DM

DIAGNOSIS MANUAL
COMMON RAIL SYSTEM

03-CR-E4,
03-CR-TE4,
03-CR-TE4BG,
03-CR-TIE4(DOC only)

Kubota

KiSC issued 05, 2015 A

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	2014.11	Added the information of 03-CR-TIE4 (DOC only)	

I INFORMATION

INFORMATION

CONTENTS

1. SAFETY FIRST I-1

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.**

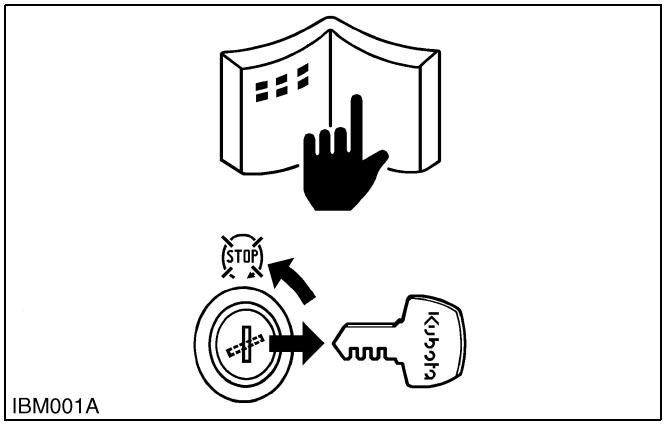
⚠ WARNING
- **Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

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

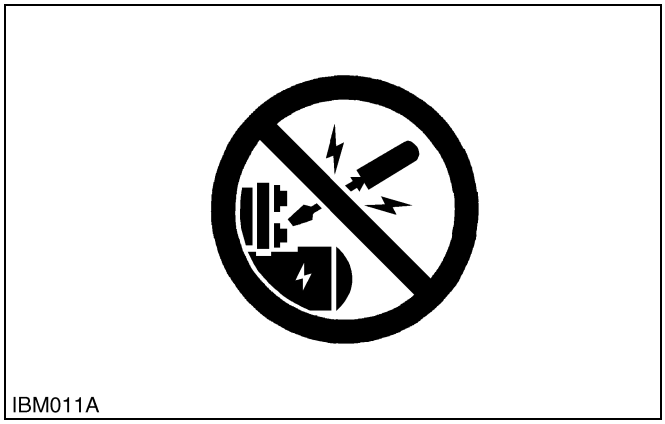
■ IMPORTANT
- **Indicates that equipment or property damage could result if instructions are not followed.**

■ NOTE
- **Gives helpful information.**

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BEFORE SERVICING AND REPAIRING

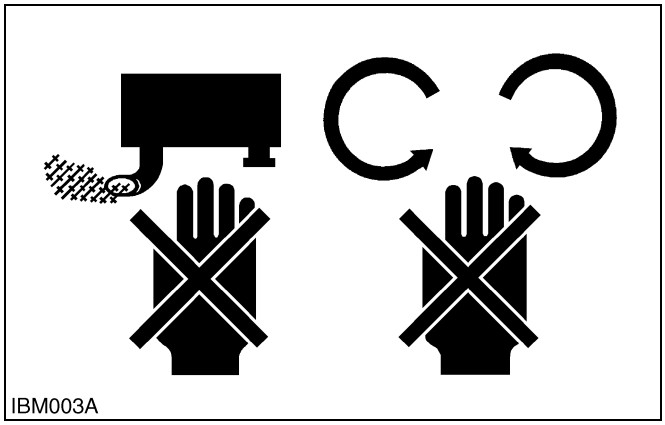
- Read all instructions and safety instructions in this manual and on your machine safety decals.
- Clean the work area and machine.
- Park the machine on a firm and level ground.
- Allow the engine to cool before proceeding.
- Stop the engine, and remove the key.
- Disconnect the battery negative cable.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

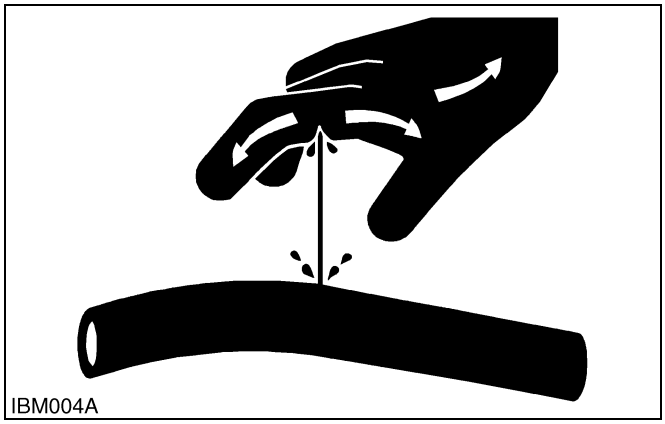
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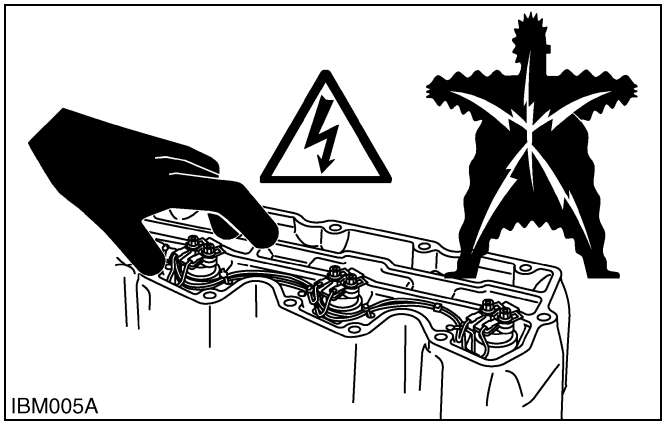
SAFETY STARTING

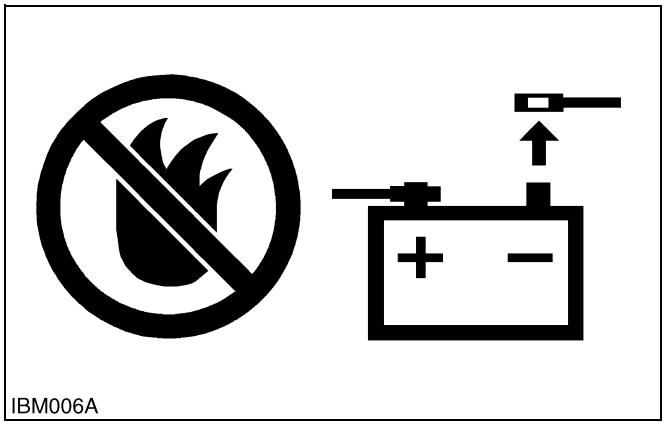
- Do not start the engine by shorting across starter terminals or bypassing the safety start switch.
- Unauthorized modifications to the engine may impair the function and / or safety and affect engine life.

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SAFETY WORKING

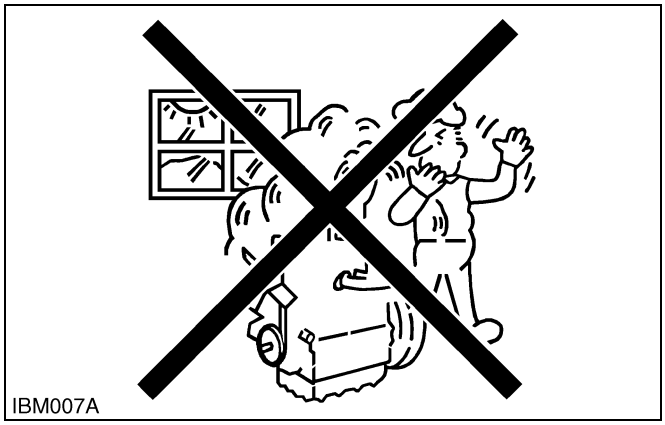
- Do not work on the machine while under the influence of alcohol, medication, or other substances or while fatigued.
- Wear close fitting clothing and safety equipment appropriate to the job.
- Use tools appropriate to the work. Makeshift tools, parts, and procedures are not recommended.
- When servicing 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.

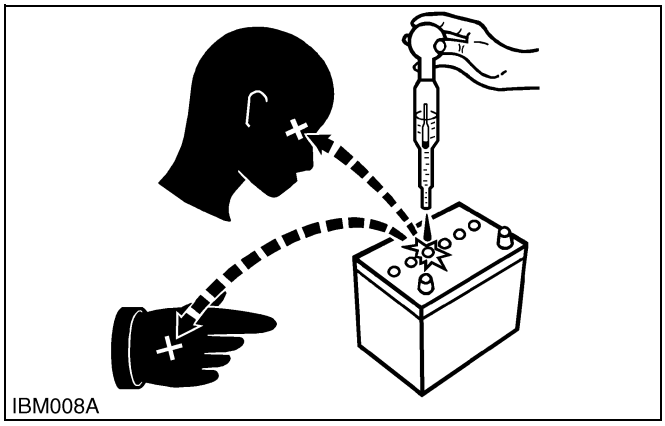
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VENTILATE WORK AREA

- 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.

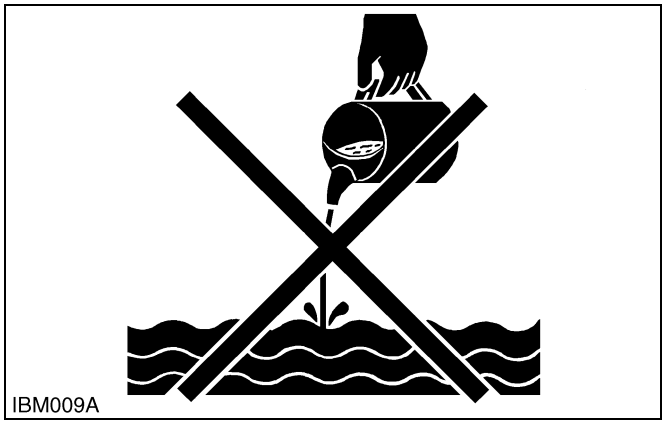
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PREVENT ACID BURNS

- 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.

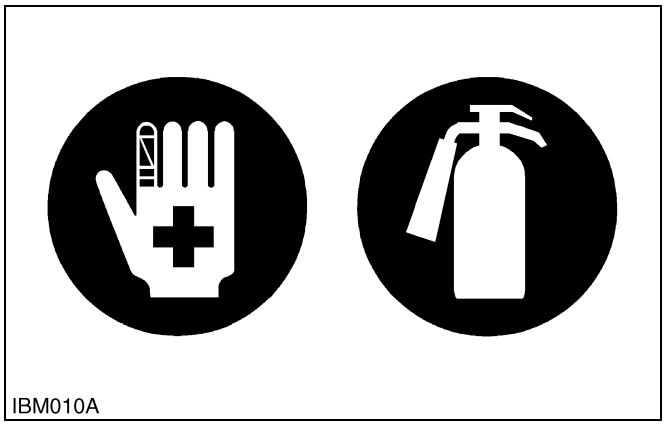
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DISPOSE OF FLUIDS PROPERLY

- 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

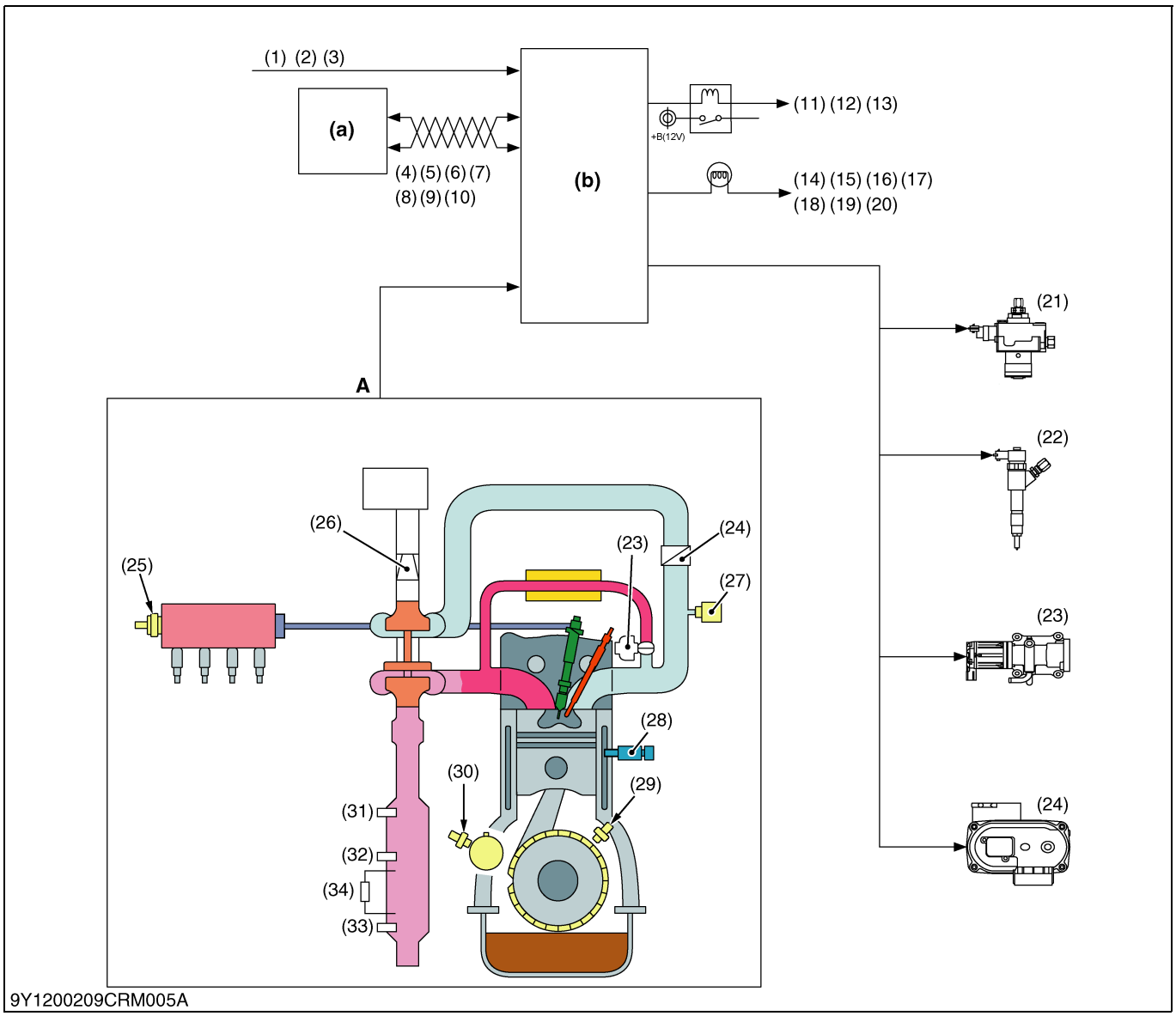
MECHANISM

CONTENTS

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1. BASIC SYSTEM INFORMATION

[1] SYSTEM CONFIGURATION



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(1) Key Switch
(2) Starter Switch
(3) Oil Switch
(4) Neutral Switch
(5) Stop Switch
(6) Parking Switch
(7) *Parked Regeneration Switch
(8) *Regeneration Inhibit Switch
(9) Accel Sensor
(10) Machine Speed Sensor
(11) Main Relay
(12) Starter Relay
(13) Glow Relay
(14) Engine Warning Lamp
(15) Heater Lamp
(16) Engine Stop Lamp
(17) Oil Pressure Lamp
(18) Overheat Lamp
(19) *Parked Regeneration Request Lamp
(20) *Active Regeneration Lamp
(21) SCV (Suction Control Valve)
(22) Injector
(23) EGR Valve
(24) *Intake Throttle Valve
(25) Rail Pressure Sensor
(26) Mass Air Flow Sensor
(27) Boost Pressure Sensor (Turbo only)
(28) Coolant Temperature Sensor
(29) Crankshaft Position Sensor
(30) Camshaft Position Sensor
(31) *Exhaust Gas Temperature Sensor0 (T0)
(32) *Exhaust Gas Temperature Sensor1 (T1)
(33) *Exhaust Gas Temperature Sensor2 (T2)
(34) *Differential Pressure Sensor (DPF Differential Pressure) (ΔP)

