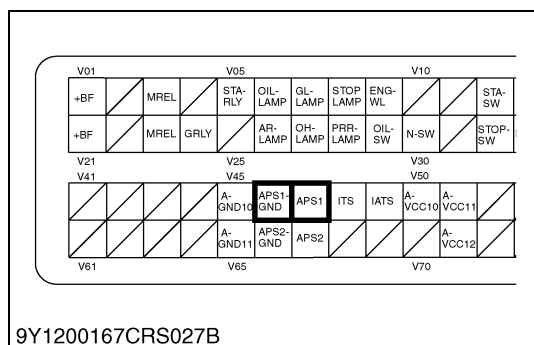
3. Measure the Terminal Voltage

1. Measure the voltage between ECU terminals V46 and V51.

Factory specification	4.5 to 5.5 V
-----------------------	--------------

OK	The wiring harness between the ECU and sensor is faulty. → Repair.
NG	Check the ECU connectors.
OK	Faulty ECU → Replace.
NG	Repair the ECU connectors.

9Y1200226CRS1027US0



4. Measure the ECU Terminal Voltage

1. Place the key switch in the OFF position, and plug the accelerator position sensor connector into the socket.
2. Place the key switch in the ON position, and measure the voltage between ECU terminals V47 and V46.

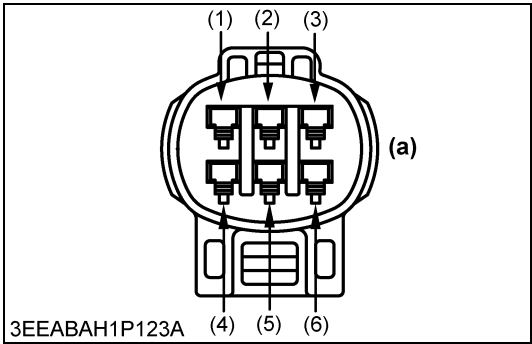
Factory specification	Accelerator pedal fully closed: 1.35 V or lower (1.1) Accelerator pedal full throttle: 4.0 V or higher (4.2) (): Follow the OEM adjusted value
-----------------------	---

NOTE

- "Full close" and "Full open" are with the accelerator position sensor, not with the accelerator pedal or hand accelerator.

OK	Check the ECU connectors.
OK	Faulty ECU → Replace.
NG	Repair the ECU connectors.
NG	Go to "5. Measure the Voltage Between Sensor Terminals".

9Y1200226CRS1028US0



5. Measure the Voltage Between Sensor Terminals

1. Keep the accelerator position sensor connector plugged into socket.
2. Measure the voltage between terminals (2) and (3) of accelerator position sensor connector (at the machine wiring harness side).

Factory specification	Accelerator pedal fully closed: 1.35 V or lower (1.1) Accelerator pedal full throttle: 4.0 V or higher (4.2) (): Follow the OEM adjusted value
-----------------------	---

OK	Wiring harness open circuit, short → Check and repair.
NG	Faulty accelerator sensor → Replace.

- (1) Terminal A-VCC11
- (2) Terminal APS1
- (3) Terminal APS1 GND
- (4) Terminal A-VCC10
- (5) Terminal APS2
- (6) Terminal APS2 GND

(a) Terminal Layout

9Y1200226CRS1029US0

(39) Accelerator Position Sensor 2 Abnormality (DTC P2127 / 29-4, P2128 / 29-3)

P2127 / 29-4: Accelerator position sensor 2 abnormality (Low side)

Behaviour during malfunction:

- Insufficient output

Detection item:

- Ground short circuit / open circuit of sensor / harness

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC1 is normal

DTC set parameter:

- Voltage of accelerator position sensor 2 is 0.3 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Forced Idle (Accelerator = 0 %)

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS1030US0

P2128 / 29-3: Accelerator position sensor 2 abnormality (High side)

Behaviour during malfunction:

- Insufficient output

Detection item:

- Battery short circuit out of sensor / harness

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC1 is normal

DTC set parameter:

- Voltage of accelerator position sensor 2 is 4.8 V or less

Engine warning light:

- ON

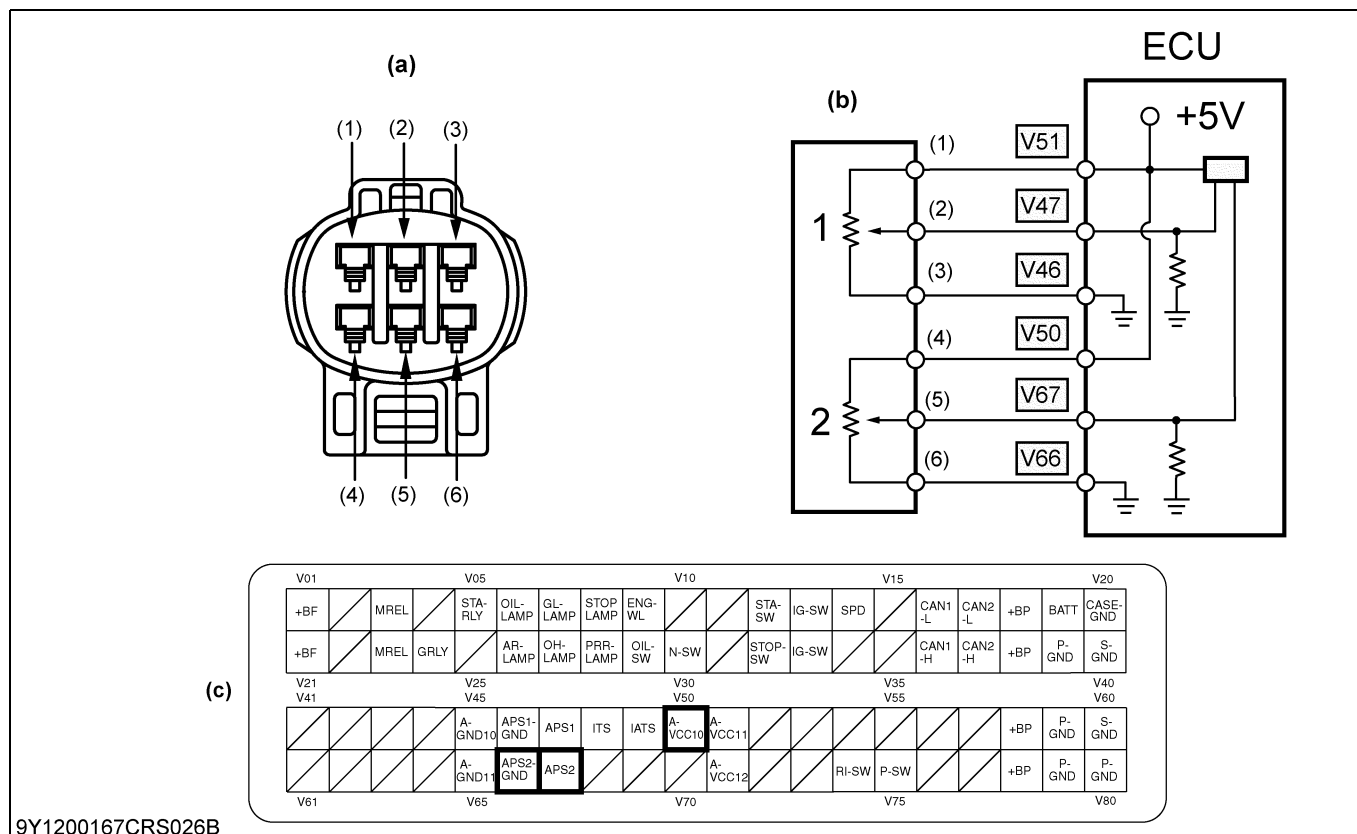
Limp home action by engine ECU (system action):

- Forced Idle (Accelerator = 0 %)

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS1031US0



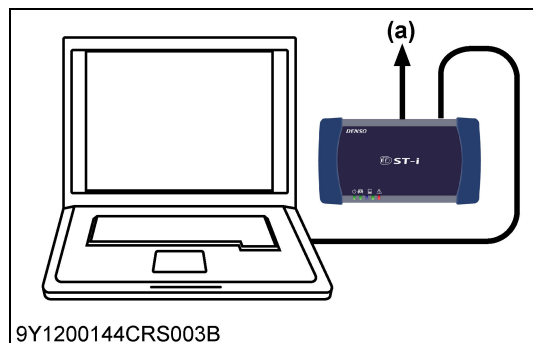
- (1) Terminal A-VCC11
 (2) Terminal APS1
 (3) Terminal APS1 GND

- (4) Terminal A-VCC10
 (5) Terminal APS2
 (6) Terminal APS2 GND

- (a) Terminal Layout
 (b) Accelerator Position Sensor

- (c) ECU Connector 2
 (Machine Side)

9Y1200226CRS1032US0



1. Check the Accelerator Position Sensor Signals

1. Place the key switch in the ON position, and check the "Accelerator position" and "Accelerator position sensor 2 output voltage" on the diagnosis tool data monitor.

Factory specification		
Actual accelerator pedal position	Accelerator pedal position	Output voltage
Fully close	0 %	1.35 V or lower (1.1) (): Follow the OEM adjusted value
Fully open	100 %	4.0 V or higher (4.2) (): Follow the OEM adjusted value

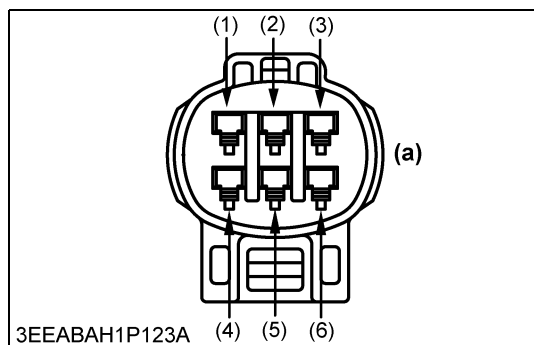
NOTE

- "Full close" and "Full open" are with the accelerator position sensor, not with the accelerator pedal or hand accelerator.

OK	Clear the DTC and check whether it is detected again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Voltage Between Sensor Terminals".	

- (a) CAN1 Connector

9Y1200226CRS1033US0



2. Measure the Voltage Between Sensor Terminals

1. Place the key switch in the OFF position, unplug the accelerator position sensor connector from the socket, and return the key switch to the ON position again.
2. Measure the voltage between terminals (4) and (6) of accelerator position sensor connector (at the machine wiring harness side).

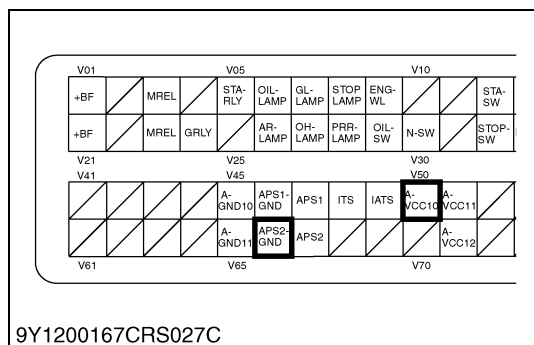
Factory specification	4.5 to 5.5 V
-----------------------	--------------

OK	Go to "4. Measure the ECU Terminal Voltage".
NG	Go to "3. Measure the Terminal Voltage".

- (1) Terminal A-VCC11
- (2) Terminal APS1
- (3) Terminal APS1 GND
- (4) Terminal A-VCC10
- (5) Terminal APS2
- (6) Terminal APS2 GND

(a) Terminal Layout

9Y1200226CRS1034US0



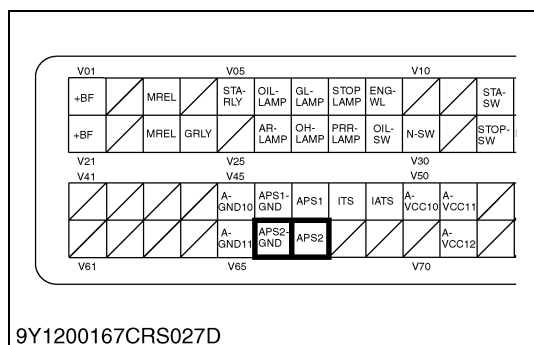
3. Measure the Terminal Voltage

1. Measure the voltage between ECU terminals V50 and V66.

Factory specification	4.5 to 5.5 V
-----------------------	--------------

OK	The wiring harness between the ECU and sensor is faulty. → Repair.
NG	Check the ECU connectors.
OK	Faulty ECU → Replace.
NG	Repair the ECU connectors.

9Y1200226CRS1035US0



4. Measure the ECU Terminal Voltage

1. Place the key switch in the OFF position, and plug the accelerator position sensor connector into the socket.
2. Place the key switch in the ON position, and measure the voltage between ECU terminals V66 and V67.

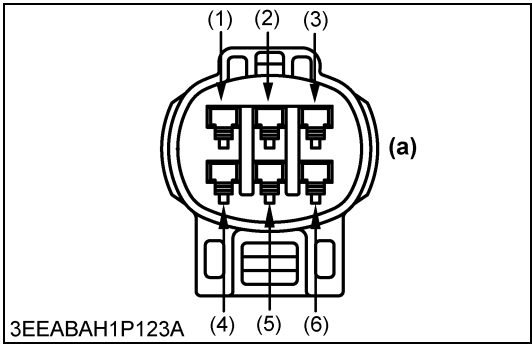
Factory specification	Accelerator pedal fully closed: 1.35 V or lower (1.1) Accelerator pedal full throttle: 4.0 V or higher (4.2) (): Follow the OEM adjusted value
-----------------------	---

NOTE

- "Full close" and "Full open" are with the accelerator position sensor, not with the accelerator pedal or hand accelerator.

OK	Check the ECU connectors.
OK	Faulty ECU → Replace.
NG	Repair the ECU connectors.
NG	Go to "5. Measure the Voltage Between Sensor Terminals".

9Y1200226CRS1036US0



5. Measure the Voltage Between Sensor Terminals

1. Keep the accelerator position sensor connector plugged into socket.
2. Measure the voltage between terminals (5) and (6) of accelerator position sensor connector (at the machine wiring harness side).

Factory specification	Accelerator pedal fully closed: 1.35 V or lower (1.1) Accelerator pedal full throttle: 4.0 V or higher (4.2) (): Follow the OEM adjusted value
-----------------------	---

OK	Wiring harness open circuit, short → Check and repair.
NG	Faulty accelerator sensor → Replace.

- (1) Terminal A-VCC11
- (2) Terminal APS1
- (3) Terminal APS1 GND
- (4) Terminal A-VCC10
- (5) Terminal APS2
- (6) Terminal APS2 GND

(a) Terminal Layout

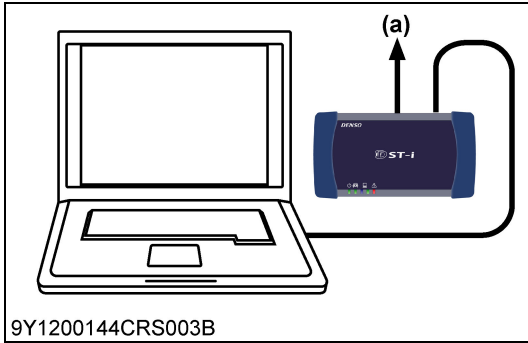
9Y1200226CRS1037US0

- Diagnostic counter = zero (CAN signal recovers)

9Y1200274CRS063A

A: To Other ECU

KiSC issued 07, 2017 A



1. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position, check whether the DTC (P2131) is output or not.

Factory specification	No DTC (P2131) is output.
OK	Normal.
NG	Go to "2. Check the Monitor of the Machine".

(a) CAN1 Connector

9Y1200226CRS1040US0

2. Check the Monitor of the Machine

1. Turn on the key switch and confirm that no defects except those in the engine occur.

Factory specification	No defects except that in the engine occur.
OK	Possible defects in the ECU for the machine. Execute the diagnosis according to the workshop manual for the machine.
NG	Defects in the accelerator sensor signal. Execute the diagnosis according to the workshop manual for the machine.

9Y1200226CRS1041US0

(41) Accelerator Position Sensor Correlation Error (DTC P2135 / 91-2)

Behaviour during malfunction:

- Insufficient output

Detection item:

- Deviation from designed correlation in two sensors

DTC set preconditions:

- Battery voltage is normal
- Accelerator position sensor 1 is normal
- Accelerator position sensor 2 is normal

DTC set parameter:

- Deviation from designed correlation in two sensors
- It depends on engine application

Engine warning light:

- ON

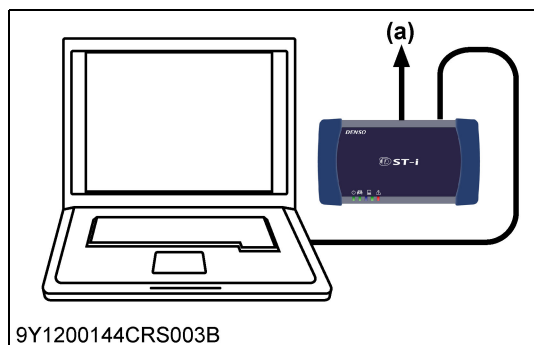
Limp home action by engine ECU (system action):

- Forced Idle (Accelerator = 0 %)

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS1042US0



9Y1200144CRS003B

1. Check the Accelerator Position Sensor 1 and 2 (Refer to items P2122, P2123, P2127 and P2128)

1. Check the accelerator position sensor 1 and 2. (Refer to page 1-S231)

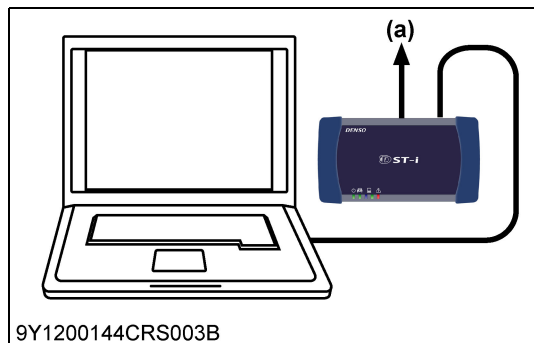
■ NOTE

- This DTC is used to detect the characteristic difference between the two sensors' output. So, check the both sensors in the same way as the procedure of the "Accelerator Position Sensor 1 (or 2) Abnormality"
- The adjustment value of the sensor signal needs to be followed by the specification of the machine.

OK	Normal
NG	Replace the accelerator position sensor 1 or 2.

(a) CAN1 Connector

9Y1200226CRS1043US0



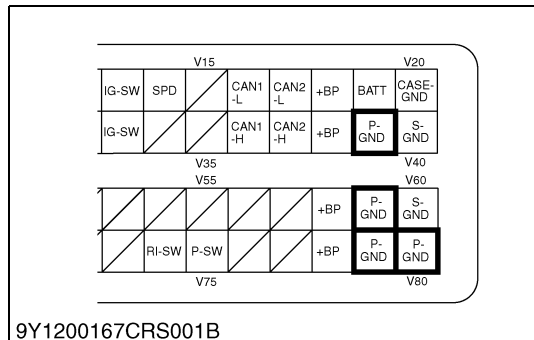
1. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position, check whether the DTC (P2146, P2149) is output or not.

Factory specification	Either DTC P2146 or P2149 is output.
OK	Go to "4. Measure the Resistance Between ECU Terminals".
NG	Go to "2. Check the "P- GND" Wiring Harness".

(a) CAN1 Connector

9Y1200226CRS1046US0

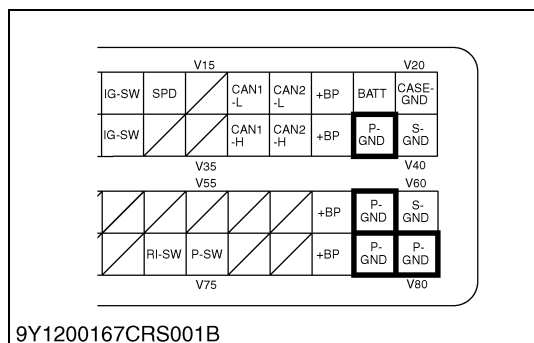


2. Check the "P- GND" Wiring Harness

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between each ECU terminal and the chassis ground (at the wiring harness side).

Factory specification	1.5 Ω or lower
OK	Go to "3. Check the "P- GND" Wiring Harness Connector and ECU Pins".
NG	1. Check the "P- GND" wiring harness → Repair. 2. Locate the cause of open circuit, or increase its resistance value.

9Y1200226CRS1047US0

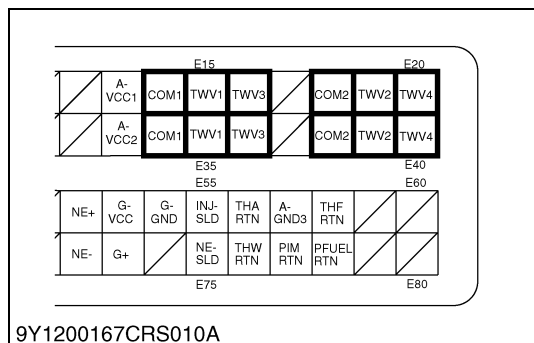


3. Check the "P- GND" Wiring Harness Connector and ECU Pins

1. Place the key switch in the OFF position, unplug the ECU connector from the socket, and check the ECU pins for faulty connection, deformation, poor contact or other defects.

Factory specification	Must be free from faulty connection, deformation, poor contact or other defects.
OK	Go to "4. Measure the Resistance Between ECU Terminals".
NG	Repair wiring harness connectors and ECU pins, or replace them if defective.

9Y1200226CRS1048US0



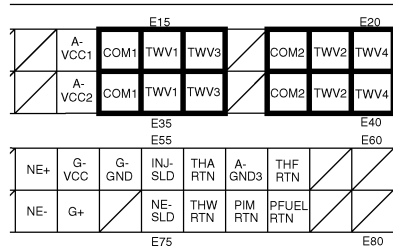
4. Measure the Resistance Between ECU Terminals

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector, and measure the resistance between each terminal at the connector side as shown on the following table.

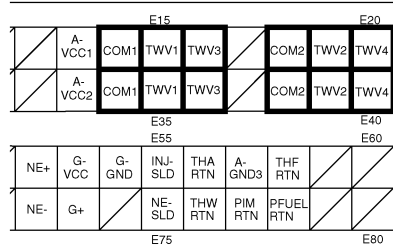
DTC	ECU Terminals Measured	
P2146	E14, E34	No. 1 cylinder E15, E35
		No. 4 cylinder E16, E36
P2149	E18, E38	No. 3 cylinder E19, E39
		No. 2 cylinder E20, E40

Factory specification	Both system cables must have 1.5 Ω or lower.
OK	Go to "6. Check the Wiring Harness Connectors and ECU Pins".
NG	Go to "5. Check the Wiring Harness → Repair or Replace the Faulty Area".

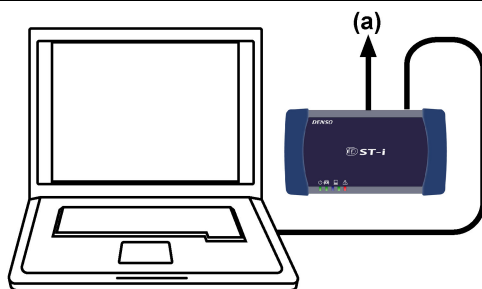
9Y1200226CRS1049US0



9Y1200167CRS010A



9Y1200167CRS010A



9Y1200144CRS003B

5. Check the Wiring Harness → Repair or Replace the Faulty Area

Check the wiring harness between ECU terminals E14 / E34 or E18 / E38 and each injector terminal (E15 / E35, E16 / E36, E19 / E39 or E20 / E40), and locate the open harness.

9Y1200226CRS1050US0

6. Check the Wiring Harness Connectors and ECU Pins

1. Check the wiring harness connectors of each ECU terminal and the ECU pins for faulty connection, deformation or other defects.

OK	Go to "7. Check the DTC".
NG	The connectors or ECU pins are faulty. → Repair them or replace the ECU.

9Y1200226CRS1051US0

7. Check the DTC

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Start the engine, and clear the past DTCs.
3. Read the DTC again.

Factory specification	Normal (No DTC is output.)
OK	Normal.
NG	Faulty ECU → Replace.

(a) CAN1 Connector

9Y1200226CRS1052US0

(43) Common 1 TWV Actuation System Short (DTC P2147 / 523523-4, P2148 / 523523-3)

P2147 / 523523-4: Common 1 TWV actuation system ground short

Behaviour during malfunction:

- Insufficient output
- Large vibration
- Worsening exhaust gas performance
- Engine stops in some case

Detection item:

- Wiring harness short to ground

DTC set preconditions:

- Engine is operating
- Battery voltage is normal

DTC set parameter:

- When wiring harness short to ground occurs

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Injectors which have DTC stop injection
- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1053US0

P2148 / 523523-3: Common 1 TWV actuation system +B short

Behaviour during malfunction:

- Insufficient output
- Large vibration
- Worsening exhaust gas performance
- Engine stops in some case

Detection item:

- Wiring harness short to +B

DTC set preconditions:

- Engine is operating
- Battery voltage is normal

DTC set parameter:

- When wiring harness short to +B occurs

Engine warning light:

- ON

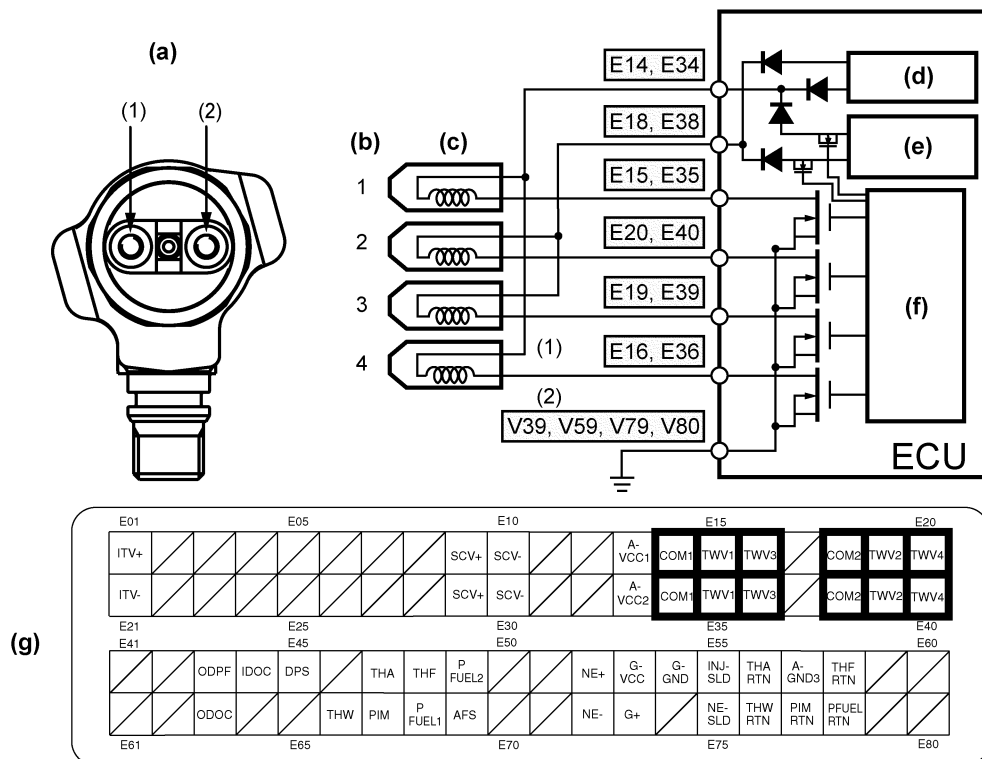
Limp home action by engine ECU (system action):

- Injectors which have DTC stop injection
- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1054US0



9Y1200167CRS009A

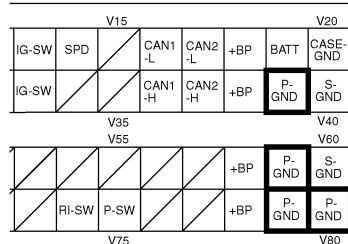
- (1) Terminal COMMON
(2) Terminal TWV

- (a) Terminal Layout
(b) Engine Cylinder No.
(c) Injector

- (d) Rated amperage circuit
(e) High-voltage generating circuit

- (f) Control circuit
(g) ECU Connector 1 (Engine Side)

9Y1200226CRS1055US0



9Y1200167CRS001B

1. Check the "P- GND" Wiring Harness

- Place the key switch in the OFF position, unplug the ECU wiring harness connector 2 (machine side) from the socket, and measure the resistance between each of ECU terminals V39, V59, V79 or V80 and the chassis ground (at the wiring harness side).

Factory specification	1.5 Ω or lower
-----------------------	----------------

OK	Go to "2. Check the Wiring Harness Connectors and ECU Pins".
NG	Check the "P- GND" wiring harness. → Repair. Locate the cause of open circuit, or increase its resistance value.

9Y1200226CRS1056US0

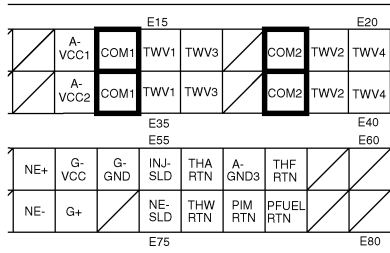
2. Check the Wiring Harness Connectors and ECU Pins

- Place the key switch in the OFF position, unplug the ECU connector 1 (engine side) from the socket, and check the ECU pins for faulty connection, deformation, poor contact or other defects.

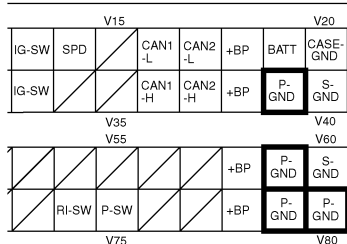
Factory specification	Must be free from faulty connection, deformation, poor contact or other defects.
-----------------------	--

OK	Go to "3. Measure the ECU Terminal Voltage (Part 1)".
NG	Repair wiring harness connectors and ECU pins, or replace them if defective.

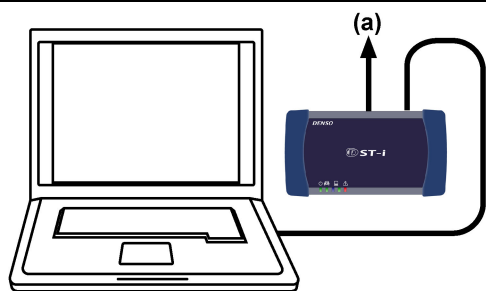
9Y1200226CRS1057US0



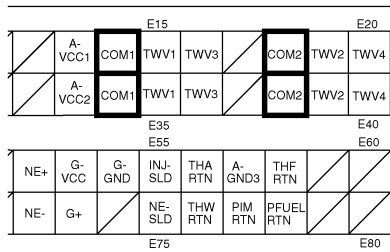
9Y1200167CRS010E



9Y1200167CRS001B



9Y1200144CRS003B



9Y1200167CRS010E

3. Measure the ECU Terminal Voltage (Part 1)

- Place the key switch in the ON position, and measure the voltage between ECU terminal E14 / E34 or E18 / E38 and "P-GND" terminal.

Factory specification	Approx. 6 V
-----------------------	-------------

OK	Go to "4. Check the DTC".
NG	Go to "5. Measure the ECU Terminal Voltage (Part 2)".

9Y1200226CRS1058US0

4. Check the DTC

- Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
- Start the engine, and clear the past DTCs.
- Read the DTC again.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

OK	Normal.
NG	Faulty ECU → Replace.

(a) CAN1 Connector

9Y1200226CRS1059US0

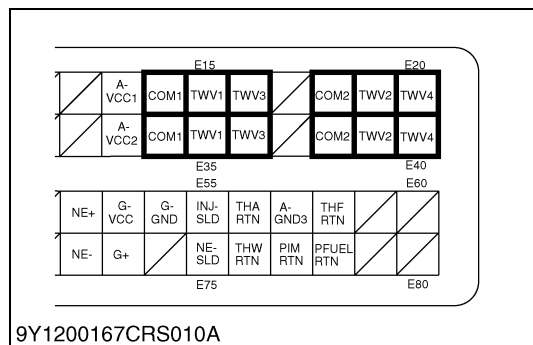
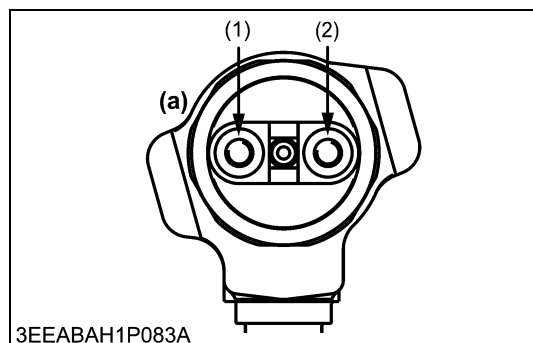
5. Measure the ECU Terminal Voltage (Part 2)

- Place the key switch in the OFF position, unplug the ECU wiring harness connector 1 (engine side) from the socket, return the key switch to the ON position again, and measure the voltage between each of ECU terminal pins E14 / E34 and E18 / E38 and the "P-GND" terminal (at the wiring harness side).

Factory specification	Approx. 6 V
-----------------------	-------------

OK	Go to "6. Check the Wiring Harness".
NG	Faulty ECU → Replace.

9Y1200226CRS1060US0



6. Check the Wiring Harness

Locate the cause of wiring harness ground short, and repair the faulty area.

DTC	Relating ECU Terminals	Shorted Harness Side
P2147	Terminal E14 / E34 or E18 / E38 (E15 / E35, E16 / E36, E19 / E39, E20 / E40 occurring simultaneously)	Ground
P2148	Terminal E14 / E34 or E18 / E38 (E15 / E35, E16 / E36, E19 / E39, E20 / E40 occurring simultaneously)	Power supply

NOTE

- If DTC P2147 (Shorted injector actuation circuit to the ground) has occurred, be sure to check the insulation of injector itself in the following procedure.

- Place the key switch in the OFF position, unplug each injector connector from socket, and visually check the connector status.

Factory specification	Must be free from sludge and sparks.
-----------------------	--------------------------------------

- Using an insulation resistance tester (megger tester), measure the resistance between each of terminals (1) and (2) and the chassis ground (at the injector side).

Factory specification	10 MΩ or higher
-----------------------	-----------------

OK	The injector functions normally. Locate another cause.
NG	Faulty injector → Replace.

- (1) Terminal COMMON
(2) Terminal TWV

(a) Injector

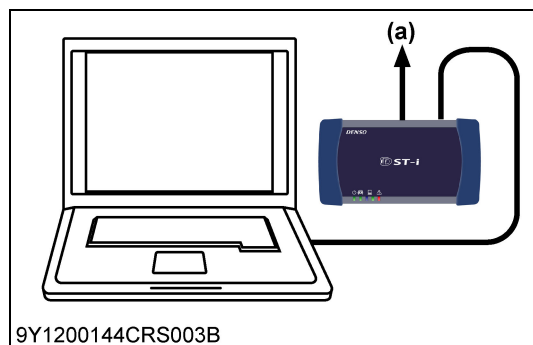
9Y1200226CRS1061US0

- Key switch turn OFF

9Y1200167CRS009A

- (f) **Control Circuit**
(g) **ECU Connector 1**
(Engine Side)

KiSC issued 07, 2017 A



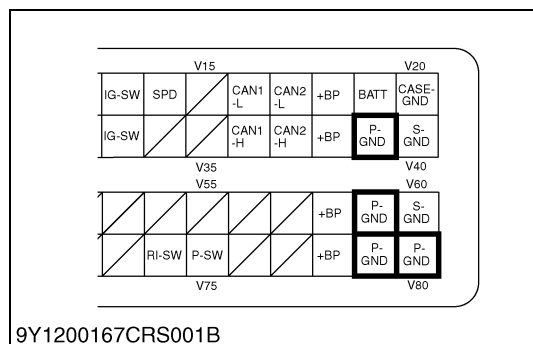
1. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position, check whether the DTC (P2146, P2149) is output or not.

Factory specification	Either DTC P2146 or P2149 is output.
OK	Go to "4. Measure the Resistance Between ECU Terminals".
NG	Go to "2. Check the "P- GND" Wiring Harness".

(a) CAN1 Connector

9Y1200226CRS1064US0

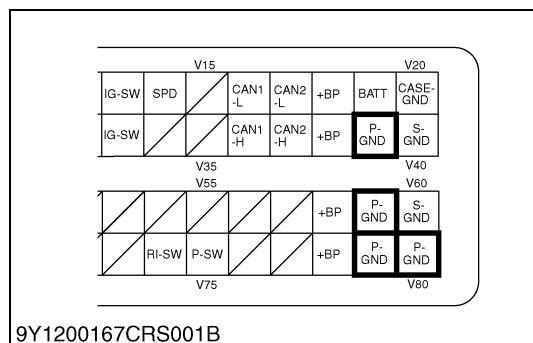


2. Check the "P- GND" Wiring Harness

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between each ECU terminal and the chassis ground (at the wiring harness side).

Factory specification	1.5 Ω or lower
OK	Go to "3. Check the "P- GND" Wiring Harness Connector and ECU Pins".
NG	1. Check the "P- GND" wiring harness → Repair. 2. Locate the cause of open circuit, or increase its resistance value.

9Y1200226CRS1065US0

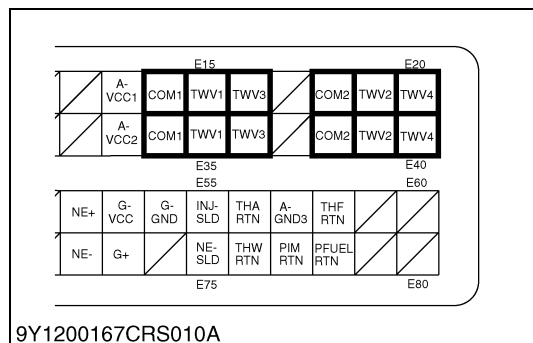


3. Check the "P- GND" Wiring Harness Connector and ECU Pins

1. Place the key switch in the OFF position, unplug the ECU connector from the socket, and check the ECU pins for faulty connection, deformation, poor contact or other defects.

Factory specification	Must be free from faulty connection, deformation, poor contact or other defects.
OK	Go to "4. Measure the Resistance Between ECU Terminals".
NG	Repair wiring harness connectors and ECU pins, or replace them if defective.

9Y1200226CRS1066US0



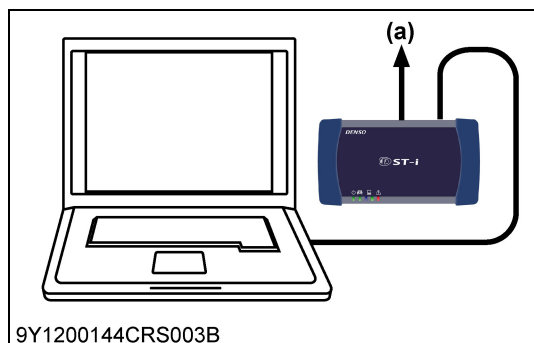
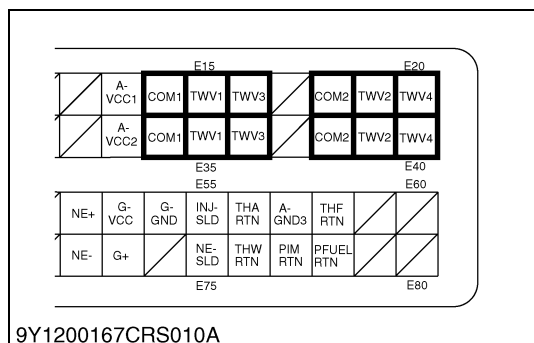
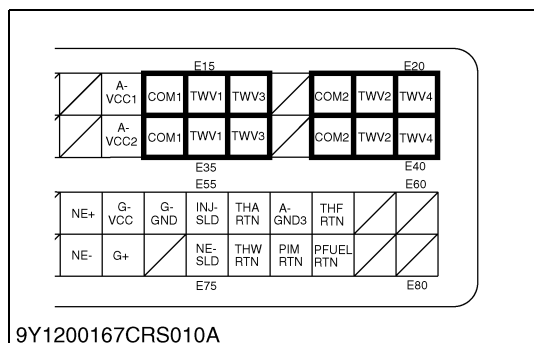
4. Measure the Resistance Between ECU Terminals

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector, and measure the resistance between each terminal at the connector side as shown on the following table.

DTC	ECU Terminals Measured	
P2146	E14, E34	No. 1 cylinder E15, E35
		No. 4 cylinder E16, E36
P2149	E18, E38	No. 3 cylinder E19, E39
		No. 2 cylinder E20, E40

Factory specification	Both system cables must have 1.5 Ω or lower.
OK	Go to "6. Check the Wiring Harness Connectors and ECU Pins".
NG	Go to "5. Check the Wiring Harness → Repair or Replace the Faulty Area".

9Y1200226CRS1067US0



5. Check the Wiring Harness → Repair or Replace the Faulty Area

Check the wiring harness between ECU terminals E14 / E34 or E18 / E38 and each injector terminal (E15 / E35, E16 / E36, E19 / E39 or E20 / E40), and locate the open harness.

9Y1200226CRS1068US0

6. Check the Wiring Harness Connectors and ECU Pins

1. Check the wiring harness connectors of each ECU terminal and the ECU pins for faulty connection, deformation or other defects.

OK	Go to "7. Check the DTC".
NG	The connectors or ECU pins are faulty. → Repair them or replace the ECU.

9Y1200226CRS1069US0

7. Check the DTC

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Start the engine, and clear the past DTCs.
3. Read the DTC again.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

OK	Normal.
NG	Faulty ECU → Replace.

(a) CAN1 Connector

9Y1200226CRS1070US0

(45) Common 2 TWV Actuation System Short (DTC P2150 / 523524-4, P2151 / 523524-3)

P2150 / 523524-4: Common 2 TWV actuation system ground short

Behaviour during malfunction:

- Insufficient output
- Large vibration
- Worsening exhaust gas performance
- Engine stops in some case

Detection item:

- Wiring harness short to ground

DTC set preconditions:

- Engine is operating
- Battery voltage is normal

DTC set parameter:

- When wiring harness short to ground occurs

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Injectors which have DTC stop injection
- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1071US0

P2151 / 523524-3: Common 2 TWV actuation system +B short

Behaviour during malfunction:

- Insufficient output
- Large vibration
- Worsening exhaust gas performance
- Engine stops in some case

Detection item:

- Wiring harness short to +B

DTC set preconditions:

- Engine is operating
- Battery voltage is normal

DTC set parameter:

- When wiring harness short to +B occurs

Engine warning light:

- ON

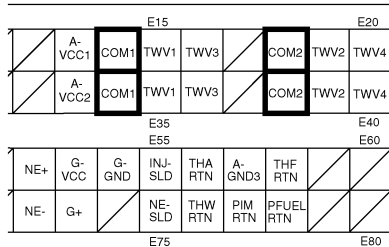
Limp home action by engine ECU (system action):

- Injectors which have DTC stop injection
- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

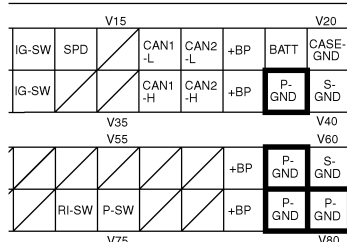
Recovery from error:

- Key switch turn OFF

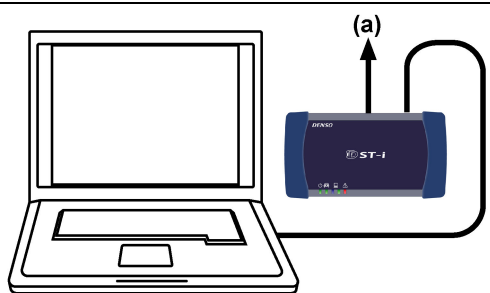
9Y1200226CRS1072US0



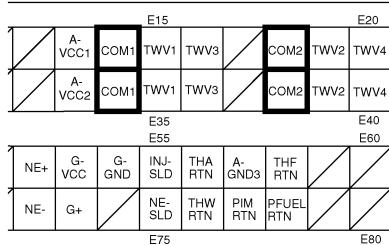
9Y1200167CRS010E



9Y1200167CRS001B



9Y1200144CRS003B



9Y1200167CRS010E

3. Measure the ECU Terminal Voltage (Part 1)

- Place the key switch in the ON position, and measure the voltage between ECU terminal E14 / E34 or E18 / E38 and "P-GND" terminal.

Factory specification	Approx. 6 V
-----------------------	-------------

OK	Go to "4. Check the DTC".
NG	Go to "5. Measure the ECU Terminal Voltage (Part 2)".

9Y1200226CRS1076US0

4. Check the DTC

- Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
- Start the engine, and clear the past DTCs.
- Read the DTC again.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

OK	Normal.
NG	Faulty ECU → Replace.

(a) CAN1 Connector

9Y1200226CRS1077US0

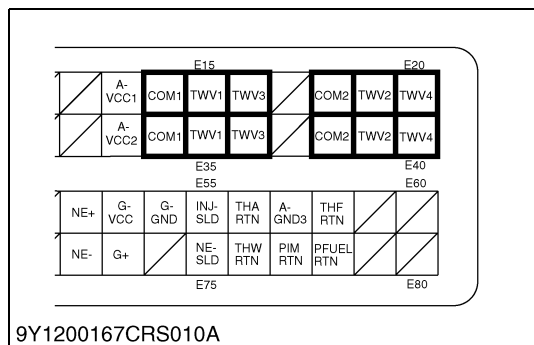
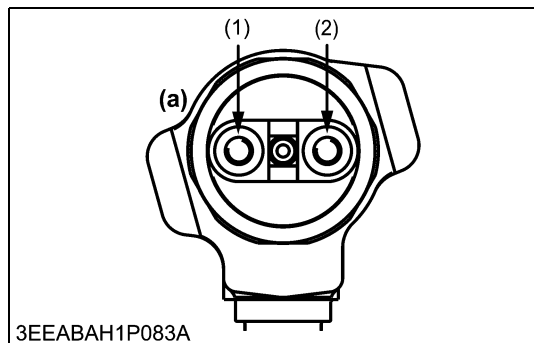
5. Measure the ECU Terminal Voltage (Part 2)

- Place the key switch in the OFF position, unplug the ECU wiring harness connector 1 (engine side) from the socket, return the key switch to the ON position again, and measure the voltage between each of ECU terminal pins E14 / E34 and E18 / E38 and the "P -GND" terminal (at the wiring harness side).

Factory specification	Approx. 6 V
-----------------------	-------------

OK	Go to "6. Check the Wiring Harness".
NG	Faulty ECU → Replace.

9Y1200226CRS1078US0



6. Check the Wiring Harness

Locate the cause of wiring harness ground short, and repair the faulty area.

DTC	Relating ECU Terminals	Shorted Harness Side
P2147	Terminal E14 / E34 or E18 / E38 (E15 / E35, E16 / E36, E19 / E39, E20 / E40 occurring simultaneously)	Ground
P2148	Terminal E14 / E34 or E18 / E38 (E15 / E35, E16 / E36, E19 / E39, E20 / E40 occurring simultaneously)	Power supply

NOTE

- If DTC P2147 (Shorted injector actuation circuit to the ground) has occurred, be sure to check the insulation of injector itself in the following procedure.

- Place the key switch in the OFF position, unplug each injector connector from socket, and visually check the connector status.

Factory specification	Must be free from sludge and sparks.
-----------------------	--------------------------------------

- Using an insulation resistance tester (megger tester), measure the resistance between each of terminals (1) and (2) and the chassis ground (at the injector side).

Factory specification	10 MΩ or higher
-----------------------	-----------------

OK	The injector functions normally. Locate another cause.
NG	Faulty injector → Replace.

- (1) Terminal COMMON
(2) Terminal TWV

(a) Injector

9Y1200226CRS1079US0

(46) Barometric Pressure Sensor Error (DTC P2228 / 108-4, P2229 / 108-3)**P2228 / 108-4: Barometric pressure sensor error (Low side)****Behaviour during malfunction (At high altitude):**

- Insufficient output

Detection item:

- Sensor / ECU internal circuit short to ground

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Barometric pressure sensor voltage: 1.6 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- 65 kPa (0.66 kgf/cm², 9.4 psi) [default value]

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS1080US0

P2229 / 108-3: Barometric pressure sensor error (High side)**Behaviour during malfunction (At high altitude):**

- Insufficient output

Detection item:

- Sensor / ECU internal circuit short to +B

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Barometric pressure sensor voltage: 4.4 V or more

Engine warning light:

- ON

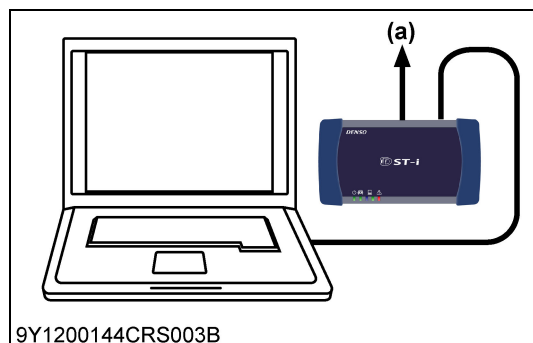
Limp home action by engine ECU (system action):

- 65 kPa (0.66 kgf/cm², 9.4 psi) [default value]


Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS1081US0

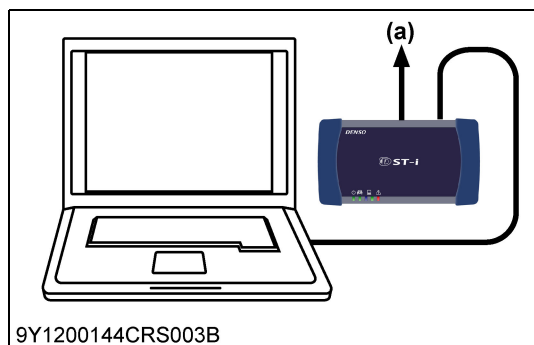
**1. Check the Atmospheric Pressure Signals**

1. Place the key switch in the ON position, and check the "Atmospheric pressure" on the diagnosis tool data monitor.

Factory specification		Atmospheric pressure Actual atmospheric pressure (Approx. 100 kPa (1.02 kgf/cm ² , 14.5 psi))	
OK	Clear the DTC and check whether it is detected again or not. 		
	OK	Normal.	
	NG	Replace the ECU.	
NG	Go to "2. Check the DTC".		

(a) CAN1 Connector

9Y1200226CRS1082US0



2. Check the DTC

1. Place the key switch to the OFF position first, then return it to the ON position again.
2. Clear the past DTCs, and check whether the same DTC (P2228 or P2229) is output again or not.

Factory specification	OK
OK	An electromagnetic interference (EMI) may have caused the temporary malfunction. There is no problem if the system has recovered.
NG	Faulty atmospheric pressure sensor → Replace the engine ECU.

(a) CAN1 Connector

9Y1200226CRS1083US0

(47) EGR (DC Motor) Abnormality (DTC P2413 / 523575-7, P2414 / 523576-2, P2415 / 523577-2)

P2413 / 523575-7: EGR actuator valve stuck

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas performance

Detection item:

- EGR actuator valve stuck

DTC set preconditions:

- Battery voltage is normal
- No DTC of U0077 "CAN1 Bus off"
- EGR control line is normal

DTC set parameter:

- EGR actuator valve stuck error signal received via CAN

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition EGR stop

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1084US0

P2414 / 523576-2: EGR (DC motor) overheat

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas performance

Detection item:

- EGR (DC motor) overheat

DTC set preconditions:

- Battery voltage is normal
- No DTC of U0077 "CAN1 Bus off"
- EGR control line is normal

DTC set parameter:

- EGR (DC motor) temperature error signal (thermistor: 125 °C (257 °F) or more) received via CAN

Engine warning light:

- ON

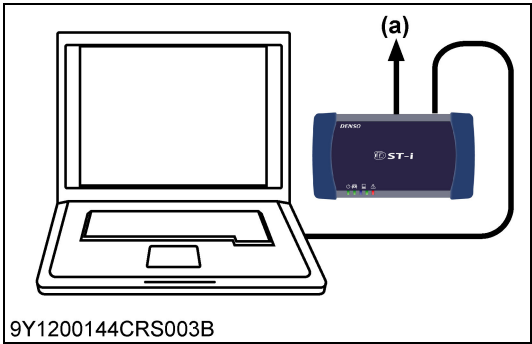
Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1085US0



1. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Place the key switch in the ON position, check whether the DTC is output or not.
3. Check the DTC again after starting up the engine with the coolant temperature over 65 °C (149 °F).

Factory specification	DTC must not be output.
OK	Normal.
NG	Replace the EGR assembly.

(a) CAN1 Connector

9Y1200226CRS1088US0

(48) Exhaust Gas Temperature Sensor 2 (T2) Abnormality (DTC P242C / 3246-4, P242D / 3246-3)

P242C / 3246-4: Exhaust gas temperature sensor 2 (T2) abnormality (Low side)

Behaviour during malfunction:

- None

Detection item:

- Sensor / Harness short to ground

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- DPF outlet temperature sensor (T2) voltage: 0.08 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- 0 °C (32 °F) [default value]
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1089US0

P242D / 3246-3: Exhaust gas temperature sensor 2 (T2) abnormality (High side)

Behaviour during malfunction:

- None

Detection item:

- Sensor / Harness open circuit and short to +B

DTC set preconditions:

- Battery voltage is normal
- Coolant temperature is 65 °C (149 °F) or more: continues longer than 10 min. 100 °C (212 °F) ≤ T0 ≤ 800 °C (1472 °F): continues longer than 10 sec. or 100 °C (212 °F) ≤ T1 ≤ 800 °C (1472 °F): continues longer than 10 sec.

DTC set parameter:

- DPF outlet temperature sensor (T2) voltage: 4.92 V or more

Engine warning light:

- ON

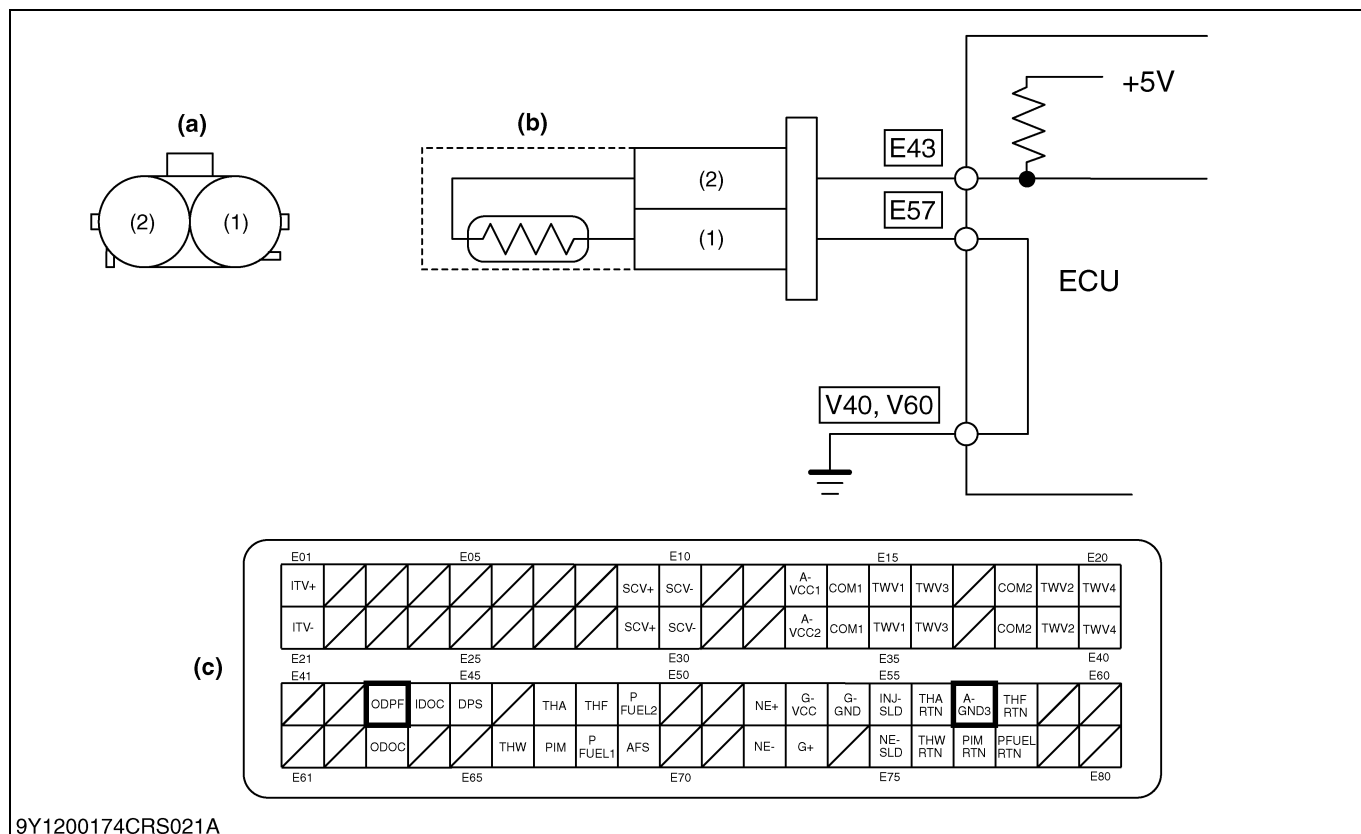
Limp home action by engine ECU (system action):

- 0 °C (32 °F) [default value]
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Recovers when the key switch is OFF

9Y1200226CRS1090US0



9Y1200174CRS021A

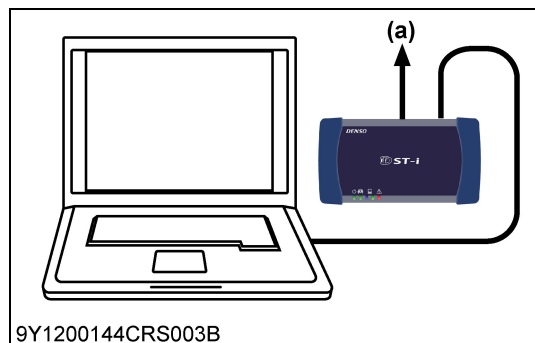
(1) Terminal A-GND3

(2) Terminal ODPF

(a) Terminal Layout
(b) Exhaust Gas Temperature Sensor 2 (T2)

(c) ECU Connector 1
(Engine Side)

9Y1200226CRS1091US0



9Y1200144CRS003B

1. Check the Exhaust Gas Temperature Sensor Signals

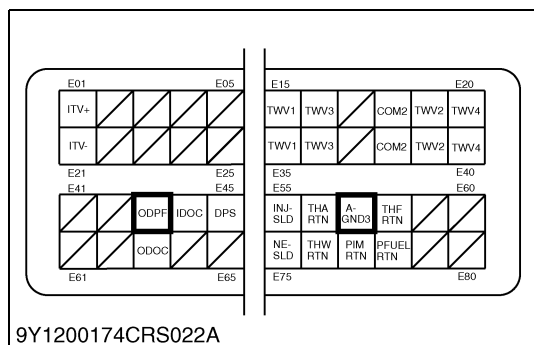
- Place the key switch in the ON position, and check the "Exhaust gas temperature" and "Exhaust gas temperature sensor output voltage" on the diagnosis tool data monitor.

Factory specification		
Actual exhaust gas temperature	Exhaust gas temperature	Output voltage
100 °C (212 °F)	100 °C (212 °F)	Approx. 4.4 V
150 °C (302 °F)	150 °C (302 °F)	Approx. 3.7 V
200 °C (392 °F)	200 °C (392 °F)	Approx. 3.0 V
250 °C (482 °F)	250 °C (482 °F)	Approx. 2.3 V

OK	Clear the DTC and check whether it is output again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Resistance Between Terminals".	

(a) CAN1 Connector

9Y1200226CRS1092US0



2. Measure the Resistance Between Terminals

- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals E43 and E57 of the connector.

Factory specification	
Temperature	Resistance
100 °C (212 °F)	Approx. 18.3 kΩ
150 °C (302 °F)	Approx. 7.88 kΩ
200 °C (392 °F)	Approx. 4.00 kΩ
250 °C (482 °F)	Approx. 2.30 kΩ

OK	Go to "4. Measure the ECU Terminal Voltage".
NG	Go to "3. Check the Sensor".

9Y1200226CRS1093US0

3. Check the Sensor

- Turn the key switch OFF, remove the connector from the sensor side and measure the resistance between the terminals on the sensor side.

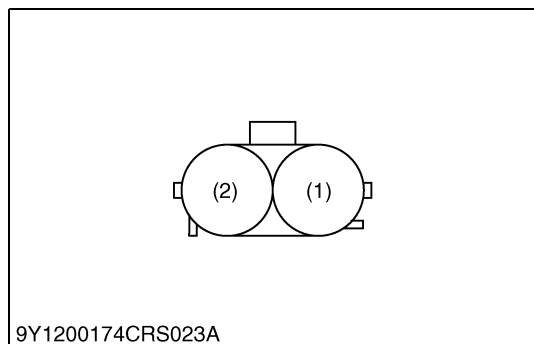
Factory specification	
Temperature	Resistance
100 °C (212 °F)	Approx. 18.3 kΩ
150 °C (302 °F)	Approx. 7.88 kΩ
200 °C (392 °F)	Approx. 4.00 kΩ
250 °C (482 °F)	Approx. 2.30 kΩ

OK	Wiring harness open circuit or connector fault → Check and repair.
NG	Exhaust gas temperature sensor fault → Replace the exhaust gas temperature sensor 2 (T2).

(1) Terminal A-GND3

(1) Terminal ODPF

9Y1200226CRS1094US0

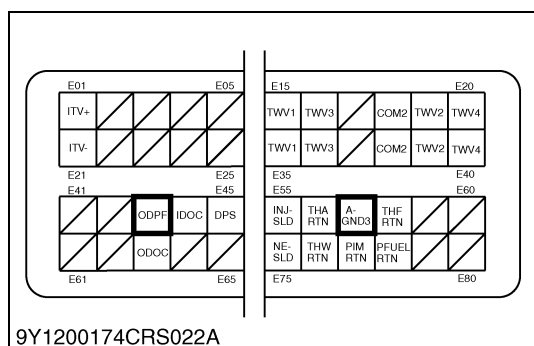


4. Measure the ECU Terminal Voltage

- Plug the ECU wiring harness connector into socket again, unplug the sensor connector, and measure the voltage between ECU terminals E43 and E57 at the ECU side.

Factory specification	Approx. 5 V
OK	The ECU connector is faulty or its wiring harness is shorted.
NG	Confirm by using other sensors that there is no ground short malfunction before replacing the ECU.

9Y1200226CRS1095US0



(49) Differential Pressure Sensor 1 Abnormality (DTC P2454 / 3251-4, P2455 / 3251-3)

P2454 / 3251-4: Differential pressure sensor 1 abnormality (Low side)

Behaviour during malfunction:

- None

Detection item:

- Sensor / Harness short to ground

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- No ST signal

DTC set parameter:

- DPF differential pressure sensor voltage: 0.21 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- 0 kPa (0.0 kgf/cm², 0.0 psi) [default value]
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1096US0

P2455 / 3251-3: Differential pressure sensor 1 abnormality (High side)

Behaviour during malfunction:

- None

Detection item:

- Sensor / Harness open circuit and short to +B

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- No ST signal

DTC set parameter:

- DPF differential pressure sensor voltage: 4.7 V or more

Engine warning light:

- ON

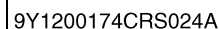
Limp home action by engine ECU (system action):

- 0 kPa (0.0 kgf/cm², 0.0 psi) [default value]
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

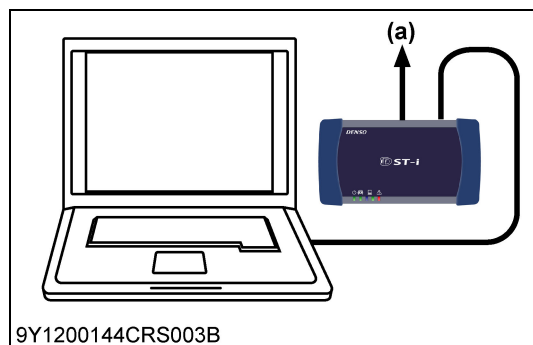
- Key switch turn OFF

9Y1200226CRS1097US0



- (c) **ECU Connector 1
(Engine Side)**
- (d) **ECU Connector 2
(Machine Side)**

9Y1200226CRS1098US0



1. Check the Differential Pressure Signals

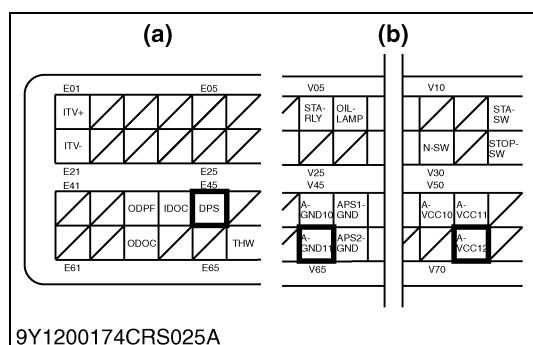
- Place the key switch in the OFF position, attach the diagnosis tool to the CAN1 connector, and return the key switch to the ON position again. Then, check the "Differential pressure" and "Differential pressure sensor output voltage" on the diagnosis tool data monitor.

Factory specification		
Engine state	Actual differential pressure	Output voltage
Key switch is ON	Approx. 0 Pa (0 kgf/cm ² , 0 psi)	Approx. 0.7 V

OK	Clear the DTC and check whether it is output again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the ECU Terminal Voltage".	

(a) CAN1 Connector

9Y1200226CRS1099US0



2. Measure the ECU Terminal Voltage

- Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals E45 and V71.

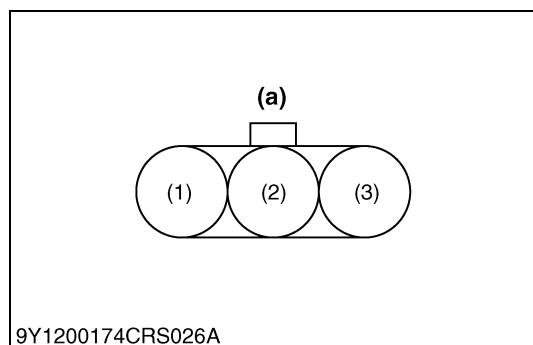
Factory specification	
Engine state	Output voltage
Key switch ON	Approx. 0.7 V

OK	Check the harness connectors and ECU pins.	
	OK	Faulty ECU → Replace.
	NG	Repair or replace the wiring harness, or replace the ECU.
NG	Go to "3. Measure the Voltage Between Differential Pressure Sensor Terminals".	

(a) ECU Connector 1 (Engine Side)

(b) ECU Connector 2 (Machine Side)

9Y1200226CRS1100US0



3. Measure the Voltage Between Differential Pressure Sensor Terminals

- Place the key switch in the ON position, and measure the voltage between terminals (2) and (3) of the differential pressure sensor at the wiring harness side.

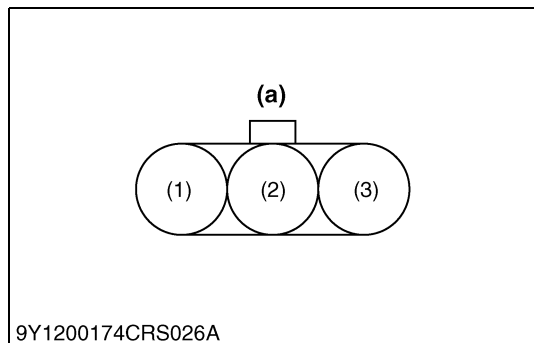
Factory specification	
Engine state	Output voltage
Key switch ON	Approx. 0.7 V

OK	Check the wiring harness (between ECU terminal E45 and sensor terminal (3)). → Repair the faulty area.	
	Go to "4. Measure the Voltage Between Differential Pressure Sensor Terminals".	
NG	Go to "4. Measure the Voltage Between Differential Pressure Sensor Terminals".	

- Terminal A-VCC12
- Terminal A-GND11
- Terminal DPS

(a) Differential Pressure Sensor Connector

9Y1200226CRS1101US0



4. Measure the Voltage Between Differential Pressure Sensor Terminals

1. Set the key switch to the OFF position, and unplug the differential pressure sensor connector from the socket.
2. Place the key switch in the ON position, and measure the voltage between terminals (1) and (2) of the differential pressure sensor connector (at the wiring harness side).

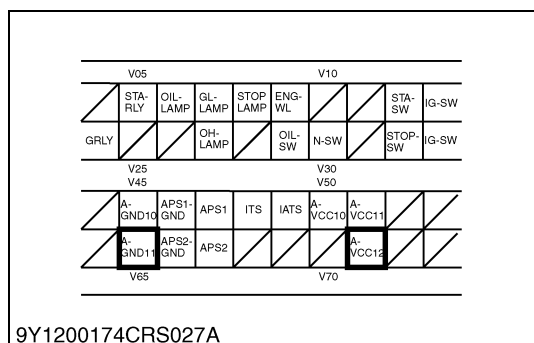
Factory specification	Approx. 5 V
-----------------------	-------------

OK	Check the wiring harness connector and sensor pins.	
	OK	Faulty differential pressure sensor → Replace.
	NG	1. Repair or replace the wiring harness. 2. Replace the differential pressure sensor.
NG	Go to "5. Measure the ECU Terminal Voltage".	

- (1) Terminal A-VCC12
(2) Terminal A-GND11
(3) Terminal DPS

(a) Differential Pressure Sensor Connector

9Y1200226CRS1102US0



5. Measure the ECU Terminal Voltage

1. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals V65 and V71.

Factory specification	Approx. 5 V
-----------------------	-------------

OK	Check the harness connectors and ECU pins.	
	OK	Faulty ECU → Replace.
	NG	Repair or replace the wiring harness, or replace the ECU.
NG	Check the wiring harness (between ECU terminal V65 and sensor terminal (2) and between ECU terminal V71 and sensor terminal (1)). → Repair the faulty area.	

NOTE

- Check the pipe between diesel particulate filter (DPF) and sensor, When it is damaged, the differential pressure can not reach the sensor.

9Y1200226CRS1103US0

(50) Intake Throttle Lift Sensor Abnormality (DTC P2621 / 523583-4, P2622 / 523582-3)

P2621 / 523583-4: Intake throttle lift sensor (Low side)

Behaviour during malfunction:

- None

Detection item:

- Intake throttle lift sensor low

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Intake throttle lift sensor voltage: 0.1 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1104US0

P2622 / 523582-3: Intake throttle lift sensor (High side)

Behaviour during malfunction:

- None

Detection item:

- Intake throttle lift sensor high

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Intake throttle lift sensor voltage: 4.89 V or more

Engine warning light:

- ON

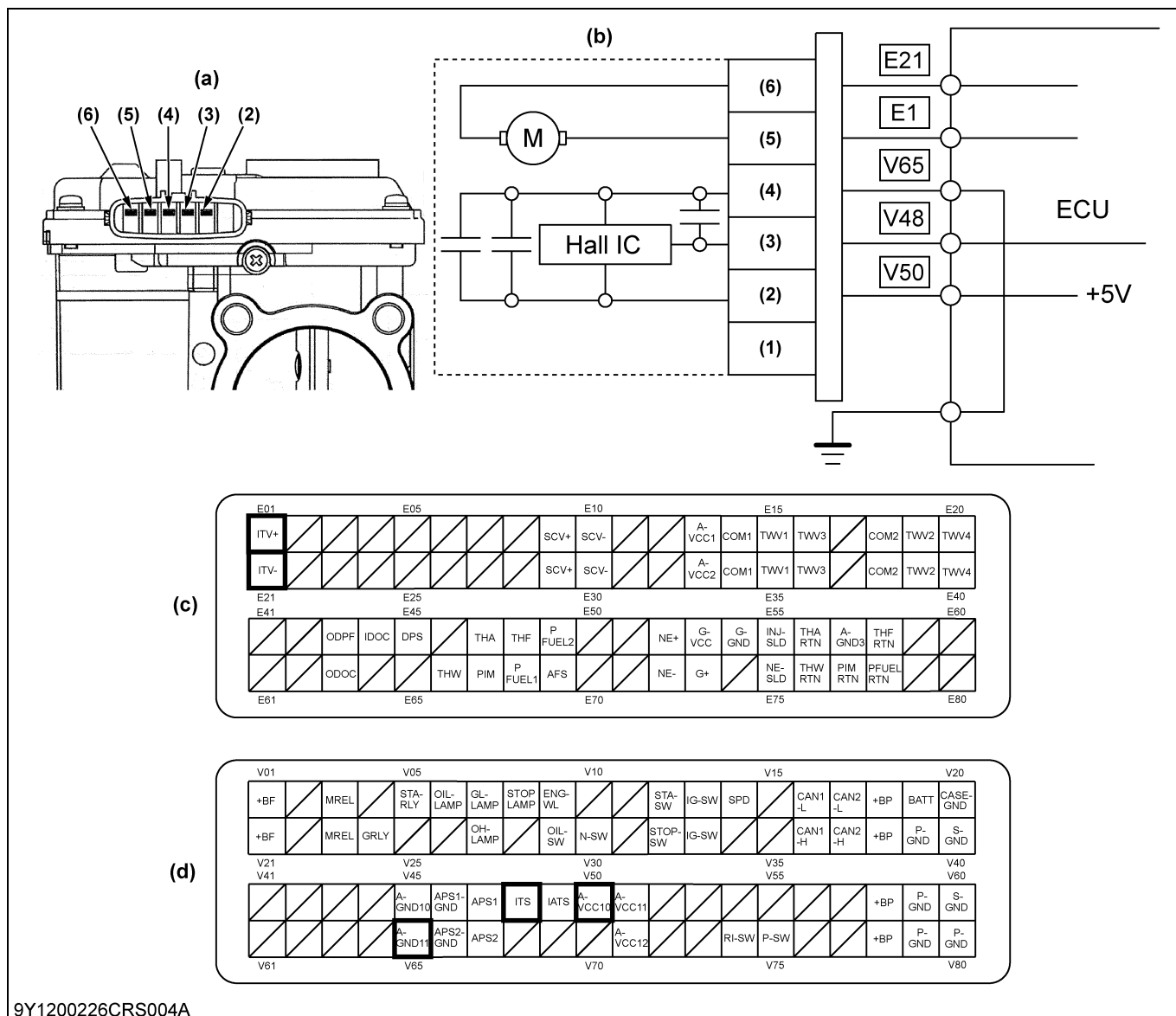
Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1105US0



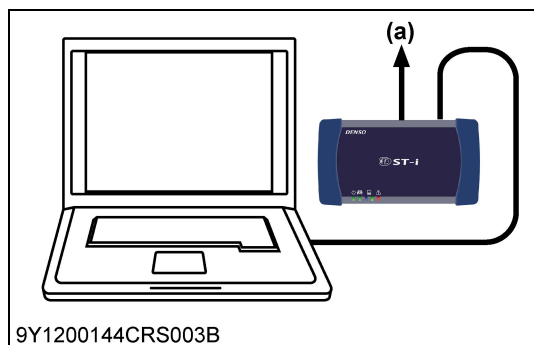
- (1) No Connection
 (2) Terminal A-VCC10 (+5 V)
 (3) Terminal ITS (Output)

- (4) Terminal A-GND11 (Ground)
 (5) Terminal ITV-
 (6) Terminal ITV+

- (a) Terminal Layout
 (b) Intake Throttle Valve

- (c) ECU Connector 1
 (Engine Side)
 (d) ECU Connector 2
 (Machine Side)

9Y1200226CRS1106US0



1. Check the Intake Throttle Signal

- After operating the engine, perform an active test. Monitor the "Actual intake throttle valve opening" and "Intake throttle opening output voltage", and check the values.
*** For details, refer to the active test section.**
- Clear the DTC and check whether it is output again or not.

Factory specification	No DTC is output.
OK	Normal.
NG	Replace the intake throttle assembly.

- (a) CAN1 Connector

9Y1200226CRS1107US0

(51) Emission Deterioration (DTC P3001 / 3252-0)

Behaviour during malfunction:

- Insufficient output

Detection item:

- DOC is heated up due to unburned fuel

DTC set preconditions:

- Not in the Regeneration mode
- Coolant temperature is 65 °C (149 °F) or more: continues longer than 5 min

DTC set parameter:

- $T1 - T0 \geq 250 \text{ °C (482 °F)}$

Engine warning light:

- ON

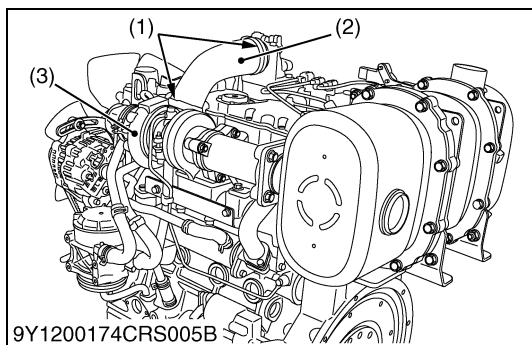
Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1108US0



1. Check the Air Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

■ NOTE

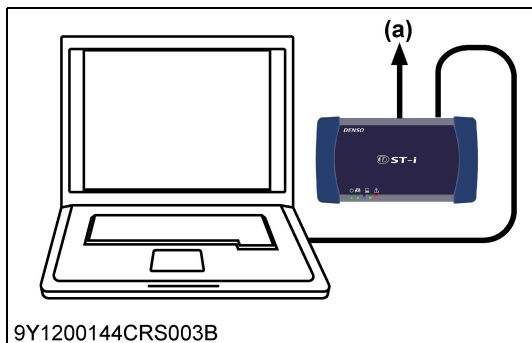
- Check the clogging condition of the air cleaner. If it is very dirty, replace the new one.
- Check if the suction hose of the turbo blower does not come off. If the hose comes off, install it.
- Check the suction path for leaks. (Suction path joints, suction pipes, hoses)
- Check the installation of all exhaust gas temperature sensors (T0, T1 and T2).
- Check the engine oil level.
- Check the engine coolant level.
- Check whether turbo has abnormality. (sound and externals)

OK	Go to "2. Check the DTC".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

- (1) Hose Clamp
(2) Hose

- (3) Turbocharger

9Y1200226CRS1109US0



2. Check the DTC

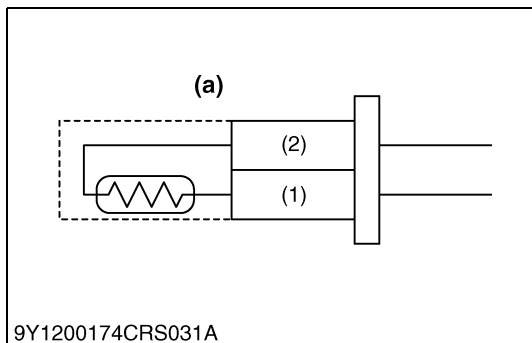
1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position and select the "Exhaust Gas Temperature sensor 0", "Exhaust gas temperature sensor 1" and "Exhaust gas temperature sensor 2" on the data monitor function.
3. Check whether the DTC is output or not after starting up the engine by monitoring the data signals.

Factory specification	No DTC is output.
-----------------------	-------------------

OK	Normal.
NG	Go to "3. Check the Exhaust Gas Temperature Sensor".

(a) CAN1 Connector

9Y1200226CRS1110US0



3. Check the Exhaust Gas Temperature Sensors

1. Check the exhaust gas temperature sensors (T0, T1 and T2).

OK	Normal.
NG	Replace the exhaust gas temperature sensor or engine combustion main parts. (Follow the diagnostic procedure of items P0543, P0546 and P242C)

(1) Terminal A-GND3

(2) Terminal IDOC, ODOC or ODPF

(a) Exhaust Gas Temperature Sensor (T0, T1 and T2)

9Y1200226CRS1111US0

(52) Exhaust Gas Temperature Sensor 0: Emergency High (DTC P3002 / 4765-0)

Behaviour during malfunction:

- Engine stops
- Inhibit cranking until down to 300 °C (572 °F)

Detection item:

- DOC inlet temperature (T0) high

DTC set preconditions:

- Exhaust gas temperature sensor T0, T1 and T2 are normal
- Battery voltage is normal

DTC set parameter:

- DOC inlet temperature (T0): 700 °C (1292 °F) or more

Engine warning light:

- ON

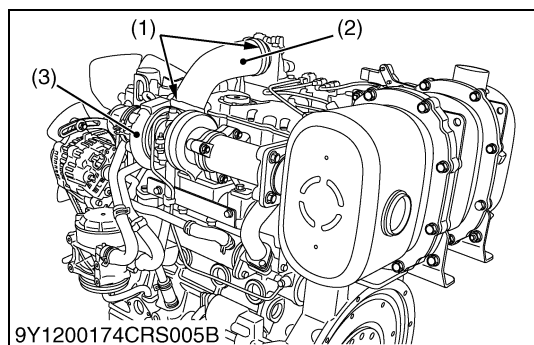
Limp home action by engine ECU (system action):

- Stop injection (Q = 0 mm³/st)
- Engine stop
- Inhibit starter relay activation until Exhaust Gas Temperature reduces down to 300 °C (572 °F)

Recovery from error:

- Under 300 °C (572 °F) & key switch turn OFF

9Y1200226CRS1112US0



1. Check the Air Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

■ IMPORTANT

- If the two errors occur from "Emergency exhaust gas temperature sensor T0 high", "Emergency exhaust gas temperature sensor T1 high", and "Emergency exhaust gas temperature T2 high" at the same time, check the exhaust gas temperature starting from a bigger number.

■ NOTE

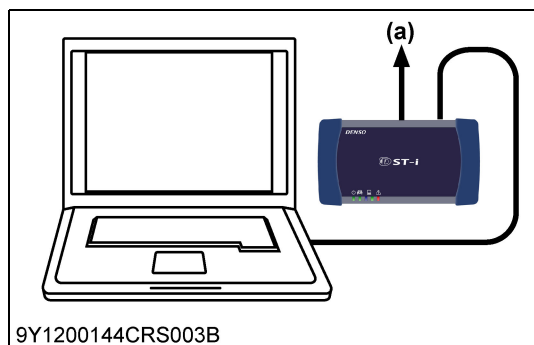
- Check the clogging condition of the air cleaner. If it is very dirty, replace the new one.
- Check if the suction hose of the turbo blower does not come off. If the hose comes off, install it.
- Check the suction path for leaks. (Suction path joints, suction pipes, hoses)
- Check the clogging condition of the fuel filter. If it is very dirty, replace the new one.
- Check the installation of all exhaust gas temperature sensors (T0, T1 and T2).
- Check the engine oil level.
- Check the engine coolant level.

OK	Go to "2. Check the Exhaust Gas Temperature".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

- (1) Hose Clamp
(2) Hose

- (3) Turbocharger

9Y1200226CRS1113US0



2. Check the Exhaust Gas Temperature

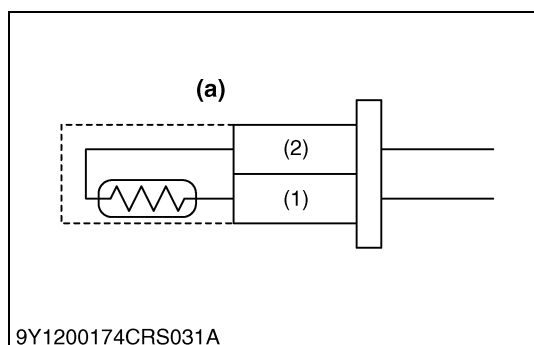
1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position and select the "Exhaust gas temperature Sensor 0", "Exhaust gas temperature Sensor 1" and "Exhaust gas temperature Sensor 2" on the data monitor function.
3. If the exhaust gas temperature is above 300 °C (572 °F), wait till the temperature decreases below 300 °C (572 °F).

Factory specification	The actual exhaust gas temperature and monitoring exhaust gas temperature should be approximately the same.
-----------------------	---

OK	Go to "4. Check the DTC".
NG	Go to "3. Check the Exhaust Gas Temperature Sensors (Refer to items P0543, P0546 and P242C)".

(a) CAN1 Connector

9Y1200226CRS1114US0



3. Check the Exhaust Gas Temperature Sensors (Refer to items P0543, P0546 and P242C)

1. Check the exhaust gas temperature sensors (T0, T1 and T2).

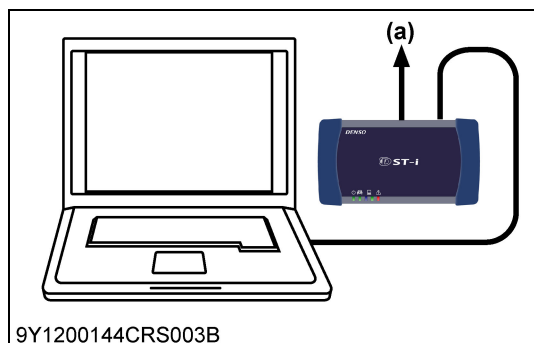
OK	Go to "4. Check the DTC".
NG	Replace the exhaust gas temperature sensor or engine combustion main parts. (Follow the diagnostic procedure of items P0543, P0546 and P242C)

(1) Terminal A-GND3

(2) Terminal IDOC, ODOC or ODPF

(a) Exhaust Gas Temperature Sensor (T0, T1 and T2)

9Y1200226CRS1115US0



4. Check the DTC

1. Check the engine noise and vibration after starting up the engine.
Check whether turbo has abnormality. (sound and externals)
2. Check whether the other DTC is output or not by operating the engine in the normal condition.
3. If it is OK, restart and operate the engine for 10 minutes with the engine in the no-load maximum speed status.
Check whether the DTC is output or not.

Factory specification	No DTC is output.
-----------------------	-------------------

OK	Normal.
NG	Replace the exhaust gas temperature sensor or engine combustion main parts. (Follow the diagnostic procedure of items P0543, P0546 and P242C)

(a) CAN1 Connector

9Y1200226CRS1116US0

(53) Exhaust Gas Temperature Sensor 1: Emergency High (DTC P3003 / 3242-0)

Behaviour during malfunction:

- Engine stops
- Inhibit cranking until down to 300 °C (572 °F)

Detection item:

- DPF inlet temperature (T1) high

DTC set preconditions:

- Exhaust gas temperature sensor T0, T1 and T2 are normal
- Battery voltage is normal

DTC set parameter:

- DPF inlet temperature (T1): 715 °C (1319 °F) or more

Engine warning light:

- ON

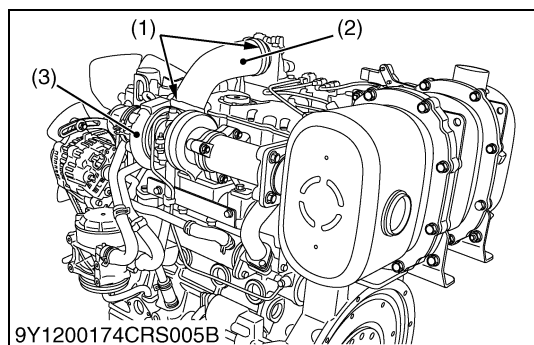
Limp home action by engine ECU (system action):

- Stop injection (Q = 0 mm³/st)
- Engine stop
- Inhibit starter relay activation until Exhaust Gas Temperature reduces down to 300 °C (572 °F)

Recovery from error:

- Under 300 °C (572 °F) & key switch turn OFF

9Y1200226CRS1117US0



1. Check the Air Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

■ IMPORTANT

- If the two errors occur from "Emergency exhaust gas temperature sensor T0 high", "Emergency exhaust gas temperature sensor T1 high", and "Emergency exhaust gas temperature T2 high" at the same time, check the exhaust gas temperature starting from a bigger number.

■ NOTE

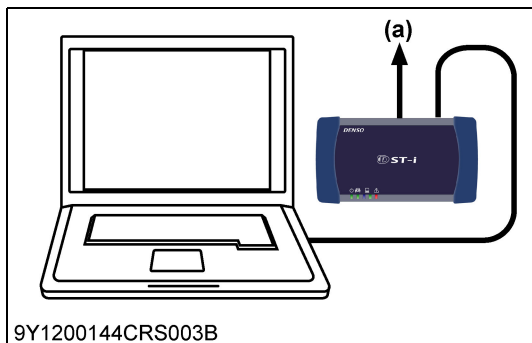
- Check the clogging condition of the air cleaner. If it is very dirty, replace the new one.
- Check if the suction hose of the turbo blower does not come off. If the hose comes off, install it.
- Check the suction path for leaks. (Suction path joints, suction pipes, hoses)
- Check the clogging condition of the fuel filter. If it is very dirty, replace the new one.
- Check the installation of all exhaust gas temperature sensors (T0, T1 and T2).
- Check the engine oil level.
- Check the engine coolant level.

OK	Go to "2. Check the Exhaust Gas Temperature".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

- (1) Hose Clamp
(2) Hose

- (3) Turbocharger

9Y1200226CRS1118US0



2. Check the Exhaust Gas Temperature

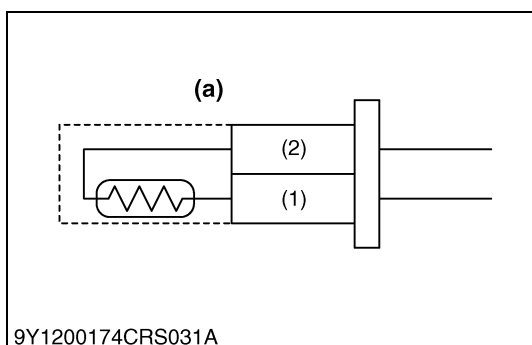
1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position and select the "Exhaust Gas Temperature Sensor 0", "Exhaust Gas Temperature Sensor 1" and "Exhaust Gas Temperature Sensor 2" on the data monitor function.
3. If the exhaust gas temperature is above 300 °C (572 °F), wait till the temperature decreases below 300 °C (572 °F).

Factory specification	The actual exhaust gas temperature and monitoring exhaust gas temperature should be approximately the same.
-----------------------	---

OK	Go to "4. Check the DTC".
NG	Go to "3. Check the Exhaust Gas Temperature Sensors (Refer to items P0543, P0546 and P242C)".

(a) CAN1 Connector

9Y1200226CRS1119US0



3. Check the Exhaust Gas Temperature Sensors (Refer to items P0543, P0546 and P242C)

1. Check the exhaust gas temperature sensors (T0, T1 and T2).

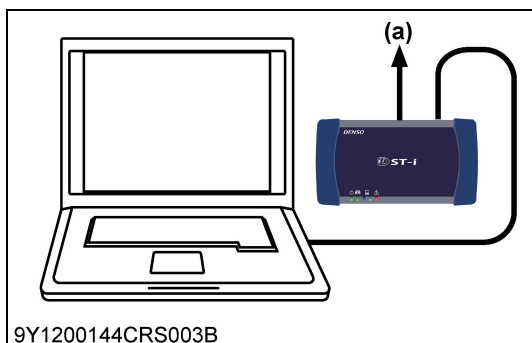
OK	Go to "4. Check the DTC".
NG	Replace the exhaust gas temperature sensor or engine combustion main parts. (Follow the diagnostic procedure of items P0543, P0546 and P242C)

(1) Terminal A-GND3

(2) Terminal IDOC, ODOC or ODPF

(a) Exhaust Gas Temperature Sensor (T0, T1 and T2)

9Y1200226CRS1120US0



4. Check the DTC

1. Check the engine noise and vibration after starting up the engine. Check whether turbo has abnormality. (sound and externals)
2. Check whether the other DTC is output or not by operating the engine in the normal condition.
3. If it is OK, restart and operate the engine for 10 minutes with the engine in the no-load maximum speed status. Check whether the DTC is output or not.

Factory specification	No DTC is output.
-----------------------	-------------------

OK	Normal.
NG	Replace the DPF assembly.

(a) CAN1 Connector

9Y1200226CRS1121US0

(54) Exhaust Gas Temperature Sensor 2: Emergency High (DTC P3004 / 3246-0)

Behaviour during malfunction:

- Engine stops
- Inhibit cranking until down to 300 °C (572 °F)

Detection item:

- DPF outlet temperature (T2) high

DTC set preconditions:

- Exhaust gas temperature sensor T0, T1 and T2 are normal
- Battery voltage is normal

DTC set parameter:

- DPF outlet temperature (T2): 820 °C (1508 °F) or more

Engine warning light:

- ON

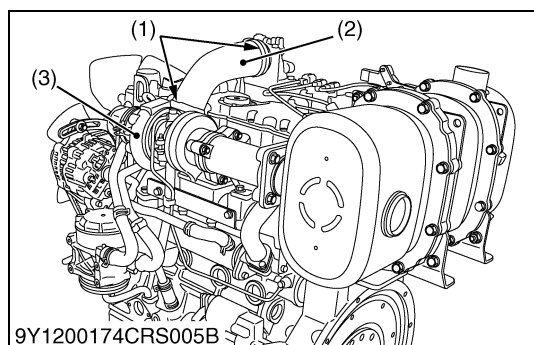
Limp home action by engine ECU (system action):

- Stop injection ($Q = 0 \text{ mm}^3/\text{st}$)
- Engine stop
- EGR stop
- Intake throttle 0 % open (Close)
- Inhibit starter relay activation until exhaust gas temperature reduces down to 300 °C (572 °F)

Recovery from error:

- Under 300 °C (572 °F) & key switch turn OFF

9Y1200226CRS1122US0



1. Check the Air Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

■ IMPORTANT

- If the two errors occur from "Emergency exhaust gas temperature sensor T0 high", "Emergency exhaust gas temperature sensor T1 high", and "Emergency exhaust gas temperature T2 high" at the same time, check the exhaust gas temperature starting from a bigger number.

■ NOTE

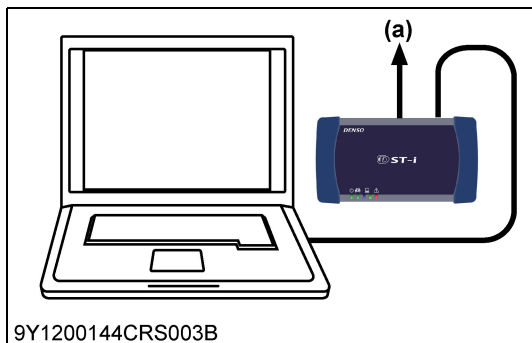
- Check the clogging condition of the air cleaner. If it is very dirty, replace the new one.
- Check if the suction hose of the turbo blower does not come off. If the hose comes off, install it.
- Check the suction path for leaks. (Suction path joints, suction pipes, hoses)
- Check the clogging condition of the fuel filter. If it is very dirty, replace the new one.
- Check the installation of all exhaust gas temperature sensors (T0, T1 and T2).
- Check the engine oil level.
- Check the engine coolant level.

OK	Go to "2. Check the Exhaust Gas Temperature".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

- (1) Hose Clamp
(2) Hose

- (3) Turbocharger

9Y1200226CRS1123US0



2. Check the Exhaust Gas Temperature

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position and select the "Exhaust Gas Temperature Sensor 0", "Exhaust Gas Temperature Sensor 1" and "Exhaust Gas Temperature Sensor 2" on the data monitor function.
3. If the exhaust gas temperature is above 300 °C (572 °F), wait till the temperature decreases below 300 °C (572 °F).

Factory specification	The actual exhaust gas temperature and monitoring exhaust gas temperature should be approximately the same.
-----------------------	---

OK	Go to "4. Check the DTC".
NG	Go to "3. Check the Exhaust Gas Temperature Sensors (Refer to items P0543, P0546 and P242C)".

(a) CAN1 Connector

9Y1200226CRS1124US0

3. Check the Exhaust Gas Temperature Sensors (Refer to items P0543, P0546 and P242C)

1. Check the exhaust gas temperature sensors (T0, T1 and T2).

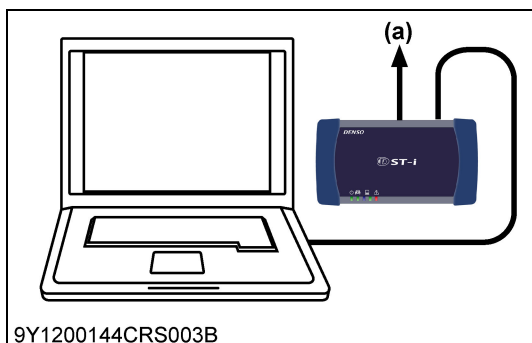
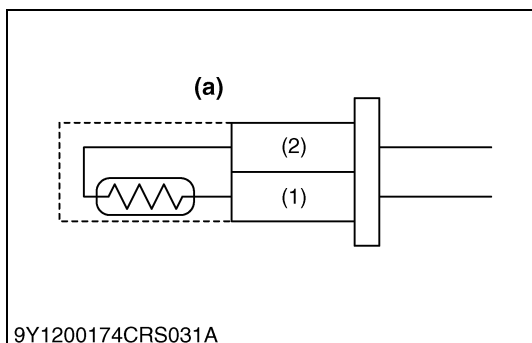
OK	Go to "4. Check the DTC".
NG	Replace the exhaust gas temperature sensor or engine combustion main parts. (Follow the diagnostic procedure of items P0543, P0546 and P242C)

(1) Terminal A-GND3

(2) Terminal IDOC, ODOC or ODPF

(a) Exhaust Gas Temperature Sensor (T0, T1 and T2)

9Y1200226CRS1125US0



4. Check the DTC

1. Check the engine noise and vibration after starting up the engine. Check whether turbo has abnormality. (sound and externals)
2. Check whether the other DTC is output or not by operating the engine in the normal condition.
3. If it is OK, restart and operate the engine for 10 minutes with the engine in the no-load maximum speed status. Check whether the DTC is output or not.

Factory specification	No DTC is output.
-----------------------	-------------------

OK	Normal.
NG	Go to "5. Check the DPF".

(a) CAN1 Connector

9Y1200226CRS1126US0

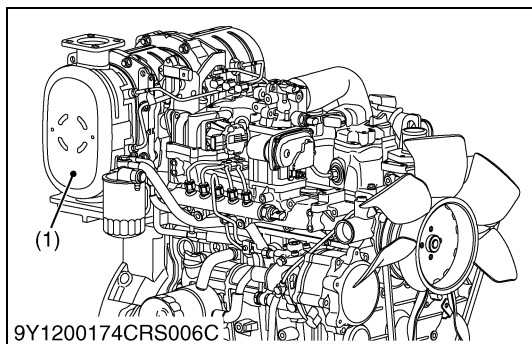
5. Check the DPF

1. Visually check if soot is not attached to the tail pipe which is connected to the DPF assembly.
2. Check whether the intake throttle opens completely after starting up the engine.
3. Check whether the coolant temperature is over 65 °C (149 °F) by operating the engine in the normal condition.

OK	Replace the ECU.
NG	Replace the DPF assembly.

(1) DPF Assembly

9Y1200226CRS1127US0



(55) Excessive PM3 (DTC P3006 / 3701-15)

Behaviour during malfunction:

- Insufficient output

Detection item:

- PM accumulation level3

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- PM accumulation more than trigger level
Regeneration level = 3

Engine warning light:

- ON

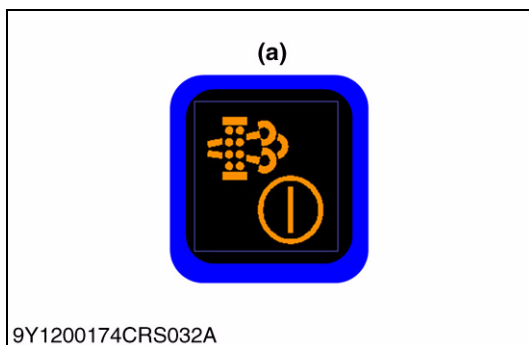
Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS1128US0



1. DPF Manual Regeneration

1. Start DPF Manual Regeneration immediately.

■ NOTE

- This DTC means the warning to urge to start regeneration rather than error. (Basically, Service Call is not necessary.)
- Followings are potential causes.
 - A low load operation has been continuing.
 - An engine is often left idling.
 - A short time operation below 30 minutes has been continuing.

- (a) DPF Manual Regeneration
Request Button

9Y1200226CRS1129US0

(56) Excessive PM4 (DTC P3007 / 3701-16)

Behaviour during malfunction:

- Insufficient output

Detection item:

- PM accumulation level4

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- PM accumulation more than trigger level
Regeneration level = 4

Engine warning light:

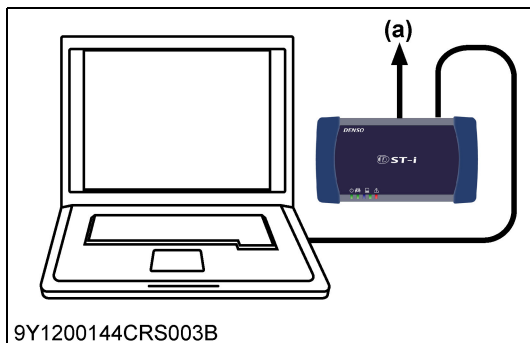
- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition

Recovery from error:

- Diagnostic counter = zero



9Y1200226CRS1130US0

1. DPF Manual Regeneration Request Function

1. Perform the diagnosis tool active test ("DPF Manual Regeneration").

■ NOTE

- Followings are potential causes.
 - A manual regeneration has not been carried out. Start DPF manual regeneration immediately when the manual regeneration warning light comes ON.

(a) CAN1 Connector

9Y1200226CRS1131US0

(57) Excessive PM5 (DTC P3008 / 3701-0)

Behaviour during malfunction:

- Insufficient output

Detection item:

- PM accumulation level5

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- PM accumulation more than trigger level
Regeneration level = 5

Engine warning light:

- ON

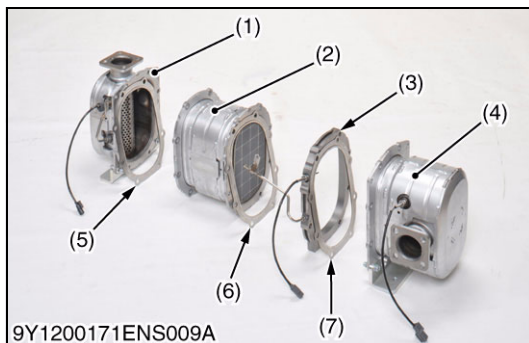
Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1132US0



9Y1200171ENS009A

1. Replace of DPF

1. Replace the DPF.

■ NOTE

- Followings are potential causes.
– A manual regeneration has not been carried out.

- (1) DPF Outlet Body
- (2) DPF Filter Comp
- (3) DPF Collar
- (4) DOC Catalyst

- (5) DPF Gasket
- (6) DPF Gasket
- (7) DPF Gasket

9Y1200226CRS1133US0

(58) Boost Pressure Low (DTC P3011 / 132-15)

Behaviour during malfunction:

- Insufficient output

Detection item:

- Dismount the hose between the turbo blower out and intake flange

DTC set preconditions:

- Not in the Regeneration mode
- Engine speed is 1600 rpm or more
- Target intake air flow value is 950 mg/cyl or more
- MAF sensor is normal
- EGR valve is normal
- Intake throttle valve is normal
- Boost pressure sensor is normal
- Barometric pressure sensor is normal
- Coolant temperature sensor is normal

DTC set parameter:

- Boost pressure sensor output is below target level in high air flow operating condition

Engine warning light:

- ON

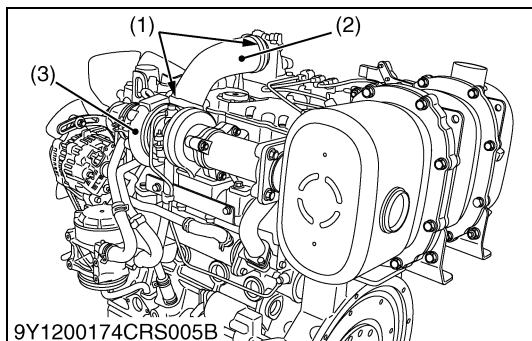
Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1134US0



1. Check the Air Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

■ NOTE

- Check if the suction hose of the turbo blower does not come off.
- Check if the hose of the boost pressure sensor does not come off.

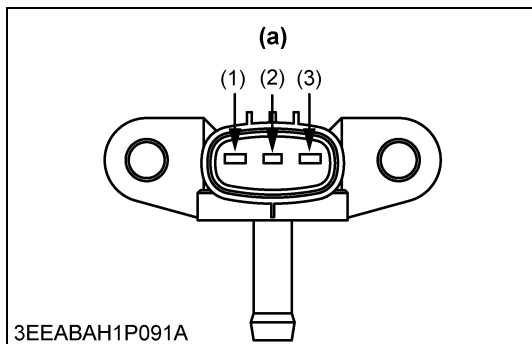
OK	Go to "2. Check the Boost Pressure Sensor (Refer to items P0237 and P0238)".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

(1) Hose Clamp

(3) Turbocharger

(2) Hose

9Y1200226CRS1135US0



2. Check the Boost Pressure Sensor (Refer to items P0237 and P0238)

1. Check the boost pressure sensor.

OK	Go to "3. Check the DTC".
NG	Replace the boost pressure sensor or its related parts. (Follow the diagnostic procedure of items P0237 and P0238)

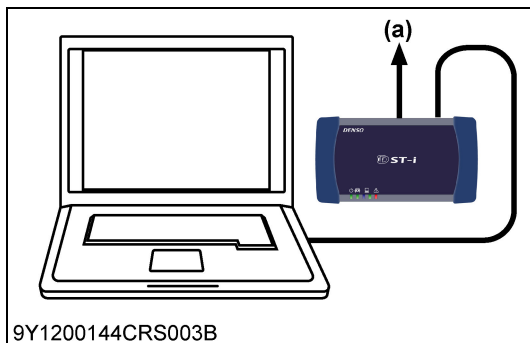
(1) Terminal A-VCC2

(a) Boost Pressure Sensor

(2) Terminal PIM

(3) Terminal PIM RTN

9Y1200226CRS1136US0



3. Check the DTC

1. Check the engine noise and vibration after starting up the engine.
Check whether turbo has abnormality. (sound and externals)
2. Check whether the other DTC is output or not by operating the engine in the normal condition.
3. If it is OK, restart and operate the engine for 10 minutes with the engine in the no-load maximum speed status. Check whether the DTC is output or not.

Factory specification	No DTC is output.
OK	Normal.
NG	Replace the ECU

(a) CAN1 Connector

9Y1200226CRS1137US0

(59) Low Coolant Temperature in Parked Regeneration (DTC P3012 / 523589-17)

Behaviour during malfunction:

- None

Detection item:

- During regeneration mode, engine warm-up condition is not formed (coolant temperature is low)

DTC set preconditions:

- In the manual Regeneration mode [DPFSTATUS = 5]

DTC set parameter:

- Engine coolant temperature stays below 65 °C (149 °F) under parked regeneration process, when the state above continues for 1500 seconds or more

Engine warning light:

- ON

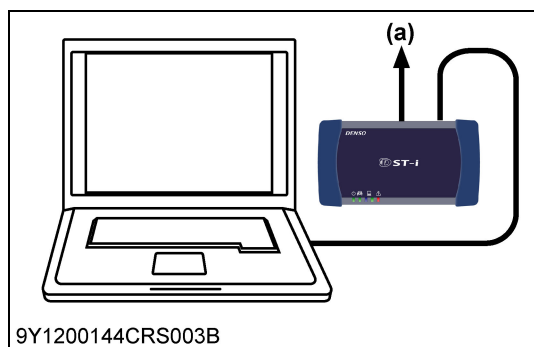
Limp home action by engine ECU (system action):

- None

Recovery from error:

- Diagnostic counter = zero (Leaving from parked active regeneration status)

9Y1200226CRS1138US0



1. Check the Coolant Temperature

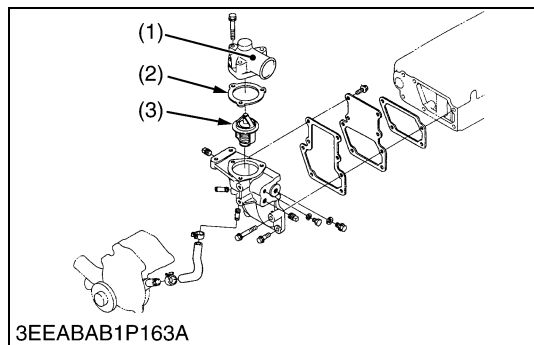
1. Perform the DPF Manual Regeneration again after warming up the engine.
2. Monitor the coolant temperature in the no-load maximum speed status with the diagnosis tool.

Factory specification	The coolant temperature should be 65 °C (149 °F) or more within 10 minutes.
-----------------------	---

OK	Normal.
NG	Go to "2. Check the Thermostat".

(a) CAN1 Connector

9Y1200226CRS1139US0



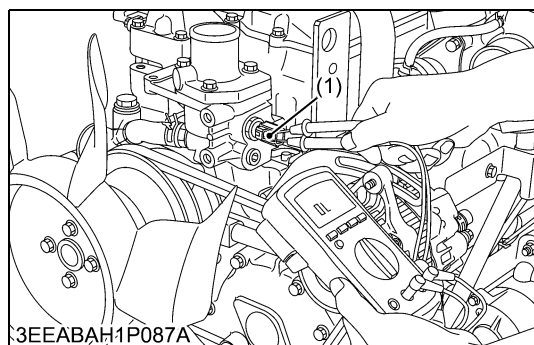
2. Check the Thermostat

1. Check the thermostat.

OK	Go to "3. Check the Coolant Temperature Sensor (Refer to items P0117 and P118)".
NG	Replace the thermostat.

- (1) Thermostat Cover (3) Thermostat Assembly
(2) Thermostat Cover Gasket

9Y1200226CRS1140US0



3. Check the Coolant Temperature Sensor (Refer to items P0117 and P118)

1. Check the coolant temperature sensor.

OK	Normal.
NG	Replace the coolant temperature sensor or engine coolant system. (Follow the diagnostic procedure of items P0117 and P118)

- (1) Coolant Temperature Sensor

9Y1200226CRS1141US0

(60) Parked Regeneration Time Out (DTC P3013 / 523590-16)

Behaviour during malfunction:

- None

Detection item:

- Time out error: regeneration incomplete due to low temperature of DPF

DTC set preconditions:

- In the manual Regeneration mode [DPFSTATUS = 7]

DTC set parameter:

- Coolant temperature is 65 °C (149 °F) or more and Regeneration was not completed within target time (approximately 30 min.) when the state above continues for 2700 seconds or more

Engine warning light:

- ON

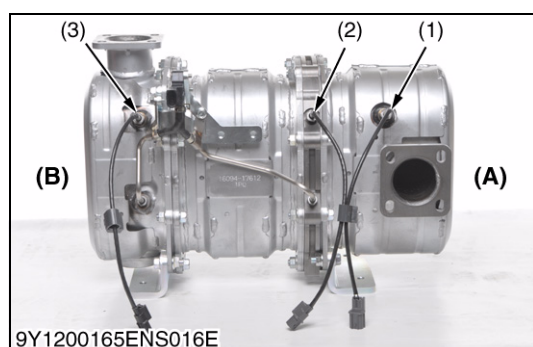
Limp home action by engine ECU (system action):

- None

Recovery from error:

- Diagnostic counter = zero (Leaving from parked active regeneration status)

9Y1200226CRS1142US0



1. Check the Installation of Exhaust Gas Temperature sensor

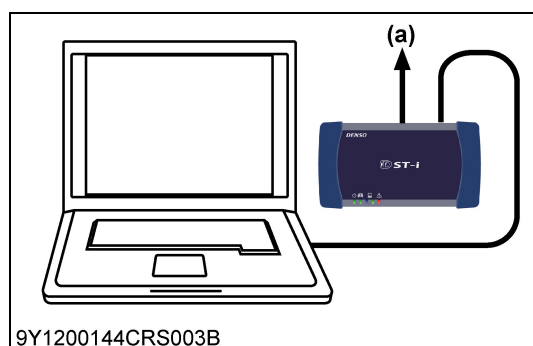
1. Check the installation of all exhaust gas temperature sensors (T0, T1 and T2).
2. Check the installation condition of the thermostat, and whether rust is not occurred.
3. Reinstall or replace the thermostat as necessary.

OK	Go to "2. DPF Manual Regeneration".
NG	Replace the exhaust gas temperature sensor or thermostat. (Follow the diagnostic procedure of items P0543, P0546 and P242C)

- (1) Exhaust Gas Temperature Sensor T0
- (2) Exhaust Gas Temperature Sensor T1
- (3) Exhaust Gas Temperature Sensor T2

(A) Exhaust Inlet Side
(B) Exhaust Outlet Side

9Y1200226CRS1143US0



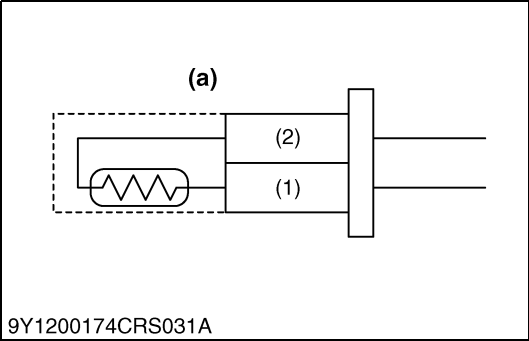
2. DPF Manual Regeneration

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position and select the "Exhaust Gas Temperature Sensor 0", "Exhaust Gas Temperature Sensor 1" and "Exhaust Gas Temperature Sensor 2" on the data monitor function.
3. Perform the diagnosis tool active test ("DPF Manual Regeneration").

Factory specification	No DTC is output.
OK	Normal.
NG	Go to 3. Check the Exhaust Gas Temperature Sensors (Refer to items P0543, P0546 and P242C)".

(a) CAN1 Connector

9Y1200226CRS1144US0



3. Check the Exhaust Gas Temperature Sensors (Refer to items P0543, P0546 and P242C)

1. Check the exhaust gas temperature sensors (T0, T1 and T2).

OK	Normal.
NG	Replace the exhaust gas temperature sensor or engine combustion main parts. (Follow the diagnostic procedure of items P0543, P0546 and P242C)

- (1) Terminal A-GND3

(2) Terminal IDOC, ODOC or ODPF
- (a) Exhaust Gas Temperature Sensor (T0, T1 and T2)

9Y1200226CRS1145US0

(61) All Exhaust Gas Temperature Sensor Failure (DTC P3018 / 523599-0)

Behaviour during malfunction:

- None

Detection item:

- All exhaust gas temperature sensor failure simultaneously

DTC set preconditions:

- Engine speed is 1400 min⁻¹ (rpm) or more
- Quantity of injection is 30 mm³/st or more
- Coolant temperature is 65 °C (149 °F) or more: continues longer than 300 sec.
- Intake air temperature is 0 °C (32 °F) or more
- It continues longer than 100 sec. after cranking mode

DTC set parameter:

- All exhaust gas temperature sensor failure (sensor low) simultaneously

Engine warning light:

- ON

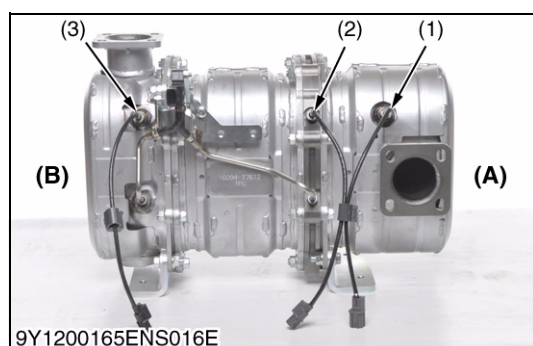
Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS1146US0



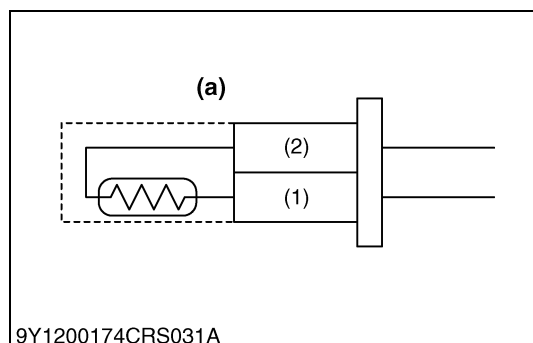
1. Check the Installation of Exhaust Gas Temperature sensor

1. Check the installation of all exhaust gas temperature sensors (T0, T1 and T2).

OK	Go to "2. Check the Exhaust Gas Temperature Sensors (Refer to items P0543, P0546 and P242C)".
NG	Replace the exhaust gas temperature sensor or engine combustion main parts. (Follow the diagnostic procedure of items P0543, P0546 and P242C)

- | | |
|---------------------------------------|--------------------------------|
| (1) Exhaust Gas Temperature Sensor T0 | (A) Exhaust Inlet Side |
| (2) Exhaust Gas Temperature Sensor T1 | (B) Exhaust Outlet Side |
| (3) Exhaust Gas Temperature Sensor T2 | |

9Y1200226CRS1147US0



2. Check the Exhaust Gas Temperature Sensors (Refer to items P0543, P0546 and P242C)

1. Check the exhaust gas temperature sensors (T0, T1 and T2).

OK	Normal.
NG	Replace the exhaust gas temperature sensor or engine combustion main parts. (Follow the diagnostic procedure of items P0543, P0546 and P242C)

- | | |
|---------------------------------|---|
| (1) Terminal A-GND3 | (a) Exhaust Gas Temperature Sensor (T0, T1 and T2) |
| (2) Terminal IDOC, ODOC or ODPF | |

9Y1200226CRS1148US0

(62) Initial Pump-calibration Incomplete (DTC P3019 / 523600-0)

Behaviour during malfunction:

- None

Detection item:

- Pump-calibration history

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Initial pump calibration incomplete

Engine warning light:

- ON

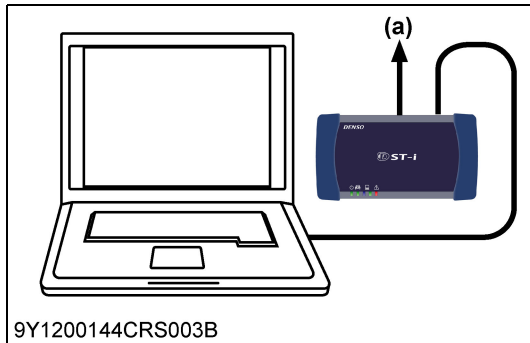
Limp home action by engine ECU (system action):

- None

Recovery from error:

- Diagnostic counter = zero (Leaving from parked active regeneration status)

9Y1200226CRS1149US0



1. Initial Pump-calibration

1. Place the key switch in the OFF position, attach the diagnosis tool the CAN1 connector, and perform the supply pump difference learning on the utility function.

■ NOTE

- This warning indicates that supply pump difference learning not performed after replacing ECU on the site.

(a) CAN1 Connector

9Y1200226CRS1150US0

(63) High Exhaust Gas Temperature After Emergency High Temperature DTC (DTC P3023 / 523601-0)

Behaviour during malfunction:

- None

Detection item:

- Exhaust gas temperature sensor 0, 1, 2 output

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- All exhaust gas temperature (T0, T1 and T2) reduces down to 300 °C (572 °F)

Engine warning light:

- ON

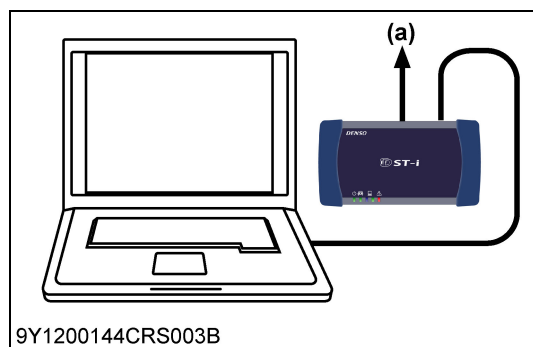
Limp home action by engine ECU (system action):

- Engine stop
- Inhibit starter relay activation until all exhaust gas temperature (T0, T1 and T2) reduces down to 300 °C (572 °F)

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS1151US0



1. Check the DTC

1. If DTC is output when the key switch is ON, do not start-up the engine. (Engine can not be started-up)
2. Engine can be started up after the DTC goes off.

■ NOTE

- **This DTC does not mean error.**
This warning indicates that error of emergency exhaust gas temperature sensor has been continuing.

(a) CAN1 Connector

9Y1200226CRS1152US0

(64) High Frequency of Regeneration (DTC P3024 / 523602-0)

Behaviour during malfunction:

- Worsening exhaust gas performance (NOx)

Detection item:

- Time interval from the end time to the start time of the regeneration

DTC set preconditions:

- Battery voltage is normal
- Key switch is ON

DTC set parameter:

- Regeneration time interval within 30 min. occurs three times continuously

Engine warning light:

- ON

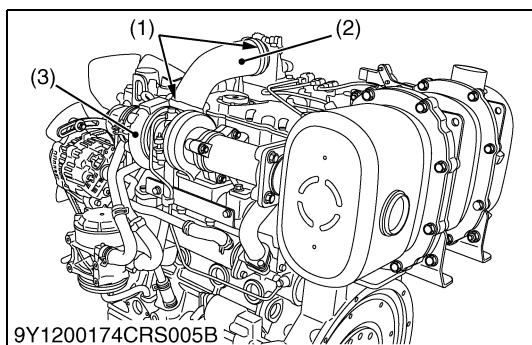
Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1153US0



1. Check the Air Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

■ NOTE

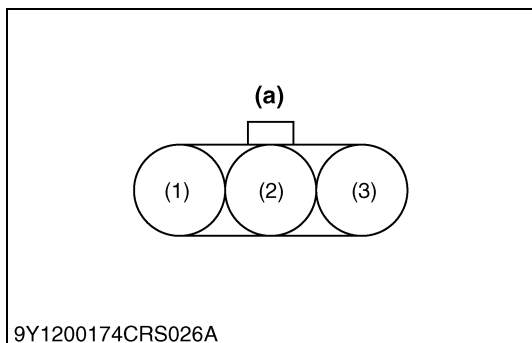
- Check the installation of the differential pressure sensor pipes.
- Check the engine oil maintenance history (Oil consumption).

OK	Go to "2. Check the Differential Pressure Sensor (Refer to items P2454 and P2455)".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

- (1) Hose Clamp
(2) Hose

- (3) Turbocharger

9Y1200226CRS1154US0



2. Check the Differential Pressure Sensor (Refer to items P2454 and P2455)

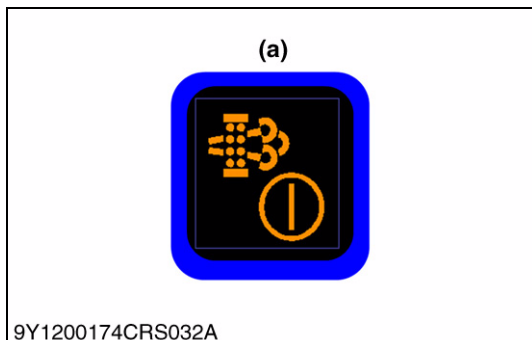
1. Check the differential pressure sensor.

OK	Go to "3. Check the Function of DPF".
NG	Replace the differential pressure sensor or its related parts. (Follow the diagnostic procedure of items P2454 and P2455.)

- (1) Terminal A-VCC12
(2) Terminal A-GND11
(3) Terminal DPS

- (a) **Differential Pressure Sensor Connector**

9Y1200226CRS1155US0



3. Check the Function of DPF

1. Operate the engine for 30 minutes in the normal condition.

Factory specification	"DPF Regeneration Request" is not detected within 30 minutes.
OK	Normal.
NG	Replace the DPF assembly.

- (a) **DPF Manual Regeneration Request Button**

9Y1200226CRS1156US0

(65) Over Heat Pre-caution (DTC P3025 / 523603-15)

Behaviour during malfunction:

- Worsening exhaust gas performance (NOx)

Detection item:

- Limitation of EGR valve activation due to High temperature AECD

DTC set preconditions:

- Coolant temperature sensor is normal

DTC set parameter:

- Engine coolant temperature $\geq 110\text{ }^{\circ}\text{C}$ (230 $^{\circ}\text{F}$)

Engine warning light:

- ON

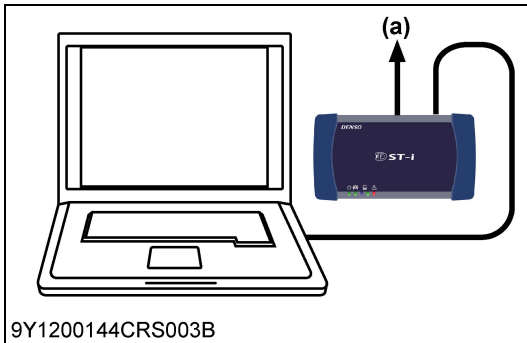
Limp home action by engine ECU (system action):

- None

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS1157US0



1. Check the DTC

1. This DTC does not mean error.

The EGR operation is restricted when the coolant temperature rises above 110 $^{\circ}\text{C}$ (230 $^{\circ}\text{F}$).

So, this warning indicates that emission could worsen due to the limitation.

- (a) CAN1 Connector

9Y1200226CRS1158US0

(66) CAN2 Bus Off (DTC U0075 / 523547-2)**Behaviour during malfunction:**

- Insufficient output
- Transmitted data is invalid

Detection item:

- CAN2 + B/GND open circuit or high traffic error

DTC set preconditions:

- Battery voltage is normal
- Key switch is ON

DTC set parameter:

- CAN2 Bus off

Engine warning light:

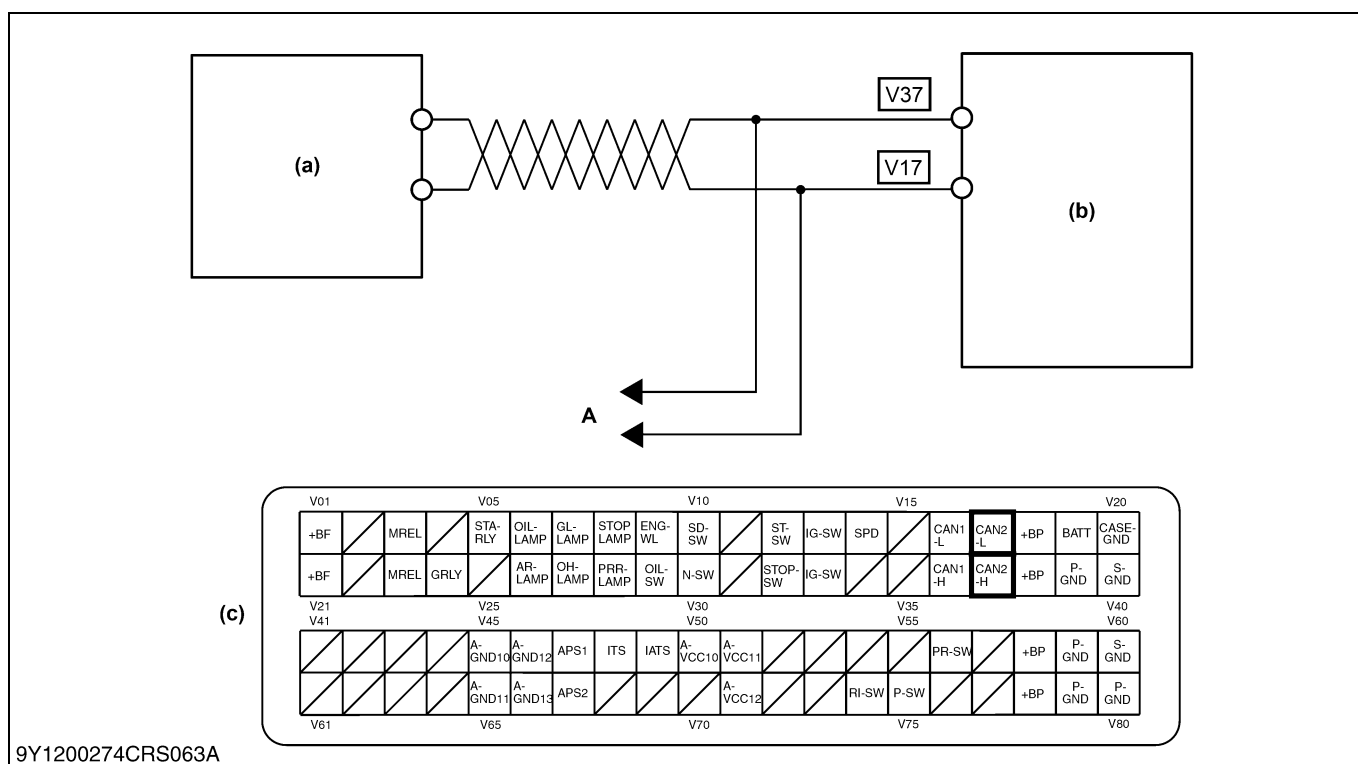
- ON

Limp home action by engine ECU (system action):

- Forced Idle (Accelerator = 0 %)

Recovery from error:

- Key switch turn OFF



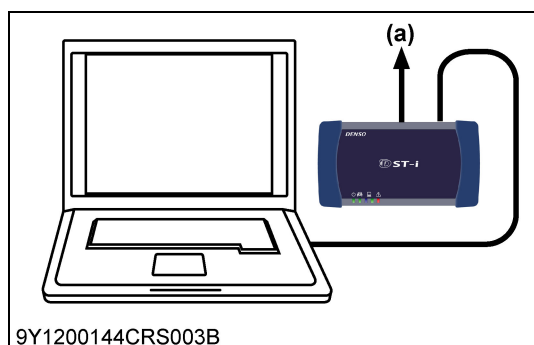
9Y1200274CRS063A

(a) ECU for Machine

(b) Engine ECU

(c) ECU Connector 2
(Machine Side)

A: To Other ECU



9Y1200144CRS003B

1. DTC Judgment

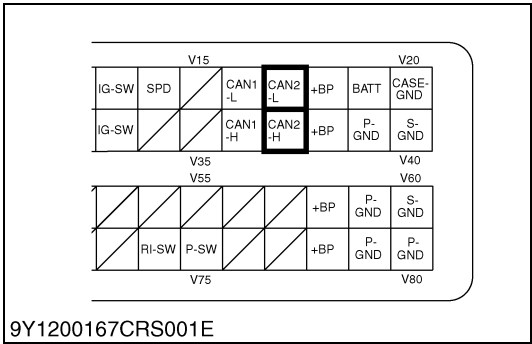
1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Place the key switch in the ON position, check whether the DTC (U0075) is output or not.

Factory specification	DTC (U0075) must not be output.
OK	Normal.
NG	Go to "2. Check the Wiring Related to the CAN of the Common Rail System".

(a) CAN1 Connector

9Y1200226CRS1159US0

9Y1200226CRS1160US0



2. Check the Wiring Related to the CAN of the Common Rail System

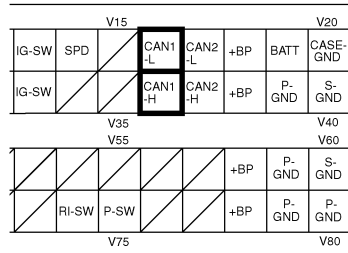
1. Check the wiring harness and connectors being connected to ECU terminals V17 and V37 for a short or an open circuit.

■ IMPORTANT

- Refer to "6.[3] ELECTRIC SYSTEM INSPECTION PROCEDURE - (1) Basics of Checking Electrical / Electronic Circuit Systems". (Refer to page 1-S549)

OK	Replace the ECU.
NG	Repair or replace the faulty areas.

9Y1200226CRS1161US0



9Y1200174CRS028A

1. Check the Wiring Related to the CAN of the Common Rail System

1. Check the connector and the wiring harness being connected to ECU terminal V16 and V36 for a short or an open circuit.

■ IMPORTANT

- Refer to "6.[3] ELECTRIC SYSTEM INSPECTION PROCEDURE - (1) Basics of Checking Electrical / Electronic Circuit Systems". (Refer to page 1-S549)

■ NOTE

- If the "CAN 1 Bus off error" is output at the same time, carry out this inspection first.

OK	Go to "2. Measure the EGR Terminal Voltage".
NG	Repair or replace the faulty areas.

9Y1200226CRS1164US0

2. Measure the EGR Terminal Voltage

1. Place the key switch in the ON position, and measure the voltage between EGR terminals (3) and (4).

Factory specification	Approx. 10 to 16 V
-----------------------	--------------------

OK	Go to "3. Check the DTC Again".
NG	Repair or replace the faulty areas.

(1) Terminal CAN-H

(3) Terminal Ground

(2) Terminal CAN-L

(4) Terminal Power (+12 V)

9Y1200226CRS1165US0

3. Check the DTC Again

1. Clear the past malfunction data, and make sure that the same DTC is output again in the reproduction test.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

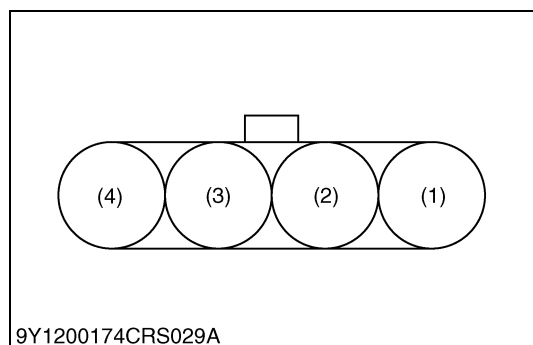
■ NOTE

- Check the DTC again after starting up the engine with the coolant temperature over 65 °C (149 °F).

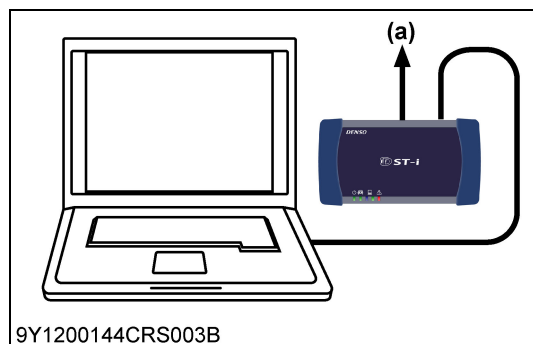
OK	Normal.
NG	Replace the EGR assembly.

(a) CAN1 Connector

9Y1200226CRS1166US0



9Y1200174CRS029A



9Y1200144CRS003B

(68) CAN1 Bus Off (DTC U0077 / 523604-2)

Behaviour during malfunction:

- Insufficient output
- Transmitted data is invalid

Detection item:

- CAN1 +B/GND open circuit or high traffic error

DTC set preconditions:

- Battery voltage is normal
- Key switch is ON

DTC set parameter:

- CAN1 Bus off

Engine warning light:

- ON

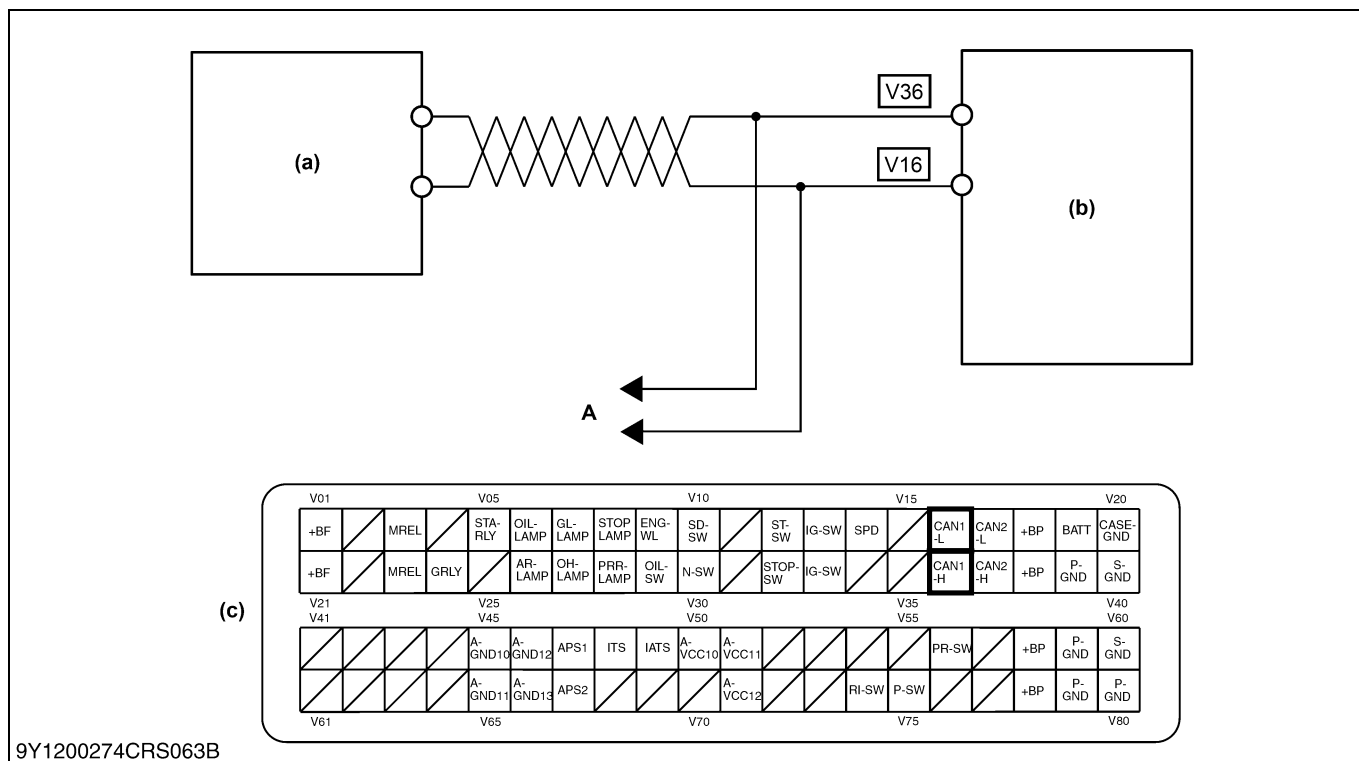
Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1167US0



9Y1200274CRS063B

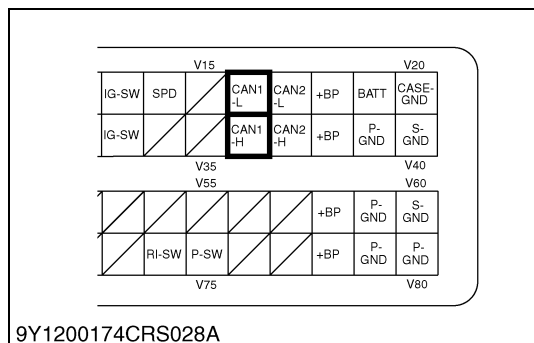
(a) EGR Valve Assembly

(b) Engine ECU

(c) ECU Connector 2
(Machine Side)

A: To Diagnosis Tool

9Y1200226CRS1168US0



9Y1200174CRS028A

1. Check the Wiring Related to the CAN of the Common Rail System

1. Check the connector and the wiring harness being connected to ECU terminal V16 and V36 for a short or an open circuit.

■ IMPORTANT

- Refer to "6.[3] ELECTRIC SYSTEM INSPECTION PROCEDURE - (1) Basics of Checking Electrical / Electronic Circuit Systems". (Refer to page 1-S549)

OK	Replace the ECU.
NG	Repair or replace the faulty areas.

9Y1200226CRS1169US0

(69) CAN2 Frame Error (DTC U0081 / 523548-2, U0082 / 523591-2, U0083 / 523592-2, U0084 / 523593-2, U0085 / 523594-2, U0086 / 523595-2, U0087 / 523596-2, U0089 / 523598-2)

U0081 / 523548-2: CAN-KBT frame error

Behaviour during malfunction:

- Insufficient output

Detection item:

- CAN-KBT original frame error

DTC set preconditions:

- Battery voltage is normal
- Key switch turn OFF to ON
- No ST signal
- No error of "CAN2 Bus off"

DTC set parameter:

- CAN2 KBT frame error open circuit or short circuit

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Forced Idle (Accelerator = 0 %)

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1170US0

U0082 / 523591-2: CAN CCVS (Parking SW and Vehicle Speed) frame error

Behaviour during malfunction:

- None

Detection item:

- CAN_CCVS communication stopping

DTC set preconditions:

- Battery voltage is normal
- No ST signal

DTC set parameter:

- CAN CCVS frame time out error

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Parking SW = OFF, Vehicle speed = 0 [default value]

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1171US0

U0083 / 523592-2: CAN CM1 (Regen SW) frame error

Behaviour during malfunction:

- None

Detection item:

- CAN_CM1 communication stopping

DTC set preconditions:

- Battery voltage is normal
- No ST signal

DTC set parameter:

- CAN CM1 frame time out error

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Regeneration inhibit = ON, Parked regeneration switch = OFF [default value]

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1172US0

U0084 / 523593-2: CAN DDC1 (Transmission) frame error**Behaviour during malfunction:**

- None

Detection item:

- CAN_DDC1 communication stopping

DTC set preconditions:

- Battery voltage is normal
- No ST signal

DTC set parameter:

- CAN DDC1 frame time out error

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Accelerator non-linear processing flag = 0 [default value]
- Accelerator non-linear processing invalid

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1173US0

U0085 / 523594-2: CAN ETC2 (Neutral SW) frame error**Behaviour during malfunction:**

- None

Detection item:

- CAN_ETC2 communication stopping

DTC set preconditions:

- Battery voltage is normal
- No ST signal

DTC set parameter:

- CAN ETC2 frame time out error

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Neutral SW = OFF [default value]

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1174US0

U0086 / 523595-2: CAN ETC5 (Neutral SW) frame error**Behaviour during malfunction:**

- None

Detection item:

- CAN_ETC5 communication stopping

DTC set preconditions:

- Battery voltage is normal
- No ST signal

DTC set parameter:

- CAN ETC5 frame time out error

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Neutral SW = OFF [default value]

Recovery from error:

- Key switch turn OFF

9Y1200226CRS1175US0

U0087 / 523596-2: CAN TSC1 frame error**Behaviour during malfunction:**

- None

Detection item:

- CAN_TSC1 communication stopping

DTC set preconditions:

- Battery voltage is normal
- No ST signal

DTC set parameter:

- When not receive the request to "TSC1 buffer" 3 times continuously at each timing after receiving over-ride control request (other than 0x00)

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Override control mode = Normal mode [default value]

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS1176US0

U0089 / 523598-2: CAN EBC1 frame error**Behaviour during malfunction:**

- None

Detection item:

- CAN_EBC1 communication stopping

DTC set preconditions:

- Battery voltage is normal
- No ST signal

DTC set parameter:

- CAN EBC1 frame time out error

Engine warning light:

- ON

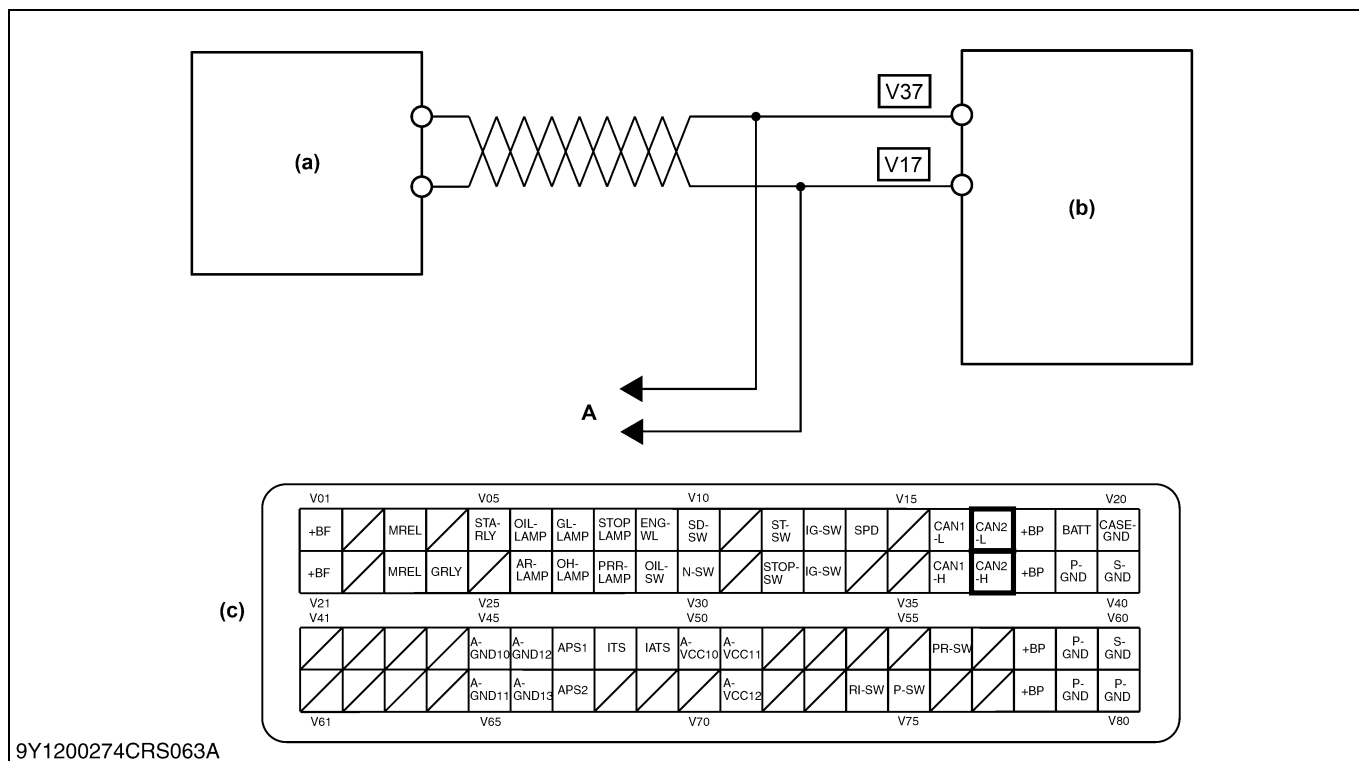
Limp home action by engine ECU (system action):

- Non shutdown [default value]
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Diagnostic counter = zero

9Y1200226CRS1177US0



9Y1200274CRS063A

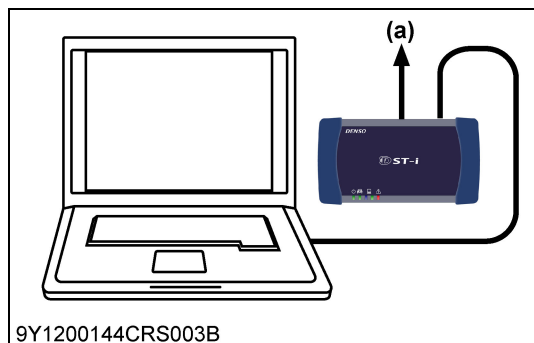
(a) ECU for Machine

(b) Engine ECU

(c) ECU Connector 2
(Machine Side)

A: To Other ECU

9Y1200226CRS1178US0

**1. DTC Judgment**

- Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
- Place the key switch in the ON position, check whether the DTC is output or not.

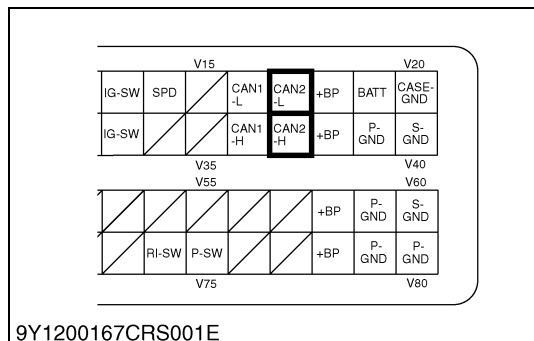
NOTE

- If the "CAN 2 Bus off error" is output at the same time, carry out this inspection first.
- Make sure that the ECU on the machine side operates properly.

Factory specification	DTC must not be output.
OK	Normal.
NG	Go to "2. Check the Wiring Related to the CAN of the Common Rail System".

(a) CAN1 Connector

9Y1200226CRS1179US0

**2. Check the Wiring Related to the CAN of the Common Rail System**

- Check the wiring harness and connectors being connected to ECU terminals V17 and V37 for a short or an open circuit.

IMPORTANT

- Refer to "6.[3] ELECTRIC SYSTEM INSPECTION PROCEDURE - (1) Basics of Checking Electrical / Electronic Circuit Systems". (Refer to page 1-S549)

OK	Replace the ECU.
NG	Repair or replace the faulty areas.

9Y1200226CRS1180US0

[3] DTC LIST (V3800-TIE4/-TIE4C)

Name		NE-G phase shift
ISO 14229 P-Code		P0016
J1939-73	SPN	636
	FMI	7
SPN Name SAE J1939 Table C1		Engine Position Sensor
DTC Name		NE-G phase shift
Management Unit for Detected Part		NEGUM
Detection item		<ul style="list-style-type: none"> Large phase shift between NE (crankshaft position sensor) pulse and G (camshaft position sensor) pulse
DTC Set Preconditions		<ul style="list-style-type: none"> Engine is operating above low idle speed Battery voltage is normal Sensor supply voltage VCC# is normal NE signal is normal G signal is normal Coolant temperature is 10 °C (50 °F) or higher
DTC set parameter		(Approximate) <ul style="list-style-type: none"> Phase difference between NE pulse and G pulse is within ± 0.26 rad ($\pm 15^\circ$)
Time to action or number of error detection		<ul style="list-style-type: none"> 10 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		(Invalid G signal) <ul style="list-style-type: none"> Engine hesitates at start-up
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter =zero
Delay time for recovery		<ul style="list-style-type: none"> Delay time varies with engine speed in proportional relation. If it is set 30 sec at 800 min^{-1} (rpm), it is shorten to 15 sec at 1600 min^{-1} (rpm) operation.
Remark		<ul style="list-style-type: none"> NE: Crankshaft position sensor G: Camshaft position sensor

9Y1200226CRS1211US0

Name		Intake air temperature built-in MAF sensor abnormality	
ISO 14229 P-Code		P0072	P0073
J1939-73	SPN	171	171
	FMI	4	3
SPN Name SAE J1939 Table C1		Ambient Air Temperature	Ambient Air Temperature
DTC Name		Intake air temperature built-in MAF sensor: Low	Intake air temperature built-in MAF sensor: High
Management Unit for Detected Part		THAIL	THAIH
Detection item		<ul style="list-style-type: none"> Ground short circuit of sensor or harness 	<ul style="list-style-type: none"> Open circuit or +B short circuit of sensor or harness.
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal 	<ul style="list-style-type: none"> Battery voltage is normal
DTC set parameter		<ul style="list-style-type: none"> Intake air temperature built-in MAF sensor voltage: 0.1 V or less 	<ul style="list-style-type: none"> Intake air temperature built-in MAF sensor voltage: 4.9 V or more
Time to action or number of error detection		<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> 25 °C (77 °F) [default value] 	<ul style="list-style-type: none"> 25 °C (77 °F) [default value]
Behaviour During Malfunction		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> Immediately 	<ul style="list-style-type: none"> Immediately
Remark			

9Y1200226CRS1212US0

Name		High rail pressure
ISO 14229 P-Code		P0088
J1939-73	SPN	157
	FMI	0
SPN Name SAE J1939 Table C1		Engine Injector Metering Rail 1 Pressure
DTC Name		High rail pressure
Management Unit for Detected Part		PCEX
Detection item		<ul style="list-style-type: none"> Actual pressure exceeds the command pressure
DTC Set Preconditions		<ul style="list-style-type: none"> Rail pressure sensor is normal Sensor supply voltage VCC# is normal
DTC set parameter		<ul style="list-style-type: none"> Actual pressure ≥ 267 MPa (2720 kgf/cm², 38700 psi)
Time to action or number of error detection		<ul style="list-style-type: none"> 1 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Engine stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Engine stops
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> 30 sec.
Remark		<ul style="list-style-type: none"> To minimize PM emission

9Y1200226CRS1213US0

Name		PCV boost time-out	Open circuit of harness or coil in PCV line
ISO 14229 P-Code		P0089	P0090
J1939-73	SPN	523627	523612
	FMI	8	5
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		PCV boost time-out	Open circuit of harness or coil in PCV line
Management Unit for Detected Part		BTPCV1	NCPCV1
Detection item		<ul style="list-style-type: none"> Open circuit of discharge MOS-IC in ECU 	<ul style="list-style-type: none"> Open circuit of harness Open circuit of PCV coil
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal During injection CPU is normal (VDIC2 is normal) 	<ul style="list-style-type: none"> Battery voltage is normal During PCV driving CPU is normal (VDIC2 is normal)
DTC set parameter		<ul style="list-style-type: none"> Open circuit of discharge MOS-IC in ECU 	<ul style="list-style-type: none"> Open circuit of harness or open circuit of PCV coil
Time to action or number of error detection		<ul style="list-style-type: none"> 20 times or more 	<ul style="list-style-type: none"> 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine stops in some cases 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine stops
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1214US0

Name		PCV or PRV drive line short	
ISO 14229 P-Code		P0091	P0092
J1939-73	SPN	523607	523607
	FMI	4	3
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		PCV or PRV drive line short to ground at power supply side (COM3), or all driver line short to ground simultaneously	PCV or PRV drive line short to +B at power supply side (COM3), or all driver line short to +B simultaneously
Management Unit for Detected Part		GSCOM3	BSCOM3
Detection item		<ul style="list-style-type: none"> Wiring harness short to ground 	<ul style="list-style-type: none"> Wiring harness short to +B
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal CPU is normal (VDIC2 is normal) Starter switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> Battery voltage is normal CPU is normal (VDIC2 is normal) Starter switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> Wiring harness short to ground 	<ul style="list-style-type: none"> Wiring harness short to +B
Time to action or number of error detection		<ul style="list-style-type: none"> 8 times or more 	<ul style="list-style-type: none"> 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine stop 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine stop
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1215US0

Name		Fuel leak (in high pressured fuel system) or air bubbles in fuel line
ISO 14229 P-Code		P0093
J1939-73	SPN	1239
	FMI	1
SPN Name SAE J1939 Table C1		Engine Fuel Leakage 1
DTC Name		Fuel leak (in high pressured fuel system) or air bubbles in fuel line
Management Unit for Detected Part		FLEAK
Detection item		<ul style="list-style-type: none"> Fuel leak from high pressured fuel system (Fuel consumption is calculated from the difference of fuel pressure of before and after the injection, and the error will be detected when excess fuel consumption is found)
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC# is normal Rail pressure sensor is normal Injector and injector drive circuit are normal NE signal is active [Engine is operating (700 min^{-1} (rpm) or higher)] PRV is not in active, PCV is in active and normal
DTC set parameter		<ul style="list-style-type: none"> Flow-rate difference between "Fuel flow-rate calculated from dropped rail pressure" and "Other calculated flow-rate (volume of injection, leakage, pump discharge)" is more than $100 \text{ mm}^3/\text{st}$
Time to action or number of error detection		<ul style="list-style-type: none"> 1 time or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine stops in some cases
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> To minimize PM emission

9Y1200226CRS1216US0

Name		Intake air volume: Low
ISO 14229 P-Code		P0101
J1939-73	SPN	132
	FMI	1
SPN Name SAE J1939 Table C1		Engine Inlet Air Mass Flow Rate
DTC Name		Intake air volume: Low
Management Unit for Detected Part		GA
Detection item		<ul style="list-style-type: none"> • Engine inlet air mass flow rate lacking (Disconnect turbo blower intake hose)
DTC Set Preconditions		<ul style="list-style-type: none"> • Engine is operating [1000 min^{-1} (rpm) or higher] • Coolant temperature is $15 \text{ }^{\circ}\text{C}$ ($59 \text{ }^{\circ}\text{F}$) or higher (Coolant temperature sensor is normal) • MAF sensor is normal • EGR valve is normal • Intake throttle valve is normal • Battery voltage is normal
DTC set parameter		<ul style="list-style-type: none"> • Engine Inlet Air Mass Flow Rate: less than half of target value
Time to action or number of error detection		<ul style="list-style-type: none"> • 10.0 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—
Remark		

9Y1200226CRS1217US0

Name		MAF sensor abnormality	
ISO 14229 P-Code		P0102	P0103
J1939-73	SPN	132	132
	FMI	4	3
SPN Name SAE J1939 Table C1		Engine Inlet Air Mass Flow Rate	Engine Inlet Air Mass Flow Rate
DTC Name		MAF sensor: Low	MAF sensor: High
Management Unit for Detected Part		MAFL	MAFH
Detection item		<ul style="list-style-type: none"> Open circuit or ground short circuit of sensor or harness. 	<ul style="list-style-type: none"> +B short circuit of sensor or harness
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Starter switch signal (ECU: V12 terminal) is not activated Sensor supply voltage is normal 	<ul style="list-style-type: none"> Battery voltage is normal $700 \text{ min}^{-1} (\text{rpm}) \leq \text{engine speed} \leq 2800 \text{ min}^{-1} (\text{rpm})$ Target intake mass air flow is 460 or less and it continues for 3 seconds Sensor supply voltage is normal
DTC set parameter		<ul style="list-style-type: none"> Mass air flow sensor voltage: 0.1 V or less 	<ul style="list-style-type: none"> Mass air flow sensor voltage: 4.9 V or more in certain operation condition
Time to action or number of error detection		<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Sensor output: 0.7 times of target value at normal condition [default value] Output limitation: Approximately 75 % of normal condition EGR stop Intake throttle 100 % open 	<ul style="list-style-type: none"> Sensor output: 0.7 times of target value at normal condition [default value] Output limitation: Approximately 75 % of normal condition EGR stop Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> Engine is not stopped forcibly by ECU. However KUBOTA strongly recommends operator to stop engine as soon as possible. 	<ul style="list-style-type: none"> Engine is not stopped forcibly by ECU. However KUBOTA strongly recommends operator to stop engine as soon as possible.

9Y1200226CRS1218US0

Name		Intake air temperature: high (Inter cooler model only)
ISO 14229 P-Code		P0111
J1939-73	SPN	172
	FMI	0
SPN Name SAE J1939 Table C1		Air Inlet Temperature
DTC Name		Intake air temperature: high (Inter cooler model only)
Management Unit for Detected Part		THAABH
Detection item		<ul style="list-style-type: none"> Intake air temperature too high
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Key switch is ON
DTC set parameter		<ul style="list-style-type: none"> Intake air temperature higher than ambient temperature +60 °C (+140 °F)
Time to action or number of error detection		<ul style="list-style-type: none"> 10 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> Inter cooler model only

9Y1200226CRS1219US0

Name		Intake air temperature error	
ISO 14229 P-Code		P0112	P0113
J1939-73	SPN	172	172
	FMI	4	3
SPN Name SAE J1939 Table C1		Engine Air Inlet Temperature	Engine Air Inlet Temperature
DTC Name		Intake air temperature error: Low	Intake air temperature error: High
Management Unit for Detected Part		THAL	THAH
Detection item		<ul style="list-style-type: none"> Ground short circuit of sensor or harness 	<ul style="list-style-type: none"> Open circuit or +B short circuit of sensor or harness
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal 	<ul style="list-style-type: none"> Battery voltage is normal
DTC set parameter		<ul style="list-style-type: none"> Voltage of intake air temperature sensor is 0.05 V or less 	<ul style="list-style-type: none"> Voltage of intake air temperature sensor is 4.9 V or above
Time to action or number of error detection		<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> During start-up = -20 °C (-4 °F) [default value] Under other conditions = 40 °C (104 °F) [default value] 	<ul style="list-style-type: none"> During start-up = -20 °C (-4 °F) [default value] Under other conditions = 40 °C (104 °F) [default value]
Behaviour During Malfunction		<ul style="list-style-type: none"> White smoke increases at low temperature 	<ul style="list-style-type: none"> White smoke increases at low temperature
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> 30 sec. 	<ul style="list-style-type: none"> 30 sec.
Remark			

9Y1200226CRS1220US0

Name		Coolant temperature sensor abnormality	
ISO 14229 P-Code		P0117	P0118
J1939-73	SPN	110	110
	FMI	4	3
SPN Name SAE J1939 Table C1		Engine Coolant Temperature	Engine Coolant Temperature
DTC Name		Coolant temperature sensor: Low	Coolant temperature sensor: High
Management Unit for Detected Part		THWL	THWH
Detection item		<ul style="list-style-type: none"> Ground short circuit of sensor or harness 	<ul style="list-style-type: none"> Open circuit or +B short circuit of sensor or harness
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal 	<ul style="list-style-type: none"> Battery voltage is normal
DTC set parameter		<ul style="list-style-type: none"> Voltage of coolant temperature sensor is 0.1 V or less 	<ul style="list-style-type: none"> Voltage of coolant temperature sensor is 4.9 V or above
Time to action or number of error detection		<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> During start-up = -25 °C (-13 °F) [default value] Under other conditions = 80 °C (176 °F) [default value] Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> During start-up = -25 °C (-13 °F) [default value] Under other conditions = 80 °C (176 °F) [default value] Output limitation: Approximately 75 % of normal condition EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> White smoke increases at low temperature Insufficient output Worsening exhaust gas emissions 	<ul style="list-style-type: none"> White smoke increases at low temperature Insufficient output Worsening exhaust gas emissions
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1221US0

Name		Rail pressure too low
ISO 14229 P-Code		P0191
J1939-73	SPN	157
	FMI	1
SPN Name SAE J1939 Table C1		Engine Injector Metering Rail 1 Pressure
DTC Name		Rail pressure too low
Management Unit for Detected Part		PCUND
Detection item		<ul style="list-style-type: none"> Rail pressure too low (Negative pressure at the inlet of supply pump is high and supply pump delivery system error, ex filter clogging, cavitation)
DTC Set Preconditions		<ul style="list-style-type: none"> Injection Q is 0 mm³/st and more and the difference between current direction and previous direction value is 50 mm³/st and lower During PMP normal operating During discharge value is high
DTC set parameter		<ul style="list-style-type: none"> Delta error (Direction value - real value of rail pressure) continue during 5 seconds and more
Time to action or number of error detection		<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine stops
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—
Remark		

9Y1200226CRS1222US0

Name		Rail pressure sensor abnormality	
ISO 14229 P-Code		P0192	P0193
J1939-73	SPN	157	157
	FMI	4	3
SPN Name SAE J1939 Table C1		Engine Injector Metering Rail 1 Pressure	Engine Injector Metering Rail 1 Pressure
DTC Name		Rail pressure sensor: Low	Rail pressure sensor: High
Management Unit for Detected Part		PCL	PCH
Detection item		<ul style="list-style-type: none"> Ground short circuit of sensor or harness Failure of sensor 	<ul style="list-style-type: none"> Open circuit or +B short circuit of sensor or harness. Failure of sensor
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC# is normal 	<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC# is normal
DTC set parameter		<ul style="list-style-type: none"> Voltage of rail pressure sensor is 0.275 V or less 	<ul style="list-style-type: none"> Voltage of rail pressure sensor is 4.735 V or above
Time to action or number of error detection		<ul style="list-style-type: none"> Transient 	<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop Engine forcibly stopped 60 sec. later 	<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop Engine forcibly stopped 60 sec. later
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine running noise increases White smoke increases Engine stops 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine running noise increases White smoke increases Engine stops
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> To minimize PM emission 	<ul style="list-style-type: none"> To minimize PM emission

9Y1200226CRS1223US0

Name		Common Rail Pressure Sensor Signal keeping a middle range
ISO 14229 P-Code		P0194
J1939-73	SPN	157
	FMI	2
SPN Name SAE J1939 Table C1		Engine Injector Metering Rail 1 Pressure
DTC Name		Common Rail Pressure Sensor Signal keeping a middle range
Management Unit for Detected Part		PCP
Detection item		<ul style="list-style-type: none"> Common Rail Pressure Sensor Signal keeping a middle range
DTC Set Preconditions		<ul style="list-style-type: none"> Key switch is ON Engine speed is 850 min^{-1} (rpm) or more Direction rail pressure is 32 MPa (330 kgf/cm², 4600 psi) or more and real rail pressure is 20 MPa (200 kgf/cm², 2900 psi) or more Direction injection Q is 25 mm³/s or more PMP studying is completed Diagnostician once every 160 msec
DTC set parameter		<ul style="list-style-type: none"> 1st tentative error [Average direction pressure - Average real pressure] is 5 MPa (50 kgf/cm², 700 psi) or more and [Max - Min] of sampling real pressure during 160 msec is within 0.01 V (conversion to voltage) Tentative error after 2nd [Max - Min] of sampling real pressure during 160 msec is within 0.01 V (conversion to voltage) DTC is set after these tentative error continue 3 times
Time to action or number of error detection		<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop Engine forcibly stopped 60 sec later
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine running noise increases White smoke increases at low temperature Engine stops in some cases
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—
Remark		

9Y1200226CRS1224US0

Name		Injector charge voltage: High
ISO 14229 P-Code		P0200
J1939-73	SPN	523535
	FMI	0
SPN Name SAE J1939 Table C1		proprietary
DTC Name		Injector charge voltage: High
Management Unit for Detected Part		OCHG
Detection item		<ul style="list-style-type: none"> • Injector charge voltage: High • ECU circuit failure
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • CPU is normal
DTC set parameter		<ul style="list-style-type: none"> • Injector charge voltage: High • Failure of charge circuit of ECU
Time to action or number of error detection		<ul style="list-style-type: none"> • 10 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop • Engine forcibly stopped 60 sec. later
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output • Worsening exhaust gas emissions • Engine stops
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—
Remark		

9Y1200226CRS1225US0

Name		Open circuit of harness or coil in cylinder injector	
ISO 14229 P-Code		P0201	P0202
J1939-73	SPN	651	653
	FMI	3	3
SPN Name SAE J1939 Table C1		Engine Injector Cylinder #01	Engine Injector Cylinder #03
DTC Name		Open circuit of harness or coil in 1st cylinder injector	Open circuit of harness or coil in 3rd cylinder injector
Management Unit for Detected Part		NCTWV1	NCTWV2
Detection item		<ul style="list-style-type: none"> • Open circuit of harness • Open circuit of injector coil 	<ul style="list-style-type: none"> • Open circuit of harness • Open circuit of injector coil
DTC Set Preconditions		<ul style="list-style-type: none"> • Engine is operating • Battery voltage is normal • During injection • CPU is normal (VDIC2 is normal) 	<ul style="list-style-type: none"> • Engine is operating • Battery voltage is normal • During injection • CPU is normal (VDIC2 is normal)
DTC set parameter		<ul style="list-style-type: none"> • Open circuit of harness or open circuit of injector coil 	<ul style="list-style-type: none"> • Open circuit of harness or open circuit of injector coil
Time to action or number of error detection		<ul style="list-style-type: none"> • 8 times or more 	<ul style="list-style-type: none"> • 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop 	<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output • Engine vibration increases • Worsening exhaust gas emissions 	<ul style="list-style-type: none"> • Insufficient output • Engine vibration increases • Worsening exhaust gas emissions
Engine Warning Light		<ul style="list-style-type: none"> • ON 	<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF 	<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> • Injectors which have no error are operated • To minimize PM emission 	<ul style="list-style-type: none"> • Injectors which have no error are operated • To minimize PM emission

9Y1200226CRS1226US0

Name		Open circuit of harness or coil in cylinder injector	
ISO 14229 P-Code		P0203	P0204
J1939-73	SPN	654	652
	FMI	3	3
SPN Name SAE J1939 Table C1		Engine Injector Cylinder #04	Engine Injector Cylinder #02
DTC Name		Open circuit of harness or coil in 4th cylinder injector	Open circuit of harness or coil in 2nd cylinder injector
Management Unit for Detected Part		NCTWV3	NCTWV4
Detection item		<ul style="list-style-type: none"> • Open circuit of harness • Open circuit of injector coil 	<ul style="list-style-type: none"> • Open circuit of harness • Open circuit of injector coil
DTC Set Preconditions		<ul style="list-style-type: none"> • Engine is operating • Battery voltage is normal • During injection • CPU is normal (VDIC2 is normal) 	<ul style="list-style-type: none"> • Engine is operating • Battery voltage is normal • During injection • CPU is normal (VDIC2 is normal)
DTC set parameter		<ul style="list-style-type: none"> • Open circuit of harness or open circuit of injector coil 	<ul style="list-style-type: none"> • Open circuit of harness or open circuit of injector coil
Time to action or number of error detection		<ul style="list-style-type: none"> • 8 times or more 	<ul style="list-style-type: none"> • 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop 	<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output • Engine vibration increases • Worsening exhaust gas emissions 	<ul style="list-style-type: none"> • Insufficient output • Engine vibration increase • Worsening exhaust gas emissions
Engine Warning Light		<ul style="list-style-type: none"> • ON 	<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF 	<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> • Injectors which have no error are operated • To minimize PM emission 	<ul style="list-style-type: none"> • Injectors which have no error are operated • To minimize PM emission

9Y1200226CRS1227US0

Name		Engine overheat	Engine overrun
ISO 14229 P-Code		P0217	P0219
J1939-73	SPN	110	190
	FMI	0	0
SPN Name SAE J1939 Table C1		Engine Coolant Temperature	Engine Speed
DTC Name		Engine overheat	Engine overrun
Management Unit for Detected Part		THWOT	NEOR
Detection item		• Overheat of engine coolant temperature	• Engine speed exceeds threshold speed
DTC Set Preconditions		• Coolant temperature sensor is normal	• Key switch is ON
DTC set parameter		• Engine coolant temperature $\geq 120\text{ }^{\circ}\text{C}$ (248 $^{\circ}\text{F}$)	• Engine speed $\geq 3500\text{ min}^{-1}$ (rpm)
Time to action or number of error detection		• 5 sec. or more	• 3 revolutions or more
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition • EGR stop	• Stop injection ($Q = 0\text{ mm}^3/\text{st}$)
Behaviour During Malfunction		• Insufficient output • Overheat	• Overrun
Engine Warning Light		• ON	• ON
Recovery from error		• Diagnostic counter = zero	• Diagnostic counter = zero
Delay time for recovery		• 30 sec.	• Immediately
Remark			

9Y1200226CRS1228US0

Name		Boost pressure sensor abnormality	
ISO 14229 P-Code		P0237	P0238
J1939-73	SPN	102	102
	FMI	4	3
SPN Name SAE J1939 Table C1		Engine Intake Manifold #1 Pressure	Engine Intake Manifold #1 Pressure
DTC Name		Boost pressure sensor: Low	Boost pressure sensor: High
Management Unit for Detected Part		PIML	PIMH
Detection item		<ul style="list-style-type: none"> Ground short circuit of sensor or harness Failure of sensor 	<ul style="list-style-type: none"> Open circuit or +B short circuit of sensor or harness Failure of sensor
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC# is normal 	<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC# is normal
DTC set parameter		<ul style="list-style-type: none"> Voltage of boost pressure sensor is 0.2 V or below 	<ul style="list-style-type: none"> Voltage of boost pressure sensor is 4.9 V or above
Time to action or number of error detection		<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> 65 kPa (0.66 kgf/cm², 9.4 psi) [default value] 	<ul style="list-style-type: none"> 65 kPa (0.66 kgf/cm², 9.4 psi) [default value]
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output 	<ul style="list-style-type: none"> Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> Default value is set in consideration with high altitude usage 	<ul style="list-style-type: none"> Default value is set in consideration with high altitude usage

9Y1200226CRS1229US0

Name		Crankshaft position sensor (NE sensor) abnormality	
ISO 14229 P-Code		P0335	P0336
J1939-73	SPN	636	636
	FMI	8	2
SPN Name SAE J1939 Table C1		Engine Position Sensor	Engine Position Sensor
DTC Name		No input of NE sensor (Crankshaft position sensor) pulse	NE sensor (Crankshaft position sensor) pulse number error
Management Unit for Detected Part		NENOP	NEPUM
Detection item		<ul style="list-style-type: none"> • Open circuit or short circuit of sensor or harness • Failure of sensor 	<ul style="list-style-type: none"> • Open circuit or short circuit of sensor or harness • Failure of sensor
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • Sensor supply voltage VCC# is normal • Engine is not stalled 	<ul style="list-style-type: none"> • Battery voltage is normal • Sensor supply voltage VCC# is normal • Engine speed is 350 min⁻¹ (rpm) or higher
DTC set parameter		<ul style="list-style-type: none"> • No recognition of Ne sensor pulse 	<ul style="list-style-type: none"> • Pulse count per rotation is not 56 teeth
Time to action or number of error detection		<ul style="list-style-type: none"> • 10 times or more 	<ul style="list-style-type: none"> • 10 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition 	<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		(Running only with G signal) <ul style="list-style-type: none"> • Faulty starting • Engine Vibration increases slightly • Insufficient output 	(Running only with G signal) <ul style="list-style-type: none"> • Faulty starting • Engine Vibration increases slightly • Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> • ON 	<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Diagnostic counter = zero 	<ul style="list-style-type: none"> • Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> • Delay time varies with engine speed in proportional relation • If it is set 30 sec. at 800 min⁻¹ (rpm), it is shorten to 15 sec. at 1600 min⁻¹ (rpm) operation 	<ul style="list-style-type: none"> • Delay time varies with engine speed in proportional relation • If it is set 30 sec. at 800 min⁻¹ (rpm), it is shorten to 15 sec. at 1600 min⁻¹ (rpm) operation
Remark			

9Y1200226CRS1230US0

Name		Camshaft position sensor (G sensor) abnormality	
ISO 14229 P-Code		P0340	P0341
J1939-73	SPN	723	723
	FMI	8	2
SPN Name SAE J1939 Table C1		Engine Speed 2	Engine Speed 2
DTC Name		No input of G sensor (Camshaft position sensor) pulse	G sensor (Camshaft position sensor) pulse number error
Management Unit for Detected Part		GNOP	GPUM
Detection item		<ul style="list-style-type: none"> • Open circuit or short circuit of sensor or harness • Failure of sensor 	<ul style="list-style-type: none"> • Open circuit or short circuit of sensor or harness • Failure of sensor
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • Sensor supply voltage VCC# is normal • Engine is not stalled 	<ul style="list-style-type: none"> • Battery voltage is normal • Sensor supply voltage VCC# is normal • Engine speed is 350 min⁻¹ (rpm) or higher
DTC set parameter		<ul style="list-style-type: none"> • No recognition of G sensor pulse 	<ul style="list-style-type: none"> • Pulse count per rotation is not 5 teeth
Time to action or number of error detection		<ul style="list-style-type: none"> • 10 times or more 	<ul style="list-style-type: none"> • 10 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • None
Behaviour During Malfunction		(Invalid G signal) <ul style="list-style-type: none"> • Engine hesitates at start-up 	(Invalid G signal) <ul style="list-style-type: none"> • Engine hesitates at start-up
Engine Warning Light		<ul style="list-style-type: none"> • ON 	<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Diagnostic counter = zero 	<ul style="list-style-type: none"> • Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> • Delay time varies with engine speed in proportional relation • If it is set 30 sec. at 800 min⁻¹ (rpm), it is shorten to 15 sec. at 1600 min⁻¹ (rpm) operation 	<ul style="list-style-type: none"> • Delay time varies with engine speed in proportional relation • If it is set 30 sec. at 800 min⁻¹ (rpm), it is shorten to 15 sec. at 1600 min⁻¹ (rpm) operation
Remark			

9Y1200226CRS1231US0

Name		Air heater relay driving circuit abnormality	
ISO 14229 P-Code		P0380	P0380
J1939-73	SPN	523544	523544
	FMI	3	4
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		+B short of air heater relay driving circuit	Ground short of air heater relay driving circuit
Management Unit for Detected Part		GRELBT	GRELGD
Detection item		<ul style="list-style-type: none"> +B short of air heater relay driving circuit 	<ul style="list-style-type: none"> Ground short or open circuit of air heater relay driving circuit
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal During air heater relay drive command is activated 	<ul style="list-style-type: none"> Battery voltage is normal Other than during air heater relay drive command is activated
DTC set parameter		<ul style="list-style-type: none"> +B short circuit of harness 	<ul style="list-style-type: none"> Ground short or open circuit of harness
Time to action or number of error detection		<ul style="list-style-type: none"> 1 sec. or more 	<ul style="list-style-type: none"> 1 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Behaviour During Malfunction		(At low temperature) <ul style="list-style-type: none"> Faulty starting White smoke increases 	(At low temperature) <ul style="list-style-type: none"> Faulty starting White smoke increases
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1232US0

Name		Heater lamp error
ISO 14229 P-Code		P0381
J1939-73	SPN	675
	FMI	3
SPN Name SAE J1939 Table C1		Engine Glow Plug Lamp
DTC Name		Heater lamp error
Management Unit for Detected Part		GLPBT
Detection item		<ul style="list-style-type: none"> +B short of lamp driving circuit when lamp is on
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Starter switch signal (ECU: V12 terminal) is not activated Heater lamp is on
DTC set parameter		<ul style="list-style-type: none"> +B short circuit
Time to action or number of error detection		<ul style="list-style-type: none"> 2 sec or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> None
Behaviour During Malfunction		<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> For driver circuit protection

9Y1200226CRS1233US0

Name		EGR actuator abnormality		
ISO 14229 P-Code		P0403	P0404	P0409
J1939-73	SPN	523574	523574	523572
	FMI	3	4	4
SPN Name SAE J1939 Table C1		proprietary	proprietary	proprietary
DTC Name		EGR actuator open circuit	EGR actuator coil short	EGR position sensor failure
Management Unit for Detected Part		DCMEGROPC	DCMEGROCC	LEGRC
Detection item		• EGR actuator open circuit	• EGR actuator coil short	• EGR position sensor failure
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal No DTC of U0077 "CAN1 Bus off" EGR control line is normal 	<ul style="list-style-type: none"> Battery voltage is normal No DTC of U0077 "CAN1 Bus off" EGR control line is normal 	<ul style="list-style-type: none"> Battery voltage is normal No DTC of U0077 "CAN1 Bus off" EGR control line is normal
DTC set parameter		• EGR actuator open error signal received via CAN	• EGR actuator coil short error signal received via CAN	• EGR position sensor error signal received via CAN
Time to action or number of error detection		• 2.8 sec or more	• 2.8 sec. or more	• 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions
Engine Warning Light		• ON	• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		—	—	—
Remark				

9Y1200226CRS1234US0

Name		Oil pressure error
ISO 14229 P-Code		P0524
J1939-73	SPN	100
	FMI	1
SPN Name SAE J1939 Table C1		Engine Oil Pressure
DTC Name		Oil pressure error
Management Unit for Detected Part		POILDN
Detection item		<ul style="list-style-type: none"> Oil pressure switch
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Key switch turn ON Starter switch signal (ECU: V12 terminal) is not activated 10 sec or more after engine start [700 min^{-1} (rpm) or higher]
DTC set parameter		<ul style="list-style-type: none"> Oil pressure switch ON: continues one sec or more
Time to action or number of error detection		<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> None
Behaviour During Malfunction		<ul style="list-style-type: none"> Engine stops
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—
Remark		

9Y1200226CRS1235US0

Name		Battery voltage abnormality	
ISO 14229 P-Code		P0562	P0563
J1939-73	SPN	168	168
	FMI	4	3
SPN Name SAE J1939 Table C1		Battery Potential / Power Input 1	Battery Potential / Power Input 1
DTC Name		Battery voltage: Low	Battery voltage: High
Management Unit for Detected Part		VBBL	VBBH
Detection item		<ul style="list-style-type: none"> • Open circuit, short circuit or damage of harness • Failure of battery 	<ul style="list-style-type: none"> • Open circuit, short circuit or damage of harness • Failure of battery
DTC Set Preconditions		<ul style="list-style-type: none"> • Key switch is ON • Starter switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> • Key switch is ON • Starter switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> • ECU recognition of battery voltage is below 8 V in 12 V system 	<ul style="list-style-type: none"> • ECU recognition of battery voltage is above 16 V in 12 V system
Time to action or number of error detection		<ul style="list-style-type: none"> • 1 sec. or more 	<ul style="list-style-type: none"> • 1 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open 	<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> • Faulty starting • Insufficient output • Worsening exhaust gas emissions • Engine stops in some cases 	<ul style="list-style-type: none"> • Faulty starting • Insufficient output • Worsening exhaust gas emissions
Engine Warning Light		<ul style="list-style-type: none"> • ON 	<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Diagnostic counter = zero 	<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		<ul style="list-style-type: none"> • 30 sec. 	—
Remark			

9Y1200226CRS1236US0

Name		QR data abnormality	
ISO 14229 P-Code		P0602	P0602
J1939-73	SPN	523538	523538
	FMI	2	7
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		QR data error	No QR data
Management Unit for Detected Part		QRERR	QRNOT
Detection item		<ul style="list-style-type: none"> QR data read error 	<ul style="list-style-type: none"> QR data is unwritten
DTC Set Preconditions		<ul style="list-style-type: none"> Key switch is ON 	<ul style="list-style-type: none"> Key switch is ON
DTC set parameter		<ul style="list-style-type: none"> QR data read error from EEPROM 	<ul style="list-style-type: none"> Area of QR data on EEPROM is vacant
Time to action or number of error detection		<ul style="list-style-type: none"> Transient 	<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Nozzle correction is not executed Output limitation: Approximately 75 % of normal condition 	<ul style="list-style-type: none"> Nozzle correction factor = 0 [default value] Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output 	<ul style="list-style-type: none"> Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> To cover each injector dispersion 	

9Y1200226CRS1237US0

Name		ECU FLASH ROM and CPU abnormality	
ISO 14229 P-Code		P0605	P0605
J1939-73	SPN	628	628
	FMI	2	2
SPN Name SAE J1939 Table C1		Program Memory	Program Memory
DTC Name		ECU FLASH ROM error	SUB CPU (Monitoring IC) FLASH ROM error
Management Unit for Detected Part		FROM	SFROM
Detection item		• FLASH ROM error	• FLASH ROM of monitoring IC error
DTC Set Preconditions		• Key switch is ON	• Key switch is ON
DTC set parameter		• Check-sum error	• Check-sum error
Time to action or number of error detection		• 1 time or more	• 1 time or more
Limp Home Action by engine ECU (system action)		• Engine stop	• Engine stop
Behaviour During Malfunction		• Engine stops	• Engine stops
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1238US0

Name		ECU FLASH ROM and CPU abnormality	
ISO 14229 P-Code		P0606	P0606
J1939-73	SPN	1077	523527
	FMI	2	2
SPN Name SAE J1939 Table C1		Engine Fuel Injection Pump Controller	
DTC Name		ECU CPU (Main IC) error	ECU CPU (Monitoring IC) error
Management Unit for Detected Part		MCPU	SCPU
Detection item		• Failure of CPU	• Failure of monitoring IC of CPU
DTC Set Preconditions		• Key switch is ON	• Key switch is ON
DTC set parameter		• Battery voltage is normal and "CPU has fatal error or sub-CPU has alert signal"	• Battery voltage is normal and Failure of monitoring IC of CPU
Time to action or number of error detection		• 1 time or more	• 1 time or more
Limp Home Action by engine ECU (system action)		• Engine stop	• Engine stop
Behaviour During Malfunction		• Engine stops	• Engine stops
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1239US0

Name		Injector charge voltage: Low
ISO 14229 P-Code		P0611
J1939-73	SPN	523525
	FMI	1
SPN Name SAE J1939 Table C1		proprietary
DTC Name		Injector charge voltage: Low
Management Unit for Detected Part		LCHG
Detection item		<ul style="list-style-type: none"> • Injector charge voltage: Low • Failure of charge circuit of ECU
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • CPU is normal
DTC set parameter		<ul style="list-style-type: none"> • Injector charge voltage: Low • Failure of charge circuit of ECU
Time to action or number of error detection		<ul style="list-style-type: none"> • Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition • EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output • Worsening exhaust gas emissions • Engine stops in some cases
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> • To minimize PM emission

9Y1200226CRS1240US0

Name		Internal IC of ECU abnormality	
ISO 14229 P-Code		P062B	P062B
J1939-73	SPN	523614	523614
	FMI	2	2
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		Internal IC (VDIC2) clock error 1	Internal IC (VDIC2) clock error 2
Management Unit for Detected Part		VDIC2CLK	VDIC2CLK2
Detection item		• Internal power control IC clock error 1	• Internal power control IC clock error 2
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal CPU is normal Starter switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> Battery voltage is normal CPU is normal Starter switch signal (ECU: V12 terminal) is not activated
DTC set parameter		• Clock error	• Clock error
Time to action or number of error detection		• 1.0 sec or more	• 1.0 sec or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine stops 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine stops
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1241US0

Name		Internal IC of ECU abnormality	
ISO 14229 P-Code		P062B	P062B
J1939-73	SPN	523614	523614
	FMI	2	2
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		Internal IC (VDIC2) communication error 1	Internal IC (VDIC2) communication error 2
Management Unit for Detected Part		VDIC2CMC	VDIC2CMC2
Detection item		<ul style="list-style-type: none"> Internal power control IC communication error 1 	<ul style="list-style-type: none"> Internal power control IC communication error 2
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal CPU is normal Starter switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> Battery voltage is normal CPU is normal Starter switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> Communication error 	<ul style="list-style-type: none"> Communication error
Time to action or number of error detection		<ul style="list-style-type: none"> 1.0 sec or more 	<ul style="list-style-type: none"> 1.0 sec or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine stops 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine stops
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1242US0