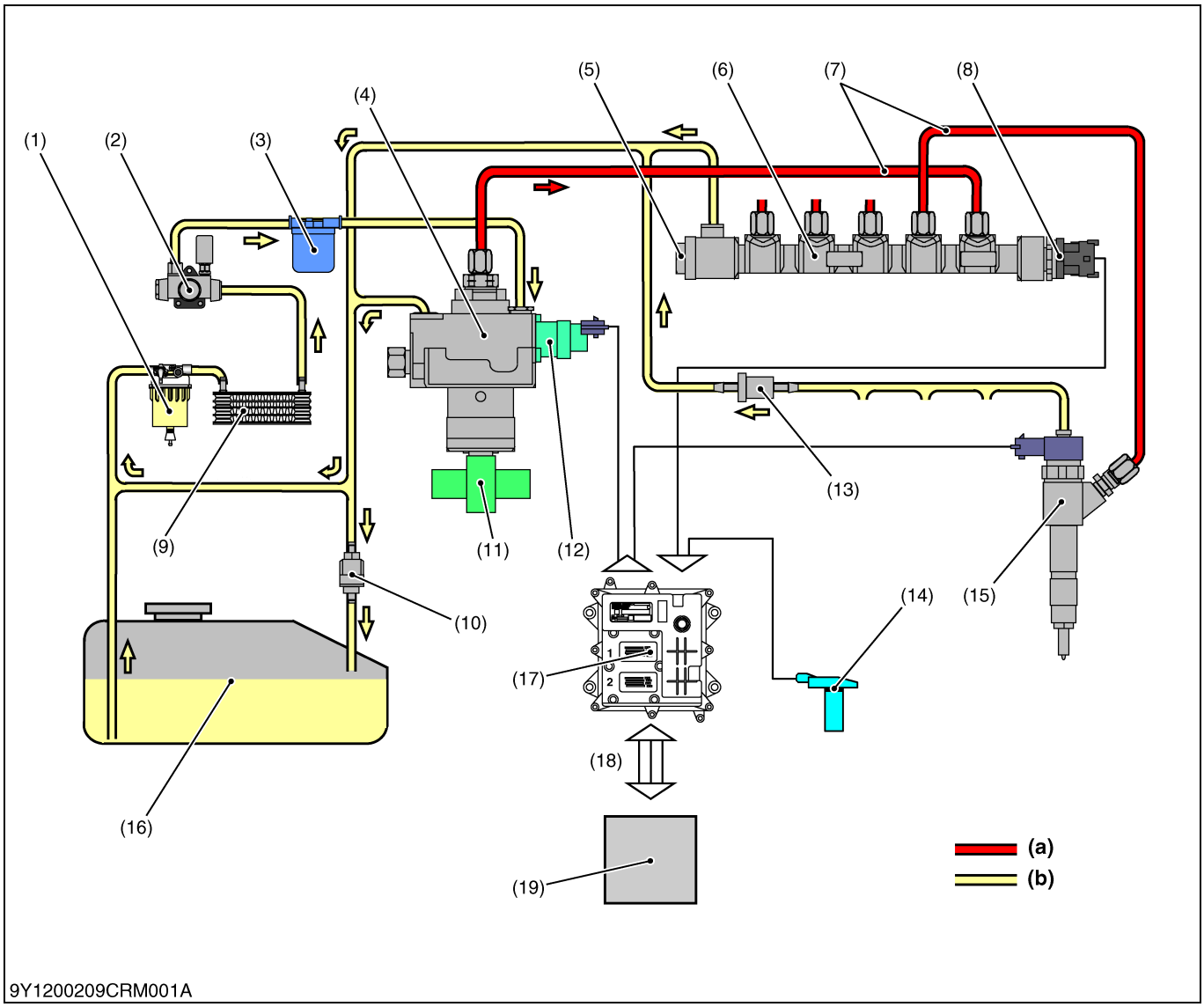
A: Sensors

(a) ECU for Machine
(b) ECU for Engine

■ **NOTE**
- **The signals marked with * are only for -E4, -TE4. (TIE4 do not equip the parts)**
- **Communication between (a) and (b) is CAN communication.**

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[2] FUEL SYSTEM



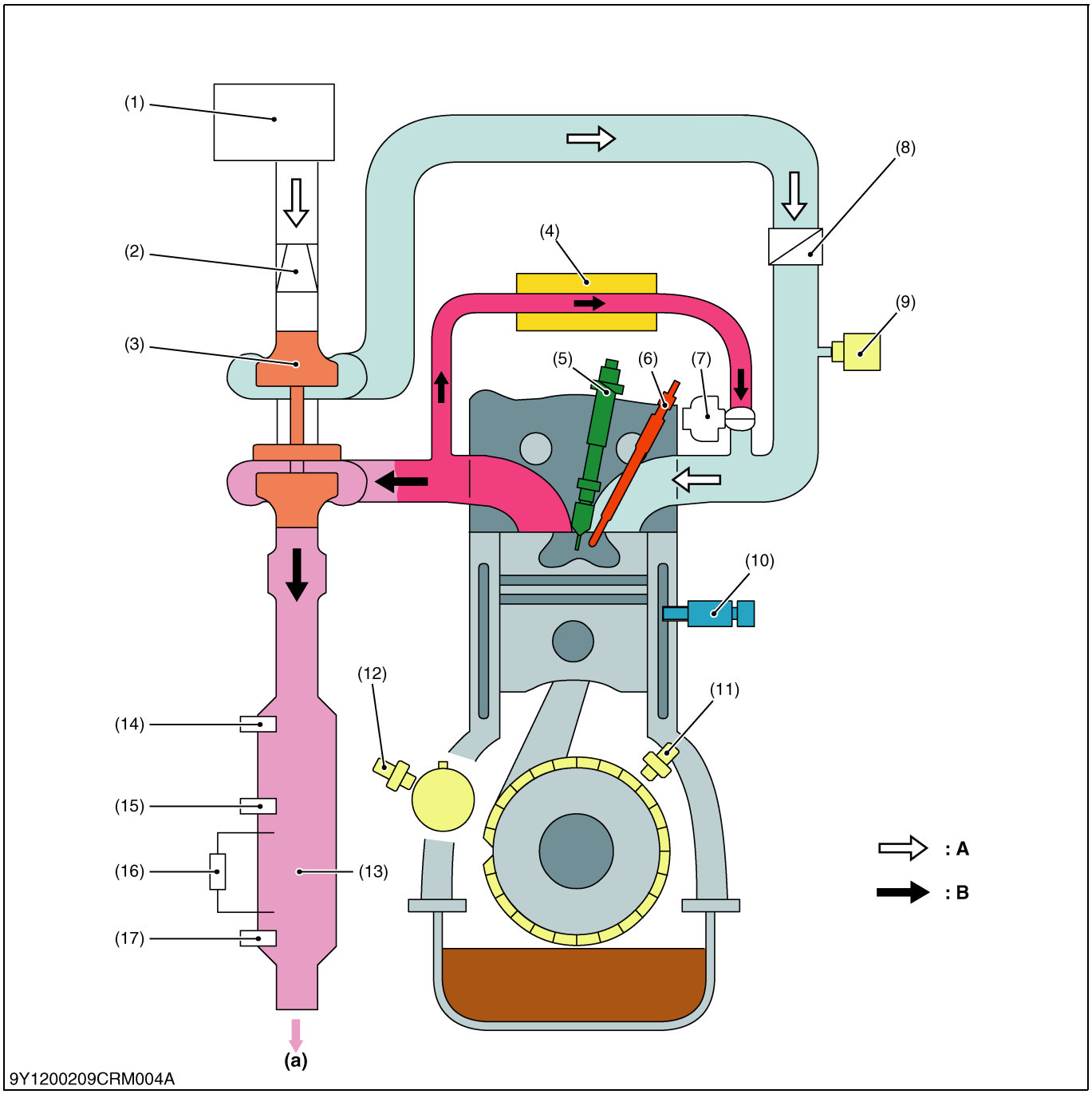
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(1) Water Separator
(2) Fuel Pump
(3) Fuel Filter
(4) Supply Pump
(5) Pressure Limiter
(6) Rail
(7) Injection Pipe
(8) Rail Pressure Sensor
(9) Fuel Cooler
(10) Check Valve
(11) Fuel Camshaft
(12) SCV (Suction Control Valve)
(13) Check Valve
(14) Sensors
(15) Injector
(16) Fuel Tank
(17) ECU for Engine
(18) CAN Connection
(19) ECU for Machine

(a) High Pressure Fuel Flow
(b) Low Pressure Fuel Flow

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[3] INTAKE AND EXHAUST SYSTEM



(1) Air Cleaner
(2) Mass Air Flow Sensor
(3) Turbocharger
(4) EGR Cooler
(5) Injector
(6) Glow Plug
(7) EGR Valve Motor
(8) *Intake Throttle Valve
(9) Boost Pressure Sensor
(10) Coolant Temperature Sensor
(11) Crankshaft Position Sensor
(12) Camshaft Position Sensor
(13) *Diesel Particulate Filter (Hereinafter Referred to as the "DPF") Muffler
(14) *Exhaust Gas Temperature Sensor (T0)
(15) *Exhaust Gas Temperature Sensor (T1)
(16) *Differential Pressure Sensor (DPF Differential Pressure) (ΔP)
(17) *Exhaust Gas Temperature Sensor (T2)

A: Intake Air Flow
B: Exhaust Gas Flow

(a) To Muffler

■ **NOTE**

- **The parts marked with * are only for -E4, -TE4. (TIE4 do not equip the parts)**

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[4] AVAILABLE DATA MONITOR SIGNALS (LEVEL 1)

(1) Monitor Items

Classification		Signal Name	Unit	Terminal No.
Input	Pulse / Rotary signal	Engine speed	min^{-1} (rpm)	1-3, 1-42, 1-43
		Machine speed *	km/h	1-13, 2-10, 2-11
	Analog signal	Accelerator pedal position	%	–
		Accelerator pedal position sensor 1 output voltage *	V	2-1, 2-29, 2-40
		Accelerator pedal position sensor 2 output voltage *	V	2-2, 2-14, 2-27
		Boost pressure	kPa	–
		Boost pressure sensor output voltage	V	1-8, 1-15, 1-32
		Coolant temperature	°C	–
		Coolant temperature sensor output voltage	V	1-19, 1-37
		Intake air temperature	°C	–
		Intake air temperature sensor output voltage	V	1-8, 1-31
		Atmospheric pressure	kPa	–
		Atmospheric pressure sensor output voltage	V	–
		Battery voltage	V	2-51, 2-52, 2-53, 2-54, 2-55, 2-56
	Digital signal	Key switch	–	2-26
		Starter switch	–	1-21, 1-36, 2-16
		Neutral switch *	–	2-17

■ **NOTE**

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

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Classification		Signal Name	Unit	Terminal No.
Output	Basic control signal	Final fuel injection quantity	mm^3/st	–
		Target rail pressure	MPa	–
		Actual rail pressure	MPa	–
		Rail pressure sensor output voltage	V	1-1, 1-28, 1-29
		Target suction control valve (SCV) current	mA	–
		Actual suction control valve (SCV) current	mA	1-11, 1-12
		Engine stop flag	–	–
		Low temperature start mode flag	–	–
	Actuator	Exhaust gas recirculation (EGR) valve target position	%	–
		Exhaust gas recirculation (EGR) valve actual position	%	2-31, 2-43
		Glow relay	–	1-35, 2-50

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Classification		Signal Name	Unit	Terminal No.
Output	DPF data	Differential pressure 1 output voltage	V	1-4, 1-15, 1-30
		Exhaust gas temperature 0 output voltage	V	1-4, 1-7
		Exhaust gas temperature 1 output voltage	V	1-4, 1-39
		Exhaust gas temperature 2 output voltage	V	1-4, 1-6
		Intake air temperature built-in MAF output voltage	V	2-3, 2-4
		Intake throttle valve lift output voltage	V	1-20
		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	–
		Hour meter	h	–
		DPF auto regeneration last active time	sec	–
		Regeneration running time	min	–
		Source address of TSC1	–	–
		Parking switch	–	–
		DPF auto regeneration inhibit switch	–	–
		DPF manual regeneration force switch	–	–
		Oil pressure switch	–	–
		Target speed of isochronous control	min^{-1} (rpm)	–
		DPF regeneration control level	–	–
		DPF regeneration control status	–	–

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(2) Normal Value

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)
		Machine speed	km/h	When the machine stopped: 0				
	Analog signal	Accelerator pedal position	%	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 sensor output voltage	V	4.75 to 5.25 V				
		Coolant temperature	°C	Representative value: Approx. 20 °C (68 °F) → Approx. 3.1 V Representative value: Approx. 80 °C (176°F) → Approx. 0.9 V				
		Coolant temperature sensor voltage output	V					
		Intake air temperature	°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 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				

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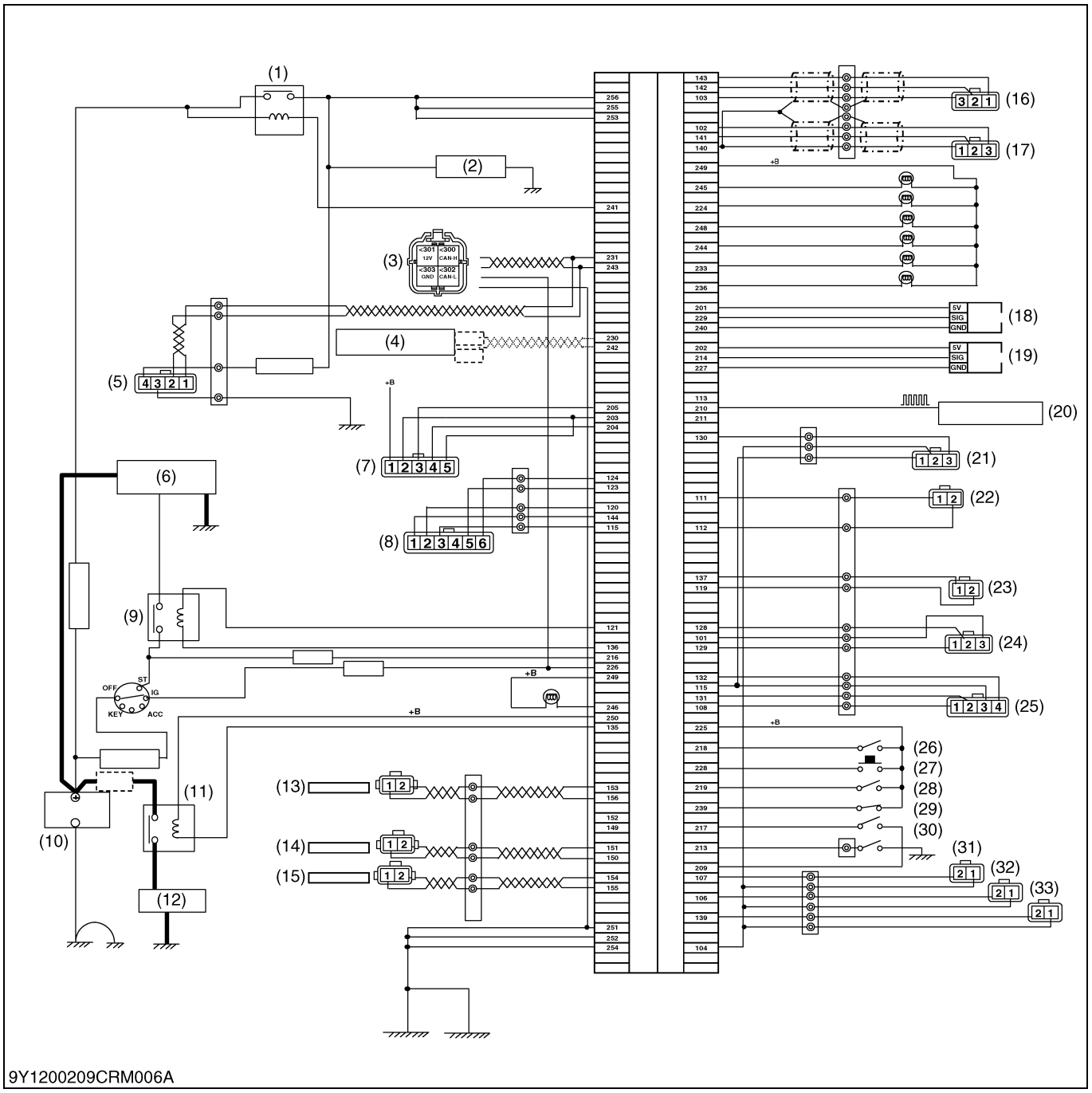
Classification		Signal Name	Unit	Engine Stops	During Start-Up	Idling	During Acceleration	During No-load Maximum Speed
Output	Basic control signal	Final fuel injection quantity	mm^3 /st	0	0 → 45 (Ordinary temperature)	Below 7 (After warm-up)	–	Below 10 (After warm-up)
		Target rail pressure	MPa	Depends on the rotation speed, load (After warm-up) When idling: Approx. 25 MPa During no-load maximum speed: 70 MPa During acceleration : 50 to 160 MPa				
		Actual rail pressure	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 Representative value : When idling: 0.7 V During no-load maximum speed: 1.4 V During acceleration: 0.6 to 2.6 V				
		Target suction control valve (SCV) current	mA	Approx. 400	Approx. 1600	Approx. 1420	Approx. 1050 to 1600	Approx. 1340
		Actual suction control valve (SCV) current	mA	Approx. the same as the target value (Follow to the target value)				
		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 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. 200 °C (392 °F) → Approx. 4 V Representative value : Approx. 650 °C (1202 °F) → Approx. 0.7 V				
		Exhaust gas temperature 0 sensor output voltage	V					
		Exhaust gas temperature 1	°C	Representative value : Approx. 200 °C (392 °F) → Approx. 4 V Representative value : Approx. 650 °C (1202°F) → Approx. 0.7 V				
		Exhaust gas temperature 1 sensor output voltage	V					
		Exhaust gas temperature 2	°C	Representative value : Approx. 200 °C (392 °F) → Approx. 4 V Representative value : Approx. 650 °C (1202 °F) → Approx. 0.7 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					
		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		