Name		Sensor supply voltage 1 abnormality	
ISO 14229 P-Code		P0642	P0643
J1939-73	SPN	3509	3509
	FMI	4	3
SPN Name SAE J1939 Table C1		Sensor supply voltage 1	Sensor supply voltage 1
DTC Name		Sensor supply voltage 1: Low	Sensor supply voltage 1: High
Management Unit for Detected Part		VCC1L	VCC1H
Detection item		<ul style="list-style-type: none"> • Sensor supply voltage 1 error or recognition error 	<ul style="list-style-type: none"> • Sensor supply voltage 1 error or recognition error
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • Key switch turn ON • Starter switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> • Battery voltage is normal • Key switch turn ON • Starter switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> • Voltage to sensor is below 4.375 V 	<ul style="list-style-type: none"> • Voltage to sensor is above 5.625 V
Time to action or number of error detection		<ul style="list-style-type: none"> • Transient 	<ul style="list-style-type: none"> • Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 50 % of normal condition • Speed limitation (Accelerator limitation: 50 %) • EGR stop • Intake throttle 100 % open 	<ul style="list-style-type: none"> • Output limitation: Approximately 50 % of normal condition • Speed limitation (Accelerator limitation: 50 %) • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> • Faulty starting • Insufficient output • Worsening exhaust gas emissions • Engine stops in some cases 	<ul style="list-style-type: none"> • Faulty starting • Insufficient output • Worsening exhaust gas emissions • Engine stops in some cases
Engine Warning Light		<ul style="list-style-type: none"> • ON 	<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF 	<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> • Emission related 	<ul style="list-style-type: none"> • Emission related

9Y1200226CRS1243US0

Name		Sensor supply voltage 2 abnormality	
ISO 14229 P-Code		P0652	P0653
J1939-73	SPN	3510	3510
	FMI	4	3
SPN Name SAE J1939 Table C1		Sensor supply voltage 2	Sensor supply voltage 2
DTC Name		Sensor supply voltage 2: Low	Sensor supply voltage 2: High
Management Unit for Detected Part		VCC2L	VCC2H
Detection item		<ul style="list-style-type: none"> • Sensor supply voltage 2 error or recognition error 	<ul style="list-style-type: none"> • Sensor supply voltage 2 error or recognition error
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • Key switch turn ON • Starter switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> • Battery voltage is normal • Key switch turn ON • Starter switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> • Voltage to sensor is below 4.375 V 	<ul style="list-style-type: none"> • Voltage to sensor is above 5.625 V
Time to action or number of error detection		<ul style="list-style-type: none"> • Transient 	<ul style="list-style-type: none"> • Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition 	<ul style="list-style-type: none"> • Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		<ul style="list-style-type: none"> • Faulty starting • Insufficient output • Worsening exhaust gas emissions 	<ul style="list-style-type: none"> • Faulty starting • Insufficient output • Worsening exhaust gas emissions
Engine Warning Light		<ul style="list-style-type: none"> • ON 	<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF 	<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> • Emission related 	<ul style="list-style-type: none"> • Emission related

9Y1200226CRS1244US0

Name		Over heat lamp error	Main relay is locked in closed position
ISO 14229 P-Code		P0655	P0687
J1939-73	SPN	523624	1485
	FMI	3	2
SPN Name SAE J1939 Table C1		proprietary	ECM Main Relay
DTC Name		Over heat lamp error	Main relay is locked in closed position
Management Unit for Detected Part		THWOVLPBT	MRYCS
Detection item		<ul style="list-style-type: none"> +B short of lamp driving circuit when lamp is on 	<ul style="list-style-type: none"> Failure of main relay
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Starter switch signal (ECU: V12 terminal) is not activated Over heat lamp is on 	<ul style="list-style-type: none"> Key switch is OFF Engine stops
DTC set parameter		<ul style="list-style-type: none"> +B short circuit 	<ul style="list-style-type: none"> After the self-power-off process of the main relay, + B voltage continues more than 75 seconds
Time to action or number of error detection		<ul style="list-style-type: none"> 2 sec or more 	<ul style="list-style-type: none"> 2 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Behaviour During Malfunction		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Battery goes dead
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> OFF
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		—	<ul style="list-style-type: none"> 5.3 sec.
Remark		<ul style="list-style-type: none"> For driver circuit protection 	

9Y1200226CRS1245US0

Name		Starter relay driving error
ISO 14229 P-Code		P081B
J1939-73	SPN	677
	FMI	3
SPN Name SAE J1939 Table C1		Engine Starter Motor Relay
DTC Name		Starter relay driving error
Management Unit for Detected Part		STARELBT
Detection item		<ul style="list-style-type: none"> • +B short of relay driving circuit when relay is on
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • Starter switch signal (ECU: V12 terminal) is not activated • Starter relay is on
DTC set parameter		<ul style="list-style-type: none"> • +B short circuit
Time to action or number of error detection		<ul style="list-style-type: none"> • 2 sec or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • None
Behaviour During Malfunction		<ul style="list-style-type: none"> • None
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> • For driver circuit protection

9Y1200226CRS1246US0

Name		Pump seizing	
ISO 14229 P-Code		P1274	P1275
J1939-73	SPN	523539	523540
	FMI	2	2
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		Pump seizing 1	Pump seizing 2
Management Unit for Detected Part		PMPPR	PMPEX
Detection item		• High pressure 1 error	• High pressure 2 error
DTC Set Preconditions		<ul style="list-style-type: none"> • Sensor supply voltage VCC# is normal • Rail pressure sensor is normal 	<ul style="list-style-type: none"> • Sensor supply voltage VCC# is normal • Rail pressure sensor is normal
DTC set parameter		(Approximate parameter) <ul style="list-style-type: none"> • Rail pressure of 300 MPa (3060 kgf/cm², 43500 psi) or more continues 1 second under the condition of above 500 min⁻¹ (rpm) [Threshold changes depending on the engine speed. 2600 min⁻¹ (rpm) should be used as a reference] 	(Approximate parameter) <ul style="list-style-type: none"> • Rail pressure of above 267 MPa (2720 kgf/cm², 38700 psi), and below 300 MPa (3060 kgf/cm², 43500 psi) continues total time for 35 seconds under condition of above 500 min⁻¹ (rpm) [Threshold changes depending on the engine speed. 2600 min⁻¹ (rpm) should be used as a reference] • Or, rail pressure of above 107 MPa (1090 kgf/cm², 15500 psi) and below 195 MPa (1990 kgf/cm², 28300 psi) continues total time for 35 seconds [Threshold changes depending on the engine speed. 200 min⁻¹ (rpm) should be used as a reference]
Time to action or number of error detection		• 1 time or more	• 1 time or more
Limp Home Action by engine ECU (system action)		• Engine stop	• Engine stop
Behaviour During Malfunction		• Engine stops	• Engine stops
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> • To minimize PM emission to DPF • To avoid extremely high pressure in injection system 	<ul style="list-style-type: none"> • To minimize PM emission to DPF • To avoid extremely high pressure in injection system

9Y1200226CRS1247US0

Name		High pressure delivery system too high
ISO 14229 P-Code		P1A06
J1939-73	SPN	523608
	FMI	2
SPN Name SAE J1939 Table C1		proprietary
DTC Name		High pressure delivery system too high
Management Unit for Detected Part		FPOVR2
Detection item		<ul style="list-style-type: none"> • +B short of relay driving circuit when relay is on
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • Starter switch signal (ECU: V12 terminal) is not activated • During PMP normal operating (angle studying is complete) • NE sensing is normal • Tentative error and PCV action continue for XX msec • Target pressure is under 10 MPa • No noise in sensing pressure
DTC set parameter		<ul style="list-style-type: none"> • Pressure relief valve (PRV) drive too much error (Real rail pressure value > target pressure value) occur specified times
Time to action or number of error detection		<ul style="list-style-type: none"> • Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 50 % of normal condition • Speed limitation (Accelerator limitation: 50 %) • EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output • Worsening exhaust gas emissions • Engine stops
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—
Remark		

9Y1200226CRS1248US0

Name		Coil short in cylinder injector	
ISO 14229 P-Code		P1A07	P1A08
J1939-73	SPN	651	653
	FMI	6	6
SPN Name SAE J1939 Table C1		Engine Injector Cylinder #01	Engine Injector Cylinder #03
DTC Name		Coil short in 1st cylinder injector	Coil short in 3rd cylinder injector
Management Unit for Detected Part		RSTWV1	RSTWV2
Detection item		• Injector coil short (over current)	• Injector coil short (over current)
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal During injection CPU is normal (VDIC2 is normal) 	<ul style="list-style-type: none"> Battery voltage is normal During injection CPU is normal (VDIC2 is normal)
DTC set parameter		• Injector coil short (over current)	• Injector coil short (over current)
Time to action or number of error detection		• 8 times or more	• 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Injectors which have error stop injection Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> Injectors which have error stop injection Output limitation: Approximately 75 % of normal condition EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Engine vibration increases Worsening exhaust gas emissions Engine stops in some cases 	<ul style="list-style-type: none"> Insufficient output Engine vibration increases Worsening exhaust gas emissions Engine stops in some cases
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1249US0

Name		Coil short in cylinder injector	
ISO 14229 P-Code		P1A09	P1A0A
J1939-73	SPN	654	652
	FMI	6	6
SPN Name SAE J1939 Table C1		Engine Injector Cylinder #04	Engine Injector Cylinder #02
DTC Name		Coil short in 4th cylinder injector	Coil short in 2nd cylinder injector
Management Unit for Detected Part		RSTWV3	RSTWV4
Detection item		<ul style="list-style-type: none"> • Injector coil short (over current) 	<ul style="list-style-type: none"> • Injector coil short (over current)
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • During injection • CPU is normal (VDIC2 is normal) 	<ul style="list-style-type: none"> • Battery voltage is normal • During injection • CPU is normal (VDIC2 is normal)
DTC set parameter		<ul style="list-style-type: none"> • Injector coil short (over current) 	<ul style="list-style-type: none"> • Injector coil short (over current)
Time to action or number of error detection		<ul style="list-style-type: none"> • 8 times or more 	<ul style="list-style-type: none"> • 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Injectors which have error stop injection • Output limitation: Approximately 75 % of normal condition • EGR stop 	<ul style="list-style-type: none"> • Injectors which have error stop injection • Output limitation: Approximately 75 % of normal condition • EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output • Engine vibration increases • Worsening exhaust gas emissions • Engine stops in some cases 	<ul style="list-style-type: none"> • Insufficient output • Engine vibration increases • Worsening exhaust gas emissions • Engine stops in some cases
Engine Warning Light		<ul style="list-style-type: none"> • ON 	<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF 	<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1250US0

Name		Coil short in PCV	Coil short in PRV
ISO 14229 P-Code		P1A0B	P1A0C
J1939-73	SPN	523609	523610
	FMI	6	6
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		Coil short in PCV	Coil short in PRV
Management Unit for Detected Part		RSPCV1	RSPRV
Detection item		• PCV coil short (over current)	• PRV coil short (over current)
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal During PCV driving CPU is normal (VDIC2 is normal) 	<ul style="list-style-type: none"> Battery voltage is normal During PRV driving CPU is normal (VDIC2 is normal)
DTC set parameter		• PCV coil short (over current)	• PRV coil short (over current)
Time to action or number of error detection		• 8 times or more	• 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Injectors which have error stop injection Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop 	<ul style="list-style-type: none"> Injectors which have error stop injection Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine stops 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine stops
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1251US0

Name		High pressure pump too high
ISO 14229 P-Code		P1A0D
J1939-73	SPN	523611
	FMI	2
SPN Name SAE J1939 Table C1		proprietary
DTC Name		High pressure pump too high
Management Unit for Detected Part		FPOVRH
Detection item		<ul style="list-style-type: none"> High pressure pump too high
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Starter switch signal (ECU: V12 terminal) is not activated Key switch is ON
DTC set parameter		<ul style="list-style-type: none"> High pressure error detected specified times (Set pressure value are depending on engine speed)
Time to action or number of error detection		<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Engine stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Engine stops
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—
Remark		

9Y1200226CRS1252US0

Name		Lamp driving circuit error
ISO 14229 P-Code		P1A10
J1939-73	SPN	523621
	FMI	3
SPN Name SAE J1939 Table C1		proprietary
DTC Name		Stop lamp error
Management Unit for Detected Part		OPLP2BT
Detection item		<ul style="list-style-type: none"> • +B short of lamp driving circuit when lamp is on
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • Starter switch signal (ECU: V12 terminal) is not activated • Stop lamp is on
DTC set parameter		<ul style="list-style-type: none"> • +B short circuit
Time to action or number of error detection		<ul style="list-style-type: none"> • 2 sec or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • None
Behaviour During Malfunction		<ul style="list-style-type: none"> • None
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> • For driver circuit protection

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Name		Lamp driving circuit error	
ISO 14229 P-Code		P1A11	P1A12
J1939-73	SPN	523622	4115
	FMI	3	3
SPN Name SAE J1939 Table C1		proprietary	DTCx Amber Warning Lamp Support & Status
DTC Name		Low oil pressure lamp error	Engine warning lamp error
Management Unit for Detected Part		POILLPBT	SVSLPBT
Detection item		<ul style="list-style-type: none"> +B short of lamp driving circuit when lamp is on 	<ul style="list-style-type: none"> +B short of lamp driving circuit when lamp is on
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Starter switch signal (ECU: V12 terminal) is not activated Low oil pressure lamp is on 	<ul style="list-style-type: none"> Battery voltage is normal Starter switch signal (ECU: V12 terminal) is not activated Engine warning lamp is on
DTC set parameter		<ul style="list-style-type: none"> +B short circuit 	<ul style="list-style-type: none"> +B short circuit
Time to action or number of error detection		<ul style="list-style-type: none"> 2 sec or more 	<ul style="list-style-type: none"> 2 sec or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Behaviour During Malfunction		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> For driver circuit protection 	<ul style="list-style-type: none"> For driver circuit protection

9Y1200226CRS1254US0

Name		SUB CPU software version unmatched
ISO 14229 P-Code		P1A16
J1939-73	SPN	523626
	FMI	2
SPN Name SAE J1939 Table C1		proprietary
DTC Name		SUB CPU software version unmatched
Management Unit for Detected Part		MSSOFTUM
Detection item		<ul style="list-style-type: none"> SUB CPU software version unmatched
DTC Set Preconditions		<ul style="list-style-type: none"> Key switch is ON Battery voltage is 10 V or more Starter switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> SUB CPU software version unmatched
Time to action or number of error detection		<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Engine stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Engine stops
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		1 sec
Remark		

9Y1200226CRS1255US0

Name		TWV boost time-out	
ISO 14229 P-Code		P1A18	P1A19
J1939-73	SPN	651	653
	FMI	8	8
SPN Name SAE J1939 Table C1		Engine Injector Cylinder #01	Engine Injector Cylinder #03
DTC Name		TWV1 boost time-out	TWV2 boost time-out
Management Unit for Detected Part		BTTWV1	BTTWV2
Detection item		<ul style="list-style-type: none"> Open circuit of discharge MOS-IC in ECU 	<ul style="list-style-type: none"> Open circuit of discharge MOS-IC in ECU
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal During injection CPU is normal (VDIC2 is normal) 	<ul style="list-style-type: none"> Battery voltage is normal During injection CPU is normal (VDIC2 is normal)
DTC set parameter		<ul style="list-style-type: none"> Open circuit of discharge MOS-IC in ECU 	<ul style="list-style-type: none"> Open circuit of discharge MOS-IC in ECU
Time to action or number of error detection		<ul style="list-style-type: none"> 20 times or more 	<ul style="list-style-type: none"> 20 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Engine vibration increases Worsening exhaust gas emissions 	<ul style="list-style-type: none"> Insufficient output Engine vibration increases Worsening exhaust gas emissions
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1256US0

Name		TWV boost time-out	
ISO 14229 P-Code		P1A1A	P1A1B
J1939-73	SPN	654	652
	FMI	8	8
SPN Name SAE J1939 Table C1		Engine Injector Cylinder #04	Engine Injector Cylinder #02
DTC Name		TWV3 boost time-out	TWV4 boost time-out
Management Unit for Detected Part		BTTWV3	BTTWV4
Detection item		<ul style="list-style-type: none"> Open circuit of discharge MOS-IC in ECU 	<ul style="list-style-type: none"> Open circuit of discharge MOS-IC in ECU
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal During injection CPU is normal (VDIC2 is normal) 	<ul style="list-style-type: none"> Battery voltage is normal During injection CPU is normal (VDIC2 is normal)
DTC set parameter		<ul style="list-style-type: none"> Open circuit of discharge MOS-IC in ECU 	<ul style="list-style-type: none"> Open circuit of discharge MOS-IC in ECU
Time to action or number of error detection		<ul style="list-style-type: none"> 20 times or more 	<ul style="list-style-type: none"> 20 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Engine vibration increases Worsening exhaust gas emissions 	<ul style="list-style-type: none"> Insufficient output Engine vibration increases Worsening exhaust gas emissions
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1257US0

Name		Intake throttle feedback error
ISO 14229 P-Code		P2108
J1939-73	SPN	523580
	FMI	2
SPN Name SAE J1939 Table C1		proprietary
DTC Name		Intake throttle feedback error
Management Unit for Detected Part		DCMIFB
Detection item		<ul style="list-style-type: none"> Intake throttle feedback error
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal
DTC set parameter		(Approximate parameter) <ul style="list-style-type: none"> Deviation of throttle position is not corrected in 20 times of duty error recovery action
Time to action or number of error detection		<ul style="list-style-type: none"> 5 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition Intake throttle 100 % open
Behaviour During Malfunction		<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—
Remark		

9Y1200226CRS1258US0

Name		Accelerator position sensor 1 abnormality	
ISO 14229 P-Code		P2122	P2123
J1939-73	SPN	91	91
	FMI	4	3
SPN Name SAE J1939 Table C1		Accelerator Pedal Position 1	Accelerator Pedal Position 1
DTC Name		Accelerator position sensor 1: Low	Accelerator position sensor 1: High
Management Unit for Detected Part		ACCP1L	ACCP1H
Detection item		<ul style="list-style-type: none"> Ground short circuit or open circuit of sensor or harness 	<ul style="list-style-type: none"> Battery short circuit out of sensor or harness
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC2 is normal 	<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC2 is normal
DTC set parameter		<ul style="list-style-type: none"> Voltage of accelerator position sensor 1 is 0.3 V or less 	<ul style="list-style-type: none"> Voltage of accelerator position sensor 1 is 4.8 V or less
Time to action or number of error detection		<ul style="list-style-type: none"> Transient 	<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Forced Idle (Accelerator = 0 %) 	<ul style="list-style-type: none"> Forced Idle (Accelerator = 0 %)
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output 	<ul style="list-style-type: none"> Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> 3 sec. 	<ul style="list-style-type: none"> 3 sec.
Remark			

9Y1200226CRS1259US0

Name		Accelerator position sensor 2 abnormality	
ISO 14229 P-Code		P2127	P2128
J1939-73	SPN	29	29
	FMI	4	3
SPN Name SAE J1939 Table C1		Accelerator Pedal Position 2	Accelerator Pedal Position 2
DTC Name		Accelerator position sensor 2: Low	Accelerator position sensor 2: High
Management Unit for Detected Part		ACCP2L	ACCP2H
Detection item		<ul style="list-style-type: none"> Ground short circuit or open circuit of sensor or harness 	<ul style="list-style-type: none"> Battery short circuit out of sensor or harness
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC1 is normal 	<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC1 is normal
DTC set parameter		<ul style="list-style-type: none"> Voltage of accelerator position sensor 2 is 0.3 V or less 	<ul style="list-style-type: none"> Voltage of accelerator position sensor 2 is 4.8 V or less
Time to action or number of error detection		<ul style="list-style-type: none"> Transient 	<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Forced Idle (Accelerator = 0 %) 	<ul style="list-style-type: none"> Forced Idle (Accelerator = 0 %)
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output 	<ul style="list-style-type: none"> Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> 3 sec. 	<ul style="list-style-type: none"> 3 sec.
Remark			

9Y1200226CRS1260US0

Name		Accelerator position sensor error (CAN)
ISO 14229 P-Code		P2131
J1939-73	SPN	523543
	FMI	2
SPN Name SAE J1939 Table C1		proprietary
DTC Name		Accelerator position sensor error (CAN)
Management Unit for Detected Part		ACCPCAN
Detection item		<ul style="list-style-type: none"> Accelerator position sensor signal error (sensor or harness open circuit, ground short circuit etc)
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Key switch turn ON Starter switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> Accelerator position sensor error signal received by CAN
Time to action or number of error detection		<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Not applicable
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero (CAN signal recovers)
Delay time for recovery		<ul style="list-style-type: none"> Immediately
Remark		

9Y1200226CRS1261US0

Name		Injector drive circuit open in No.1 and 4 cylinder simultaneously
ISO 14229 P-Code		P2146
J1939-73	SPN	523523
	FMI	2
SPN Name SAE J1939 Table C1		proprietary
DTC Name		Injector drive circuit open in No.1 and 4 cylinder simultaneously
Management Unit for Detected Part		NCCOM1
Detection item		<ul style="list-style-type: none"> Wiring harness open circuit
DTC Set Preconditions		<ul style="list-style-type: none"> Engine is operating Battery voltage is normal During injection CPU is normal (VDIC2 is normal)
DTC set parameter		<ul style="list-style-type: none"> Wiring harness open circuit
Time to action or number of error detection		<ul style="list-style-type: none"> 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Engine vibration increases Worsening exhaust gas emissions Engine stops in some cases
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> Injectors which have no error are operated To minimize PM emission

9Y1200226CRS1262US0

Name		No. 1 and 4 cylinder injector short or all cylinder injector short	
ISO 14229 P-Code		P2147	P2148
J1939-73	SPN	523523	523523
	FMI	4	3
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		No. 1 and 4 cylinder injector short to ground at power supply side, or all cylinder injector short to ground	No. 1 and 4 cylinder injector short to +B at power supply side, or all cylinder injector short to +B
Management Unit for Detected Part		GSTWV1	BSTWV1
Detection item		<ul style="list-style-type: none"> Wiring harness short to ground 	<ul style="list-style-type: none"> Wiring harness short to +B
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal CPU is normal (VDIC2 is normal) Starter switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> Battery voltage is normal CPU is normal (VDIC2 is normal) Starter switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> When wiring harness short to ground occurs 	<ul style="list-style-type: none"> When wiring harness short to +B occurs
Time to action or number of error detection		<ul style="list-style-type: none"> 8 times or more 	<ul style="list-style-type: none"> 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Injectors which have error stop injection Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> Injectors which have error stop injection Output limitation: Approximately 75 % of normal condition EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Large vibration Worsening exhaust gas performance Engine stops in some case 	<ul style="list-style-type: none"> Insufficient output Large vibration Worsening exhaust gas performance Engine stops in some case
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> Injectors which have no error are operated To minimize PM emission 	<ul style="list-style-type: none"> Injectors which have no error are operated To minimize PM emission

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Name		Injector drive circuit open in No.2 and 3 cylinder simultaneously
ISO 14229 P-Code		P2149
J1939-73	SPN	523524
	FMI	2
SPN Name SAE J1939 Table C1		proprietary
DTC Name		Injector drive circuit open in No.2 and 3 cylinder simultaneously
Management Unit for Detected Part		NCCOM2
Detection item		<ul style="list-style-type: none"> Wiring harness open circuit
DTC Set Preconditions		<ul style="list-style-type: none"> Engine is operating Battery voltage is normal During injection CPU is normal (VDIC2 is normal)
DTC set parameter		<ul style="list-style-type: none"> Wiring harness open circuit
Time to action or number of error detection		<ul style="list-style-type: none"> 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Engine vibration increases Worsening exhaust gas emissions Engine stops in some cases
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> Injectors which have no error are operated To minimize PM emission

9Y1200226CRS1264US0

Name		No. 2 and 3 cylinder injector short or all cylinder injector short	
ISO 14229 P-Code		P2150	P2151
J1939-73	SPN	523524	523524
	FMI	4	3
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		No. 2 and 3 cylinder injector short to ground at power supply side, or all cylinder injector short to ground	No. 2 and 3 cylinder injector short to +B at power supply side, or all cylinder injector short to +B
Management Unit for Detected Part		GSTWV2	BSTWV2
Detection item		<ul style="list-style-type: none"> Wiring harness short to ground 	<ul style="list-style-type: none"> Wiring harness short to +B
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal CPU is normal (VDIC2 is normal) Starter switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> Battery voltage is normal CPU is normal (VDIC2 is normal) Starter switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> Wiring harness short to ground 	<ul style="list-style-type: none"> Wiring harness short to +B
Time to action or number of error detection		<ul style="list-style-type: none"> 8 times or more 	<ul style="list-style-type: none"> 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Injectors which have error stop injection Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> Injectors which have error stop injection Output limitation Approximately 75 % of normal condition EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Engine vibration increases Worsening exhaust gas emissions Engine stops in some cases 	<ul style="list-style-type: none"> Insufficient output Engine vibration increases Worsening exhaust gas emissions Engine stops in some cases
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark		<ul style="list-style-type: none"> Injectors which have no error are operated To minimize PM emission 	<ul style="list-style-type: none"> Injectors which have no error are operated To minimize PM emission

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Name		Barometric pressure sensor error	
ISO 14229 P-Code		P2228	P2229
J1939-73	SPN	108	108
	FMI	4	3
SPN Name SAE J1939 Table C1		Barometric Pressure	Barometric Pressure
DTC Name		Barometric pressure sensor error (Low side)	Barometric pressure sensor error (High side)
Management Unit for Detected Part		PATML	PATMH
Detection item		<ul style="list-style-type: none"> Sensor or ECU internal circuit short to ground 	<ul style="list-style-type: none"> Sensor or ECU internal circuit short to +B
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal 	<ul style="list-style-type: none"> Battery voltage is normal
DTC set parameter		<ul style="list-style-type: none"> Barometric pressure sensor voltage: 1.6 V or less 	<ul style="list-style-type: none"> Barometric pressure sensor voltage: 4.4 V or more
Time to action or number of error detection		<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> 65 kPa (0.66 kgf/cm², 9.4 psi) [default value] 	<ul style="list-style-type: none"> 65 kPa (0.66 kgf/cm², 9.4 psi) [default value]
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output 	<ul style="list-style-type: none"> Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> Immediately 	<ul style="list-style-type: none"> Immediately
Remark		<ul style="list-style-type: none"> Default value is set in consideration with high altitude usage 	<ul style="list-style-type: none"> Default value is set in consideration with high altitude usage

9Y1200226CRS1266US0

Name		Pressure relief valve error	PRV boost time-out
ISO 14229 P-Code		P2293	P2293
J1939-73	SPN	523606	523628
	FMI	2	8
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		Pressure relief valve error	PRV boost time-out
Management Unit for Detected Part		PRVFUN	BTPRV
Detection item		<ul style="list-style-type: none"> Pressure relief valve error 	<ul style="list-style-type: none"> Open circuit of discharge MOS-IC in ECU
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Starter switch signal (ECU: V12 terminal) is not activated During PMP normal operating (angle studying is complete) NE sensing is normal Injection Q is 0 mm³/s or lower Not occur tentative error of pressure No noise in sensing pressure 	<ul style="list-style-type: none"> Battery voltage is normal During injection CPU is normal (VDIC2 is normal)
DTC set parameter		<ul style="list-style-type: none"> After pressure relief valve (PRV) driving, higher pressure value is detected more than supposed value 	<ul style="list-style-type: none"> Open circuit of discharge MOS-IC in ECU
Time to action or number of error detection		<ul style="list-style-type: none"> Transient 	<ul style="list-style-type: none"> 20 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine stops 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions Engine stops in some cases
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1267US0

Name		Open circuit of harness or coil in PRV line
ISO 14229 P-Code		P2294
J1939-73	SPN	523613
	FMI	5
SPN Name SAE J1939 Table C1		proprietary
DTC Name		Open circuit of harness or coil in PRV line
Management Unit for Detected Part		NCPRV
Detection item		<ul style="list-style-type: none"> • Open circuit of harness • Open circuit of PRV coil
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • During PRV driving • CPU is normal (VDIC2 is normal)
DTC set parameter		<ul style="list-style-type: none"> • Open circuit of harness or open circuit of PRV coil
Time to action or number of error detection		<ul style="list-style-type: none"> • 8 times or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 50 % of normal condition • Speed limitation (Accelerator limitation: 50 %) • EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output • Worsening exhaust gas emissions • Engine stops
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—
Remark		

9Y1200226CRS1268US0

Name		EGR (DC motor) abnormality		
ISO 14229 P-Code		P2413	P2414	P2415
J1939-73	SPN	523575	523576	523577
	FMI	7	2	2
SPN Name SAE J1939 Table C1		proprietary	proprietary	proprietary
DTC Name		EGR actuator valve stuck	EGR (DC motor) overheat	EGR (DC motor) temperature sensor failure
Management Unit for Detected Part		EGRVSC	EGRAMBTMPC	EGRTHC
Detection item		<ul style="list-style-type: none"> EGR actuator valve stuck 	<ul style="list-style-type: none"> EGR (DC motor) overheat 	<ul style="list-style-type: none"> EGR (DC motor) temperature sensor failure
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal No DTC of U0077 "CAN1 Bus off" EGR control line is normal 	<ul style="list-style-type: none"> Battery voltage is normal No DTC of U0077 "CAN1 Bus off" EGR control line is normal 	<ul style="list-style-type: none"> Battery voltage is normal No DTC of U0077 "CAN1 Bus off" EGR control line is normal
DTC set parameter		<ul style="list-style-type: none"> EGR actuator valve stuck error signal received via CAN 	<ul style="list-style-type: none"> EGR (DC motor) temperature error signal (thermistor: 125 °C (257 °F) or more) received via CAN 	<ul style="list-style-type: none"> EGR (DC motor) temperature sensor error signal received via CAN
Time to action or number of error detection		<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more 	<ul style="list-style-type: none"> 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions 	<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—	—
Remark				

9Y1200226CRS1269US0

Name		Intake throttle lift sensor abnormality	
ISO 14229 P-Code		P2621	P2622
J1939-73	SPN	523582	523582
	FMI	4	3
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		Intake throttle lift sensor: Low	Intake throttle lift sensor: High
Management Unit for Detected Part		ITHRPREL	ITHRPREH
Detection item		• Intake throttle lift sensor low	• Intake throttle lift sensor high
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC# is normal 	<ul style="list-style-type: none"> Battery voltage is normal Sensor supply voltage VCC# is normal
DTC set parameter		• Intake throttle lift sensor voltage: 0.1 V or less	• Intake throttle lift sensor voltage: 4.89 V or more
Time to action or number of error detection		• 2.8 sec or more	• 2.8 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition Intake throttle 100 % open 	<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition Intake throttle 100 % open
Behaviour During Malfunction		• None	• None
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1270US0

Name		Boost pressure low
ISO 14229 P-Code		P3011
J1939-73	SPN	132
	FMI	15
SPN Name SAE J1939 Table C1		Engine Inlet Air Mass Flow Rate
DTC Name		Boost pressure low
Management Unit for Detected Part		GA2
Detection item		<ul style="list-style-type: none"> • Disconnect the hose between the turbo blower out and intake flange
DTC Set Preconditions		<ul style="list-style-type: none"> • Other than during regeneration mode • Engine speed is 1600 min⁻¹ (rpm) or more • Target intake air flow value is 950 mg/cyl or more • MAF sensor is normal • EGR valve is normal • Intake throttle valve is normal • Boost pressure sensor is normal • Barometric pressure sensor is normal • Coolant temperature sensor is normal
DTC set parameter		<ul style="list-style-type: none"> • Boost pressure sensor output is below target level in high air flow operating condition
Time to action or number of error detection		<ul style="list-style-type: none"> • 10 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> • Output limitation: Approximately 50 % of normal condition • Speed limitation (Accelerator limitation: 50 %) • EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF
Delay time for recovery		—
Remark		<ul style="list-style-type: none"> • Engine power is restricted by boost pressure signal accordingly • To minimize PM emission

9Y1200226CRS1271US0

Name		Initial pump-calibration incomplete
ISO 14229 P-Code		P3019
J1939-73	SPN	523600
	FMI	0
SPN Name SAE J1939 Table C1		proprietary
DTC Name		Initial pump-calibration incomplete
Management Unit for Detected Part		IPMPSTDYNOT
Detection item		<ul style="list-style-type: none"> Pump-calibration history
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal
DTC set parameter		<ul style="list-style-type: none"> Initial pump calibration flag = "0"
Time to action or number of error detection		<ul style="list-style-type: none"> Transient
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> None
Behaviour During Malfunction		<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> Immediately
Remark		

9Y1200226CRS1272US0

Name		Over heat pre-caution	CAN2 Bus off
ISO 14229 P-Code		P3025	U0075
J1939-73	SPN	523603	523547
	FMI	15	2
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		Over heat pre-caution	CAN2 Bus off
Management Unit for Detected Part		THWOT2	CANB2
Detection item		<ul style="list-style-type: none"> Coolant temperature 	<ul style="list-style-type: none"> CAN2 +B or GND short circuit or high traffic error
DTC Set Preconditions		<ul style="list-style-type: none"> Coolant temperature sensor is normal 	<ul style="list-style-type: none"> Battery voltage is normal Key switch is ON
DTC set parameter		<ul style="list-style-type: none"> Engine coolant temperature $\geq 110\text{ }^{\circ}\text{C}$ (230 $^{\circ}\text{F}$) 	<ul style="list-style-type: none"> CAN2 Bus off
Time to action or number of error detection		<ul style="list-style-type: none"> Transient 	<ul style="list-style-type: none"> 2 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Forced Idle (Accelerator = 0 %)
Behaviour During Malfunction		<ul style="list-style-type: none"> Worsening exhaust gas emissions (NOx) 	<ul style="list-style-type: none"> Insufficient output Transmitted CAN data are invalid
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		<ul style="list-style-type: none"> Immediately 	—
Remark			

9Y1200226CRS1273US0

Name		No communication with EGR	CAN1 Bus off
ISO 14229 P-Code		U0076	U0077
J1939-73	SPN	523578	523604
	FMI	2	2
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		No communication with EGR	CAN1 Bus off
Management Unit for Detected Part		CANOPENEGR	CANB1
Detection item		<ul style="list-style-type: none"> No communication with EGR 	<ul style="list-style-type: none"> CAN1 +B or GND short circuit or high traffic error
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Starter switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> Battery voltage is normal Key switch is ON
DTC set parameter		<ul style="list-style-type: none"> Interruption of CAN 	<ul style="list-style-type: none"> CAN1 Bus off
Time to action or number of error detection		<ul style="list-style-type: none"> 1.3 sec. or more 	<ul style="list-style-type: none"> 2 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Output limitation: Approximately 75 % of normal condition EGR stop 	<ul style="list-style-type: none"> Output limitation: Approximately 50 % of normal condition Speed limitation (Accelerator limitation: 50 %) EGR stop
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output Worsening exhaust gas emissions 	<ul style="list-style-type: none"> Insufficient output Transmitted CAN data are invalid
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1274US0

Name		CAN2 frame error	
ISO 14229 P-Code		U0081	U0082
J1939-73	SPN	523548	523591
	FMI	2	2
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		CAN-KBT frame error	CAN CCVS (Vehicle speed) frame error
Management Unit for Detected Part		CANOPENGENU	CANOPENCCVS
Detection item		<ul style="list-style-type: none"> CAN-KBT original frame open circuit error 	<ul style="list-style-type: none"> CAN_CCVS communication stopping
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Key switch turn OFF to ON Starter switch signal (ECU: V12 terminal) is not activated No error of "CAN2 Bus off" 	<ul style="list-style-type: none"> Battery voltage is normal Starter switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> CAN2 KBT frame open circuit error 	<ul style="list-style-type: none"> CAN CCVS frame time out error
Time to action or number of error detection		<ul style="list-style-type: none"> Transient 	<ul style="list-style-type: none"> 0.5 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Forced Idle (Accelerator = 0 %) 	<ul style="list-style-type: none"> Vehicle speed = 0 [default value]
Behaviour During Malfunction		<ul style="list-style-type: none"> Insufficient output 	<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Key switch turn OFF 	<ul style="list-style-type: none"> Key switch turn OFF
Delay time for recovery		—	—
Remark			

9Y1200226CRS1275US0

Name		CAN2 frame error		
ISO 14229 P-Code		U0084	U0085	U0086
J1939-73	SPN	523593	523594	523595
	FMI	2	2	2
SPN Name SAE J1939 Table C1		proprietary	proprietary	proprietary
DTC Name		CAN DDC1 (Transmission) frame error	CAN ETC2 (Neutral SW) frame error	CAN ETC5 (Neutral SW) frame error
Management Unit for Detected Part		CANOPENDDC	CANOPENETC2	CANOPENETC5
Detection item		• CAN_DDC1 communication stopping	• CAN_ETC2 communication stopping	• CAN_ETC5 communication stopping
DTC Set Preconditions		• Battery voltage is normal • Starter switch signal (ECU: V12 terminal) is not activated	• Battery voltage is normal • Starter switch signal (ECU: V12 terminal) is not activated	• Battery voltage is normal • Starter switch signal (ECU: V12 terminal) is not activated
DTC set parameter		• CAN DDC1 frame time out Error	• CAN ETC2 frame time out error	• CAN ETC5 frame time out error
Time to action or number of error detection		• 0.5 sec. or more	• 0.5 sec. or more	• 0.5 sec. or more
Limp Home Action by engine ECU (system action)		• Accelerator non-linear processing flag = 0 [default value] • Accelerator non-linear processing invalid	• Neutral SW = OFF [default value]	• Neutral SW = OFF [default value]
Behaviour During Malfunction		• None	• None	• None
Engine Warning Light		• ON	• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		—	—	—
Remark				

9Y1200226CRS1276US0

Name		CAN2 frame error	
ISO 14229 P-Code		U0087	U0089
J1939-73	SPN	523596	523598
	FMI	2	2
SPN Name SAE J1939 Table C1		proprietary	proprietary
DTC Name		CAN TSC1 frame error	CAN EBC1 frame error
Management Unit for Detected Part		CANOPENTSC1TM	CANOPENABS
Detection item		• CAN_TSC1 communication stopping	• CAN_EBC1 communication stopping
DTC Set Preconditions		<ul style="list-style-type: none"> Battery voltage is normal Starter switch signal (ECU: V12 terminal) is not activated 	<ul style="list-style-type: none"> Battery voltage is normal Starter switch signal (ECU: V12 terminal) is not activated
DTC set parameter		<ul style="list-style-type: none"> No request to "TSC1 buffer" continues 3 times after over-ride control request (other than 0x00) 	<ul style="list-style-type: none"> CAN EBC1 frame time out error
Time to action or number of error detection		<ul style="list-style-type: none"> 60 msec. or more 	<ul style="list-style-type: none"> 0.5 sec. or more
Limp Home Action by engine ECU (system action)		<ul style="list-style-type: none"> Override control mode = Normal mode [default value] 	<ul style="list-style-type: none"> Non shutdown [default value] Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Engine Warning Light		<ul style="list-style-type: none"> ON 	<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter = zero 	<ul style="list-style-type: none"> Diagnostic counter = zero
Delay time for recovery		<ul style="list-style-type: none"> Immediately 	<ul style="list-style-type: none"> Immediately
Remark			

9Y1200226CRS1277US0

[4] DIAGNOSTIC PROCEDURE BY DTC (V3800-TIE4/-TIE4C)

Follow the instructions of the diagnostic procedure when required to refer to other items.

In this manual, the diagnostic procedures are listed according to the Diagnostic Trouble Code (DTC) numbers as shown. (In exceptional cases, some procedures are given in different positions.)

ISO 14229 P-Code	J1939-73		Name	Reference Page
	SPN	FMI		
P0016	636	7	NE-G phase shift	1-S370
P0072	171	4	Intake air temperature built-in MAF sensor abnormality	1-S371
P0073	171	3		
P0088	157	0	High rail pressure	1-S374
P0089	523627	8	PCV boost time-out	1-S378
P0090	523612	5	Open circuit of harness or coil in PCV line	1-S379
P0091	523607	4	PCV or PRV drive line short	1-S381
P0092	523607	3		
P0093	1239	1	Fuel leak (in high pressured fuel system) or air bubbles in fuel line	1-S385
P0101	132	1	Intake air volume: Low	1-S390
P0102	132	4	MAF sensor abnormality	1-S391
P0103	132	3		
P0111	172	0	Intake air temperature: high (inter cooler model only)	1-S393
P0112	172	4	Intake air temperature error	1-S394
P0113	172	3		
P0117	110	4	Coolant temperature sensor abnormality	1-S397
P0118	110	3		
P0191	157	1	Rail pressure too low	1-S400
P0192	157	4	Rail pressure sensor abnormality	1-S404
P0193	157	3		
P0194	157	2	Common Rail Pressure Sensor Signal keeping a middle range	1-S408
P0200	523535	0	Injector charge voltage: High	1-S412
P0201	651	3	Open circuit of harness or coil in cylinder injector	1-S414
P0202	653	3		
P0203	654	3		
P0204	652	3		
P0217	110	0	Engine overheat	1-S417
P0219	190	0	Engine overrun	1-S419
P0237	102	4	Boost pressure sensor abnormality	1-S420
P0238	102	3		
P0335	636	8	Crankshaft position sensor (NE sensor) abnormality	1-S424
P0336	636	2		
P0340	723	8	Camshaft position sensor (G sensor) abnormality	1-S428
P0341	723	2		
P0380	523544	3	Air heater relay driving circuit abnormality	1-S432
P0380	523544	4		
P0381	675	3	Heater lamp error	1-S435

ISO 14229 P-Code	J1939-73		Name	Reference Page
	SPN	FMI		
P0403	523574	3	EGR actuator abnormality	1-S437
P0404	523574	4		
P0409	523572	4		
P0524	100	1	Oil pressure error	1-S440
P0562	168	4	Battery voltage abnormality	1-S442
P0563	168	3		
P0602	523538	2	QR data abnormality	1-S445
P0602	523538	7		
P0605	628	2	ECU FLASH ROM and CPU abnormality	1-S446
P0605	628	2		
P0606	1077	2		
P0606	523527	2		1-S447
P0611	523525	1	Injector charge voltage: Low	1-S448
P062B	523614	2	Internal IC of ECU abnormality	1-S450
P062B	523614	2		
P062B	523614	2		1-S451
P062B	523614	2		
P0642	3509	4	Sensor supply voltage 1 abnormality	1-S452
P0643	3509	3		
P0652	3510	4	Sensor supply voltage 2 abnormality	1-S454
P0653	3510	3		
P0655	523624	3	Over heat lamp error	1-S456
P0687	1485	2	Main relay is locked in closed position	1-S458
P081B	677	3	Starter relay driving error	1-S461
P1274	523539	2	Pump seizing	1-S463
P1275	523540	2		
P1A06	523608	2	High pressure delivery system too high	1-S467
P1A07	651	6	Coil short in cylinder injector	1-S471
P1A08	653	6		
P1A09	654	6		1-S472
P1A0A	652	6		
P1A0B	523609	6	Coil short in PCV	1-S476
P1A0C	523610	6	Coil short in PRV	1-S478
P1A0D	523611	2	High pressure pump too high	1-S480
P1A10	523621	3	Lamp driving circuit error	1-S483
P1A11	523622	3		
P1A12	4115	3		1-S484
P1A16	523626	2	SUB CPU software version unmatched	1-S486

ISO 14229 P-Code	J1939-73		Name	Reference Page
	SPN	FMI		
P1A18	651	8	TWV boost time-out	1-S487
P1A19	653	8		
P1A1A	654	8		1-S488
P1A1B	652	8		
P2108	523580	2	Intake throttle feedback error	1-S489
P2122	91	4	Accelerator position sensor 1 abnormality	1-S491
P2123	91	3		
P2127	29	4	Accelerator position sensor 2 abnormality	1-S495
P2128	29	3		
P2131	523543	2	Accelerator position sensor error (CAN)	1-S499
P2146	523523	2	Injector drive circuit open in No. 1 and 4 cylinder simultaneously	1-S501
P2147	523523	4	No. 1 and 4 cylinder injector short or all cylinder injector short	1-S504
P2148	523523	3		
P2149	523524	2	Injector drive circuit open in No. 2 and 3 cylinder simultaneously	1-S508
P2150	523524	4	No. 2 and 3 cylinder injector short or all cylinder injector short	1-S511
P2151	523524	3		
P2228	108	4	Barometric pressure sensor error	1-S515
P2229	108	3		
P2293	523606	2	Pressure relief valve error	1-S517
P2293	523628	8	PRV boost time-out	1-S521
P2294	523613	5	Open circuit of harness or coil in PRV line	1-S522
P2413	523575	7	EGR (DC motor) abnormality	1-S524
P2414	523576	2		
P2415	523577	2		
P2621	523582	4	Intake throttle lift sensor abnormality	1-S527
P2622	523582	3		
P3011	132	15	Boost pressure low	1-S529
P3019	523600	0	Initial pump-calibration incomplete	1-S531
P3025	523603	15	Over heat pre-caution	1-S532
U0075	523547	2	CAN2 Bus off	1-S533
U0076	523578	2	No communication with EGR	1-S535
U0077	523604	2	CAN1 Bus off	1-S537
U0081	523548	2	CAN2 frame error	1-S539
U0082	523591	2		
U0084	523594	2		
U0085	523593	2		
U0086	523595	2		
U0087	523596	2		
U0089	523598	2		

(1) NE - G Phase Shift (DTC P0016 / 636-7)

Behaviour during malfunction: (Invalid G signal)

- Engine hesitates at start-up

Detection item:

- Large phase shift between NE (crankshaft position sensor) pulse and G (camshaft position sensor) pulse

DTC set preconditions:

- Engine is operating above low idle speed
- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- NE signal is normal
- G signal is normal
- Coolant temperature is 10 °C (50 °F) or higher

DTC set parameter: (Approximate)

- Phase difference between NE pulse and G pulse is within ± 0.26 rad ($\pm 15^\circ$)

Engine warning light:

- ON

Limp home action by engine ECU (system action):

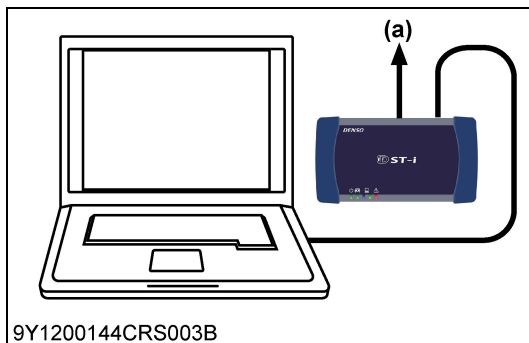
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1279US0



1. Check the Crankshaft Position Sensor and Camshaft Position Sensor Signals

1. Run the engine and check the values of the "Engine speed active flag" and "Cam speed active flag" with the data monitor function.

Factory specification	Constantly ON
OK	Check the DTC (speed signal phase shift) again.
	OK Normal.
	NG Check each pulsar for damage and deviation, and correct.
NG	Refer to "Crankshaft Position Sensor (NE sensor) Abnormality" (page 1-S424) and "Camshaft Position Sensor (G sensor) Abnormality" (page 1-S428).

■ NOTE

(Crankshaft position sensor side)

- The NE pulsar has deviated.
- A large magnetic substance has adhered to the pulsar, hardened and rotates together with it, or the teeth have been ground down.

(Camshaft position sensor side)

- The G pulsar plate is disconnected.
- The cam gear unit is disconnected, etc. (large side clearance).
- A large magnetic substance has adhered to the pulsar, hardened and rotates together with it, or the teeth have been ground down.

(a) CAN1 Connector

9Y1200226CRS1280US0

(2) Intake Air Temperature Built-in MAF Sensor Abnormality (DTC P0072 / 171-4, DTC P0073 / 171-3)

P0072 / 171-4: Intake air temperature built-in MAF sensor: Low

Behaviour during malfunction:

- None

Detection item:

- Ground short circuit of sensor or harness

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Intake air temperature built-in MAF sensor voltage: 0.1 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- 25 °C (77 °F) [default value]

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1281US0

P0073 / 171-3: Intake air temperature built-in MAF sensor: High

Behaviour during malfunction:

- None

Detection item:

- Open circuit or +B short circuit of sensor or harness

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Intake air temperature built-in MAF sensor voltage: 4.9 V or more

Engine warning light:

- ON

Limp home action by engine ECU (system action):

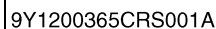
- 25 °C (77 °F) [default value]

Recovery from error:

- Diagnostic counter = zero

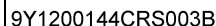
Remark:

9Y1200226CRS1282US0




- | | | | |
|----------------------------|-----------------------|--------------------------------|--|
| (1) Terminal Power (+12 V) | (4) Terminal IATS | (a) Terminal Layout | (c) Intake Air Temperature
(Built-in MAF) |
| (2) Terminal Ground | (5) Terminal A-GND 10 | (b) Mass Air Flow (MAF) Sensor | (d) ECU Connector 1
(Engine Side) |
| (3) Terminal AFS | | | |

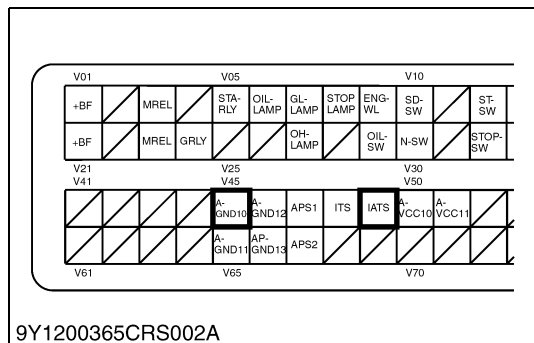
9Y1200226CRS1283US0



1. Place the key switch in the ON position, and check the "Intake air temperature" and "Intake air temperature sensor output voltage" on the diagnosis tool data monitor.

OK	Clear the DTC and check whether it is output again or not. 	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Resistance Between Terminals".	

9Y1200226CRS1284US0



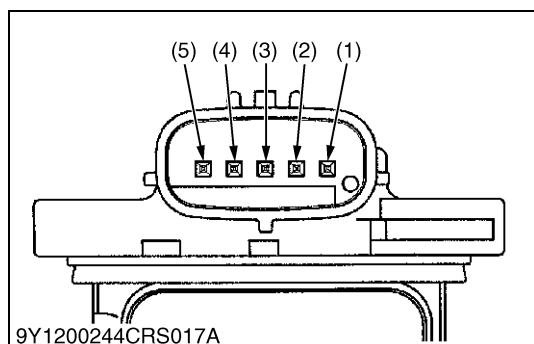
2. Measure the Resistance Between Terminals

- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals V45 and V49 of the connector.

Factory specification	
Temperature	Resistance
20 °C (68 °F)	Approx. 2.43 kΩ
40 °C (104 °F)	Approx. 1.15 kΩ
60 °C (140 °F)	Approx. 0.587 kΩ
80 °C (176 °F)	Approx. 0.321 kΩ

OK	Go to "4. Measure the ECU Terminal Voltage".
NG	Go to "3. Check the sensor".

9Y1200226CRS1285US0



3. Check the Sensor

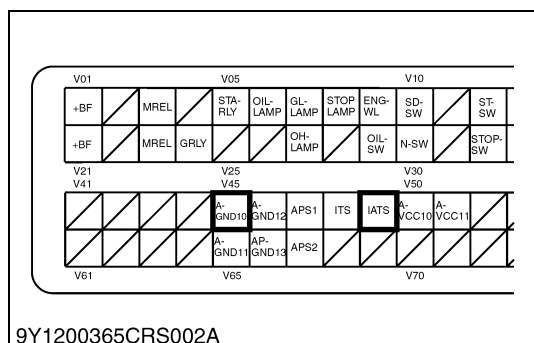
- Turn the key switch OFF, remove the connector from the sensor side and measure the resistance between the terminals on the sensor side.

Factory specification	
Temperature	Resistance
20 °C (68 °F)	Approx. 2.43 kΩ
40 °C (104 °F)	Approx. 1.15 kΩ
60 °C (140 °F)	Approx. 0.587 kΩ
80 °C (176 °F)	Approx. 0.321 kΩ

OK	Wiring harness open circuit or connector fault → Check and repair.
NG	Intake air temperature sensor fault → Replace the mass air flow sensor.

- (1) Terminal Power (+12 V) (4) Terminal IATS
 (2) Terminal Ground (5) Terminal A-GND 10
 (3) Terminal AFS

9Y1200226CRS1286US0



4. Measure the ECU Terminal Voltage

- Plug the ECU wiring harness connector into socket again, unplug the sensor connector, and measure the voltage between ECU terminals V45 and V49 at the ECU side.

Factory specification	Approx. 5 V
OK	The ECU connector is faulty or its wiring harness is shorted.
NG	Confirm by using other sensors that there is no ground short malfunction before replacing the ECU.

9Y1200226CRS1287US0

(3) High Rail Pressure (DTC P0088 / 157-0)

Behaviour during malfunction:

- Engine stops

Detection item:

- Actual pressure exceeds the command pressure

DTC set preconditions:

- Rail pressure sensor is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Actual pressure ≥ 267 MPa (2720 kgf/cm², 38700 psi)

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Engine stop

Recovery from error:

- Diagnostic counter = zero

Remark:

- To minimize PM emission

9Y1200226CRS1288US0

Diagnostic Procedure for Pressure System DTCs

Checking of fault conditions and actions taken

If DTCs of non-pressure system are detected (*Refer to the pressure system DTCs given below.)

First locate the non-pressure system problem indicated by DTCs, and repair the affected parts. After the repair has been carried out, check for an output of pressure system DTCs. If so, begin the diagnosis of the affected pressure system.

If only pressure system DTCs are detected (*Refer to the pressure system DTCs given below.)

Diagnose the affected pressure system indicated by DTCs.

If a DTC currently exists

Begin diagnosis without returning the key switch to the OFF position. However, carefully make satisfactory / unsatisfactory judgments as the injection amount and rail pressure are limited by system actions.

If only a past DTC exists

Log the freeze-frame data, clear the DTCs, and stop the engine. Then, try to reproduce the problem using the freeze-frame data and the trouble check sheet.

Pressure system DTCs*[High pressure abnormality]**

1. P0088: High rail pressure
2. P1A0D: High pressure pump too high

[Low pressure abnormality]

1. P0093: Fuel leak
2. P0191: Rail pressure too low

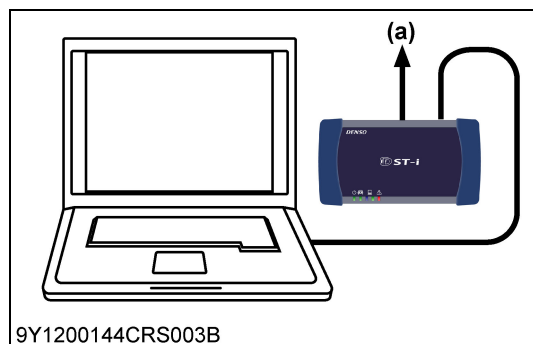
[Abnormal pressure]

1. P1274: Pump seizing 1
2. P1275: Pump seizing 2
3. P1A06: High pressure delivery system too high
4. P2293: Pressure relief valve error / PRV driving circuit error

■ IMPORTANT

- Multiple pressure system DTCs may be output simultaneously. Also, both abnormal high pressure and abnormal low pressure may be reported simultaneously under certain malfunction conditions.

9Y1200226CRS1289US0



1. Check the Data Related to the Rail Pressure

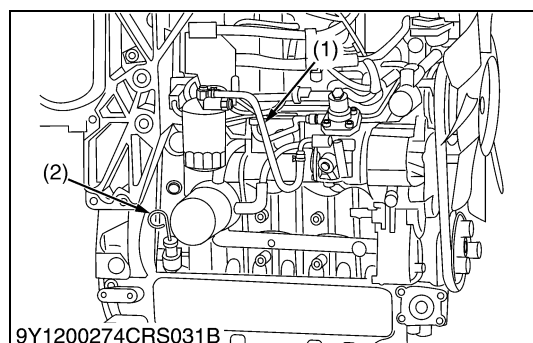
1. Connect the diagnosis tool to the CAN1 connector, and select the "Actual rail pressure" and "Target rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure"
	1. When idling: 35 to 60 MPa (360 to 610 kgf/cm ² , 5100 to 8700 psi)
	2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 155 MPa (1580 kgf/cm ² , 22500 psi)
	3. No-load maximum speed: 75.0 to 155 MPa (765 to 1580 kgf/cm ² , 10900 to 22400 psi)
	4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.

OK	Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.
NG	Go to "2. Check the Fuel System for the Existence of Air".

(a) CAN1 Connector

9Y1200226CRS1290US0



2. Check the Fuel System for the Existence of Air

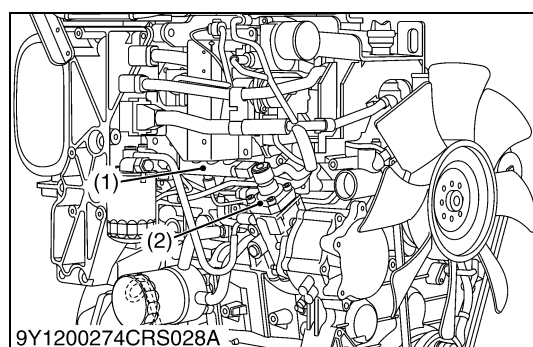
1. Check each joint of the fuel system for the existence of air.
To detect the existence of air effectively, replace the fuel hose with a transparent one.

OK	Go to "3. Check the Fuel System".
NG	Locate the position of the fuel leakage in the piping and repair it.

(1) Fuel Hose

(2) Dipstick

9Y1200226CRS1291US0



3. Check the Fuel System



CAUTION

- Visually check there is no leak in the high pressure fuel pipe system.
- A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.

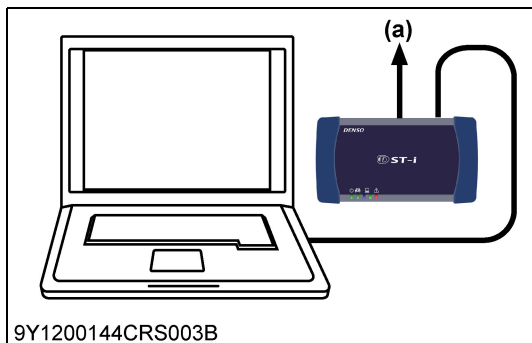
1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "4. Check the Rail Pressure Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

(1) Rail

(2) Supply Pump

9Y1200226CRS1292US0



4. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)

1. Check the rail pressure sensor.

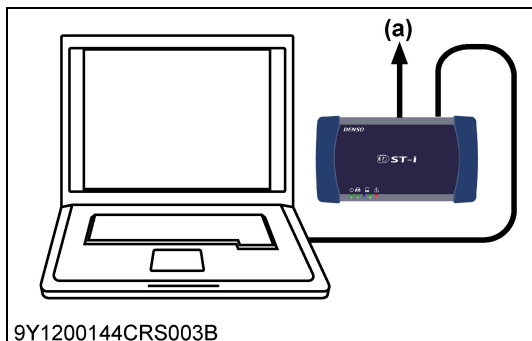
■ NOTE

- Closely check sensor signals for a noise component and an abnormality that exists for a short time.

OK	Go to "5. Check the DTC Again".
NG	Replace the rail assembly or its related parts. (Follow the diagnostic procedure of items P0192 and P0193.) (Refer to page 1-S404)

(a) CAN1 Connector

9Y1200226CRS1293US0



5. Check the DTC Again

1. Clear the past malfunction data, and make sure that the same DTC is output again in the reproduction test.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

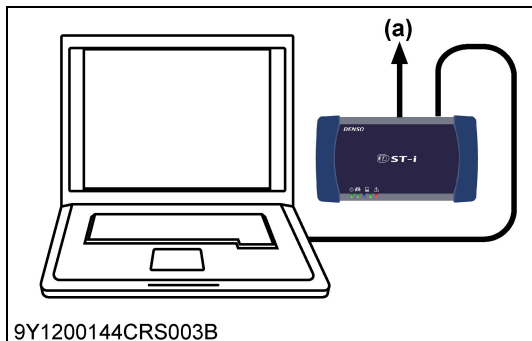
■ NOTE

- Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.

OK	Normal.
NG	Go to "6. Check the PCV (or PRV)-related Data".

(a) CAN1 Connector

9Y1200226CRS1294US0



6. Check the PCV (or PRV)-related Data

1. Check the "Target rail pressure" and "Actual rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

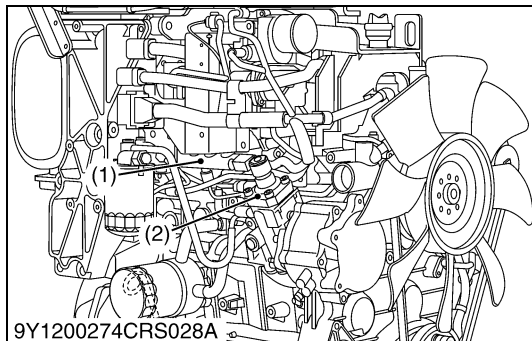
Factory specification	<ol style="list-style-type: none"> 1. The "Actual rail pressure" always follow to the "Target rail pressure". <p>A: Normal operating B: Accelerator opening: 0→100 % (During acceleration) C: Accelerator closing: 100→0 % (During rapid deceleration) D: Just after key switch OFF</p>
-----------------------	--

OK	After confirming that an intermittent malfunction (such as power supply system or noise generation) does not occur in relation to the ECU, replace the ECU.
NG	Case A or B: Faulty PCV → Replace the supply pump. Case C or D: Faulty PRV → Replace the rail assembly.

- (1) Rail
- (2) Supply Pump

(a) CAN1 Connector

9Y1200226CRS1295US0



(4) PCV Boost Time-out (DTC P0089 / 523627-8)

Behavior during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Open circuit of discharge MOS-IC in ECU

DTC set preconditions:

- Battery voltage is normal
- During injection
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- Open circuit of discharge MOS-IC in ECU

Engine warning light:

- ON

Limp home action by engine ECU (System action):

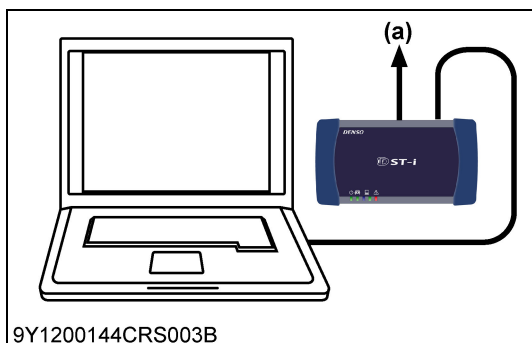
- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1296US0



1. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Operate the engine by performing the actual run test.
3. Place the key switch in the ON position, check whether the DTC (P0089) is output or not.

Factory specification	DTC (P0089) must not be output.
OK	Normal.
NG	Replace the ECU.

(a) CAN1 Connector

9Y1200226CRS1297US0

(5) Open Circuit of Harness or Coil in PCV Line (DTC P0090 / 523612-5)

Behavior during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops

Detection item:

- Open circuit of harness
- Open circuit of PCV coil

DTC set preconditions:

- Battery voltage is normal
- During PCV driving
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- Open circuit of harness or open circuit of PCV coil

Engine warning light:

- ON

Limp home action by engine ECU (System action):

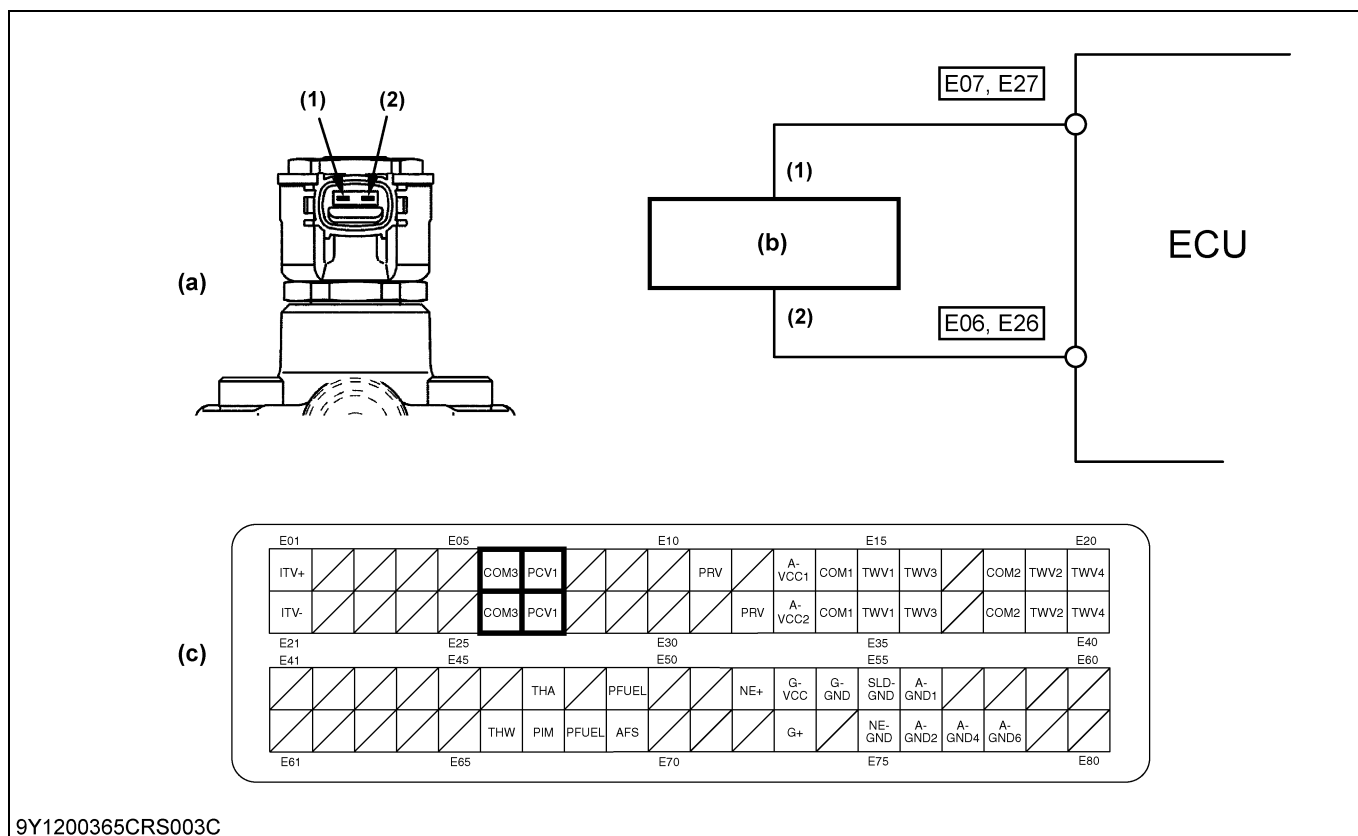
- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1298US0



9Y1200365CRS003C

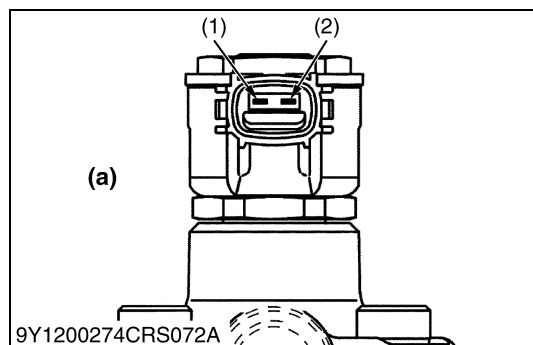
(1) Terminal PCV-
(2) Terminal PCV+

(a) Terminal Layout

(b) PCV
(Pre-stroke Control Valve)

(c) ECU Connector 1
(Engine Side)

9Y1200226CRS1299US0



1. Measure the Resistance Between PCV Terminals

- Place the key switch in the OFF position, unplug the PCV wiring harness connector, and measure the resistance between PCV terminals (1) and (2).

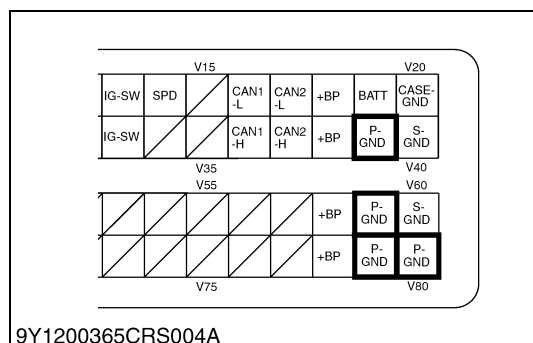
Factory specification	0.47 Ω at 20 °C
-----------------------	------------------------

OK	Go to "2. Check the Connector and Wiring Harnesses for Poor Contact".
NG	Faulty PCV → Replace the supply pump.

- Terminal PCV-
- Terminal PCV+

(a) PCV (Pre-stroke Control Valve)

9Y1200226CRS1300US0



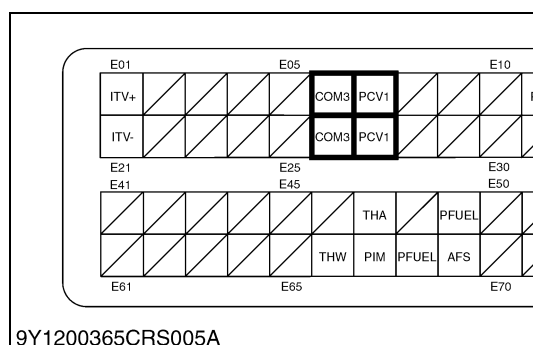
2. Check the Connector and Wiring Harnesses for Poor Contact

- Set the key switch to the OFF position, and check the wiring harness connectors and ECU pins for incorrect connection, deformation, poor contact or other defects.

Factory specification	Must be free from faulty connection, deformation, poor contact or other defects.
-----------------------	--

OK	Go to "3. Measure the Resistance Between ECU Terminals".
NG	Check the PCV wiring harnesses and connectors. → Repair.

9Y1200226CRS1301US0



3. Measure the Resistance Between ECU Terminals

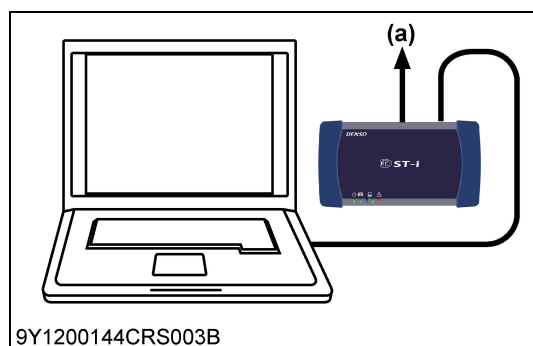
- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance each terminal of the connector.

Measurement terminal	E06, E26 ↔ E07, E27
----------------------	---------------------

Factory specification	2 Ω or lower
-----------------------	---------------------

OK	Go to "4. Check the DTC".
NG	Check the wiring harnesses and connectors for a poor contact. → Repair.

9Y1200226CRS1302US0



4. Check the DTC

- Plug the ECU connector into socket, and start the engine.
- Clear the DTCs that occurred previously, and check the currently existing trouble.

Factory specification	No DTC is output.
-----------------------	-------------------

OK	Normal.
NG	Faulty ECU → Replace the ECU.

(a) CAN1 Connector

9Y1200226CRS1303US0

(6) PCV or PRV Drive Line Short (DTC P0091 / 523607-4, DTC P0092 / 523607-3)

DTC P0091 / 523607-4: PCV or PRV drive line short to ground at power supply side (COM3), or all driver line short to ground simultaneously

Behavior during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops

Detection item:

- Wiring harness short to ground

DTC set preconditions:

- Battery voltage is normal
- CPU is normal (VDIC2 is normal)
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Wiring harness short to ground

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1304US0

DTC P0092 / 523607-3:PCV or PRV drive line short to +B at power supply side (COM3), or all driver line short to +B simultaneously

Behavior during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops

Detection item:

- Wiring harness short to +B

DTC set preconditions:

- Battery voltage is normal
- CPU is normal (VDIC2 is normal)
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Wiring harness short to +B

Engine warning light:

- ON

Limp home action by engine ECU (System action):

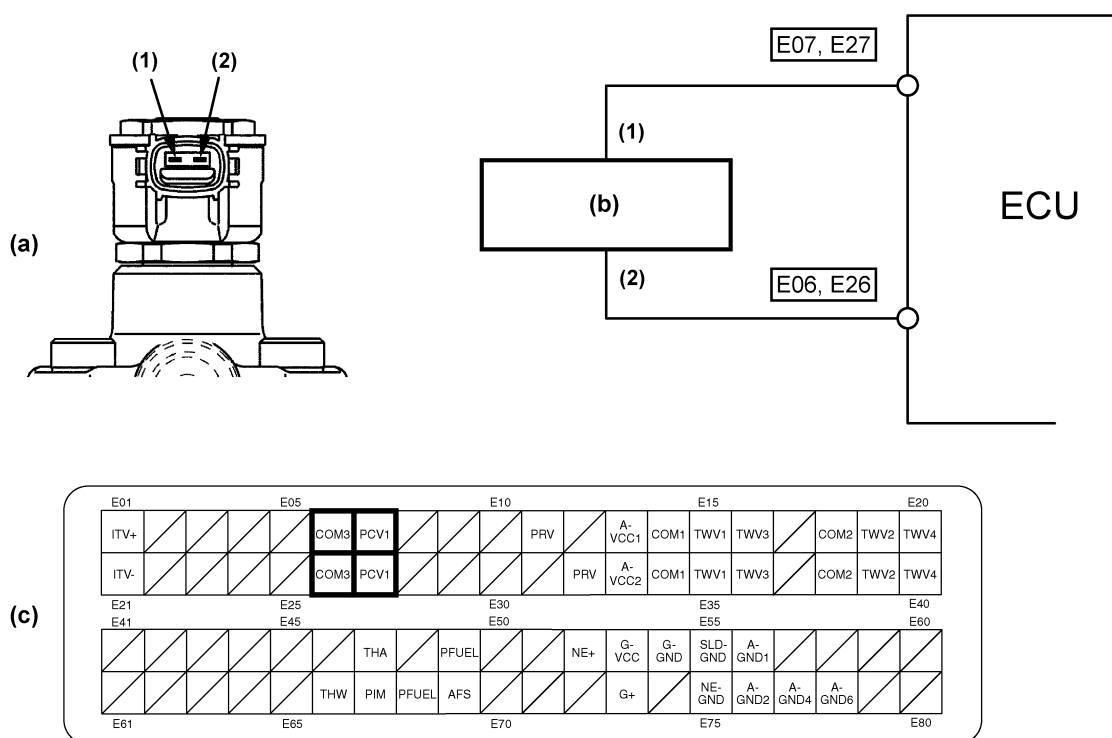
- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1305US0



9Y1200365CRS003C

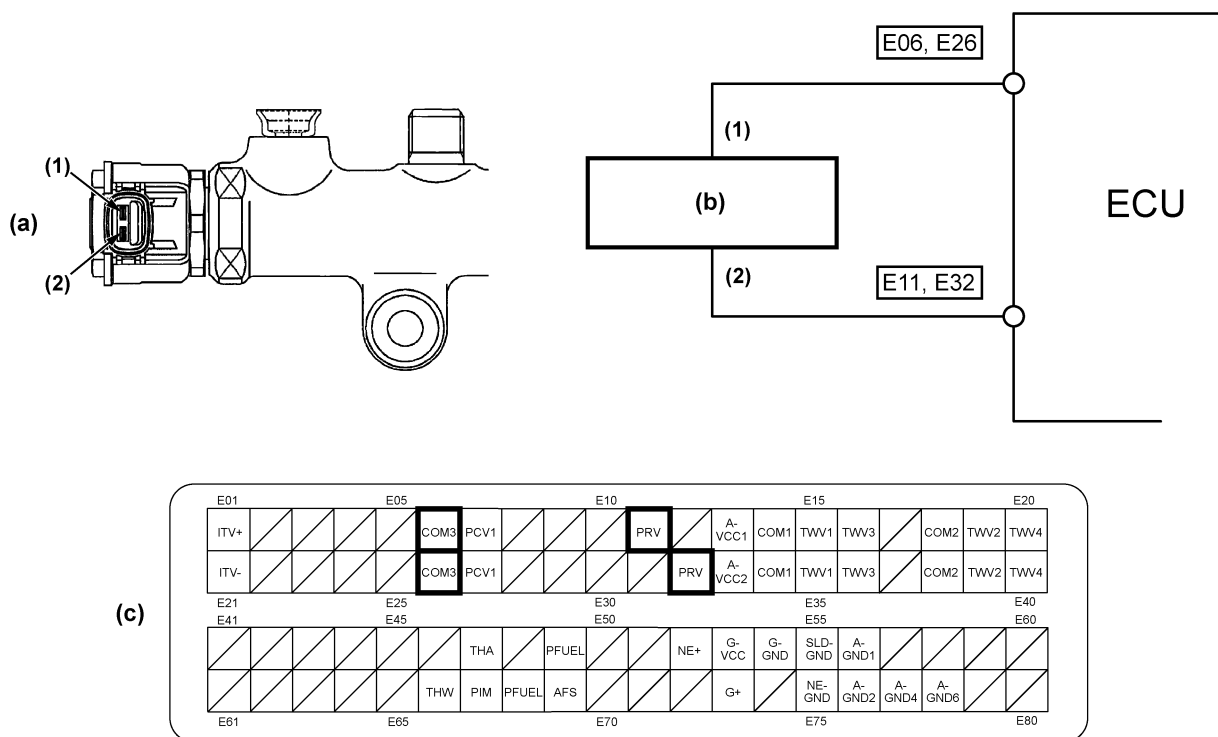
- (1) Terminal PCV-
(2) Terminal PCV+

(a) Terminal Layout

(b) PCV (Pre-stroke Control Valve)

(c) ECU Connector 1 (Engine Side)

9Y1200226CRS1306US0



9Y1200365CRS006B

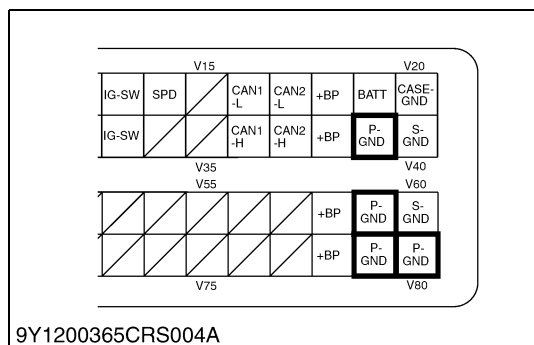
- (1) Terminal PRV+
(2) Terminal PRV-

(a) Terminal Layout

(b) PRV (Pressure Relief Valve)

(c) ECU Connector 1 (Engine Side)

9Y1200226CRS1307US0



1. Check the "P- GND" Wiring Harness

- Place the key switch in the OFF position, unplug the ECU wiring harness connector 2 (machine side) from the socket, and measure the resistance between each of ECU terminals V39, V59, V79 or V80 and the chassis ground (at the wiring harness side).

Factory specification	1.5 Ω or lower
-----------------------	-----------------------

OK	Go to "2. Check the Wiring Harness Connectors and ECU Pins".
NG	Check the "P- GND" wiring harness. → Repair. Locate the cause of open circuit, or increase its resistance value.

9Y1200226CRS1308US0

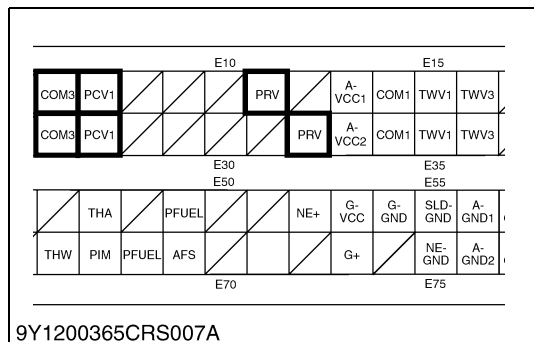
2. Check the Wiring Harness Connectors and ECU Pins

- Place the key switch in the OFF position, unplug the ECU connector 1 (engine side) from the socket, and check the ECU pins for faulty connection, deformation, poor contact or other defects.

Factory specification	Must be free from faulty connection, deformation, poor contact or other defects.
-----------------------	--

OK	P2147: Go to "3. Measure the ECU Terminal Resistance (Part 1)". P2148: Go to "4. Measure the ECU Terminal Voltage (Part 1)".
NG	Repair wiring harness connectors and ECU pins, or replace them if defective.

9Y1200226CRS1309US0



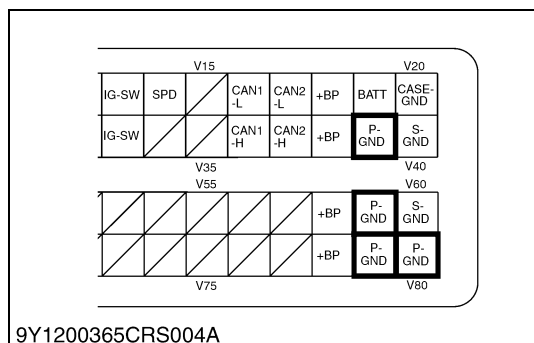
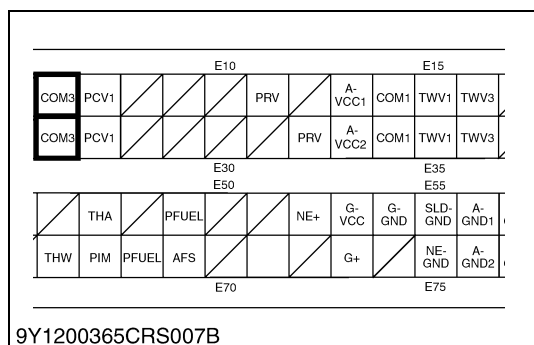
3. Measure the ECU Terminal Resistance (Part 1)

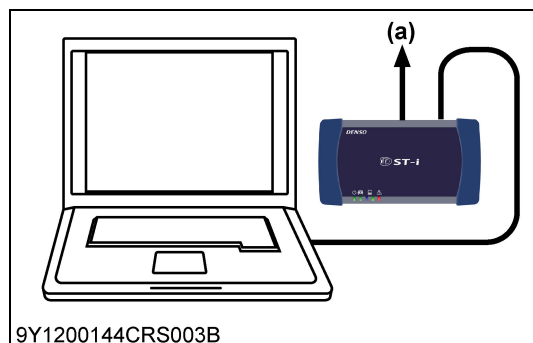
- Place the key switch in the OFF position, unplug each ECU connector from socket.
- Using an insulation resistance tester (megohmmeter tester), measure the resistance between ECU terminal E06 / E26 and "PGND" terminal.

Factory specification	10 M Ω or higher (between terminal and body, 500 V)
-----------------------	--

OK	Go to "4. Check the DTC".
NG	Go to "6. Measure the ECU Terminal Voltage (Part 2)".

9Y1200226CRS1310US0





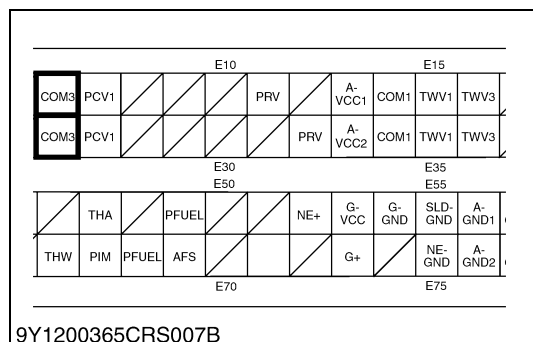
4. Check the DTC

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Start the engine, and clear the past DTCs.
3. Read the DTC again.

Factory specification	Normal (No DTC is output.)
OK	Normal.
NG	Faulty ECU → Replace.

(a) CAN1 Connector

9Y1200226CRS1311US0

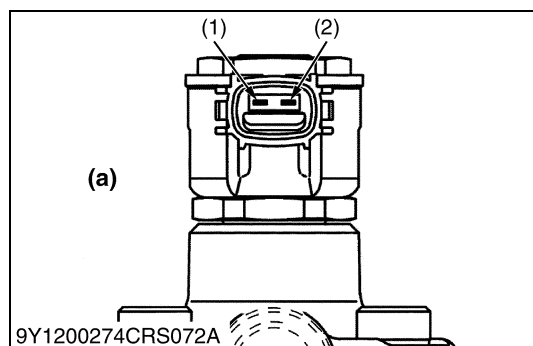


5. Measure the ECU Terminal Resistance (Part 2)

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector 1 (engine side) from the socket and measure the resistance between each of ECU terminal pins E06 / E26 and the "P- GND" terminal (at the wiring harness side).

Factory specification	10 MΩ or higher (between terminal and body, 500 V)
OK	Go to "6. Check the Wiring Harness".
NG	Faulty ECU → Replace.

9Y1200226CRS1312US0



6. Check the Wiring Harness

1. Locate the cause of wiring harness ground short, and repair the faulty area.

DTC	Relating ECU Terminals	Shorted Harness Side
P0091	Terminal E06 / E26 (E07 / E27 and E11 / E32 occurring simultaneously)	Ground
P0092	Terminal E06 / E26 (E07 / E27 and E11 / E32 occurring simultaneously)	Power supply

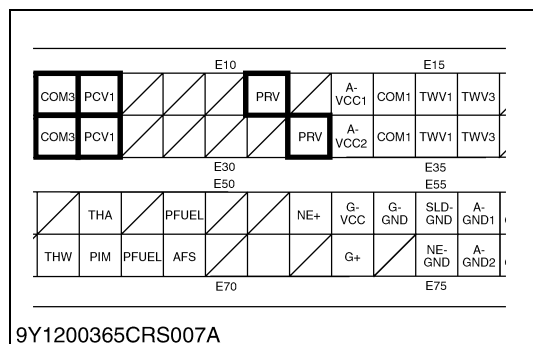
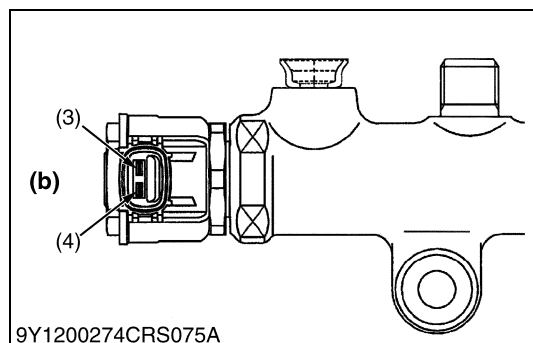
1. Place the key switch in the OFF position, unplug each injector connector from socket, and visually check the connector status.

Factory specification	Must be free from sludge and sparks.
Factory specification	10 MΩ or higher (between terminal and body, 500 V)
OK	The PCV or PRV functions normally. Locate another cause.
NG	Faulty PCV or PRV → Replace the supply pump or rail assembly.

- (1) Terminal PCV-
- (2) Terminal PCV+
- (3) Terminal PRV+
- (4) Terminal PRV-

- (a) PCV (Pre-stroke Control Valve)
- (b) PRV (Pressure Relief Valve)

9Y1200226CRS1313US0



(7) Fuel Leak (in High Pressured Fuel System) or Air Bubbles in Fuel Line (DTC P0093 / 1239-1)

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Fuel leak from high pressured fuel system (Fuel consumption is calculated from the difference of fuel pressure of before and after the injection, and the error will be detected when excess fuel consumption is found)

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- Rail pressure sensor is normal
- Injector and injector drive circuit are normal
- NE signal is active [Engine is operating (700 min^{-1} (rpm) or higher)]
- PRV is not in active, PCV is in active and normal

DTC set parameter:

- Flow-rate difference between "Fuel flow-rate calculated from dropped rail pressure" and "Other calculated flow-rate (volume of injection, leakage, pump discharge)" is more than $100 \text{ mm}^3/\text{st}$

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

- To minimize PM emission

9Y1200226CRS1314US0

Diagnostic Procedure for Pressure System DTCs

Checking of fault conditions and actions taken

If DTCs of non-pressure system are detected (*Refer to the pressure system DTCs given below.)

First locate the non-pressure system problem indicated by DTCs, and repair the affected parts. After the repair has been carried out, check for an output of pressure system DTCs. If so, begin the diagnosis of the affected pressure system.

If only pressure system DTCs are detected (*Refer to the pressure system DTCs given below.)

Diagnose the affected pressure system indicated by DTCs.

If a DTC currently exists

Begin diagnosis without returning the key switch to the OFF position. However, carefully make satisfactory / unsatisfactory judgments as the injection amount and rail pressure are limited by system actions.

If only a past DTC exists

Log the freeze-frame data, clear the DTCs, and stop the engine. Then, try to reproduce the problem using the freeze-frame data and the trouble check sheet.

Pressure system DTCs*[High pressure abnormality]**

1. P0088: High rail pressure
2. P1A0D: High pressure pump too high

[Low pressure abnormality]

1. P0093: Fuel leak
2. P0191: Rail pressure too low

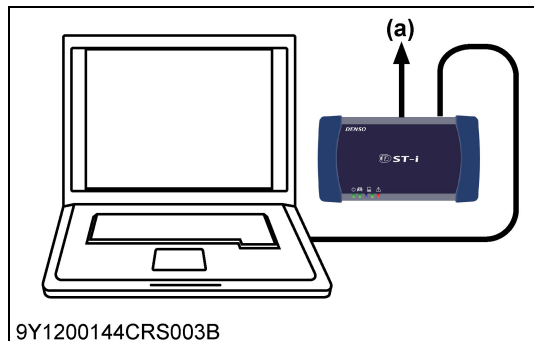
[Abnormal pressure]

1. P1274: Pump seizing 1
2. P1275: Pump seizing 2
3. P1A06: High pressure delivery system too high
4. P2293: Pressure relief valve error / PRV driving circuit error

■ IMPORTANT

- Multiple pressure system DTCs may be output simultaneously. Also, both abnormal high pressure and abnormal low pressure may be reported simultaneously under certain malfunction conditions.

9Y1200226CRS1315US0



1. Check the Data Related to the Rail Pressure

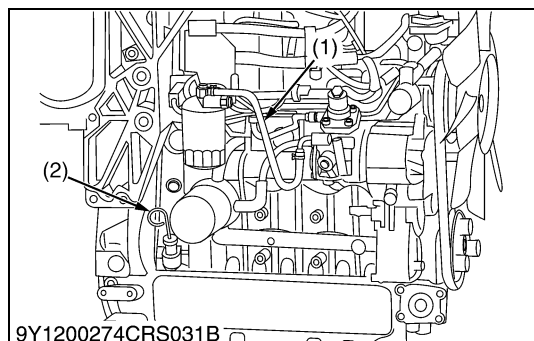
1. Connect the diagnosis tool to the CAN1 connector, and select the "Actual rail pressure" and "Target rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure"
	1. When idling: 35 to 60 MPa (360 to 610 kgf/cm ² , 5100 to 8700 psi)
	2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 155 MPa (1580 kgf/cm ² , 22500 psi)
	3. No-load maximum speed: 75.0 to 155 MPa (765 to 1580 kgf/cm ² , 10900 to 22400 psi)
	4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.

OK	Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.
NG	Go to "2. Check the Fuel System for the Existence of Air".

(a) CAN1 Connector

9Y1200226CRS1316US0



2. Check the Fuel System for the Existence of Air

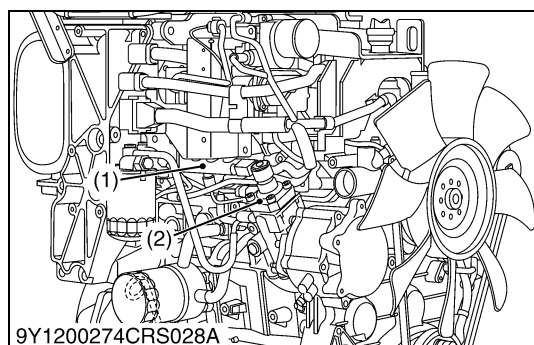
1. Check each joint of the fuel system for the existence of air.
To detect the existence of air effectively, replace the fuel hose with a transparent one.

OK	Go to "3. Check the Fuel System".
NG	Rotate the fuel feed pump sufficiently and bleed the air. Locate the position of the fuel leakage in the piping and repair it.

(1) Fuel Hose

(2) Dipstick

9Y1200226CRS1317US0



3. Check the Fuel System



CAUTION

- Visually check there is no leak in the high pressure fuel pipe system.
- A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.

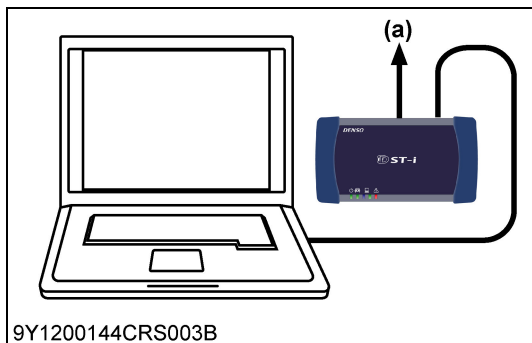
1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "4. Check the Rail Pressure Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

(1) Rail

(2) Supply Pump

9Y1200226CRS1318US0



4. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)

1. Check the rail pressure sensor.

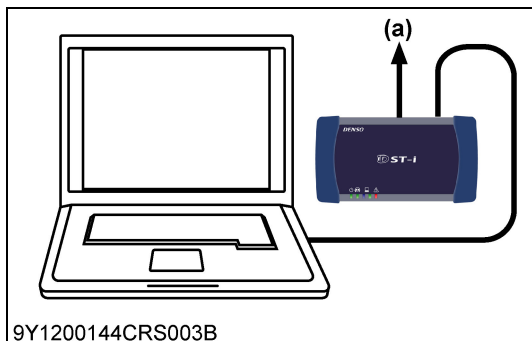
■ NOTE

- Closely check sensor signals for a noise component and an abnormality that exists for a short time.

OK	Go to "5. Check for a Fuel Leakage".
NG	Replace the rail assembly or its related parts. (Follow the diagnostic procedure of items P0192 and P0193.) (Refer to page 1-S404)

(a) CAN1 Connector

9Y1200226CRS1319US0



5. Check for a Fuel Leakage

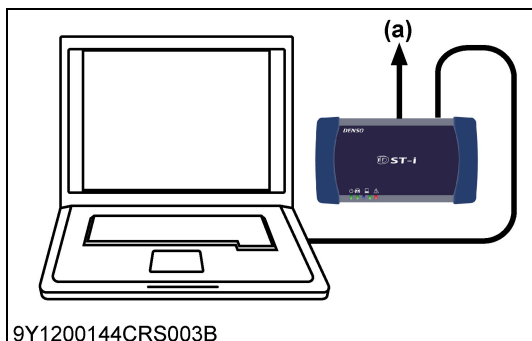
1. Increase the rail pressure by operating the accelerator pedal or accelerator lever, and check for a fuel leakage.

Factory specification	No fuel leaks.
-----------------------	----------------

OK	Go to "6. Check the DTC Again".
NG	Locate the leakage position and repair it.

(a) CAN1 Connector

9Y1200226CRS1320US0



6. Check the DTC Again

1. Clear the past malfunction data, and make sure that the same DTC is output again in the reproduction test.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

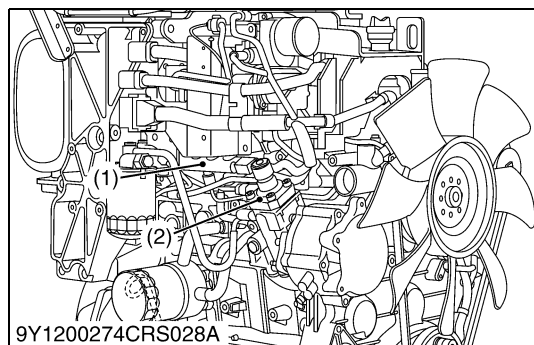
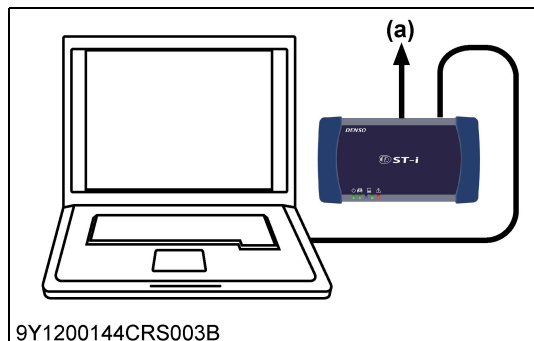
■ NOTE

- Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.

OK	Normal.
NG	Go to "7. Check the PCV (or PRV)-related Data".

(a) CAN1 Connector

9Y1200226CRS1321US0



7. Check the PCV (or PRV)-related Data

1. Check the "Target rail pressure" and "Actual rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	<ol style="list-style-type: none"> 1. The "Actual rail pressure" always follow to the "Target rail pressure". <p>A: Normal operating B: Accelerator opening: 0→100 % (During acceleration) C: Accelerator closing: 100→0 % (During rapid deceleration) D: Just after key switch OFF</p>
OK	After confirming that an intermittent malfunction (such as power supply system or noise generation) does not occur in relation to the ECU, replace the ECU.
NG	<p>Case A or B: Faulty PCV → Replace the supply pump. Case C or D: Faulty PRV → Replace the rail assembly.</p>

- (1) Rail
 (2) Supply Pump

(a) **CAN1 Connector**

9Y1200226CRS1322US0

(8) Intake Air Volume: Low (DTC P0101 / 132-1)

Behaviour during malfunction:

- Insufficient output

Detection item:

- Engine inlet air mass flow rate lacking (Disconnect turbo blower intake hose)

DTC set preconditions:

- Engine is operating [1000 min⁻¹ (rpm) or higher]
- Coolant temperature is 15 °C (59 °F) or higher (Coolant temperature sensor is normal)
- MAF sensor is normal
- EGR valve is normal
- Intake throttle valve is normal
- Battery voltage is normal

DTC set parameter:

- Engine Inlet Air Mass Flow Rate: less than half of target value

Engine warning light:

- ON

Limp home action by engine ECU (system action):

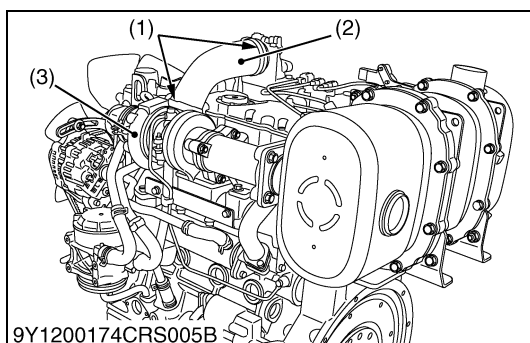
- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1323US0



1. Check the Air Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

■ NOTE

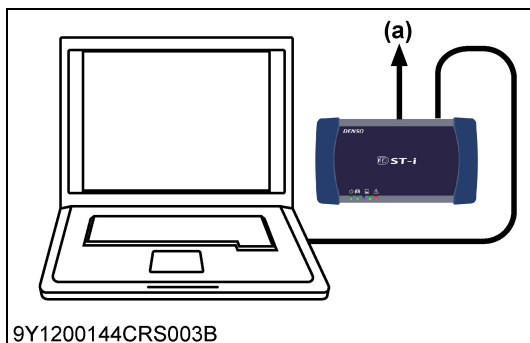
- Check if the suction hose of the turbo blower does not come off. If the hose comes off, install it.
- Check the clogging condition of the air cleaner. If it is very dirty, replace the new one.

OK	Go to "2. DTC Judgment".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

- (1) Hose Clamp
(2) Hose

- (3) Turbocharger

9Y1200226CRS1324US0



2. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Operate the engine for 2 to 3 minutes with the engine in the idle status.
3. Check whether the DTC is output or not.

Factory specification	Either DTC is output.
OK	Normal.
NG	Replace the MAF Sensor or replace the ECU.

- (a) CAN1 Connector

9Y1200226CRS1325US0

(9) MAF Sensor Abnormality (DTC P0102 / 132-4, P0103 / 132-3)**P0102 / 132-4: MAF sensor: Low****Behaviour during malfunction:**

- Insufficient output
- Worsening exhaust gas emissions

Detection item:

- Open circuit or ground short circuit of sensor or harness.

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated
- Sensor supply voltage is normal

DTC set parameter:

- Mass air flow sensor voltage: 0.1 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Sensor output: 0.7 times of target value at normal condition [default value]
- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1326US0

P0103 / 132-3: MAF sensor: High**Behaviour during malfunction:**

- Insufficient output
- Worsening exhaust gas emissions

Detection item:

- +B short circuit of sensor or harness

DTC set preconditions:

- Battery voltage is normal
- $700 \text{ min}^{-1} (\text{rpm}) \leq \text{engine speed} \leq 2800 \text{ min}^{-1} (\text{rpm})$
- Target intake mass air flow is 460 or less and it continues for 3 seconds
- Sensor supply voltage is normal

DTC set parameter:

- Mass air flow sensor voltage: 4.9 V or more in certain operation condition

Engine warning light:

- ON

Limp home action by engine ECU (system action):

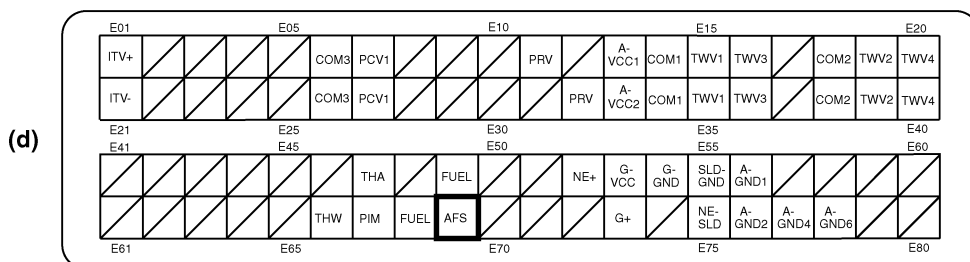
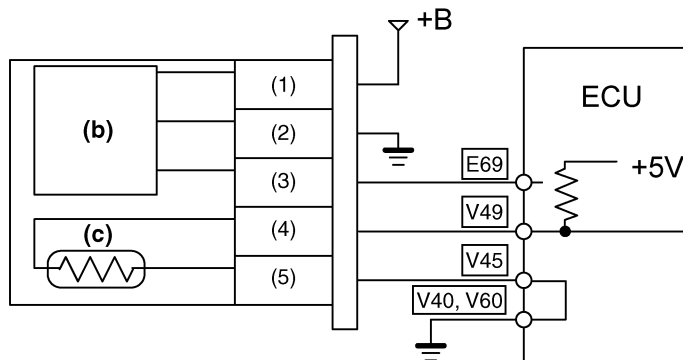
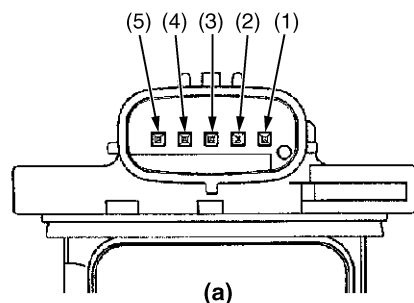
- Sensor output: 0.7 times of target value at normal condition [default value]
- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1327US0



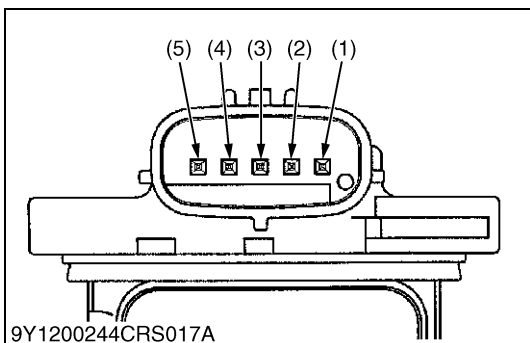
9Y1200365CRS008A

- (1) Terminal Power (+12 V)
 (2) Terminal Ground
 (3) Terminal AFS
 (4) Terminal IATS
 (5) Terminal A-GND10

- (a) Terminal Layout
 (b) Mass Air Flow (MAF) Sensor

- (c) Intake Air Temperature Sensor (Built-in MAF)
 (d) ECU Connector 1 (Engine Side)

9Y1200226CRS1328US0



9Y1200244CRS017A

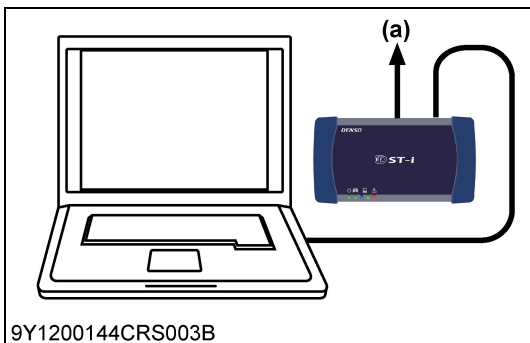
1. Measure the Sensor Terminal Voltage

- Move the key switch from the OFF to the ON position, and measure the voltage between sensor terminals 1 and 2.

Factory specification	Approx. 10 to 16 V
OK	Go to "2. DTC Judgment".
NG	Repair or replace the wiring harness, or replace the sensor

- (1) Terminal Power (+12 V)
 (2) Terminal Ground
 (3) Terminal AFS
 (4) Terminal IATS
 (5) Terminal A-GND10

9Y1200226CRS1329US0



9Y1200144CRS003B

2. DTC Judgment

- Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
- Operate the engine for 2 to 3 minutes with the engine in the idle status.
- Check whether the DTC is output or not.

Factory specification	Either DTC is output.
OK	Normal.
NG	Replace the MAF Sensor or replace the ECU.

- (a) CAN1 Connector

9Y1200226CRS1330US0

(10) Intake Air Temperature: High (Inter Cooler Model Only) (DTC P0111 / 172-0)

Behaviour during malfunction:

- None

Detection item:

- Intake air temperature too high

DTC set preconditions:

- Battery voltage is normal
- Key switch is ON

DTC set parameter:

- Intake air temperature higher than ambient temperature +60 °C (+140 °F)

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition

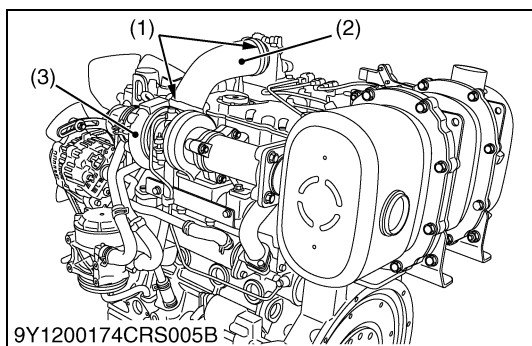
Recovery from error:

- Key switch turn OFF

Remark:

- Inter cooler model only

9Y1200226CRS1331US0



1. Check the Air Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

■ NOTE

- Check the clogging condition of the inter cooler. (Check whether the inter cooler functions properly. If the inter cooler has an electric fan, check whether it operates properly.)
- Check whether the connection pipe of the inter cooler does not come off.

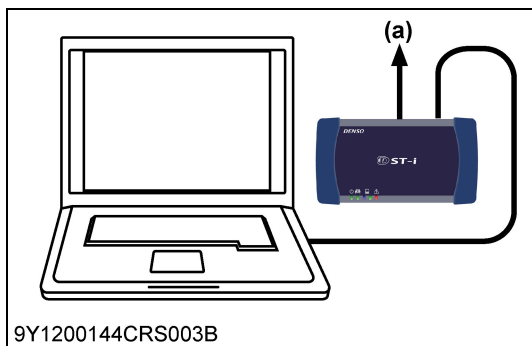
OK	Go to "2. Check the Intake Air Temperature (Refer to items P0072 and P0073)".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

(1) Hose Clamp

(3) Turbocharger

(2) Hose

9Y1200226CRS1332US0



2. Check the Intake Air Temperature Sensor (*Refer to Items P0072 and P0073)

1. Check the intake air temperature sensor. (Refer to page 1-S371)

OK	Normal.
NG	Replace the intake air temperature sensor or its related parts. (Follow the diagnostic procedure of items P0072 and P0073.) (Refer to page 1-S371)

(a) CAN1 Connector

9Y1200226CRS1333US0

(11) Intake Air Temperature Error (DTC P0112 / 172-4, P0113 / 172-3)

P0112 / 172-4: Intake air temperature error: Low

Behaviour during malfunction:

- White smoke increases at low temperature

Detection item:

- Ground short circuit of sensor or harness

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Voltage of intake air temperature sensor is 0.05 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- During start-up = -20 °C (-4 °F) [default value]
- Under other conditions = 40 °C (104 °F) [default value]

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1334US0

P0113 / 172-3: Intake air temperature error: High

Behaviour during malfunction:

- White smoke increases at low temperature

Detection item:

- Open circuit or +B short circuit of sensor or harness

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Voltage of intake air temperature sensor is 4.9 V or above

Engine warning light:

- ON

Limp home action by engine ECU (system action):

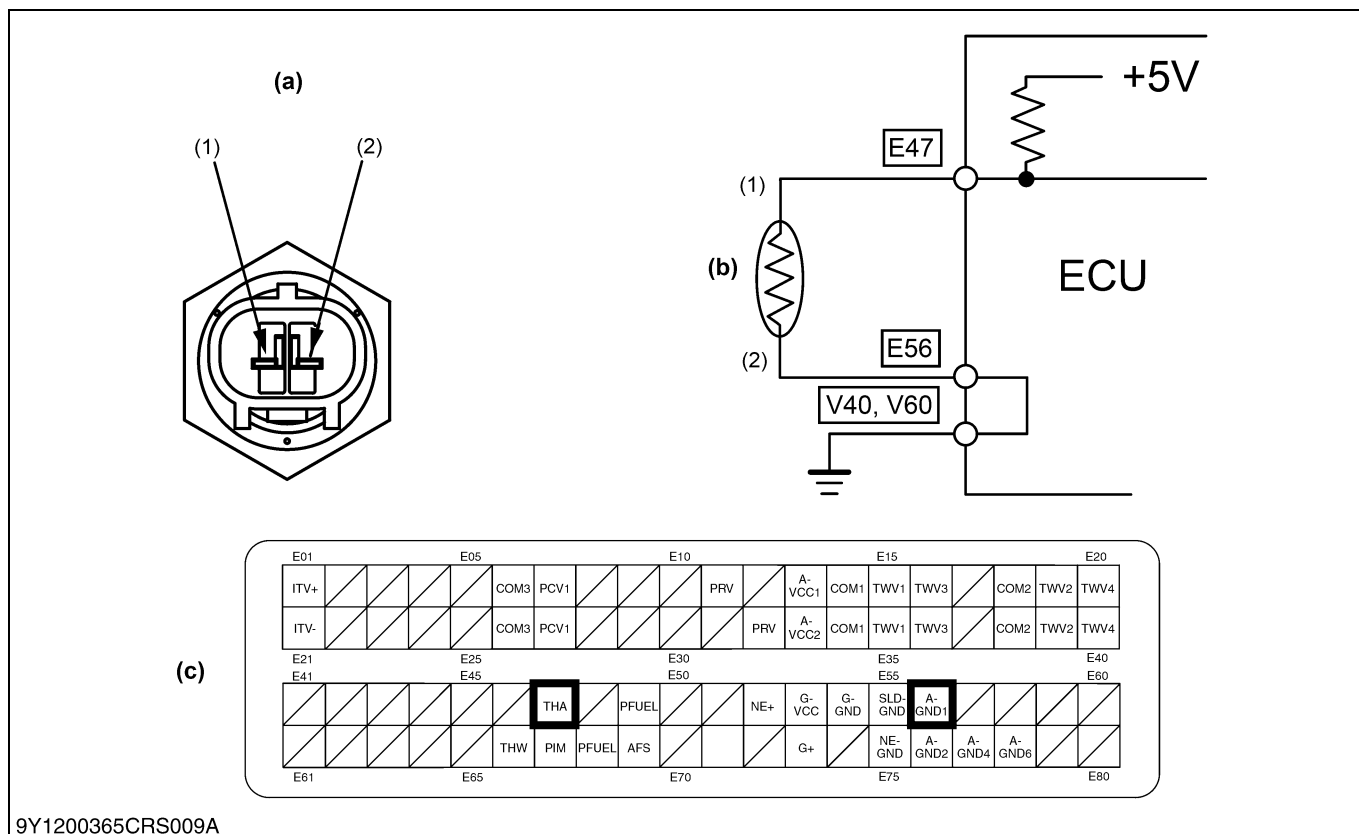
- During start-up = -20 °C (-4 °F) [default value]
- Under other conditions = 40 °C (104 °F) [default value]

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1335US0



9Y1200365CRS009A

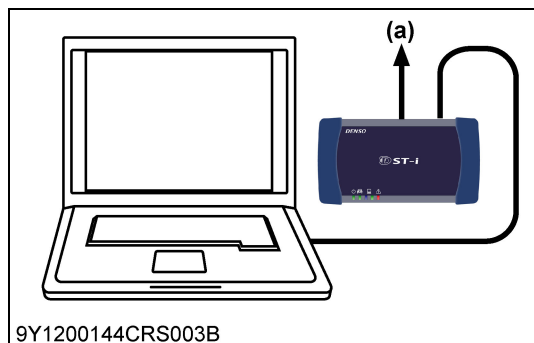
(1) Terminal THA

(2) Terminal A-GND1

(a) Terminal Layout
(b) Intake Air Temperature Sensor

(c) ECU Connector 1
(Engine Side)

9Y1200226CRS1336US0



9Y1200144CRS003B

1. Check the Intake Air Temperature Sensor Signals

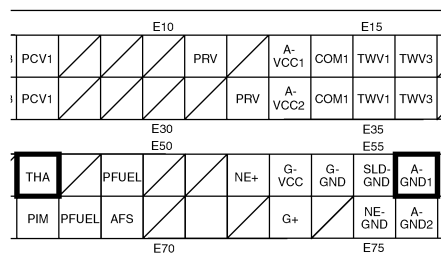
- Place the key switch in the ON position, and check the "Intake air temperature" and "Intake air temperature sensor output voltage" on the diagnosis tool data monitor.

Factory specification		
Actual intake air temperature	Intake air temperature	Output voltage
20 °C (68 °F)	20 °C (68 °F)	Approx. 2.4 V
40 °C (104 °F)	40 °C (104 °F)	Approx. 1.5 V
60 °C (140 °F)	60 °C (140 °F)	Approx. 0.9 V
80 °C (176 °F)	80 °C (176 °F)	Approx. 0.5 V

OK	Clear the DTC and check whether it is output again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Resistance Between Terminals".	

(a) CAN1 Connector

9Y1200226CRS1337US0



9Y1200365CRS010A

2. Measure the Resistance Between Terminals

- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals E47 and E56 of the connector.

Factory specification	
Temperature	Resistance
20 °C (68 °F)	Approx. 2.4 kΩ
60 °C (140 °F)	Approx. 0.58 kΩ
100 °C (212 °F)	Approx. 0.18 kΩ

OK	Go to "4. Measure the ECU Terminal Voltage".
NG	Go to "3. Check the Sensor".

9Y1200226CRS1338US0

3. Check the Sensor

- Turn the key switch OFF, remove the connector from the sensor side and measure the resistance between the terminals on the sensor side.

Factory specification	
Temperature	Resistance
20 °C (68 °F)	Approx. 2.4 kΩ
60 °C (140 °F)	Approx. 0.58 kΩ
100 °C (212 °F)	Approx. 0.18 kΩ

OK	Wiring harness open circuit or connector fault → Check and repair.
NG	Intake air temperature sensor fault → Replace the intake air temperature sensor.

- (1) Intake Air Temperature Sensor

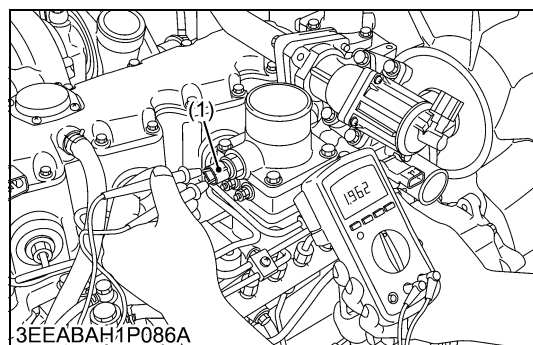
9Y1200226CRS1339US0

4. Measure the ECU Terminal Voltage

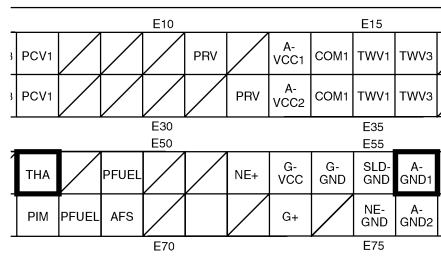
- Plug the ECU wiring harness connector into socket again, unplug the sensor connector, and measure the voltage between ECU terminals E47 and E56 at the ECU side.

Factory specification	Approx. 5 V
OK	The ECU connector is faulty or its wiring harness is shorted.
NG	Confirm by using other sensors that there is no ground short malfunction before replacing the ECU.

9Y1200226CRS1340US0



3EEABAH1P086A



9Y1200365CRS010A

(12) Coolant Temperature Sensor Abnormality (DTC P0117 / 110-4, P0118 / 110-3)

P0117 / 110-4: Coolant temperature sensor: Low

Behaviour during malfunction:

- White smoke increases at low temperature
- Insufficient output
- Worsening exhaust gas emissions

Detection item:

- Ground short circuit of sensor or harness

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Voltage of coolant temperature sensor is 0.1 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- During start-up = -25 °C (-13 °F) [default value]
- Under other conditions = 80 °C (176 °F) [default value]
- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1341US0

P0118 / 110-3: Coolant temperature sensor: High

Behaviour during malfunction:

- White smoke increases at low emissions
- Insufficient output
- Worsening exhaust gas performance

Detection item:

- Open circuit or +B short circuit of sensor or harness

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Voltage of coolant temperature sensor is 4.9 V or above

Engine warning light:

- ON

Limp home action by engine ECU (system action):

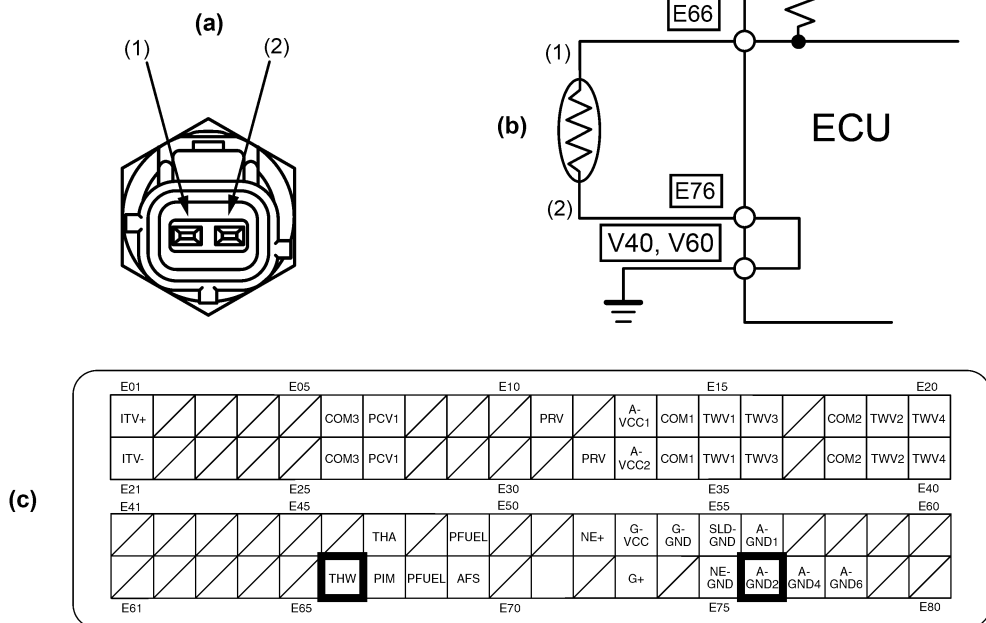
- During start-up = -25 °C (-13 °F) [default value]
- Under other conditions = 80 °C (176 °F) [default value]
- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1342US0



9Y1200365CRS011A

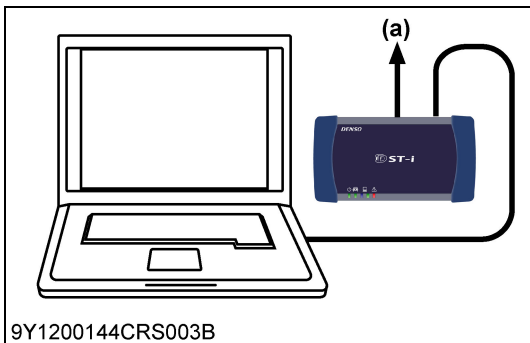
(1) Terminal THW

(2) Terminal A-GND2

(a) Terminal Layout
(b) Coolant Temperature Sensor

(c) ECU Connector 1
(Engine Side)

9Y1200226CRS1343US0



9Y1200144CRS003B

1. Check the Coolant Temperature Sensor Signals

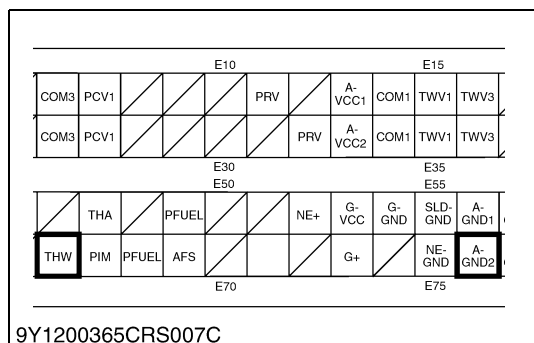
- Place the key switch in the ON position, and check the "Coolant temperature" and "Coolant temperature sensor output voltage" on the diagnosis tool data monitor.

Factory specification		
Actual coolant temperature	Coolant temperature	Output voltage
20 °C (68 °F)	20 °C (68 °F)	Approx. 2.4 V
40 °C (104 °F)	40 °C (104 °F)	Approx. 1.5 V
60 °C (140 °F)	60 °C (140 °F)	Approx. 0.9 V
80 °C (176 °F)	80 °C (176 °F)	Approx. 0.5 V
100 °C (212 °F)	100 °C (212 °F)	Approx. 0.3 V

OK	Clear the DTC and check whether it is output again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Resistance Between Terminals".	

(a) CAN1 Connector

9Y1200226CRS1344US0



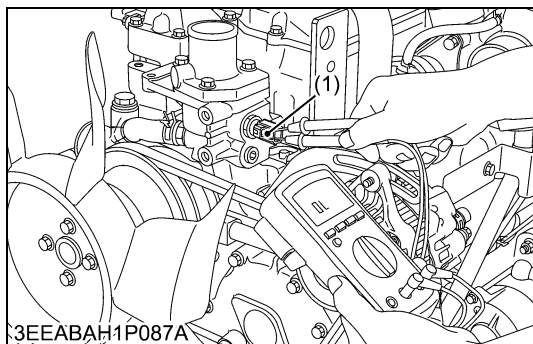
2. Measure the Resistance Between Terminals

- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals E66 and E76 of the connector.

Factory specification	
Temperature	Resistance
20 °C (68 °F)	Approx. 2.5 kΩ
40 °C (104 °F)	Approx. 1.2 kΩ
60 °C (140 °F)	Approx. 0.58 kΩ
80 °C (176 °F)	Approx. 0.32 kΩ
100 °C (212 °F)	Approx. 0.18 kΩ

OK	Go to "4. Measure the ECU Terminal Voltage".
NG	Go to "3. Check the sensor".

9Y1200226CRS1345US0



3. Check the Sensor

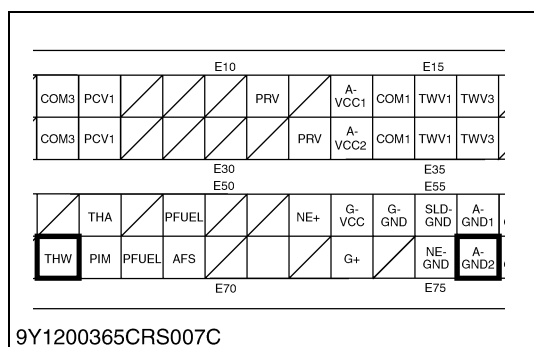
- Turn the key switch OFF, remove the connector from the sensor side and measure the resistance between the terminals on the sensor side.

Factory specification	
Temperature	Resistance
20 °C (68 °F)	Approx. 2.5 kΩ
40 °C (104 °F)	Approx. 1.2 kΩ
60 °C (140 °F)	Approx. 0.58 kΩ
80 °C (176 °F)	Approx. 0.32 kΩ
100 °C (212 °F)	Approx. 0.18 kΩ

OK	Wiring harness open circuit or connector fault → Check and repair.
NG	Coolant temperature sensor fault → Replace the coolant temperature sensor.

(1) Coolant Temperature Sensor

9Y1200226CRS1346US0



4. Measure the ECU Terminal Voltage

- Plug the ECU wiring harness connector into socket again, unplug the sensor connector, and measure the voltage between ECU terminals E66 and E76 at the ECU side.

Factory specification	Approx. 5 V
OK	The ECU connector is faulty or its wiring harness is shorted.
NG	Confirm by using other sensors that there is no ground short malfunction before replacing the ECU.

9Y1200226CRS1347US0

(13) Rail Pressure too Low (DTC P0191 / 157-1)

Behavior during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops

Detection item:

- Rail pressure too low
(Negative pressure at the inlet of supply pump is high and supply pump delivery system error,ex filter clogging, cavitation)

DTC set preconditions:

- Injection Q is 0 mm³/st and more and the difference between current direction and previous direction value is 50 mm³/st and lower
- During PMP normal operating
- During discharge value is high

DTC set parameter:

- Delta error (Direction value - real value of rail pressure) continue during 5 seconds and more

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1348US0

Diagnostic Procedure for Pressure System DTCs

Checking of fault conditions and actions taken

If DTCs of non-pressure system are detected (*Refer to the pressure system DTCs given below.)

First locate the non-pressure system problem indicated by DTCs, and repair the affected parts. After the repair has been carried out, check for an output of pressure system DTCs. If so, begin the diagnosis of the affected pressure system.

If only pressure system DTCs are detected (*Refer to the pressure system DTCs given below.)

Diagnose the affected pressure system indicated by DTCs.

If a DTC currently exists

Begin diagnosis without returning the key switch to the OFF position. However, carefully make satisfactory / unsatisfactory judgments as the injection amount and rail pressure are limited by system actions.

If only a past DTC exists

Log the freeze-frame data, clear the DTCs, and stop the engine. Then, try to reproduce the problem using the freeze-frame data and the trouble check sheet.

Pressure system DTCs*[High pressure abnormality]**

1. P0088: High rail pressure
2. P1A0D: High pressure pump too high

[Low pressure abnormality]

1. P0093: Fuel leak
2. P0191: Rail pressure too low

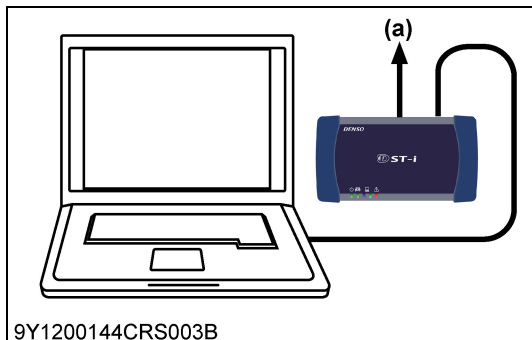
[Abnormal pressure]

1. P1274: Pump seizing 1
2. P1275: Pump seizing 2
3. P1A06: High pressure delivery system too high
4. P2293: Pressure relief valve error / PRV driving circuit error

■ IMPORTANT

- Multiple pressure system DTCs may be output simultaneously. Also, both abnormal high pressure and abnormal low pressure may be reported simultaneously under certain malfunction conditions.

9Y1200226CRS1349US0

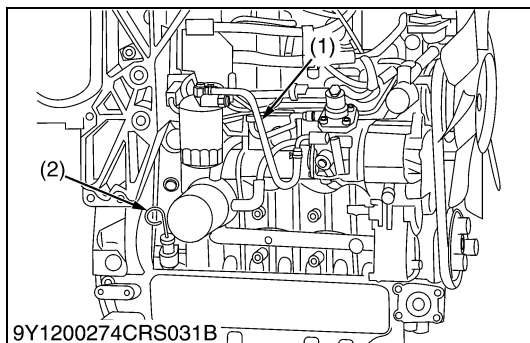
**1. Check the Data Related to the Rail Pressure**

1. Connect the diagnosis tool to the CAN1 connector, and select the "Actual rail pressure" and "Target rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	<p>The "Actual rail pressure" always follow to the "Target rail pressure"</p> <ol style="list-style-type: none"> 1. When idling: 35 to 60 MPa (360 to 610 kgf/cm², 5100 to 8700 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 155 MPa (1580 kgf/cm², 22500 psi) 3. No-load maximum speed: 75.0 to 155 MPa (765 to 1580 kgf/cm², 10900 to 22400 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.
OK	Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.
NG	Go to "2. Check the Fuel System for the Existence of Air".

(a) CAN1 Connector

9Y1200226CRS1350US0



2. Check the Fuel System for the Existence of Air

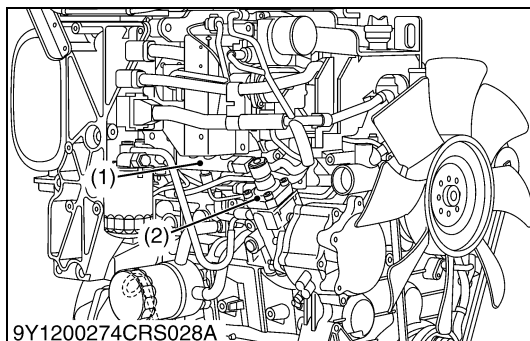
1. Check each joint of the fuel system for the existence of air.
To detect the existence of air effectively, replace the fuel hose with a transparent one.

OK	Go to "3. Check the Fuel System".
NG	Locate the position of the fuel leakage in the piping and repair it.

(1) Fuel Hose

(2) Dipstick

9Y1200226CRS1351US0



3. Check the Fuel System



CAUTION

- Visually check there is no leak in the high pressure fuel pipe system.
- A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.

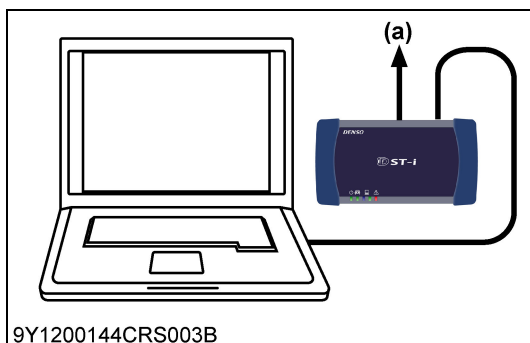
1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "4. Check the Rail Pressure Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

(1) Rail

(2) Supply Pump

9Y1200226CRS1352US0



4. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)

1. Check the rail pressure sensor.

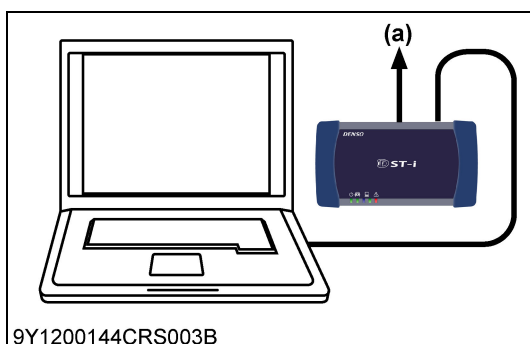
NOTE

- Closely check sensor signals for a noise component and an abnormality that exists for a short time.

OK	Go to "5. Check the DTC Again".
NG	Replace the rail assembly or its related parts. (Follow the diagnostic procedure of items P0192 and P0193.) (Refer to page 1-S404)

(a) CAN1 Connector

9Y1200226CRS1353US0



5. Check the DTC Again

1. Clear the past malfunction data, and make sure that the same DTC is output again in the reproduction test.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

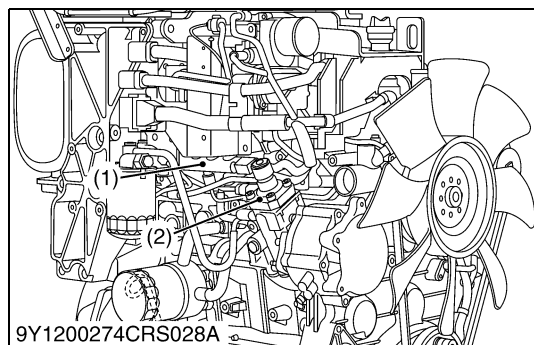
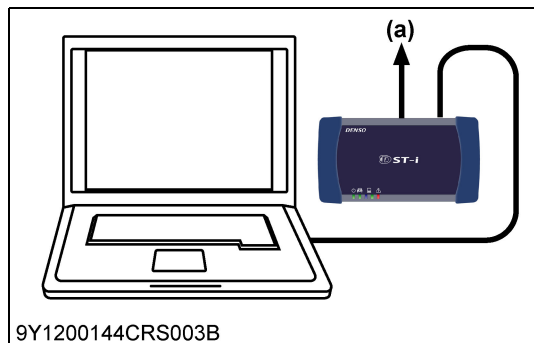
NOTE

- Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.

OK	Normal.
NG	Go to "6. Check the PCV (or PRV)-related Data".

(a) CAN1 Connector

9Y1200226CRS1354US0



6. Check the PCV (or PRV)-related Data

1. Check the "Target rail pressure" and "Actual rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	<ol style="list-style-type: none"> 1. The "Actual rail pressure" always follow to the "Target rail pressure". <p>A: Normal operating B: Accelerator opening: 0→100 % (During acceleration) C: Accelerator closing: 100→0 % (During rapid deceleration) D: Just after key switch OFF</p>
OK	After confirming that an intermittent malfunction (such as power supply system or noise generation) does not occur in relation to the ECU, replace the ECU.
NG	<p>Case A or B: Faulty PCV → Replace the supply pump. Case C or D: Faulty PRV → Replace the rail assembly.</p>

- (1) Rail
(2) Supply Pump

(a) **CAN1 Connector**

9Y1200226CRS1355US0

(14) Rail Pressure Sensor Abnormality (DTC P0192 / 157-4, P0193 / 157-3)

P0192 / 157-4: Rail pressure sensor: Low

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine running noise increases
- White smoke increases
- Engine stops

Detection item:

- Ground short circuit of sensor or harness
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Voltage of rail pressure sensor is 0.275 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Engine forcibly stopped 60 sec. later

Recovery from error:

- Key switch turn OFF

Remark:

- To minimize PM emission

9Y1200226CRS1356US0

P0193 / 157-3: Rail pressure sensor: High

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine running noise increases
- White smoke increases
- Engine stops

Detection item:

- Open circuit or +B short circuit of sensor or harness.
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Voltage of rail pressure sensor is 4.735 V or above

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Engine forcibly stopped 60 sec. later

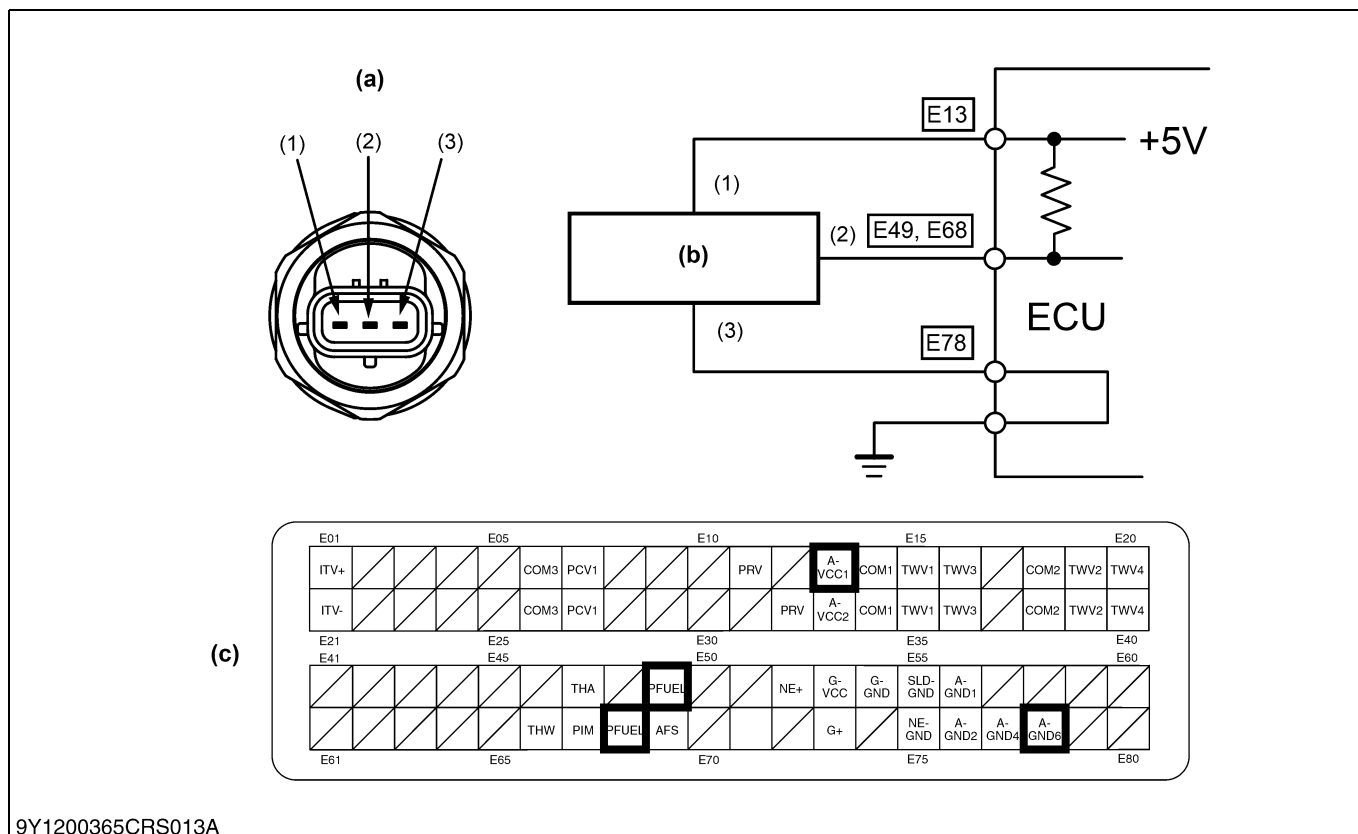
Recovery from error:

- Key switch turn OFF

Remark:

- To minimize PM emission

9Y1200226CRS1357US0



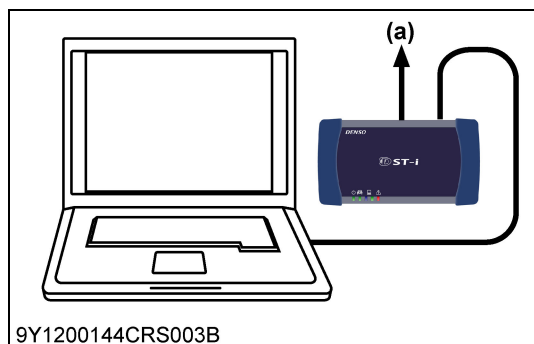
(1) Terminal A-VCC1
(2) Terminal PFUEL

(3) Terminal A-GND6

(a) Terminal Layout
(b) Rail pressure sensor

(c) ECU Connector 1
(Engine Side)

9Y1200226CRS1358US0



1. Check the Rail Pressure Sensor Signals

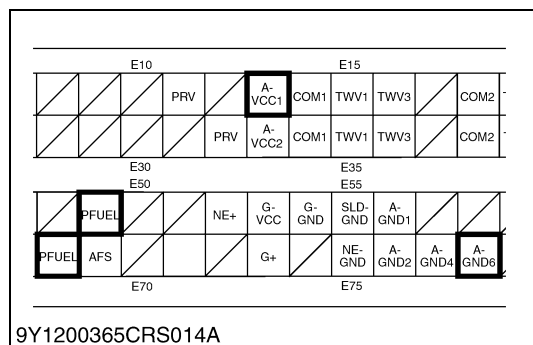
- Place the key switch in the ON position, and check the "Actual rail pressure" and "Rail pressure sensor output voltage" on the diagnosis tool data monitor.
- Next, start the engine, change the depressed amount of the accelerator pedal, and check the same items again.

Factory specification		
Engine state	Actual rail pressure	Output voltage
Key switch is ON	Approx. 0 MPa (0 kgf/cm ² , 0 psi)	Approx. 0.5 V
After engine start-up	Approx. 35.0 to 210 MPa (357 to 2140 kgf/cm ² , 5080 to 30400 psi)	Approx. 0.9 to 2.9 V

OK	Clear the DTC and check whether it is output again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the ECU terminal voltage".	

(a) CAN1 Connector

9Y1200226CRS1359US0



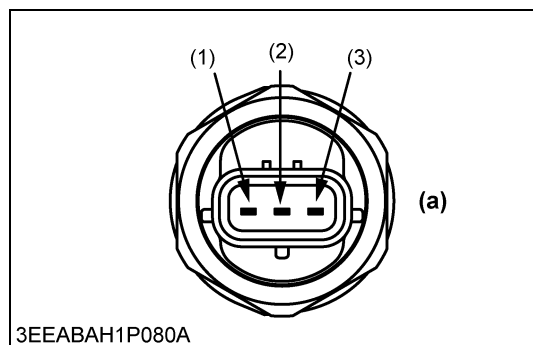
2. Measure the ECU Terminal Voltage

1. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals E68 and E78 and between terminals E49 and E78.
2. Next, start the engine, change the depressed amount of the accelerator pedal, and check the same items again.

Factory specification		
Engine state	Actual rail pressure	Output voltage
Key switch is ON	Approx. 0 MPa (0 kgf/cm ² , 0 psi)	Approx. 0.5 V
After engine start-up	Approx. 35.0 to 210 MPa (357 to 2140 kgf/cm ² , 5080 to 30400 psi)	Approx. 0.9 to 2.9 V

OK	Check the harness connectors and ECU pins.	
	OK	Faulty ECU → Replace.
	NG	Repair or replace the wiring harness, or replace the ECU.
NG	Go to "3. Measure the voltage between rail pressure sensor terminals - 1".	

9Y1200226CRS1360US0



3. Measure the Voltage Between Rail Pressure Sensor Terminals - 1

1. Place the key switch in the ON position, and measure the voltage between terminals (2) and (3) of the rail pressure sensor at the wiring harness side.
2. Next, start the engine, change the depressed amount of the accelerator pedal, and check the same items again.

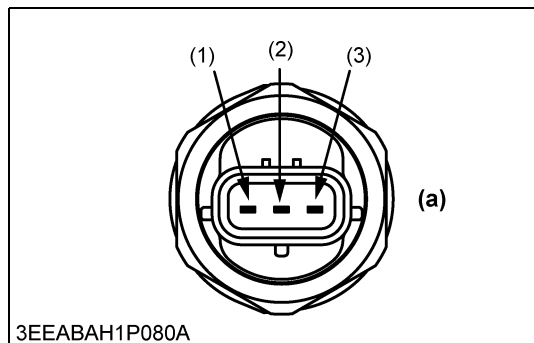
Factory specification		
Engine state	Actual rail pressure	Output voltage
Key switch is ON	Approx. 0 MPa (0 kgf/cm ² , 0 psi)	Approx. 0.5 V
After engine start-up	Approx. 35.0 to 210 MPa (357 to 2140 kgf/cm ² , 5080 to 30400 psi)	Approx. 0.9 to 2.9 V

OK	Check the wiring harness (between ECU terminals E49 / E68 and sensor terminal (2)). → Repair the faulty area.	
NG	Go to "4. Measure the voltage between rail pressure sensor terminals - 2".	

- (1) Terminal A-VCC1
- (2) Terminal PFUEL
- (3) Terminal A-GND6

(a) Terminal Layout

9Y1200226CRS1361US0



4. Measure the Voltage Between Rail Pressure Sensor Terminals - 2

1. Set the key switch to the OFF position, and unplug the rail pressure sensor connector from the socket.
2. Place the key switch in the ON position, and measure the voltage between terminals (1) and (3) of the rail pressure sensor connector (at the wiring harness side).

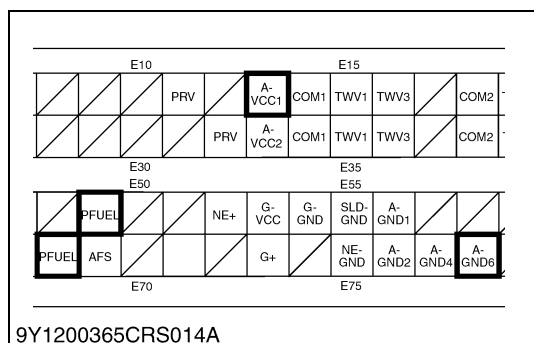
Factory specification	Approx. 5 V
-----------------------	-------------

OK	Check the wiring harness connector and sensor pins.	
	OK	Faulty rail pressure sensor → Replace.
	NG	1. Repair or replace the wiring harness. 2. Replace the rail assembly.
NG	Go to "5. Measure the ECU Terminal Voltage".	

- (1) Terminal A-VCC1
(2) Terminal PFUEL
(3) Terminal A-GND6

(a) Terminal Layout

9Y1200226CRS1362US0



5. Measure the ECU Terminal Voltage

1. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals E13 and E78.

Factory specification	Approx. 5 V
-----------------------	-------------

OK	Check the harness connectors and ECU pins.	
	OK	Faulty ECU → Replace.
	NG	Repair or replace the wiring harness, or replace the ECU.
NG	Check the wiring harness (between ECU terminal E13 and sensor terminal (1) and between ECU terminal E78 and sensor terminal (3)). → Repair the faulty area.	

9Y1200226CRS1363US0

(15) Common Rail Pressure Sensor Signal Keeping a Middle Range (DTC P0194 / 157-2)

Behavior during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine running noise increases
- White smoke increases at low temperature
- Engine stops in some cases

Detection item:

- Common Rail Pressure Sensor Signal keeping a middle range

DTC set preconditions:

- Key switch is ON
- Engine speed is 850 min⁻¹ (rpm) or more
- Direction rail pressure is 32 MPa (330 kgf/cm², 4600 psi) or more and real rail pressure is 20 MPa (200 kgf/cm², 2900 psi) or more
- Direction injection Q is 25 mm³/st or more
- PMP studying is completed
- Diagnostic once every 160 msec

DTC set parameter:

- 1st tentative error
[Average direction pressure - Average real pressure] is 5 MPa (50 kgf/cm², 700 psi) or more and [Max - Min] of sampling real pressure during 160 msec is within 0.01 V (conversion to voltage)
- Tentative error after 2nd
[Max - Min] of sampling real pressure during 160 msec is within 0.01 V (conversion to voltage)
- DTC is set after these tentative error continue 3 times

Engine warning light:

- ON

Limp home action by engine ECU (System action):

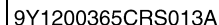
- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Engine forcibly stopped 60 sec later

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1364US0




- (c) ECU Connector 1
(Engine Side)**

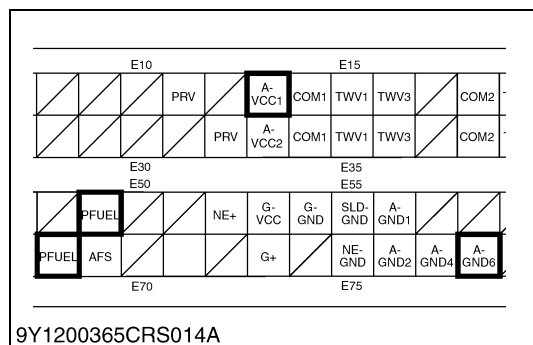
9Y1200226CRS1365US0



1. Place the key switch in the ON position, and check the "Actual rail pressure" and "Rail pressure sensor output voltage" on the diagnosis tool data monitor.
2. Next, start the engine, change the depressed amount of the accelerator pedal, and check the same items again.

OK	Clear the DTC and check whether it is output again or not. 	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the ECU terminal voltage".	

9Y1200226CRS1366US0



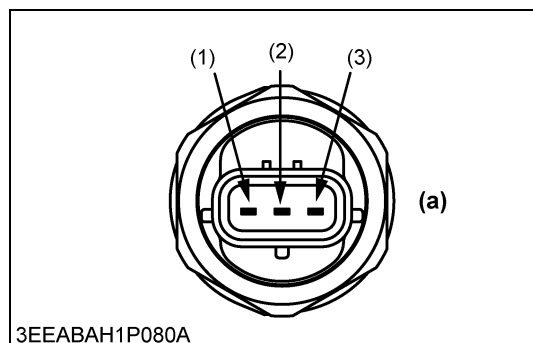
2. Measure the ECU Terminal Voltage

1. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals E68 and E78 and between terminals E49 and E78.
2. Next, start the engine, change the depressed amount of the accelerator pedal, and check the same items again.

Factory specification		
Engine state	Actual rail pressure	Output voltage
Key switch is ON	Approx. 0 MPa (0 kgf/cm ² , 0 psi)	Approx. 0.5 V
After engine start-up	Approx. 35.0 to 210 MPa (357 to 2140 kgf/cm ² , 5080 to 30400 psi)	Approx. 0.9 to 2.9 V

OK	Check the harness connectors and ECU pins.	
	OK	Faulty ECU → Replace.
	NG	Repair or replace the wiring harness, or replace the ECU.
NG	Go to "3. Measure the voltage between rail pressure sensor terminals - 1".	

9Y1200226CRS1367US0



3. Measure the Voltage Between Rail Pressure Sensor Terminals - 1

1. Place the key switch in the ON position, and measure the voltage between terminals (2) and (3) of the rail pressure sensor at the wiring harness side.
2. Next, start the engine, change the depressed amount of the accelerator pedal, and check the same items again.

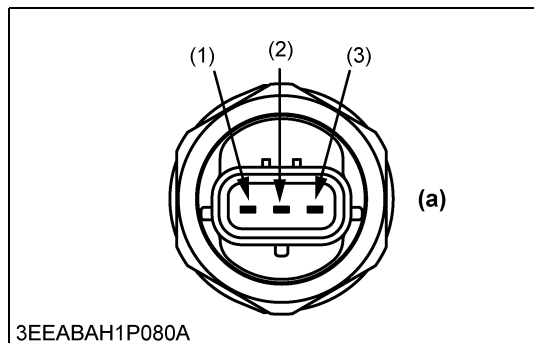
Factory specification		
Engine state	Actual rail pressure	Output voltage
Key switch is ON	Approx. 0 MPa (0 kgf/cm ² , 0 psi)	Approx. 0.5 V
After engine start-up	Approx. 35.0 to 210 MPa (357 to 2140 kgf/cm ² , 5080 to 30400 psi)	Approx. 0.9 to 2.9 V

OK	Check the wiring harness (between ECU terminals E49 / E68 and sensor terminal (2)). → Repair the faulty area.	
NG	Go to "4. Measure the voltage between rail pressure sensor terminals - 2".	

- (1) Terminal A-VCC1
- (2) Terminal PFUEL
- (3) Terminal A-GND6

(a) Terminal Layout

9Y1200226CRS1368US0



4. Measure the Voltage Between Rail Pressure Sensor Terminals - 2

1. Set the key switch to the OFF position, and unplug the rail pressure sensor connector from the socket.
2. Place the key switch in the ON position, and measure the voltage between terminals (1) and (3) of the rail pressure sensor connector (at the wiring harness side).

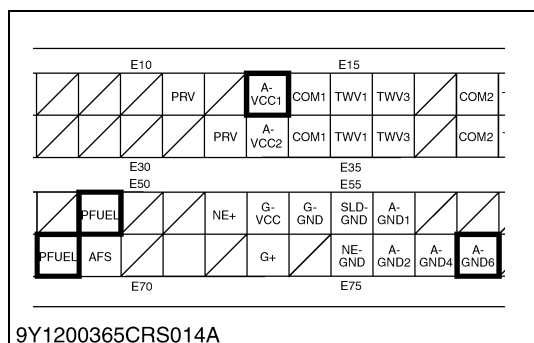
Factory specification	Approx. 5 V
-----------------------	-------------

OK	Check the wiring harness connector and sensor pins.	
	OK	Faulty rail pressure sensor → Replace.
	NG	1. Repair or replace the wiring harness. 2. Replace the rail assembly.
NG	Go to "5. Measure the ECU Terminal Voltage".	

- (1) Terminal A-VCC1
(2) Terminal PFUEL
(3) Terminal A-GND6

(a) Terminal Layout

9Y1200226CRS1369US0



5. Measure the ECU Terminal Voltage

1. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals E13 and E78.

Factory specification	Approx. 5 V
-----------------------	-------------

OK	Check the harness connectors and ECU pins.	
	OK	Faulty ECU → Replace.
	NG	Repair or replace the wiring harness, or replace the ECU.
NG	Check the wiring harness (between ECU terminal E13 and sensor terminal (1) and between ECU terminal E78 and sensor terminal (3)). → Repair the faulty area.	

9Y1200226CRS1370US0

(16) Injector Charge Voltage: High (DTC P0200 / 523535-0)

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops

Detection item:

- Injector charge voltage: High
- ECU circuit failure

DTC set preconditions:

- Battery voltage is normal
- CPU is normal

DTC set parameter:

- Injector charge voltage: High
- Failure of charge circuit of ECU

Engine warning light:

- ON

Limp home action by engine ECU (system action):

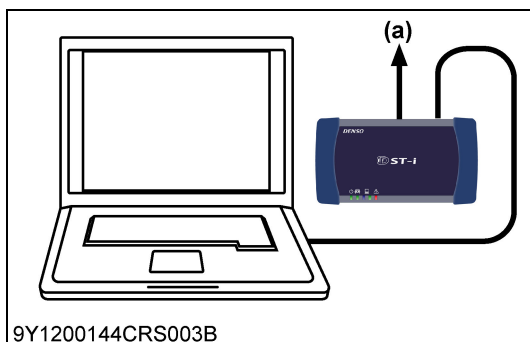
- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Engine forcibly stopped 60 sec. later

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1371US0



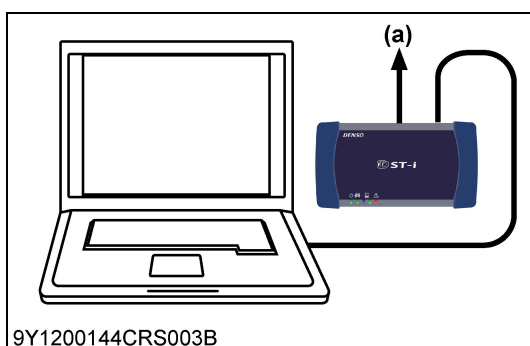
1. Checking Whether the DTC is Detected Again

1. Turn the key switch OFF and then ON again.
2. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
3. Check whether or not the same DTC (P0200) is detected.

Factory specification	DTC is not detected.
OK	It could be a temporary malfunction caused by obstructions to the radio waves, so as long as it recovers to normal operation there is no problem.
NG	Go to "2. Replacing the Injector and Checking Whether the DTC Is Detected Again".

(a) CAN1 Connector

9Y1200226CRS1372US0



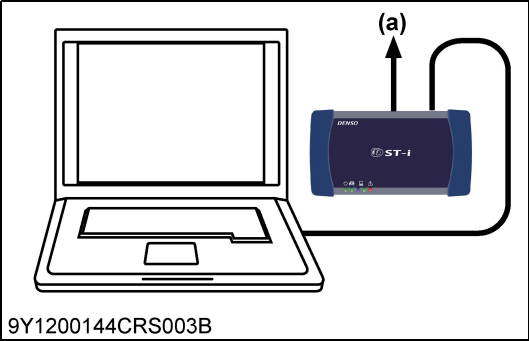
2. Replacing the Injector and Checking Whether the DTC Is Detected Again

1. Replace the injector.
2. Turn the key switch OFF and then ON again.
3. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
4. Check whether or not the same DTC (P0200) is detected.

Factory specification	DTC is not detected.
OK	Injector fault → Replace the injector.
NG	Go to "3. Replacing the ECU and Checking Whether the DTC Is Detected Again".

(a) CAN1 Connector

9Y1200226CRS1373US0



3. Replacing the ECU and Checking Whether the DTC Is Detected Again

1. Replace the ECU.
2. Turn the key switch OFF and then ON again.
3. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
4. Check whether or not the same DTC (P0200) is detected.

Factory specification	DTC is not detected.
OK	ECU fault → Replace the ECU.

(a) CAN1 Connector

9Y1200226CRS1374US0

(17) Open Circuit of Harness or Coil in Cylinder Injector (DTC P0201 / 651-3, P0202 / 653-3, P0203 / 654-3, P0204 / 652-3)

P0201 / 651-3: Open circuit of harness or coil in 1st cylinder injector

P0202 / 653-3: Open circuit of harness or coil in 3rd cylinder injector

P0203 / 654-3: Open circuit of harness or coil in 4th cylinder injector

P0204 / 652-3: Open circuit of harness or coil in 2nd cylinder injector

Behaviour during malfunction:

- Insufficient output
- Engine vibration increases
- Worsening exhaust gas emissions

Detection item:

- Open circuit of harness
- Open circuit of injector coil

DTC set preconditions:

- Engine is operating
- Battery voltage is normal
- During injection
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- Open circuit of harness or open circuit of injector coil

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop

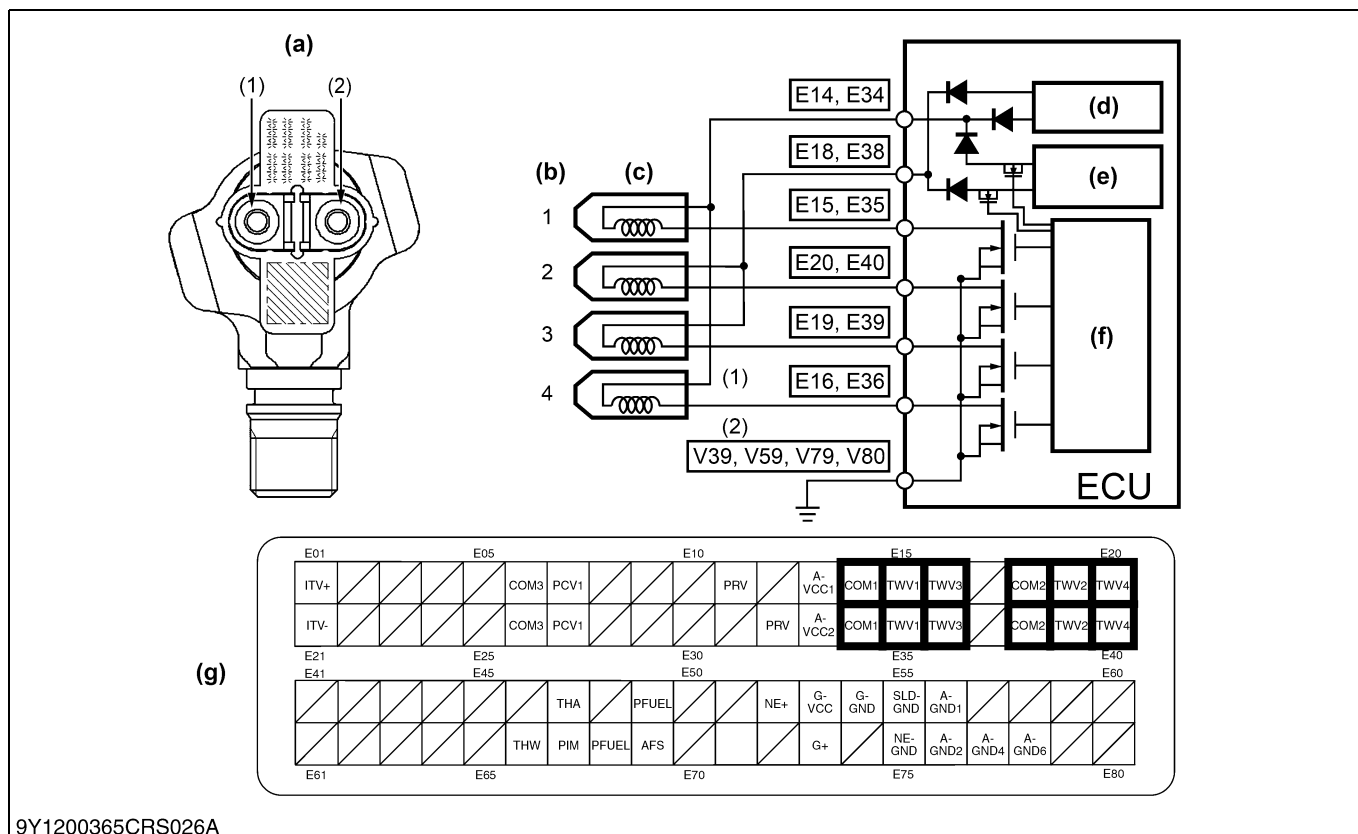
Recovery from error:

- Key switch turn OFF

Remark:

- Injectors which have no error are operated
- To minimize PM emission

9Y1200226CRS1375US0



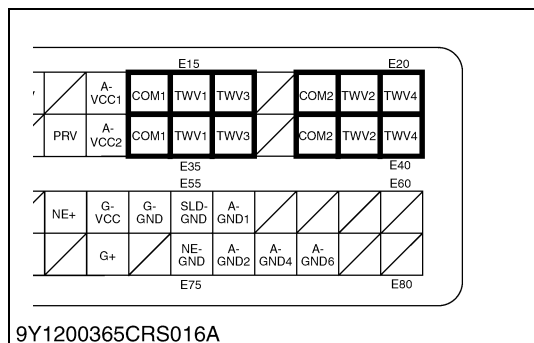
9Y1200365CRS026A

- (1) Terminal COMMON
(2) Terminal TWV

- (a) Terminal Layout
(b) Engine Cylinder No.
(c) Injectors

- (d) Constant Amperage Circuit
(e) High Voltage Generation
(f) Control Circuit
(g) ECU Connector 1 (Engine Side)

9Y1200226CRS1376US0



9Y1200365CRS016A

1. Measure the Resistance Between ECU Terminals

- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance each terminal of the connector.

Engine cylinder / TWV number	Measurement terminal
No. 1 cylinder / TWV1	E14, E34 ↔ E15, E35
No. 3 cylinder / TWV2	E18, E38 ↔ E19, E39
No. 4 cylinder / TWV3	E14, E34 ↔ E16, E36
No. 2 cylinder / TWV4	E18, E38 ↔ E20, E40

Factory specification	1.5 Ω or lower
-----------------------	----------------

OK	Go to "2. Check the DTC".
NG	Go to "4. Measure the Resistance Between Injector Terminals".

9Y1200226CRS1377US0

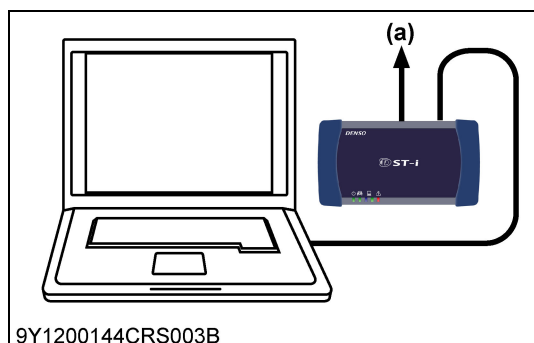
2. Check the DTC

- Plug the ECU connector into socket, and start the engine.
- Clear the DTCs that occurred previously, and check the currently existing trouble.

Factory specification	No DTC is output.
-----------------------	-------------------

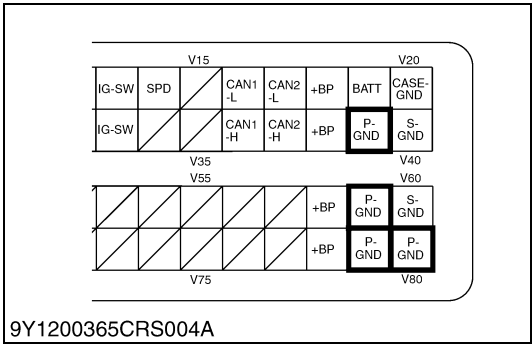
OK	Go to "3. Check the Connector and Wiring Harnesses for Poor Contact".
NG	Faulty ECU → Replace.

(a) CAN1 Connector



9Y1200144CRS003B

9Y1200226CRS1378US0



3. Check the Connector and Wiring Harnesses for Poor Contact

1. Set the key switch to the OFF position, and check the wiring harness connectors and ECU pins for incorrect connection, deformation, poor contact or other defects.

Factory specification	Must be free from faulty connection, deformation, poor contact or other defects.
-----------------------	--

- NOTE
- Intermediate connector and wiring harness in head cover should be checked, they are possible cause.

OK	Check the wiring harness and connector of P- GND terminal (ECU terminals V39, V59, V79 and V80). → Repair.
NG	Check the injector wiring harnesses and connectors. → Repair.

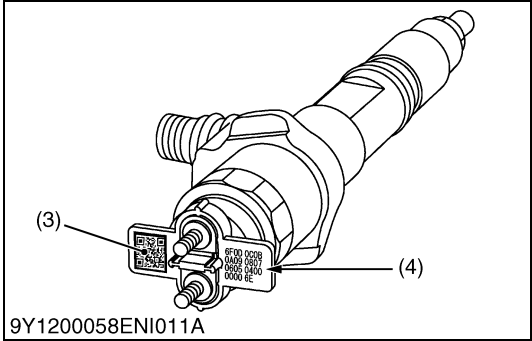
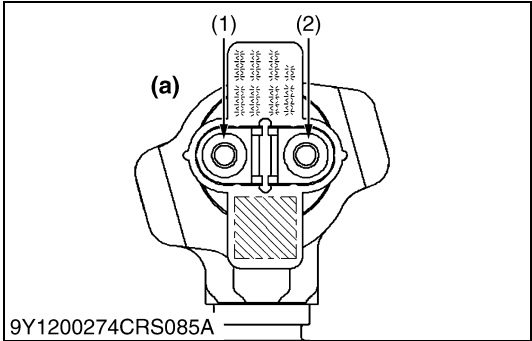
9Y1200226CRS1379US0

4. Measure the Resistance Between Injector Terminals

1. Unplug the injector cable connector of the cylinder indicated by the DTC, and measure the resistance between injector terminals (1) and (2).

Factory specification	0.4 to 0.7 Ω
-----------------------	--------------

OK	Check the wiring harnesses and connectors for a poor contact. → Repair.
NG	Faulty injector → Replace (Using the diagnosis tool, write the ID (QR) code of replaced injector in the ECU.)

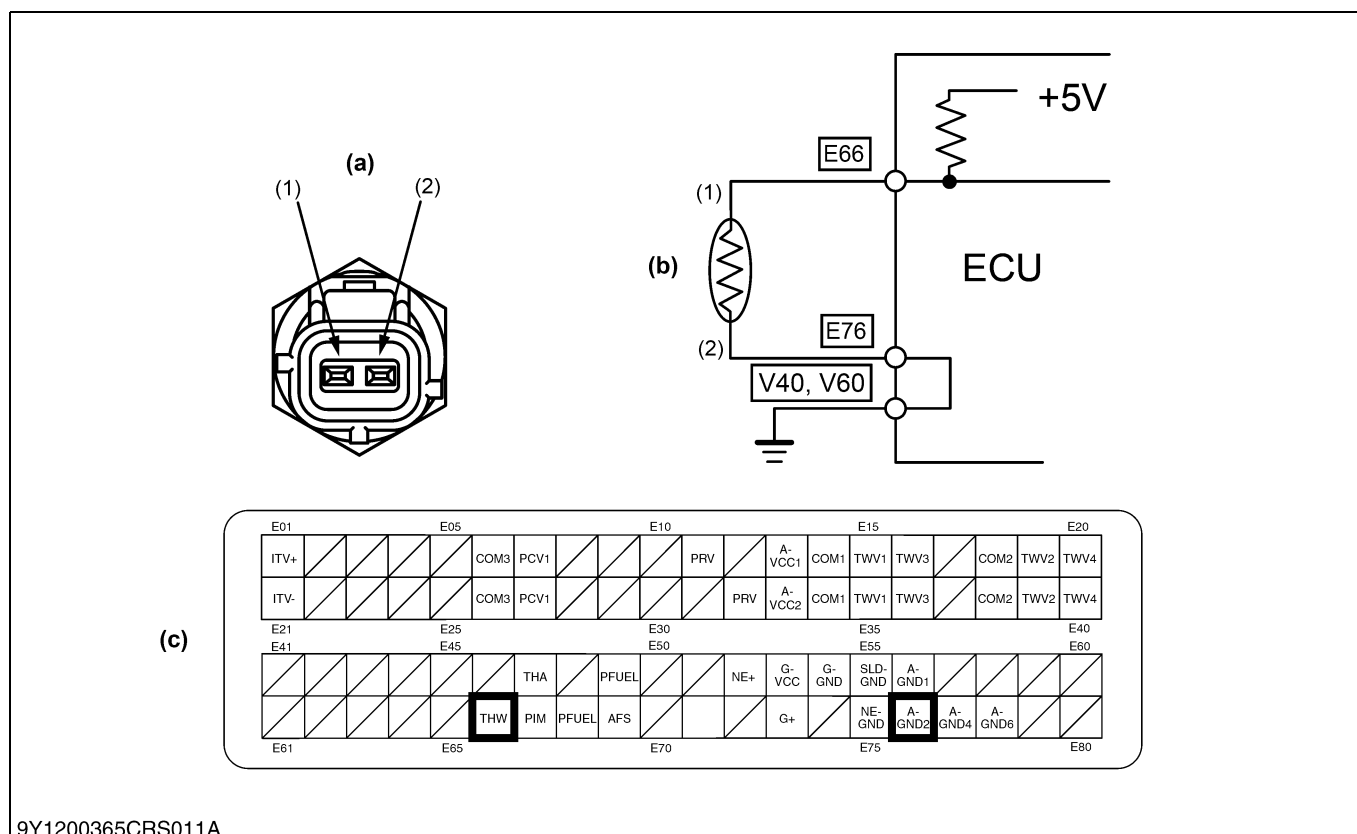


- (1) Terminal COMMON (a) Injector
- (2) Terminal TWV
- (3) QR Code
- (4) ID Code

9Y1200226CRS1380US0

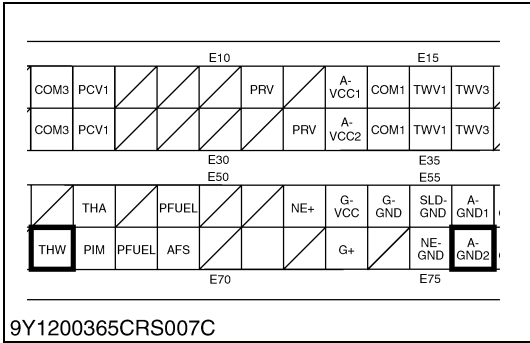
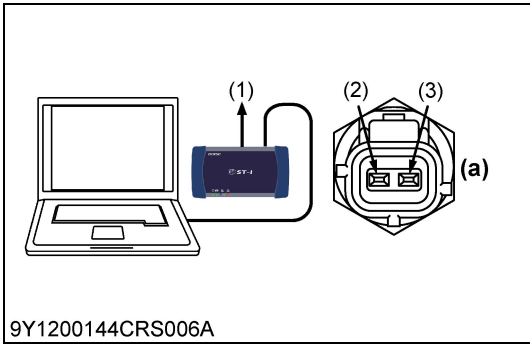
Remark:

9Y1200226CRS1381US0



(c) **ECU Connector 1
(Engine Side)**

9Y1200226CRS1382US0



1. Check the Coolant Temperature Sensor Characteristics for An Error

1. Refer to DTC P0117, P0118, and check the ECU, wiring harness and sensor for an error.

OK	Check the cooling system. → Repair the faulty area. If the cooling system is operating normally, ask the user about malfunction occurrence based on the freeze-frame data to determine whether or not the system was used improperly.
NG	Check and repair or replace the faulty parts.

- (1) CAN1 Connector
(2) Terminal THW
(3) Terminal A-GND2

(a) Terminal Layout

9Y1200226CRS1383US0

(19) Engine Overrun (DTC P0219 / 190-0)

Behaviour during malfunction:

- Overrun

Detection item:

- Engine speed exceeds threshold speed

DTC set preconditions:

- Key switch is ON

DTC set parameter:

- Engine speed $\geq 3500 \text{ min}^{-1}$ (rpm)

Engine warning light:

- ON

Limp home action by engine ECU (system action):

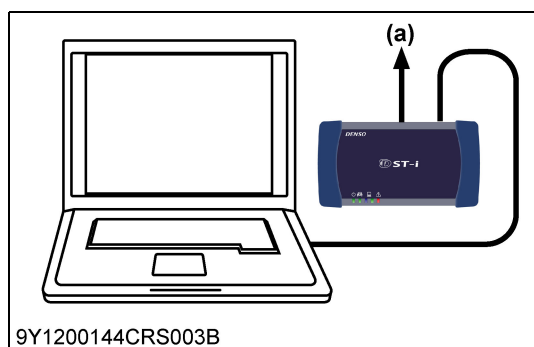
- Stop injection ($Q = 0 \text{ mm}^3/\text{st}$)

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1384US0



1. Checking Whether the DTC Is Detected Again

1. Turn the key switch OFF and then ON again.
2. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
3. Check whether or not the same DTC (P0219) is detected.

Factory specification	DTC is not detected.
OK	Go to "2. Checking with the User".
NG	It could be a temporary malfunction caused by obstructions to the radio waves, so as long as it recovers to normal operation there is no problem.

(a) CAN1 Connector

9Y1200226CRS1385US0

2. Checking with the User

1. The following actions may have caused the overrun.
 - Towing heavy objects
 - Drag phenomenon when driving downhill
 - Mistaken operation when making a sudden shift change
 Question the user in detail about the items above and give guidance.

9Y1200226CRS1386US0

(20) Boost Pressure Sensor Abnormality (DTC P0237 / 102-4, P0238 / 102-3)**P0237 / 102-4: Boost pressure sensor: Low****Behaviour during malfunction:**

- Insufficient output

Detection item:

- Ground short circuit of sensor or harness
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Voltage of boost pressure sensor is 0.2 V or below

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- 65 kPa (0.66 kgf/cm², 9.4 psi) [default value]

Recovery from error:

- Key switch turn OFF

Remark:

- Default value is set in consideration with high altitude usage

9Y1200226CRS1387US0

P0238 / 102-3: Boost pressure sensor: High**Behaviour during malfunction:**

- Insufficient output

Detection item:

- Open circuit or +B short circuit of sensor or harness
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Voltage of boost pressure sensor is 4.9 V or above

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- 65 kPa (0.66 kgf/cm², 9.4 psi) [default value]

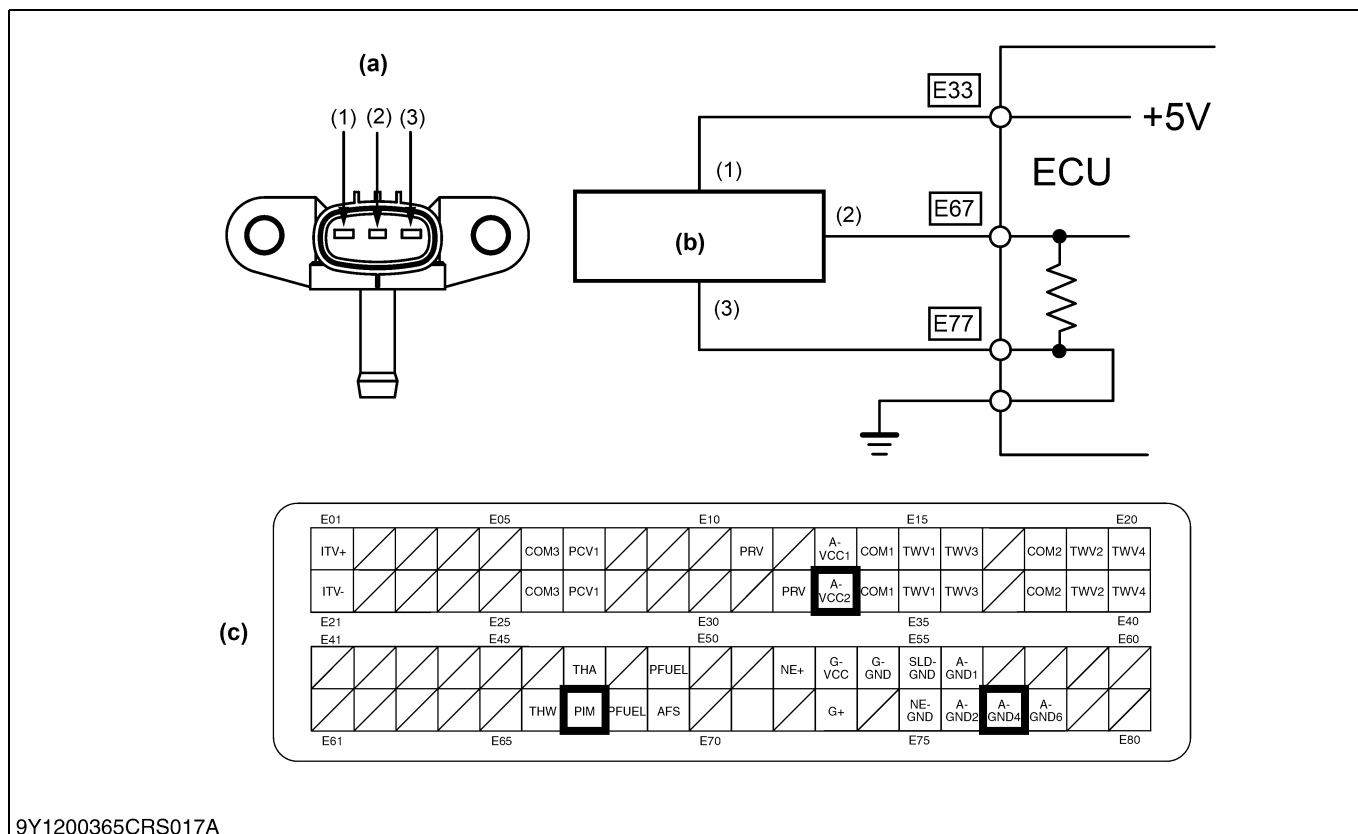
Recovery from error:

- Key switch turn OFF

Remark:

- Default value is set in consideration with high altitude usage

9Y1200226CRS1388US0



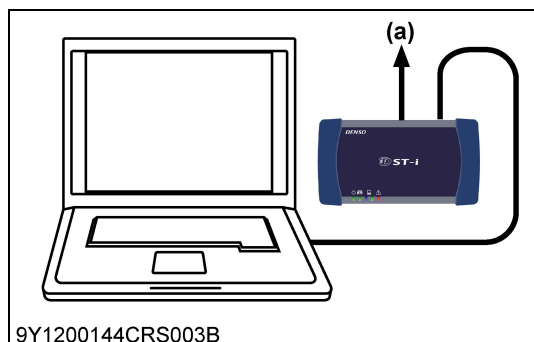
- (1) Terminal A-VCC2
- (2) Terminal PIM

(3) Terminal A-GND4

(a) Terminal Layout
(b) Boost Pressure Sensor

**(c) ECU Connector 1
(Engine Side)**

9Y1200226CRS1389US0




1. Check the Boost Pressure Signals

1. Place the key switch in the OFF position, attach the diagnosis tool to the CAN1 connector, and return the key switch to the ON position again. Then, check the "Boost pressure" and "Boost pressure sensor output voltage" on the diagnosis tool data monitor.
2. Next, start the engine, change the depressed amount of the accelerator pedal, and check the same items again.

Factory specification		
Engine state	Actual boost pressure	Output voltage
Key switch is ON	Approx. 100 kPa (1.02 kgf/cm ² , 14.5 psi)	Approx. 1.0 V
After engine start-up	100 to 180 kPa (1.02 to 1.83 kgf/cm ² , 14.5 to 26.1 psi)	1.0 to 2.2 V

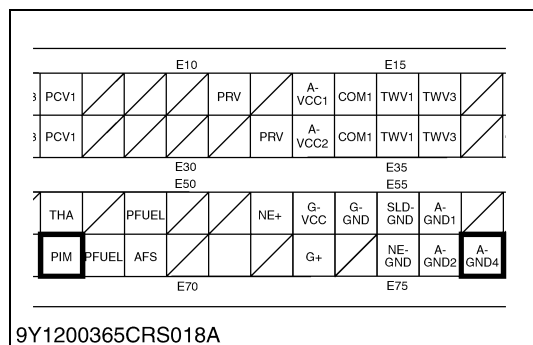
■ NOTE

- **Reference value (Factory specification) has complete linearity.**

OK	Clear the DTC and check whether it is output again or not. 	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the ECU Terminal Voltage".	

(a) CAN1 Connector

9Y1200226CRS1390US0



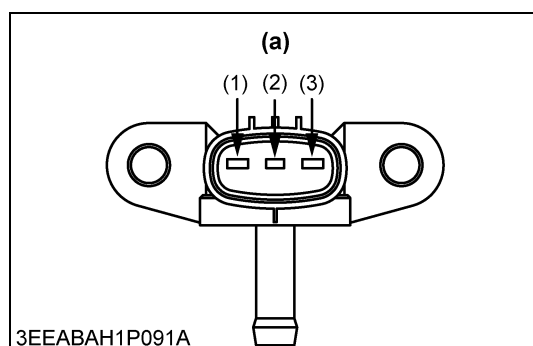
2. Measure the ECU Terminal Voltage

1. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals E67 and E77.
2. Next, start the engine, change the depressed amount of the accelerator pedal, and check the same items again.

Factory specification	
Engine state	Output voltage
Key switch ON	Approx. 1.0 V
After engine start-up	1.0 to 2.2 V

OK	Check the harness connectors and ECU pins.
	OK Faulty ECU → Replace.
	NG Repair or replace the wiring harness, or replace the ECU.
NG	Go to "3. Measure the Voltage Between Boost Pressure Sensor Terminals".

9Y1200226CRS1391US0



3. Measure the Voltage Between Boost Pressure Sensor Terminals

1. Place the key switch in the ON position, and measure the voltage between terminals (2) and (3) of the boost pressure sensor at the wiring harness side.
2. Next, start the engine, change the depressed amount of the accelerator pedal, and check the same items again.

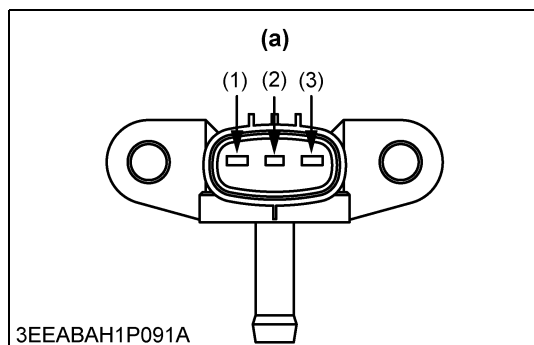
Factory specification	
Engine state	Output voltage
Key switch ON	Approx. 1.0 V
After engine start-up	1.0 to 2.2 V

OK	Check the wiring harness (between ECU terminal E67 and sensor terminal (2)). → Repair the faulty area.
NG	Go to "4. Measure the Voltage Between Boost Pressure Sensor Terminals".

- (1) Terminal A-VCC2
- (2) Terminal PIM
- (3) Terminal A-GND4

(a) Terminal Layout

9Y1200226CRS1392US0



4. Measure the Voltage Between Boost Pressure Sensor Terminals

1. Set the key switch to the OFF position, and unplug the boost pressure sensor connector from the socket.
2. Place the key switch in the ON position, and measure the voltage between terminals (1) and (3) of the boost pressure sensor connector (at the wiring harness side).

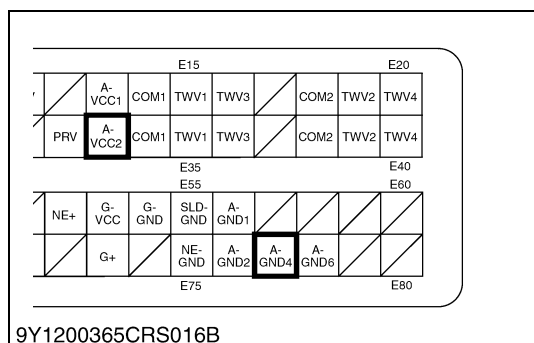
Factory specification	Approx. 5 V
-----------------------	-------------

OK	Check the wiring harness connector and sensor pins.	
	OK	Faulty boost pressure sensor → Replace.
	NG	1. Repair or replace the wiring harness. 2. Replace the boost pressure sensor.
NG	Go to "5. Measure the ECU Terminal Voltage".	

- (1) Terminal A-VCC2
(2) Terminal PIM
(3) Terminal A-GND4

(a) Terminal Layout

9Y1200226CRS1393US0



5. Measure the ECU Terminal Voltage

1. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals E33 and E77.

Factory specification	Approx. 5 V
-----------------------	-------------

OK	Check the harness connectors and ECU pins.	
	OK	Faulty ECU → Replace.
	NG	Repair or replace the wiring harness, or replace the ECU.
NG	Check the wiring harness (between ECU terminal E33 and sensor terminal (1) and between ECU terminal E77 and sensor terminal (3)). → Repair the faulty area.	

NOTE

- Check the hose between intake manifold and sensor, When it is damaged, the boost pressure can not reach the sensor.