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[5] SYSTEM WIRING DIAGRAM

D1803-CR-E4, -TE4

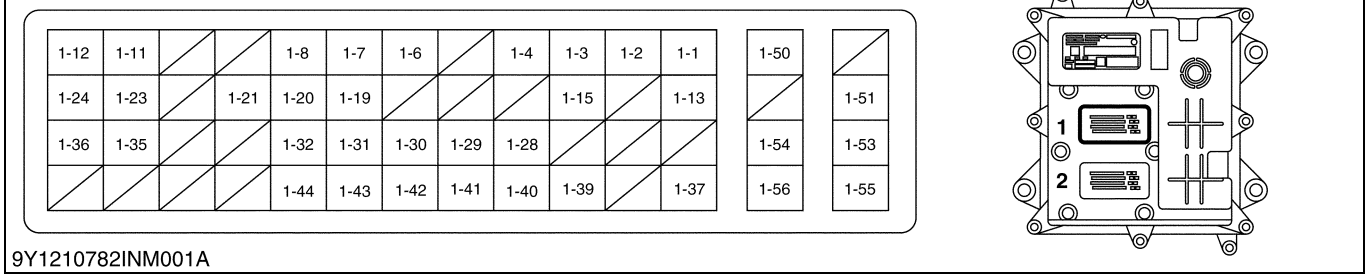


(1) Main Relay
(2) Fuel Feed Pump
(3) CAN1 Connector (For Service)
(4) CAN2 Connector (For Vehicle)
(5) EGR Valve
(6) Starter
(7) Air Flow Sensor
(8) Intake Throttle Valve
(9) Starter Relay
(10) Battery
(11) Glow Relay
(12) Glow Heater
(13) Injector 1
(14) Injector 3
(15) Injector 2
(16) Crankshaft Position Sensor
(17) Camshaft Position Sensor
(18) Accel Sensor 1
(19) Accel Sensor 2
(20) Vehicle Speed Sensor
(21) DPF Differential Pressure Sensor (ΔP)
(22) MPROP (SCV)
(23) Coolant Temperature Sensor
(24) Rail Pressure Sensor
(25) Boost Sensor
(26) Stop Switch
(27) Parked Regeneration Switch
(28) Parking Switch
(29) Regeneration Inhibit Switch
(30) Neutral Switch
(31) DPF Temperature Sensor (T0)
(32) DPF Temperature Sensor (T1)
(33) DPF Temperature Sensor (T2)

DPF: Diesel Particulate Filter

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ECU Terminal Layout 1 for D1803-E4, -TE4

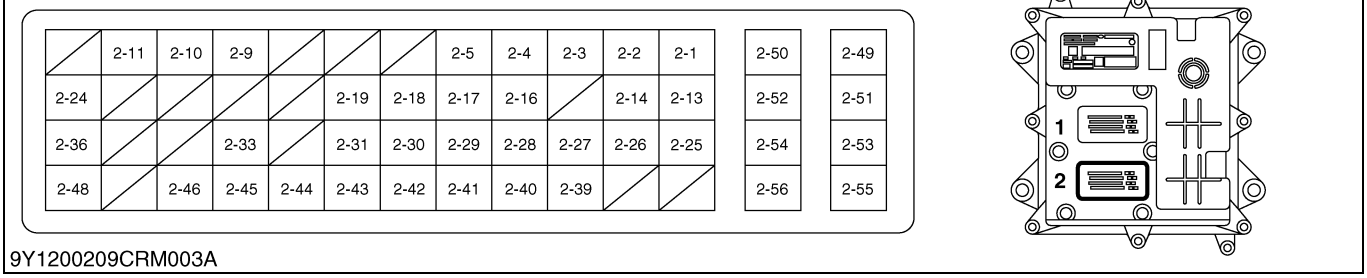


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Terminal NO.	Signal Name	Terminal NO.	Signal Name
1-1	RAIL PRESSURE SENSOR (+)	1-29	RAIL PRESSURE SENSOR (−)
1-2	CAMSHAFT POSITION SENSOR (+)	1-30	DIFFERENTIAL PRESSURE SENSOR
1-3	CRANKSHAFT POSITION SENSOR (+)	1-31	BOOST TEMPERATURE SENSOR
1-4	• EXHAUST GAS TEMPERATURE SENSORS T0, T1, T2 (−) • DIFFERENTIAL PRESSURE SENSOR (−)	1-32	BOOST PRESSURE SENSOR
1-5	–	1-33	–
1-6	DPF TEMPERATURE SENSOR T2	1-34	–
1-7	DPF TEMPERATURE SENSOR T0	1-35	GLOW RELAY
1-8	• BOOST TEMPERATURE SENSOR (−) • BOOST PRESSURE SENSOR (−)	1-36	STARTER RELAY
1-9	–	1-37	COOLANT TEMPERATURE SENSOR (−)
1-10	–	1-38	–
1-11	SCV (MPROP) (−)	1-39	EXHAUST GAS TEMPERATURE SENSOR T1
1-12	SCV (MPROP) (+)	1-40	CAMSHAFT POSITION SENSOR (−)
1-13	VEHICLE SPEED SENSOR (+)	1-41	CAMSHAFT POSITION SENSOR
1-14	–	1-42	CRANKSHAFT POSITION SENSOR
1-15	DIFFERENCE PRESSURE SENSOR (+) BOOST PRESSURE SENSOR (+) THROTTLE POSITION SENSOR (+)	1-43	CRANKSHAFT POSITION SENSOR (−)
1-16	–	1-44	THROTTLE POSITION SENSOR (−)
1-17	–	1-45	–
1-18	–	1-46	–
1-19	COOLANT TEMPERATURE SENSOR	1-47	–
1-20	THROTTLE POSITION SENSOR	1-48	–
1-21	STARTER RELAY (+)	1-49	–
1-22	–	1-50	INJECTOR 3 (−)
1-23	INTAKE THROTTLE MOTOR (+)	1-51	INJECTOR 3 (+)
1-24	INTAKE THROTTLE MOTOR (−)	1-52	–
1-25	–	1-53	INJECTOR 1 (+)
1-26	–	1-54	INJECTOR 2 (+)
1-27	–	1-55	INJECTOR 2 (−)
1-28	RAIL PRESSURE SENSOR	1-56	INJECTOR 1 (−)

9Y1200209CRM0012US0

ECU Terminal Layout 2 for D1803-E4, -TE4

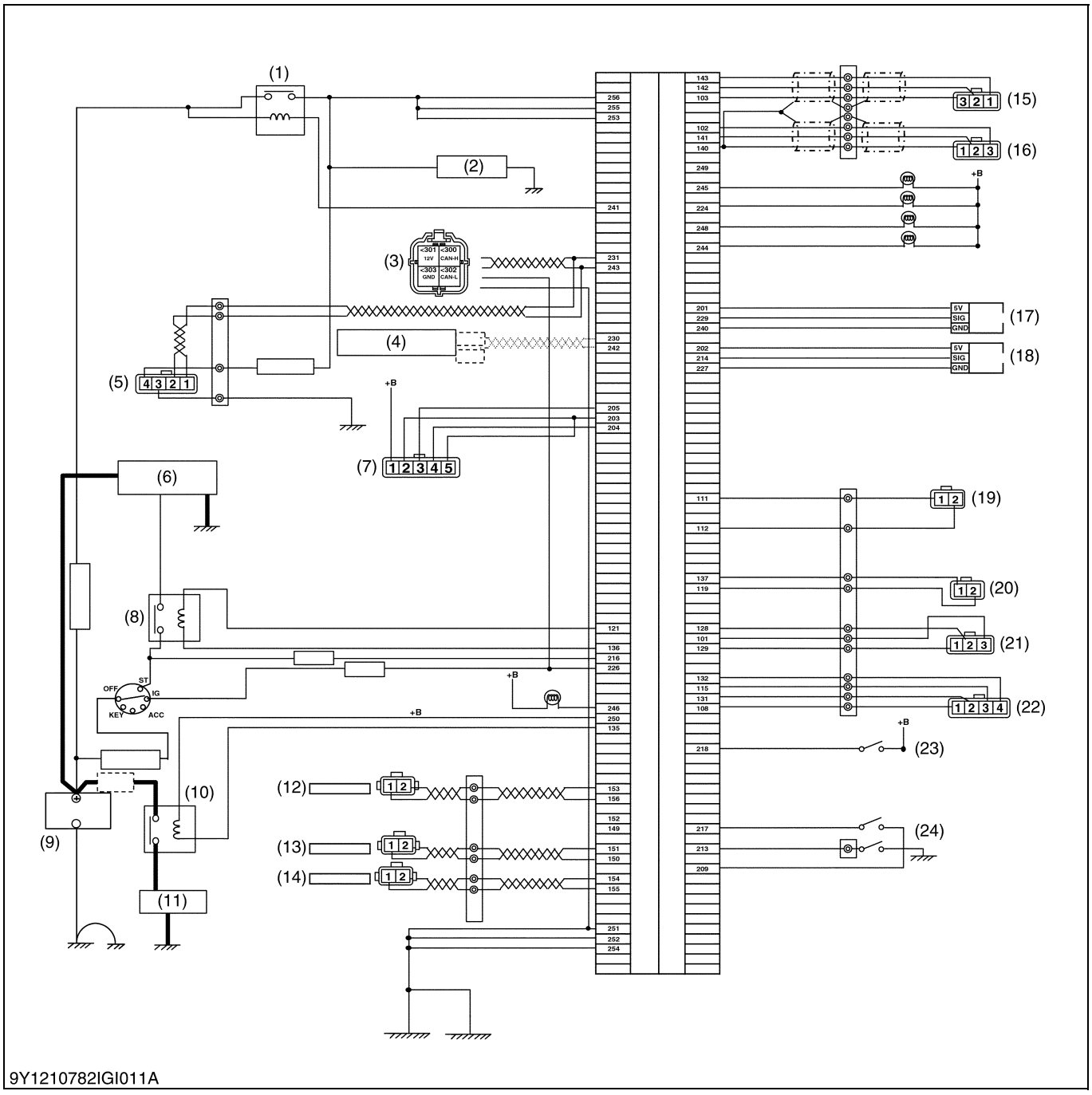


9Y1200209CRM003A

Terminal NO.	Signal Name	Terminal NO.	Signal Name
2-1	ACCELERATION PEDAL 1 (+)	2-29	ACCELERATION PEDAL 1
2-2	ACCELERATION PEDAL 2 (+)	2-30	CAN2 H
2-3	AIR FLOW SENSOR (−)	2-31	CAN1 H
2-4	• INTAKE AIR TEMPERATURE SENSOR • INTAKE AIR TEMPERATURE SENSOR (built-in MAF sensor)	2-32	–
2-5	AIR FLOW SENSOR	2-33	MANUAL REGENERATION LAMP
2-6	–	2-34	–
2-7	–	2-35	–
2-8	–	2-36	REGENERATION LAMP
2-9	LOW SIDE SWITCH (−)	2-37	–
2-10	VEHICLE SPEED SENSOR	2-38	–
2-11	VEHICLE SPEED SENSOR (−)	2-39	REGENERATION INHIBIT SWITCH
2-12	–	2-40	ACCELERATION PEDAL 1 (−)
2-13	OIL SWITCH	2-41	MAIN RELAY
2-14	ACCELERATION PEDAL 2	2-42	CAN 2 L
2-15	–	2-43	CAN 1 L
2-16	STARTER SWITCH	2-44	OVERHEAT LAMP
2-17	NEUTRAL SWITCH	2-45	ENGINE WARNING LAMP
2-18	STOP SWITCH	2-46	HEATER LAMP
2-19	PARKING SWITCH	2-47	–
2-20	–	2-48	LOW OIL PRESSURE LAMP
2-21	–	2-49	HEATER LAMP (+)
2-22	–	2-50	GLOW RELAY (+)
2-23	–	2-51	BATTERY (−)
2-24	ENGINE STOP LAMP	2-52	BATTERY (−)
2-25	BATTERY SOURCE	2-53	BATTERY (+)
2-26	KEY SWITCH	2-54	BATTERY (−)
2-27	ACCELERATION PEDAL 2 (−)	2-55	BATTERY (+)
2-28	PARKED REGENERATION SWITCH	2-56	BATTERY (+)

9Y1200209CRM0013US0

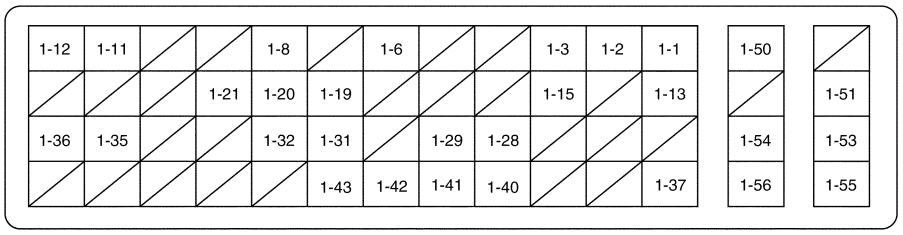
D1803-CR-TIE4

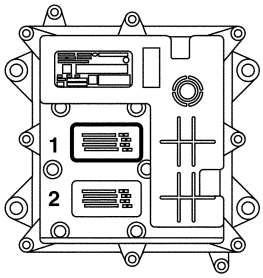


(1) Main Relay
(2) Fuel Feed Pump
(3) CAN1 Connector (For Service)
(4) CAN2 Connector (For Vehicle)
(5) EGR Valve
(6) Starter
(7) Air Flow Sensor
(8) Starter Relay
(9) Battery
(10) Glow Relay
(11) Glow Heater
(12) Injector 1
(13) Injector 3
(14) Injector 2
(15) Crankshaft Position Sensor
(16) Camshaft Position Sensor
(17) Accel Sensor 1
(18) Accel Sensor 2
(19) MPROP (SCV)
(20) Coolant Temperature Sensor
(21) Rail Pressure Sensor
(22) Boost Sensor
(23) Stop Switch
(24) Neutral Switch

9Y1200209CRM0014US0

ECU Terminal Layout 1 for D1803-TIE4



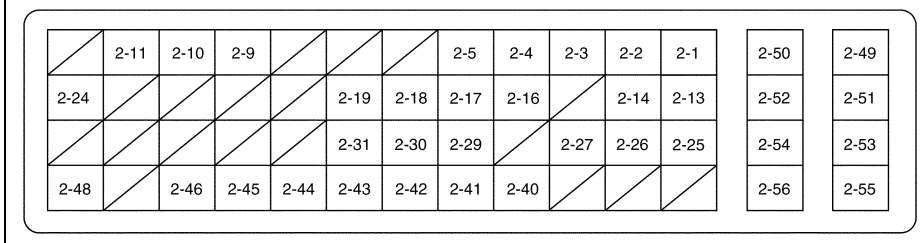


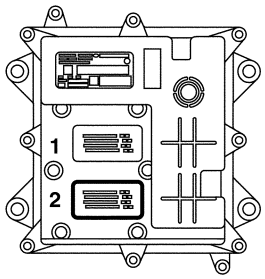
9Y1210782INM002A

Terminal NO.	Signal Name	Terminal NO.	Signal Name
1-1	RAIL PRESSURE SENSOR (+)	1-29	RAIL PRESSURE SENSOR (−)
1-2	CAMSHAFT POSITION SENSOR (+)	1-30	–
1-3	CRANKSHAFT POSITION SENSOR (+)	1-31	BOOST TEMPERATURE SENSOR
1-4	–	1-32	BOOST PRESSURE SENSOR
1-5	–	1-33	–
1-6	DPF TEMPERATURE SENSOR T2	1-34	–
1-7	–	1-35	GLOW RELAY
1-8	• BOOST TEMPERATURE SENSOR (−) • BOOST PRESSURE SENSOR (−)	1-36	STARTER RELAY
1-9	–	1-37	COOLANT TEMPERATURE SENSOR (−)
1-10	–	1-38	–
1-11	SCV (MPROP) (−)	1-39	–
1-12	SCV (MPROP) (+)	1-40	CAMSHAFT POSITION SENSOR (−)
1-13	VEHICLE SPEED SENSOR (+)	1-41	CAMSHAFT POSITION SENSOR
1-14	–	1-42	CRANKSHAFT POSITION SENSOR
1-15	BOOST PRESSURE SENSOR (+)	1-43	CRANKSHAFT POSITION SENSOR (−)
1-16	–	1-44	–
1-17	–	1-45	–
1-18	–	1-46	–
1-19	COOLANT TEMPERATURE SENSOR	1-47	–
1-20	–	1-48	–
1-21	STARTER RELAY (+)	1-49	–
1-22	–	1-50	INJECTOR 3 (−)
1-23	–	1-51	INJECTOR 3 (+)
1-24	–	1-52	–
1-25	–	1-53	INJECTOR 1 (+)
1-26	–	1-54	INJECTOR 2 (+)
1-27	–	1-55	INJECTOR 2 (−)
1-28	RAIL PRESSURE SENSOR	1-56	INJECTOR 1 (−)