9Y1200226CRS1394US0

(21) Crankshaft Position Sensor (NE Sensor) Abnormality (DTC P0335 / 636-8, P0336 / 636-2)

P0335 / 636-8: No input of NE sensor (Crank position sensor) pulse

Behaviour during malfunction (Running only with G signal):

- Faulty starting
- Engine Vibration increases slightly
- Insufficient output

Detection item:

- Open circuit or short circuit of sensor or harness
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- Engine is not stalled

DTC set parameter:

- No recognition of Ne sensor pulse

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition

■ **NOTE**

- Engine will stop if both NE and G fail

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1395US0

P0336 / 636-2: NE sensor (Crank position sensor) pulse number error

Behaviour during malfunction (Running only with G signal):

- Faulty starting
- Engine Vibration increases slightly
- Insufficient output

Detection item:

- Open circuit or short circuit of sensor or harness
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- Engine speed is 350 min⁻¹ (rpm) or higher

DTC set parameter:

- Pulse count per rotation is not 56 teeth

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition

■ **NOTE**

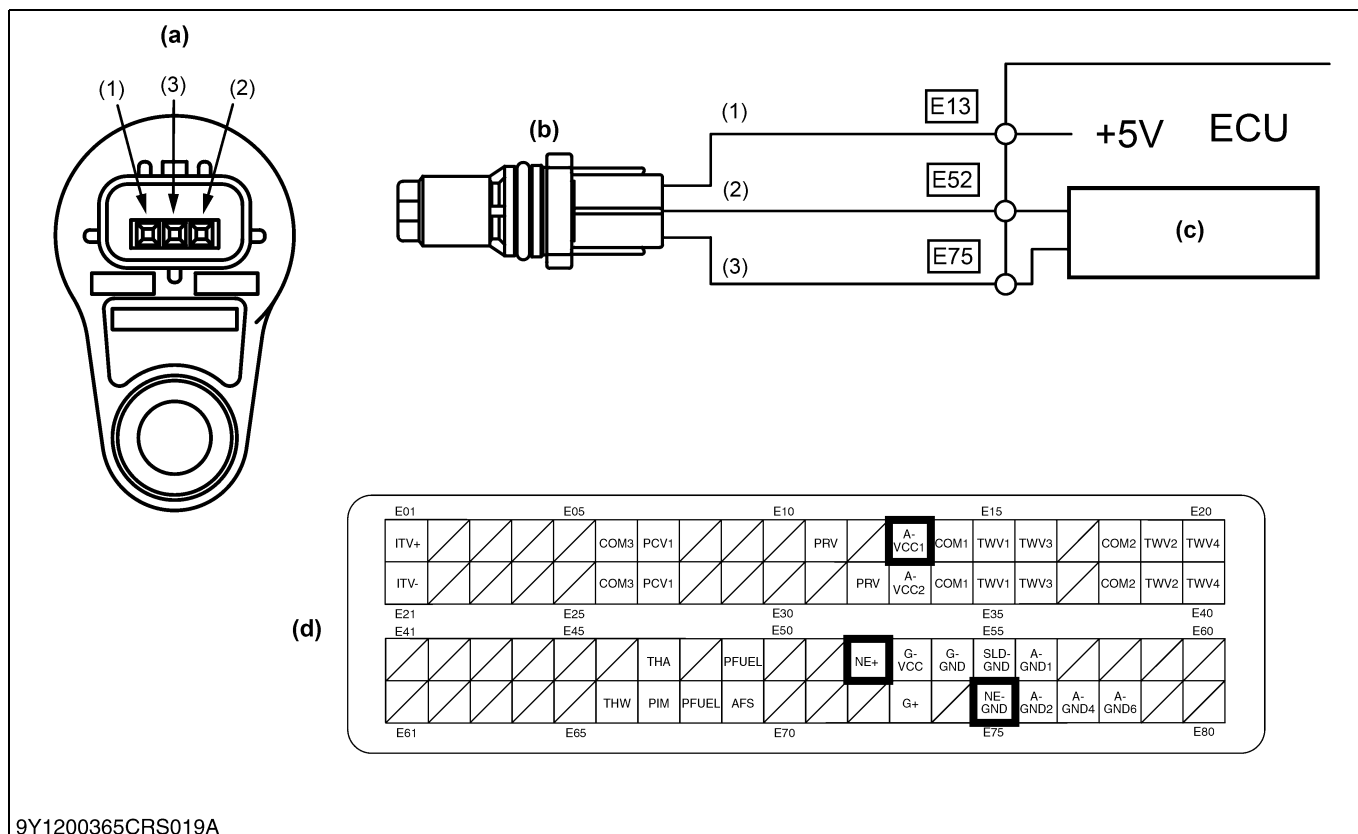
- Engine will stop if both NE and G fail

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1396US0



(1) Terminal A-VCC1
(2) Terminal NE+

(3) Terminal NE-GND

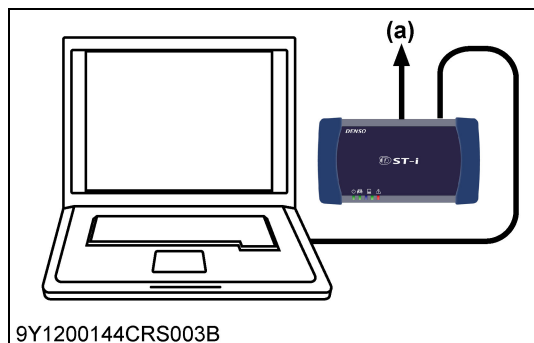
(a) Terminal Layout

(b) Crankshaft Position Sensor
(NE Sensor)

(c) NE Sensor Input Circuit

(d) ECU Connector 1
(Engine Side)

9Y1200226CRS1397US0



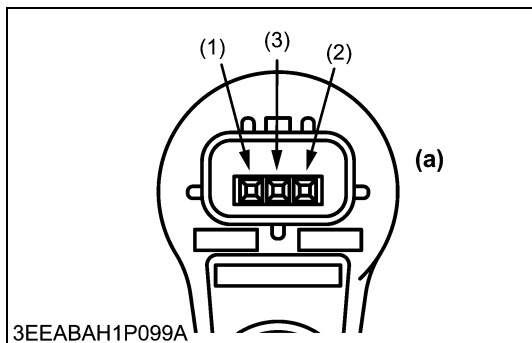
1. Check the Crankshaft Position Sensor Signals

1. Rotate the engine, and check the "Engine speed active flag" value on the diagnosis tool data monitor.

Factory specification	Always ON
OK	It should be confirmed two or more times while changing the accelerator.
	OK Normal.
	NG Go to "2. Check the Voltage Between Crankshaft Position Sensor Terminals".
NG	Go to "2. Check the Voltage Between Crankshaft Position Sensor Terminals".

(a) CAN1 Connector

9Y1200226CRS1398US0



2. Check the Voltage Between Crankshaft Position Sensor Terminals

1. Place the key switch in the OFF position, and unplug the crankshaft position sensor connector from the socket.
2. Place the key switch in the ON position, and measure the voltage between A-VCC1 terminal and NE-GND terminal at the wiring harness side.

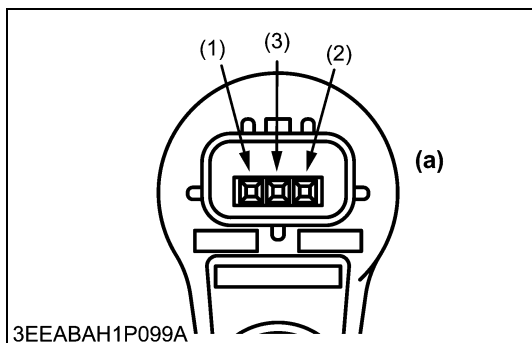
Factory specification	Approx. 5 V
-----------------------	-------------

OK	Go to "3. Check the Connectors".
NG	Go to "5. Measure the ECU Terminal Voltage".

- (1) Terminal A-VCC1
- (2) Terminal NE+
- (3) Terminal NE-GND

(a) Terminal Layout

9Y1200226CRS1399US0



3. Check the Connectors

1. Check the sensor and wiring harness connectors for incorrect connection, inappropriate fitting, poor contact or other faulty areas.

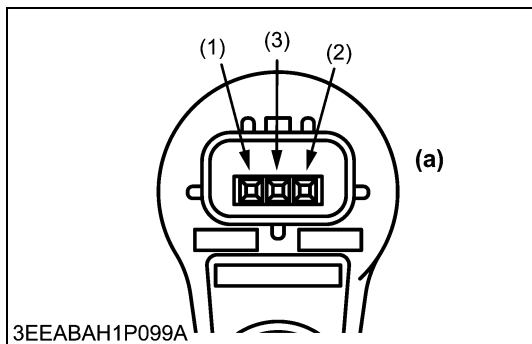
Factory specification	Must be free from incorrect connection, inappropriate fitting, poor contact.
-----------------------	--

OK	Go to "4. Check the Wiring Harness".
NG	Repair or replace.

- (1) Terminal A-VCC1
- (2) Terminal NE+
- (3) Terminal NE-GND

(a) Terminal Layout

9Y1200226CRS1400US0



4. Check the Wiring Harness

1. Check the wiring harness between NE+ terminal of sensor and ECU for a short or an open circuit.

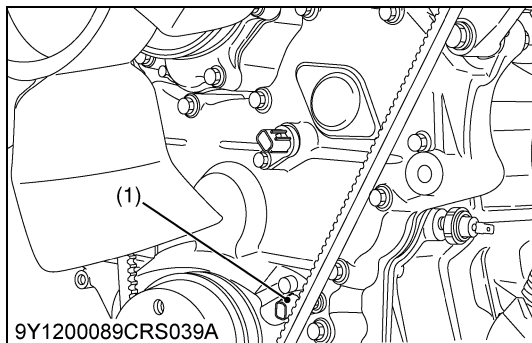
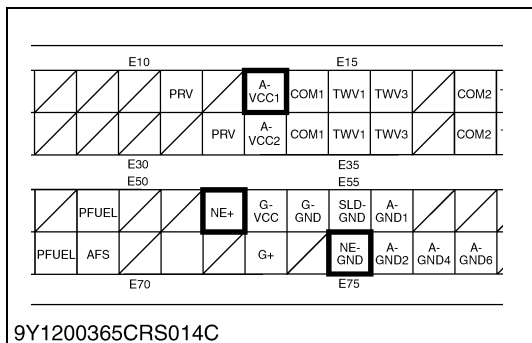
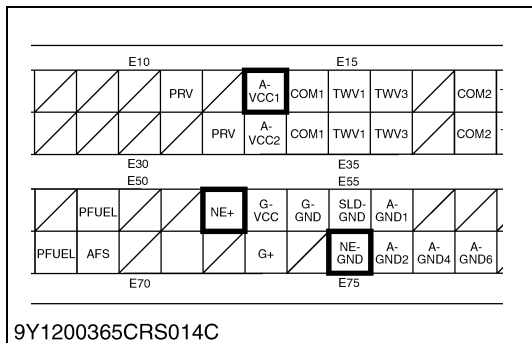
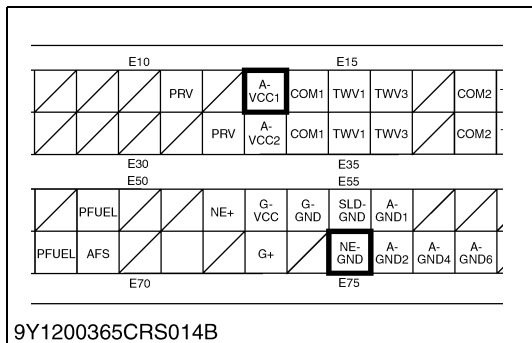
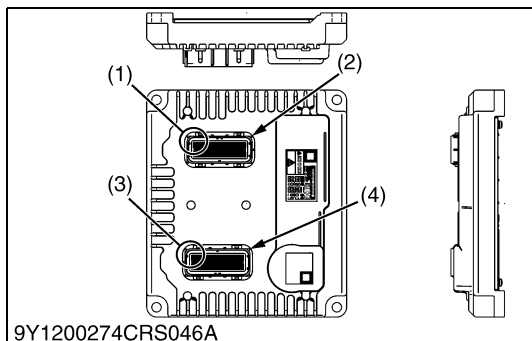
Factory specification	Must be free from shorts and open circuit.
-----------------------	--

OK	The sensor has abnormality. → Replace.
NG	Repair.

- (1) Terminal A-VCC1
- (2) Terminal NE+
- (3) Terminal NE-GND

(a) Terminal Layout

9Y1200226CRS1401US0



5. Measure the ECU Terminal Voltage

1. Place the key switch in the OFF position, and unplug the ECU wiring harness connector 1 (1) from the socket.
2. Place the key switch in the ON position, and measure the voltage between ECU terminals E13 and E75.

Factory specification	Approx. 5 V
-----------------------	-------------

OK	Go to "6. Check the connectors".
NG	Replace the ECU.

- (1) E01 Pin Position (3) V01 Pin Position
(2) ECU Connector 1 (Engine Side) (4) ECU Connector 2 (Machine Side)

9Y1200226CRS1402US0

6. Check the Connectors

1. Check ECU terminals E13, E52 and E75 (at the ECU side) and the connectors (at the wiring harness side) for incorrect connection, inappropriate fitting, poor contact.

Factory specification	Must be free from incorrect connection, inappropriate fitting, poor contact.
-----------------------	--

OK	Go to "7. Check the wiring harness".
NG	Repair or replace.

9Y1200226CRS1403US0

7. Check the Wiring Harness

1. Check the wiring harness being connected to ECU terminals E13, E52 and E75 for a short or an open circuit.

Factory specification	Must be free from shorts and open circuit.
-----------------------	--

OK	Go to "8. Check the Sensor".
NG	Repair.

9Y1200226CRS1404US0

8. Check the Sensor

1. Disconnect the sensor and check the following items.
 - Is there a large amount of magnetic foreign material adhering to the sensor surface?
 - Are there interference marks of the pulsar and the sensor?
 - Are there any pulsar gear abnormalities?

OK	Replace the ECU and test.
NG	Replace the sensor.

- (1) Crankshaft Position Sensor
(NE Sensor)

9Y1200226CRS1405US0

(22) Camshaft Position Sensor (G Sensor) Abnormality (DTC P0340 / 723-8, P0341 / 723-2)

P0340 / 723-8: No input of G sensor (Camshaft position sensor) pulse

Behaviour during malfunction (Invalid G signal):

- Engine hesitates at start-up

Detection item:

- Open circuit or short circuit of sensor or harness
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- Engine is not stalled

DTC set parameter:

- No recognition of G sensor pulse

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- None

■ **NOTE**

- Engine will stop if both NE and G fail

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1406US0

P0341 / 723-2: G sensor (Camshaft position sensor) pulse number error

Behaviour during malfunction (Invalid G signal):

- Engine hesitates at start-up

Detection item:

- Open circuit or short circuit of sensor or harness
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- Engine speed is 350 min⁻¹ (rpm) or higher

DTC set parameter:

- Pulse count per rotation is not 5 teeth

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- None

■ **NOTE**

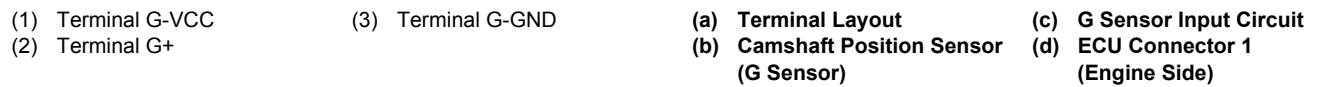
- Engine will stop if both NE and G fail

Recovery from error:


- Diagnostic counter = zero

Remark:

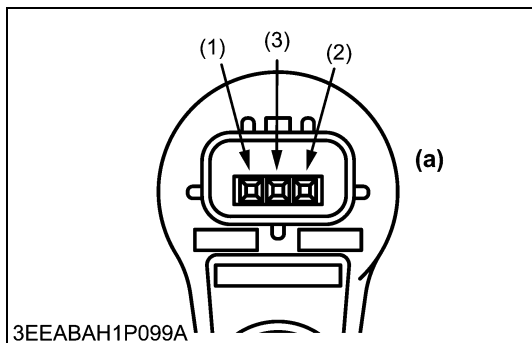
9Y1200226CRS1407US0



1. Rotate the engine, and check the "Cam speed active flag" value on the diagnosis tool data monitor.

Factory specification	Always ON	
OK	It should be confirmed two or more times while changing the accelerator. 	
	OK	Normal.
	NG	Go to "2. Check the Voltage Between Camshaft Position Sensor Terminals".
NG	Go to "2. Check the Voltage Between Camshaft Position Sensor Terminals".	

9Y1200226CRS1409US0



2. Check the Voltage Between Camshaft Position Sensor Terminals

1. Place the key switch in the OFF position, and unplug the camshaft position sensor connector from the socket.
2. Place the key switch in the ON position, and measure the voltage between G-VCC and G-GND terminals at the wiring harness side.

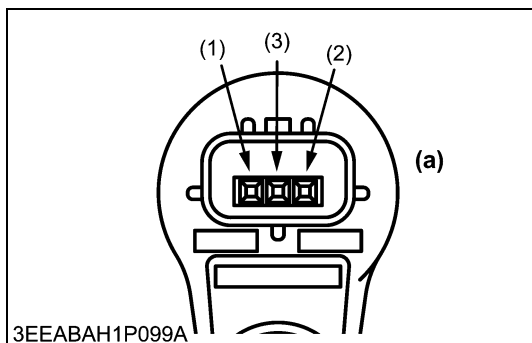
Factory specification	Approx. 5 V
-----------------------	-------------

OK	Go to "3. Check the Connectors".
NG	Go to "5. Measure the ECU Terminal Voltage".

- (1) Terminal G-VCC
(2) Terminal G+
(3) Terminal G-GND

(a) Terminal Layout

9Y1200226CRS1410US0



3. Check the Connectors

1. Check the sensor and wiring harness connectors for incorrect connection, inappropriate fitting, poor contact or other faulty areas.

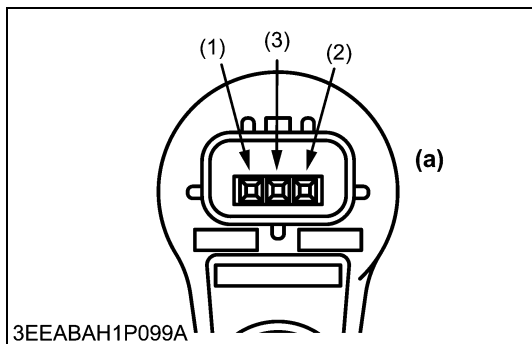
Factory specification	Must be free from incorrect connection, inappropriate fitting, poor contact.
-----------------------	--

OK	Go to "4. Check the Wiring Harness".
NG	Repair or replace.

- (1) Terminal G-VCC
(2) Terminal G+
(3) Terminal G-GND

(a) Terminal Layout

9Y1200226CRS1411US0



4. Check the Wiring Harness

1. Check the wiring harness between G+ terminal of sensor and ECU for a short or an open circuit.

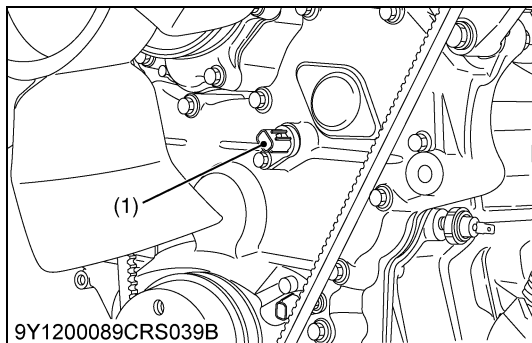
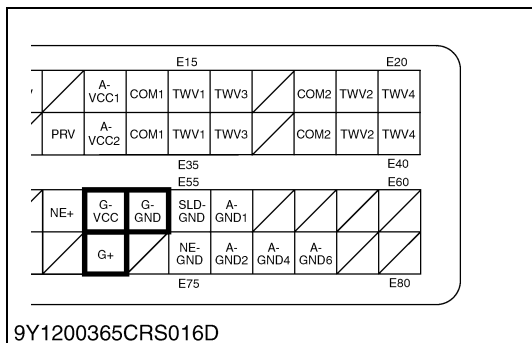
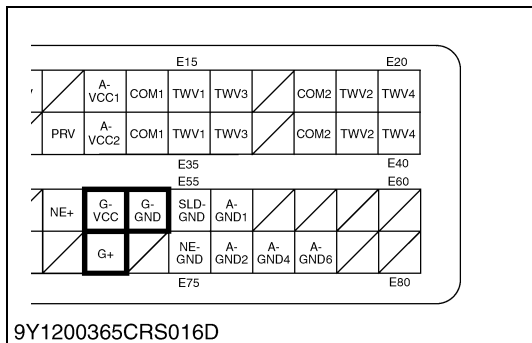
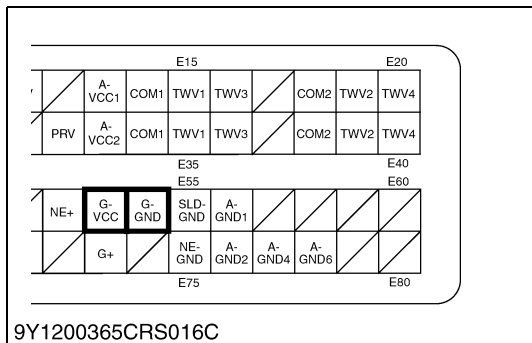
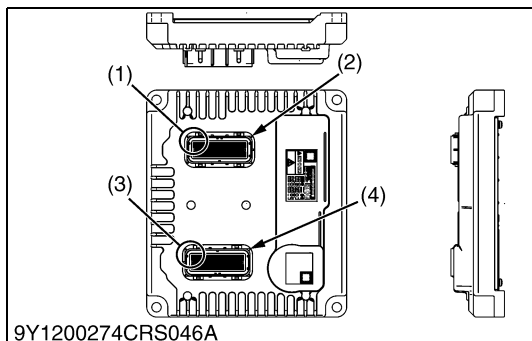
Factory specification	Must be free from shorts and open circuit.
-----------------------	--

OK	The sensor has abnormality. → Replace.
NG	Repair.

- (1) Terminal G-VCC
(2) Terminal G+
(3) Terminal G-GND

(a) Terminal Layout

9Y1200226CRS1412US0



5. Measure the ECU Terminal Voltage

- Place the key switch in the OFF position, and unplug the ECU wiring harness connector 1 (1) from the socket.
- Place the key switch in the ON position, and measure the voltage between ECU terminals E53 and E54.

Factory specification	Approx. 5 V
-----------------------	-------------

OK	Go to "6. Check the Connectors".
NG	Replace the ECU.

- (1) E01 Pin Position (3) V01 Pin Position
(2) ECU Connector 1 (Engine Side) (4) ECU Connector 2 (Machine Side)

9Y1200226CRS1413US0

6. Check the Connectors

- Check ECU terminals E53, E73 and, E54 (at the ECU side) and the connectors (at the wiring harness side) for incorrect connection, inappropriate fitting, poor contact.

Factory specification	Must be free from incorrect connection, inappropriate fitting, poor contact.
-----------------------	--

OK	Go to "7. Check the Wiring Harness".
NG	Repair or replace.

9Y1200226CRS1414US0

7. Check the Wiring Harness

- Check the wiring harness being connected to ECU terminals E53, E73 and E54 for a short or an open circuit.

Factory specification	Must be free from shorts and open circuit.
-----------------------	--

OK	Go to "8. Check the Sensor".
NG	Repair.

9Y1200226CRS1415US0

8. Check the Sensor

- Disconnect the sensor and check the following items.
 - Is there a large amount of magnetic foreign material adhering to the sensor surface?
 - Are there interference marks of the pulsar and the sensor?
 - Are there any pulsar gear abnormalities?

OK	Replace the ECU and test.
NG	Replace the sensor.

- (1) Camshaft Position Sensor
(G Sensor)

9Y1200226CRS1416US0

(23) Air Heater Relay Driving Circuit Abnormality (DTC P0380 / 523544-3 / 523544-4)

P0380 / 523544-3: +B short of air heater relay driving circuit

Behaviour during malfunction (At low temperature):

- Faulty starting
- White smoke increases

Detection item:

- +B short of air heater relay driving circuit

DTC set preconditions:

- Battery voltage is normal
- During air heater relay drive command is activated

DTC set parameter:

- +B short circuit of harness

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- None

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1417US0

P0380 / 523544-4: Ground short of air heater relay driving circuit

Behaviour during malfunction (At low temperature):

- Faulty starting
- White smoke increases

Detection item:

- Ground short or open circuit of air heater relay driving circuit

DTC set preconditions:

- Battery voltage is normal
- Other than during air heater relay drive command is activated

DTC set parameter:

- Ground short or open circuit of harness

Engine warning light:

- ON

Limp home action by engine ECU (system action):

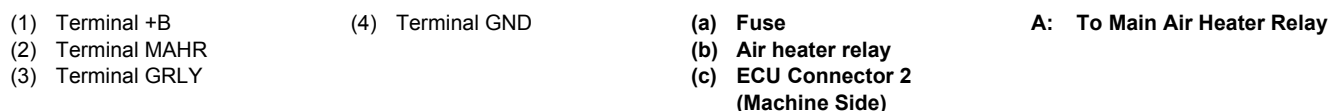
- None

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1418US0



3EEBAH1P141A

1. Run the engine until the coolant temperature is 10 °C (50 °F) or higher.
2. Check the "Glow relay" data with the data monitor.

Factory specification	OFF
-----------------------	-----

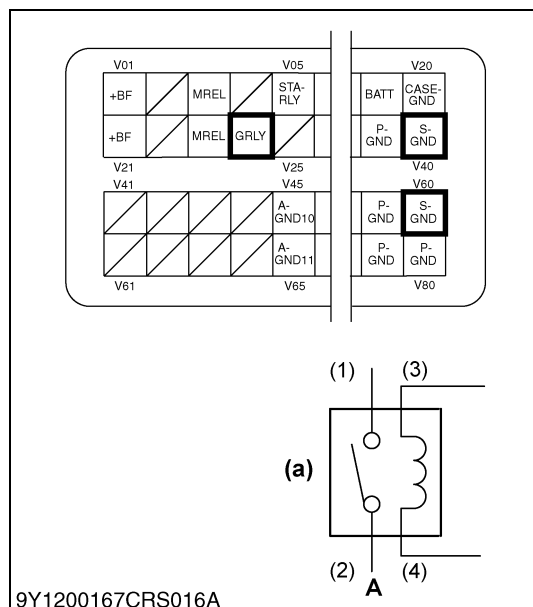
3. After disconnecting the connector (2) of coolant temperature sensor and connect the dummy resistor (1) as shown in the left figure, and turn the key switch ON.
Dummy Resistor: 15 to 25 kΩ [Comparable to Approx. -30 to -20 °C (Approx. -22 to -5 °F)]
4. Check the "Glow relay" data with the data monitor.

Factory specification	ON
-----------------------	----

OK	Normal.
NG	Go to "2. Check the Wiring Harness / Connector".

- (1) Dummy Resistor (a) Coolant Temperature Sensor
(2) Connector

KiSC issued 07, 2017 A



2. Check the Wiring Harness / Connector

1. Remove the connector from the ECU side and check the state of the continuity between terminal V24 and (3).
2. Next, check the state of the continuity between terminal V40 / V60 and (4).

Factory specification	Both have continuity
-----------------------	----------------------

3. Check the connector for poor connection, engagement and contact.

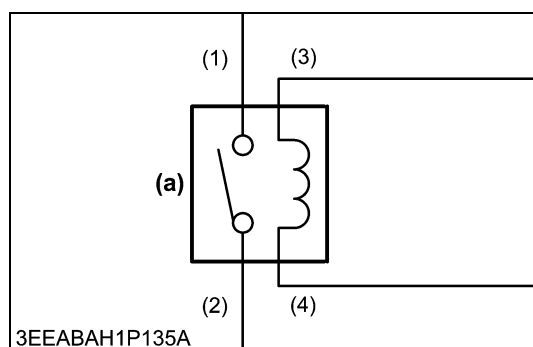
Factory specification	No poor connection, engagement or contact.
-----------------------	--

OK	Go to "3. Check the Relay".
NG	Repair or replace the faulty areas.

- (1) Terminal +B
 (2) Terminal MAHR
 (3) Terminal GRLY
 (4) Terminal GND

(a) **Air Heater Relay**
A: To Main Air Heater Relay

9Y1200226CRS1421US0



3. Check the Relay

1. After disconnecting the connector of coolant temperature sensor and connect the dummy resistor (5) as shown in the left figure, and turn the key switch ON.
 Dummy Resistor: 15 to 25 kΩ [Comparable to Approx. -30 to -20 °C (Approx. -22 to -5 °F)]
2. Measure the voltage between (3) and (4).

Factory specification	When relay is ON: Battery voltage value When relay is OFF: Approx. 0 V
-----------------------	---

3. Check the state of the continuity between (1) and (2).

Factory specification	When relay is ON: Continuity When relay is OFF: No continuity
-----------------------	--

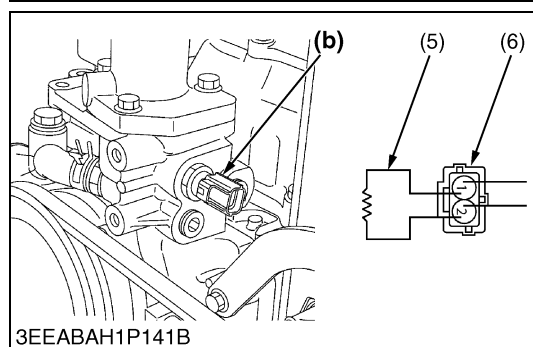
4. Measure the resistance in the relay unit (between (3) and (4)).

Factory specification	Coil resistance value of relay to use
-----------------------	---------------------------------------

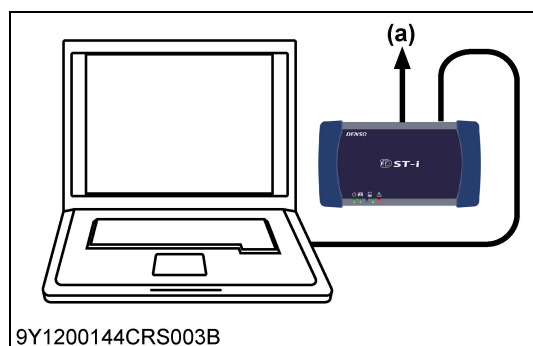
OK	Go to "4. ECU replacement check".
NG	Relay fault → Replace.

- (1) Terminal +B
 (2) Terminal MAHR
 (3) Terminal GRLY
 (4) Terminal GND
 (5) Dummy Resistor
 (6) Connector

(a) **Air Heater Relay**
(b) Coolant Temperature Sensor



9Y1200226CRS1422US0



4. ECU Replacement Check

1. Replace the ECU and perform the previous "Check the GRLY signal".

OK	ECU fault → Replace the ECU.
-----------	------------------------------

- (a) **CAN1 Connector**

9Y1200226CRS1423US0

(24) Heater Lamp Error (DTC P0381 / 675-3)

Behavior during malfunction:

- None

Detection item:

- +B short of lamp driving circuit when lamp is on

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated
- Heater lamp is on

DTC set parameter:

- +B short circuit

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- None

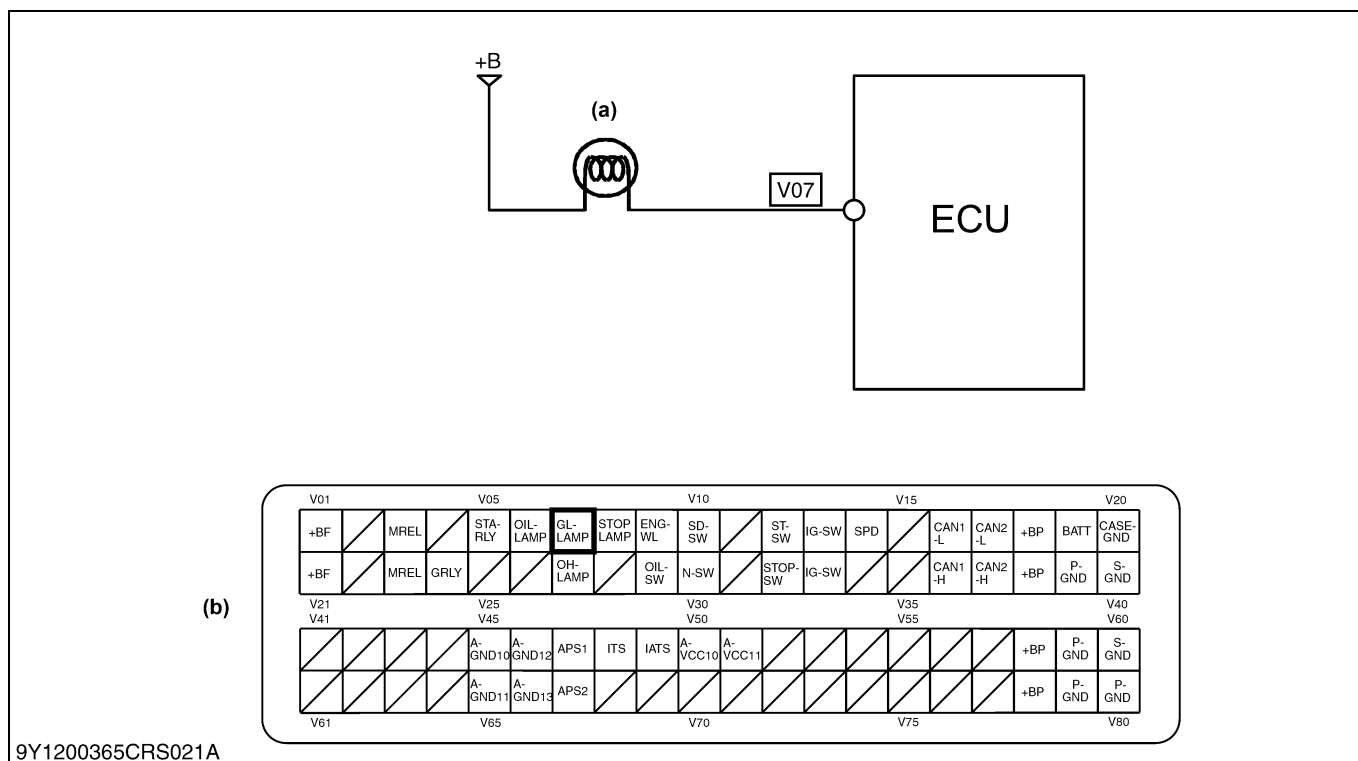
Recovery from error:

- Key switch turn OFF

Remark:

- For driver circuit protection

9Y1200226CRS1424US0

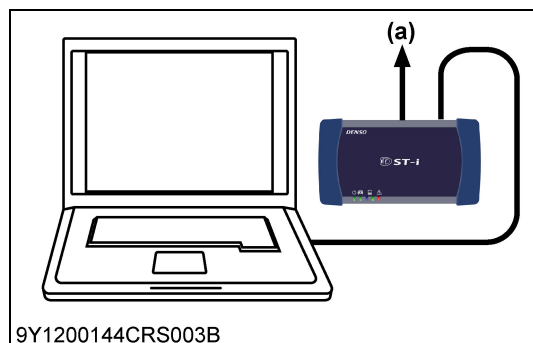


9Y1200365CRS021A

(a) Heater Lamp

(b) ECU Connector 2
(Machine Side)

9Y1200226CRS1425US0



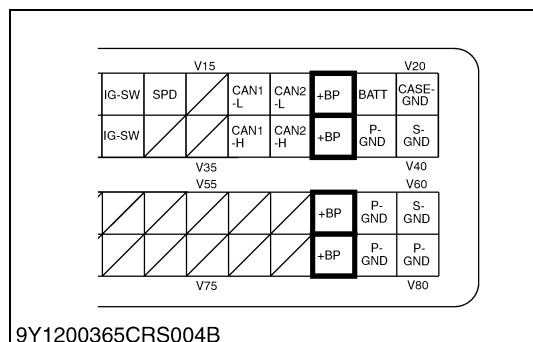
1. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Place the key switch in the ON position, check whether the DTC (P0381) is output or not.

Factory specification	DTC (P0381) must not be output.
OK	Normal.
NG	Go to "2. Check the "+BP" Wiring Harness".

(a) CAN1 Connector

9Y1200226CRS1426US0

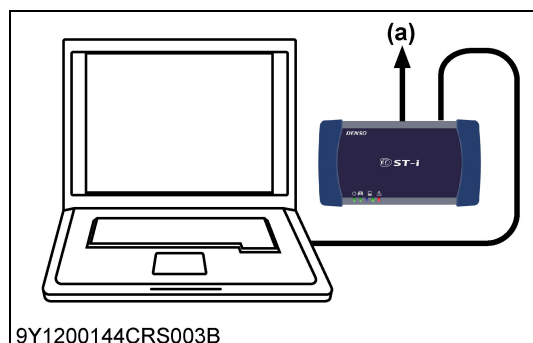
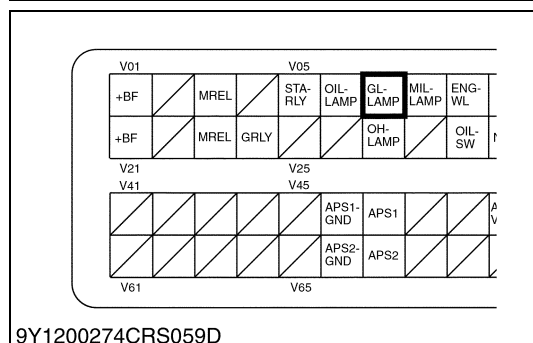


2. Check the "+BP" Wiring Harness

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between ECU wiring harness connector V18 / V38 / V58 / V78 and V07.

Factory specification	several Ω to several k Ω
OK	Go to "3. Check the DTC".
NG	Check the wiring harness → Repair or replace the faulty area.

9Y1200226CRS1427US0



3. Check the DTC

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Start the engine, and clear the past DTCs.
3. Read the DTC again.

Factory specification	Normal (No DTC is output.)
OK	Normal.
NG	Faulty ECU → Replace the ECU.

(a) CAN1 Connector

9Y1200226CRS1428US0

(25) EGR Actuator Abnormality (DTC P0403 / 523574-3, DTC P0404 / 523574-4, P0409 / 523572-4)

P0403 / 523574-3: EGR actuator open circuit

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas emissions

Detection item:

- EGR actuator open circuit

DTC set preconditions:

- Battery voltage is normal
- No DTC of U0077 "CAN1 Bus off"
- EGR control line is normal

DTC set parameter:

- EGR actuator open error signal received via CAN

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1429US0

P0404 / 523574-4: EGR actuator coil short

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas emissions

Detection item:

- EGR actuator coil short

DTC set preconditions:

- Battery voltage is normal
- No DTC of U0077 "CAN1 Bus off"
- EGR control line is normal

DTC set parameter:

- EGR actuator coil short error signal received via CAN

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1430US0

P0409 / 523572-4: EGR position sensor failure**Behaviour during malfunction:**

- Insufficient output
- Worsening exhaust gas emissions

Detection item:

- EGR position sensor failure

DTC set preconditions:

- Battery voltage is normal
- No DTC of U0077 "CAN1 Bus off"
- EGR control line is normal

DTC set parameter:

- EGR position sensor error signal received via CAN

Engine warning light:

- ON

Limp home action by engine ECU (system action):

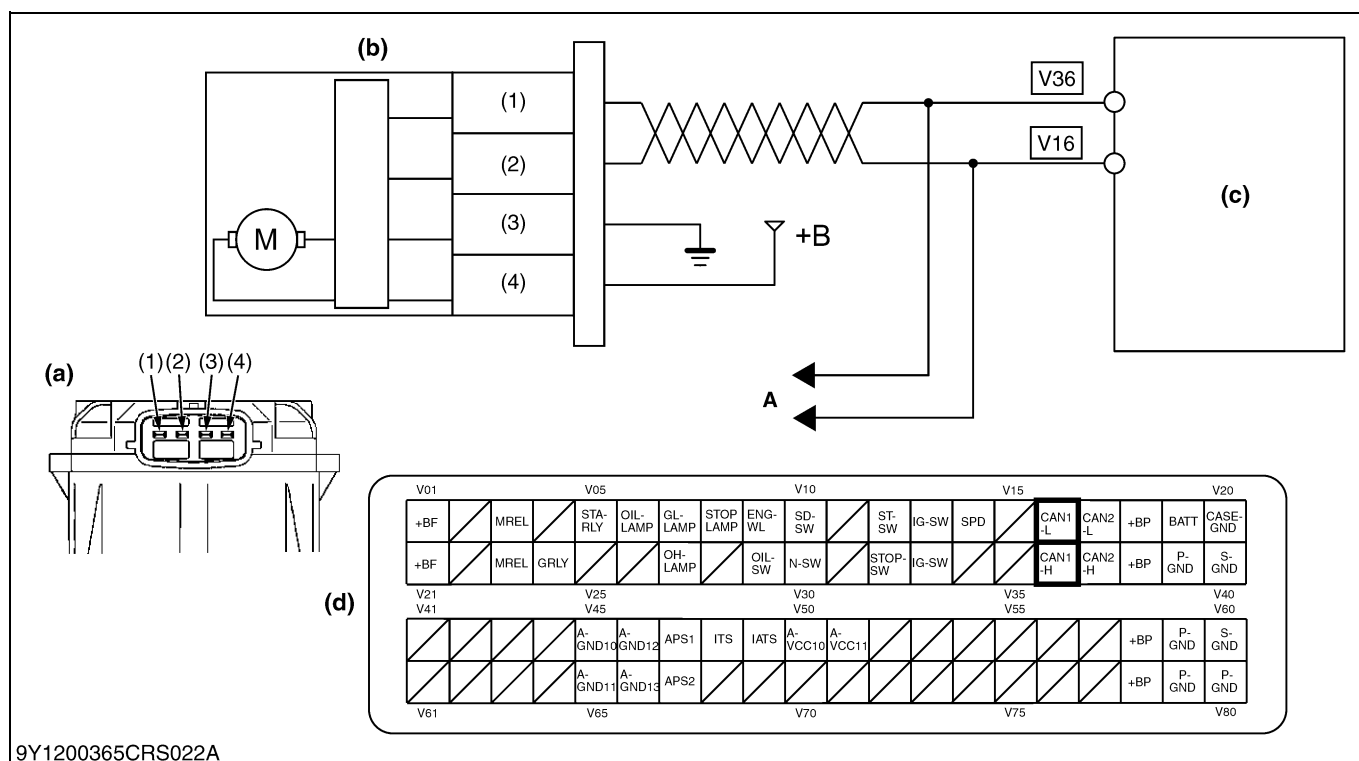
- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1431US0



9Y1200365CRS022A

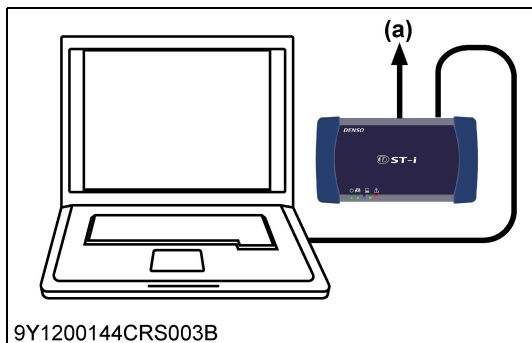
- (1) Terminal CAN-H
(2) Terminal CAN-L

- (3) Terminal Ground
(4) Terminal Power (+12 V)

- (a) Terminal Layout
(b) EGR Valve Assembly
(c) Engine ECU

- (d) ECU Connector 2
(Machine Side)
A: To Diagnosis Tool

9Y1200226CRS1432US0

**1. DTC Judgment**

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Place the key switch in the ON position, check whether the DTC is output or not.
3. Check the DTC again after starting up the engine with the coolant temperature over 65 °C (149 °F).

Factory specification	DTC must not be output.
OK	Normal.
NG	Replace the EGR assembly.

(a) **CAN1 Connector**

9Y1200226CRS1433US0

(26) Oil Pressure Error (P0524 / 100-1)

Behaviour during malfunction:

- Engine stops

Detection item:

- Oil pressure switch

DTC set preconditions:

- Battery voltage is normal
- Key switch turn ON
- Starter switch signal (ECU: V12 terminal) is not activated
- 10 sec or more after engine start [700 min^{-1} (rpm) or higher]

DTC set parameter:

- Oil pressure switch ON: continues one sec or more

Engine warning light:

- ON

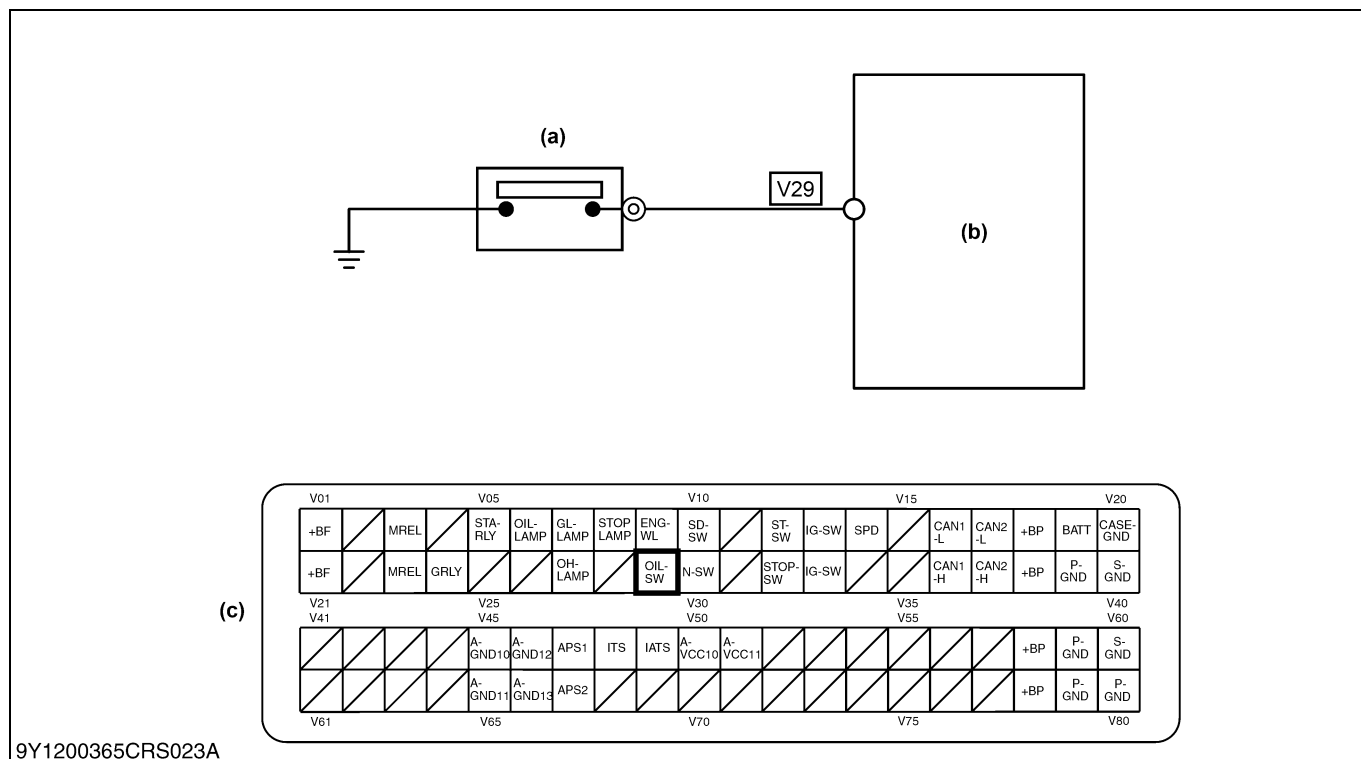
Limp home action by engine ECU (system action):

- None

Recovery from error:

- Key switch turn OFF

Remark:

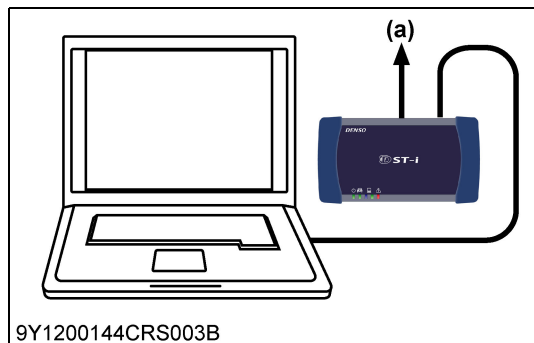


(a) Oil Pressure Switch

(b) Engine ECU

(c) ECU Connector 2 (Machine Side)

9Y1200226CRS1434US0



1. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Place the key switch in the ON position, check whether the DTC (P0524) is output or not.

Factory specification	DTC (P0524) must not be output.
-----------------------	---------------------------------

OK	Normal.
NG	Go to "2. Check the Wiring Related to the Oil Pressure Switch".

(a) CAN1 Connector

9Y1200226CRS1435US0

2. Check the Wiring Related to the Oil Pressure Switch

1. Check the connector and the wiring harness being connected to ECU terminal V29 for a short or an open circuit.

■ IMPORTANT

- Refer to "6.[3] ELECTRIC SYSTEM INSPECTION PROCEDURE - (1) Basics of Checking Electrical / Electronic Circuit System". (Refer to page 1-S549)

OK	Go to "3. Check the Oil Pressure Switch".
NG	Repair or replace the faulty areas.

9Y1200226CRS1436US0

3. Check the Oil Pressure Switch

1. Replace the oil pressure switch and reconfirms it with the service tool.
If the oil pressure can be measured, perform the oil pressure measurement.

Factory specification	Operating pressure of the oil pressure switch: 0.5 kgf/cm ²
-----------------------	--

OK	Oil pressure switch fault → Replace
NG	Go to "4. Check the Oil and Oil Filter".

(1) 1 Oil Pressure Switch

(2) Engine ECU

9Y1200226CRS1437US0

4. Check the Oil and Oil Filter

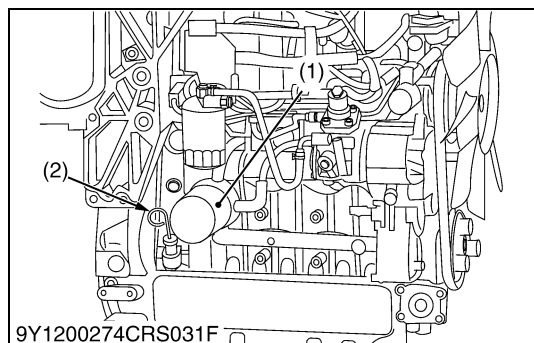
1. Replace specified oil and the oil filter and reconfirms it with the service tool.

OK	Deterioration of the oil and oil filter → Change
NG	Go to "5. Check the Engine"

(1) Oil Filter

(2) Dipstick

9Y1200226CRS1438US0

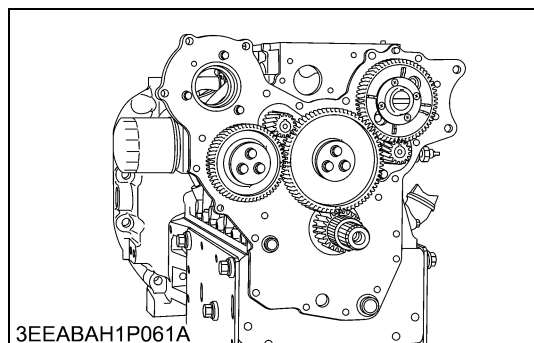


5. Check the Engine

1. Check the inside of the engine (oil passage).

OK	Normal.
NG	Repair the malfunction.

9Y1200226CRS1439US0



(27) Battery Voltage Abnormality (DTC P0562 / 168-4, P0563 / 168-3)

P0562 / 168-4: Battery voltage: Low

Behaviour during malfunction:

- Faulty starting
- Insufficient output
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Open circuit, short circuit or damage of harness
- Failure of battery

DTC set preconditions:

- Key switch is ON
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- ECU recognition of battery voltage is below 8 V in 12 V system

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1440US0

P0563 / 168-3: Battery voltage: High

Behaviour during malfunction:

- Faulty starting
- Insufficient output
- Worsening exhaust gas emissions

Detection item:

- Open circuit, short circuit or damage of harness
- Failure of battery

DTC set preconditions:

- Key switch is ON
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- ECU recognition of battery voltage is above 16 V in 12 V system

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1441US0

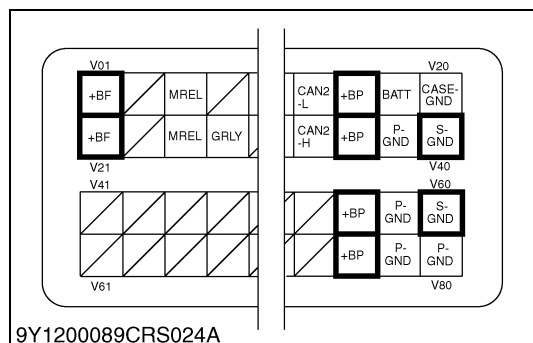


1. Place the key switch in the OFF position, attach the diagnosis tool to the CAN1 connector, and return the key switch to the ON position again. Then, check the "Battery voltage" status on the data monitor.
2. Change the engine operation status, and check the "Battery voltage".

NOTE

- Try to change the engine speed as the generated voltage changes accordingly.

(a) CAN1 Connector



2. Check the ECU Terminal Voltage (Part 1)

1. Change the engine operation status, and measure the voltage between ECU terminals V18 / V38 / V58 / V78 and V40 / V60 and between terminals V01 / V02 and V40 / V60.

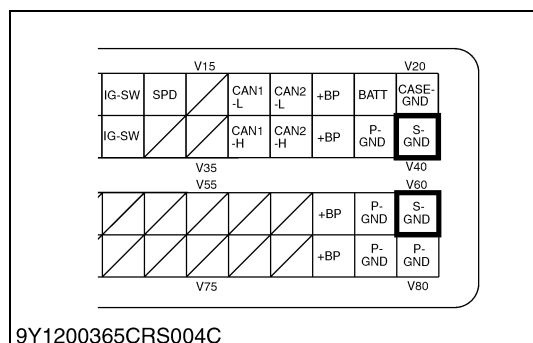
Factory specification	8 V or higher, 15 V or lower (except intense cold temperature)
-----------------------	---

NOTE

- Try to change the engine speed as the generated voltage changes accordingly.

OK	Check the harness connectors and ECU pins.	
	OK	Faulty ECU → Replace.
	NG	Repair or replace the wiring harness, or replace the ECU.
NG	Go to "3. Check the ECU Terminal Voltage (Part 2)".	

9Y1200226CRS1444US0



3. Check the ECU Terminal Voltage (Part 2)

1. Change the engine operation status, and measure the voltage between ECU terminal V40 / V60 and chassis ground terminal.

Factory specification	Always 0.5 V or lower
-----------------------	-----------------------

NOTE

- Try to change the engine speed as the generated voltage changes accordingly.

OK	1. Check the charging system, the battery itself, wiring harness and cables. → Repair the faulty area. 2. Locate the cause of excessively high or low voltage.
NG	Check the wiring harness between ECU terminal and the body ground terminal. → Repair the defects.

9Y1200226CRS1444US0

(28) QR Data Abnormality (DTC P0602/523538-2, P0602/523538-7)

P0602 / 523538-2: QR data error

Behaviour during malfunction:

- Insufficient output

Detection item:

- QR data read error

DTC set preconditions:

- Key switch is ON

DTC set parameter:

- QR data read error from EEPROM

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Nozzle correction is not executed
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Key switch turn OFF

Remark:

- To cover each injector dispersion

9Y1200226CRS1446US0

P0602 / 523538-7: No QR data

Behaviour during malfunction:

- Insufficient output

Detection item:

- QR data is unwritten

DTC set preconditions:

- Key switch is ON

DTC set parameter:

- Area of QR data on EEPROM is vacant

Engine warning light:

- ON

Limp home action by engine ECU (system action):

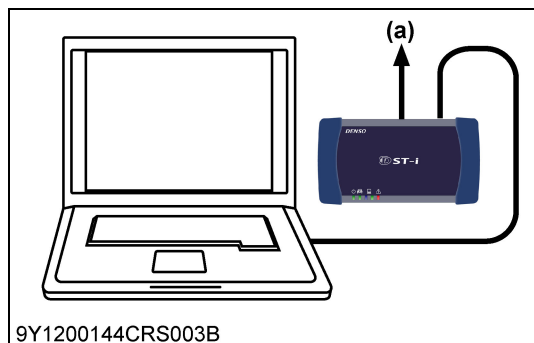
- Nozzle correction factor = 0 [default value]
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1447US0



9Y1200144CRS003B

1. Write the QR Codes and Read the DTC Again

1. Using the diagnosis tool, write the correct QR codes in the ECU.
2. Clear the DTC and check whether the same DTC is output again or not.

Factory specification	OK
OK	An electromagnetic interference (EMI) may have caused the temporary malfunction. There is no problem if the system has recovered.
NG	Faulty Engine ECU.

(a) CAN1 Connector

9Y1200226CRS1448US0

(29) ECU Flash-ROM and CPU Abnormality (DTC P0605 / 628-2, P0606 / 1077-2, P0606/ 523527-2)

P0605 / 628-2: ECU Flash-ROM error

Behaviour during malfunction:

- Engine stops

Detection item:

- FLASH ROM error

DTC set preconditions:

- Key switch is ON

DTC set parameter:

- Check-sum error

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Engine stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1449US0

DTC P0605 / 628-2: SUB CPU (Monitoring IC) FLASH ROM error

Behaviour during malfunction:

- Engine stops

Detection item:

- FLASH ROM of monitoring IC error

DTC set preconditions:

- Key switch is ON

DTC set parameter:

- Check-sum error

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Engine stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1450US0

P0606 / 1077-2: ECU CPU (Main IC) error

Behaviour during malfunction:

- Engine stops

Detection item:

- Failure of CPU

DTC set preconditions:

- Key switch is ON

DTC set parameter:

- Battery voltage is normal and "CPU has fatal error or sub-CPU has alert signal"

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Engine stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1451US0

P0606 / 523527-2: ECU CPU (Monitoring IC) error**Behaviour during malfunction:**

- Engine stops

Detection item:

- Failure of monitoring IC of CPU

DTC set preconditions:

- Key switch is ON

DTC set parameter:

- Battery voltage is normal and Failure of monitoring IC of CPU

Engine warning light:

- ON

Limp home action by engine ECU (system action):

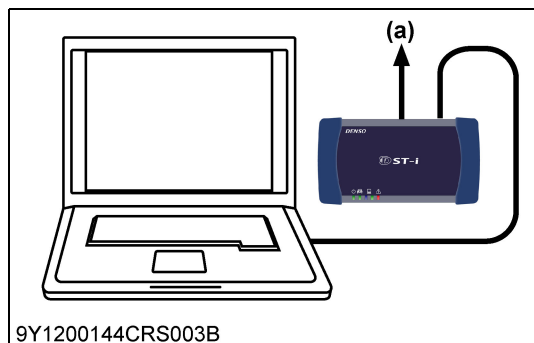
- Engine stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1452US0

**1. Check the DTC**

1. Place the key switch in the OFF position, attach the diagnosis tool to the CAN1 connector, and return the key switch to the ON position again.
2. Clear the DTC, and check whether the same DTC (P0605 or P0606) is output again or not.

Factory specification	No DTC is output.
OK	An electromagnetic interference (EMI) may have caused the temporary malfunction. There is no problem if the system has recovered.
NG	Faulty Engine ECU → Replace.

(a) CAN1 Connector

9Y1200226CRS1453US0

(30) Injector Charge Voltage: Low (DTC P0611 / 523525-1)

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Injector charge voltage: Low
- Failure of charge circuit of ECU

DTC set preconditions:

- Battery voltage is normal
- CPU is normal

DTC set parameter:

- Injector charge voltage: Low
- Failure of charge circuit of ECU

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop

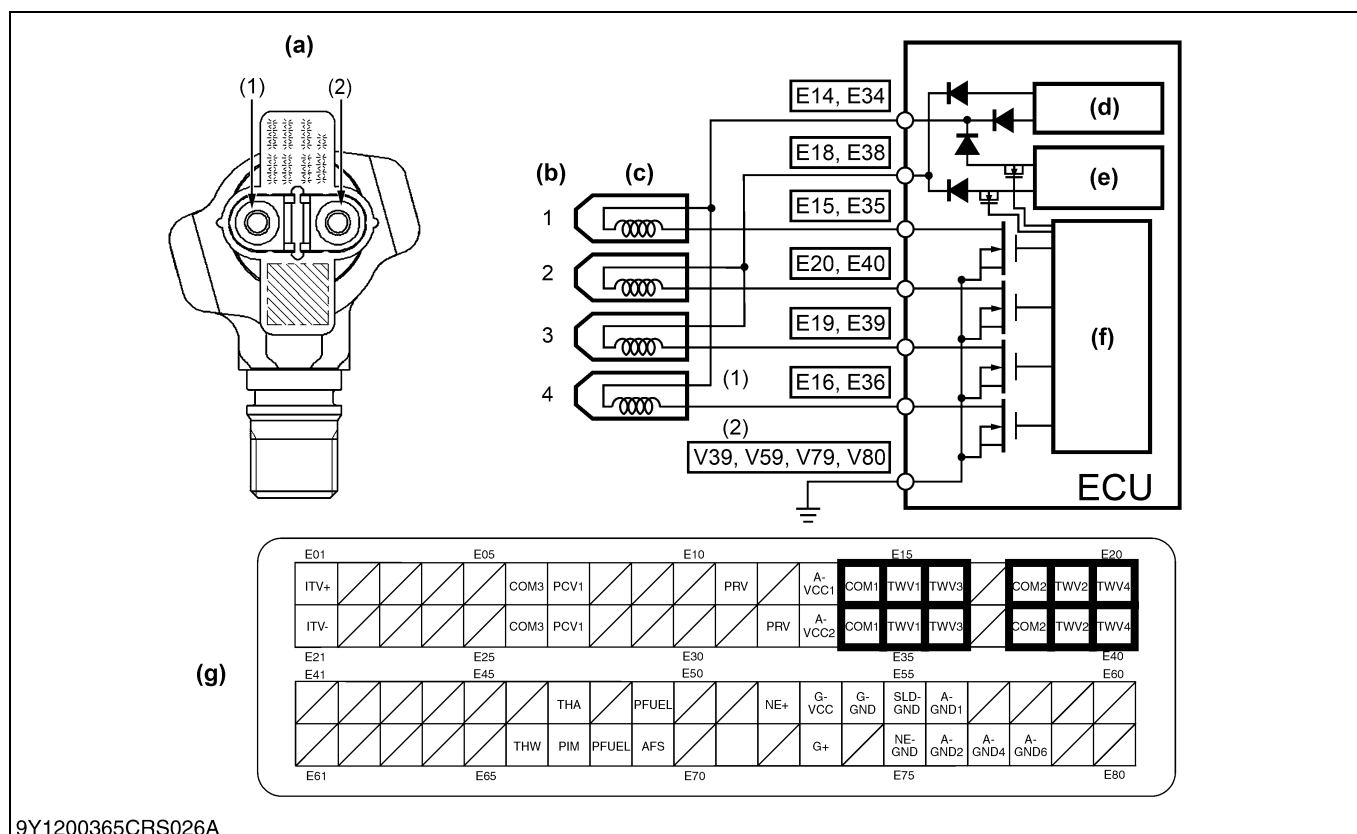
Recovery from error:

- Key switch turn OFF

Remark:

- To minimize PM emission

9Y1200226CRS1454US0



9Y1200365CRS026A

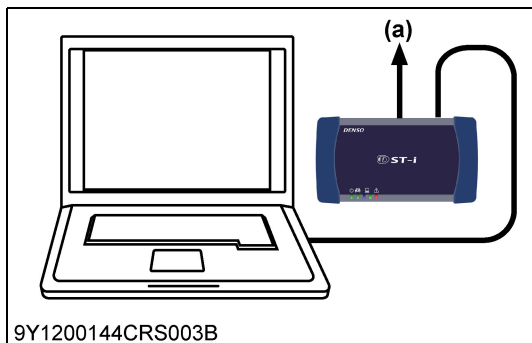
- (1) Terminal COMMON
(2) Terminal TWV

- (a) Terminal Layout
(b) Engine Cylinder No.
(c) Injector

- (d) Constant Amperage Circuit
(e) High Voltage Generation Circuit

- (f) Control Circuit
(g) ECU Connector 1 (Engine Side)

9Y1200226CRS1455US0



1. Checking Whether the DTC Is Detected Again

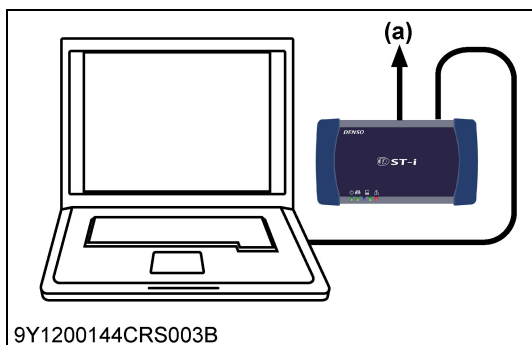
1. Turn the key switch OFF and then ON again.
2. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
3. Check whether or not the same DTC (P0611) is detected.

Factory specification	DTC is not detected.
-----------------------	----------------------

OK	It could be a temporary malfunction caused by obstructions to the radio waves, so as long as it recovers to normal operation there is no problem.
NG	Go to "2. Replacing the Injector and Checking Whether the DTC Is Detected Again".

(a) CAN1 Connector

9Y1200226CRS1456US0



2. Replacing the Injector and Checking Whether the DTC Is Detected Again

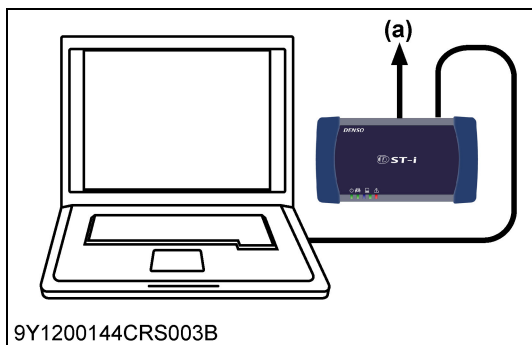
1. Replace the injector.
2. Turn the key switch OFF and then ON again.
3. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
4. Check whether or not the same DTC (P0611) is detected.

Factory specification	DTC is not detected.
-----------------------	----------------------

OK	Injector fault → Replace the injector.
NG	Go to "3. Replacing the ECU and Checking Whether the DTC Is Detected Again".

(a) CAN1 Connector

9Y1200226CRS1457US0



3. Replacing the ECU and Checking Whether the DTC Is Detected Again

1. Replace the ECU.
2. Turn the key switch OFF and then ON again.
3. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
4. Check whether or not the same DTC (P0611) is detected.

Factory specification	DTC is not detected.
-----------------------	----------------------

OK	ECU fault → Replace the ECU.
-----------	------------------------------

(a) CAN1 Connector

9Y1200226CRS1458US0

(31) Internal IC of ECU Abnormality (DTC P062B / 523614-2)

DTC P062B / 523614-2: Internal IC (VDIC2) clock error 1

Behavior during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops

Detection item:

- Internal power control IC clock error 1

DTC set preconditions:

- Battery voltage is normal
- CPU is normal
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Clock error

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1459US0

DTC P062B / 523614-2: Internal IC (VDIC2) clock error 2

Behavior during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops

Detection item:

- Internal power control IC clock error 2

DTC set preconditions:

- Battery voltage is normal
- CPU is normal
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Clock error

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1460US0

DTC P062B / 523614-2: Internal IC (VDIC2) communication error 1**Behavior during malfunction:**

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops

Detection item:

- Internal power control IC communication error 1

DTC set preconditions:

- Battery voltage is normal
- CPU is normal
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Communication error

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1461US0

DTC P062B / 523614-2: Internal IC (VDIC2) communication error 2**Behavior during malfunction:**

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops

Detection item:

- Internal power control IC communication error 2

DTC set preconditions:

- Battery voltage is normal
- CPU is normal
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Communication error

Engine warning light:

- ON

Limp home action by engine ECU (System action):

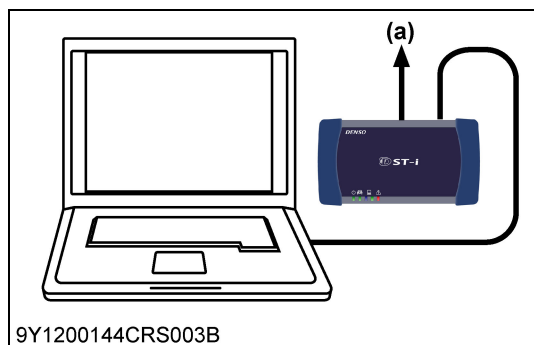
- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1462US0

**1. DTC Judgment**

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position, check whether the DTC (P0605 or P062B) is output or not.

Factory specification	Either DTC P0605 or P062B is output.
OK	Normal.
NG	Faulty ECU → Replace the ECU.

(a) CAN1 Connector

9Y1200226CRS1463US0

(32) Sensor Supply Voltage 1 Abnormality (DTC P0642 / 3509-4, P0643 / 3509-3)

P0642 / 3509-4: Sensor supply voltage 1 abnormality (Low side)

Behaviour during malfunction:

- Faulty starting
- Insufficient output
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Sensor supply voltage 1 error or recognition error

DTC set preconditions:

- Battery voltage is normal
- Key switch turn ON
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Voltage to sensor is below 4.375 V

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

Remark:

- Emission related

9Y1200226CRS1464US0

P0643 / 3509-3: Sensor supply voltage 1 abnormality (High side)

Behaviour during malfunction:

- Faulty starting
- Insufficient output
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Sensor supply voltage 1 error or recognition error

DTC set preconditions:

- Battery voltage is normal
- Key switch turn ON
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Voltage to sensor is above 5.625 V

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop
- Intake throttle 100 % open

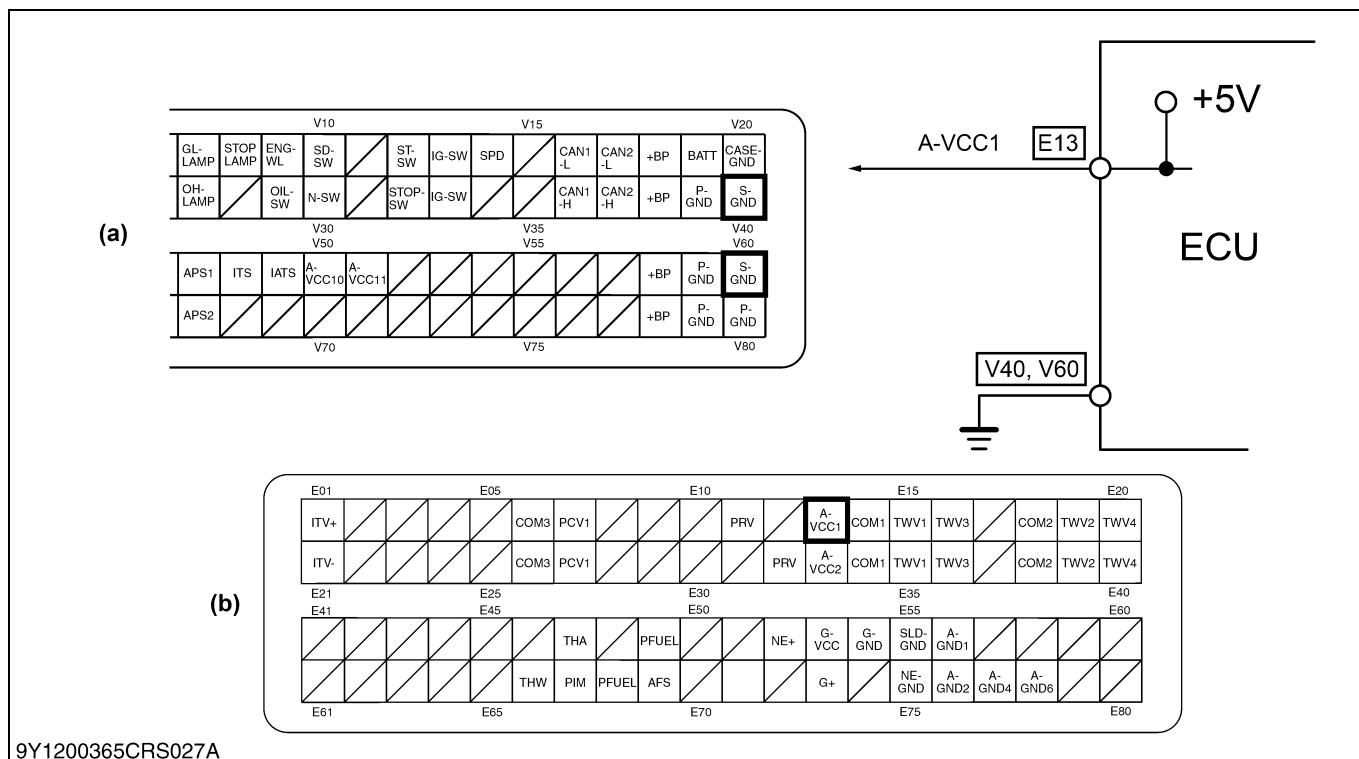
Recovery from error:

- Key switch turn OFF

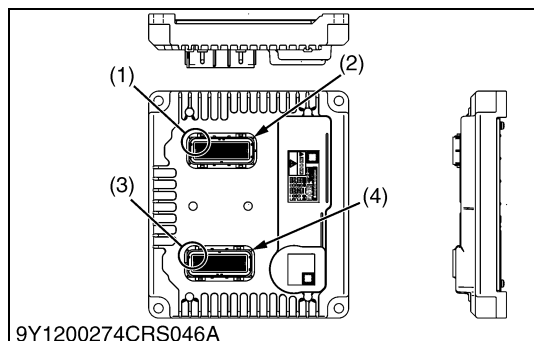
Remark:

- Emission related

9Y1200226CRS1465US0

(a) ECU Connector 2
(Machine Side)(b) ECU Connector 1
(Engine Side)

9Y1200226CRS1466US0

**1. Measure the ECU Terminal Voltage**

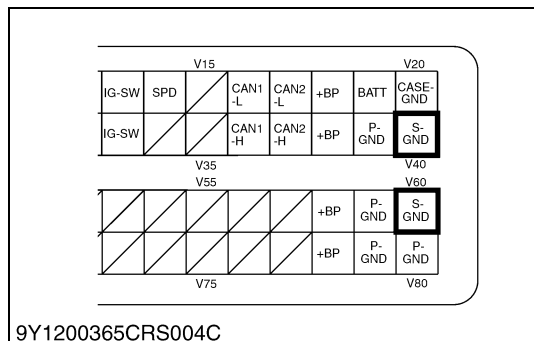
- Place the key switch in the OFF position, and unplug the ECU wiring harness connector 1 (1) from the socket.
- Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals E13 and V40 / V60.

Factory specification	Approx. 5 V
OK	Check the wiring harness (ECU terminal E13) for a short. → Repair the faulty area.
NG	Check the harness connectors and ECU pins.
OK	Faulty ECU → Replace.
NG	Repair or replace the wiring harness, or replace the ECU.

- (1) E01 Pin Position (2) ECU Connector 1 (Engine Side) (3) V01 Pin Position (4) ECU Connector 2 (Machine Side)

9Y1200226CRS1467US0

9Y1200365CRS007D



(33) Sensor Supply Voltage 2 Abnormality (DTC P0652 / 3510-4, P0653 / 3510-3)

P0652 / 3510-4: Sensor supply voltage 2: Low

Behaviour during malfunction:

- Faulty starting
- Insufficient output
- Worsening exhaust gas emissions

Detection item:

- Sensor supply voltage 2 error or recognition error

DTC set preconditions:

- Battery voltage is normal
- Key switch turn ON
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Voltage to sensor is below 4.375 V

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Key switch turn OFF

Remark:

- Emission related

9Y1200226CRS1468US0

P0653 / 3510-3: Sensor supply voltage 2: High

Behaviour during malfunction:

- Faulty starting
- Insufficient output
- Worsening exhaust gas emissions

Detection item:

- Sensor supply voltage 2 error or recognition error

DTC set preconditions:

- Battery voltage is normal
- Key switch turn ON
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Voltage to sensor is above 5.625 V

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition

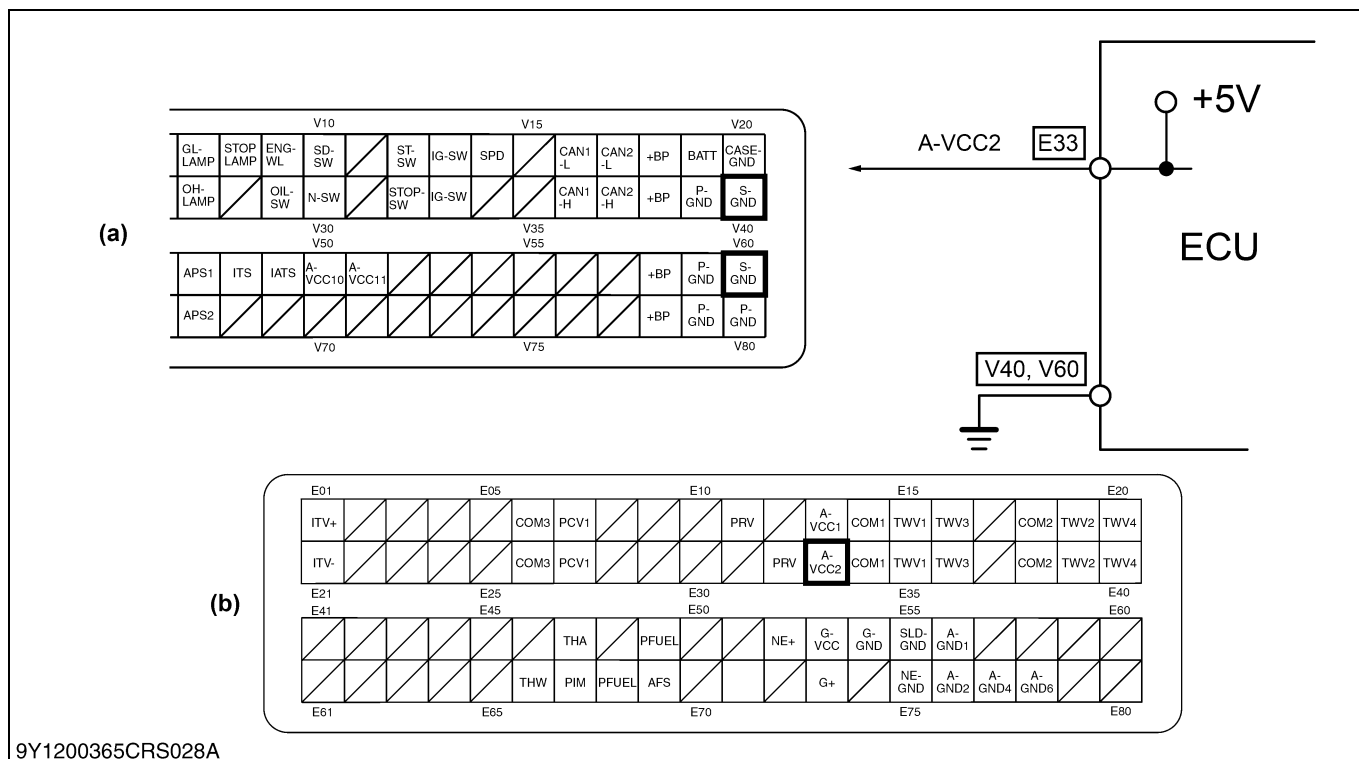
Recovery from error:

- Key switch turn OFF

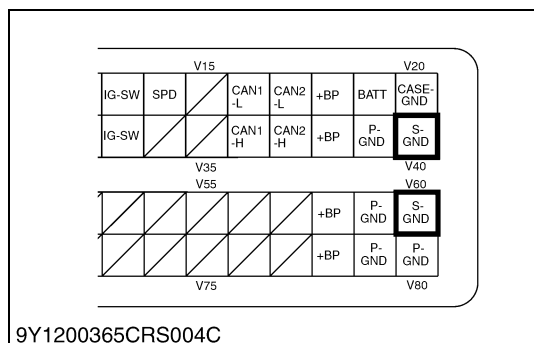
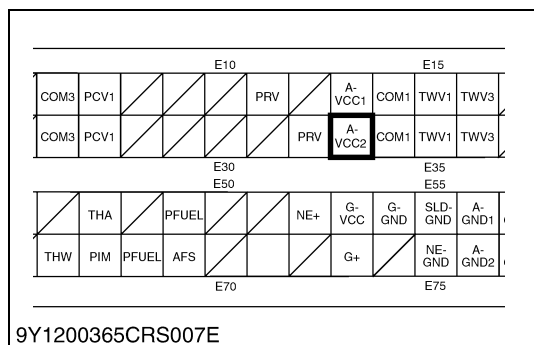
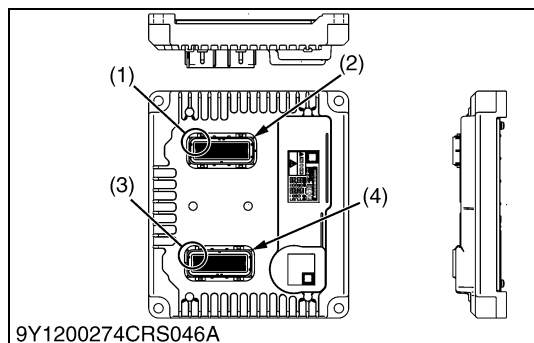
Remark:

- Emission related

9Y1200226CRS1469US0

(a) ECU Connector 2
(Machine Side)(b) ECU Connector 1
(Engine Side)

9Y1200226CRS1470US0



1. Measure the ECU Terminal Voltage

- Place the key switch in the OFF position, and unplug the ECU wiring harness connector 1 (1) from the socket.
- Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals E33 and V40 / V60.

Factory specification	Approx. 5 V
OK	Check the wiring harness (ECU terminal E33) for a short. → Repair the faulty area.
NG	Check the harness connectors and ECU pins.
OK	Faulty ECU → Replace.
NG	Repair or replace the wiring harness, or replace the ECU.

- (1) E01 Pin Position (2) ECU Connector 1 (Engine Side) (3) V01 Pin Position (4) ECU Connector 2 (Machine Side)

9Y1200226CRS1471US0

(34) Over Heat Lamp Error (DTC P0655 / 523624-3)

Behavior during malfunction:

- None

Detection item:

- +B short of lamp driving circuit when lamp is on

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated
- Over heat lamp is on

DTC set parameter:

- +B short circuit

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- None

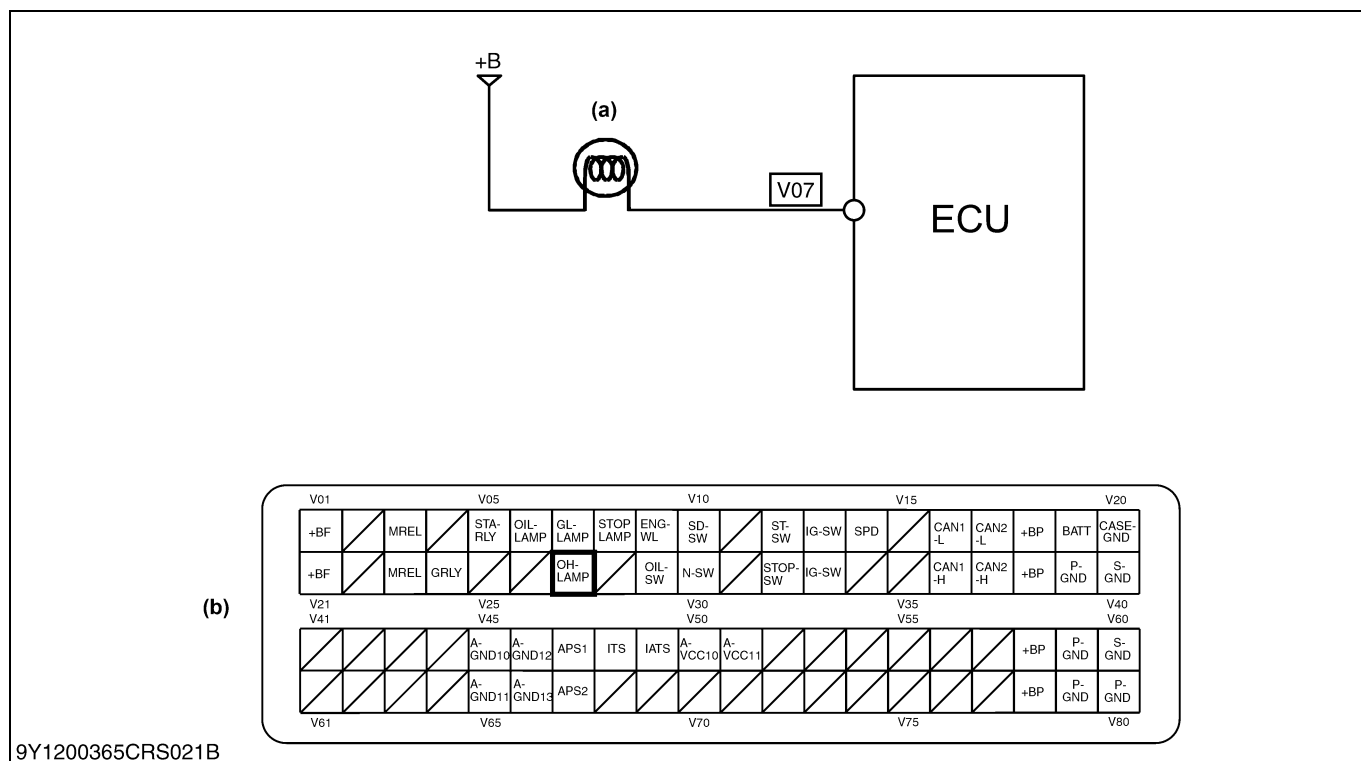
Recovery from error:

- Key switch turn OFF

Remark:

- For driver circuit protection

9Y1200226CRS1472US0

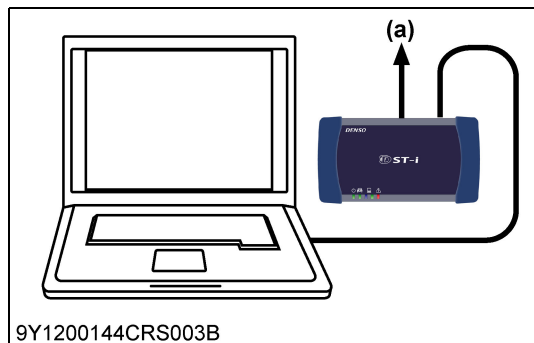


9Y1200365CRS021B

(a) Over heat Lamp

(b) ECU Connector 2
(Machine Side)

9Y1200226CRS1473US0



1. DTC Judgment

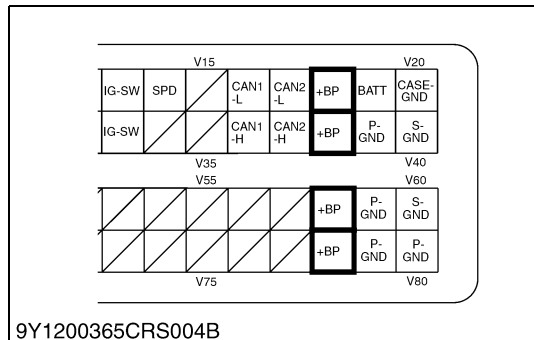
1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Place the key switch in the ON position, check whether the DTC (P0655) is output or not.

Factory specification	DTC (P0655) must not be output.
-----------------------	---------------------------------

OK	Normal.
NG	Go to "2. Check the "+BP" Wiring Harness".

(a) CAN1 Connector

9Y1200226CRS1474US0



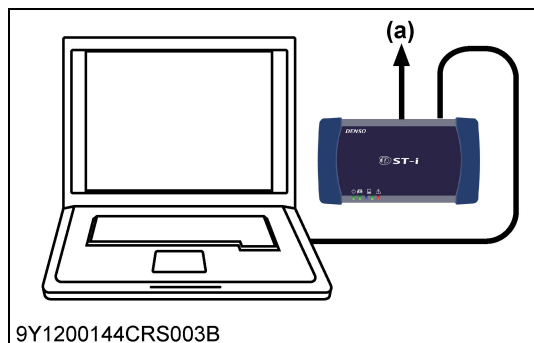
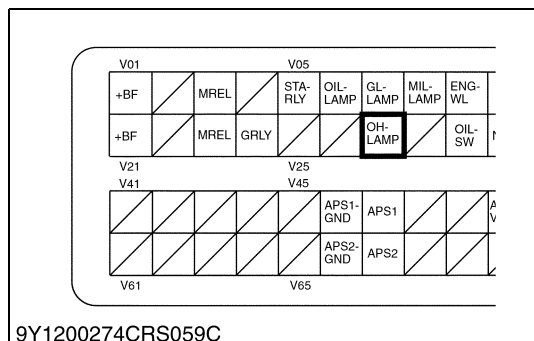
2. Check the "+BP" Wiring Harness

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between ECU wiring harness connector V18 / V38 / V58 / V78 and V27.

Factory specification	several Ω to several k Ω
-----------------------	--

OK	Go to "3. Check the DTC".
NG	Check the wiring harness → Repair or replace the faulty area.

9Y1200226CRS1475US0



3. Check the DTC

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Start the engine, and clear the past DTCs.
3. Read the DTC again.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

OK	Normal.
NG	Faulty ECU → Replace the ECU.

(a) CAN1 Connector

9Y1200226CRS1476US0

(35) Main Relay is Locked in Closed Position (DTC P0687 / 1485-2)

Behaviour during malfunction:

- Battery goes dead

Detection item:

- Failure of main relay

DTC set preconditions:

- Key switch is OFF
- Engine stops

DTC set parameter:

- After the self-power-off process of the main relay, + B voltage continues more than 75 seconds

Engine warning light:

- OFF

Limp home action by engine ECU (system action):

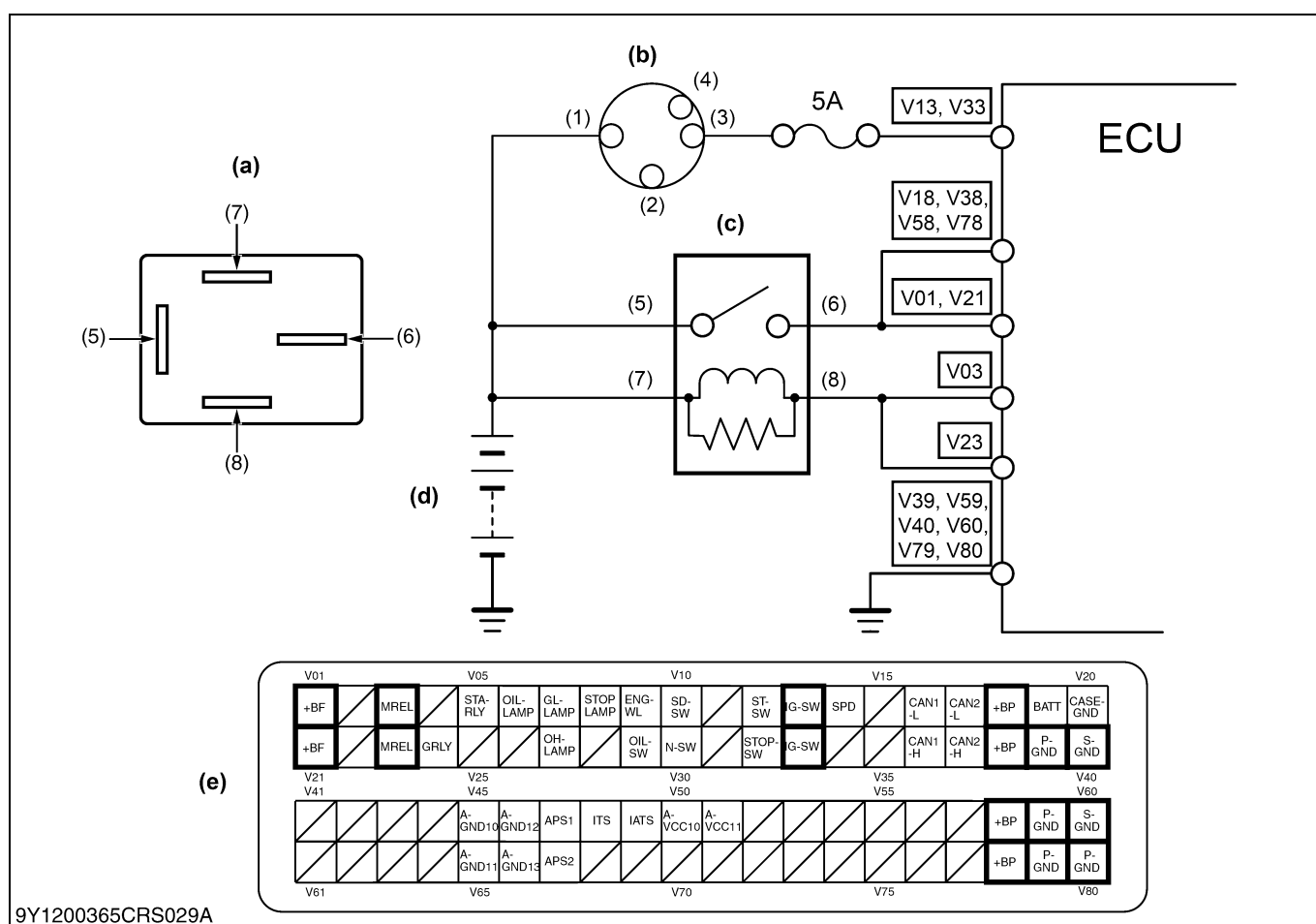
- None

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1477US0



9Y1200365CRS029A

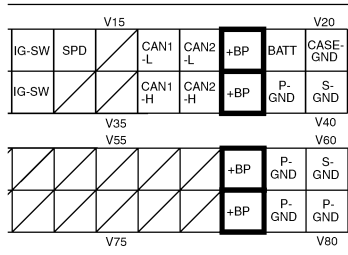
- (1) Input Terminal
(2) ACC
(3) Output Terminal
(4) START

- (5) Terminal 1
(6) Terminal 2
(7) Terminal 3
(8) Terminal 4

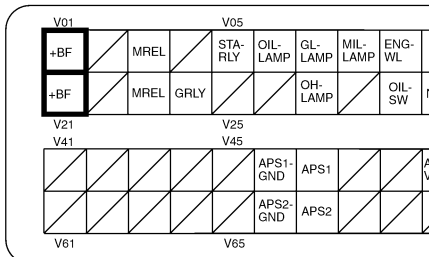
- (a) Main Relay Terminal Layout
(b) Key Switch
(c) Main Relay

- (d) Battery
(e) ECU Connector 2
(Machine Side)

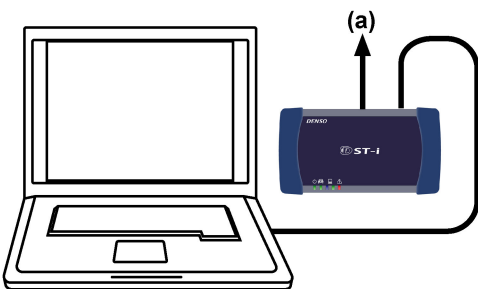
9Y1200226CRS1478US0



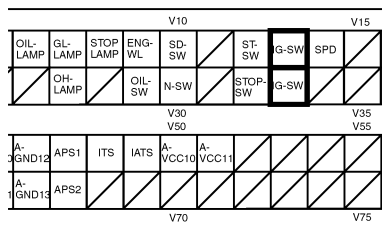
9Y1200365CRS004B



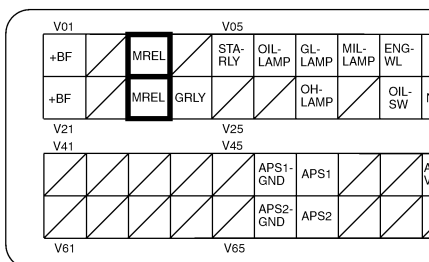
9Y1200274CRS059A



9Y1200144CRS003B



9Y1200365CRS024B



9Y1200274CRS059B

1. Measure the ECU Terminal Voltage

- Place the key switch in the OFF position, and measure the voltage between ECU terminals V18 / V38 / V58 / V78 and V01 / V21 and the chassis ground.

Factory specification	0 V
-----------------------	-----

OK	Clear the DTC and check whether it is detected again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Check the Key Switch Signal".	

9Y1200226CRS1479US0

2. Check the Key Switch Signal

- Place the key switch in the OFF position, attach the diagnosis tool to the CAN1 connector, and return the key switch to the ON position again.
- Using the data monitor function of diagnosis tool, check the "Key switch" data when the key switch is placed in the OFF position.

Factory specification	OFF
-----------------------	-----

OK	Go to "4. Check the ECU Terminal Voltage".
NG	Go to "3. Check the IG-SW Signal".

(a) CAN1 Connector

9Y1200226CRS1480US0

3. Check the IG-SW Signal

- Place the key switch in the OFF position, and measure the voltage at ECU terminal V13 / V33.

Factory specification	0 V
-----------------------	-----

OK	Go to "4. Check the ECU Terminal Voltage".
NG	1. Check the wiring harness and the key switch. → Repair. 2. Locate the cause of constant voltage supply to the wiring harness.

9Y1200226CRS1481US0

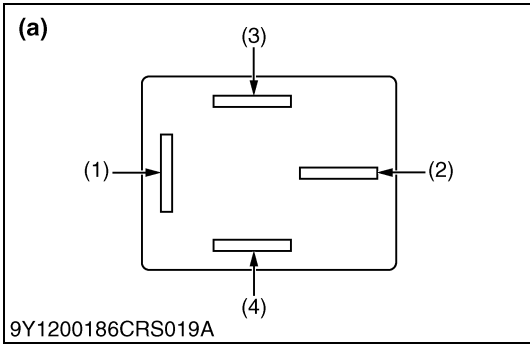
4. Check the ECU Terminal Voltage

- Keep the key switch in the OFF position, and measure the voltage at ECU main relay terminals V03 and V23.

Factory specification	10 V or higher
-----------------------	----------------

OK	Go to "5. Measure the Resistance Between Relay Terminals (for Confirmation)".
NG	1. Check the wiring harness between relay and ECU and connectors. → Repair. 2. Locate the cause of constant shorted wiring harness to the ground.

9Y1200226CRS1482US0



5. Measure the Resistance Between Relay Terminals (for Confirmation)

1. Remove the main relay, and measure the resistance between each relay terminal.

Example of main relay terminal layout

Factory specification	Between terminals (3) and (4): Coil resistance value of relay to use Between terminals (1) and (2): Infinity
-----------------------	--

NG	Faulty main relay → Replace.
----	------------------------------

- (1) Terminal 1 (Contact Terminal)

(2) Terminal 2 (Contact Terminal)

(3) Terminal 3
(Coil Operating Terminal)

(4) Terminal 4
(Coil Operating Terminal)
- (a) Terminal Layout

9Y1200226CRS1483US0

(36) Starter Relay Driving Error (DTC P081B / 677-3)

Behavior during malfunction:

- None

Detection item:

- +B short of relay driving circuit when relay is on

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated
- Starter relay is on

DTC set parameter:

- +B short circuit

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- None

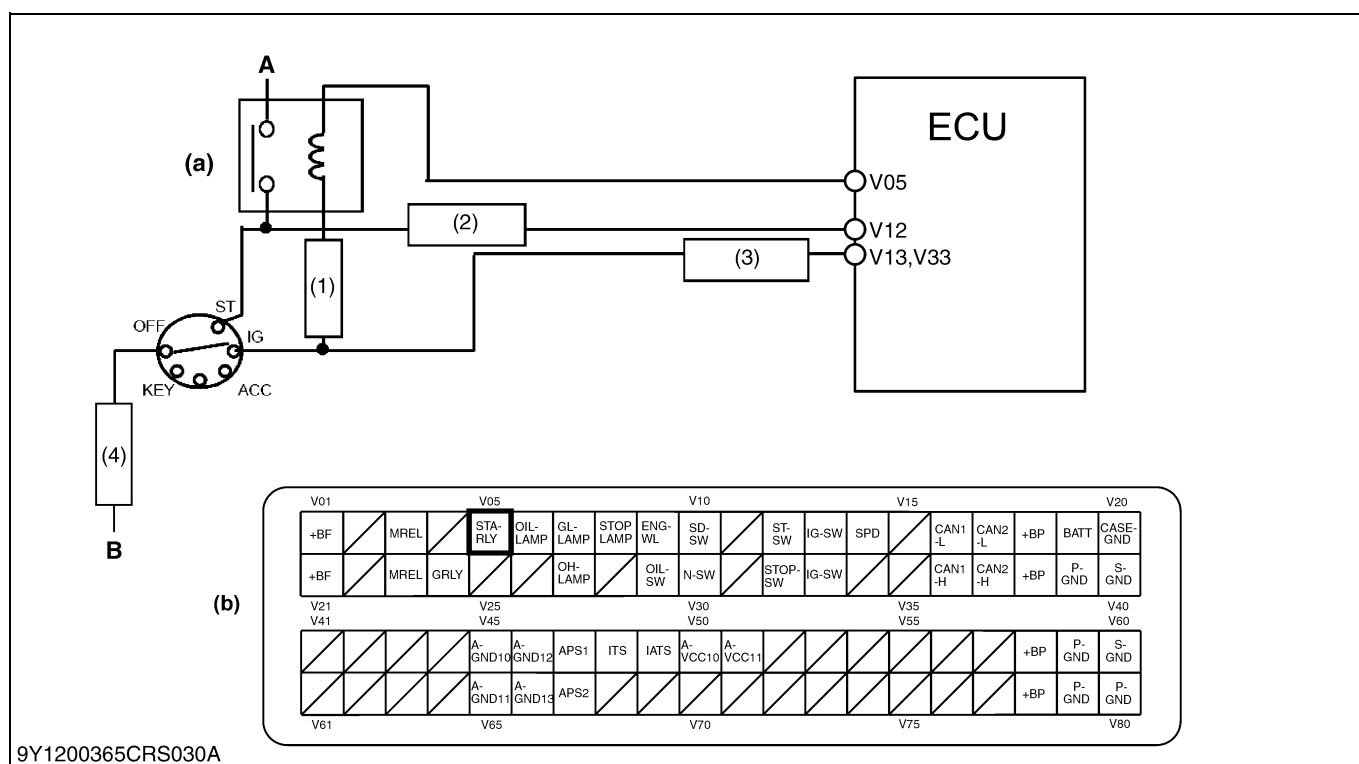
Recovery from error:

- Key switch turn OFF

Remark:

- For driver circuit protection

9Y1200226CRS1484US0



(1) Fuse (5A)

(2) Fuse (5A)

(3) Fuse (5A)

(4) Fuse (50A)

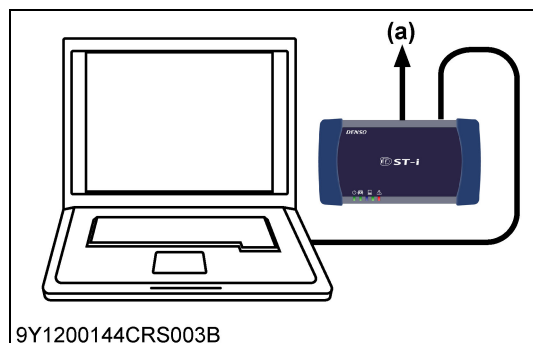
(a) Starter Relay

(b) ECU Connector 2
(Machine Side)

A: To Starter ST Terminal

B: To Battery +

9Y1200226CRS1485US0



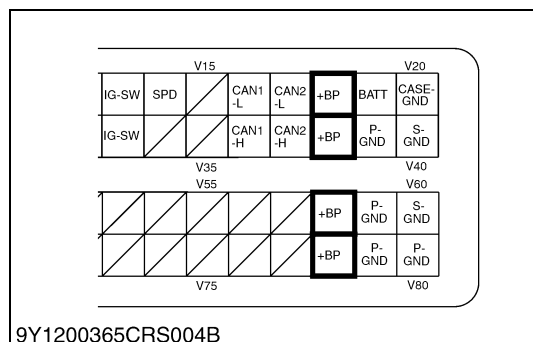
1. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Place the key switch in the ON position, start the engine and check whether the DTC (P081B) is output or not.

Factory specification	DTC (P081B) must not be output.
OK	Normal.
NG	Go to "2. Check the "+BP" Wiring Harness".

(a) CAN1 Connector

9Y1200226CRS1486US0

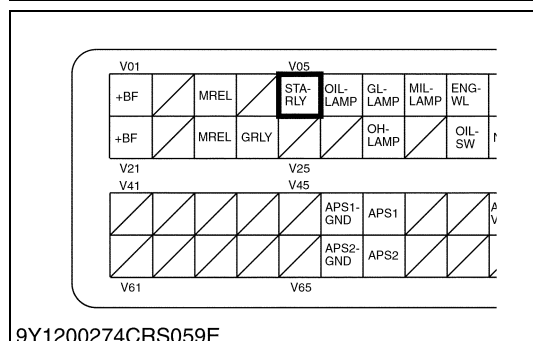


2. Check the "+BP" Wiring Harness

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between ECU wiring harness connector V18 / V38 / V58 / V78 and V05.

Factory specification	several ten Ω and more
OK	Go to "3. Check the DTC".
NG	Check the wiring harness → Repair or replace the faulty area.

9Y1200226CRS1487US0



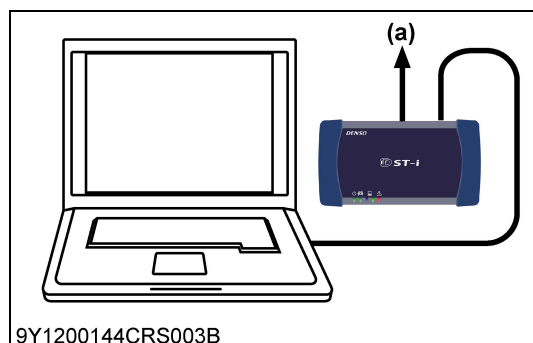
3. Check the DTC

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Start the engine, and clear the past DTCs.
3. Read the DTC again.

Factory specification	Normal (No DTC is output.)
OK	Normal.
NG	Faulty ECU → Replace the ECU.

(a) CAN1 Connector

9Y1200226CRS1488US0



(37) Pump Seizing (DTC P1274 / 523539-2, P1275 / 523540-2)**P1274 / 523539-2: Pump seizing 1****Behaviour during malfunction:**

- Engine stops

Detection item:

- High pressure 1 error

DTC set preconditions:

- Sensor supply voltage VCC# is normal
- Rail pressure sensor is normal

DTC set parameter (Approximate parameter):

- Rail pressure of 300 MPa (3060 kgf/cm², 43500 psi) or more continues 1 second under the condition of above 500 min⁻¹ (rpm) [Threshold changes depending on the engine speed. 2600 min⁻¹ (rpm) should be used as a reference]

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Engine stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1489US0

P1275 / 523540-2: Pump seizing 2**Behaviour during malfunction:**

- Engine stops

Detection item:

- High pressure 2 error

DTC set preconditions:

- Sensor supply voltage VCC# is normal
- Rail pressure sensor is normal

DTC set parameter (Approximate parameter):

- Rail pressure of above 267 MPa (2720 kgf/cm², 38700 psi), and below 300 MPa (3060 kgf/cm², 43500 psi) continues total time for 35 seconds under condition of above 500 min⁻¹ (rpm) [Threshold changes depending on the engine speed. 2600 min⁻¹ (rpm) should be used as a reference]
- Or, rail pressure of above 107 MPa (1090 kgf/cm², 15500 psi) and below 195 MPa (1990 kgf/cm², 28300 psi) continues total time for 35 seconds [Threshold changes depending on the engine speed. 200 min⁻¹ (rpm) should be used as a reference]

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Engine stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1490US0

Diagnostic Procedure for Pressure System DTCs

Checking of fault conditions and actions taken

If DTCs of non-pressure system are detected (*Refer to the pressure system DTCs given below.)

First locate the non-pressure system problem indicated by DTCs, and repair the affected parts. After the repair has been carried out, check for an output of pressure system DTCs. If so, begin the diagnosis of the affected pressure system.

If only pressure system DTCs are detected (*Refer to the pressure system DTCs given below.)

Diagnose the affected pressure system indicated by DTCs.

If a DTC currently exists

Begin diagnosis without returning the key switch to the OFF position. However, carefully make satisfactory / unsatisfactory judgments as the injection amount and rail pressure are limited by system actions.

If only a past DTC exists

Log the freeze-frame data, clear the DTCs, and stop the engine. Then, try to reproduce the problem using the freeze-frame data and the trouble check sheet.

Pressure system DTCs*[High pressure abnormality]**

1. P0088: High rail pressure
2. P1A0D: High pressure pump too high

[Low pressure abnormality]

1. P0093: Fuel leak
2. P0191: Rail pressure too low

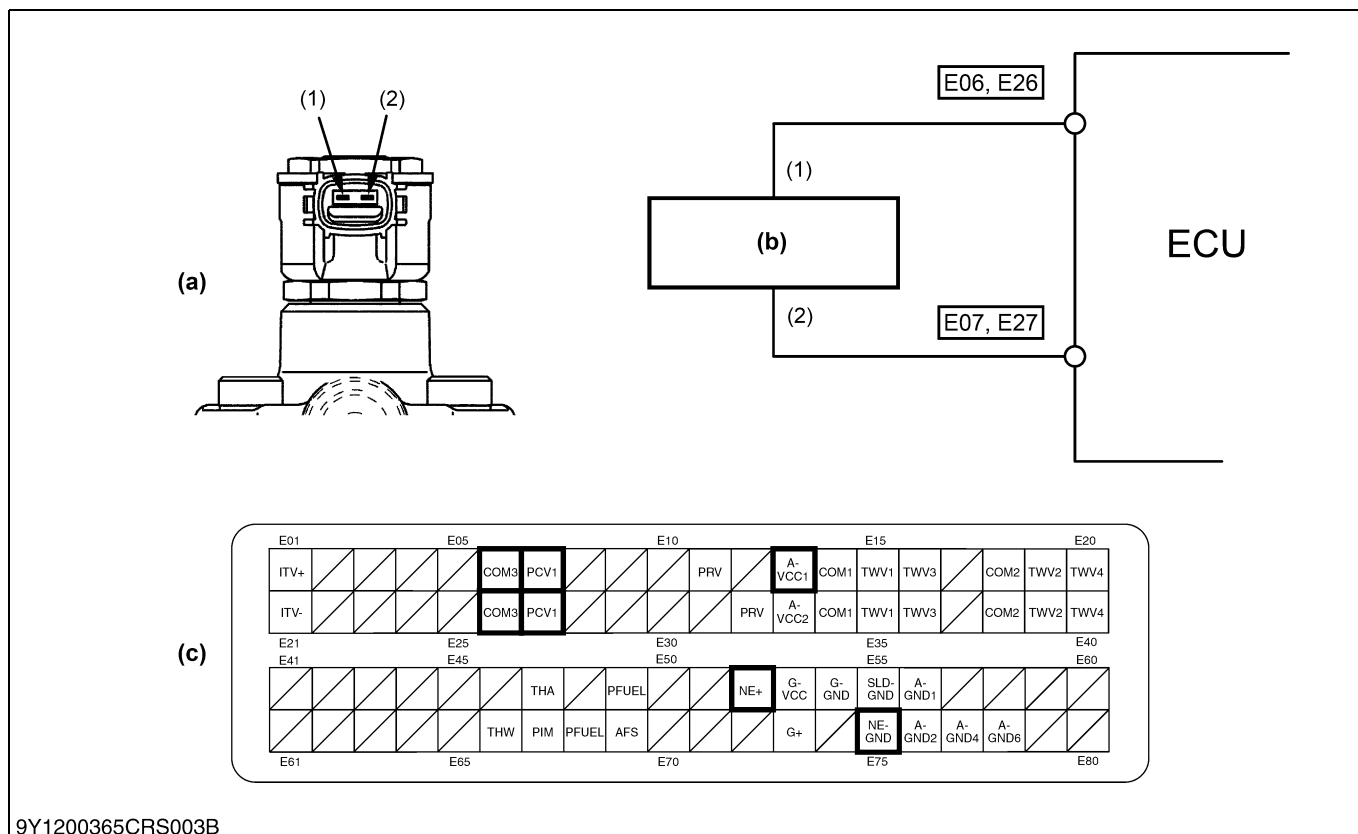
[Abnormal pressure]

1. P1274: Pump seizing 1
2. P1275: Pump seizing 2
3. P1A06: High pressure delivery system too high
4. P2293: Pressure relief valve error / PRV driving circuit error

■ IMPORTANT

- Multiple pressure system DTCs may be output simultaneously. Also, both abnormal high pressure and abnormal low pressure may be reported simultaneously under certain malfunction conditions.

9Y1200226CRS1491US0



(1) Terminal COM3

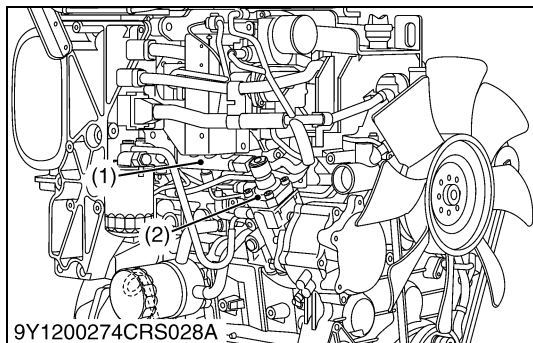
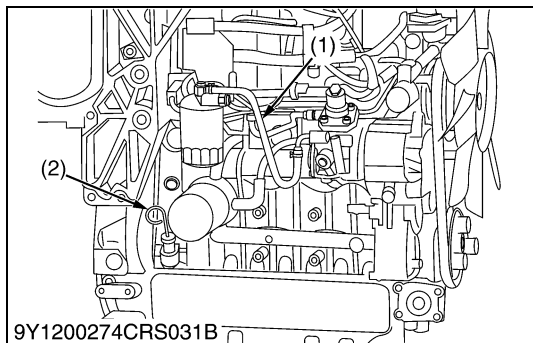
(2) Terminal PCV1

(a) Terminal Layout

(b) PCV

(Pre-stroke Control Valve)

**(c) ECU Connector 1
(Engine Side)**



1. Check the Fuel System for the Existence of Air

1. Check each joint of the fuel system for the existence of air.
To detect the existence of air effectively, replace the fuel hose with a transparent one.

OK	Go to "2. Check the Fuel System".
NG	1. Rotate the fuel feed pump sufficiently and bleed the air. 2. Locate the position of the fuel leakage in the piping and repair it.

- (1) Fuel Hose

- (2) Dipstick

2. Check the Fuel System



CAUTION

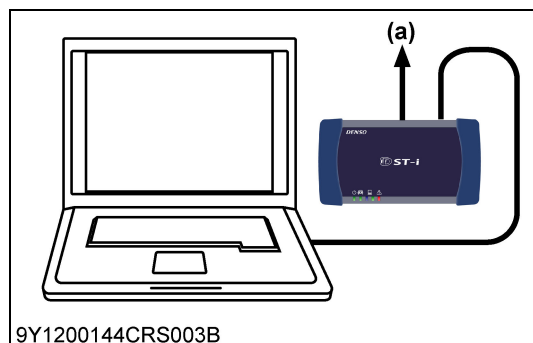
- Visually check there is no leak in the high pressure fuel pipe system.
- A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	3. Check the data related to the rail pressure
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

- (1) Rail

- (2) Supply Pump



3. Check the Data Related to the Rail Pressure

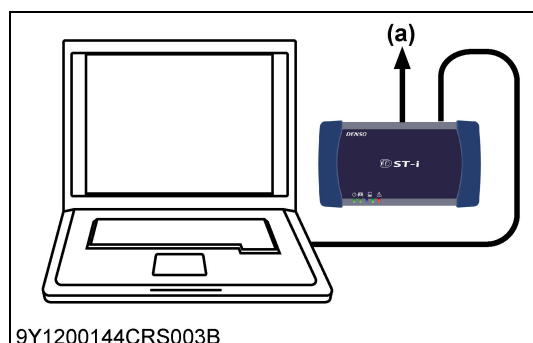
1. Connect the diagnosis tool to the CAN1 connector, and select the "Actual rail pressure" and "Target rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure"
	<ol style="list-style-type: none"> 1. When idling: 35 to 60 MPa (360 to 610 kgf/cm², 5100 to 8700 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 155 MPa (1580 kgf/cm², 22500 psi) 3. No-load maximum speed: 75.0 to 155 MPa (765 to 1580 kgf/cm², 10900 to 22400 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.

OK	Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.
NG	Go to "4. Check the Rail Pressure Sensor".

(a) CAN1 Connector

9Y1200226CRS1495US0



4. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)

1. Check the rail pressure sensor.

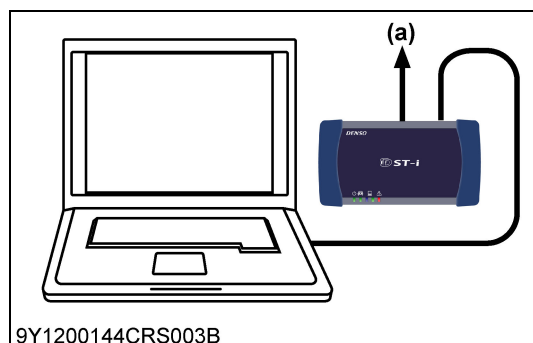
■ NOTE

- Closely check sensor signals for a noise component and an abnormality that exists for a short time.

OK	Go to "5. Check the PCV (or PRV)-related Data".
NG	Replace the rail assembly or its related parts. (Follow the diagnostic procedure of items P0192 and P0193.) (Refer to page 1-S404)

(a) CAN1 Connector

9Y1200226CRS1496US0



5. Check the PCV (or PRV)-related data

1. Check the "Target rail pressure" and "Actual rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

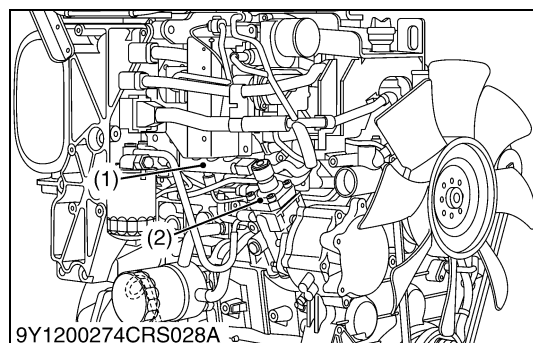
Factory specification	1. The "Actual rail pressure" always follow to the "Target rail pressure".
	A: Normal operating B: Accelerator opening: 0→100 % (During acceleration) C: Accelerator closing: 100→0 % (During rapid deceleration) D: Just after key switch OFF

OK	After confirming that an intermittent malfunction (such as power supply system or noise generation) does not occur in relation to the ECU, replace the ECU.
NG	Case A or B: Faulty PCV → Replace the supply pump. Case C or D: Faulty PRV → Replace the rail assembly.

- (1) Rail
- (2) Supply Pump

(a) CAN1 Connector

9Y1200226CRS1497US0



(38) High Pressure Delivery System too High (DTC P1A06 / 523608-2)

Behavior during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops

Detection item:

- High pressure delivery system too high

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated
- During PMP normal operating (angle studying is complete)
- NE sensing is normal
- Tentative error and PCV action continue for XX msec
- Target pressure is under 10 MPa
- No noise in sensing pressure

DTC set parameter:

- Pressure relief valve (PRV) drive too much error (Real rail pressure value > target pressure value) occur specified times

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1498US0

Diagnostic Procedure for Pressure System DTCs

Checking of fault conditions and actions taken

If DTCs of non-pressure system are detected (*Refer to the pressure system DTCs given below.)

First locate the non-pressure system problem indicated by DTCs, and repair the affected parts. After the repair has been carried out, check for an output of pressure system DTCs. If so, begin the diagnosis of the affected pressure system.

If only pressure system DTCs are detected (*Refer to the pressure system DTCs given below.)

Diagnose the affected pressure system indicated by DTCs.

If a DTC currently exists

Begin diagnosis without returning the key switch to the OFF position. However, carefully make satisfactory / unsatisfactory judgments as the injection amount and rail pressure are limited by system actions.

If only a past DTC exists

Log the freeze-frame data, clear the DTCs, and stop the engine. Then, try to reproduce the problem using the freeze-frame data and the trouble check sheet.

Pressure system DTCs*[High pressure abnormality]**

1. P0088: High rail pressure
2. P1A0D: High pressure pump too high

[Low pressure abnormality]

1. P0093: Fuel leak
2. P0191: Rail pressure too low

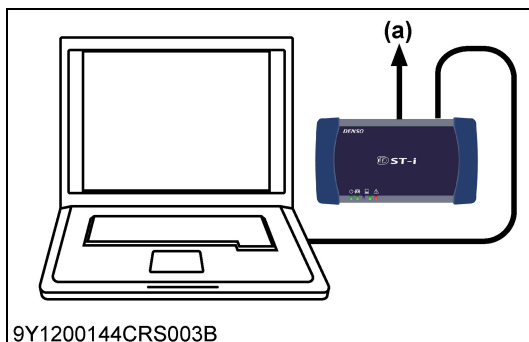
[Abnormal pressure]

1. P1274: Pump seizing 1
2. P1275: Pump seizing 2
3. P1A06: High pressure delivery system too high
4. P2293: Pressure relief valve error / PRV driving circuit error

■ IMPORTANT

- Multiple pressure system DTCs may be output simultaneously. Also, both abnormal high pressure and abnormal low pressure may be reported simultaneously under certain malfunction conditions.

9Y1200226CRS1499US0

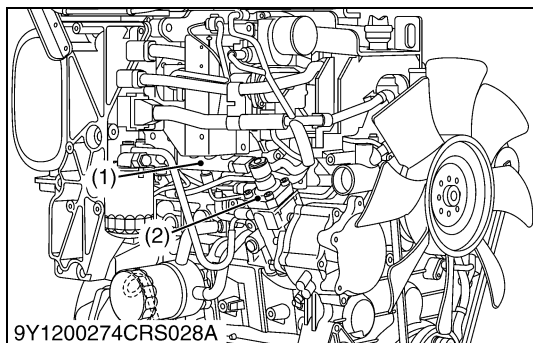
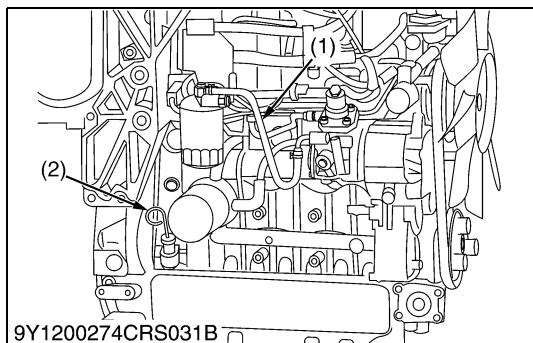
**1. Check the Data Related to the Rail Pressure**

1. Connect the diagnosis tool to the CAN1 connector, and select the "Actual rail pressure" and "Target rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure" 1. When idling: 35 to 60 MPa (360 to 610 kgf/cm ² , 5100 to 8700 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 155 MPa (1580 kgf/cm ² , 22500 psi) 3. No-load maximum speed: 75.0 to 155 MPa (765 to 1580 kgf/cm ² , 10900 to 22400 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.
OK	Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.
NG	Go to "2. Check the Fuel System for the Existence of Air".

(a) CAN1 Connector

9Y1200226CRS1500US0



2. Check the Fuel System for the Existence of Air

1. Check each joint of the fuel system for the existence of air.
To detect the existence of air effectively, replace the fuel hose with a transparent one.

OK	Go to "3. Check the Fuel System".
NG	Locate the position of the fuel leakage in the piping and repair it.

(1) Fuel Hose

(2) Dipstick

9Y1200226CRS1501US0

3. Check the Fuel System



CAUTION

- Visually check there is no leak in the high pressure fuel pipe system.
- A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.

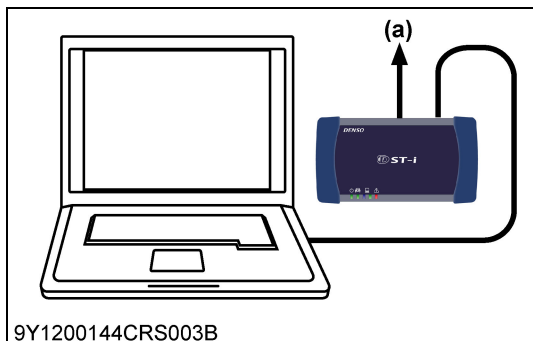
1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "4. Check the Rail Pressure Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

(1) Rail

(2) Supply Pump

9Y1200226CRS1502US0



4. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)

1. Check the rail pressure sensor.

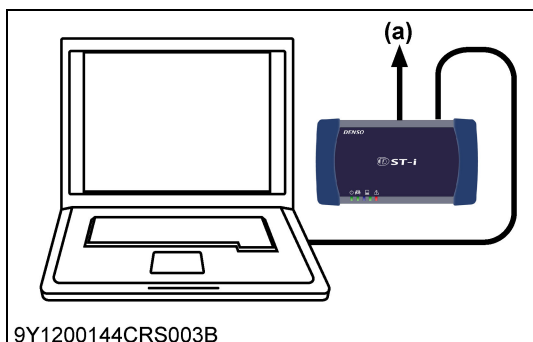
NOTE

- Closely check sensor signals for a noise component and an abnormality that exists for a short time.

OK	Go to "5. Check the DTC Again".
NG	Replace the rail assembly or its related parts. (Follow the diagnostic procedure of items P0192 and P0193.) (Refer to page 1-S404)

(a) CAN1 Connector

9Y1200226CRS1503US0



5. Check the DTC Again

1. Clear the past malfunction data, and make sure that the same DTC is output again in the reproduction test.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

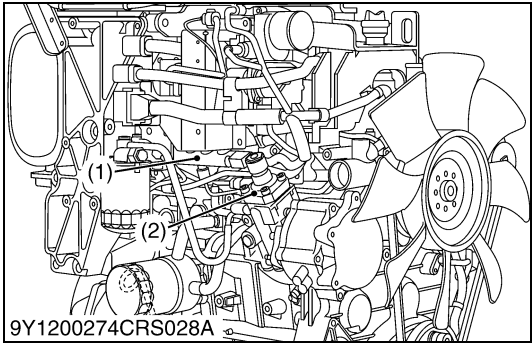
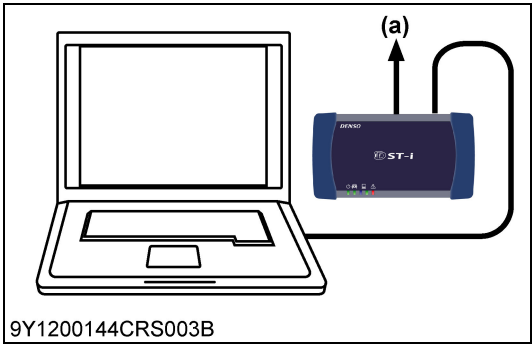
NOTE

- Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.

OK	Normal.
NG	Go to "6. Check the PCV (or PRV)-related Data".

(a) CAN1 Connector

9Y1200226CRS1504US0



6. Check the PCV (or PRV)-related Data

1. Check the "Target rail pressure" and "Actual rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	<div>1. The "Actual rail pressure" always follow to the "Target rail pressure".</div> <div>A: Normal operating</div> <div>B: Accelerator opening: 0→100 % (During acceleration)</div> <div>C: Accelerator closing: 100→0 % (During rapid deceleration)</div> <div>D: Just after key switch OFF</div>
OK	After confirming that an intermittent malfunction (such as power supply system or noise generation) does not occur in relation to the ECU, replace the ECU.
NG	Case A or B: Faulty PCV → Replace the supply pump. Case C or D: Faulty PRV → Replace the rail assembly.

- (1) Rail
- (2) Supply Pump

(a) **CAN1 Connector**

9Y1200226CRS1505US0

(39) Coil Short in Cylinder Injector (DTC P1A07 / 651-6, DTC P1A08 / 653-6, DTC P1A09 / 654-6, DTC P1A0A / 652-6)

DTC P1A07 / 651-6: Coil short in 1st cylinder injector

Behavior during malfunction:

- Insufficient output
- Engine vibration increases
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Injector coil short (over current)

DTC set preconditions:

- Battery voltage is normal
- During injection
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- Injector coil short (over current)

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- Injectors which have error stop injection
- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1506US0

DTC P1A08 / 653-6: Coil short in 3rd cylinder injector

Behavior during malfunction:

- Insufficient output
- Engine vibration increases
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Injector coil short (over current)

DTC set preconditions:

- Battery voltage is normal
- During injection
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- Injector coil short (over current)

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- Injectors which have error stop injection
- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1507US0

DTC P1A09 / 654-6: Coil short in 4th cylinder injector**Behavior during malfunction:**

- Insufficient output
- Engine vibration increases
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Injector coil short (over current)

DTC set preconditions:

- Battery voltage is normal
- During injection
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- Injector coil short (over current)

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- Injectors which have error stop injection
- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1508US0

DTC P1A0A / 652-6: Coil short in 2nd cylinder injector**Behavior during malfunction:**

- Insufficient output
- Engine vibration increases
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Injector coil short (over current)

DTC set preconditions:

- Battery voltage is normal
- During injection
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- Injector coil short (over current)

Engine warning light:

- ON

Limp home action by engine ECU (System action):

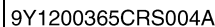
- Injectors which have error stop injection
- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

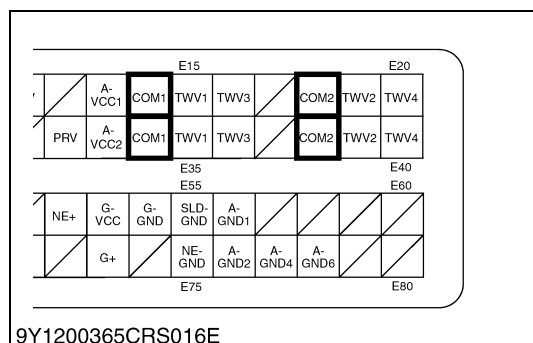
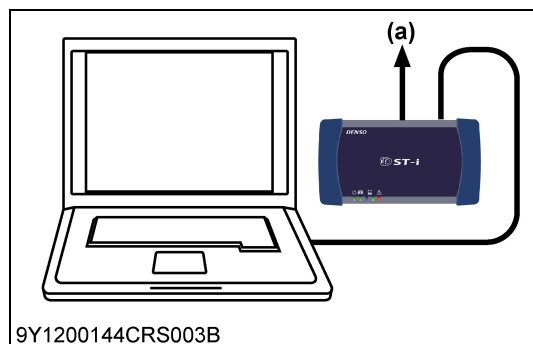
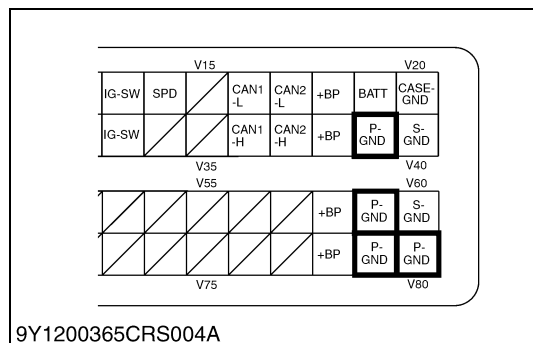
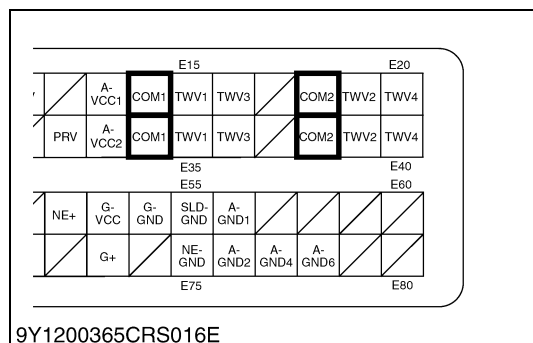
- Key switch turn OFF

Remark:

9Y1200226CRS1509US0



9Y1200365CRS016A



3. Measure the ECU Terminal Resistance (Part 1)

1. Place the key switch in the OFF position, unplug each ECU connector from socket.
2. Using an insulation resistance tester (megohmmeter tester), measure the resistance between ECU terminal E14 / E34 or E18 / E38 and "PGND" terminal.

Factory specification	10 MΩ or higher (between terminal and body, 500 V)
-----------------------	--

OK	Go to "4. Check the DTC".
NG	Go to "5. Measure the ECU Terminal Resistance (Part 2)".

9Y1200226CRS1513US0

4. Check the DTC

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Start the engine, and clear the past DTCs.
3. Read the DTC again.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

OK	Normal.
NG	Faulty ECU → Replace.

(a) CAN1 Connector

9Y1200226CRS1514US0

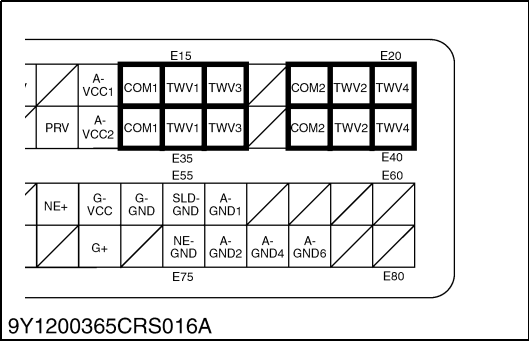
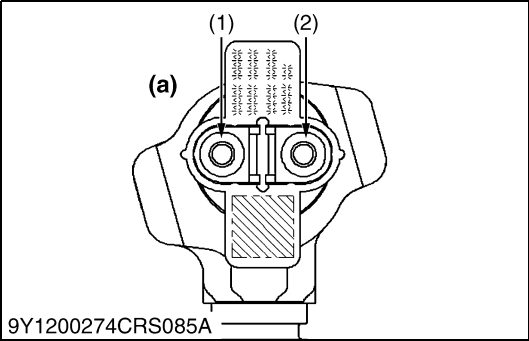
5. Measure the ECU Terminal Resistance (Part 2)

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector 1 (engine side) from the socket and measure the resistance between each of ECU terminal pins E14 / E34 or E18 / E38 and the "P-GND" terminal (at the wiring harness side).

Factory specification	10 MΩ or higher (between terminal and body, 500 V)
-----------------------	--

OK	Go to "6. Check the Wiring Harness".
NG	Faulty ECU → Replace the ECU.

9Y1200226CRS1515US0



6. Check the Wiring Harness

Locate the cause of wiring harness ground short, and repair the faulty area.

- Place the key switch in the OFF position, unplug each injector connector from socket, and visually check the connector status.

Factory specification	Must be free from sludge and sparks.
-----------------------	--------------------------------------

- Using an insulation resistance tester (megohmmeter tester), measure the resistance between each of terminals (1) and (2) and the chassis ground (at the injector side).

Factory specification	10 MΩ or higher (between terminal and body, 500 V)
-----------------------	--

OK	The injector functions normally. Locate another cause.
NG	Faulty injector → Replace the injector.

- (1) Terminal COMMON

(2) Terminal TWV
- (a) Injector
- 9Y1200226CRS1516US0

(40) Coil Short in PCV (DTC P1A0B / 523609-6)

Behavior during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops

Detection item:

- PCV coil short (over current)

DTC set preconditions:

- Battery voltage is normal
- During PCV driving
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- PCV coil short (over current)

Engine warning light:

- ON

Limp home action by engine ECU (System action):

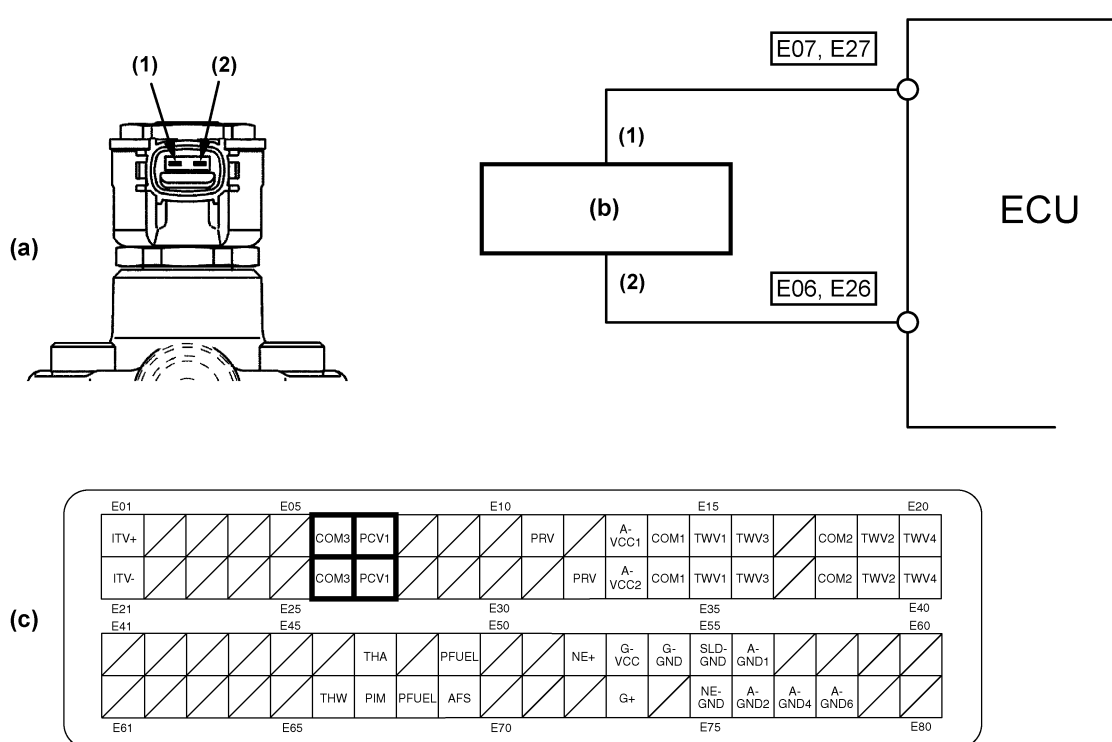
- Injectors which have error stop injection
- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1517US0



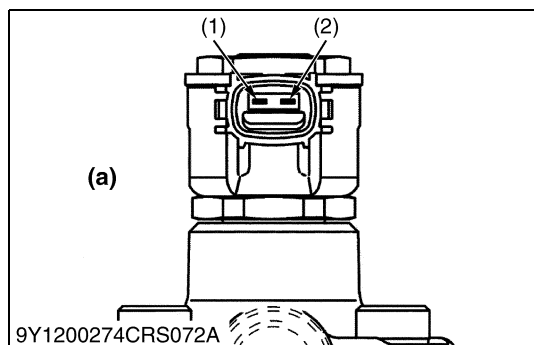
9Y1200365CRS003C

- (1) Terminal PCV-
(2) Terminal PCV+

(a) Terminal Layout

(b) PCV
(Pre-stroke Control Valve)(c) ECU Connector 1
(Engine Side)

9Y1200226CRS1518US0



1. Measure the Resistance Between PCV Terminals and Ground

- Place the key switch in the OFF position, unplug the PCV wiring harness connector from socket, and visually check the connector status.

Factory specification	Must be free from sludge and sparks.
-----------------------	--------------------------------------

- Using an insulation resistance tester (megohmmeter tester), measure the resistance between each of terminals (1) and (2) and the chassis ground (at the PCV side).

Factory specification	10 MΩ or higher (between terminal and body, 500 V)
-----------------------	--

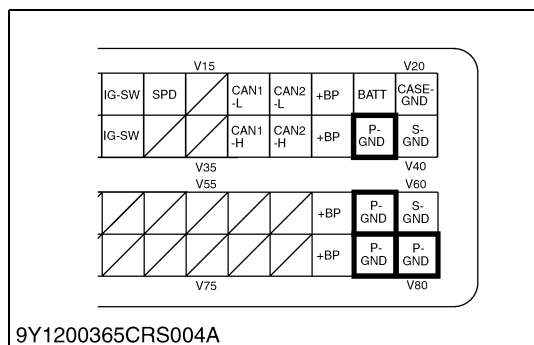
OK	Go to "2. Check the Connector and Wiring Harnesses for Poor Contact".
NG	Faulty PCV → Replace the supply pump.

(1) Terminal PCV-

(a) PCV (Pre-stroke Control Valve)

(2) Terminal PCV+

9Y1200226CRS1519US0



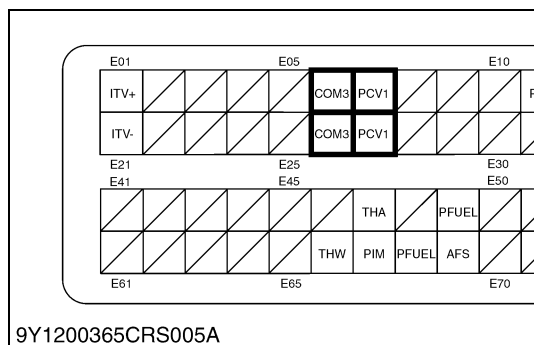
2. Check the Connector and Wiring Harnesses for Poor Contact

- Set the key switch to the OFF position, and check the wiring harness connectors and ECU pins for incorrect connection, deformation, poor contact or other defects.

Factory specification	Must be free from faulty connection, deformation, poor contact or other defects.
-----------------------	--

OK	Go to "3. Measure the Resistance Between ECU Terminals".
NG	Check the PCV wiring harnesses and connectors. → Repair.

9Y1200226CRS1520US0



3. Measure the Resistance Between ECU Terminals

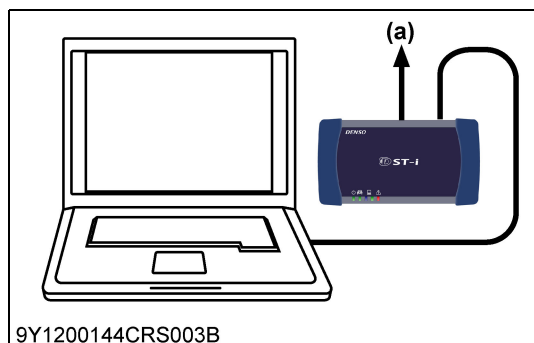
- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance each terminal of the connector.

Measurement terminal	E06, E26 ↔ E07, E27
----------------------	---------------------

Factory specification	2 Ω or lower
-----------------------	--------------

OK	Go to "4. Check the DTC".
NG	Check the wiring harnesses and connectors for a poor contact. → Repair.

9Y1200226CRS1521US0



4. Check the DTC

- Plug the ECU connector into socket, and start the engine.
- Clear the DTCs that occurred previously, and check the currently existing trouble.

Factory specification	No DTC is output.
-----------------------	-------------------

OK	Normal.
NG	Faulty ECU → Replace the ECU.

(a) CAN1 Connector

9Y1200226CRS1522US0

(41) Coil Short in PRV (DTC P1A0C / 523610-6)

Behavior during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops

Detection item:

- PRV coil short (over current)

DTC set preconditions:

- Battery voltage is normal
- During PRV driving
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- PRV coil short (over current)

Engine warning light:

- ON

Limp home action by engine ECU (System action):

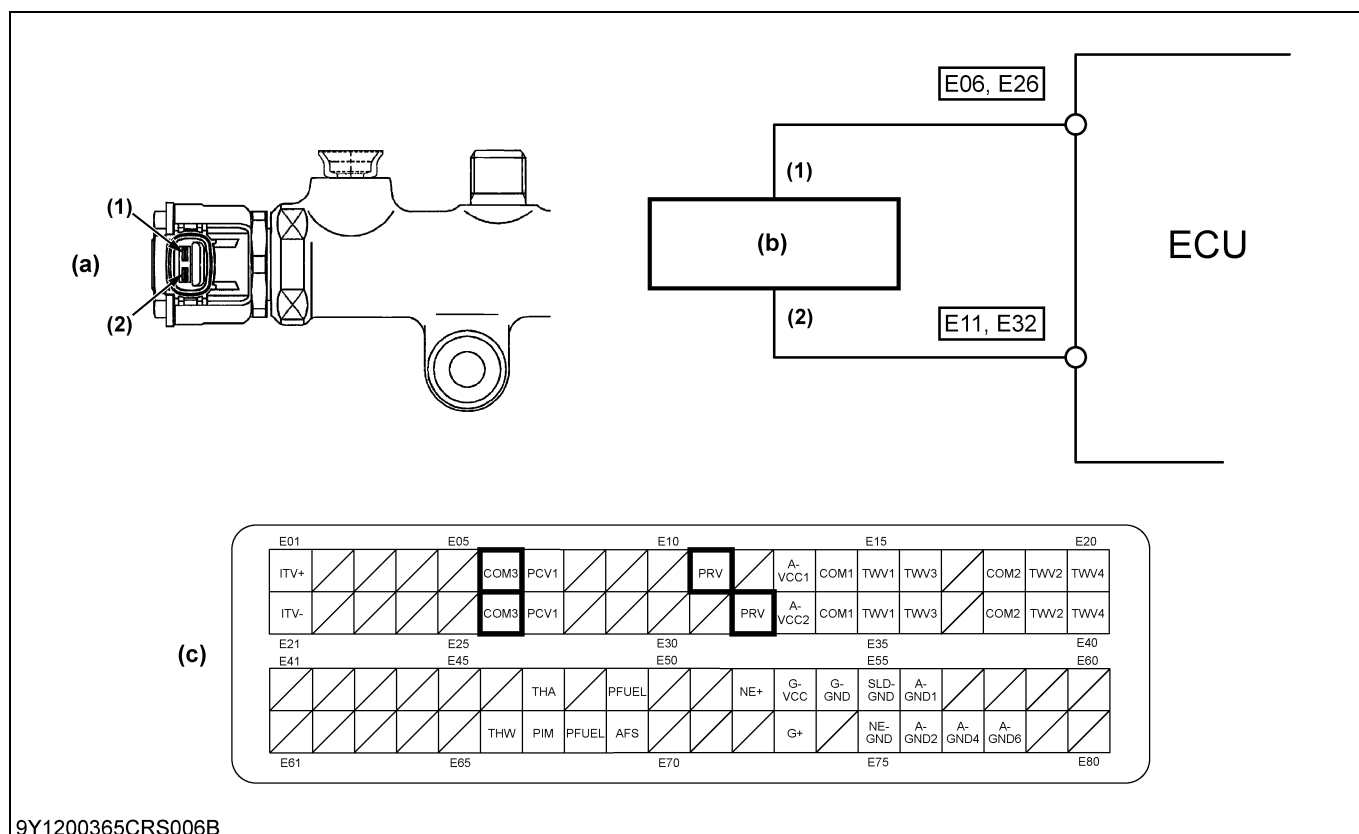
- Injectors which have error stop injection
- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1523US0



9Y1200365CRS006B

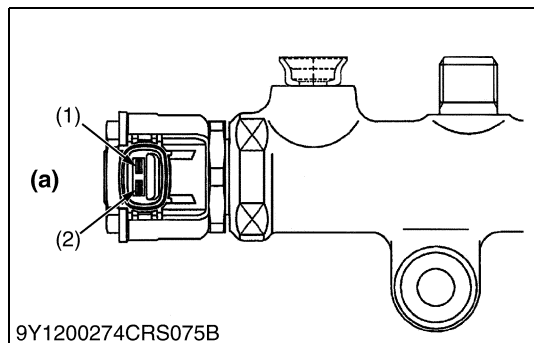
- (1) Terminal PRV+
(2) Terminal PRV-

(a) Terminal Layout

(b) PRV (Pressure Relief Valve)

(c) ECU Connector 1 (Engine Side)

9Y1200226CRS1524US0



1. Measure the Resistance Between PRV Terminals and Ground

- Place the key switch in the OFF position, unplug the PRV wiring harness connector from socket, and visually check the connector status.

Factory specification	Must be free from sludge and sparks.
-----------------------	--------------------------------------

- Using an insulation resistance tester (megohmmeter tester), measure the resistance between each of terminals (1) and (2) and the chassis ground (at the PRV side).

Factory specification	10 MΩ or higher (between terminal and body, 500 V)
-----------------------	--

OK	Go to "2. Check the Connector and Wiring Harnesses for Poor Contact".
NG	Faulty PRV → Replace the rail assembly.

(1) Terminal PRV+

(a) PRV (Pressure Relief Valve)

(2) Terminal PRV-

9Y1200226CRS1525US0

2. Check the Connector and Wiring Harnesses for Poor Contact

- Set the key switch to the OFF position, and check the wiring harness connectors and ECU pins for incorrect connection, deformation, poor contact or other defects.

Factory specification	Must be free from faulty connection, deformation, poor contact or other defects.
-----------------------	--

OK	Go to "3. Measure the Resistance Between ECU Terminals".
NG	Check the PCV wiring harnesses and connectors. → Repair.

9Y1200226CRS1526US0

3. Measure the Resistance Between ECU Terminals

- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance each terminal of the connector.

Measurement terminal	E06, E26 ↔ E11, E32
----------------------	---------------------

Factory specification	2 Ω or lower
-----------------------	--------------

OK	Go to "4. Check the DTC".
NG	Check the wiring harnesses and connectors for a poor contact. → Repair.

9Y1200226CRS1527US0

4. Check the DTC

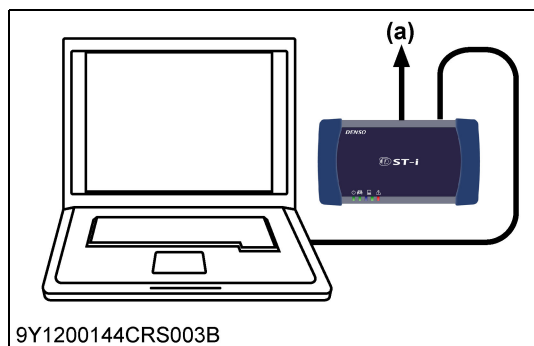
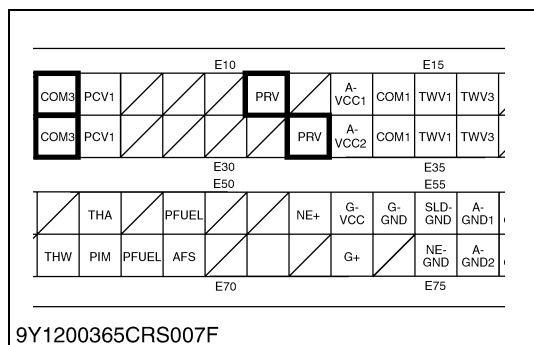
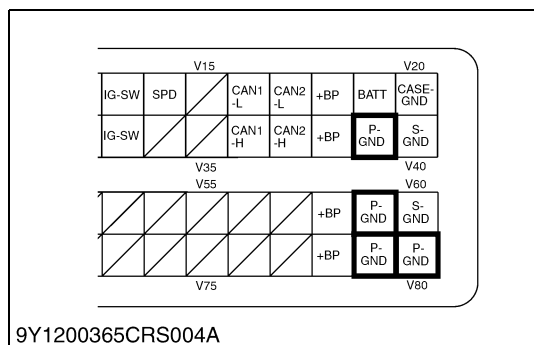
- Plug the ECU connector into socket, and start the engine.
- Clear the DTCs that occurred previously, and check the currently existing trouble.

Factory specification	No DTC is output.
-----------------------	-------------------

OK	Normal.
NG	Faulty ECU → Replace the ECU.

(a) CAN1 Connector

9Y1200226CRS1528US0



(42) High Pressure Pump too High (DTC P1A0D / 523611-2)

Behavior during malfunction:

- Engine stops

Detection item:

- High pressure pump too high

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated
- Key switch is ON

DTC set parameter:

- High pressure error detected specified times (Set pressure value are depending on engine speed)

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- Engine stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1529US0

Diagnostic Procedure for Pressure System DTCs

Checking of fault conditions and actions taken

If DTCs of non-pressure system are detected (*Refer to the pressure system DTCs given below.)

First locate the non-pressure system problem indicated by DTCs, and repair the affected parts. After the repair has been carried out, check for an output of pressure system DTCs. If so, begin the diagnosis of the affected pressure system.

If only pressure system DTCs are detected (*Refer to the pressure system DTCs given below.)

Diagnose the affected pressure system indicated by DTCs.

If a DTC currently exists

Begin diagnosis without returning the key switch to the OFF position. However, carefully make satisfactory / unsatisfactory judgments as the injection amount and rail pressure are limited by system actions.

If only a past DTC exists

Log the freeze-frame data, clear the DTCs, and stop the engine. Then, try to reproduce the problem using the freeze-frame data and the trouble check sheet.

***Pressure system DTCs**

[High pressure abnormality]

1. P0088: High rail pressure
2. P1A0D: High pressure pump too high

[Low pressure abnormality]

1. P0093: Fuel leak
2. P0191: Rail pressure too low

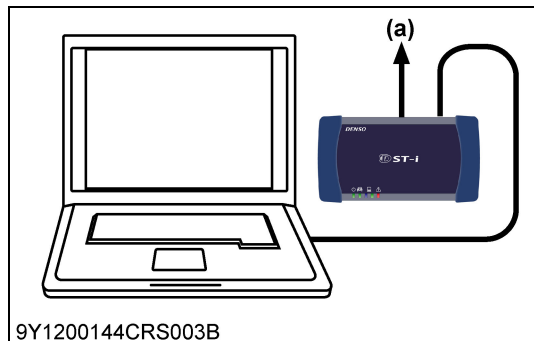
[Abnormal pressure]

1. P1274: Pump seizing 1
2. P1275: Pump seizing 2
3. P1A06: High pressure delivery system too high
4. P2293: Pressure relief valve error / PRV driving circuit error

■ IMPORTANT

- Multiple pressure system DTCs may be output simultaneously. Also, both abnormal high pressure and abnormal low pressure may be reported simultaneously under certain malfunction conditions.

9Y1200226CRS1530US0



1. Check the Data Related to the Rail Pressure

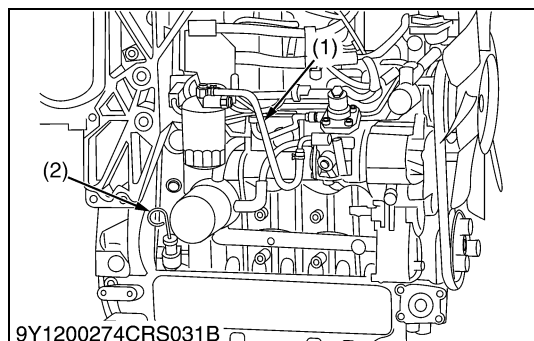
1. Connect the diagnosis tool to the CAN1 connector, and select the "Actual rail pressure" and "Target rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure"
	1. When idling: 35 to 60 MPa (360 to 610 kgf/cm ² , 5100 to 8700 psi)
	2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 155 MPa (1580 kgf/cm ² , 22500 psi)
	3. No-load maximum speed: 75.0 to 155 MPa (765 to 1580 kgf/cm ² , 10900 to 22400 psi)
	4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.

OK	Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.
NG	Go to "2. Check the Fuel System for the Existence of Air".

(a) CAN1 Connector

9Y1200226CRS1531US0



2. Check the Fuel System for the Existence of Air

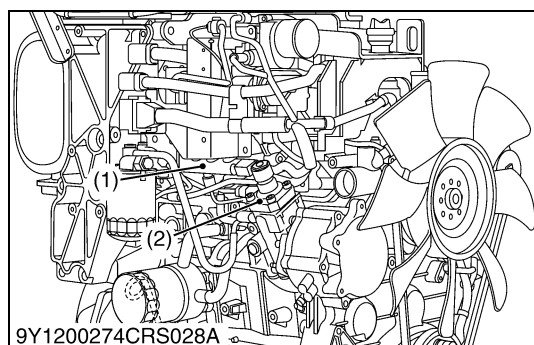
1. Check each joint of the fuel system for the existence of air.
To detect the existence of air effectively, replace the fuel hose with a transparent one.

OK	Go to "3. Check the Fuel System".
NG	Locate the position of the fuel leakage in the piping and repair it.

(1) Fuel Hose

(2) Dipstick

9Y1200226CRS1532US0



3. Check the Fuel System



CAUTION

- Visually check there is no leak in the high pressure fuel pipe system.
- A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.

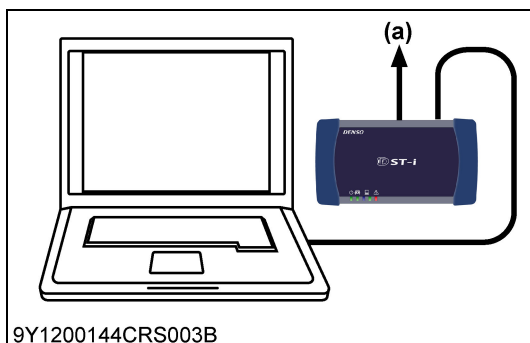
1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "4. Check the Rail Pressure Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

(1) Rail

(2) Supply Pump

9Y1200226CRS1533US0



4. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)

1. Check the rail pressure sensor.

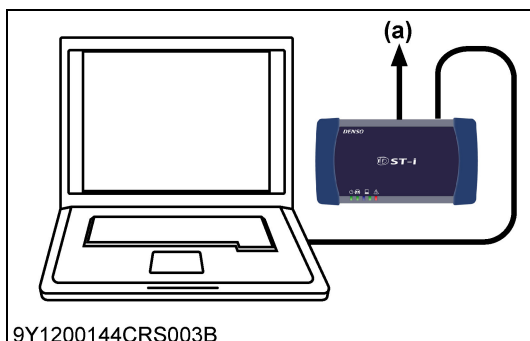
■ NOTE

- Closely check sensor signals for a noise component and an abnormality that exists for a short time.

OK	Go to "5. Check the DTC Again".
NG	Replace the rail assembly or its related parts. (Follow the diagnostic procedure of items P0192 and P0193.) (Refer to page 1-S404)

(a) CAN1 Connector

9Y1200226CRS1534US0



5. Check the DTC Again

1. Clear the past malfunction data, and make sure that the same DTC is output again in the reproduction test.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

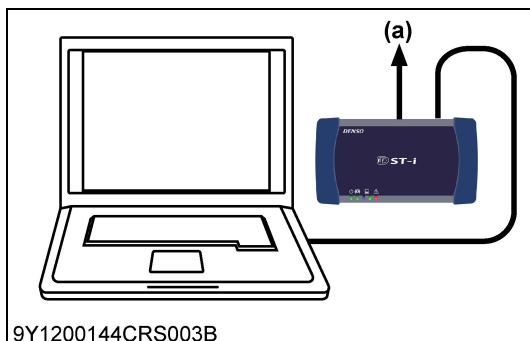
■ NOTE

- Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.

OK	Normal.
NG	Go to "6. Check the PCV (or PRV)-related Data".

(a) CAN1 Connector

9Y1200226CRS1535US0



6. Check the PCV (or PRV)-related Data

1. Check the "Target rail pressure" and "Actual rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

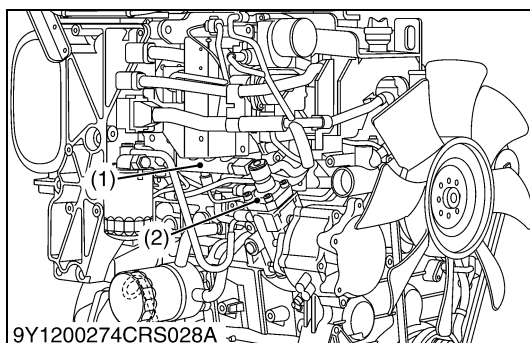
Factory specification	<ol style="list-style-type: none"> 1. The "Actual rail pressure" always follow to the "Target rail pressure". <p>A: Normal operating B: Accelerator opening: 0→100 % (During acceleration) C: Accelerator closing: 100→0 % (During rapid deceleration) D: Just after key switch OFF</p>
-----------------------	--

OK	After confirming that an intermittent malfunction (such as power supply system or noise generation) does not occur in relation to the ECU, replace the ECU.
NG	Case A or B: Faulty PCV → Replace the supply pump. Case C or D: Faulty PRV → Replace the rail assembly.

- (1) Rail
- (2) Supply Pump

(a) CAN1 Connector

9Y1200226CRS1536US0



(43) Lamp Driving Circuit Error (DTC P1A10 / 523621-3, DTC P1A11 / 523622-3, DTC P1A12 / 4115-3)

DTC P1A10 / 523621-3: Stop lamp error

Behavior during malfunction:

- None

Detection item:

- +B short of lamp driving circuit when lamp is on

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated
- Stop lamp is on

DTC set parameter:

- +B short circuit

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- None

Recovery from error:

- Key switch turn OFF

Remark:

- For driver circuit protection

9Y1200226CRS1537US0

DTC P1A11 / 523622-3: Low oil pressure lamp error

Behavior during malfunction:

- None

Detection item:

- +B short of lamp driving circuit when lamp is on

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated
- Low oil pressure lamp is on

DTC set parameter:

- +B short circuit

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- None

Recovery from error:

- Key switch turn OFF

Remark:

- For driver circuit protection

9Y1200226CRS1538US0

DTC P1A12 / 4115-3: Engine warning lamp error**Behavior during malfunction:**

- None

Detection item:

- +B short of lamp driving circuit when lamp is on

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated
- Engine warning lamp is on

DTC set parameter:

- +B short circuit

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- None

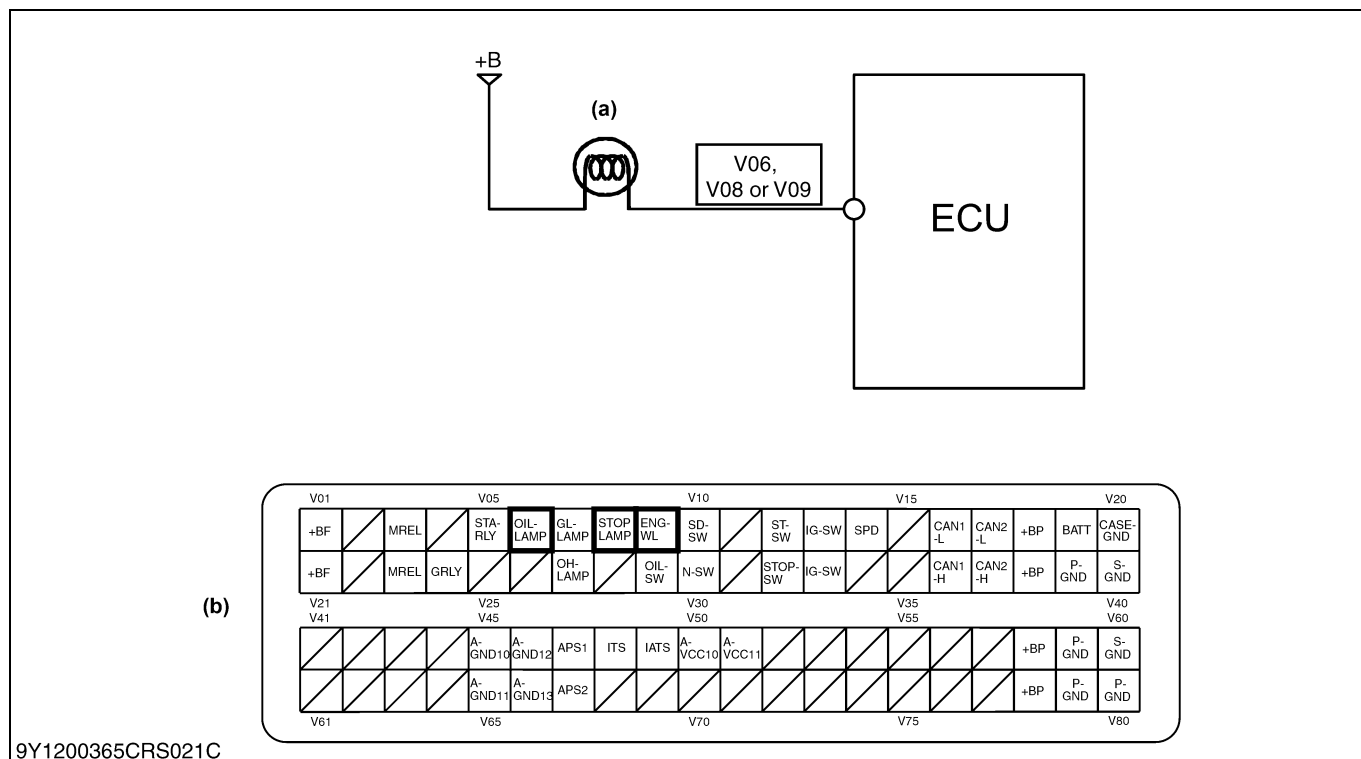
Recovery from error:

- Key switch turn OFF

Remark:

- For driver circuit protection

9Y1200226CRS1539US0

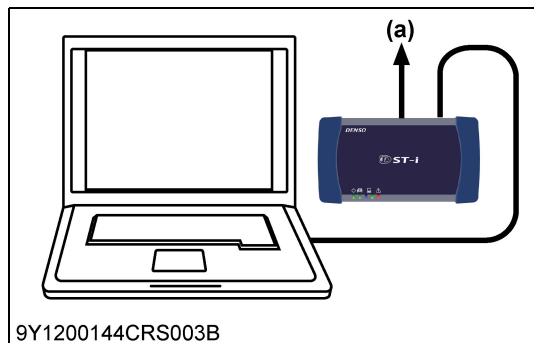


9Y1200365CRS021C

(a) P1A10: Stop Lamp
(Terminal V08)
P1A11: Low Oil Pressure
Lamp (Terminal V06)
P1A12: Engine Warning
Lamp (Terminal V09)

(b) ECU Connector 2
(Machine Side)

9Y1200226CRS1540US0



1. DTC Judgment

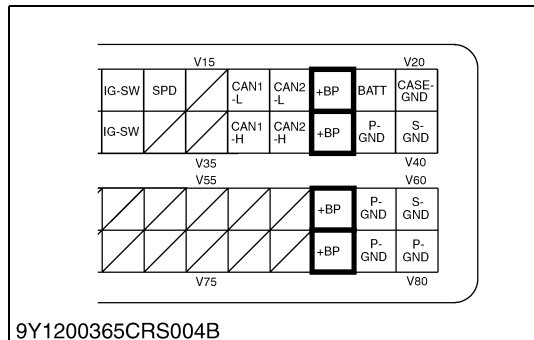
1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Place the key switch in the ON position, check whether the DTC (P1A10, P1A11 or P1A12) is output or not.

Factory specification	DTC (P1A10, P1A11 or P1A12) must not be output.
-----------------------	---

OK	Normal.
NG	Go to "2. Check the "+BP" Wiring Harness".

(a) CAN1 Connector

9Y1200226CRS1541US0



2. Check the "+BP" Wiring Harness

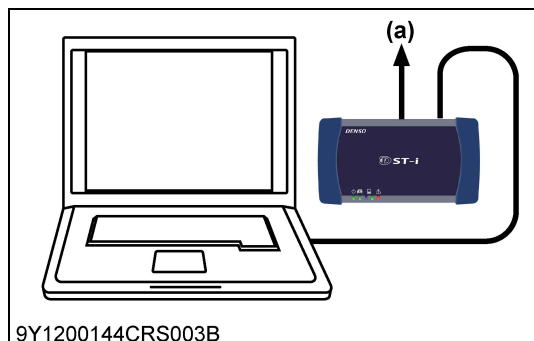
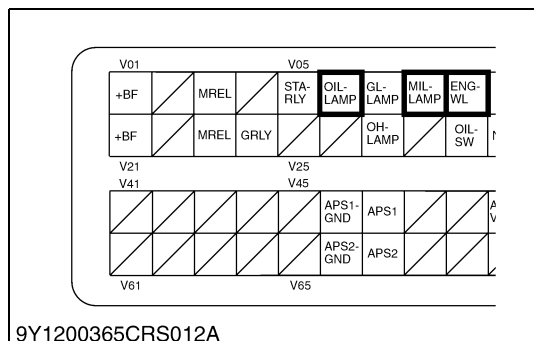
1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between ECU wiring harness connector V18 / V38 / V58 / V78 and following terminal.

DTC	ECU Connector Terminal
P1A10	V08
P1A11	V06
P1A12	V09

Factory specification	several Ω to several k Ω
-----------------------	--

OK	Go to "3. Check the DTC".
NG	Check the wiring harness → Repair or replace the faulty area.

9Y1200226CRS1542US0



3. Check the DTC

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Start the engine, and clear the past DTCs.
3. Read the DTC again.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

OK	Normal.
NG	Faulty ECU → Replace the ECU.

(a) CAN1 Connector

9Y1200226CRS1543US0

(44) SUB CPU Software Version Unmatch (DTC P1A16 / 523626-2)

Behavior during malfunction:

- Engine stops

Detection item:

- SUB CPU software version unmatch

DTC set preconditions:

- Key switch is ON
- Battery voltage is 10 V or more
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- SUB CPU software version unmatch

Engine warning light:

- ON

Limp home action by engine ECU (System action):

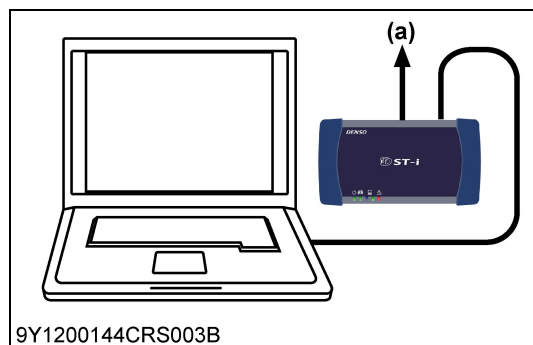
- Engine stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1544US0



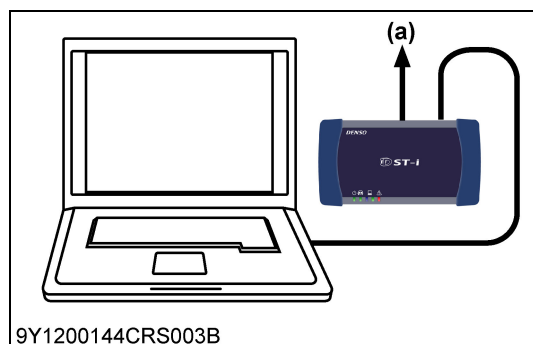
1. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Place the key switch in the ON position, check whether the DTC (P1A16) is output or not.

Factory specification	DTC (P1A16) must not be output.
OK	Normal.
NG	Go to "2. Check the DTC".

(a) CAN1 Connector

9Y1200226CRS1545US0



2. Check the DTC

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Rewrite the ECU main programming data again.
3. Read the DTC again.

Factory specification	Normal (No DTC is output.)
OK	Normal.
NG	Faulty ECU → Replace the ECU.

(a) CAN1 Connector

9Y1200226CRS1546US0

(45) TWV Boost Time-out (DTC P1A18 / 651-8, DTC P1A19 / 653-8, DTC P1A1A / 654-8, DTC P1A1B / 652-8)

DTC P1A18 / 651-8: TWV1 boost time-out

Behavior during malfunction:

- Insufficient output
- Engine vibration increases
- Worsening exhaust gas emissions

Detection item:

- Open circuit of discharge MOS-IC in ECU

DTC set preconditions:

- Battery voltage is normal
- During injection
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- Open circuit of discharge MOS-IC in ECU

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1547US0

DTC P1A19 / 653-8: TWV2 boost time-out

Behavior during malfunction:

- Insufficient output
- Engine vibration increases
- Worsening exhaust gas emissions

Detection item:

- Open circuit of discharge MOS-IC in ECU

DTC set preconditions:

- Battery voltage is normal
- During injection
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- Open circuit of discharge MOS-IC in ECU

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1548US0

DTC P1A1A / 654-8: TWV3 boost time-out**Behavior during malfunction:**

- Insufficient output
- Engine vibration increases
- Worsening exhaust gas emissions

Detection item:

- Open circuit of discharge MOS-IC in ECU

DTC set preconditions:

- Battery voltage is normal
- During injection
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- Open circuit of discharge MOS-IC in ECU

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1549US0

DTC P1A1B / 652-8: TWV4 boost time-out**Behavior during malfunction:**

- Insufficient output
- Engine vibration increases
- Worsening exhaust gas emissions

Detection item:

- Open circuit of discharge MOS-IC in ECU

DTC set preconditions:

- Battery voltage is normal
- During injection
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- Open circuit of discharge MOS-IC in ECU

Engine warning light:

- ON

Limp home action by engine ECU (System action):

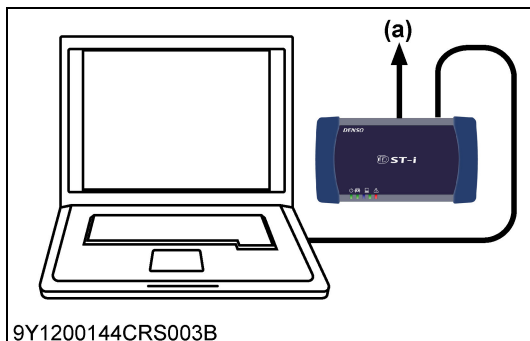
- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1550US0

**1. DTC Judgment**

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Operate the engine by performing the actual run test.
3. Place the key switch in the ON position, check whether the DTC (P1A18, P1A19, P1A1A or P1A1B) is output or not.

Factory specification	DTC (P1A18, P1A19, P1A1A or P1A1B) must not be output.
OK	Normal.
NG	Replace the ECU.

(a) CAN1 Connector

9Y1200226CRS1551US0

(46) Intake Throttle Feedback Error (DTC P2108 / 523580-2)

Behaviour during malfunction:

- None

Detection item:

- Intake throttle feedback error

DTC set preconditions:

- Battery voltage is normal

DTC set parameter (Approximate parameter):

- Deviation of throttle position is not corrected in 20 times of duty error recovery action

Engine warning light:

- ON

Limp home action by engine ECU (system action):

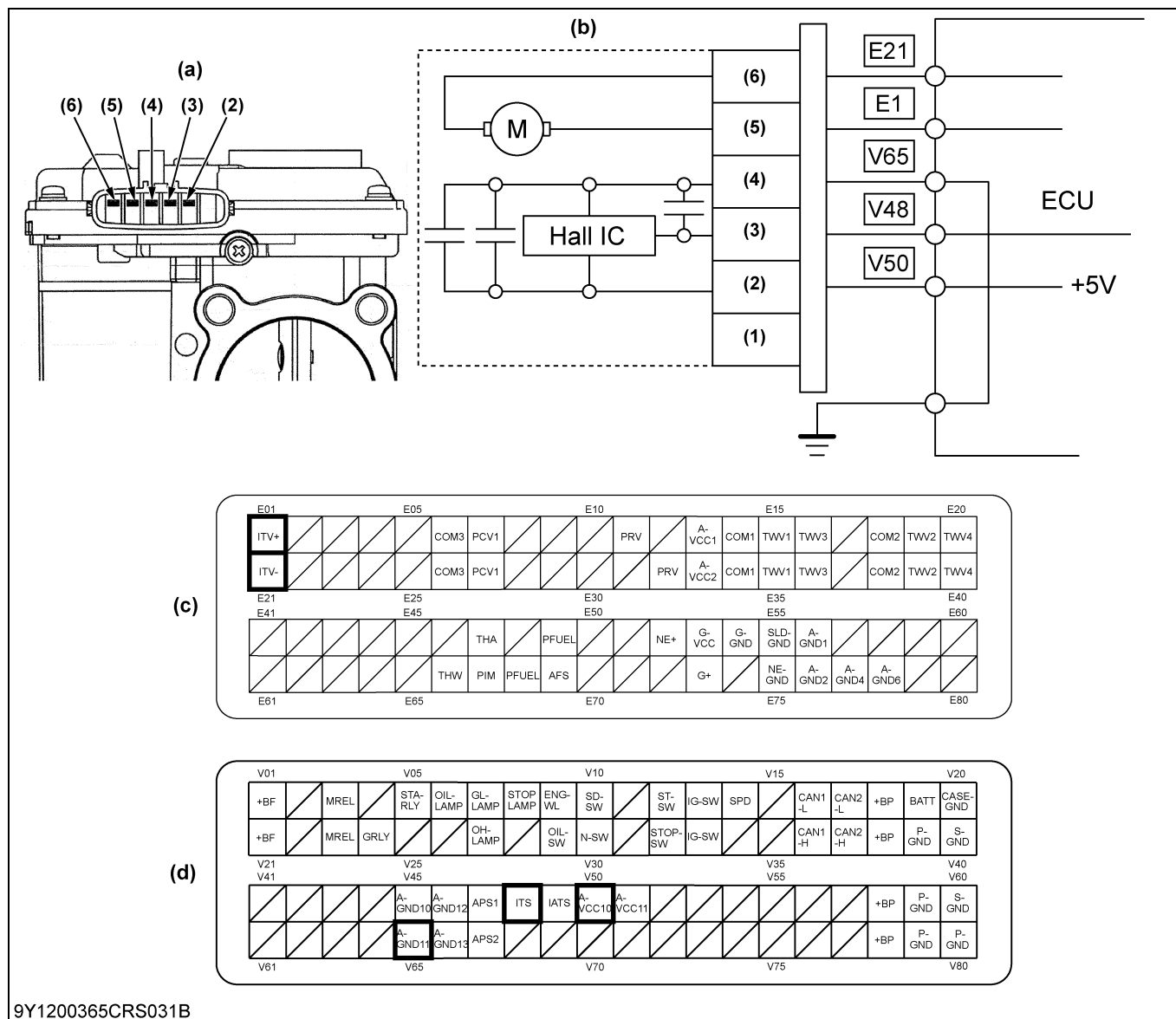
- Output limitation: Approximately 75 % of normal condition
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1552US0



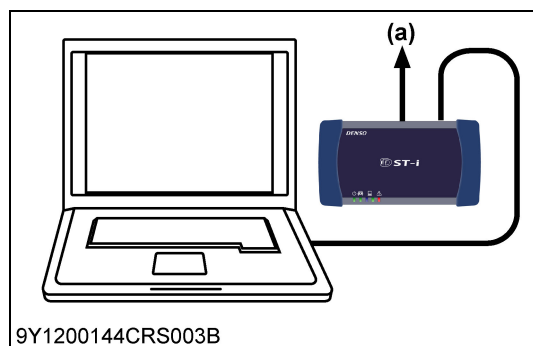
- (1) No Connection
(2) Terminal A-VCC10 (+5 V)
(3) Terminal ITS (Output)

- (4) Terminal A-GND11 (Ground)
(5) Terminal ITV-
(6) Terminal ITV+

- (a) Terminal Layout
(b) Intake Throttle Valve

- (c) ECU Connector 1 (Engine Side)
(d) ECU Connector 2 (Machine Side)

9Y1200226CRS1553US0



1. Check the Intake Throttle Signal

- After operating the engine, perform an active test. Monitor the "Actual intake throttle valve opening" and "Intake throttle opening output voltage", and check the values.
*** For details, refer to the active test section.**
- Clear the DTC and check whether it is output again or not.

Factory specification	No DTC is output.
OK	Normal.
NG	Replace the intake throttle assembly.

- (a) CAN1 Connector

9Y1200226CRS1554US0

(47) Accelerator Position Sensor 1 Abnormality (DTC P2122 / 91-4, P2123 / 91-3)

P2122 / 91-4: Accelerator position sensor 1: Low

Behaviour during malfunction:

- Insufficient output

Detection item:

- Ground short circuit or open circuit of sensor or harness

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC2 is normal

DTC set parameter:

- Voltage of accelerator position sensor 1 is 0.3 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Forced Idle (Accelerator = 0 %)

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1555US0

P2123 / 91-3: Accelerator position sensor 1: High

Behaviour during malfunction:

- Insufficient output

Detection item:

- Battery short circuit out of sensor or harness

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC2 is normal

DTC set parameter:

- Voltage of accelerator position sensor 1 is 4.8 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

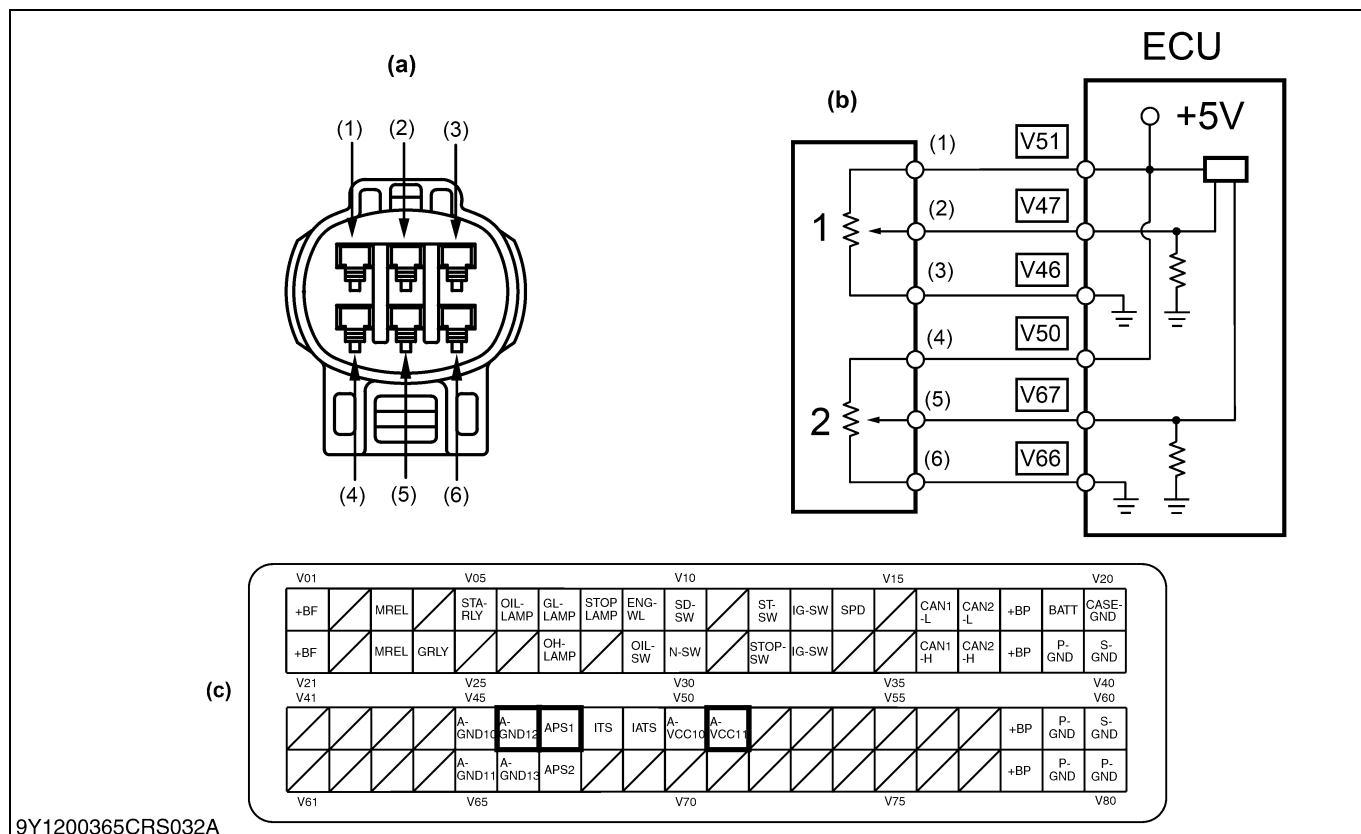
- Forced Idle (Accelerator = 0 %)

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1556US0

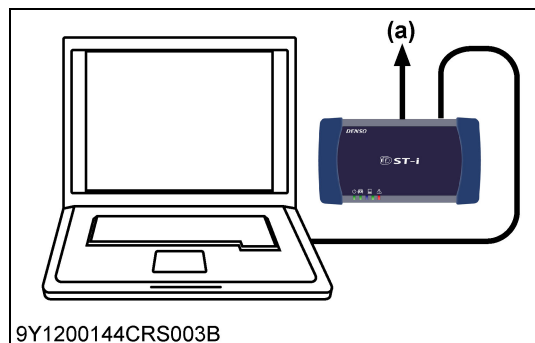


9Y1200365CRS032A

- (1) Terminal A-VCC11
 (2) Terminal APS1
 (3) Terminal APS1 GND
 (4) Terminal A-VCC10
 (5) Terminal APS2
 (6) Terminal APS2 GND

- (a) Terminal Layout
 (b) Accelerator Position Sensor
 (c) ECU Connector 2 (Machine Side)

9Y1200226CRS1557US0



9Y1200144CRS003B

1. Check the Accelerator Position Sensor Signals

- Place the key switch in the ON position, and check the "Accelerator position" and "Accelerator position sensor 1 output voltage" on the diagnosis tool data monitor.