9Y1200209CRM0015US0

ECU Terminal Layout 2 for D1803-TIE4



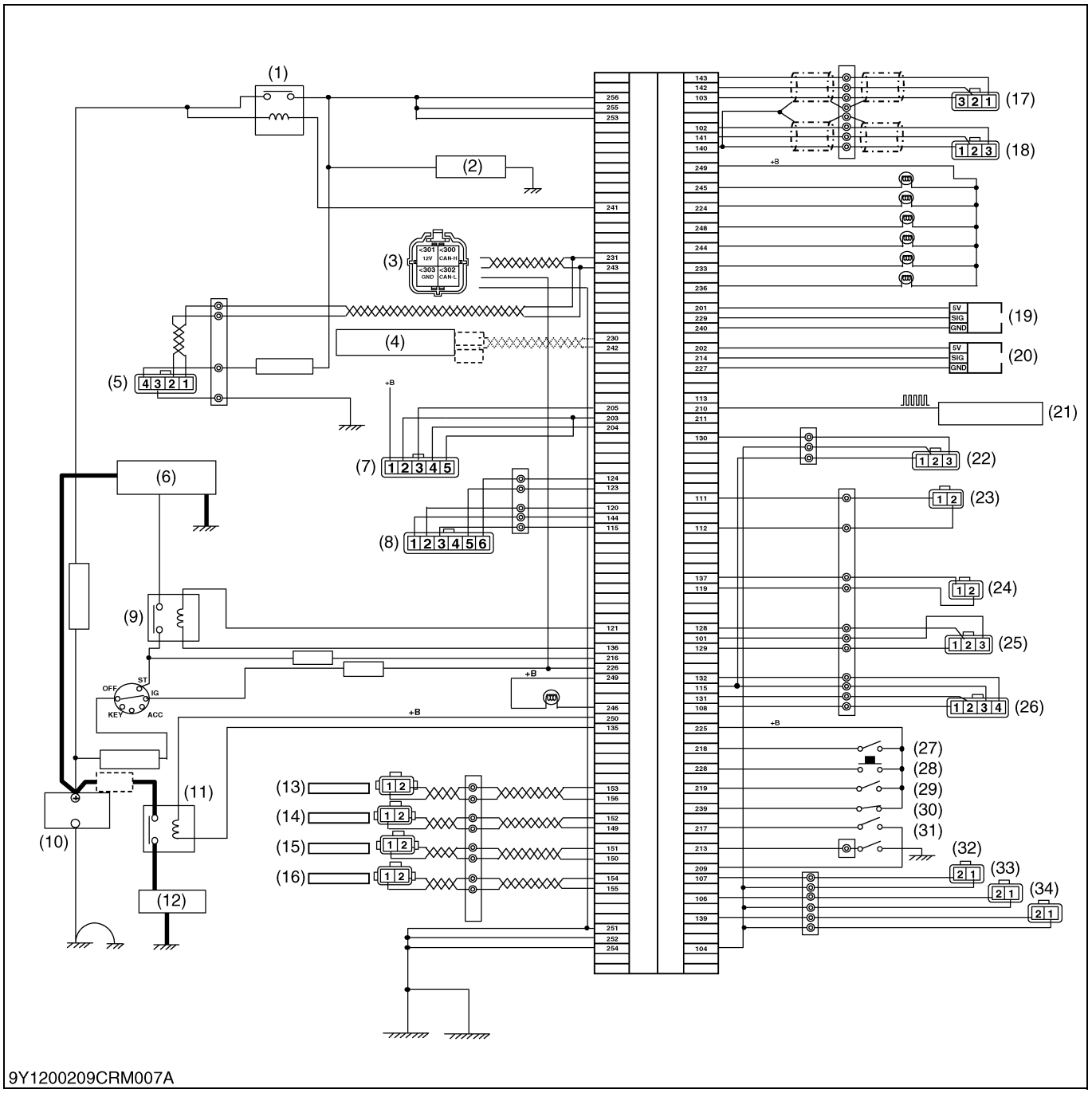


9Y1210782INM003A

Terminal NO.	Signal Name	Terminal NO.	Signal Name
2-1	ACCELERATION PEDAL 1 (+)	2-29	ACCELERATION PEDAL 1
2-2	ACCELERATION PEDAL 2 (+)	2-30	CAN2 H
2-3	AIR FLOW SENSOR (−)	2-31	CAN1 H
2-4	• INTAKE AIR TEMPERATURE SENSOR • INTAKE AIR TEMPERATURE SENSOR (built-in MAF sensor)	2-32	–
2-5	AIR FLOW SENSOR	2-33	–
2-6	–	2-34	–
2-7	–	2-35	–
2-8	–	2-36	–
2-9	LOW SIDE SWITCH (−)	2-37	–
2-10	VEHICLE SPEED SENSOR	2-38	–
2-11	VEHICLE SPEED SENSOR (−)	2-39	–
2-12	–	2-40	ACCELERATION PEDAL 1 (−)
2-13	OIL SWITCH	2-41	MAIN RELAY
2-14	ACCELERATION PEDAL 2	2-42	CAN 2 L
2-15	–	2-43	CAN 1 L
2-16	STARTER SWITCH	2-44	OVERHEAT LAMP
2-17	NEUTRAL SWITCH	2-45	ENGINE WARNING LAMP
2-18	STOP SWITCH	2-46	HEATER LAMP
2-19	PARKING SWITCH	2-47	–
2-20	–	2-48	LOW OIL PRESSURE LAMP
2-21	–	2-49	HEATER LAMP (+)
2-22	–	2-50	GLOW RELAY (+)
2-23	–	2-51	BATTERY (−)
2-24	ENGINE STOP LAMP	2-52	BATTERY (−)
2-25	BATTERY SOURCE	2-53	BATTERY (+)
2-26	KEY SWITCH	2-54	BATTERY (−)
2-27	ACCELERATION PEDAL 2 (−)	2-55	BATTERY (+)
2-28	–	2-56	BATTERY (+)

9Y1200209CRM0016US0

V2403-CR-E4, -TE4



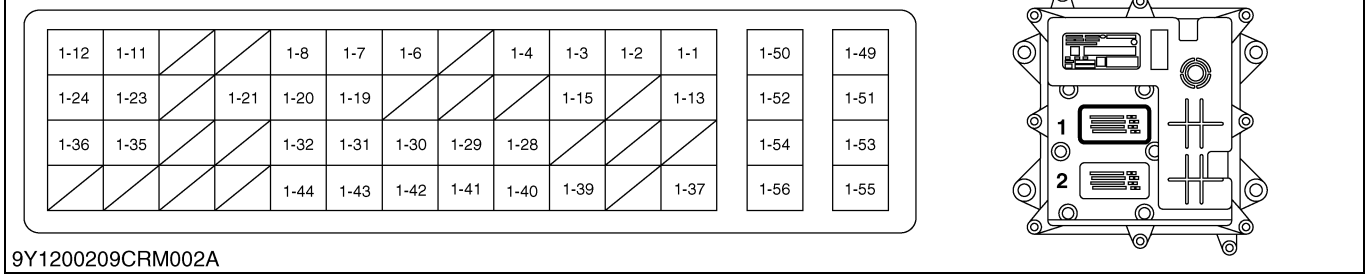
9Y1200209CRM007A

(1) Main Relay
(2) Fuel Feed Pump
(3) CAN1 Connector (For Service)
(4) CAN2 Connector (For Vehicle)
(5) EGR Valve
(6) Starter
(7) Air Flow Sensor
(8) Intake Throttle Valve
(9) Starter Relay
(10) Battery
(11) Glow Relay
(12) Glow Heater
(13) Injector 1
(14) Injector 4
(15) Injector 3
(16) Injector 2
(17) Crankshaft Position Sensor
(18) Camshaft Position Sensor
(19) Accel Sensor 1
(20) Accel Sensor 2
(21) Vehicle Speed Sensor
(22) DPF Differential Pressure Sensor (ΔP)
(23) MPROP (SCV)
(24) Coolant Temperature Sensor
(25) Rail Pressure Sensor
(26) Boost Sensor
(27) Stop Switch
(28) Parked Regeneration Switch
(29) Parking Switch
(30) Regeneration Inhibit Switch
(31) Neutral Switch
(32) DPF Temperature Sensor (T0)
(33) DPF Temperature Sensor (T1)
(34) DPF Temperature Sensor (T2)

DPF: Diesel Particulate Filter

9Y1200209CRM0017US0

ECU Terminal Layout 1 for V2403-E4, -TE4

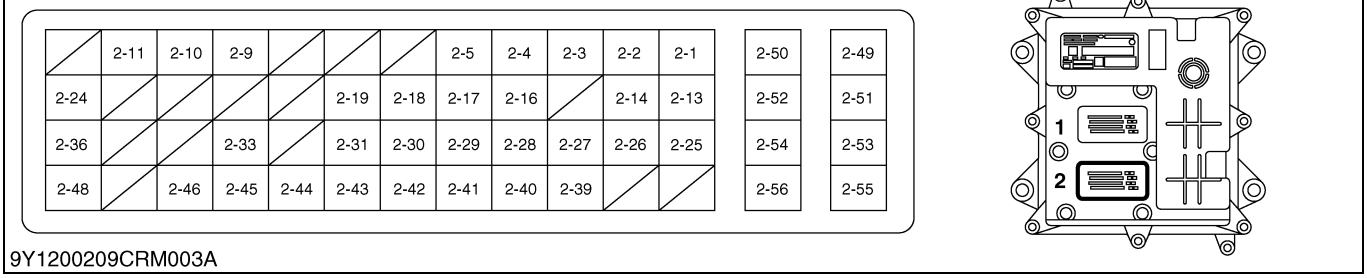


9Y1200209CRM002A

Terminal NO.	Signal Name	Terminal NO.	Signal Name
1-1	RAIL PRESSURE SENSOR (+)	1-29	RAIL PRESSURE SENSOR (−)
1-2	CAMSHAFT POSITION SENSOR (+)	1-30	DIFFERENTIAL PRESSURE SENSOR
1-3	CRANKSHAFT POSITION SENSOR (+)	1-31	BOOST TEMPERATURE SENSOR
1-4	• EXHAUST GAS TEMPERATURE SENSORS T0, T1, T2 (−) • DIFFERENTIAL PRESSURE SENSOR (−)	1-32	BOOST PRESSURE SENSOR
1-5	–	1-33	–
1-6	DPF TEMPERATURE SENSOR T2	1-34	–
1-7	DPF TEMPERATURE SENSOR T0	1-35	GLOW RELAY
1-8	• BOOST TEMPERATURE SENSOR (−) • BOOST PRESSURE SENSOR (−)	1-36	STARTER RELAY
1-9	–	1-37	COOLANT TEMPERATURE SENSOR (−)
1-10	–	1-38	–
1-11	SCV (MPROP) (−)	1-39	EXHAUST GAS TEMPERATURE SENSOR T1
1-12	SCV (MPROP) (+)	1-40	CAMSHAFT POSITION SENSOR (−)
1-13	VEHICLE SPEED SENSOR (+)	1-41	CAMSHAFT POSITION SENSOR
1-14	–	1-42	CRANKSHAFT POSITION SENSOR
1-15	DIFFERENCE PRESSURE SENSOR (+) BOOST PRESSURE SENSOR (+) THROTTLE POSITION SENSOR (+)	1-43	CRANKSHAFT POSITION SENSOR (−)
1-16	–	1-44	THROTTLE POSITION SENSOR (−)
1-17	–	1-45	–
1-18	–	1-46	–
1-19	COOLANT TEMPERATURE SENSOR	1-47	–
1-20	THROTTLE POSITION SENSOR	1-48	–
1-21	STARTER RELAY (+)	1-49	INJECTOR 2 (−)
1-22	–	1-50	INJECTOR 3 (−)
1-23	INTAKE THROTTLE MOTOR (+)	1-51	INJECTOR 3 (+)
1-24	INTAKE THROTTLE MOTOR (−)	1-52	INJECTOR 2 (+)
1-25	–	1-53	INJECTOR 1 (+)
1-26	–	1-54	INJECTOR 4 (+)
1-27	–	1-55	INJECTOR 4 (−)
1-28	RAIL PRESSURE SENSOR	1-56	INJECTOR 1 (−)

9Y1200209CRM0018US0

ECU Terminal Layout 2 for V2403-E4, -TE4

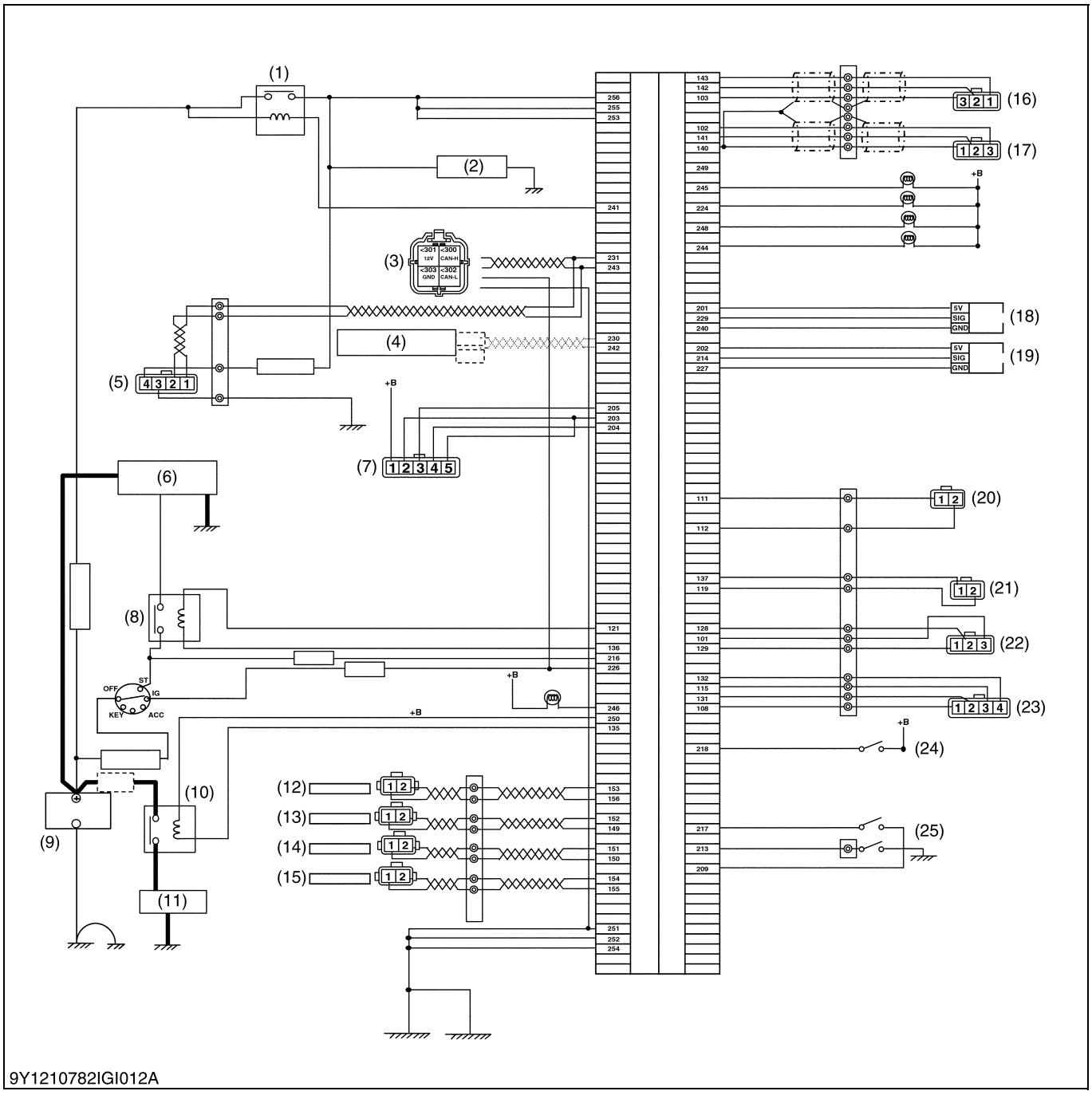


9Y1200209CRM003A

Terminal NO.	Signal Name	Terminal NO.	Signal Name
2-1	ACCELERATION PEDAL 1 (+)	2-29	ACCELERATION PEDAL 1
2-2	ACCELERATION PEDAL 2 (+)	2-30	CAN2 H
2-3	AIR FLOW SENSOR (−)	2-31	CAN1 H
2-4	• INTAKE AIR TEMPERATURE SENSOR • INTAKE AIR TEMPERATURE SENSOR (built-in MAF sensor)	2-32	–
2-5	AIR FLOW SENSOR	2-33	MANUAL REGENERATION LAMP
2-6	–	2-34	–
2-7	–	2-35	–
2-8	–	2-36	REGENERATION LAMP
2-9	LOW SIDE SWITCH (−)	2-37	–
2-10	VEHICLE SPEED SENSOR	2-38	–
2-11	VEHICLE SPEED SENSOR (−)	2-39	REGENERATION INHIBIT SWITCH
2-12	–	2-40	ACCELERATION PEDAL 1 (−)
2-13	OIL SWITCH	2-41	MAIN RELAY
2-14	ACCELERATION PEDAL 2	2-42	CAN 2 L
2-15	–	2-43	CAN 1 L
2-16	STARTER SWITCH	2-44	OVERHEAT LAMP
2-17	NEUTRAL SWITCH	2-45	ENGINE WARNING LAMP
2-18	STOP SWITCH	2-46	HEATER LAMP
2-19	PARKING SWITCH	2-47	–
2-20	–	2-48	LOW OIL PRESSURE LAMP
2-21	–	2-49	HEATER LAMP (+)
2-22	–	2-50	GLOW RELAY (+)
2-23	–	2-51	BATTERY (−)
2-24	ENGINE STOP LAMP	2-52	BATTERY (−)
2-25	BATTERY SOURCE	2-53	BATTERY (+)
2-26	KEY SWITCH	2-54	BATTERY (−)
2-27	ACCELERATION PEDAL 2 (−)	2-55	BATTERY (+)
2-28	PARKED REGENERATION SWITCH	2-56	BATTERY (+)

9Y1200209CRM0019US0

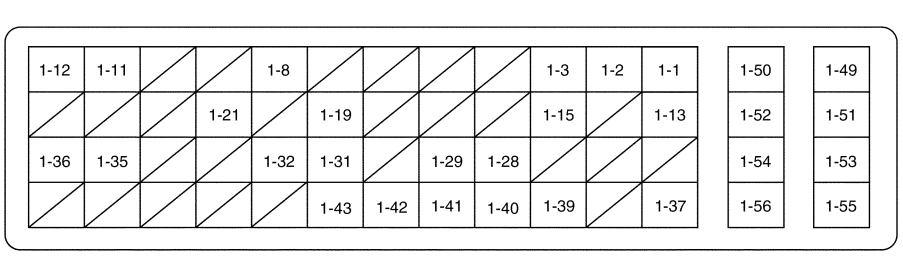
V2403-CR-TIE4

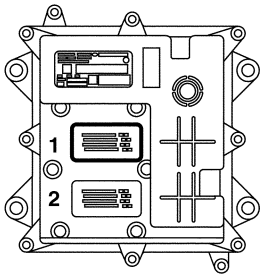


(1) Main Relay
(2) Fuel Feed Pump
(3) CAN1 Connector (For Service)
(4) CAN2 Connector (For Vehicle)
(5) EGR Valve
(6) Starter
(7) Air Flow Sensor
(8) Starter Relay
(9) Battery
(10) Glow Relay
(11) Glow Heater
(12) Injector 1
(13) Injector 4
(14) Injector 3
(15) Injector 2
(16) Crankshaft Position Sensor
(17) Camshaft Position Sensor
(18) Accel Sensor 1
(19) Accel Sensor 2
(20) MPROP (SCV)
(21) Coolant Temperature Sensor
(22) Rail Pressure Sensor
(23) Boost Sensor
(24) Stop Switch
(25) Neutral Switch

9Y1200209CRM0020US0

ECU Terminal Layout 1 for V2403-TIE4



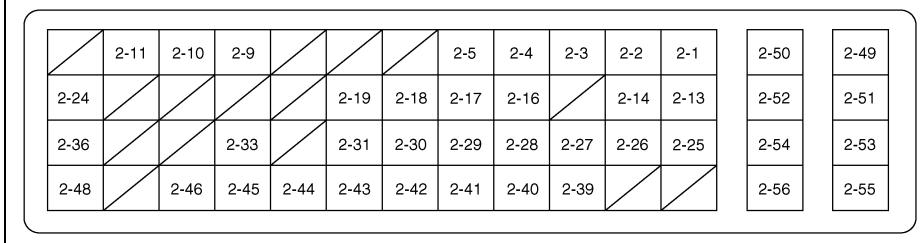


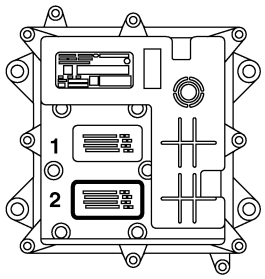
9Y1210782INM004A

Terminal NO.	Signal Name	Terminal NO.	Signal Name
1-1	RAIL PRESSURE SENSOR (+)	1-29	RAIL PRESSURE SENSOR (−)
1-2	CAMSHAFT POSITION SENSOR (+)	1-30	–
1-3	CRANKSHAFT POSITION SENSOR (+)	1-31	BOOST TEMPERATURE SENSOR
1-4	–	1-32	BOOST PRESSURE SENSOR
1-5	–	1-33	–
1-6	–	1-34	–
1-7	–	1-35	GLOW RELAY
1-8	• BOOST TEMPERATURE SENSOR (−) • BOOST PRESSURE SENSOR (−)	1-36	STARTER RELAY
1-9	–	1-37	COOLANT TEMPERATURE SENSOR (−)
1-10	–	1-38	–
1-11	SCV (MPROP) (−)	1-39	EXHAUST GAS TEMPERATURE SENSOR T1
1-12	SCV (MPROP) (+)	1-40	CAMSHAFT POSITION SENSOR (−)
1-13	VEHICLE SPEED SENSOR (+)	1-41	CAMSHAFT POSITION SENSOR
1-14	–	1-42	CRANKSHAFT POSITION SENSOR
1-15	BOOST PRESSURE SENSOR (+)	1-43	CRANKSHAFT POSITION SENSOR (−)
1-16	–	1-44	–
1-17	–	1-45	–
1-18	–	1-46	–
1-19	COOLANT TEMPERATURE SENSOR	1-47	–
1-20	–	1-48	–
1-21	STARTER RELAY (+)	1-49	INJECTOR 2 (−)
1-22	–	1-50	INJECTOR 3 (−)
1-23	–	1-51	INJECTOR 3 (+)
1-24	–	1-52	INJECTOR 2 (+)
1-25	–	1-53	INJECTOR 1 (+)
1-26	–	1-54	INJECTOR 4 (+)
1-27	–	1-55	INJECTOR 4 (−)
1-28	RAIL PRESSURE SENSOR	1-56	INJECTOR 1 (−)

9Y1200209CRM0021US0

ECU Terminal Layout 2 for V2403-TIE4





9Y1200209CRM003A

Terminal NO.	Signal Name	Terminal NO.	Signal Name
2-1	ACCELERATION PEDAL 1 (+)	2-29	ACCELERATION PEDAL 1
2-2	ACCELERATION PEDAL 2 (+)	2-30	CAN2 H
2-3	AIR FLOW SENSOR (−)	2-31	CAN1 H
2-4	• INTAKE AIR TEMPERATURE SENSOR • INTAKE AIR TEMPERATURE SENSOR (built-in MAF sensor)	2-32	–
2-5	AIR FLOW SENSOR	2-33	–
2-6	–	2-34	–
2-7	–	2-35	–
2-8	–	2-36	–
2-9	LOW SIDE SWITCH (−)	2-37	–
2-10	VEHICLE SPEED SENSOR	2-38	–
2-11	VEHICLE SPEED SENSOR (−)	2-39	–
2-12	–	2-40	ACCELERATION PEDAL 1 (−)
2-13	OIL SWITCH	2-41	MAIN RELAY
2-14	ACCELERATION PEDAL 2	2-42	CAN 2 L
2-15	–	2-43	CAN 1 L
2-16	STARTER SWITCH	2-44	OVERHEAT LAMP
2-17	NEUTRAL SWITCH	2-45	ENGINE WARNING LAMP
2-18	STOP SWITCH	2-46	HEATER LAMP
2-19	PARKING SWITCH	2-47	–
2-20	–	2-48	LOW OIL PRESSURE LAMP
2-21	–	2-49	HEATER LAMP (+)
2-22	–	2-50	GLOW RELAY (+)
2-23	–	2-51	BATTERY (−)
2-24	ENGINE STOP LAMP	2-52	BATTERY (−)
2-25	BATTERY SOURCE	2-53	BATTERY (+)
2-26	KEY SWITCH	2-54	BATTERY (−)
2-27	ACCELERATION PEDAL 2 (−)	2-55	BATTERY (+)
2-28	–	2-56	BATTERY (+)

9Y1200209CRM0022US0

SERVICING

CONTENTS

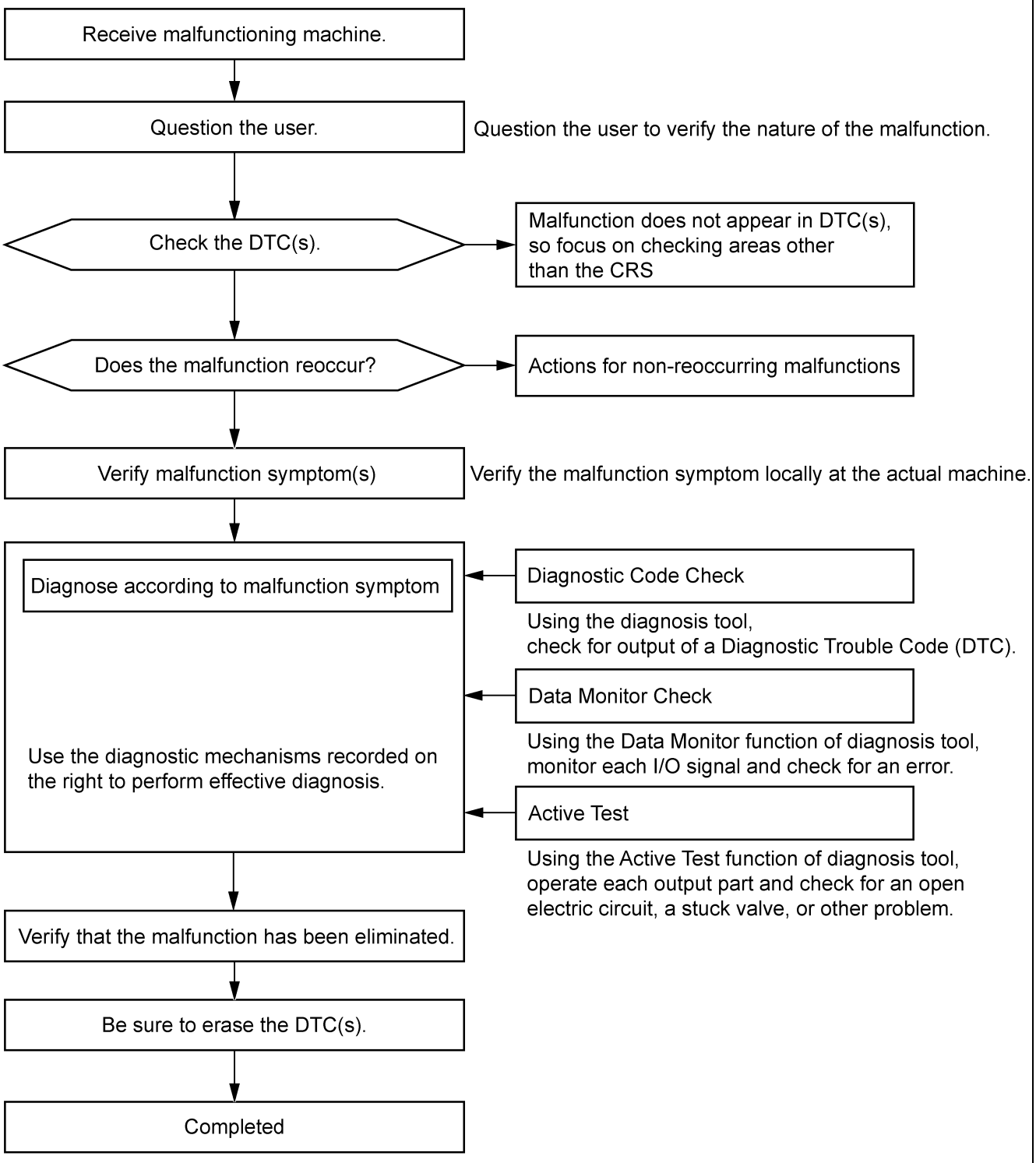
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1. GENERAL

[1] OVERALL DIAGNOSTIC PROCEDURE



9Y1200125CRS001C

9Y1200209CRS0408US0

[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)

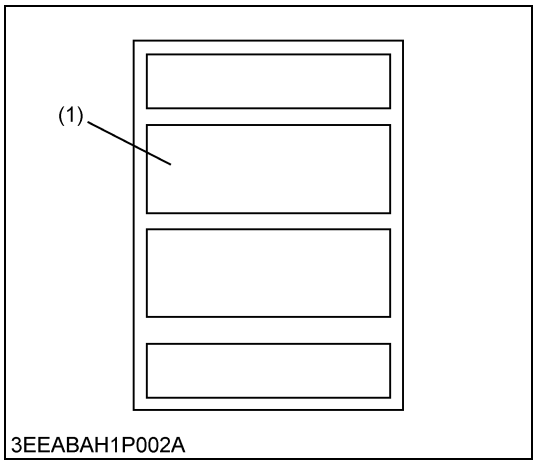
Do not ask random questions. Ask questions that will aid in narrowing down the possible malfunctioning system while making educated guesses based on the malfunction symptoms.

9Y1200209CRS0409US0

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.

9Y1200209CRS0410US0



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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:

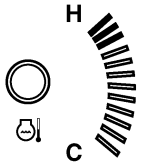
- The malfunction symptom may not be reproduced at the workshop.
- The customer's complaint does not always match the malfunction.
- If the person performing repairs is not working from the correct malfunction symptoms, man-hours will be wasted.

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

9Y1200209CRS0411US0

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	☐ Yes		☐ No		
Defective parts	☐ Injector		☐ Supply Pump		
	☐ Common rail		☐ Fuel Filter		
	☐ 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		☐ Injector 1	☐ Injector 2	
			☐ Injector 3	☐ Injector 4	
Actual part replacement	☐ Injector		☐ Supply Pump		
	☐ Common rail		☐ Fuel Filter		
	☐ ECU		☐ Others ( )		
Customer complaint					
☐ 1. Engine no start	☐ a. No initial combustion		☐ b. No complete combustion		
	☐ c. No cranking				
☐ 2. Difficult to start	☐ a. Engine crank slowly				
	☐ b. Others ( )				
☐ 3. Poor idling	☐ a. Incorrect first idle		☐ b. Noise		
	☐ c. Hunting idle from ( ) to ( ) min^{-1} (rpm)				
	☐ d. High idling ( ) min^{-1} (rpm)				
	☐ e. Low idling ( ) min^{-1} (rpm)				
	☐ f. Rough				
	☐ g. Others ( )				
☐ 4. Poor driveability	☐ a. Hesitation		☐ b. Surging		
	☐ c. Knocking		☐ d. Lack of power		
	☐ e. Others ( )				
☐ 5. Abnormal smoke	☐ a. Black		☐ b. White		
	☐ c. Others ( )				
☐ 6. Fuel leakage	☐ a. Large quantity		☐ b. Blurred		
	Leaking from:		☐ Injector	☐ Supply Pump	
			☐ Others ( )		
☐ 7. Engine not stop					
☐ 8. Engine stall					
☐ 9. Others					

9Y1200209CRS0412US0

Condition when problem occurs (Duplicated answers can be possible)		
1. Weather	☐ a. Fine	☐ b. Cloudy
	☐ c. Rainy	☐ d. Snow
	☐ e. Flood	
	☐ f. Others ( )	
2. Outdoor temperature	Approx. °C (°F)	
3. Altitude	Approx. m	
4. Engine coolant	☐ a. Cold	Write the position of the indicator on coolant temperature gauge.  9Y1200058ENI031A
	☐ b. Warming up	
	☐ c. After warming up	
	☐ d. Any temperature	
	☐ e. Others ( )	
5. Engine operation	☐ a. Starting	☐ b. Just after starting
	☐ c. Idling	☐ d. Racing
	☐ e. Acceleration	☐ f. Deceleration
	☐ g. While at work	
	☐ h. Others ( )	
6. Problem frequency	☐ a. Constant	☐ b. Once only
	☐ c. Sometime (Time per day/month)	
7. Engine warning light	☐ Turn on a light	☐ 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	☐ a. Yes (Duplicate)	☐ b. No (Not occur)
2. Diagnosis trouble code	☐ a. Abnormal (What is code)	
	☐ b. Normal (No code)	
3. Appearance	☐ a. Normal	☐ b. Cracked
	☐ c. Discolored	
	☐ d. Others ( )	
4. Fuel condition	☐ a. Normal	
	☐ b. Abnormal ( )	

9Y1200209CRS0413US0

[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.

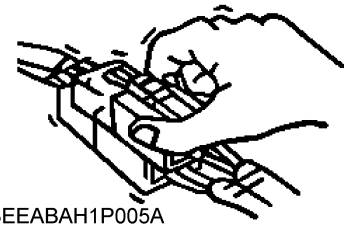
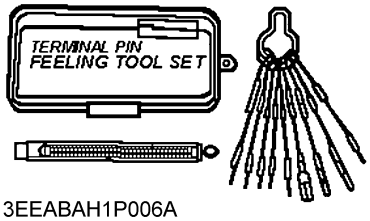
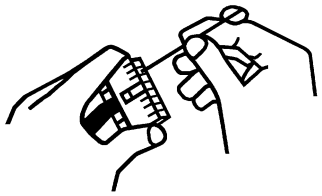
Malfunction symptom	Area of Fault	Cause	Action
Engine overheat	Fuel system	Poor fuel	Switch to the correct fuel (No.2-D diesel fuel).
	Lubrication system	Engine oil deterioration.	Change engine oil.
		Inappropriate engine oil.	Replace with the appropriate engine oil (API Service Classification CF grade 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.

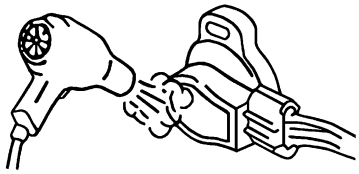
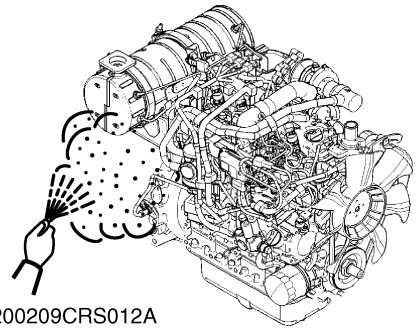
9Y1200209CRS0414US0

[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 input QR Code for injectors. If there would be no change, ECU should not be replaced.