Factory specification		
Actual accelerator pedal position	Accelerator pedal position	Output voltage
Fully close	0 %	1.35 V or lower (1.1) (): Follow the OEM adjusted value
Fully open	100 %	4.0 V or higher (4.2) (): Follow the OEM adjusted value

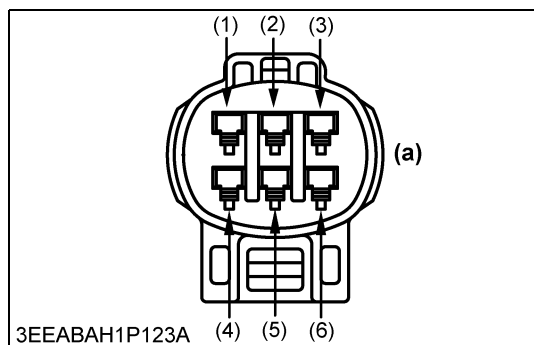
NOTE

- "Full close" and "Full open" are with the accelerator position sensor, not with the accelerator pedal or hand accelerator.

OK	Clear the DTC and check whether it is detected again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Voltage Between Sensor Terminals".	

- (a) CAN1 Connector

9Y1200226CRS1558US0



2. Measure the Voltage Between Sensor Terminals

1. Place the key switch in the OFF position, unplug the accelerator position sensor connector from the socket, and return the key switch to the ON position again.
2. Measure the voltage between terminals (1) and (3) of accelerator position sensor connector (at the machine wiring harness side).

Factory specification	4.5 to 5.5 V
-----------------------	--------------

OK	Go to "4. Measure the ECU Terminal Voltage".
NG	Go to "3. Measure the Terminal Voltage".

- (1) Terminal A-VCC11
- (2) Terminal APS1
- (3) Terminal APS1 GND
- (4) Terminal A-VCC10
- (5) Terminal APS2
- (6) Terminal APS2 GND

(a) Terminal Layout

9Y1200226CRS1559US0

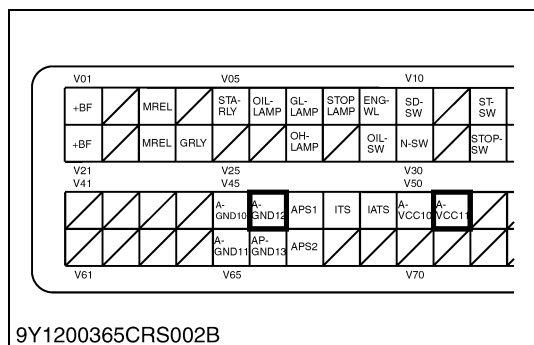
3. Measure the Terminal Voltage

1. Measure the voltage between ECU terminals V46 and V51.

Factory specification	4.5 to 5.5 V
-----------------------	--------------

OK	The wiring harness between the ECU and sensor is faulty. → Repair.
NG	Check the ECU connectors.
OK	Faulty ECU → Replace.
NG	Repair the ECU connectors.

9Y1200226CRS1560US0



4. Measure the ECU Terminal Voltage

1. Place the key switch in the OFF position, and plug the accelerator position sensor connector into the socket.
2. Place the key switch in the ON position, and measure the voltage between ECU terminals V47 and V46.

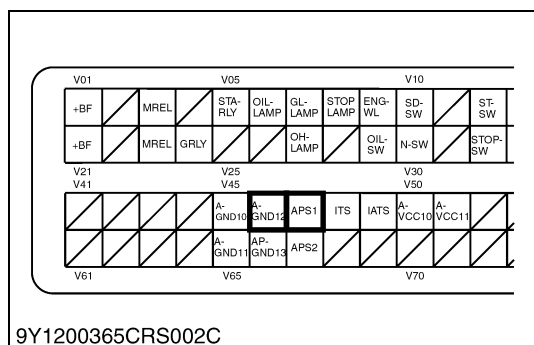
Factory specification	Accelerator pedal fully closed: 1.35 V or lower (1.1) Accelerator pedal full throttle: 4.0 V or higher (4.2) (): Follow the OEM adjusted value
-----------------------	---

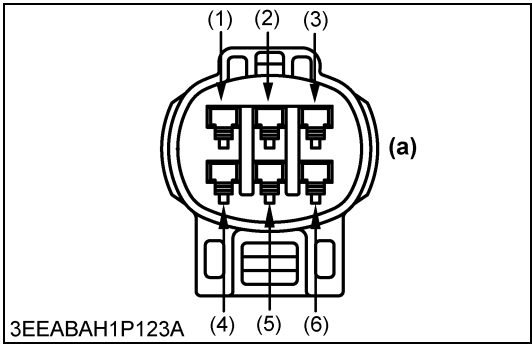
NOTE

- "Full close" and "Full open" are with the accelerator position sensor, not with the accelerator pedal or hand accelerator.

OK	Check the ECU connectors.
OK	Faulty ECU → Replace.
NG	Repair the ECU connectors.
NG	Go to "5. Measure the Voltage Between Sensor Terminals".

9Y1200226CRS1561US0





5. Measure the Voltage Between Sensor Terminals

1. Keep the accelerator position sensor connector plugged into socket.
2. Measure the voltage between terminals (2) and (3) of accelerator position sensor connector (at the machine wiring harness side).

Factory specification	Accelerator pedal fully closed: 1.35 V or lower (1.1) Accelerator pedal full throttle: 4.0 V or higher (4.2) (): Follow the OEM adjusted value
-----------------------	---

OK	Wiring harness open circuit, short → Check and repair.
NG	Faulty accelerator sensor → Replace.

- (1) Terminal A-VCC11
- (2) Terminal APS1
- (3) Terminal APS1 GND
- (4) Terminal A-VCC10
- (5) Terminal APS2
- (6) Terminal APS2 GND

(a) Terminal Layout

9Y1200226CRS1562US0

(48) Accelerator Position Sensor 2 Abnormality (DTC P2127 / 29-4, P2128 / 29-3)

P2127 / 29-4: Accelerator position sensor 2: Low

Behaviour during malfunction:

- Insufficient output

Detection item:

- Ground short circuit or open circuit of sensor or harness

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC1 is normal

DTC set parameter:

- Voltage of accelerator position sensor 2 is 0.3 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Forced Idle (Accelerator = 0 %)

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1563US0

P2128 / 29-3: Accelerator position sensor 2: High

Behaviour during malfunction:

- Insufficient output

Detection item:

- Battery short circuit out of sensor or harness

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC1 is normal

DTC set parameter:

- Voltage of accelerator position sensor 2 is 4.8 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

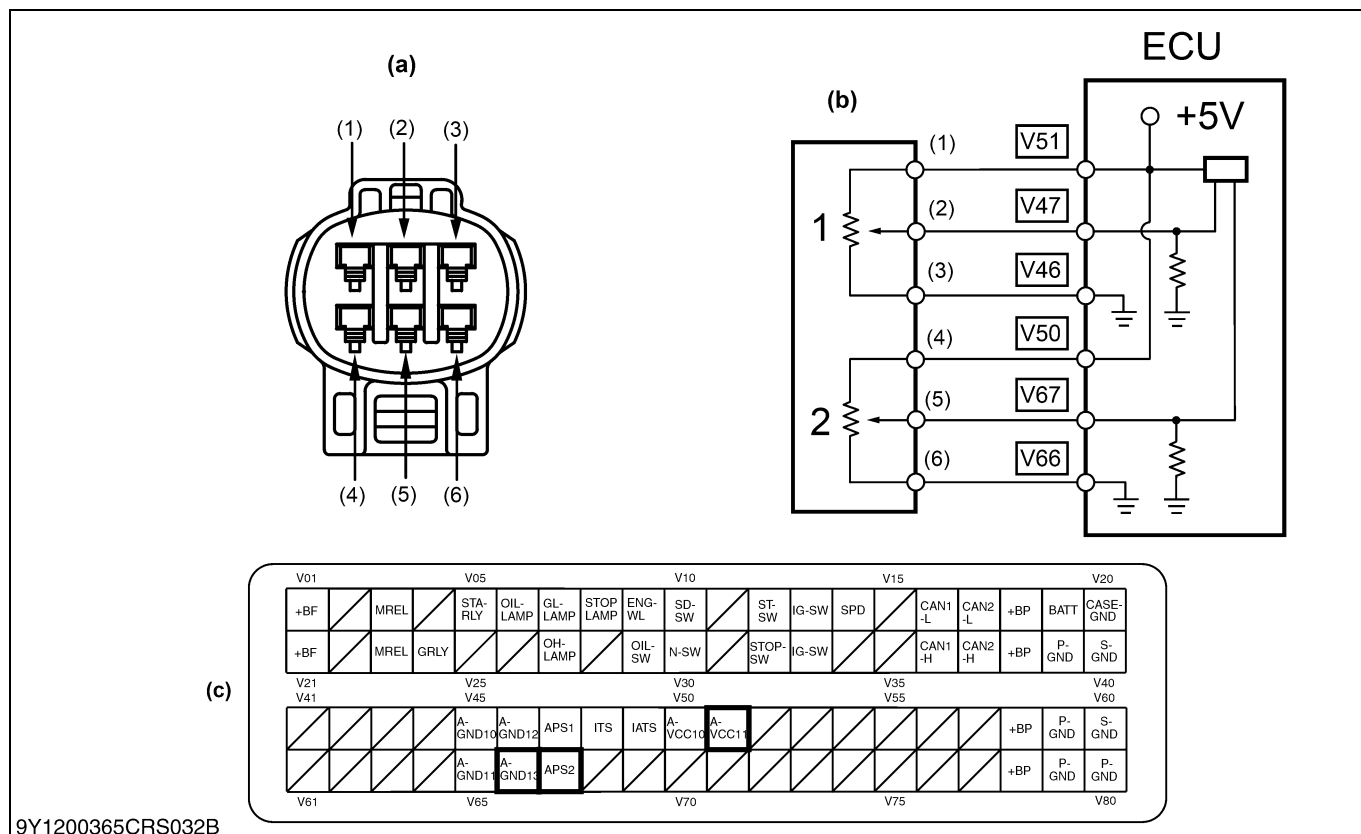
- Forced Idle (Accelerator = 0 %)

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1564US0

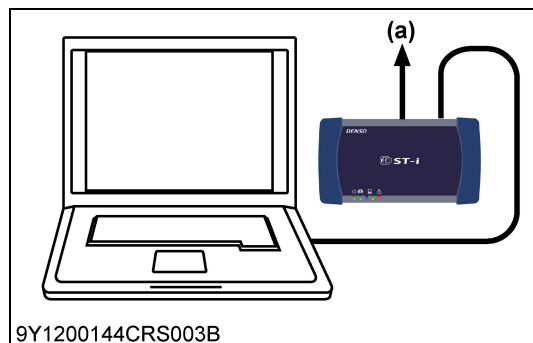


9Y1200365CRS032B

- (1) Terminal A-VCC11
 (2) Terminal APS1
 (3) Terminal APS1 GND
 (4) Terminal A-VCC10
 (5) Terminal APS2
 (6) Terminal APS2 GND

- (a) Terminal Layout
 (b) Accelerator Position Sensor
 (c) ECU Connector 2 (Machine Side)

9Y1200226CRS1565US0



9Y1200144CRS003B

1. Check the Accelerator Position Sensor Signals

- Place the key switch in the ON position, and check the "Accelerator position" and "Accelerator position sensor 2 output voltage" on the diagnosis tool data monitor.

Factory specification		
Actual accelerator pedal position	Accelerator pedal position	Output voltage
Fully close	0 %	1.35 V or lower (1.1) (): Follow the OEM adjusted value
Fully open	100 %	4.0 V or higher (4.2) (): Follow the OEM adjusted value

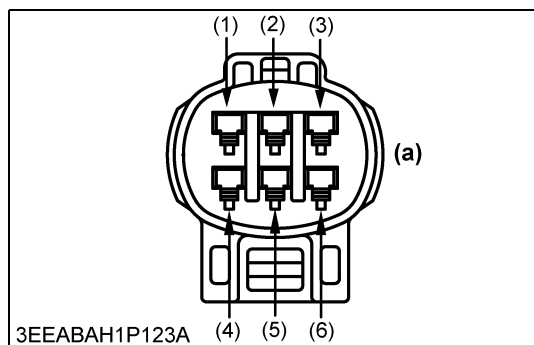
NOTE

- "Full close" and "Full open" are with the accelerator position sensor, not with the accelerator pedal or hand accelerator.

OK	Clear the DTC and check whether it is detected again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Voltage Between Sensor Terminals".	

- (a) CAN1 Connector

9Y1200226CRS1566US0



2. Measure the Voltage Between Sensor Terminals

1. Place the key switch in the OFF position, unplug the accelerator position sensor connector from the socket, and return the key switch to the ON position again.
2. Measure the voltage between terminals (4) and (6) of accelerator position sensor connector (at the machine wiring harness side).

Factory specification	4.5 to 5.5 V
-----------------------	--------------

OK	Go to "4. Measure the ECU Terminal Voltage".
NG	Go to "3. Measure the Terminal Voltage".

- (1) Terminal A-VCC11
- (2) Terminal APS1
- (3) Terminal APS1 GND
- (4) Terminal A-VCC10
- (5) Terminal APS2
- (6) Terminal APS2 GND

(a) Terminal Layout

9Y1200226CRS1567US0

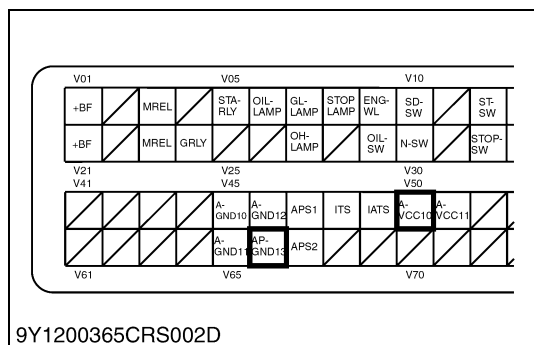
3. Measure the Terminal Voltage

1. Measure the voltage between ECU terminals V50 and V66.

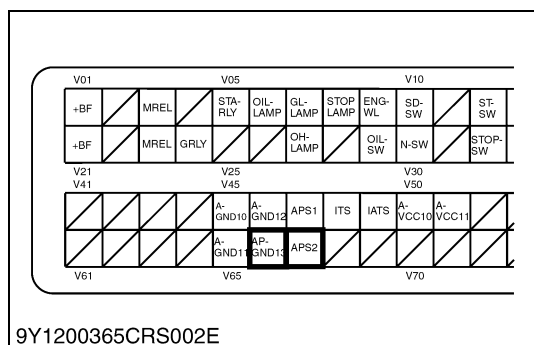
Factory specification	4.5 to 5.5 V
-----------------------	--------------

OK	The wiring harness between the ECU and sensor is faulty. → Repair.
NG	Check the ECU connectors.
OK	Faulty ECU → Replace.
NG	Repair the ECU connectors.

9Y1200226CRS1568US0



9Y1200365CRS002D



9Y1200365CRS002E

4. Measure the ECU Terminal Voltage

1. Place the key switch in the OFF position, and plug the accelerator position sensor connector into the socket.
2. Place the key switch in the ON position, and measure the voltage between ECU terminals V66 and V67.

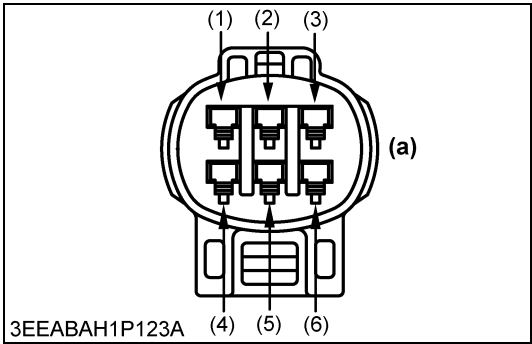
Factory specification	Accelerator pedal fully closed: 1.35 V or lower (1.1) Accelerator pedal full throttle: 4.0 V or higher (4.2) (): Follow the OEM adjusted value
-----------------------	---

NOTE

- "Full close" and "Full open" are with the accelerator position sensor, not with the accelerator pedal or hand accelerator.

OK	Check the ECU connectors.
OK	Faulty ECU → Replace.
NG	Repair the ECU connectors.
NG	Go to "5. Measure the Voltage Between Sensor Terminals".

9Y1200226CRS1569US0



5. Measure the Voltage Between Sensor Terminals

1. Keep the accelerator position sensor connector plugged into socket.
2. Measure the voltage between terminals (5) and (6) of accelerator position sensor connector (at the machine wiring harness side).

Factory specification	Accelerator pedal fully closed: 1.35 V or lower (1.1) Accelerator pedal full throttle: 4.0 V or higher (4.2) (): Follow the OEM adjusted value
-----------------------	---

OK	Wiring harness open circuit, short → Check and repair.
NG	Faulty accelerator sensor → Replace.

- (1) Terminal A-VCC11

(2) Terminal APS1

(3) Terminal APS1 GND

(4) Terminal A-VCC10

(5) Terminal APS2

(6) Terminal APS2 GND
- (a) Terminal Layout

9Y1200226CRS1570US0

(49) Accelerator Position Sensor Error (CAN) (DTC P2131 / 523543-2)

Behaviour during malfunction:

- Insufficient output

Detection item:

- Accelerator position sensor signal error (sensor or harness open circuit, ground short circuit etc.)

DTC set preconditions:

- Battery voltage is normal
- Key switch turn ON
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Accelerator position sensor error signal received by CAN

Engine warning light:

- ON

Limp home action by engine ECU (system action):

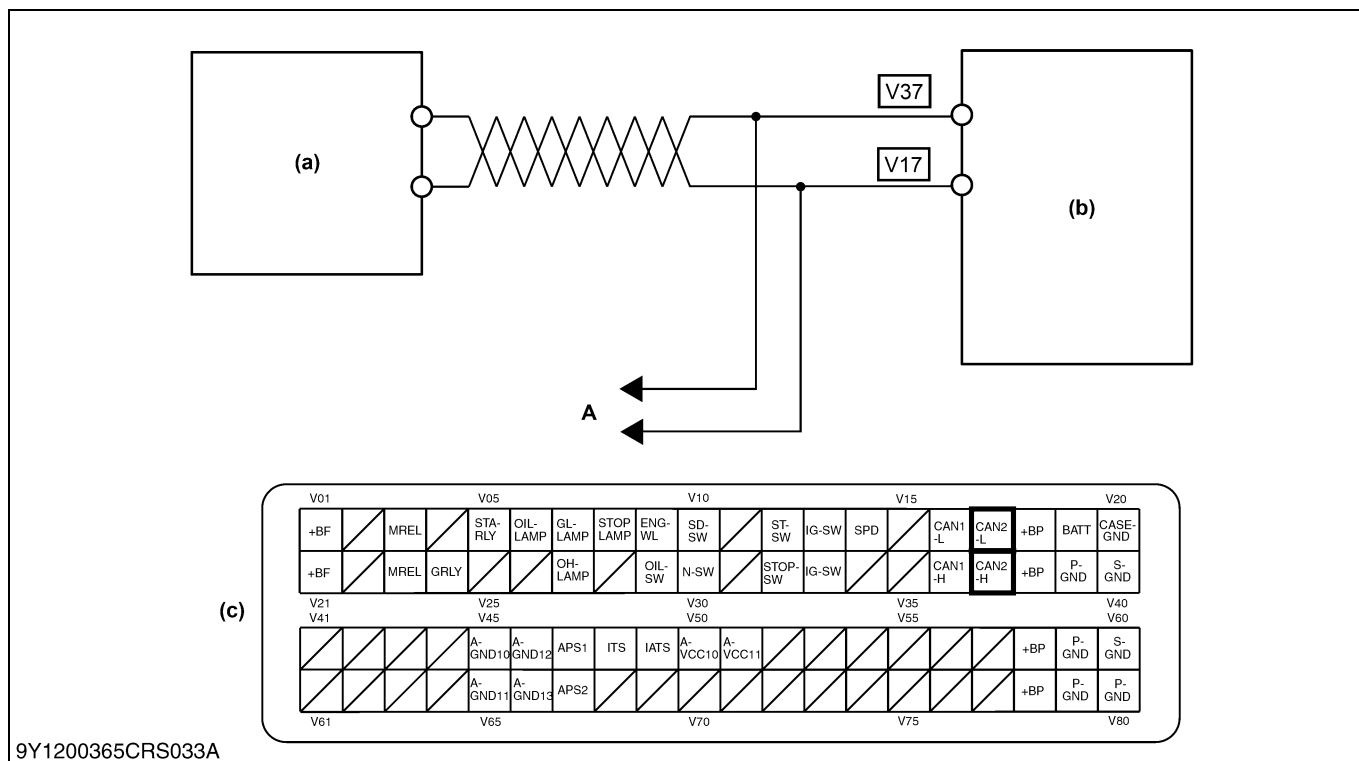
- Not applicable

Recovery from error:

- Diagnostic counter = zero (CAN signal recovers)

Remark:

9Y1200226CRS1571US0



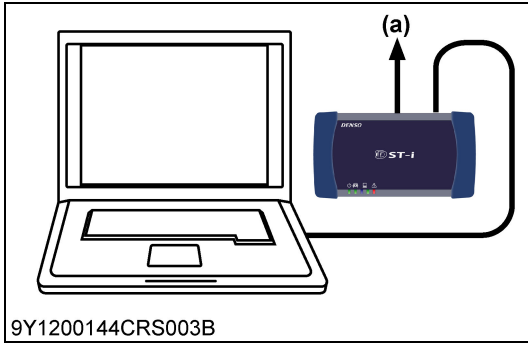
(a) ECU for Machine

(b) Engine ECU

(c) ECU Connector 2
(Machine Side)

A: To Other ECU

9Y1200226CRS1572US0



1. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position, check whether the DTC (P2131) is output or not.

Factory specification	No DTC (P2131) is output.
-----------------------	---------------------------

OK	Normal.
NG	Go to "2. Check the Monitor of the Machine".

(a) CAN1 Connector

9Y1200226CRS1573US0

2. Check the Monitor of the Machine

1. Turn on the key switch and confirm that no defects except those in the engine occur.

Factory specification	No defects except that in the engine occur.
-----------------------	---

OK	Possible defects in the ECU for the machine. Execute the diagnosis according to the workshop manual for the machine.
NG	Defects in the accelerator sensor signal. Execute the diagnosis according to the workshop manual for the machine.

9Y1200226CRS1574US0

(50) Injector Drive Circuit Open in No. 1 and 4 Cylinder Simultaneously (DTC P2146 / 523523-2)

Behaviour during malfunction:

- Insufficient output
- Engine vibration increases
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Wiring harness open circuit

DTC set preconditions:

- Engine is operating
- Battery voltage is normal
- During injection
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- Wiring harness open circuit

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop

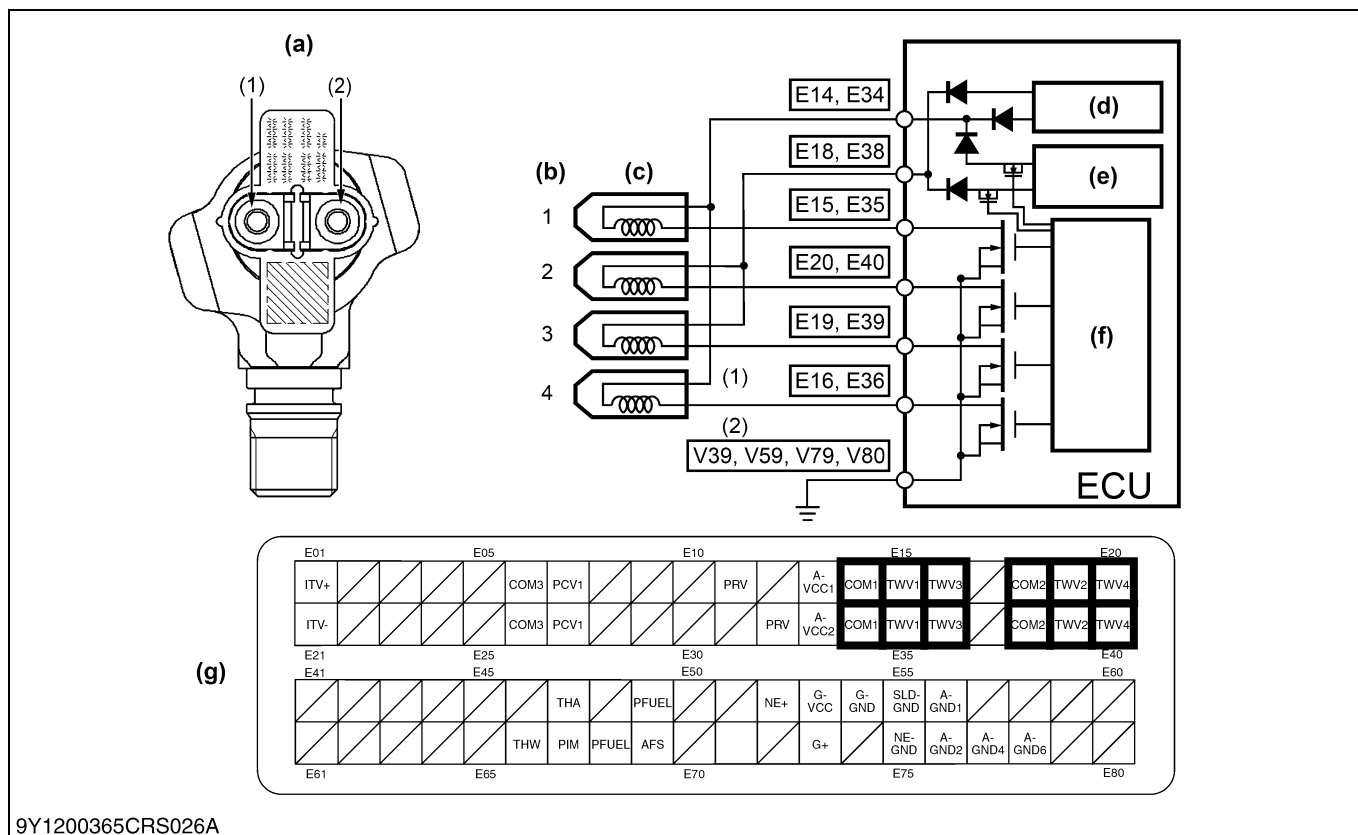
Recovery from error:

- Key switch turn OFF

Remark:

- Injectors which have no error are operated
- To minimize PM emission

9Y1200226CRS1575US0



9Y1200365CRS026A

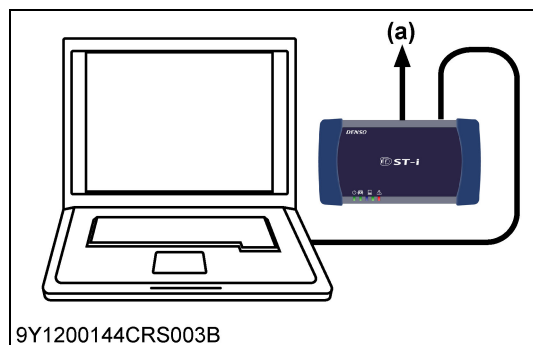
- (1) Terminal COMMON
(2) Terminal TWV

- (a) Terminal Layout
(b) Engine Cylinder No.
(c) Injectors

- (d) Constant Amperage Circuit
(e) High Voltage Generation Circuit

- (f) Control Circuit
(g) ECU Connector 1 (Engine Side)

9Y1200226CRS1576US0



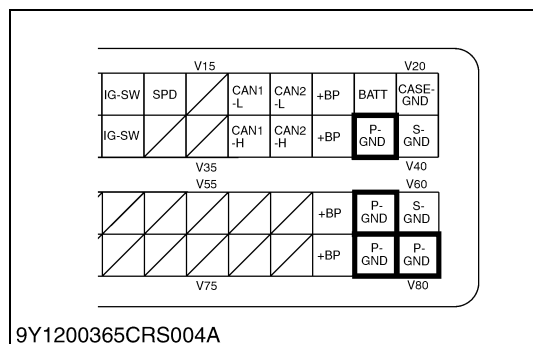
1. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position, check whether the DTC (P2146, P2149) is output or not.

Factory specification	Either DTC P2146 or P2149 is output.
OK	Go to "4. Measure the Resistance Between ECU Terminals".
NG	Go to "2. Check the "P- GND" Wiring Harness".

(a) CAN1 Connector

9Y1200226CRS1577US0

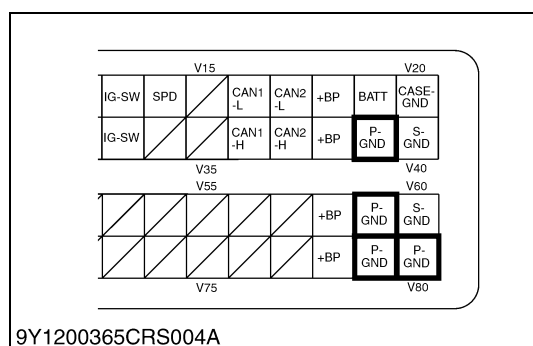


2. Check the "P- GND" Wiring Harness

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between each ECU terminal and the chassis ground (at the wiring harness side).

Factory specification	1.5 Ω or lower
OK	Go to "3. Check the "P- GND" Wiring Harness Connector and ECU Pins".
NG	1. Check the "P- GND" wiring harness → Repair. 2. Locate the cause of open circuit, or increase its resistance value.

9Y1200226CRS1578US0

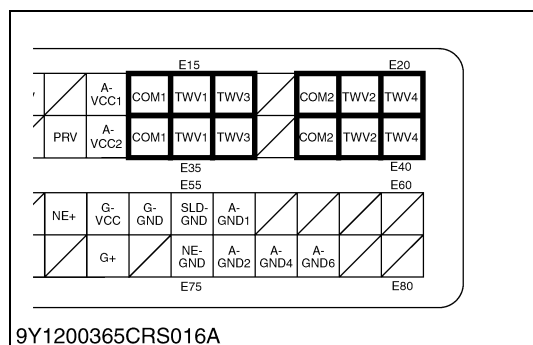


3. Check the "P- GND" Wiring Harness Connector and ECU Pins

1. Place the key switch in the OFF position, unplug the ECU connector from the socket, and check the ECU pins for faulty connection, deformation, poor contact or other defects.

Factory specification	Must be free from faulty connection, deformation, poor contact or other defects.
OK	Go to "4. Measure the Resistance Between ECU Terminals".
NG	Repair wiring harness connectors and ECU pins, or replace them if defective.

9Y1200226CRS1579US0



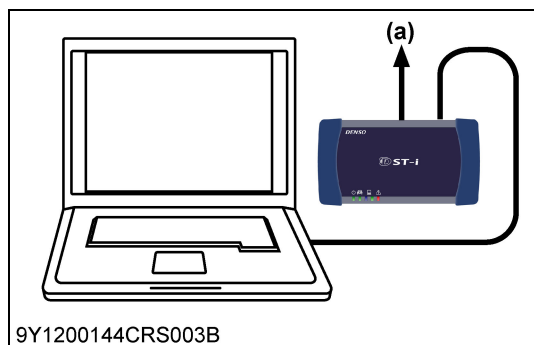
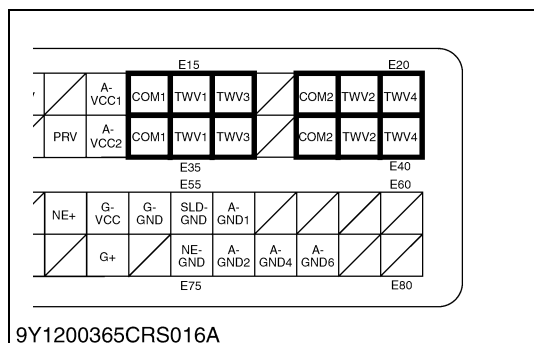
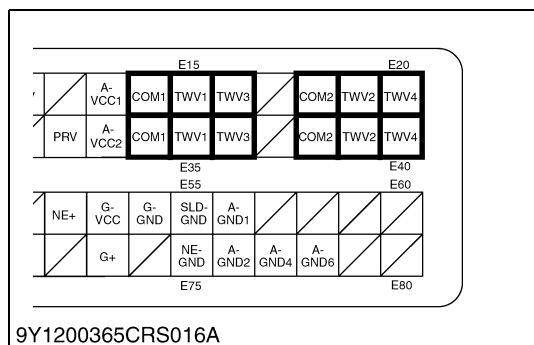
4. Measure the Resistance Between ECU Terminals

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector, and measure the resistance between each terminal at the connector side as shown on the following table.

DTC	ECU Terminals Measured	
P2146	E14, E34	No. 1 cylinder E15, E35
		No. 4 cylinder E16, E36
P2149	E18, E38	No. 3 cylinder E19, E39
		No. 2 cylinder E20, E40

Factory specification	Both system cables must have 1.5 Ω or lower.
OK	Go to "6. Check the Wiring Harness Connectors and ECU Pins".
NG	Go to "5. Check the Wiring Harness → Repair or Replace the Faulty Area".

9Y1200226CRS1580US0



5. Check the Wiring Harness → Repair or Replace the Faulty Area

Check the wiring harness between ECU terminals E14 / E34 or E18 / E38 and each injector terminal (E15 / E35, E16 / E36, E19 / E39 or E20 / E40), and locate the open harness.

9Y1200226CRS1581US0

6. Check the Wiring Harness Connectors and ECU Pins

1. Check the wiring harness connectors of each ECU terminal and the ECU pins for faulty connection, deformation or other defects.

OK	Go to "7. Check the DTC".
NG	The connectors or ECU pins are faulty. → Repair them or replace the ECU.

9Y1200226CRS1582US0

7. Check the DTC

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Start the engine, and clear the past DTCs.
3. Read the DTC again.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

OK	Normal.
NG	Faulty ECU → Replace.

(a) CAN1 Connector

9Y1200226CRS1583US0

(51) No. 1 and 4 Cylinder Injector Short or All Cylinder Injector Short (DTC P2147 / 523523-4, P2148 / 523523-3)

P2147 / 523523-4: No. 1 and 4 cylinder injector short to ground at power supply side, or all cylinder injector short to ground

Behaviour during malfunction:

- Insufficient output
- Engine vibration increases
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Wiring harness short to ground

DTC set preconditions:

- Battery voltage is normal
- CPU is normal (VDIC2 is normal)
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Wiring harness short to ground

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Injectors which have error stop injection
- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

- Injectors which have no error are operated
- To minimize PM emission

9Y1200226CRS1584US0

P2148 / 523523-3: No. 1 and 4 cylinder injector short to +B at power supply side, or all cylinder injector short to +B

Behaviour during malfunction:

- Insufficient output
- Engine vibration increases
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Wiring harness short to +B

DTC set preconditions:

- Battery voltage is normal
- CPU is normal (VDIC2 is normal)
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Wiring harness short to +B

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Injectors which have error stop injection
- Output limitation: Approximately 75 % of normal condition
- EGR stop

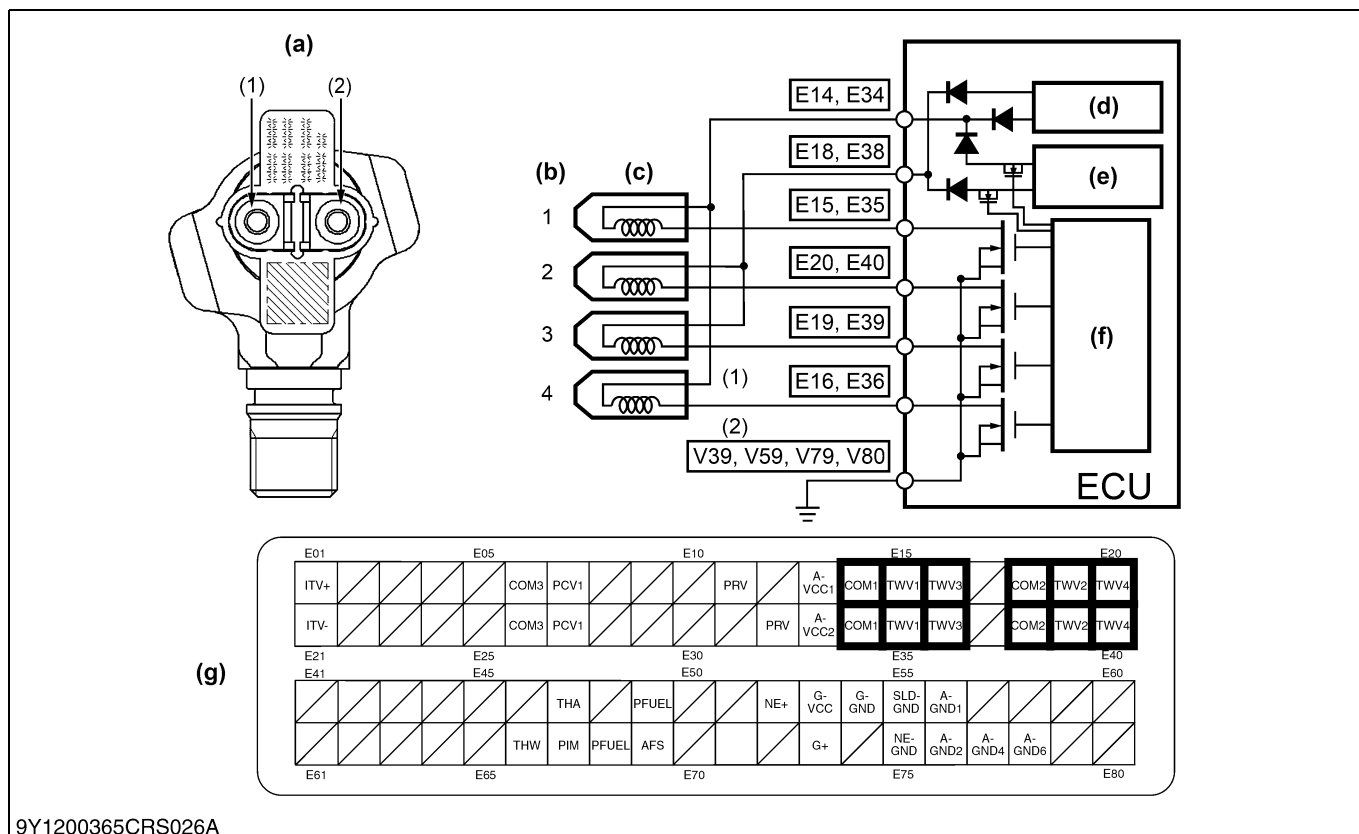
Recovery from error:

- Key switch turn OFF

Remark:

- Injectors which have no error are operated
- To minimize PM emission

9Y1200226CRS1585US0



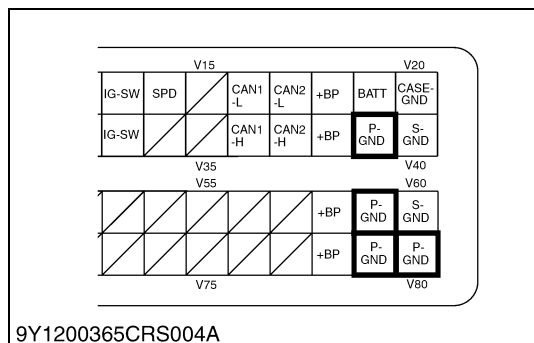
- (1) Terminal COMMON
(2) Terminal TWV

- (a) Terminal Layout
(b) Engine Cylinder No.
(c) Injector

- (d) Rated amperage circuit
(e) High-voltage generating circuit

- (f) Control circuit
(g) ECU Connector 1 (Engine Side)

9Y1200226CRS1586US0



1. Check the "P- GND" Wiring Harness

- Place the key switch in the OFF position, unplug the ECU wiring harness connector 2 (machine side) from the socket, and measure the resistance between each of ECU terminals V39, V59, V79 or V80 and the chassis ground (at the wiring harness side).

Factory specification	1.5 Ω or lower
-----------------------	-----------------------

OK	Go to "2. Check the Wiring Harness Connectors and ECU Pins".
NG	Check the "P- GND" wiring harness. → Repair. Locate the cause of open circuit, or increase its resistance value.

9Y1200226CRS1587US0

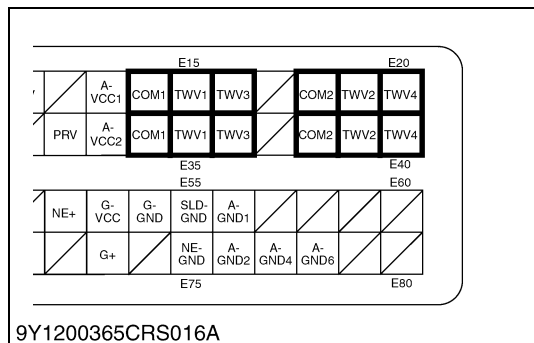
2. Check the Wiring Harness Connectors and ECU Pins

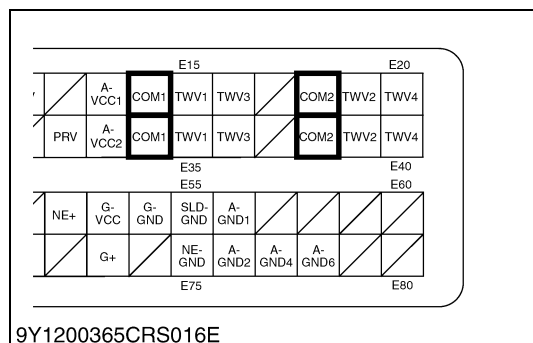
- Place the key switch in the OFF position, unplug the ECU connector 1 (engine side) from the socket, and check the ECU pins for faulty connection, deformation, poor contact or other defects.

Factory specification	Must be free from faulty connection, deformation, poor contact or other defects.
-----------------------	--

OK	P2147: Go to "3. Measure the ECU Terminal Resistance (Part 1)". P2148: Go to "4. Measure the ECU Terminal Voltage (Part 1)".
NG	Repair wiring harness connectors and ECU pins, or replace them if defective.

9Y1200226CRS1588US0





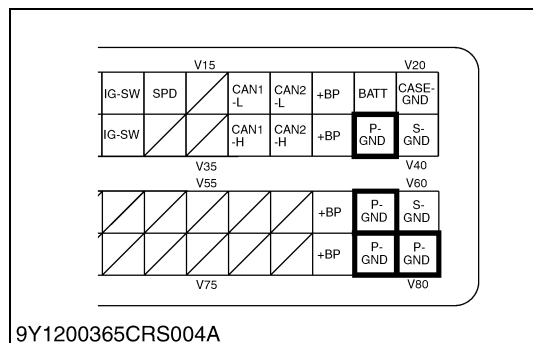
3. Measure the ECU Terminal Resistance (Part 1)

1. Place the key switch in the OFF position, unplug each ECU connector from socket.
2. Using an insulation resistance tester (megohmmeter tester), measure the resistance between ECU terminal E14 / E34 or E18 / E38 and "PGND" terminal.

Factory specification	10 MΩ or higher (between terminal and body, 500 V)
-----------------------	--

OK	Go to "5. Check the DTC".
NG	Go to "6. Measure the ECU Terminal Voltage (Part 2)".

9Y1200226CRS1589US0



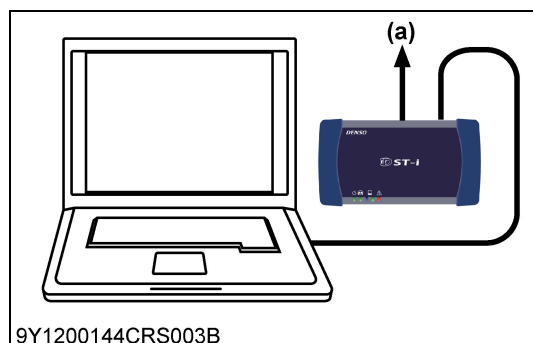
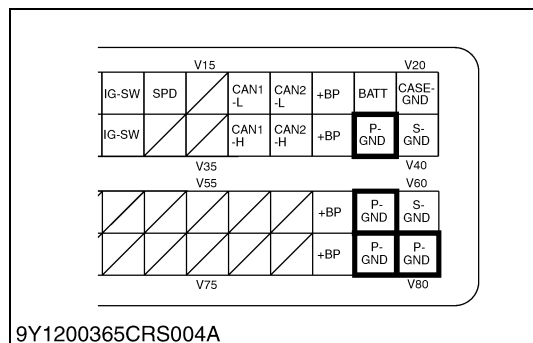
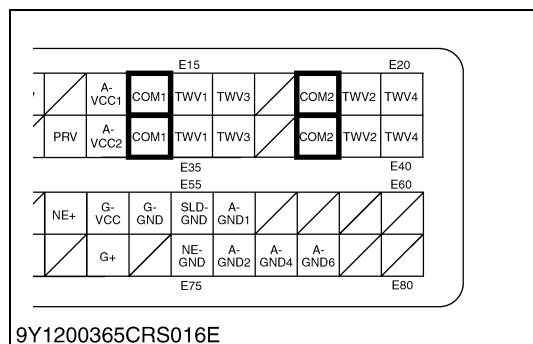
4. Measure the ECU Terminal Voltage (Part 1)

1. Place the key switch in the ON position, and measure the voltage between ECU terminal E14 / E34 or E18 / E38 and "PGND" terminal.

Factory specification	Approx. 0 V
-----------------------	-------------

OK	Go to "5. Check the DTC".
NG	Go to "7. Measure the ECU Terminal Voltage (Part 2)".

9Y1200226CRS1590US0



5. Check the DTC

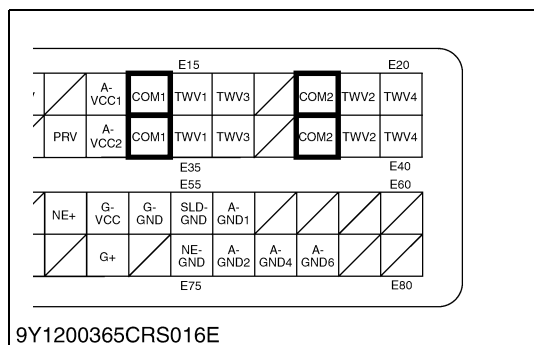
1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Start the engine, and clear the past DTCs.
3. Read the DTC again.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

OK	Normal.
NG	Faulty ECU → Replace.

(a) CAN1 Connector

9Y1200226CRS1591US0



6. Measure the ECU Terminal Resistance (Part 2)

- Place the key switch in the OFF position, unplug the ECU wiring harness connector 1 (engine side) from the socket and measure the resistance between each of ECU terminal pins E14 / E34 or E18 / E38 and the "P- GND" terminal (at the wiring harness side).

Factory specification	10 MΩ or higher (between terminal and body, 500 V)
-----------------------	--

OK	Go to "8. Check the Wiring Harness".
NG	Faulty ECU → Replace.

9Y1200226CRS1592US0

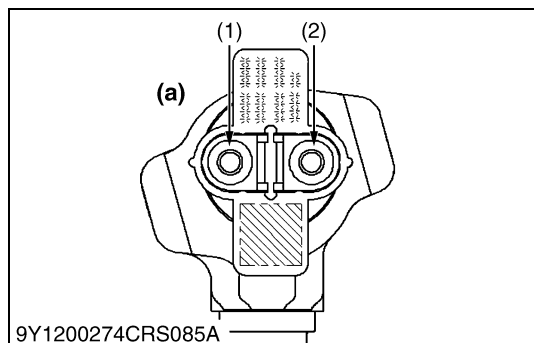
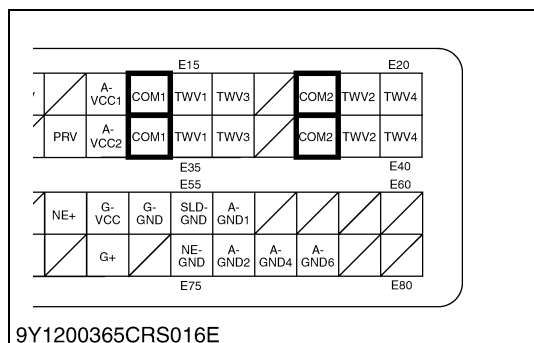
7. Measure the ECU Terminal Voltage (Part 2)

- Place the key switch in the OFF position, unplug the ECU wiring harness connector 1 (engine side) from the socket, return the key switch to the ON position again, and measure the voltage between each of ECU terminal pins E14 / E34 or E18 / E38 and the "P- GND" terminal (at the wiring harness side).

Factory specification	Approx. 0 V
-----------------------	-------------

OK	Go to "8. Check the Wiring Harness".
NG	Faulty ECU → Replace the ECU.

9Y1200226CRS1593US0



8. Check the Wiring Harness

Locate the cause of wiring harness ground short, and repair the faulty area.

DTC	Relating ECU Terminals	Shorted Harness Side
P2147	Terminal E14 / E34 or E18 / E38 (E15 / E35, E16 / E36, E19 / E39, E20 / E40 occurring simultaneously)	Ground
P2148	Terminal E14 / E34 or E18 / E38 (E15 / E35, E16 / E36, E19 / E39, E20 / E40 occurring simultaneously)	Power supply

NOTE

- If DTC P2147 (Shorted injector actuation circuit to the ground) has occurred, be sure to check the insulation of injector itself in the following procedure.

- Place the key switch in the OFF position, unplug each injector connector from socket, and visually check the connector status.

Factory specification	Must be free from sludge and sparks.
-----------------------	--------------------------------------

- Using an insulation resistance tester (megohmmeter tester), measure the resistance between each of terminals (1) and (2) and the chassis ground (at the injector side).

Factory specification	10 MΩ or higher (between terminal and body, 500 V)
-----------------------	--

OK	The injector functions normally. Locate another cause.
NG	Faulty injector → Replace the injector.

(1) Terminal COMMON

(a) Injector

(2) Terminal TWV

9Y1200226CRS1594US0

(52) Injector Drive Circuit Open in No. 2 and 3 Cylinder Simultaneously (DTC P2149 / 523524-2)

Behaviour during malfunction:

- Insufficient output
- Engine vibration increases
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Wiring harness open circuit

DTC set preconditions:

- Engine is operating
- Battery voltage is normal
- During injection
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- Wiring harness open circuit

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop

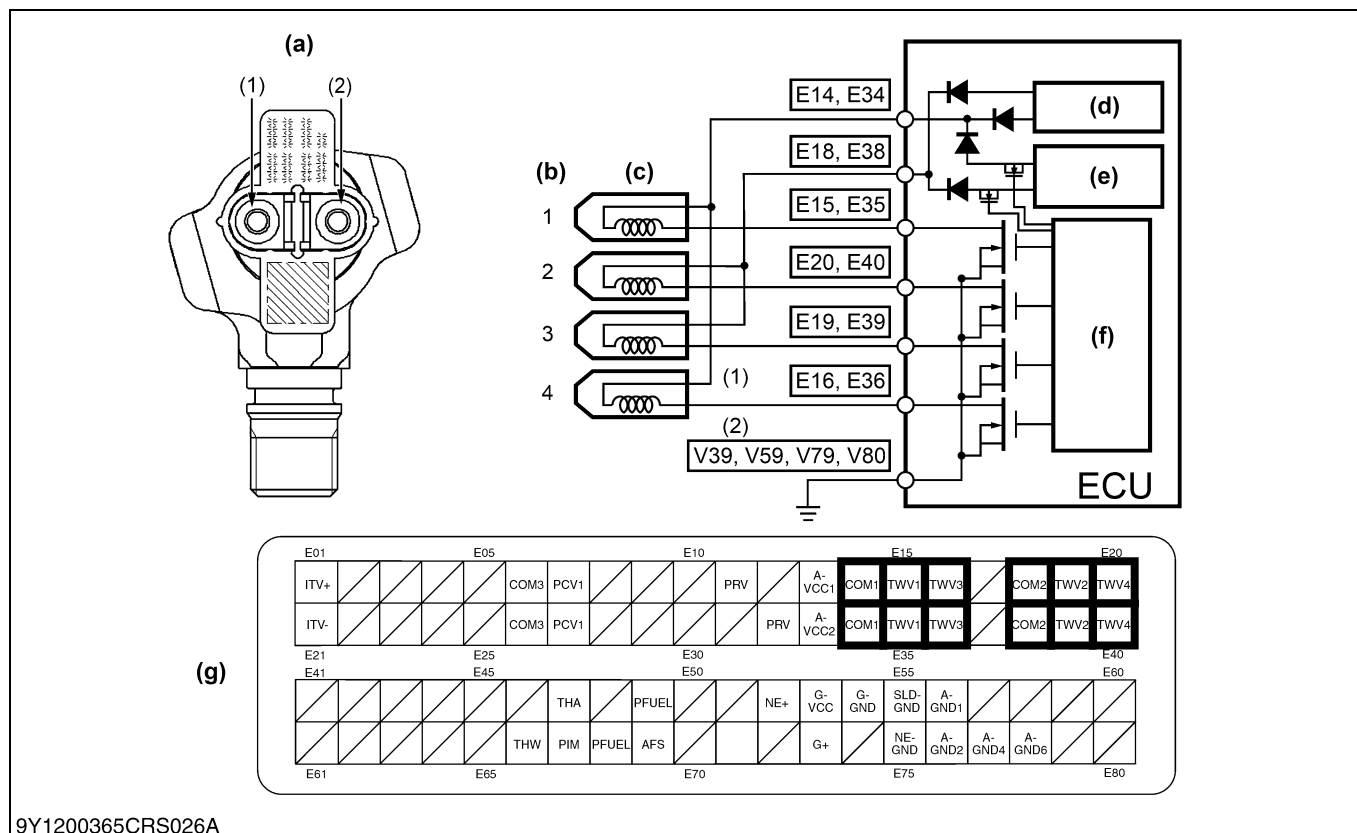
Recovery from error:

- Key switch turn OFF

Remark:

- Injectors which have no error are operated
- To minimize PM emission

9Y1200226CRS1595US0



9Y1200365CRS026A

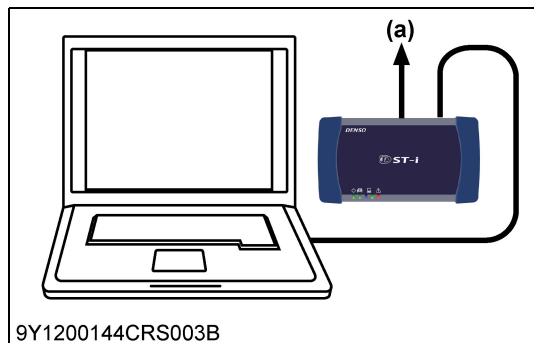
- (1) Terminal COMMON
(2) Terminal TWV

- (a) Terminal Layout
(b) Engine Cylinder No.
(c) Injectors

- (d) Constant Amperage Circuit
(e) High Voltage Generation Circuit

- (f) Control Circuit
(g) ECU Connector 1 (Engine Side)

9Y1200226CRS1596US0



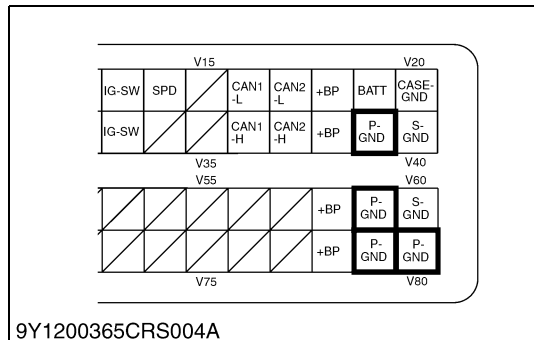
1. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position, check whether the DTC (P2146, P2149) is output or not.

Factory specification	Either DTC P2146 or P2149 is output.
OK	Go to "4. Measure the Resistance Between ECU Terminals".
NG	Go to "2. Check the "P- GND" Wiring Harness".

(a) CAN1 Connector

9Y1200226CRS1597US0

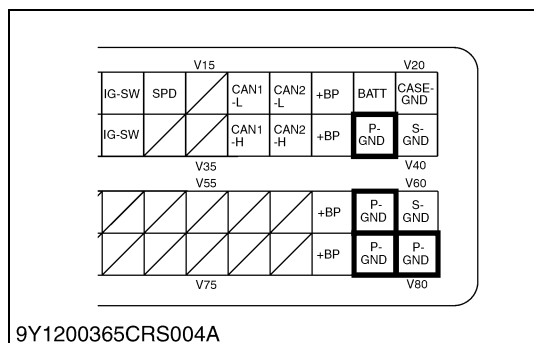


2. Check the "P- GND" Wiring Harness

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between each ECU terminal and the chassis ground (at the wiring harness side).

Factory specification	1.5 Ω or lower
OK	Go to "3. Check the "P- GND" Wiring Harness Connector and ECU Pins".
NG	1. Check the "P- GND" wiring harness → Repair. 2. Locate the cause of open circuit, or increase its resistance value.

9Y1200226CRS1598US0

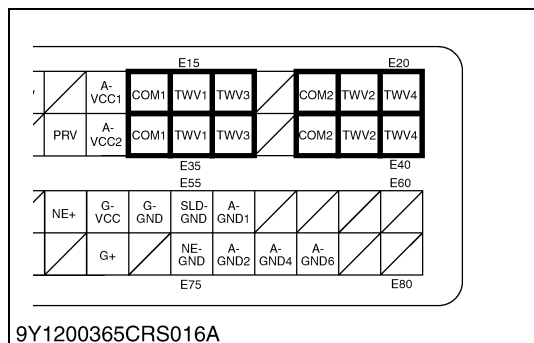


3. Check the "P- GND" Wiring Harness Connector and ECU Pins

1. Place the key switch in the OFF position, unplug the ECU connector from the socket, and check the ECU pins for faulty connection, deformation, poor contact or other defects.

Factory specification	Must be free from faulty connection, deformation, poor contact or other defects.
OK	Go to "4. Measure the Resistance Between ECU Terminals".
NG	Repair wiring harness connectors and ECU pins, or replace them if defective.

9Y1200226CRS1599US0



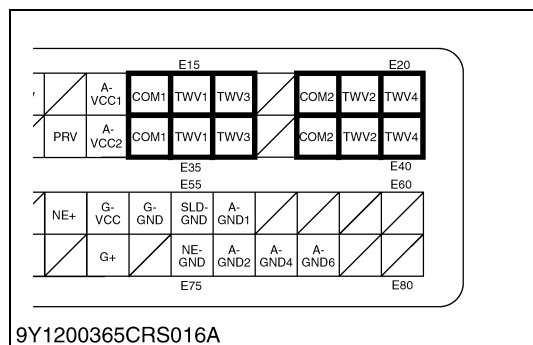
4. Measure the Resistance Between ECU Terminals

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector, and measure the resistance between each terminal at the connector side as shown on the following table.

DTC	ECU Terminals Measured	
P2146	E14, E34	No. 1 cylinder E15, E35
		No. 4 cylinder E16, E36
P2149	E18, E38	No. 3 cylinder E19, E39
		No. 2 cylinder E20, E40

Factory specification	Both system cables must have 1.5 Ω or lower.
OK	Go to "6. Check the Wiring Harness Connectors and ECU Pins".
NG	Go to "5. Check the Wiring Harness → Repair or Replace the Faulty Area".

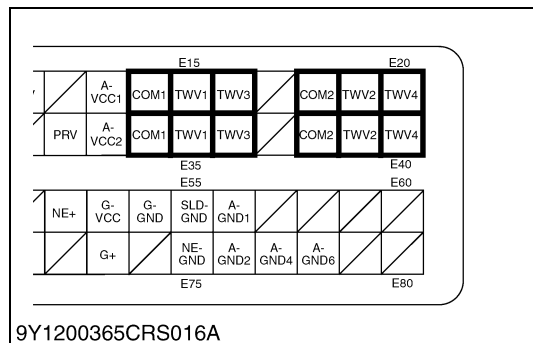
9Y1200226CRS1600US0



5. Check the Wiring Harness → Repair or Replace the Faulty Area

Check the wiring harness between ECU terminals E14 / E34 or E18 / E38 and each injector terminal (E15 / E35, E16 / E36, E19 / E39 or E20 / E40), and locate the open harness.

9Y1200226CRS1601US0

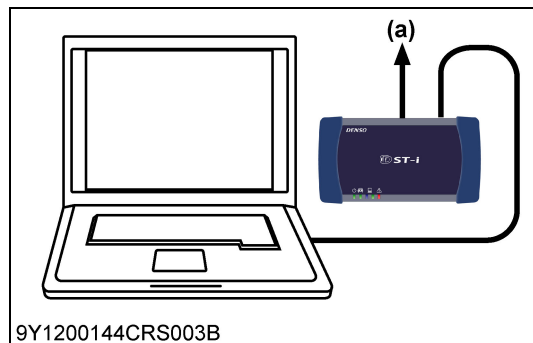


6. Check the Wiring Harness Connectors and ECU Pins

1. Check the wiring harness connectors of each ECU terminal and the ECU pins for faulty connection, deformation or other defects.

OK	Go to "7. Check the DTC".
NG	The connectors or ECU pins are faulty. → Repair them or replace the ECU.

9Y1200226CRS1602US0



7. Check the DTC

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Start the engine, and clear the past DTCs.
3. Read the DTC again.

Factory specification	Normal (No DTC is output.)
OK	Normal.
NG	Faulty ECU → Replace.

(a) CAN1 Connector

9Y1200226CRS1603US0

(53) No. 2 and 3 Cylinder Injector Short or All Cylinder Injector Short (DTC P2150 / 523524-4, P2151 / 523524-3)

P2150 / 523524-4: No. 2 and 3 cylinder injector short to ground at power supply side, or all cylinder injector short to ground

Behaviour during malfunction:

- Insufficient output
- Engine vibration increases
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Wiring harness short to ground

DTC set preconditions:

- Battery voltage is normal
- CPU is normal (VDIC2 is normal)
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Wiring harness short to ground

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Injectors which have error stop injection
- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

- Injectors which have no error are operated
- To minimize PM emission

9Y1200226CRS1604US0

P2151 / 523524-3: No. 2 and 3 cylinder injector short to +B at power supply side, or all cylinder injector short to +B

Behaviour during malfunction:

- Insufficient output
- Engine vibration increases
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Wiring harness short to +B

DTC set preconditions:

- Battery voltage is normal
- CPU is normal (VDIC2 is normal)
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Wiring harness short to +B

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Injectors which have error stop injection
- Output limitation: Approximately 75 % of normal condition
- EGR stop

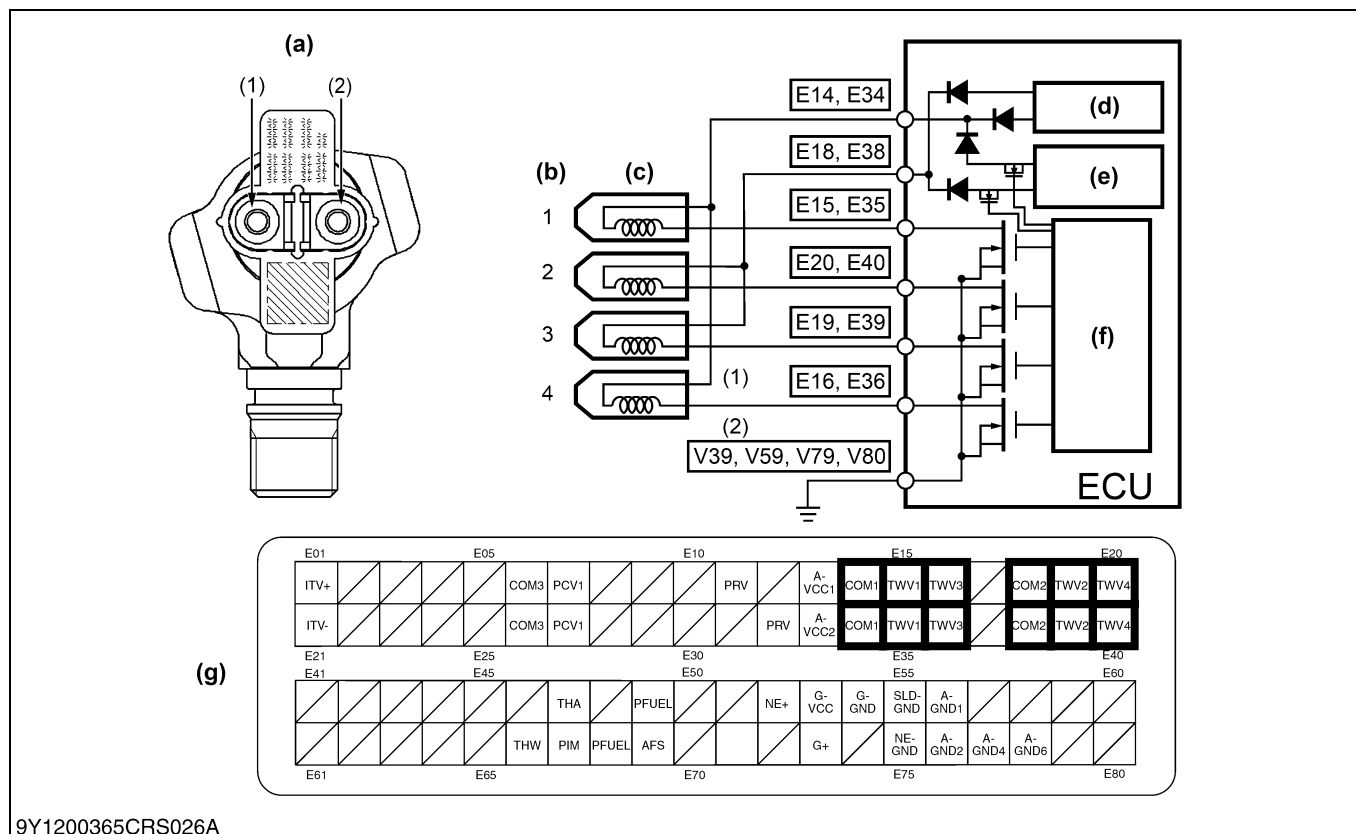
Recovery from error:

- Key switch turn OFF

Remark:

- Injectors which have no error are operated
- To minimize PM emission

9Y1200226CRS1605US0



9Y1200365CRS026A

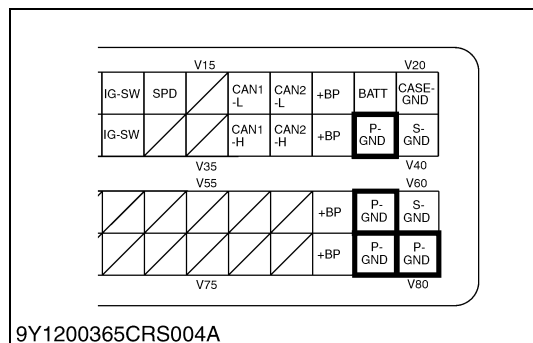
- (1) Terminal COMMON
(2) Terminal TWV

- (a) Terminal Layout
(b) Engine Cylinder No.
(c) Injector

- (d) Rated amperage circuit
(e) High-voltage generating circuit

- (f) Control circuit
(g) ECU Connector 1 (Engine Side)

9Y1200226CRS1606US0



9Y1200365CRS004A

1. Check the "P- GND" Wiring Harness

- Place the key switch in the OFF position, unplug the ECU wiring harness connector 2 (machine side) from the socket, and measure the resistance between each of ECU terminals V39, V59, V79 or V80 and the chassis ground (at the wiring harness side).

Factory specification	1.5 Ω or lower
-----------------------	----------------

OK	Go to "2. Check the Wiring Harness Connectors and ECU Pins".
NG	Check the "P- GND" wiring harness. → Repair. Locate the cause of open circuit, or increase its resistance value.

9Y1200226CRS1607US0

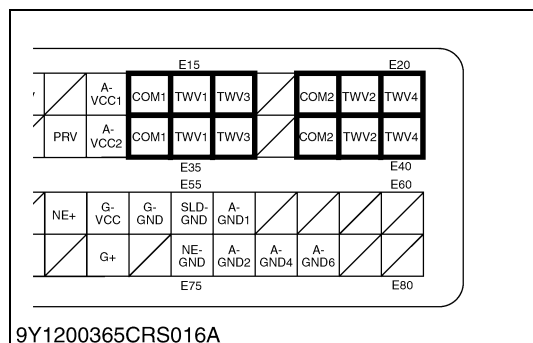
2. Check the Wiring Harness Connectors and ECU Pins

- Place the key switch in the OFF position, unplug the ECU connector 1 (engine side) from the socket, and check the ECU pins for faulty connection, deformation, poor contact or other defects.

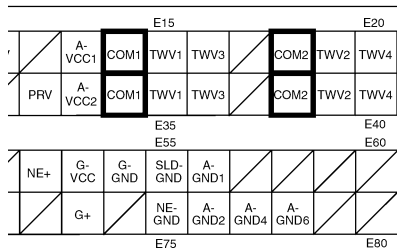
Factory specification	Must be free from faulty connection, deformation, poor contact or other defects.
-----------------------	--

OK	P2150: Go to "3. Measure the ECU Terminal Resistance (Part 1)". P2151: Go to "4. Measure the ECU Terminal Voltage (Part 1)".
NG	Repair wiring harness connectors and ECU pins, or replace them if defective.

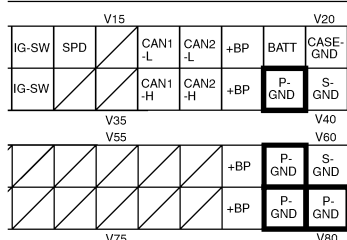
9Y1200226CRS1608US0



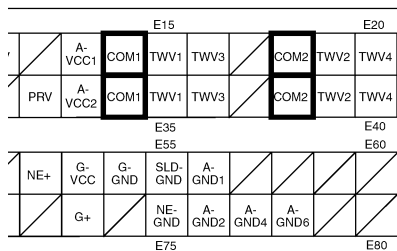
9Y1200365CRS016A



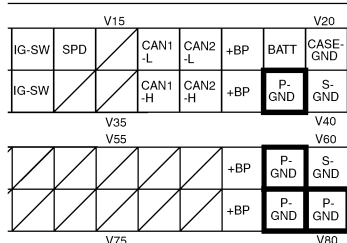
9Y1200365CRS016E



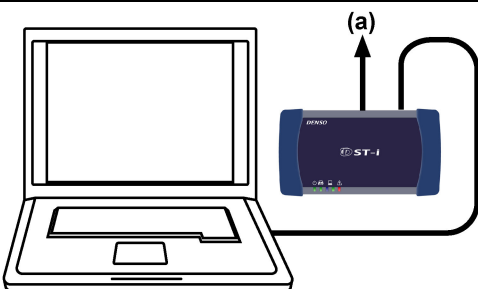
9Y1200365CRS004A



9Y1200365CRS016E



9Y1200365CRS004A



9Y1200144CRS003B

3. Measure the ECU Terminal Resistance (Part 1)

1. Place the key switch in the OFF position, unplug each ECU connector from socket.
2. Using an insulation resistance tester (megohmmeter tester), measure the resistance between ECU terminal E14 / E34 or E18 / E38 and "PGND" terminal.

Factory specification	10 MΩ or higher (between terminal and body, 500 V)
-----------------------	--

OK	Go to "5. Check the DTC".
NG	Go to "6. Measure the ECU Terminal Resistance (Part 2)".

9Y1200226CRS1609US0

4. Measure the ECU Terminal Voltage (Part 1)

1. Place the key switch in the ON position, and measure the voltage between ECU terminal E14 / E34 or E18 / E38 and "PGND" terminal.

Factory specification	Approx. 0 V
-----------------------	-------------

OK	Go to "5. Check the DTC".
NG	Go to "7. Measure the ECU Terminal Voltage (Part 2)".

9Y1200226CRS1610US0

5. Check the DTC

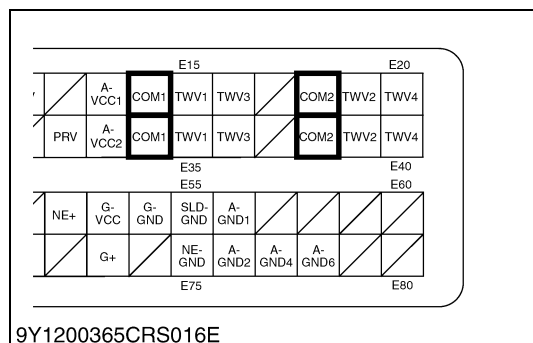
1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Start the engine, and clear the past DTCs.
3. Read the DTC again.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

OK	Normal.
NG	Faulty ECU → Replace.

(a) CAN1 Connector

9Y1200226CRS1611US0



6. Measure the ECU Terminal Resistance (Part 2)

- Place the key switch in the OFF position, unplug the ECU wiring harness connector 1 (engine side) from the socket and measure the resistance between each of ECU terminal pins E14 / E34 or E18 / E38 and the "P- GND" terminal (at the wiring harness side).

Factory specification	10 MΩ or higher (between terminal and body, 500 V)
-----------------------	--

OK	Go to "8. Check the Wiring Harness".
NG	Faulty ECU → Replace.

9Y1200226CRS1612US0

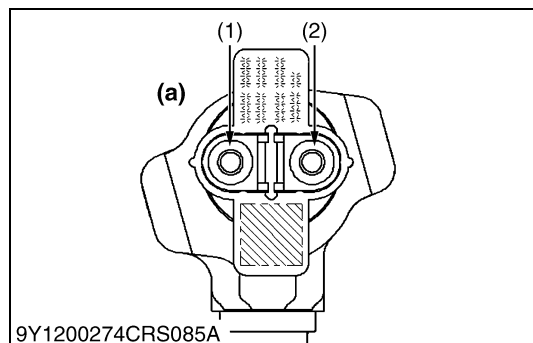
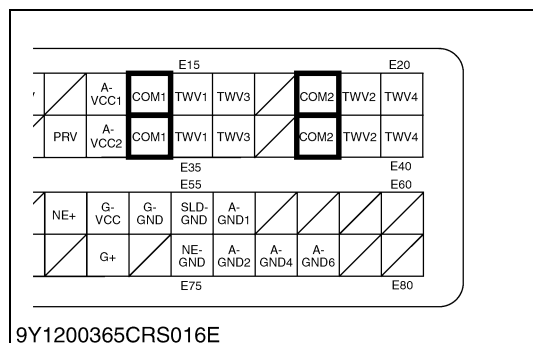
7. Measure the ECU Terminal Voltage (Part 2)

- Place the key switch in the OFF position, unplug the ECU wiring harness connector 1 (engine side) from the socket, return the key switch to the ON position again, and measure the voltage between each of ECU terminal pins E14 / E34 or E18 / E38 and the "P- GND" terminal (at the wiring harness side).

Factory specification	Approx. 0 V
-----------------------	-------------

OK	Go to "8. Check the Wiring Harness".
NG	Faulty ECU → Replace.

9Y1200226CRS1613US0



8. Check the Wiring Harness

Locate the cause of wiring harness ground short, and repair the faulty area.

DTC	Relating ECU Terminals	Shorted Harness Side
P2147	Terminal E14 / E34 or E18 / E38 (E15 / E35, E16 / E36, E19 / E39, E20 / E40 occurring simultaneously)	Ground
P2148	Terminal E14 / E34 or E18 / E38 (E15 / E35, E16 / E36, E19 / E39, E20 / E40 occurring simultaneously)	Power supply

NOTE

- If DTC P2147 (Shorted injector actuation circuit to the ground) has occurred, be sure to check the insulation of injector itself in the following procedure.

- Place the key switch in the OFF position, unplug each injector connector from socket, and visually check the connector status.

Factory specification	Must be free from sludge and sparks.
-----------------------	--------------------------------------

- Using an insulation resistance tester (megohmmeter tester), measure the resistance between each of terminals (1) and (2) and the chassis ground (at the injector side).

Factory specification	10 MΩ or higher (between terminal and body, 500 V)
-----------------------	--

OK	The injector functions normally. Locate another cause.
NG	Faulty injector → Replace.

- Terminal COMMON
- Terminal TWV

(a) Injector

9Y1200226CRS1614US0

(54) Barometric Pressure Sensor Error (DTC P2228 / 108-4, P2229 / 108-3)**P2228 / 108-4: Barometric pressure sensor error (Low side)****Behaviour during malfunction (At high altitude):**

- Insufficient output

Detection item:

- Sensor or ECU internal circuit short to ground

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Barometric pressure sensor voltage: 1.6 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- 65 kPa (0.66 kgf/cm², 9.4 psi) [default value]

Recovery from error:

- Diagnostic counter = zero

Remark:

- Default value is set in consideration with high altitude usage

9Y1200226CRS1615US0

P2229 / 108-3: Barometric pressure sensor error (High side)**Behaviour during malfunction (At high altitude):**

- Insufficient output

Detection item:

- Sensor or ECU internal circuit short to +B

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Barometric pressure sensor voltage: 4.4 V or more

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- 65 kPa (0.66 kgf/cm², 9.4 psi) [default value]

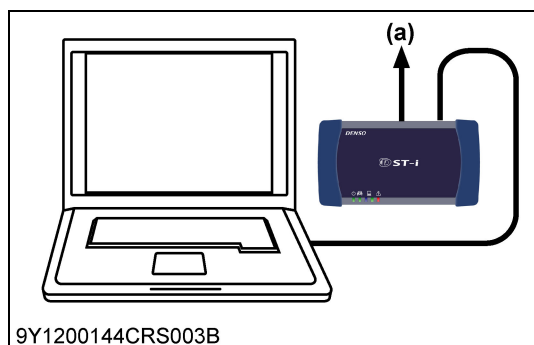
Recovery from error:

- Diagnostic counter = zero

Remark:

- Default value is set in consideration with high altitude usage

9Y1200226CRS1616US0

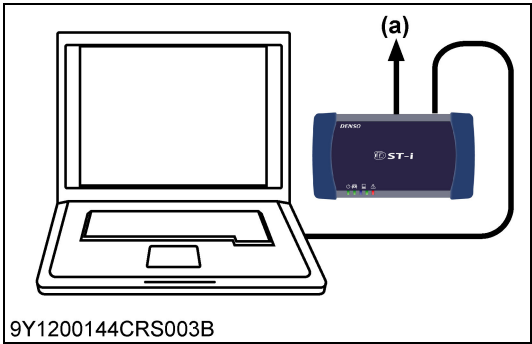
**1. Check the Atmospheric Pressure Signals**

1. Place the key switch in the ON position, and check the "Atmospheric pressure" on the diagnosis tool data monitor.

Factory specification	Atmospheric pressure Actual atmospheric pressure (Approx. 100 kPa (1.02 kgf/cm ² , 14.5 psi))	
OK	Clear the DTC and check whether it is detected again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Check the DTC".	

(a) CAN1 Connector

9Y1200226CRS1617US0



2. Check the DTC

- 1. Place the key switch to the OFF position first, then return it to the ON position again.
- 2. Clear the past DTCs, and check whether the same DTC (P2228 or P2229) is output again or not.

Factory specification	OK
OK	An electromagnetic interference (EMI) may have caused the temporary malfunction. There is no problem if the system has recovered.
NG	Faulty atmospheric pressure sensor → Replace the engine ECU.

(a) CAN1 Connector

9Y1200226CRS1618US0

(55) Pressure Relief Valve Error (DTC P2293 / 523606-2)

Behavior during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops

Detection item:

- Pressure relief valve error

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated
- During PMP normal operating (angle studying is complete)
- NE sensing is normal
- Injection Q is 0 mm³/st or lower
- Not occur tentative error of pressure
- No noise in sensing pressure

DTC set parameter:

- After pressure relief valve (PRV) driving , higher pressure value is detected more than supposed value

Engine warning light:

- ON

Limp home action by engine ECU (System action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1619US0

Diagnostic Procedure for Pressure System DTCs

Checking of fault conditions and actions taken

If DTCs of non-pressure system are detected (*Refer to the pressure system DTCs given below.)

First locate the non-pressure system problem indicated by DTCs, and repair the affected parts. After the repair has been carried out, check for an output of pressure system DTCs. If so, begin the diagnosis of the affected pressure system.

If only pressure system DTCs are detected (*Refer to the pressure system DTCs given below.)

Diagnose the affected pressure system indicated by DTCs.

If a DTC currently exists

Begin diagnosis without returning the key switch to the OFF position. However, carefully make satisfactory / unsatisfactory judgments as the injection amount and rail pressure are limited by system actions.

If only a past DTC exists

Log the freeze-frame data, clear the DTCs, and stop the engine. Then, try to reproduce the problem using the freeze-frame data and the trouble check sheet.

Pressure system DTCs*[High pressure abnormality]**

1. P0088: High rail pressure
2. P1A0D: High pressure pump too high

[Low pressure abnormality]

1. P0093: Fuel leak
2. P0191: Rail pressure too low

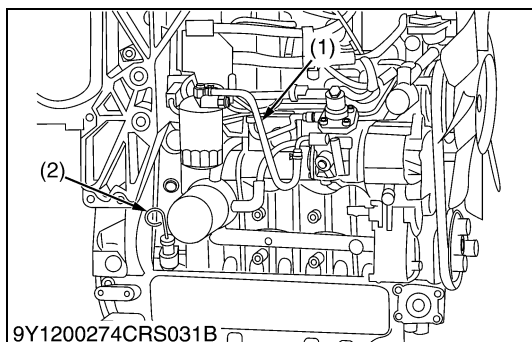
[Abnormal pressure]

1. P1274: Pump seizing 1
2. P1275: Pump seizing 2
3. P1A06: High pressure delivery system too high
4. P2293: Pressure relief valve error / PRV driving circuit error

■ IMPORTANT

- Multiple pressure system DTCs may be output simultaneously. Also, both abnormal high pressure and abnormal low pressure may be reported simultaneously under certain malfunction conditions.

9Y1200226CRS1620US0



9Y1200274CRS031B

1. Check the Fuel System for the Existence of Air

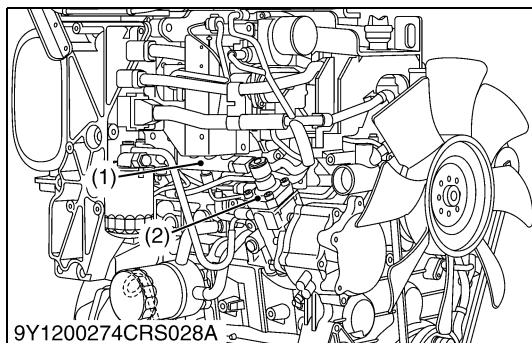
1. Check each joint of the fuel system for the existence of air.
To detect the existence of air effectively, replace the fuel hose with a transparent one.

OK	Go to "2. Check the Fuel System".
NG	Locate the position of the fuel leakage in the piping and repair it.

(1) Fuel Hose

(2) Dipstick

9Y1200226CRS1621US0



2. Check the Fuel System

CAUTION

- Visually check there is no leak in the high pressure fuel pipe system.
- A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.

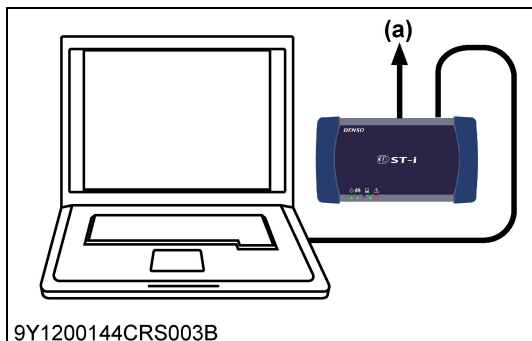
1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

OK	Go to "3. Check the Data Related to the Rail Pressure".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S544)

(1) Rail

(2) Supply Pump

9Y1200226CRS1622US0



3. Check the Data Related to the Rail Pressure

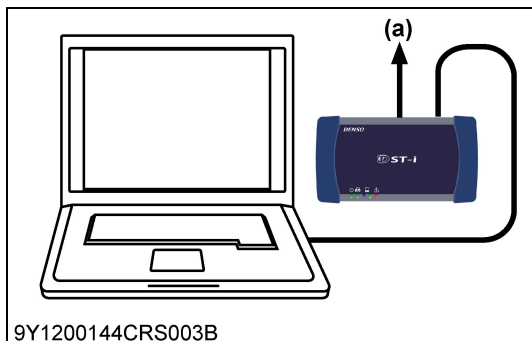
1. Connect the diagnosis tool to the CAN1 connector, and select the "Actual rail pressure" and "Target rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure"
	<ol style="list-style-type: none"> 1. When idling: 35 to 60 MPa (360 to 610 kgf/cm², 5100 to 8700 psi) 2. Accelerator opening 0 → 100 % (During acceleration): Maximum value 155 MPa (1580 kgf/cm², 22500 psi) 3. No-load maximum speed: 75.0 to 155 MPa (765 to 1580 kgf/cm², 10900 to 22400 psi) 4. The numerical value is stable under normal operating and the target value corresponds with actual pressure value.

OK	Use all of the available information and try to reproduce the problem by operating the accelerator pedal in different ways and by changing the environmental conditions.
NG	Go to "4. Check the Rail Pressure Sensor".

(a) CAN1 Connector

9Y1200226CRS1623US0



4. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)

1. Check the rail pressure sensor.

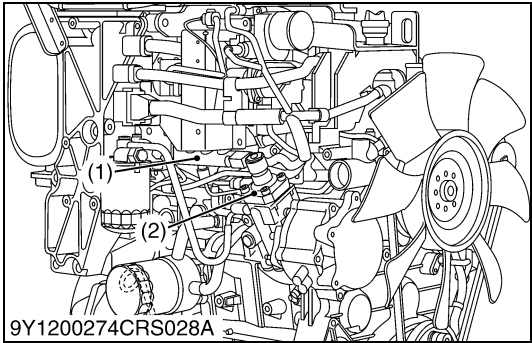
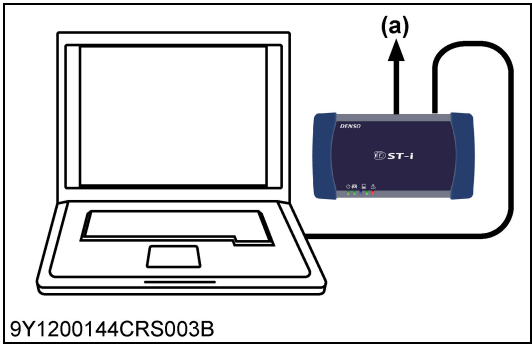
NOTE

- Closely check sensor signals for a noise component and an abnormality that exists for a short time.

OK	Go to "5. Check the PCV (or PRV)-related Data".
NG	Replace the rail assembly or its related parts. (Follow the diagnostic procedure of items P0192 and P0193.) (Refer to page 1-S404)

(a) CAN1 Connector

9Y1200226CRS1624US0



5. Check the PCV (or PRV)-related Data

1. Check the "Target rail pressure" and "Actual rail pressure" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	<div>1. The "Actual rail pressure" always follow to the "Target rail pressure".</div> <div>A: Normal operating</div> <div>B: Accelerator opening: 0→100 % (During acceleration)</div> <div>C: Accelerator closing: 100→0 % (During rapid deceleration)</div> <div>D: Just after key switch OFF</div>
OK	After confirming that an intermittent malfunction (such as power supply system or noise generation) does not occur in relation to the ECU, replace the ECU.
NG	Case A or B: Faulty PCV → Replace the supply pump. Case C or D: Faulty PRV → Replace the rail assembly.

- (1) Rail
- (2) Supply Pump

(a) CAN1 Connector

9Y1200226CRS1625US0

(56) PRV Boost Time-out (DTC P2293 / 523628-8)

Behavior during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops in some cases

Detection item:

- Open circuit of discharge MOS-IC in ECU

DTC set preconditions:

- Battery voltage is normal
- During injection
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- Open circuit of discharge MOS-IC in ECU

Engine warning light:

- ON

Limp home action by engine ECU (System action):

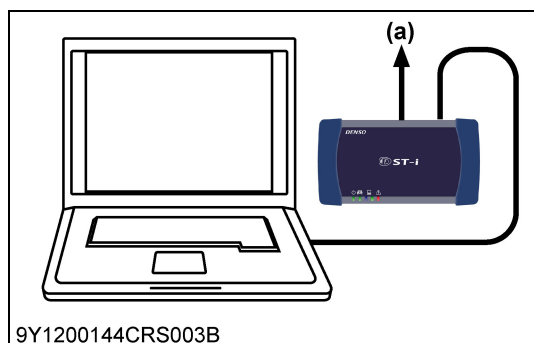
- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1626US0



1. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Operate the engine by performing the actual run test.
3. Place the key switch in the ON position, check whether the DTC (P2293) is output or not.

Factory specification	DTC (P2293) must not be output.
-----------------------	---------------------------------

OK	Normal.
NG	Replace the ECU.

(a) CAN1 Connector

9Y1200226CRS1627US0

(57) Open Circuit of Harness or Coil in PRV Line (DTC P2294 / 523613-5)

Behavior during malfunction:

- Insufficient output
- Worsening exhaust gas emissions
- Engine stops

Detection item:

- Open circuit of harness
- Open circuit of PRV coil

DTC set preconditions:

- Battery voltage is normal
- During PRV driving
- CPU is normal (VDIC2 is normal)

DTC set parameter:

- Open circuit of harness or open circuit of PRV coil

Engine warning light:

- ON

Limp home action by engine ECU (System action):

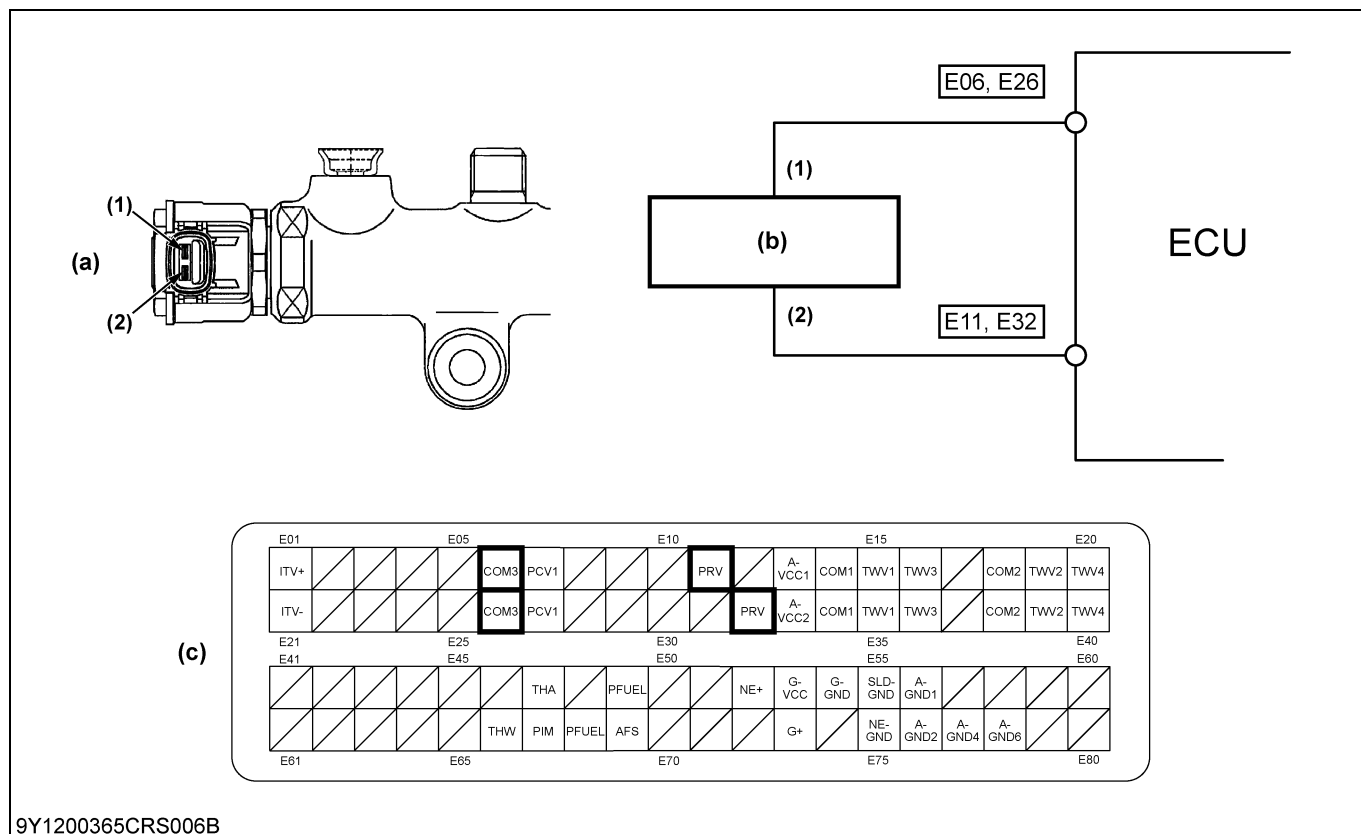
- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1628US0



9Y1200365CRS006B

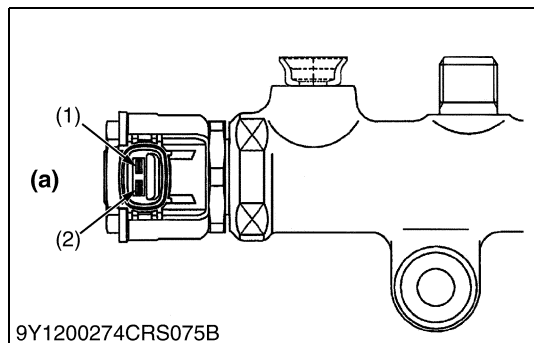
- (1) Terminal PRV+
(2) Terminal PRV-

(a) Terminal Layout

(b) PRV (Pressure Relief Valve)

(c) ECU Connector 1 (Engine Side)

9Y1200226CRS1629US0



1. Measure the Resistance Between PRV Terminals

- Place the key switch in the OFF position, unplug the PRV wiring harness connector, and measure the resistance between PRV terminals (1) and (2).