9Y1200209CRS0415US0

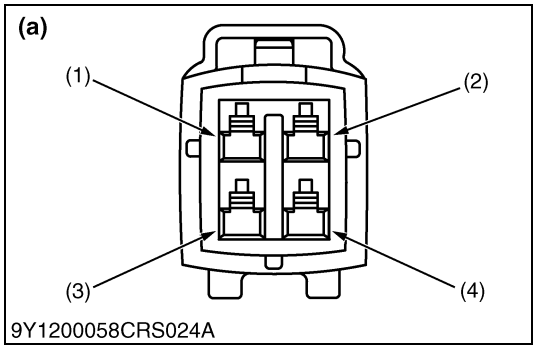
Action	Malfunction symptom		
	Dead battery	Engine will not start	Idle speed abnormal engine stall sluggish poor acceleration
Verify that there is no Diagnostic Trouble Code (DTC) stored in the memory.	–	❍	❍
Assume that an electrical system wiring harness or connector is the cause of the malfunction and vibrate these components by hand to verify whether or not a malfunction occurs and a DTC is generated.  3EEABAH1P005A	–	❍	❍
Assume that an electrical system female connector terminal is the cause of the malfunction and verify that the connection points are not defective. **Recommended Tools: KOWA Precision Handling** Feeling Tool Set (KLM-10- 20) Depending on the terminal, a matching size may not be available.  3EEABAH1P006A Insert the male terminal that matches the shape of the female terminal and check for looseness.  3EEABAH1P007A	–	❍	❍

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** • **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** • **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.**  9Y1200209CRS012A	❍		❍

9Y1200209CRS0416US0

2. DIAGNOSTIC TOOL CONNECTION PROCEDURE

[1] DIAGNOSTIC CONNECTOR POSITIONS



9Y1200058CRS024A

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

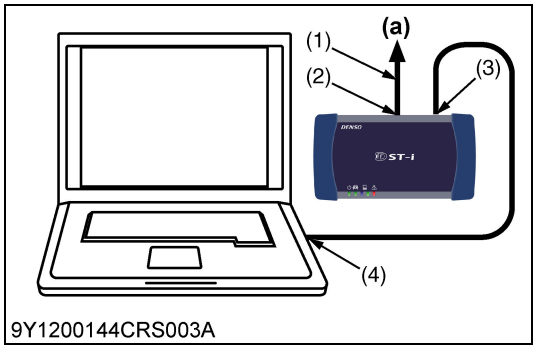
(1) Terminal IG-SW
(2) Terminal CAN1-H
(3) Terminal S-GND
(4) Terminal CAN1-L
(a) CAN1 Connector

9Y1200209CRS0417US0

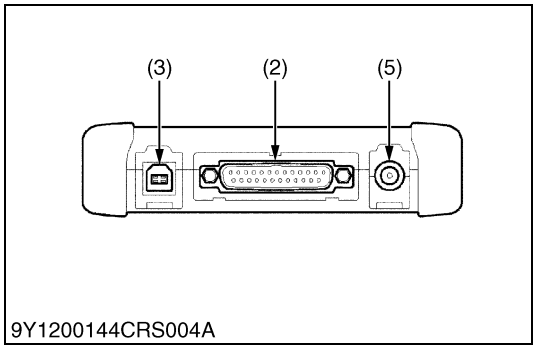
[2] DIAGNOSTIC TOOL CONNECTION PROCEDURE

■ **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.**

9Y1200209CRS0418US0



9Y1200144CRS003A



9Y1200144CRS004A

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.)

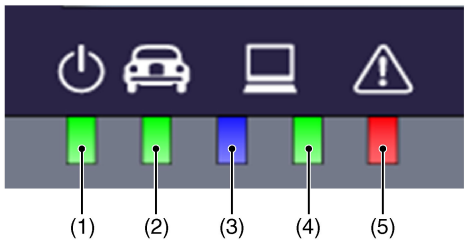
■ **NOTE**
- **The USB port used while the "Communication Setting" process, should always be used.**

(1) Cable (To Machine)
(2) Interface Connector (To Machine)
(3) USB Connector (To PC)*
(4) Cable (USB)
(5) DC Jack (Reserved)*
(a) CAN1 Connector

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

9Y1200209CRS0419US0

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



9Y1200144CRS005A

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

9Y1200209CRS0420US0

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)

9Y1200209CRS0421US0

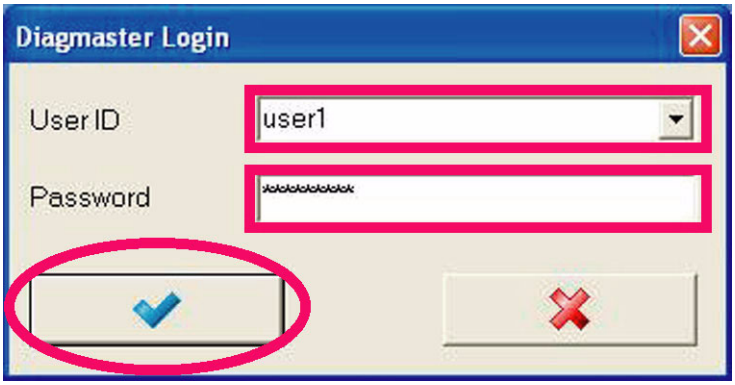
[4] CHECKING THE OPERATION OF THE ECU

(1) Starting Diagmaster

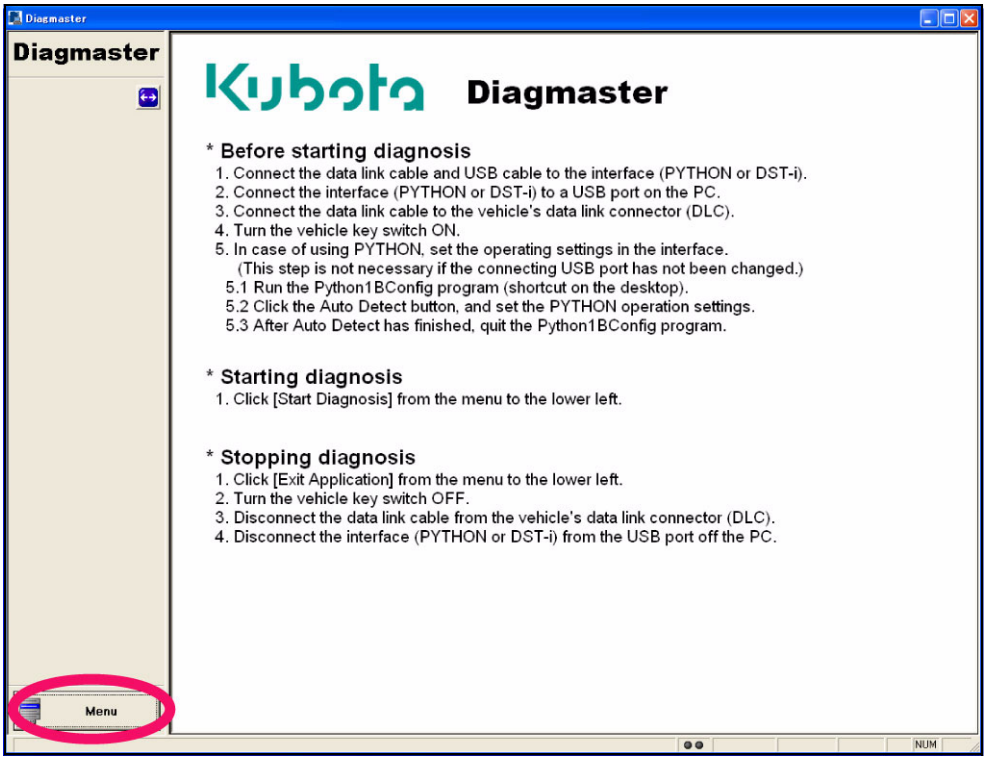
1. Double-click the Diagmaster icon on your computer desktop



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



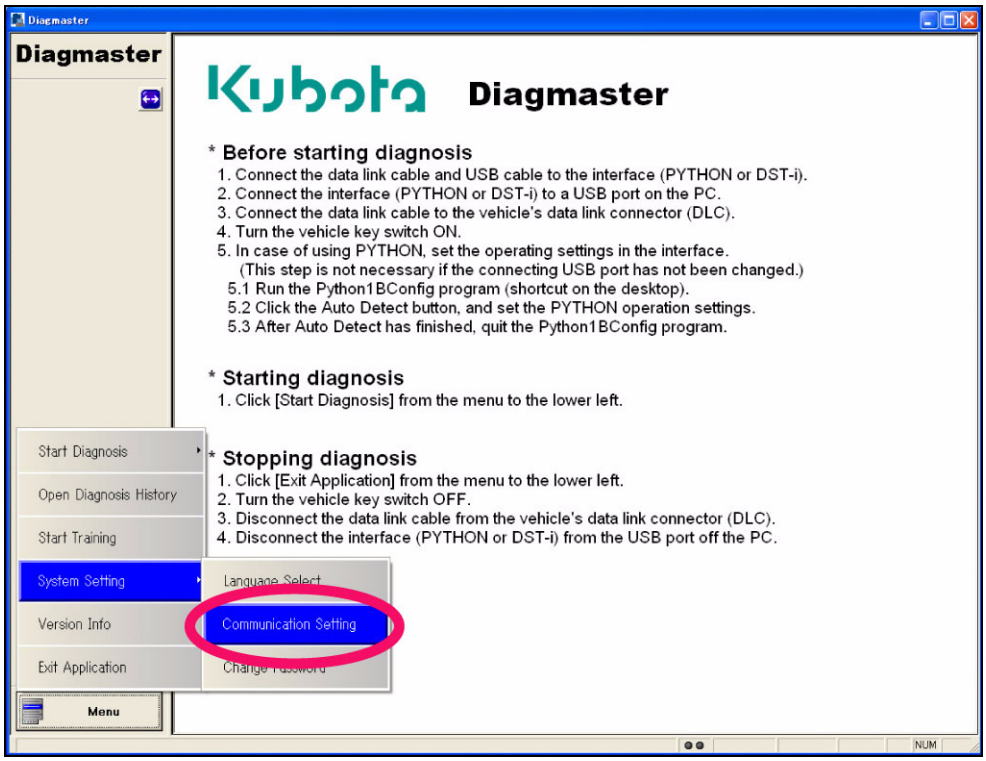
3. The Diagmaster initial screen appears.



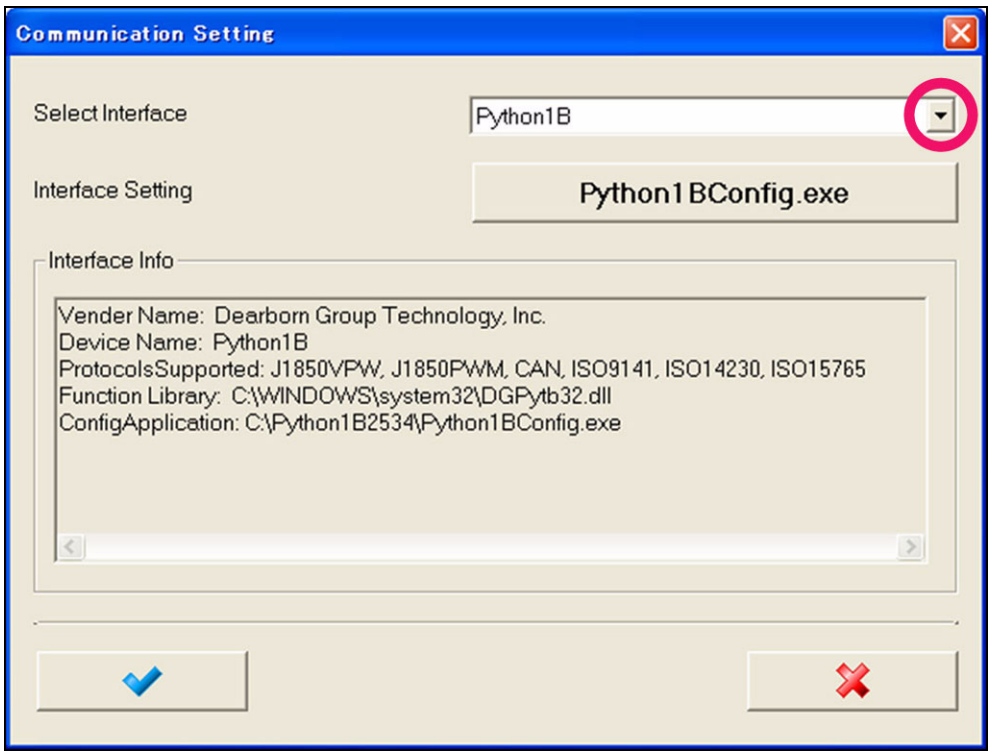
9Y1200209CRS0422US0

(2) DST-i Communication Settings

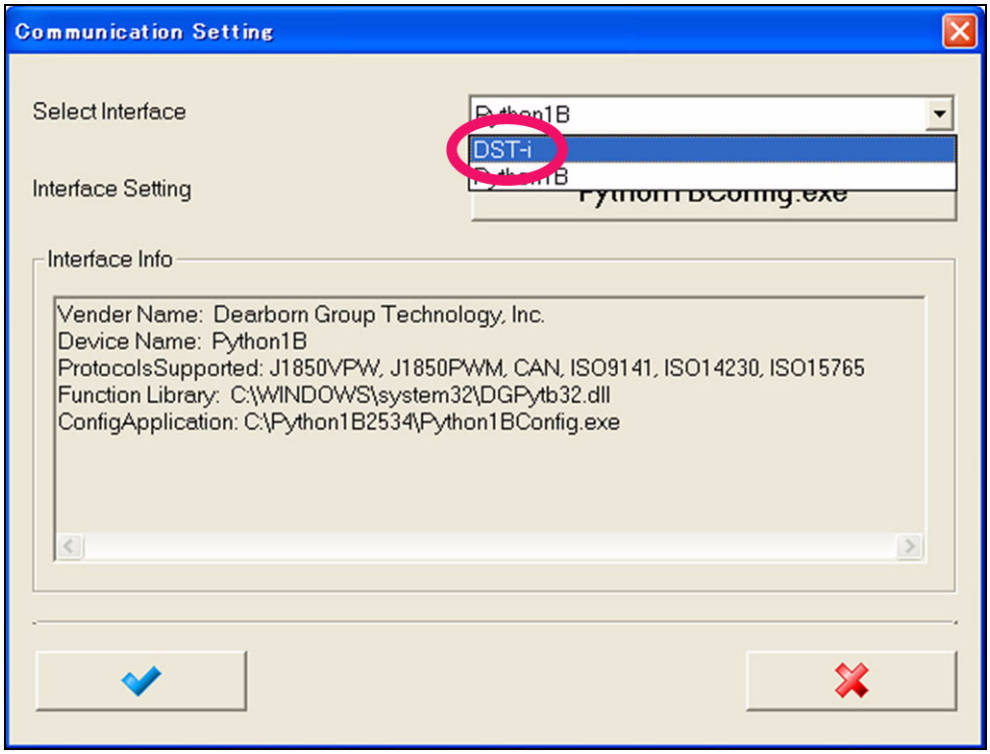
1. From the "Menu", select "System Setting", and then "Communication Setting"



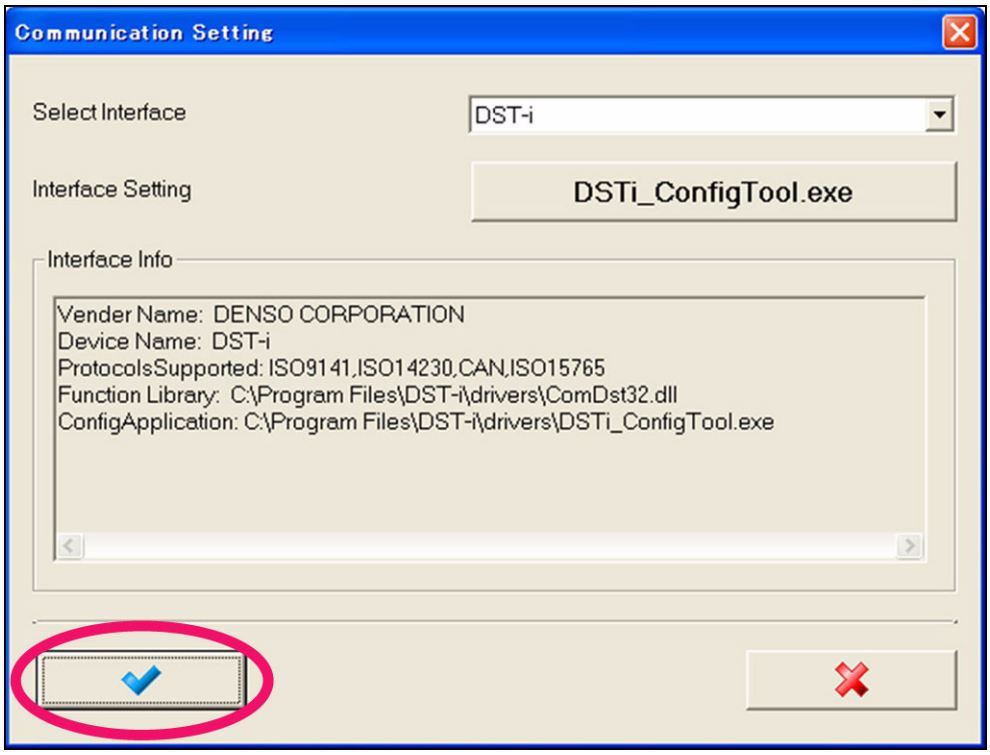
2. Click the interface select button.



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



4. Click the  button.

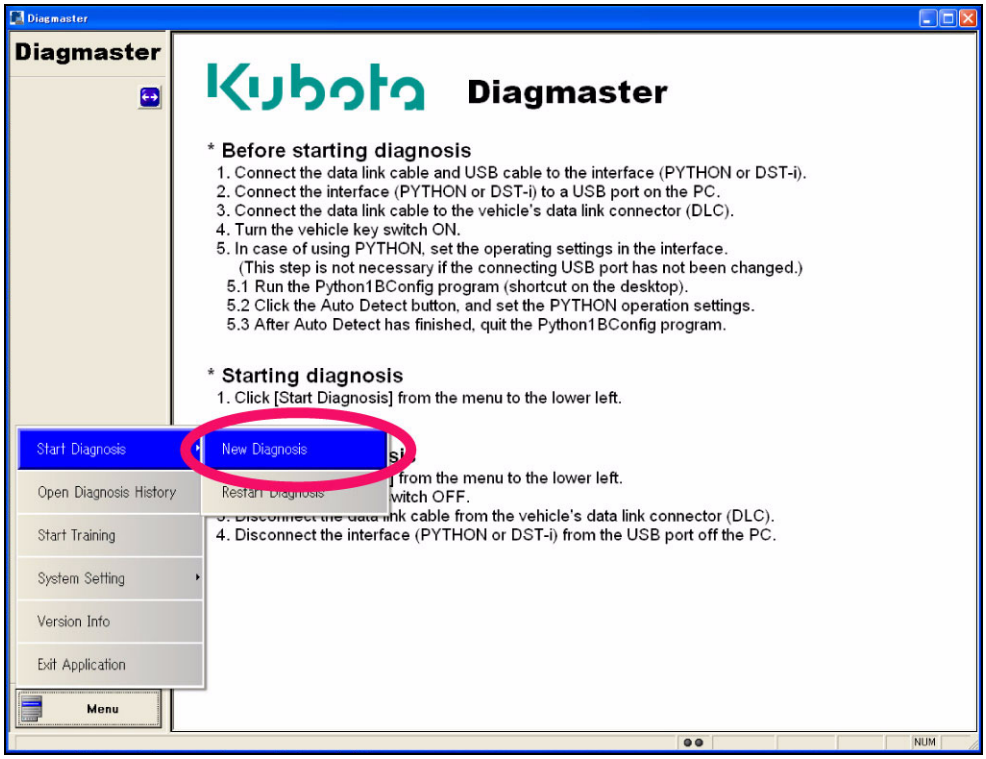


■ **NOTE**

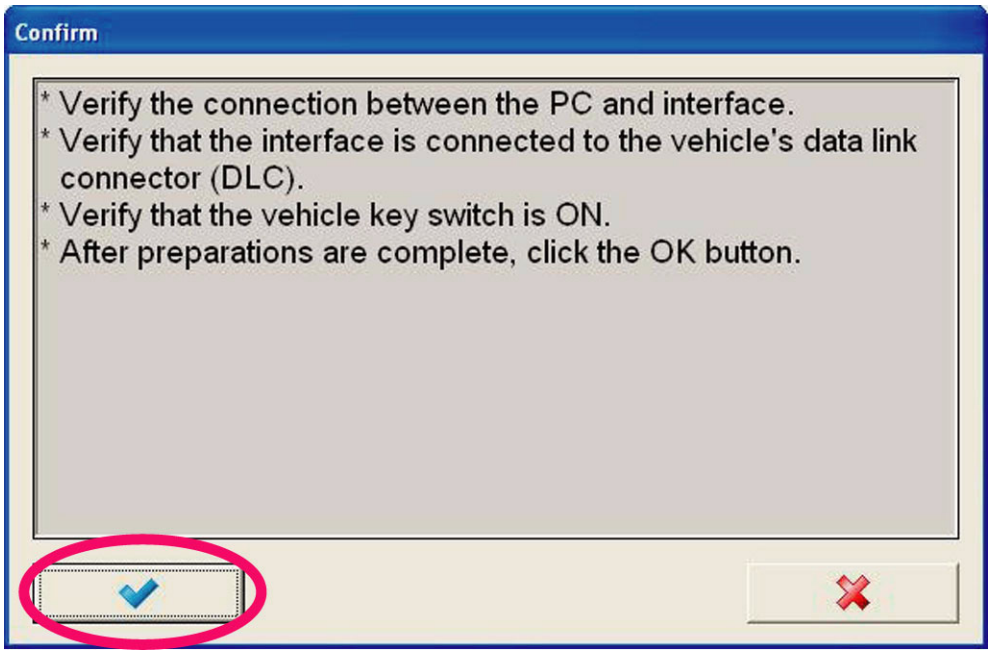
- **If you failed in the setting, confirm the connection and start again from procedure 1. to 4..**

9Y1200209CRS0423US0

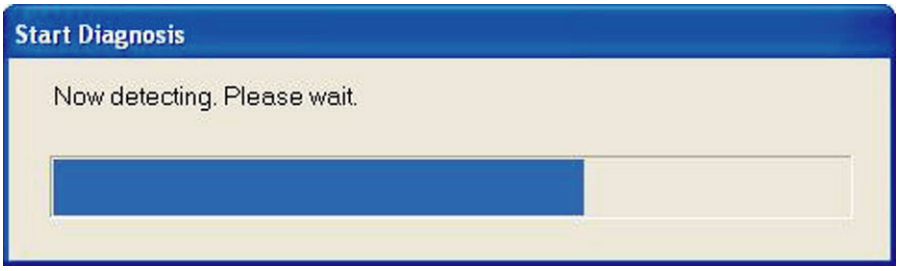
5. From "Menu", select "Start Diagnosis", and then "New Diagnosis".



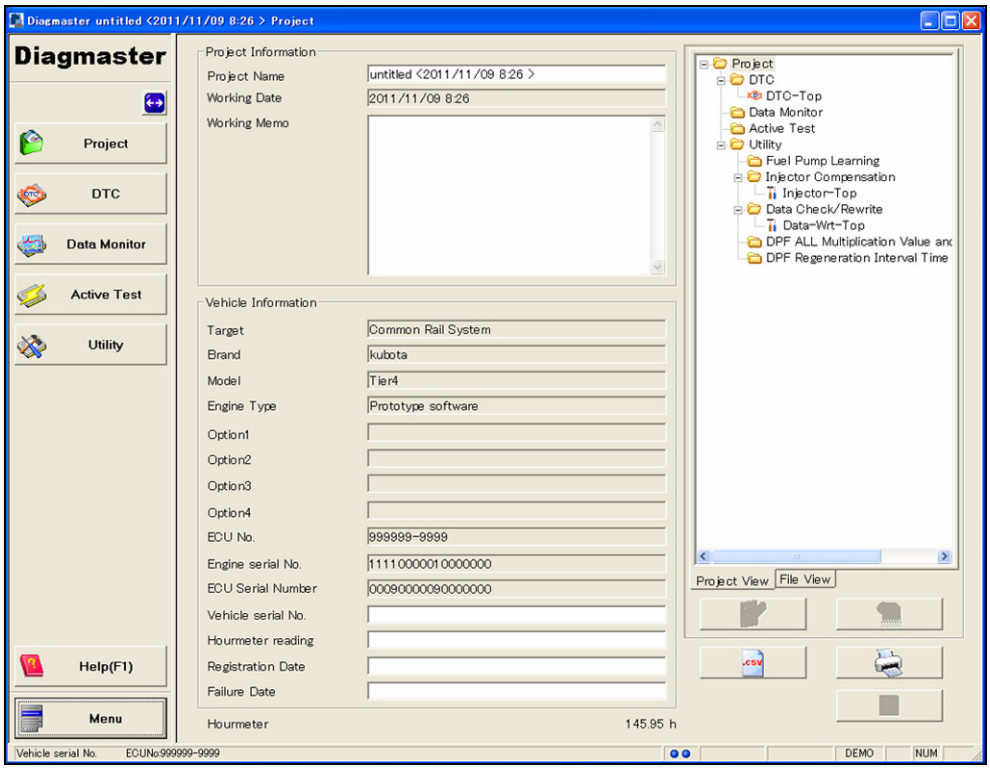
6. Click the  button.



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..**

9Y1200209CRS0424US0

3. ACTIVE TEST

The four items below are used.

1	Injector non-injection instruction	From the active test screen
2	EGR actuation test	
3	Glow relay actuation test	

9Y1200209CRS0425US0

(Operating conditions → specified tool conditions)

1. The conditions below are required for 1. Injector non-injection instruction:
   - Machine is stopped
   - Neutral switch is ON

9Y1200209CRS0426US0

[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 in accordance with the requests from the tool.

Factory specification	There is no difference between the target opening and actual 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.

3. Glow relay actuation test
   - Operate in accordance with the requests from the tool.

Factory specification	Operates repeatedly between ON and OFF.

4. Intake throttle valve actuation test
   - Operates in accordance with the requests from the tool.

Factory specification	There is no difference between the target value and actual value.

9Y1200209CRS0427US0

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.

9Y1200209CRS0433US0

Malfunction Cause		Malfunction Cause																	
		Control System											Engine						
		Crankshaft position sesor			Camshaft position sensor			Accelerator position sensor			Coolant temperature sensor								
		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	Low compression pressure	Engine internal fault	Valve clearance fault	Valve timing fault	Low engine oil viscosity	Insufficient engine oil level
1	Engine Warning Light Comes On	❍	❍	❍	❍	❍	❍	❍	❍		❍		❍ *1	❍ *1		❍ *2		
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 the engine rotation change is large, it lights.
*2: It lights for a timing positional wrong gear.

9Y1200209CRS0434US0

Malfunction Cause		Malfunction Cause																
		Control System							Engine Electrical System					Intake System				
		Boost pressure sensor		Rail pressure sensor		SCV malfunction	Main relay malfunction	EGR valve fault	Battery		Charging system malfunction	Air cleaner clogging	Starter relay malfunction	Intake system components	Glow system		Turbocharge malfunction
Malfunction Cause		No signal output	False signal output	No signal output	False signal output				Does not charge	Does not discharge				Leak	Faulty relay	Glow heater fault	
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.

9Y1200209CRS0435US0

Malfunction Cause		Malfunction Cause													
		Fuel System							Cooling System			Others			
		Fuel quality	Injectors: Blockage, leake, malfunction	Supply pump malfunction	Clogged fuel filter	Faulty fuel pressure limiter	SCV malfunction: Blockage	SCV malfunction: Leak	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		❍	❍	❍	❍	❍		❍						
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: It emphatically searches for the machine side.

9Y1200209CRS0436US0

[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-S274)
2. Connect diagnosis tool and read DTC. Refer to pertinent DTC diagnosis guidelines and implement diagnosis.

9Y1200209CRS0437US0

(2) Engine Does Not Start

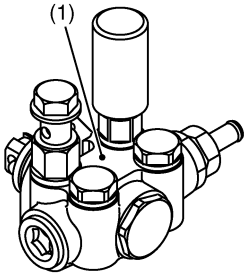
Possible causes:

1. Fuel feed pump operation fault.
2. Starting assist device (glow 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 glow 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 holes 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 operation fault
   - Main relay malfunction
5. Engine electrical system
   - Battery fault
   - Charging system malfunction
   - Starter relay malfunction
6. Intake system
   - Glow relay fault
   - Glow 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.)

9Y1200209CRS0438US0



9Y1200209CRS009A

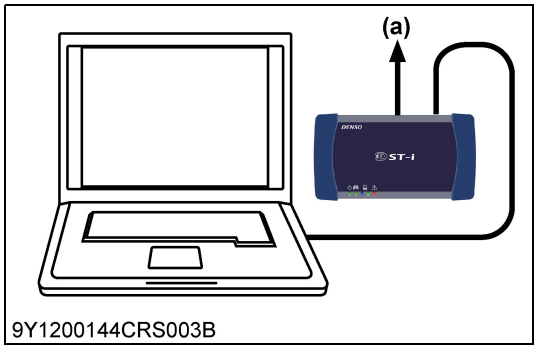
1. Check the Fuel Feed Pump Operation

1. Check the fuel feed pump is operating.

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-S274)

(1) Fuel Feed Pump

9Y1200209CRS0439US0



9Y1200144CRS003B

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

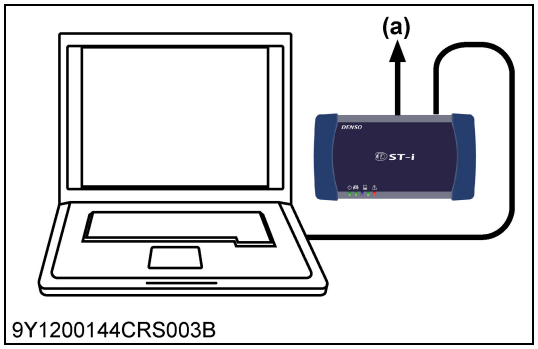
OK	Go to "3. Check the Starting Assist Device".
NG	Check in accordance with the troubleshooting procedures for each DTC.

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

9Y1200209CRS0440US0



9Y1200144CRS003B

3. Check the Starting Assist Device

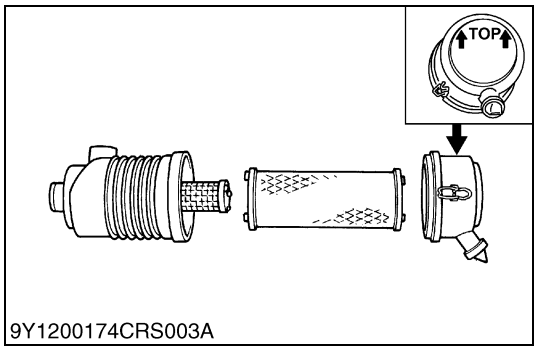
1. Refer to the workshop manual for the machine and check the glow plug, relay and related wiring harness.
2. In case the engine can not start when it is new or after the maintenance, make sure to connect the injector harness connector of the head cover position.
3. If the starter relay is used, neutral 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 (glow plug).

(a) CAN1 Connector

9Y1200209CRS0441US0



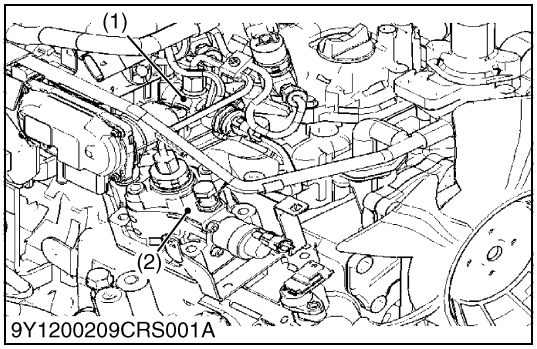
9Y1200174CRS003A

4. Check the Intake System

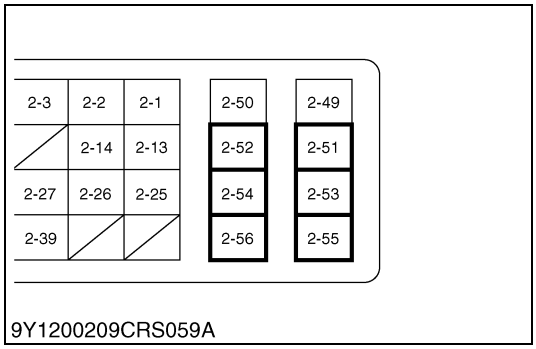
1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270)

OK	Go to "5. Check the Fuel System".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270)

9Y1200209CRS0442US0



9Y1200209CRS001A



9Y1200209CRS059A

5. Check the Fuel System

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271)

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-S271)

(1) Rail (2) Supply Pump

9Y1200209CRS0443US0

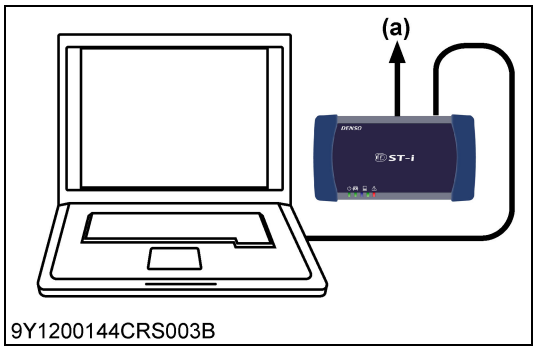
6. Check the ECU Power Supply and Grounding

1. Turn the key switch ON and measure the voltage between the ECU +BP terminals (2-53, 2-55, 2-56) and ground (body / battery terminal) and ECU Ground terminal (2-51, 2-52, 2-54) and ground (body / battery terminal).

Factory specification	+BP terminal - ground: 10 V or higher Ground 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-S279)

9Y1200209CRS0444US0



9Y1200144CRS003B

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

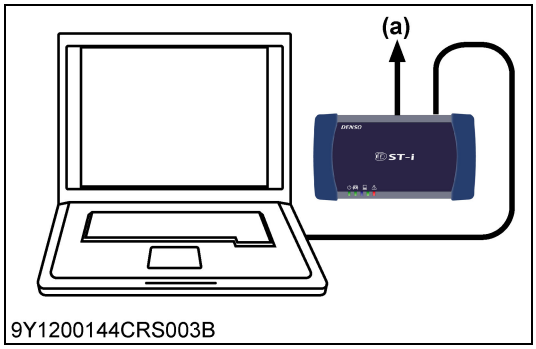
1. Set the key switch to START position and crank the engine. Check the "Engine speed active flag" and "Cam speed active flag" using the diagnosis tool data monitor function.

Factory specification	Both sides ON and constant

OK	Normal.
NG	Go to "8. 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-S160) and P0340, P0341 (Refer to page 1-S164) 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-S160) and P0340, P0341 (Refer to page 1-S164) in "5.[2] DIAGNOSIS BY DTC" as was the case in the above.