Factory specification	0.47 Ω at 20 °C
-----------------------	------------------------

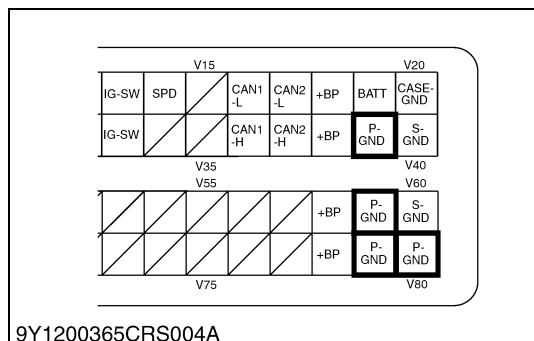
OK	Go to "2. Check the Connector and Wiring Harnesses for Poor Contact".
NG	Faulty PRV → Replace the rail assembly.

(1) Terminal PRV+

(a) PRV (Pressure Relief Valve)

(2) Terminal PRV-

9Y1200226CRS1630US0



9Y1200365CRS004A

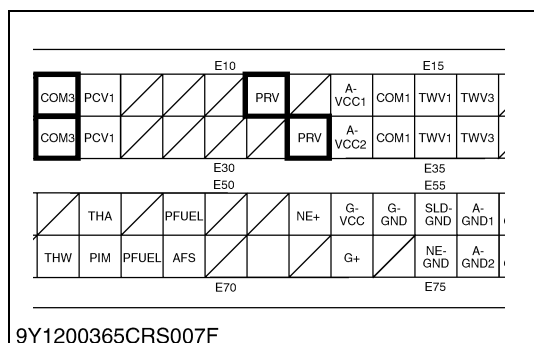
2. Check the Connector and Wiring Harnesses for Poor Contact

- Set the key switch to the OFF position, and check the wiring harness connectors and ECU pins for incorrect connection, deformation, poor contact or other defects.

Factory specification	Must be free from faulty connection, deformation, poor contact or other defects.
-----------------------	--

OK	Go to "3. Measure the Resistance Between ECU Terminals".
NG	Check the PRV wiring harnesses and connectors. → Repair.

9Y1200226CRS1631US0



9Y1200365CRS007F

3. Measure the Resistance Between ECU Terminals

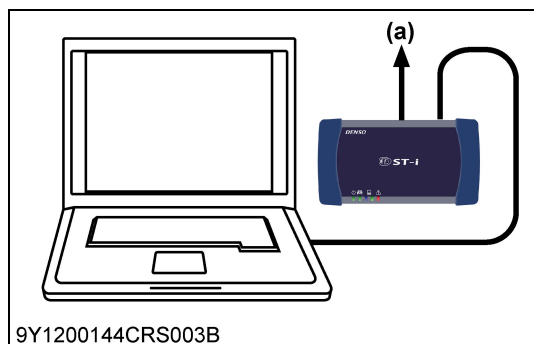
- Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance each terminal of the connector.

Measurement terminal	E06, E26 ↔ E11, E32
----------------------	---------------------

Factory specification	2 Ω or lower
-----------------------	---------------------

OK	Go to "4. Check the DTC".
NG	Check the wiring harnesses and connectors for a poor contact. → Repair.

9Y1200226CRS1632US0



9Y1200144CRS003B

4. Check the DTC

- Plug the ECU connector into socket, and start the engine.
- Clear the DTCs that occurred previously, and check the currently existing trouble.

Factory specification	No DTC is output.
-----------------------	-------------------

OK	Normal.
NG	Faulty ECU → Replace the ECU.

(a) CAN1 Connector

9Y1200226CRS1633US0

(58) EGR (DC Motor) Abnormality (DTC P2413 / 523575-7, P2414 / 523576-2, P2415 / 523577-2)

P2413 / 523575-7: EGR actuator valve stuck

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas emissions

Detection item:

- EGR actuator valve stuck

DTC set preconditions:

- Battery voltage is normal
- No DTC of U0077 "CAN1 Bus off"
- EGR control line is normal

DTC set parameter:

- EGR actuator valve stuck error signal received via CAN

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1634US0

P2414 / 523576-2: EGR (DC motor) overheat

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas emissions

Detection item:

- EGR (DC motor) overheat

DTC set preconditions:

- Battery voltage is normal
- No DTC of U0077 "CAN1 Bus off"
- EGR control line is normal

DTC set parameter:

- EGR (DC motor) temperature error signal (thermistor: 125 °C (257 °F) or more) received via CAN

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1635US0

P2415 / 523577-2: EGR (DC motor) temperature sensor failure**Behaviour during malfunction:**

- Insufficient output
- Worsening exhaust gas emissions

Detection item:

- EGR (DC motor) temperature sensor failure

DTC set preconditions:

- Battery voltage is normal
- No DTC of U0077 "CAN1 Bus off"
- EGR control line is normal

DTC set parameter:

- EGR (DC motor) temperature sensor error signal received via CAN

Engine warning light:

- ON

Limp home action by engine ECU (system action):

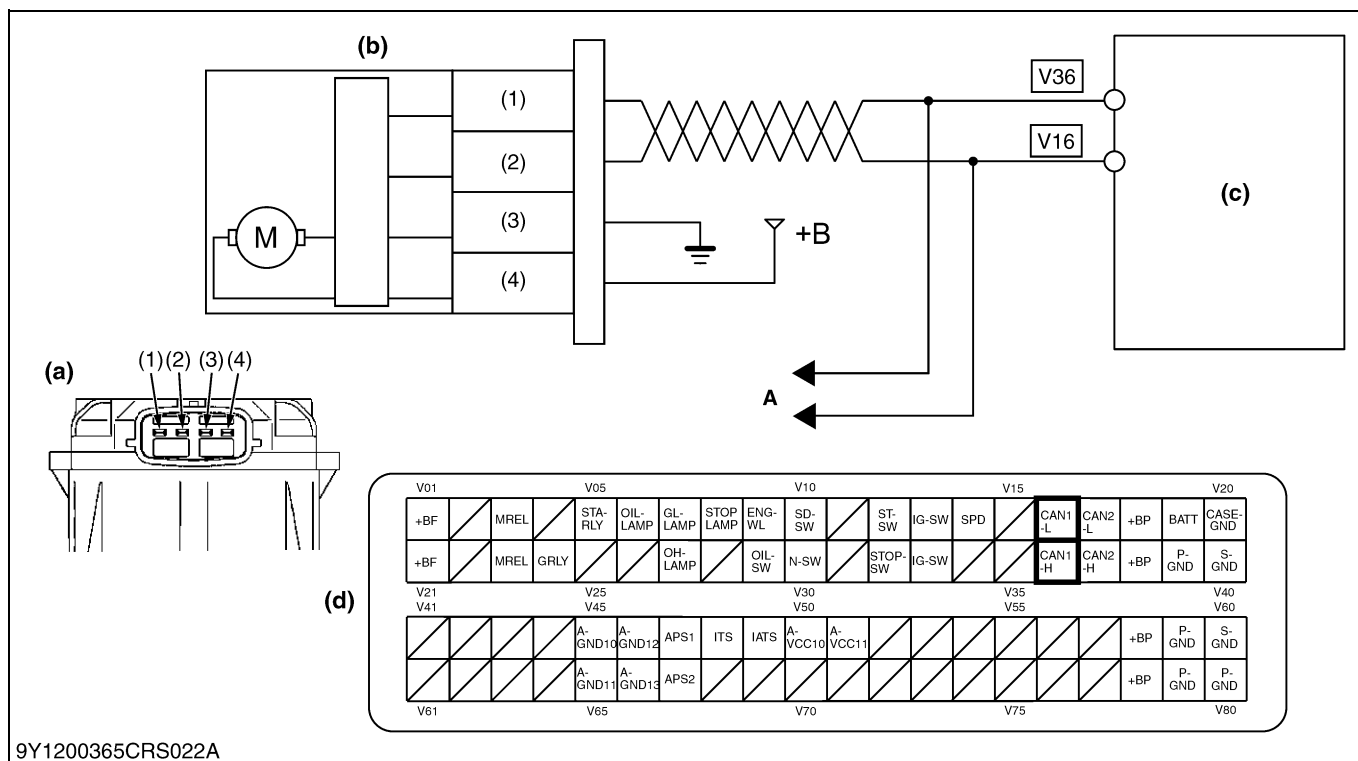
- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1636US0



9Y1200365CRS022A

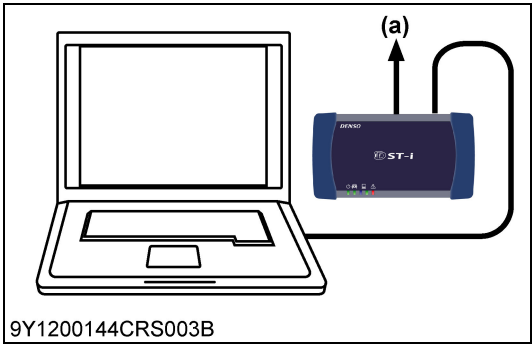
- (1) Terminal CAN-H
(2) Terminal CAN-L

- (3) Terminal Ground
(4) Terminal Power (+12 V)

- (a) Terminal Layout
(b) EGR Valve Assembly
(c) Engine ECU

- (d) ECU Connector 2
(Machine Side)
A: To Diagnosis Tool

9Y1200226CRS1637US0



1. DTC Judgment

- 1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
- 2. Place the key switch in the ON position, check whether the DTC is output or not.
- 3. Check the DTC again after starting up the engine with the coolant temperature over 65 °C (149 °F).

Factory specification	DTC must not be output.
OK	Normal.
NG	Replace the EGR assembly.

(a) CAN1 Connector

9Y1200226CRS1638US0

(59) Intake Throttle Lift Sensor Abnormality (DTC P2621 / 523583-4, P2622 / 523582-3)

P2621 / 523583-4: Intake throttle lift sensor: Low

Behaviour during malfunction:

- None

Detection item:

- Intake throttle lift sensor low

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Intake throttle lift sensor voltage: 0.1 V or less

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1639US0

P2622 / 523582-3: Intake throttle lift sensor: High

Behaviour during malfunction:

- None

Detection item:

- Intake throttle lift sensor high

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Intake throttle lift sensor voltage: 4.89 V or more

Engine warning light:

- ON

Limp home action by engine ECU (system action):

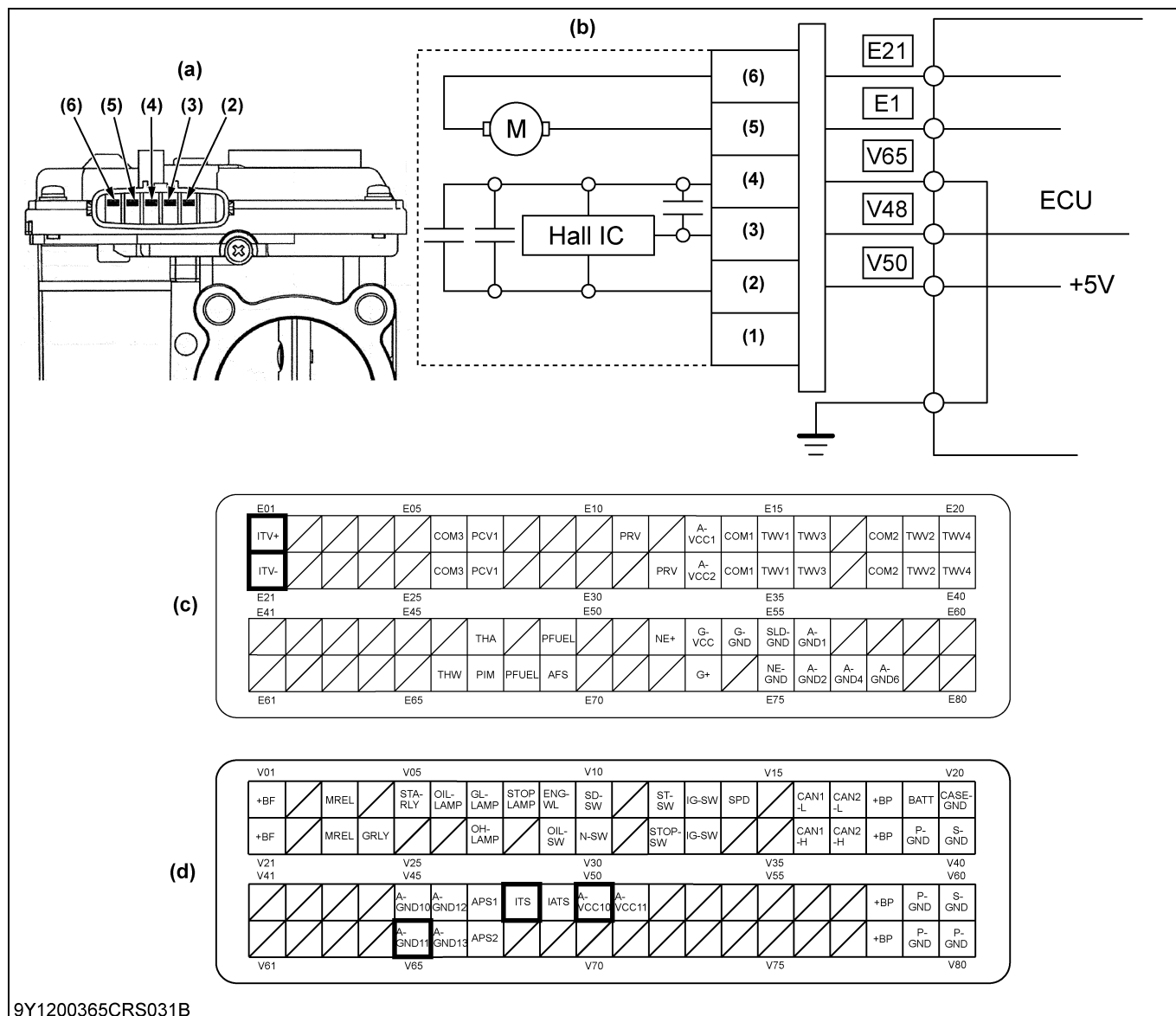
- Output limitation: Approximately 75 % of normal condition
- Intake throttle 100 % open

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1640US0

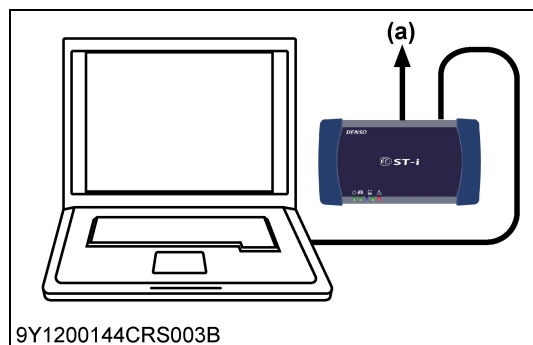


- (1) No Connection
 (2) Terminal A-VCC10 (+5 V)
 (3) Terminal ITS (Output)

- (4) Terminal A-GND11 (Ground)
 (5) Terminal ITV-
 (6) Terminal ITV+

- (a) Terminal Layout
 (b) Intake Throttle Valve
 (c) ECU Connector 1 (Engine Side)
 (d) ECU Connector 2 (Machine Side)

9Y1200226CRS1641US0



1. Check the Intake Throttle Signal

- After operating the engine, perform an active test. Monitor the "Actual intake throttle valve opening" and "Intake throttle opening output voltage", and check the values.
*** For details, refer to the active test section.**
- Clear the DTC and check whether it is output again or not.

Factory specification	No DTC is output.
OK	Normal.
NG	Replace the intake throttle assembly.

(a) CAN1 Connector

9Y1200226CRS1642US0

(60) Boost Pressure Low (DTC P3011 / 132-15)

Behaviour during malfunction:

- Insufficient output

Detection item:

- Dismount the hose between the turbo blower out and intake flange

DTC set preconditions:

- Not in the Regeneration mode
- Engine speed is 1600 min⁻¹ (rpm) or more
- Target intake air flow value is 950 mg/cyl or more
- MAF sensor is normal
- EGR valve is normal
- Intake throttle valve is normal
- Boost pressure sensor is normal
- Barometric pressure sensor is normal
- Coolant temperature sensor is normal

DTC set parameter:

- Boost pressure sensor output is below target level in high air flow operating condition

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop

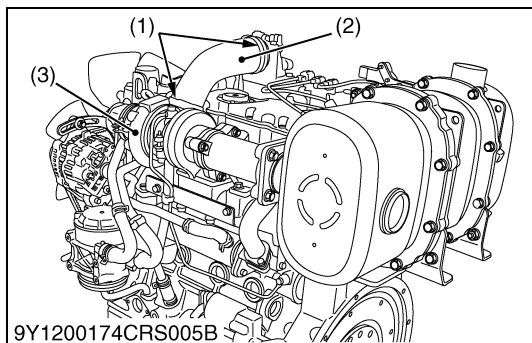
Recovery from error:

- Key switch turn OFF

Remark:

- Engine power is restricted by boost pressure signal accordingly
- To minimize PM emission

9Y1200226CRS1643US0



1. Check the Air Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

■ NOTE

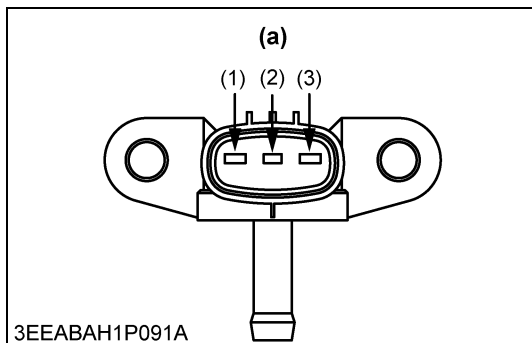
- Check if the suction hose of the turbo blower does not come off.
- Check if the hose of the boost pressure sensor does not come off.

OK	Go to "2. Check the Boost Pressure Sensor (Refer to items P0237 and P0238)".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S543)

- (1) Hose Clamp
(2) Hose

- (3) Turbocharger

9Y1200226CRS1644US0



2. Check the Boost Pressure Sensor (Refer to items P0237 and P0238)

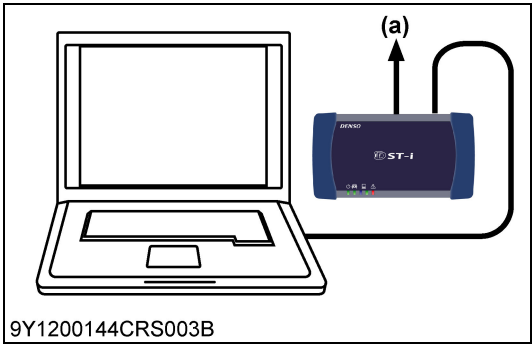
1. Check the boost pressure sensor.

OK	Go to "3. Check the DTC".
NG	Replace the boost pressure sensor or its related parts. (Follow the diagnostic procedure of items P0237 and P0238)

- (1) Terminal A-VCC2
(2) Terminal PIM
(2) Terminal PIM RTN

- (a) Boost Pressure Sensor

9Y1200226CRS1645US0



3. Check the DTC

1. Check the engine noise and vibration after starting up the engine.
Check whether turbo has abnormality. (sound and externals)
2. Check whether the other DTC is output or not by operating the engine in the normal condition.
3. If it is OK, restart and operate the engine for 10 minutes with the engine in the no-load maximum speed status. Check whether the DTC is output or not.

Factory specification	No DTC is output.
-----------------------	-------------------

OK	Normal.
NG	Replace the ECU

(a) CAN1 Connector

9Y1200226CRS1646US0

(61) Initial Pump-calibration Incomplete (DTC P3019 / 523600-0)

Behaviour during malfunction:

- None

Detection item:

- Pump-calibration history

DTC set preconditions:

- Battery voltage is normal

DTC set parameter:

- Initial pump calibration flag = "0"

Engine warning light:

- ON

Limp home action by engine ECU (system action):

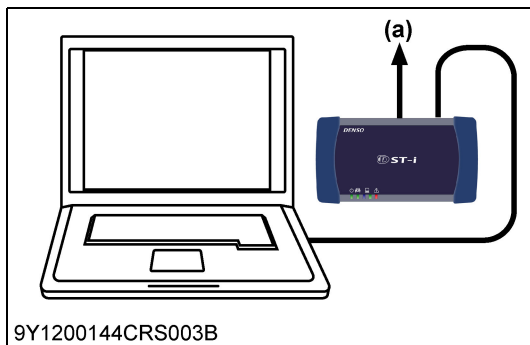
- None

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1647US0



1. Initial Pump-calibration

1. Place the key switch in the OFF position, attach the diagnosis tool the CAN1 connector, and perform the supply pump learning on the utility function.

■ NOTE

- This warning indicates that supply pump learning not performed after replacing ECU on the site.

(a) CAN1 Connector

9Y1200226CRS1648US0

(62) Over Heat Pre-caution (DTC P3025 / 523603-15)

Behaviour during malfunction:

- Worsening exhaust gas emissions (NOx)

Detection item:

- Coolant temperature

DTC set preconditions:

- Coolant temperature sensor is normal

DTC set parameter:

- Engine coolant temperature $\geq 110\text{ }^{\circ}\text{C}$ (230 $^{\circ}\text{F}$)

Engine warning light:

- ON

Limp home action by engine ECU (system action):

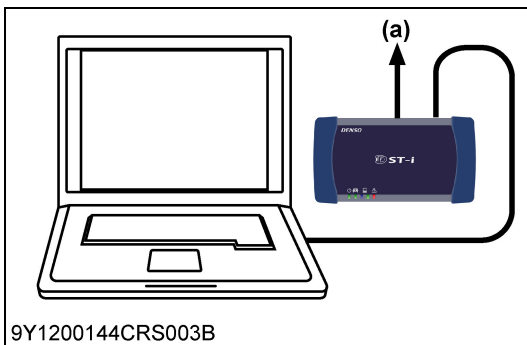
- None

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1649US0



1. Check the DTC

1. This DTC does not mean error.

The EGR operation is restricted when the coolant temperature rises above 110 $^{\circ}\text{C}$ (230 $^{\circ}\text{F}$).

So, this warning indicates that emission could worsen due to the limitation.

- (a) CAN1 Connector

9Y1200226CRS1650US0

(63) CAN2 Bus Off (DTC U0075 / 523547-2)**Behaviour during malfunction:**

- Insufficient output
- Transmitted CAN data are invalid

Detection item:

- CAN2 +B or GND short circuit or high traffic error

DTC set preconditions:

- Battery voltage is normal
- Key switch is ON

DTC set parameter:

- CAN2 Bus off

Engine warning light:

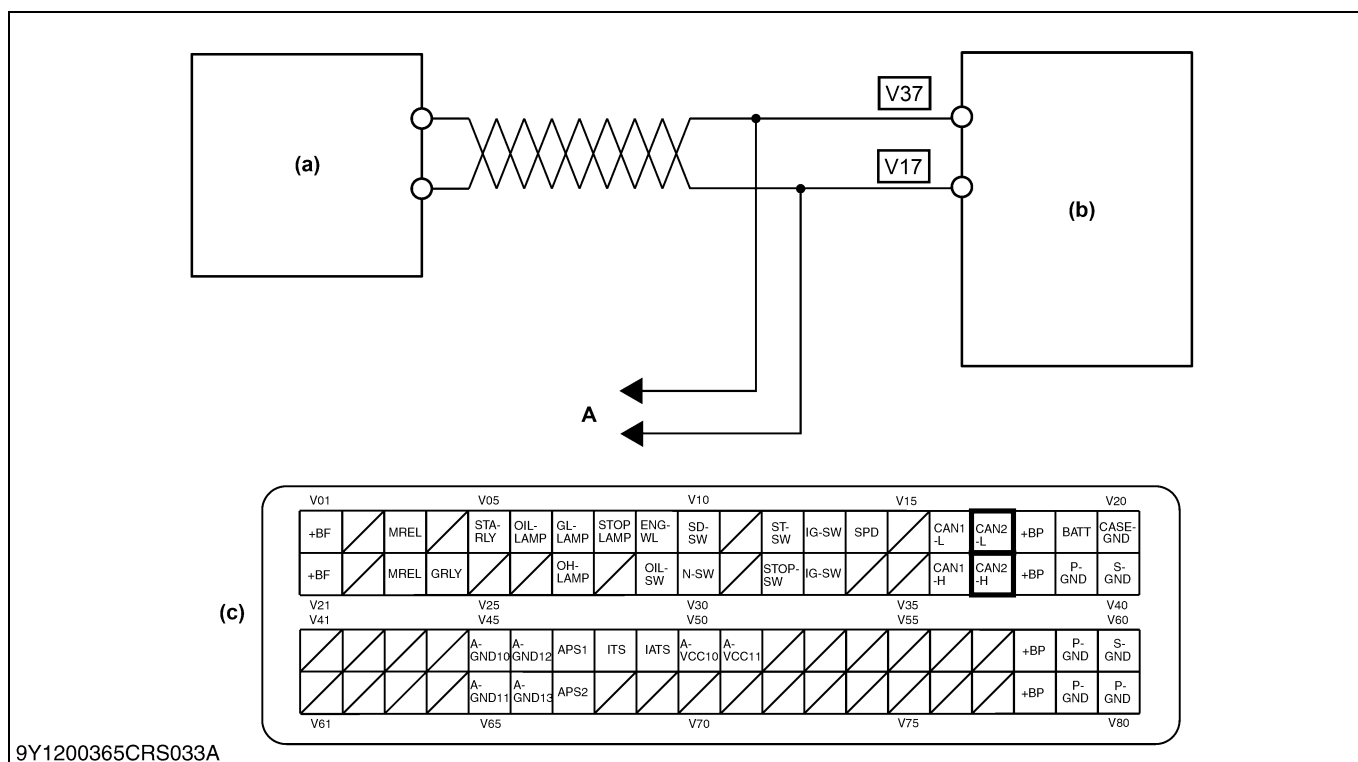
- ON

Limp home action by engine ECU (system action):

- Forced Idle (Accelerator = 0 %)

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200365CRS033A

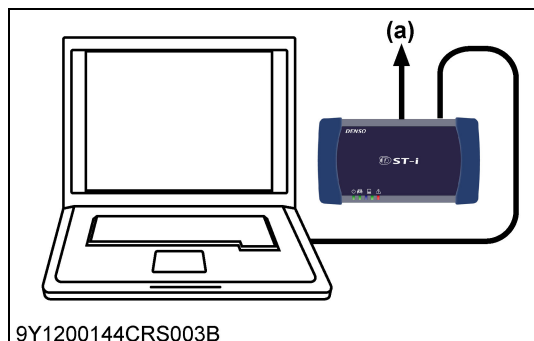
(a) ECU for Machine

(b) Engine ECU

(c) ECU Connector 2
(Machine Side)

A: To Other ECU

9Y1200226CRS1651US0



9Y1200144CRS003B

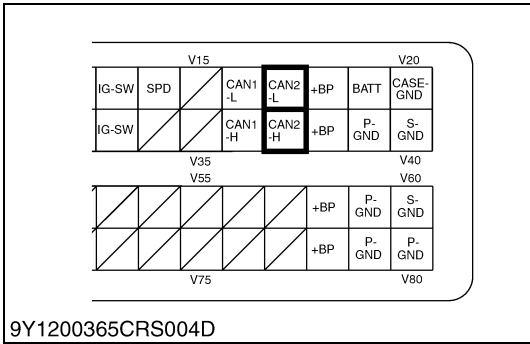
1. DTC Judgment

1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Place the key switch in the ON position, check whether the DTC (U0075) is output or not.

Factory specification	DTC (U0075) must not be output.
OK	Normal.
NG	Go to "2. Check the Wiring Related to the CAN of the Common Rail System".

(a) CAN1 Connector

9Y1200226CRS1652US0



2. Check the Wiring Related to the CAN of the Common Rail System

1. Check the wiring harness and connectors being connected to ECU terminals V17 and V37 for a short or an open circuit.

■ IMPORTANT

- Refer to "6.[3] ELECTRIC SYSTEM INSPECTION PROCEDURE - (1) Basics of Checking Electrical / Electronic Circuit Systems". (Refer to page 1-S549)

OK	Replace the ECU.
NG	Repair or replace the faulty areas.

9Y1200226CRS1653US0

(64) No Communication with EGR (DTC U0076 / 523578-2)

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas emissions

Detection item:

- No communication with EGR

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- Interruption of CAN

Engine warning light:

- ON

Limp home action by engine ECU (system action):

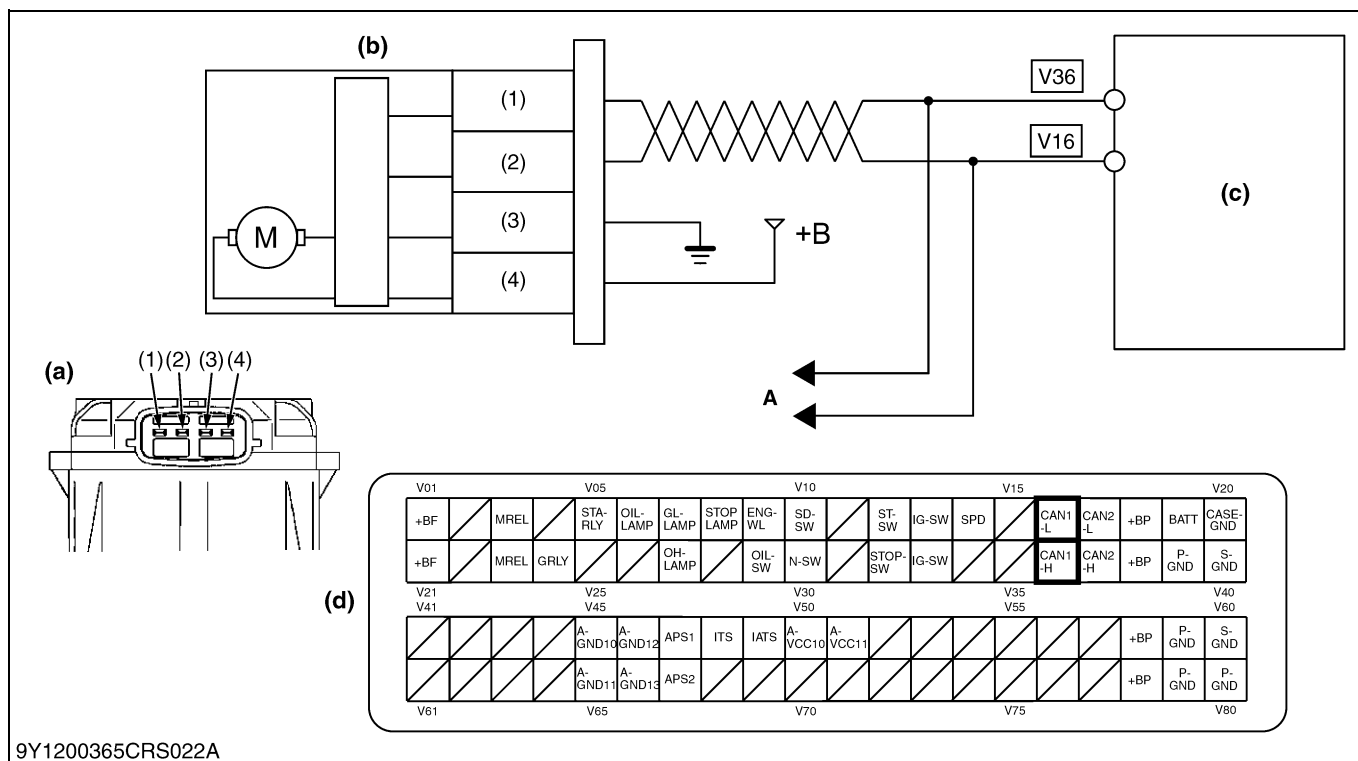
- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1654US0



9Y1200365CRS022A

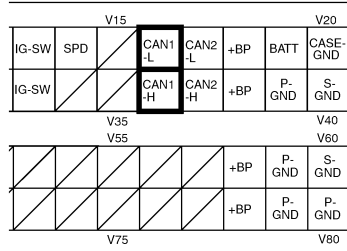
- (1) Terminal CAN-H
(2) Terminal CAN-L

- (3) Terminal Ground
(4) Terminal Power (+12 V)

- (a) Terminal Layout
(b) EGR Valve Assembly
(c) Engine ECU

- (d) ECU Connector 2 (Machine Side)
A: To Diagnosis Tool

9Y1200226CRS1655US0



9Y1200365CRS004E

1. Check the Wiring Related to the CAN of the Common Rail System

1. Check the connector and the wiring harness being connected to ECU terminal V16 and V36 for a short or an open circuit.

■ IMPORTANT

- Refer to "6.[3] ELECTRIC SYSTEM INSPECTION PROCEDURE - (1) Basics of Checking Electrical / Electronic Circuit Systems". (Refer to page 1-S549)

■ NOTE

- If the "CAN 1 Bus off error" is output at the same time, carry out this inspection first.

OK	Go to "2. Measure the EGR Terminal Voltage".
NG	Repair or replace the faulty areas.

9Y1200226CRS1656US0

2. Measure the EGR Terminal Voltage

1. Place the key switch in the ON position, and measure the voltage between EGR terminals (3) and (4).

Factory specification	Approx. 10 to 16 V
-----------------------	--------------------

OK	Go to "3. Check the DTC Again".
NG	Repair or replace the faulty areas.

- (1) Terminal CAN-H
(2) Terminal CAN-L

- (3) Terminal Ground
(4) Terminal Power (+12 V)

9Y1200226CRS1657US0

3. Check the DTC Again

1. Clear the past malfunction data, and make sure that the same DTC is output again in the reproduction test.

Factory specification	Normal (No DTC is output.)
-----------------------	----------------------------

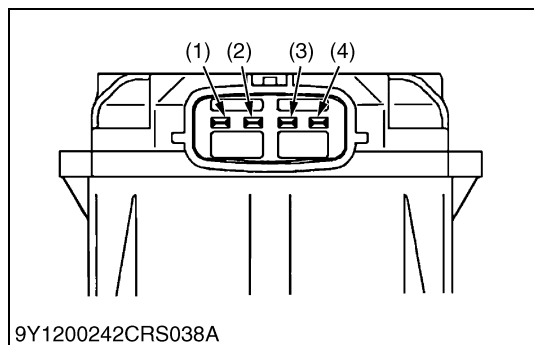
■ NOTE

- Check the DTC again after starting up the engine with the coolant temperature over 65 °C (149 °F).

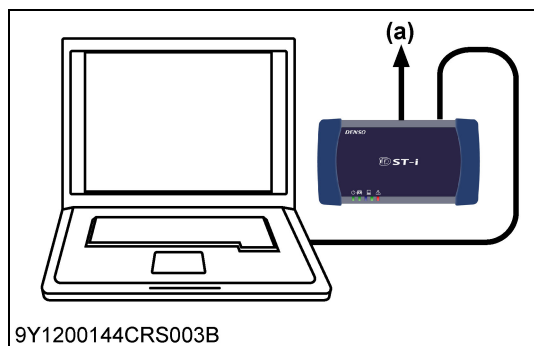
OK	Normal.
NG	Replace the EGR assembly.

(a) CAN1 Connector

9Y1200226CRS1658US0



9Y1200242CRS038A



9Y1200144CRS003B

(65) CAN1 Bus Off (DTC U0077 / 523604-2)

Behaviour during malfunction:

- Insufficient output
- Transmitted CAN data are invalid

Detection item:

- CAN1 +B or GND short circuit or high traffic error

DTC set preconditions:

- Battery voltage is normal
- Key switch is ON

DTC set parameter:

- CAN1 Bus off

Engine warning light:

- ON

Limp home action by engine ECU (system action):

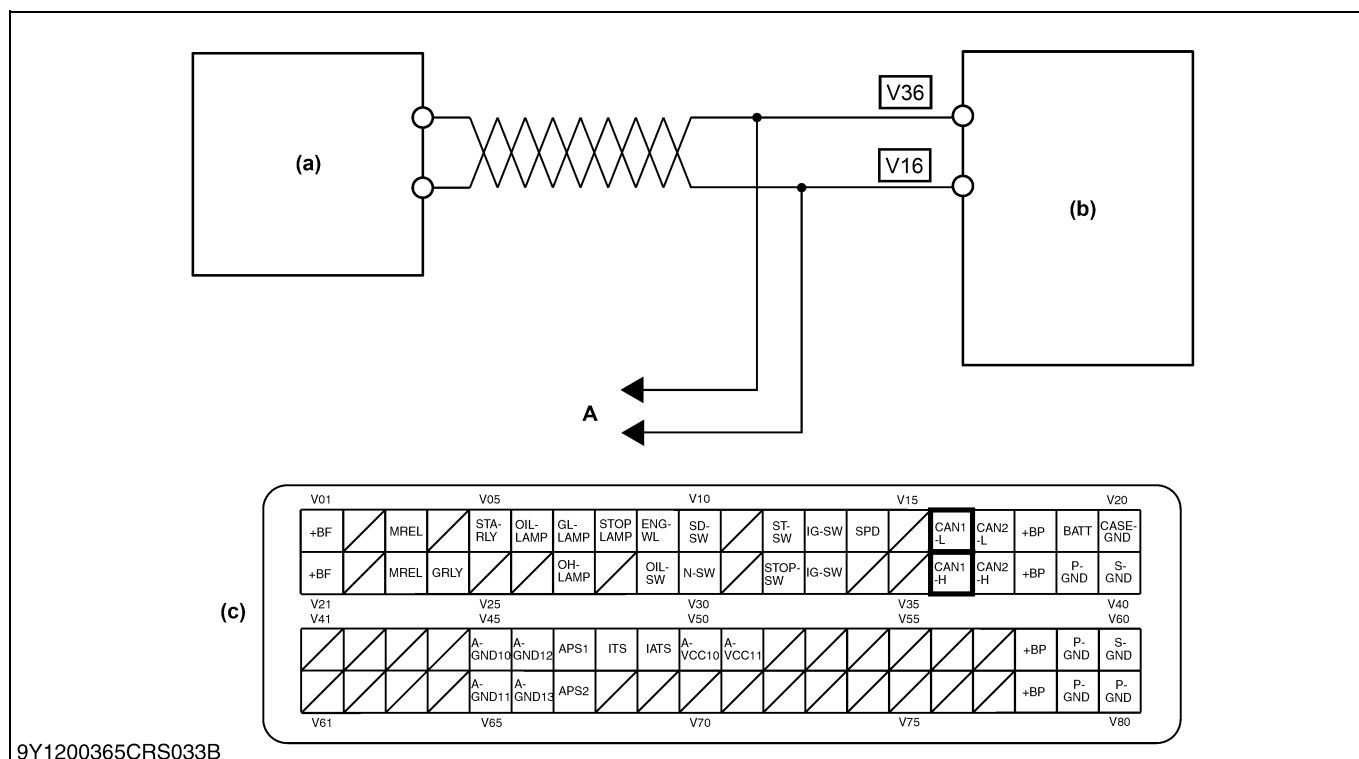
- Output limitation: Approximately 50 % of normal condition
- Speed limitation (Accelerator limitation: 50 %)
- EGR stop

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1659US0



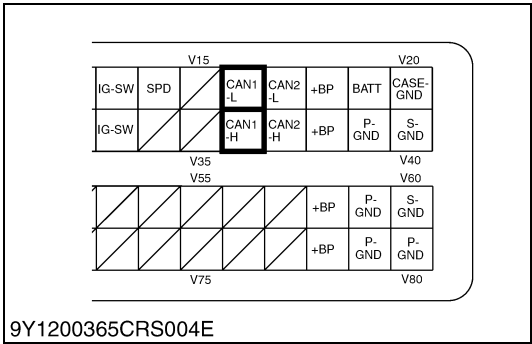
(a) EGR Valve Assembly

(b) Engine ECU

**(c) ECU Connector 2
(Machine Side)**

A: To Diagnosis Tool

9Y1200226CRS1660US0



1. Check the Wiring Related to the CAN of the Common Rail System

1. Check the connector and the wiring harness being connected to ECU terminal V16 and V36 for a short or an open circuit.

■ IMPORTANT

- Refer to "6.[3] ELECTRIC SYSTEM INSPECTION PROCEDURE - (1) Basics of Checking Electrical / Electronic Circuit Systems". (Refer to page 1-S549)

OK	Replace the ECU.
NG	Repair or replace the faulty areas.

9Y1200226CRS1661US0

(66) CAN2 Frame Error (DTC U0081 / 523548-2, U0082 / 523591-2, U0084 / 523593-2, U0085 / 523594-2, U0086 / 523595-2, U0087 / 523596-2, U0089 / 523598-2)

U0081 / 523548-2: CAN-KBT frame error

Behaviour during malfunction:

- Insufficient output

Detection item:

- CAN-KBT original frame open circuit error

DTC set preconditions:

- Battery voltage is normal
- Key switch turn OFF to ON
- Starter switch signal (ECU: V12 terminal) is not activated
- No error of "CAN2 Bus off"

DTC set parameter:

- CAN2 KBT Frame open circuit error

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Forced Idle (Accelerator = 0 %)

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1662US0

U0082 / 523591-2: CAN CCVS (Vehicle Speed) frame error

Behaviour during malfunction:

- None

Detection item:

- CAN_CCVS communication stopping

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- CAN CCVS frame time out error

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Vehicle speed = 0 [default value]

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1663US0

U0084 / 523593-2: CAN DDC1 (Transmission) frame error**Behaviour during malfunction:**

- None

Detection item:

- CAN_DDC1 communication stopping

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- CAN DDC1 frame time out error

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Accelerator non-linear processing flag = 0 [default value]
- Accelerator non-linear processing invalid

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1664US0

U0085 / 523594-2: CAN ETC2 (Neutral SW) frame error**Behaviour during malfunction:**

- None

Detection item:

- CAN_ETC2 communication stopping

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- CAN ETC2 frame time out error

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Neutral SW = OFF [default value]

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1665US0

U0086 / 523595-2: CAN ETC5 (Neutral SW) frame error**Behaviour during malfunction:**

- None

Detection item:

- CAN_ETC5 communication stopping

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- CAN ETC5 frame time out error

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Neutral SW = OFF [default value]

Recovery from error:

- Key switch turn OFF

Remark:

9Y1200226CRS1666US0

U0087 / 523596-2: CAN TSC1 frame error**Behaviour during malfunction:**

- None

Detection item:

- CAN_TSC1 communication stopping

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- No request to "TSC1 buffer" continues 3 times after over-ride control request (other than 0x00)

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Override control mode = Normal mode [default value]

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1667US0

U0089 / 523598-2: CAN EBC1 frame error**Behaviour during malfunction:**

- None

Detection item:

- CAN_EBC1 communication stopping

DTC set preconditions:

- Battery voltage is normal
- Starter switch signal (ECU: V12 terminal) is not activated

DTC set parameter:

- CAN EBC1 frame time out error

Engine warning light:

- ON

Limp home action by engine ECU (system action):

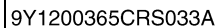
- Non shutdown [default value]
- Output limitation: Approximately 75 % of normal condition

Recovery from error:

- Diagnostic counter = zero

Remark:

9Y1200226CRS1668US0



A: To Other ECU

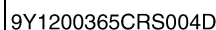


1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Place the key switch in the ON position, check whether the DTC is output or not.

- If the "CAN 2 Bus off error" is output at the same time, carry out this inspection first.
- Make sure that the ECU on the machine side operates properly.

OK	Normal.
NG	Go to "2. Check the Wiring Related to the CAN of the Common Rail System".

(a) CAN1 Connector



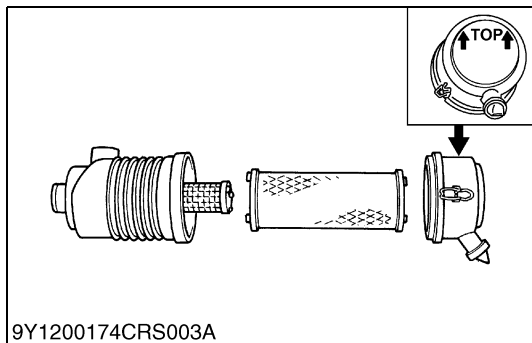
1. Check the wiring harness and connectors being connected to ECU terminals V17 and V37 for a short or an open circuit.

- Refer to "6.[3] ELECTRIC SYSTEM INSPECTION PROCEDURE - (1) Basics of Checking Electrical / Electronic Circuit Systems". (Refer to page 1-S549)

9Y1200226CRS1671US0

6. INSPECTION PROCEDURE FOR EACH SYSTEM

[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE

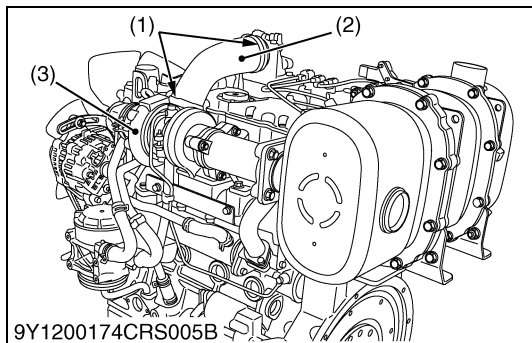


1. Check the Air Cleaner

- Check the air cleaner for clogging.
 - Clean air cleaner element (Primary and Secondary) every 250 hours.
 - Replace air cleaner element:
Once yearly or after every sixth cleaning, whichever comes first.

OK	Go to "2. Check the Suction Path".
NG	Clean or replace.

9Y1200226CRS1181US0



2. Check the Suction Path

- Check the suction path for leaks. (including mass air flow sensor, intake throttle valve, EGR valve, turbocharger, intercooler, etc.)
 - Suction path joints.
 - Suction pipes, hoses.

■ NOTE

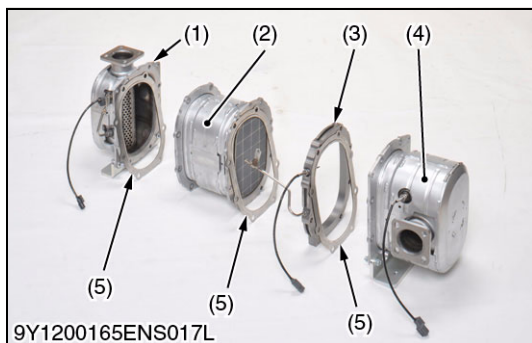
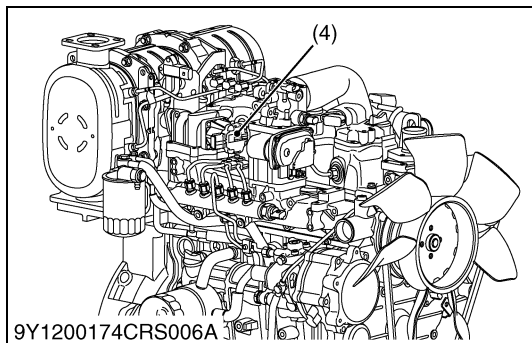
- A small amount of gas and water bleeds from the valve chamber gas bleeding hole of the EGR valve. This is normal.
- Do not change or deform the layout of the air intake system.

OK	Normal.
NG	Go to "3. Check the DPF Filter Comp".

- (1) Hose Clamp
(2) Hose

- (3) Turbocharger
(4) EGR Valve

9Y1200226CRS1182US0



3. Check the DPF Filter Comp

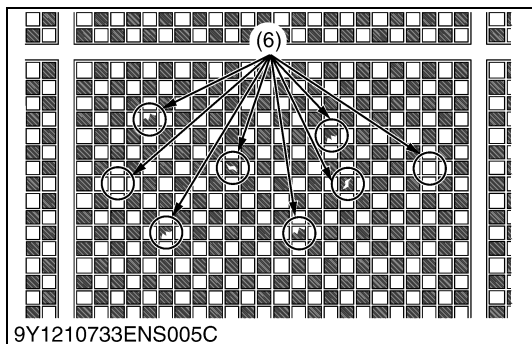
- Remove the DPF muffler full assembly.
- Remove the DPF filter comp from the DPF muffler full assembly and check to see that the surface of the both ends of the filter (inlet side and outlet side) are not darkened.
- Check whether there is no crack or loss of the sealing part of the cell holes on both ends of the filter (inlet side and outlet side).
- Repair or replace the malfunctioning components. (mass air flow sensor, intake throttle valve, EGR valve, turbocharger, intercooler, suction path joints, suction path pipes, hoses, etc.)

Factory specification	<ul style="list-style-type: none"> Both ends of the filter (inlet side and outlet side) are not darkened Number of missing sealing parts: Less than 14 There are no cracks or losses of the ceramics element
-----------------------	---

OK	Normal. Reassembly the DPF muffler full assembly.
NG	After replacing the new DPF muffler full assembly, reassembly them.

- (1) Body (DPF Outlet)
(2) DPF Filter Comp
(3) Collar (DPF)

- (4) Catalyst (DOC)
(5) Gasket
(6) Missing Sealing Parts



9Y1200226CRS1672US0

[2] FUEL SYSTEM INSPECTION PROCEDURE

Fuel:

Fuel is flammable and can be dangerous.
You should handle fuel with care.

Item	Allowable range	Condition and comments
Lubrication	Equivalent or better to HFFR 460 µm	
Water content	Up to 0.05 %	
Contamination	Less than 0.17 mg/litre	ISO4406=class 16/15/8
Temperature	-25 to 80 deg.C	Inlet at supply pump
Pressure	-30 to 40 kPa	Inlet at supply pump
Bio content	Up to 5 %	ASTM D6751, EN14214 (7 %; EU EN590: 2009)
Filtration diameter	Less than 2 micron (Over 95 % trap ratio)	

- Strongly recommended not to apply zinc coated fuel tank. High zinc content fuel may be cause of injection system trouble.
- Cetane Rating: The minimum recommended Fuel Cetane Rating is 45.
A cetane rating greater than 50 is preferred, especially for ambient temperatures below -20 °C (-4 °F) or elevations above 1500 m (5000 ft).
- Diesel Fuel Specification Type and Sulfur Content % (ppm) used, must be compliant with all applicable emission regulations for the area in which the engine is operated.
- DO NOT USE Fuels that have sulfur content greater than 0.0015 % (15 ppm).
- Diesel fuels specified to EN 590 or ASTM D975 are recommended.
- No.2-D is a distillate fuel of lower volatility for engines in industrial and heavy mobile service. (SAE J313 JUN87)
- These engines utilize Interim Tier 4 standards, the use of ultra low sulfur fuel is mandatory for these engines, when operated in US EPA regulated areas.

Therefore, please use No.2-D S15 diesel fuel as an alternative to No.2-D, and use No.1-D S15 diesel fuel as an alternative to No.1-D for ambient temperatures below -10 °C (14 °F).

1. SAE: Society of Automotive Engineers
2. EN: European Norm
3. ASTM: American Society of Testing and Materials
4. US EPA: United States Environmental Protection Agency
5. No.1-D or No.2-D, S15: Ultra Low Sulfur Diesel (ULSD) 15 ppm or 0.0015 wt. %

■ IMPORTANT

- **Be sure to use a strainer when filling the fuel tank, or dirt or sand in the fuel may cause trouble.**
- **Do not run the fuel tank level too low or completely out of fuel. Additionally, fuel system bleeding may be necessary if air enters the fuel system.**

Biodiesel fuel:

[When the B7 blended fuel is used]

When the finally blended Biodiesel fuel is B7, make sure it conforms to the updated EN590 (European) standard. Be also sure that the mineral oil diesel fuel, if used, conforms to the updated EN590 (European) standard and that the B100 blend conforms to the updated EN14214 (European) standard.

[When the B5 blended fuel is used]

When the finally blended Biodiesel fuel is B5, make sure it conforms to the updated EN590 (European) standard. Be also sure that the mineral oil diesel fuel, if used, conforms to the updated EN590 (European) standard or the ASTM D975 (U.S.) standard and that the B100 blend conforms to the updated EN14214 (European) standard or the ASTM D6751 (U.S.) standard.

(To be continued)

(Continued)**[Precautions in handling Biodiesel fuels]**

1. Keep the fuel tank full whenever possible to prevent water vapor from accumulating inside the fuel tank.
Tighten up the fuel tank filler cap to avoid the entry of moisture.
2. Routinely check the oil level before the operation.
Also strictly follow the specified oil change intervals.
3. Biodiesel fuels (BDF) during the supply process or in the machine easily deteriorate due to oxygen, water, heat and other foreign substances. With this in mind, take the following precautions.
 - Do not leave those fuels in the fuel tank or a metallic drum longer than 3 months.
 - Before storing the engine for a prolonged period, change such fuel for a conventional type of diesel fuel and run the engine for 30 minutes or longer to clean up the fuel system.
4. Bear it in mind that Biodiesel fuels have the characteristics below.
Referring to the servicing intervals specified in the KUBOTA product's Operator's Manuals, be sure to maintain and clean up the fuel system, replace the fuel rubber piping with new ones and take other necessary measures. It is advisable to replace the fuel filter with a new one after half the specified replacement intervals.
(Compared with the use of mineral oil diesel fuels, the filtration performance of fuel filters gets degraded earlier than expected.)
 - Biodiesel fuels easily induce the growth of microorganisms and foul themselves.
This may get the fuel system corroded and the fuel filter clogged.
 - In cold weather, some problems may occur: the clog of the fuel line or fuel system, starting failure, and other unforeseen troubles.
 - Biodiesel fuels easily soak up moisture, which means that they may contain higher moisture content than conventional diesel fuels.
5. Palm oil-based Biodiesel fuels are inferior in low temperature fluidity to soy-based and rapeseed-based Biodiesel fuels.
In cold season in particular, this may clog the fuel filter.
6. If Biodiesel fuels are spilt on a coated surface, the coating may get damaged.
Immediately wipe the spill off the surface.

Fuel filter:

- At least, filter mesh below is required.
5 µm dust - dust collecting efficiency 95 % or more (Standard spec. filter)
 - An additional filter which has higher cleaning efficiency may be required depending on the spec. (working condition) or area. Even the maximum period of operation time is same, in case the cleaning efficiency has improved, it is required to expand the size of a filter (A filter needs to be bigger.).

Criteria at the entrance of supply pump:

- Water content: Less than 0.05 % (500ppm)
 - Use to compare with the analysis result by the third-party organization.
- Air: No existence (Do not modify the specific fuel pipe)
 - Visually check is possible by using clear hose. Pay sufficient caution to contamination.
- Critical load: (at all operating conditions) –30 kPa or more
 - Perform a measurement of the pressure depending on the situation.

9Y1200226CRS1183US0

1. Check the Fuel System (Remaining Fuel Quantity and Properties)

1. Check the amount of fuel remaining in the tank.
2. Check properties of fuel. Request fuel analysis from a third party as necessary.
 - Color (no color, brownish, white turbidity).
 - Odor (kerosene, heavy oil, irritating odor).
 - Separation of materials (water, foreign objects).
 - Viscosity (high / low viscosity, wax consistency).

■ NOTE

- **Always use the specified fuel.**

OK	Go to "2. Check the Inside of the Tank (Checking for Tank Modification / Additions, Position of Fuel Pipe Inlet / Outlet, Clogging and Holes)".
NG	Add fuel or change fuel (clean tank).

9Y1200226CRS1184US0

2. Check the Inside of the Tank (Checking for Tank Modification / Additions, Position of Fuel Pipe Inlet / Outlet, Clogging and Holes)

1. Check the tank for modifications or additions. Consult with the customer.
 - Fuel inlet / outlet position, tank piping.
 - Foreign material inside the tank, water separation, rust.

■ NOTE

- **Use resin tanks when making tank additions.**
2. Check the tank internal fuel piping for the following.
 - Inlet / outlet position (below position "Empty").
 - Inlet clogging, whether there is bent or deformed piping (crushed pipe).
 - Crushing at pipe connections.

OK	Go to "3. Tank External Fuel Path Conditions (Crushed Hose, Clogging, Air Introduction at Hose Connection)".
NG	Restore the fuel tank.

9Y1200226CRS1185US0

3. Tank External Fuel Path Conditions (Crushed Hose, Clogging, Air Introduction at Hose Connection)

1. Check the condition of the hose.
 - Crushing around bands, over bending.
 - Pinched or crushed by other parts.
2. Check the connection (air introduction).
 - Looseness.
 - Hose deterioration (verify that there is no rubber hardening / splitting by hand or visually).

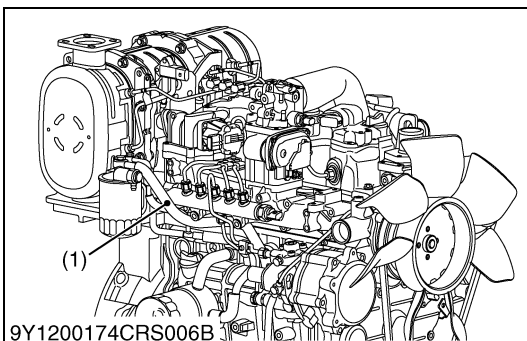
■ NOTE

- **Be cautious when vacuum pressure is present, as air will be drawn into the hose.**

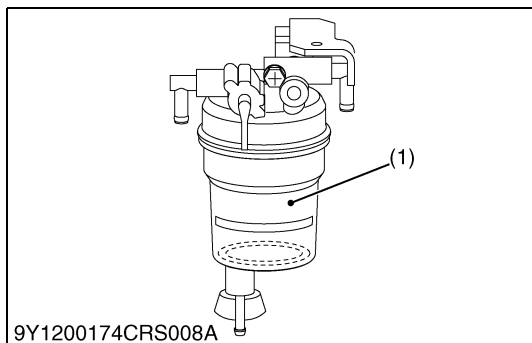
OK	Go to "4. Check the Water Separator".
NG	Replace the hose.

(1) Fuel Hose

9Y1200226CRS1186US0



9Y1200174CRS006B



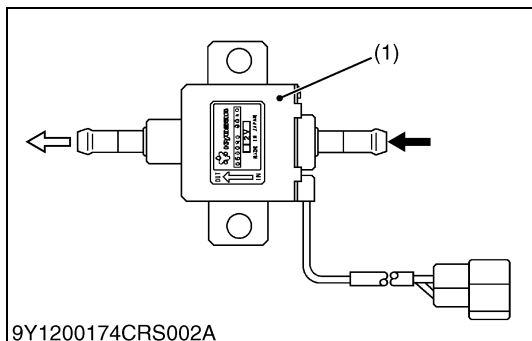
4. Check the Water Separator

1. Check the water level of the water separator and discharge some water as necessary.
2. Check for element deformation and dirt.
Clean or replace the element as necessary.

OK	Go to "5. Check the Fuel Feed Pump".
NG	Replace the filter and drain the water from the water separator.

(1) Water Separator

9Y1200226CRS1187US0



5. Check the Fuel Feed Pump

1. Set the key switch to the ON position, check the fuel feed pump alone, and check and repair the wiring harnesses.
2. Check the operation of the fuel feed pump by touching it directly by hand.

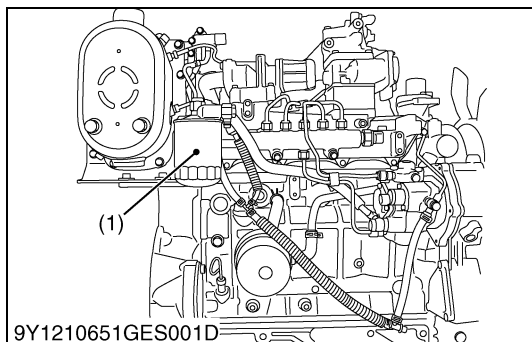
■ NOTE

- If there is a fuel feed pump malfunction, the fuel cannot be supplied and so there is greater likelihood of improper recognition of DTC codes related to the pressure and injector. (Items where improper recognition is possible.)
- Injector COM1 TWV actuation system short
- SCV, PCV or PRV actuation system abnormality
- Others

OK	Go to "6. Fuel Filter Clogged".
NG	Repair the wiring harness, and replace the fuel feed pump.

(1) Fuel Feed Pump

9Y1200226CRS1188US0



6. Fuel Filter Clogged

1. Check the fuel filter for clogging and dirt.

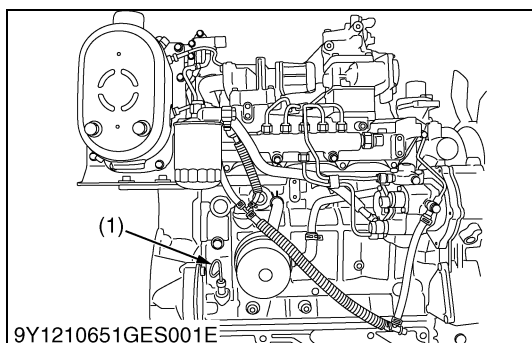
■ NOTE

- Replace the fuel filter every 500 operation hours.

OK	Go to "7. Engine Oil Level Increase (Engine Internal Leak)".
NG	Clean or replace the fuel filter and fuel pipe system.

(1) Fuel Filter

9Y1200226CRS1189US0



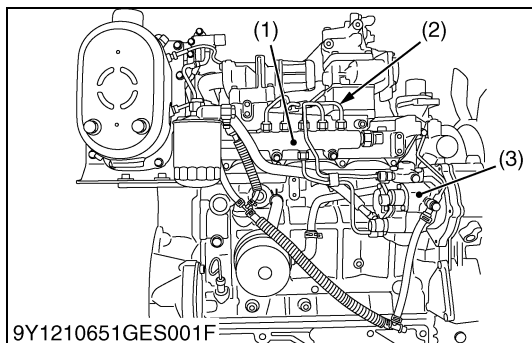
7. Engine oil Level Increase (Engine Internal Leak)

1. Check the engine oil level increase with dipstick.
2. Request fuel dilution analysis or oil analysis from a third party as necessary.

OK	Go to "8. Check the High Pressure Piping and CRS Components (Such as the Fuel Injector and the Supply Pump) for Fuel Leakage (Engine External Leak)".
NG	Check and repair interior pipes.

(1) Dipstick

9Y1200226CRS1190US0



8. Check the High Pressure Piping and CRS Components (Such as the Fuel Injector and the Supply Pump) for Fuel Leakage (Engine External Leak)

1. Visually check and specify areas leaking fuel.
2. Be cautious because there may be oil leaks in the high pressure pipe and injector areas.

OK	Normal.
NG	Repair leaking high pressure pipe, etc. or replace leaking parts.

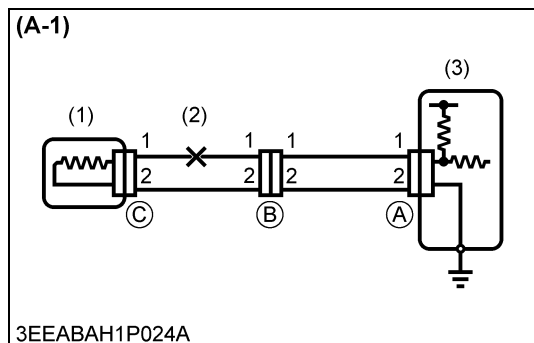
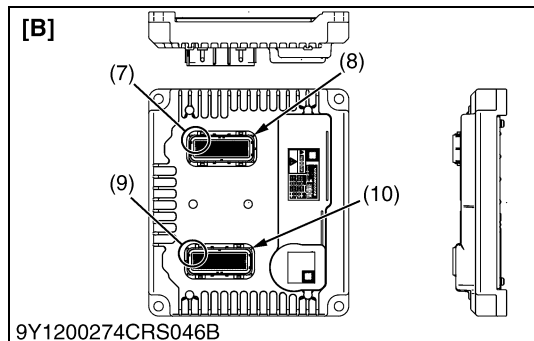
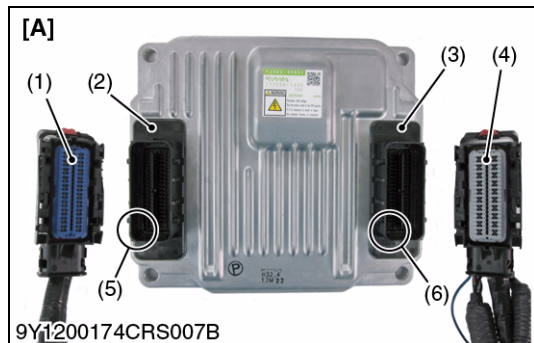
- (1) Rail
(2) Injection Pipe

(3) Supply Pump

9Y1200226CRS1191US0

[3] ELECTRIC SYSTEM INSPECTION PROCEDURE

(1) Basics Of Checking Electrical / Electronic Circuit Systems



Measure the ECU Terminal Voltage and Resistance

- When measuring the voltage and resistance of each terminal, insert the multimeter probe into the rear side of the wiring harness connector. If connectors are small making it difficult to insert the probe, insert a fine metal wire into the rear of the connector and touch the wire to the probe.

■ IMPORTANT

- When inserting a fine metal wire for measurement purposes, ensure that the connector waterproof rubber is not damaged.

- | | |
|---|-------------------------------------|
| (1) ECU Wiring Harness Connector 1 (Engine Side) | (6) V01 Position |
| (2) ECU Connector 1 (Engine Side) | (7) E01 Pin Position |
| (3) ECU Connector 2 (Machine Side) | (8) ECU Connector 1 (Engine Side) |
| (4) ECU Wiring Harness Connector 2 (Machine Side) | (9) V01 Pin Position |
| (5) E01 Position | (10) ECU Connector 2 (Machine Side) |

[A] V3800-CR-TE4/-TIE4/-TE4C/
-TIE4C

[B] V3800-TIE4/-TIE4C

9Y1200226CRS1192US0

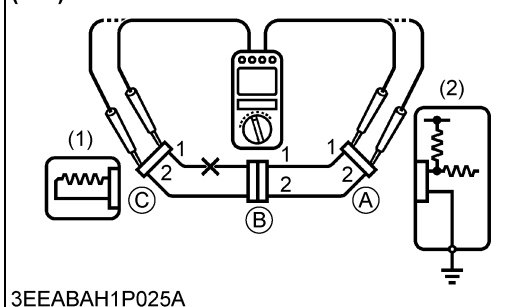
Open Circuit Check

- When dealing with a wiring harness open circuit like that depicted in Figure A-1, check continuity or voltage to determine the location of the open circuit.

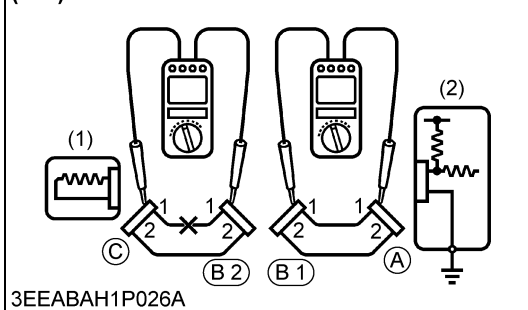
- | | |
|------------------|---------|
| (1) Sensor | (3) ECU |
| (2) Open Circuit | |

9Y1200226CRS1193US0

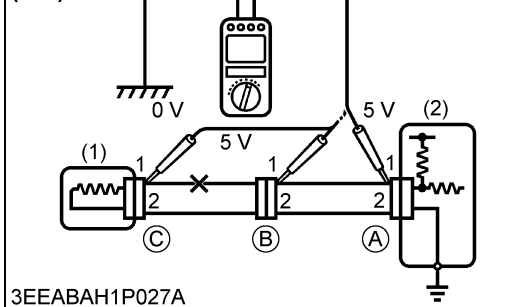
(A-2)



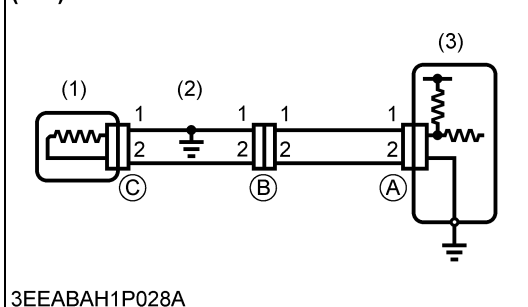
(A-3)



(A-4)



(A-5)



Check for Continuity

1. Remove connectors **"A"** and **"C"** and measure resistance between the two.

Factory specification	Less than 1 Ω
-----------------------	----------------------

(Reference)

- Measure resistance while gently shaking the wiring harness up and down, and side-to-side.
2. In the case of Figure **A-2**, there is no continuity (open circuit) between terminal 1 of connector **"A"** and terminal 1 of connector **"C"**. However, there is continuity between terminal 2 of connector **"A"** and terminal 2 of connector **"C"**. As a result, it can be said that there is an open circuit between terminal 1 of connector **"A"** and terminal 1 of connector **"C"**.
 3. Remove connector **"B"** and measure the resistance in the connector.
 4. In the case of Figure **A-3**, there is continuity between terminal 1 of connector **"A"** and terminal 1 of connector **"B1"**. However, there is no continuity (open circuit) between terminal 1 of connector **"B2"** and terminal 1 of connector **"C"**. As a result, it can be said that there is an open circuit between terminal 1 of connector **"B2"** and terminal 1 of connector **"C"**.

(1) Sensor

(2) ECU

9Y1200226CRS1194US0

Check Voltage

1. In the case of the circuit that supplies voltage to the ECU connector terminals, check for an open circuit by performing a voltage check.
2. As depicted in Figure **A-4**, measure the voltage of the ECU 5 V output terminal between the body ground and terminal 1 of connector **"A"** with all connectors connected. Next, measure in order the voltage between terminal 1 of connector **"B"** and the body ground, and terminal 1 of connector **"C"** and the body ground.
3. The faulty circuit and measurement results are as per below.

(Measurement Results)

- Voltage between terminal 1 of connector **"A"** and the body ground is 5 V.
- Voltage between terminal 1 of connector **"B"** and the body ground is 5 V.
- Voltage between terminal 1 of connector **"C"** and the body ground is 0 V.

(Faulty Circuit)

- There is an open circuit between terminal 1 of connector **"B"** and terminal 1 of connector **"C"**.

(1) Sensor

(2) ECU

9Y1200226CRS1195US0

Short Circuit Check

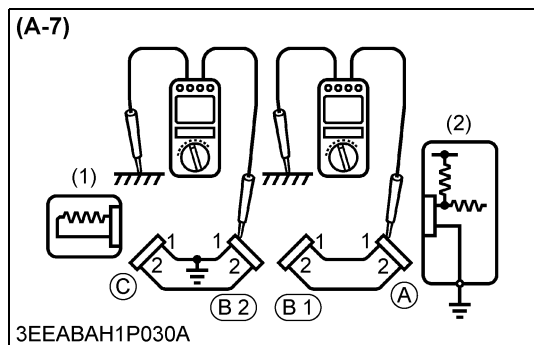
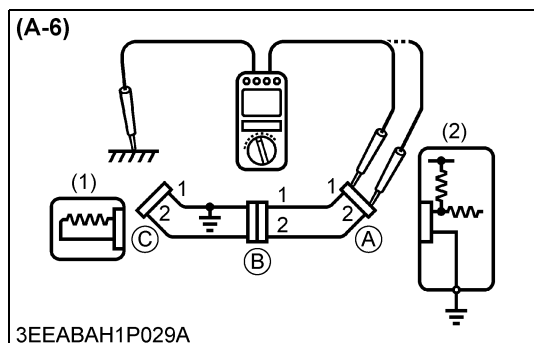
1. As per Figure **A-5**, if there is a short in the wiring harness ground, perform a **"Ground continuity check"** to determine the source of the short.

(1) Sensor

(3) ECU

(2) Short Circuit

9Y1200226CRS1196US0



Ground Continuity Check

1. Remove connector "A" and connector "C", then measure the resistance between terminals 1 and 2 of connector "A" and ground.

Factory specification	No continuity
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(Reference)

- Measure resistance while gently shaking the wiring harness up and down, and side-to-side.
2. In the case of Figure A-6, there is continuity between terminal 1 of connector "A" and the body ground (short circuit). However, there is no continuity between terminal 2 of connector "A" and the body ground. As a result, it can be said that there is an open circuit between terminal 1 of connector "A" and terminal 1 of connector "C".
 3. Remove connector "B" and measure the resistance between terminal 1 of connector "A" and the body ground, and between terminal 1 of connector "B2" and the body ground.
 4. The faulty circuit and measurement results are as per below.

(Measurement Results)

- No continuity between terminal 1 of connector "A" and the body ground.
- Continuity between terminal 1 of connector "B2" and the body ground.

(Faulty Circuit)

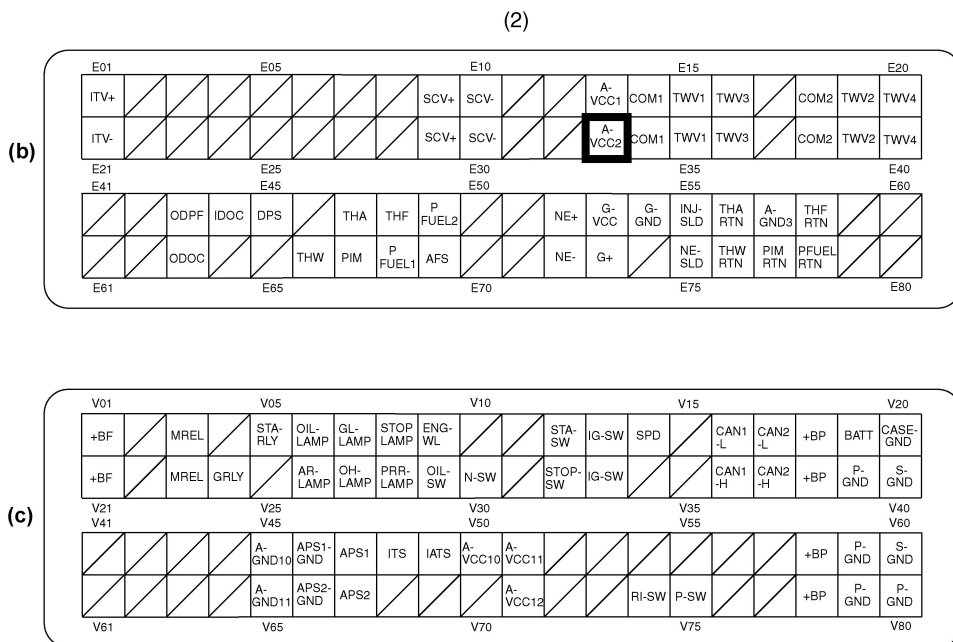
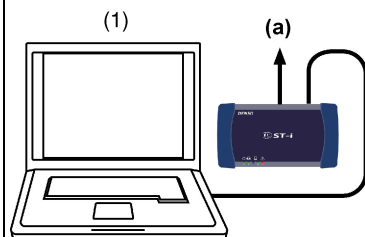
- There is a short circuit between terminal 1 of connector "B2" and terminal 1 of connector "C".

(1) Sensor

(2) ECU

9Y1200226CRS1197US0

(A)



9Y1200167CRS029A

- (1) Diagnosis Tool Data Monitor (Sensor Output Voltage) (2) Voltage Measurement

(A) Sensor Example

- (a) CAN1 Connector
- (b) ECU Connector 1
(Engine Side)
- (c) ECU Connector 2
(Machine Side)

As per the diagram above, measure both the data monitor and connector voltage simultaneously.

Ex.) Coolant temperature sensor

- a) Read in the "Coolant Temperature Output Voltage" value from the data monitor.
- b) Measure the voltage directly from the corresponding ECU terminal.

Judge as a connector connection fault if **b)** is satisfactory and **a)** is unsatisfactory. Since some malfunctions only occur intermittently, measure voltage while pulling and shaking the wires in order to try to get the malfunction to reoccur.

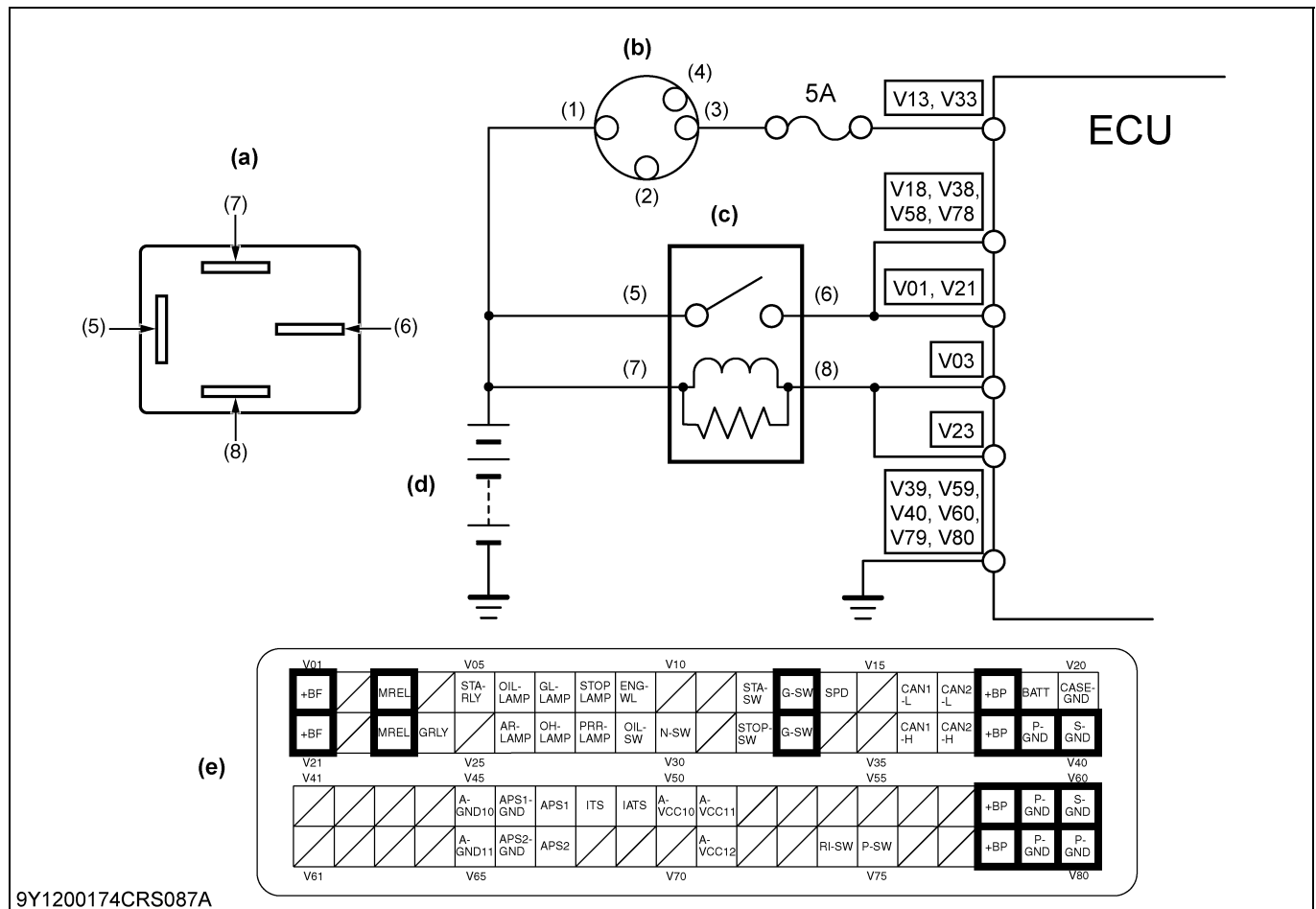
9Y1200226CRS1198US0

(3) Checking The Power And Ground System (Main Relay, ECU Circuit)

If the ECU is not operating, check the following.

Malfunction symptoms:

- Engine does not start.
- Engine warning light is not lit.
- A diagnosis tool communication error occur.

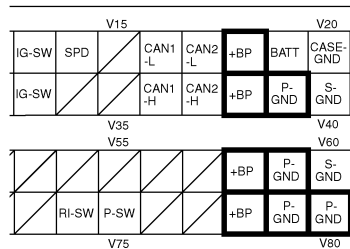


- (1) Input Terminal
- (2) ACC
- (3) Output Terminal
- (4) START

- (5) Terminal 1
- (6) Terminal 2
- (7) Terminal 3
- (8) Terminal 4

- (a) Main Relay Terminal Layout (d) Battery
(b) Key Switch (e) ECU Connector 2
(c) Main Relay (Machine Side)

9Y1200226CRS1199US0




9Y1200167CRS001F

1. Measure the ECU +BP and Ground Voltage

- Turn the key switch ON and measure the voltage between the ECU +BP terminals (V18 / V38 / V58 / V78) and ground (body / battery terminal). Then measure voltage between the ECU ground terminals (V40 / V60) and ground (body / battery terminal).

Factory specification	+BP terminal - Ground; greater than or equal to 10 V P-GND terminal - Ground; Less than or equal to 0.5 V
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+BP terminal unsatisfactory

OK	Normal.				
NG	Check battery, wiring harness, ground wire. <div style="text-align: center;">  </div> <table> <tr> <td>OK</td><td>Go to "2. Check the Relay Terminal Voltage -1".</td></tr> <tr> <td>NG</td><td>Repair or replace.</td></tr> </table>	OK	Go to "2. Check the Relay Terminal Voltage -1".	NG	Repair or replace.
OK	Go to "2. Check the Relay Terminal Voltage -1".				
NG	Repair or replace.				

Ground terminal unsatisfactory

OK	Normal.
NG	Check ECU wiring harness ground.

9Y1200226CRS1200US0

2. Check the Relay Terminal Voltage -1

- Turn the key switch ON and measure voltage at relay terminal 2 (2).

Factory specification	10 V or higher
-----------------------	----------------

OK	Check wiring between relay and ECU. → Repair. Check for connector connection fault. → Repair.
NG	Go to "3. Check the Relay Terminal Voltage - 2".

- (1) Terminal 1
- (2) Terminal 2
- (3) Terminal 3
- (4) Terminal 4

(a) Main Relay Terminal Layout

9Y1200226CRS1201US0

3. Check the Relay Terminal Voltage - 2

- Measure voltage at relay terminal 1 (1).

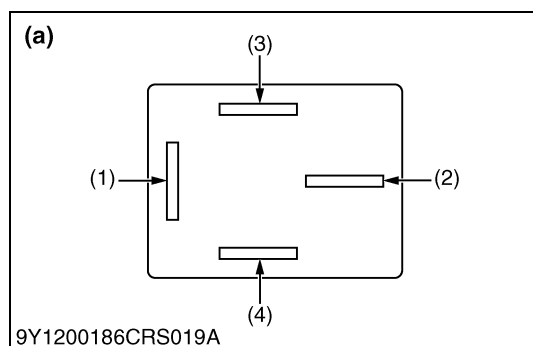
Factory specification	10 V or higher
-----------------------	----------------

OK	Go to "4. Check the Relay Terminal Voltage - 3".
NG	Check for a wiring harness open circuit and / or connector connection fault. → Repair. Inspect fuse. → Replace.

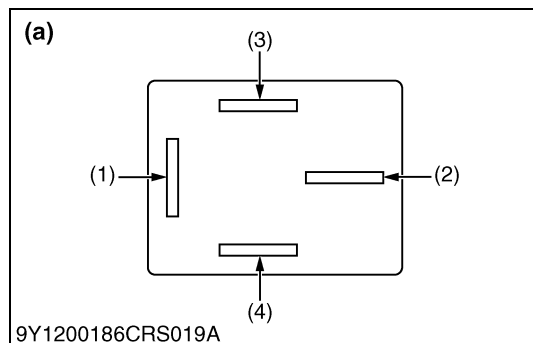
- (1) Terminal 1
- (2) Terminal 2
- (3) Terminal 3
- (4) Terminal 4

(a) Main Relay Terminal Layout

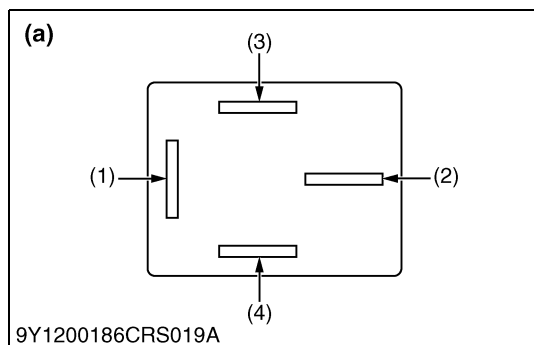
9Y1200226CRS1202US0



9Y1200186CRS019A



9Y1200186CRS019A



4. Check the Relay Terminal Voltage - 3

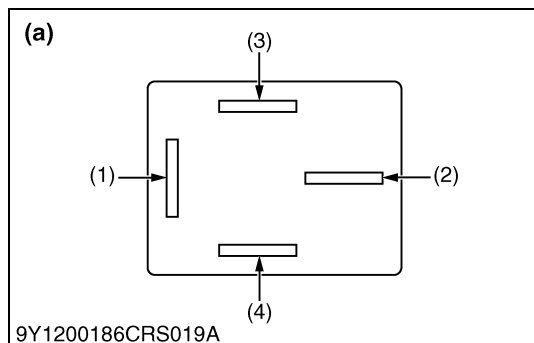
1. Measure voltage at relay terminal 3 (3).

Factory specification	10 V or higher
OK	Go to "5. Check the Relay Terminal Voltage - 4".
NG	Check for a wiring harness open circuit and / or connector connection fault. → Repair. Inspect fuse. → Replace.

- (1) Terminal 1
- (2) Terminal 2
- (3) Terminal 3
- (4) Terminal 4

(a) Main Relay Terminal Layout

9Y1200226CRS1203US0



5. Check the Relay Terminal Voltage - 4

1. Turn the key switch OFF and measure voltage at relay terminal 4 (4).

■ NOTE

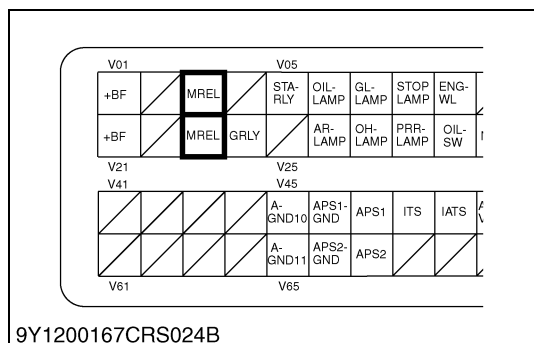
- Perform measurement two seconds after cycling the key switch ON → OFF.

Factory specification	10 V or higher
OK	Go to "6. Check the Relay Terminal Voltage - 5".
NG	Check the relay. → Repair.

- (1) Terminal 1
- (2) Terminal 2
- (3) Terminal 3
- (4) Terminal 4

(a) Main Relay Terminal Layout

9Y1200226CRS1204US0

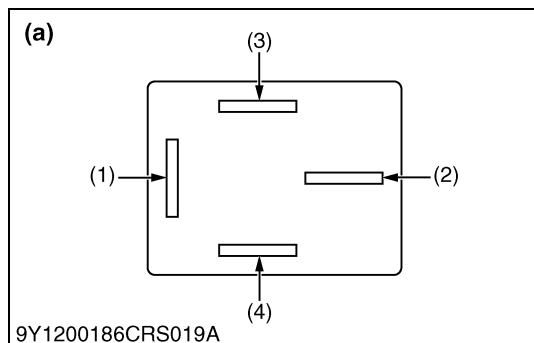


6. Check the Relay Terminal Voltage - 5

1. With the key switch OFF, measure voltage at the ECU main relay terminals (V03 / V23).

Factory specification	10 V or higher
OK	Go to "7. Check the Relay Terminal Voltage - 6".
NG	Check wiring harness between relay and ECU and connectors. → Repair.

9Y1200226CRS1205US0



7. Check the Relay Terminal Voltage - 6

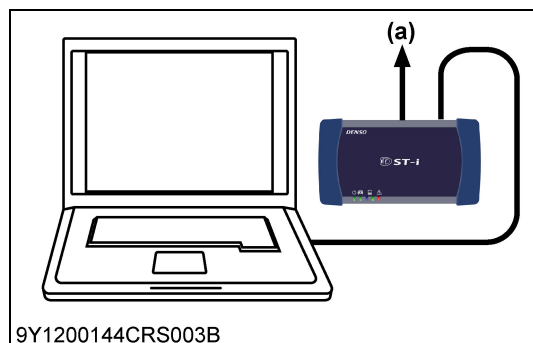
1. Turn the key switch ON and measure voltage at relay terminal 4 (4).

Factory specification	Approx. 0 V
OK	Faulty relay contacts → Replace.
NG	Go to "8. Check the Key Switch Signal -1".

- (1) Terminal 1
- (2) Terminal 2
- (3) Terminal 3
- (4) Terminal 4

(a) Main Relay Terminal Layout

9Y1200226CRS1206US0



8. Check the Key Switch Signal -1

1. Connect the diagnosis tool to diagnostic connector (CAN1 connector) and turn the key switch ON.
2. Using the diagnosis tool data monitor function, verify the "Key Switch" data when the key switch is turned ON then OFF.

Factory specification	When the key switch is set to the ON and OFF, the data output is turned ON and OFF respectively.
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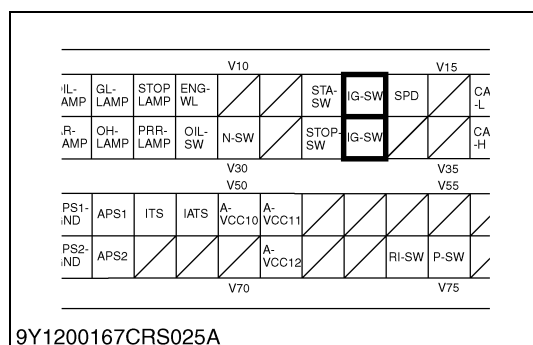
■ IMPORTANT

- Do not keep the key switch in the OFF position for more than 2 seconds, otherwise a communication error will occur.

OK	ECU internal fault → Replace the ECU.	
NG	Constantly ON	ECU internal fault → Replace the ECU.
	Consistently OFF	Go to "9. Check the Key Switch Signal -2".

(a) CAN1 Connector

9Y1200226CRS1207US0



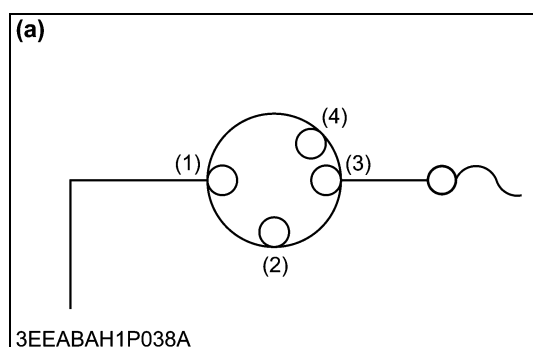
9. Check the Key Switch Signal -2

1. Place the key switch in the ON position, and measure the voltage at ECU terminal V13 / V33.

Factory specification	10 V or higher
-----------------------	----------------

OK	Check whether the connector is poorly connected.	
	OK	Replace the ECU.
	NG	Repair the connector.
NG	Go to "10. Check the Key Switch -1".	

9Y1200226CRS1208US0



10. Check the Key Switch -1

1. Set the key switch to the ON position, and measure the voltage at the key switch output terminal (3).

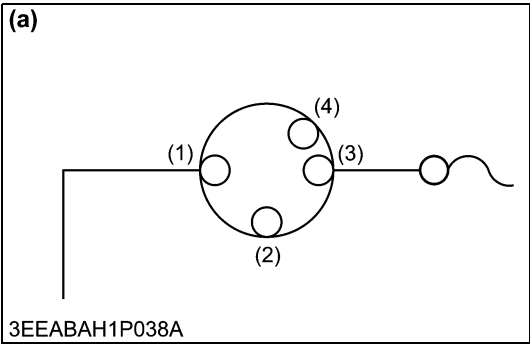
Factory specification	10 V or higher
-----------------------	----------------

OK	Check the wiring harness between the key switch output terminal and ECU terminal (V13 / V33), and the fuse. → Repair or replace.
NG	Go to "11. Check the Key Switch - 2".

- (1) Input Terminal
- (2) ACC
- (3) Output Terminal
- (4) START

(a) Key Switch

9Y1200226CRS1209US0



11. Check the Key Switch - 2

1. Measure the voltage at the key switch input terminal (1).

Factory specification	10 V or higher
OK	Check the key switch. → Replace.
NG	Check the wiring harness between the battery and key switch, and the fuse. → Repair or replace.

- (1) Input Terminal
- (2) ACC
- (3) Output Terminal
- (4) START

(a) Key Switch

9Y1200226CRS1210US0

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