(a) CAN1 Connector

9Y1200209CRS0445US0



9Y1200144CRS003B

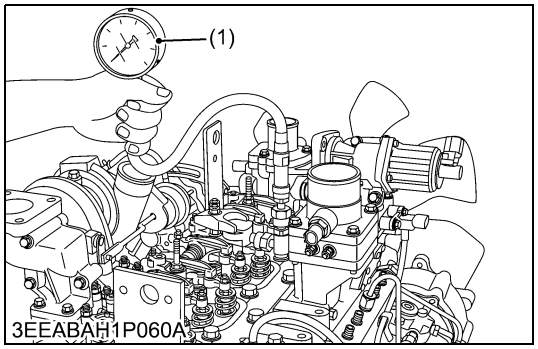
8. Checking the Monitor

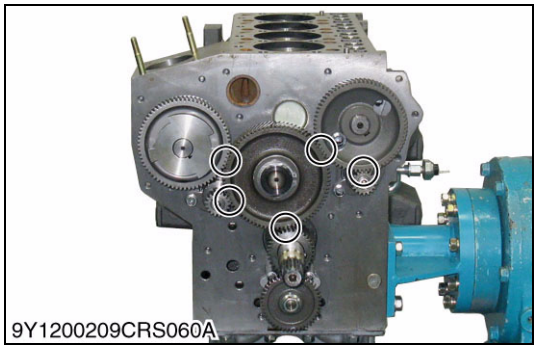
1. In accordance with the previous "List of malfunction causes by symptom", use the diagnosis tool for a monitor check of the mode flags during start-up, such as the coolant temperature, rail pressure, SCV current value and battery voltage. (Refer to page 1-S16)

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

(a) CAN1 Connector

9Y1200209CRS0446US0





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

9Y1200209CRS0447US0

(3) Takes A Long Time Before Engine Starts

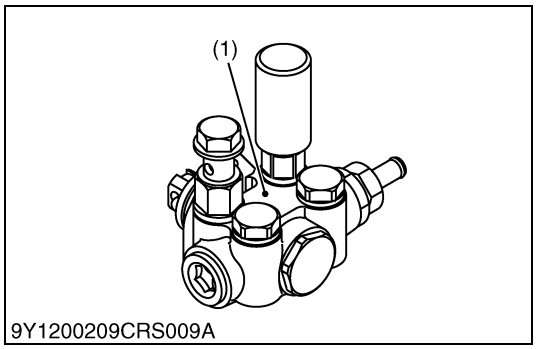
Possible causes:

1. Fuel feed pump operation fault.

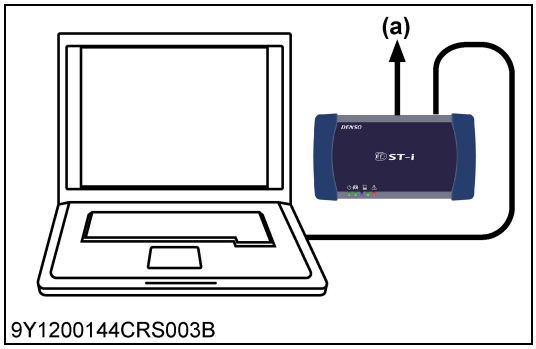
***Refer to the previous "List of malfunction causes by symptom" for the subsequent details.**

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 operation fault
4. Engine electrical system
   - Battery fault
5. Intake system
   - Glow relay fault
   - Glow plug 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.)

9Y1200209CRS0448US0



9Y1200209CRS009A



9Y1200144CRS003B

1. Check the Fuel Feed Pump Operation

1. Check the fuel feed pump is operating.

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-S274)

(1) Fuel Feed Pump

9Y1200209CRS0439US0

2. Check the DTC

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

Factory specification	No DTC is output.

DTC presently existing

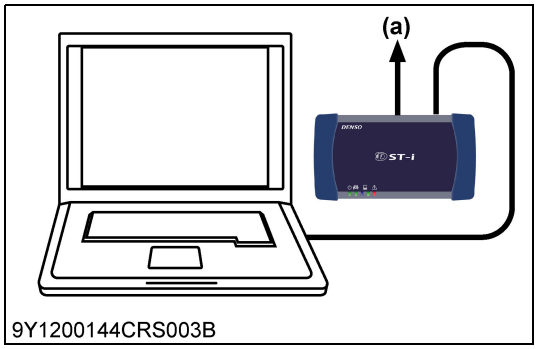
OK	Go to "3. Check the Starting Assist Device".
NG	Check in accordance with the troubleshooting procedures for each DTC.

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

9Y1200209CRS0450US0



9Y1200144CRS003B

3. Check the Starting Assist Device

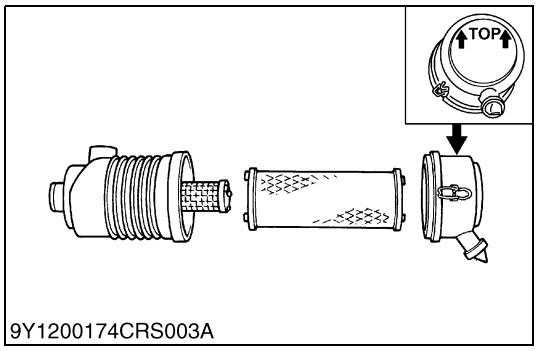
1. Refer to the workshop manual for the machine and check the glow plug, relay and related wiring harness.
2. In case the engine can not start when it is new or after the maintenance, make sure to connect the injector harness connector of the head cover position.
3. If the starter relay is used, neutral 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 (glow plug).

(a) CAN1 Connector

9Y1200209CRS0441US0



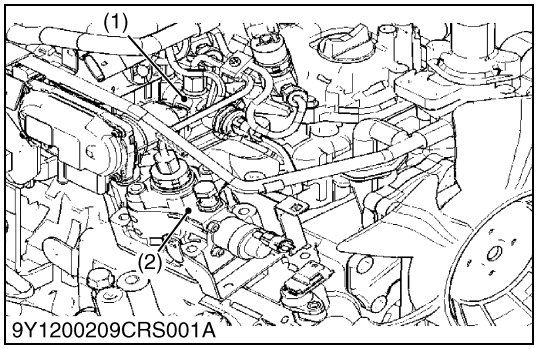
9Y1200174CRS003A

4. Check the Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270)

OK	Go to "5. Check the Fuel System".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270)

9Y1200209CRS0442US0



9Y1200209CRS001A

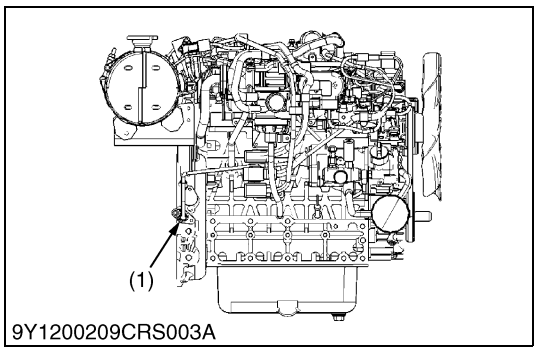
5. Check the Fuel System

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271)

OK	Go to "6. Check the Crankshaft Position Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271)

(1) Rail (2) Supply Pump

9Y1200209CRS0453US0



9Y1200209CRS003A

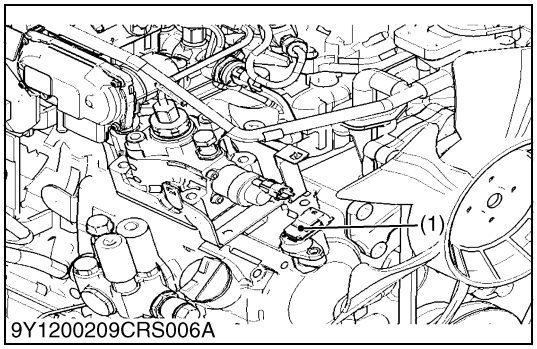
6. Check the Crankshaft Position Sensor

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)

9Y1200209CRS0454US0



9Y1200209CRS006A

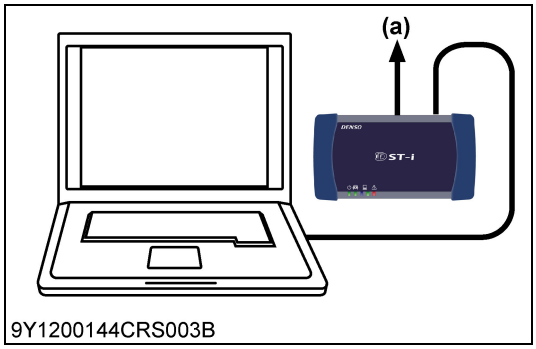
7. Check the Camshaft Position Sensor

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

OK	Go to "8. Check the Data Related to Pressure Control".
NG	Repair and replacement of camshaft position sensor-related parts.

(1) Camshaft Position Sensor
(G Sensor)

9Y1200209CRS0455US0



9Y1200144CRS003B

8. Check the Data Related to Pressure Control

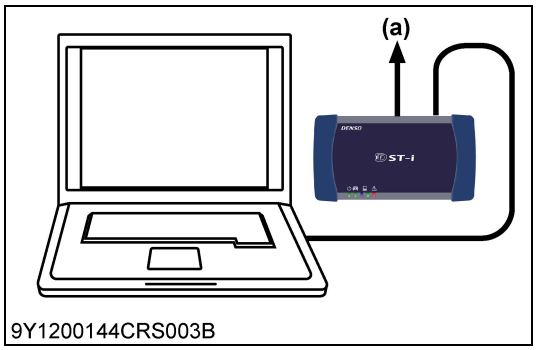
1. Measure the "Target rail pressure" and "Actual rail pressure" when accelerator is operated as indicated below using the diagnosis tool data monitor function.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure".

OK	Go to "9. Check the Injector (Including the Pipes, etc.)"
NG	**(Check the trouble related to pressure)** Refer to the pressure system items (P0087, P0088, P0089 and P0093 (Refer to page 1-S119)) and SCV abnormality items (P0628 and P0629 (Refer to 1-S191)) in "5.[2] DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts. ■ **NOTE** • **Some diagnosis items above may be mentioned twice.**

(a) CAN1 Connector

9Y1200209CRS0456US0



9Y1200144CRS003B

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

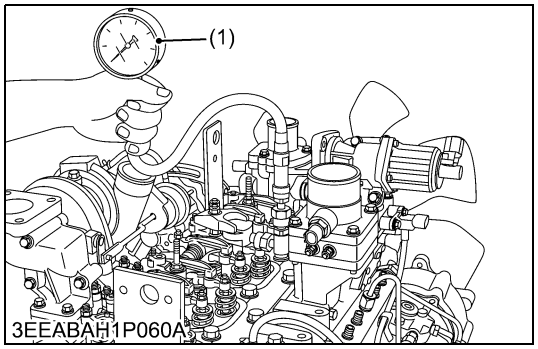
1. Perform the diagnosis tool active test (stopping the injector injection by cylinder) and check the injector performance.

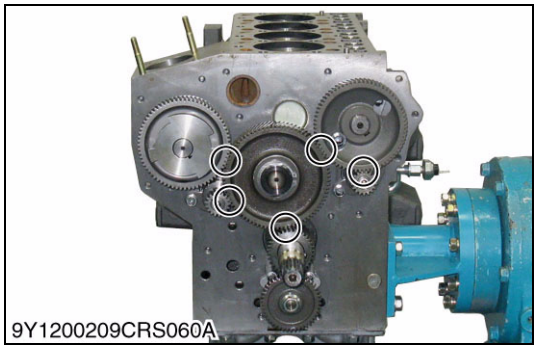
Factory specification	Engine vibration and noise are increased and the rotation rate is reduced when the injection for the corresponding cylinder is stopped. The same results must be attained from all the cylinders.

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

9Y1200209CRS0457US0





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

9Y1200209CRS0458US0

(4) Idle Failure

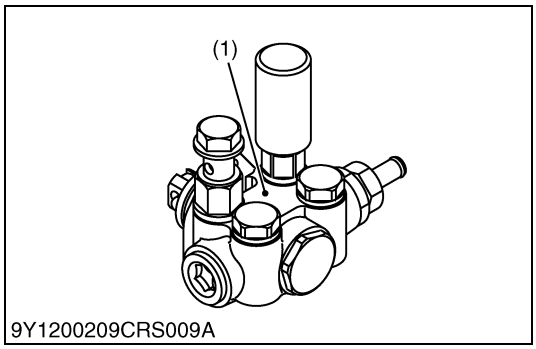
Possible causes:

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 operation fault
4. Fuel system
   - 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.)

9Y1200209CRS0459US0



9Y1200209CRS009A

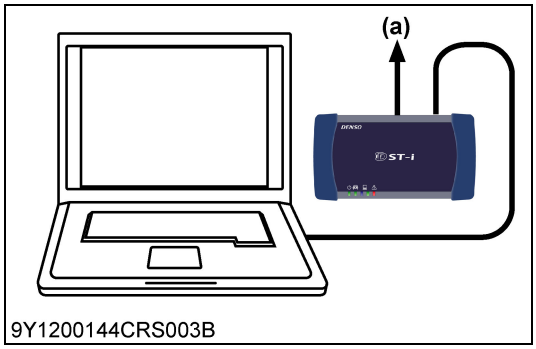
1. Check the Fuel Feed Pump Operation

1. Check the fuel feed pump is operating.

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-S274)

(1) Fuel Feed Pump

9Y1200209CRS0439US0



9Y1200144CRS003B

2. Check the DTC

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

Factory specification	No DTC is output.

DTC presently existing

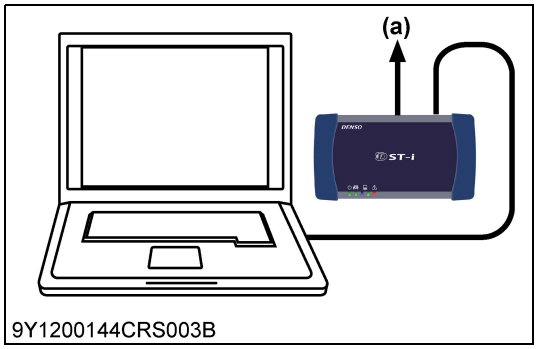
OK	Go to "3. Check the Injector (Including the Pipes, etc.)".
NG	Check in accordance with the troubleshooting procedures for each DTC.

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

9Y1200209CRS0461US0



9Y1200144CRS003B

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

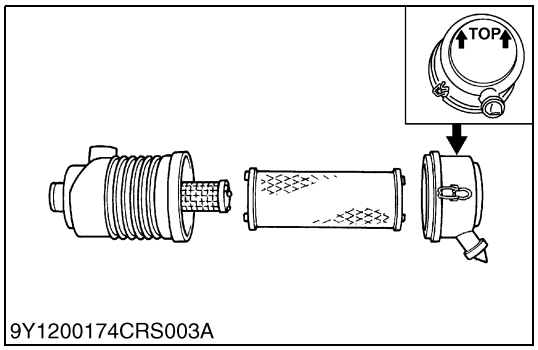
1. Perform the diagnosis tool active test (stopping the injector injection by cylinder) and check the injector performance.

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

9Y1200209CRS0462US0



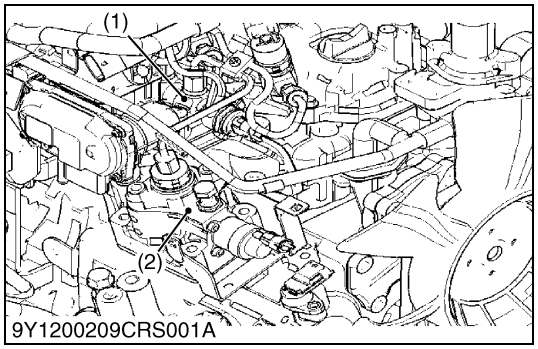
9Y1200174CRS003A

4. Check the Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270)

OK	Go to "5. Check the Fuel System".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270)

9Y1200209CRS0442US0



9Y1200209CRS001A

5. Check the Fuel System

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271)

OK	Go to "6. Check the Accelerator Position Sensor.
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271)

(1) Rail (2) Supply Pump

9Y1200209CRS0464US0

6. Check the Accelerator Position Sensor

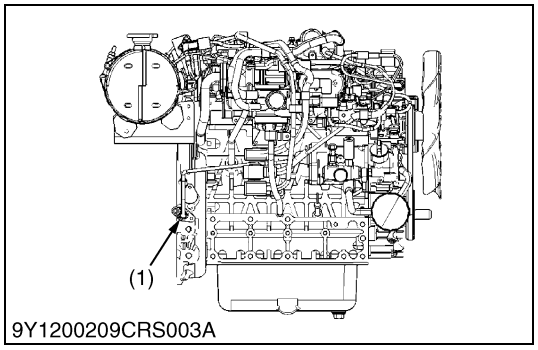
CAUTION

- **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.

9Y1200209CRS0465US0



9Y1200209CRS003A

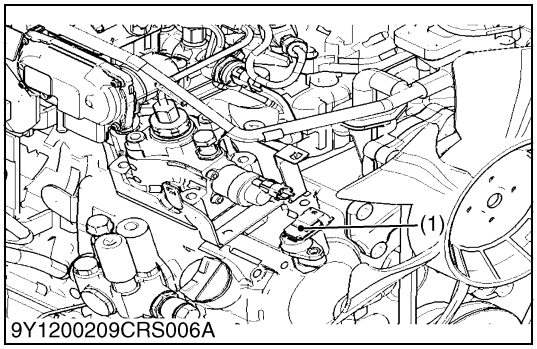
7. Check the Crankshaft Position Sensor

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)

9Y1200209CRS0466US0



9Y1200209CRS006A

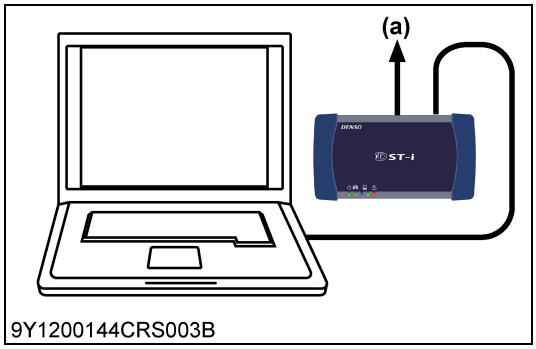
8. Check the Camshaft Position Sensor

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

OK	Go to "9. Check the Data Related to Pressure Control".
NG	Repair and replacement of camshaft position sensor-related parts.

(1) Camshaft Position Sensor
(G Sensor)

9Y1200209CRS0467US0



9Y1200144CRS003B

9. Check the Data Related to Pressure Control

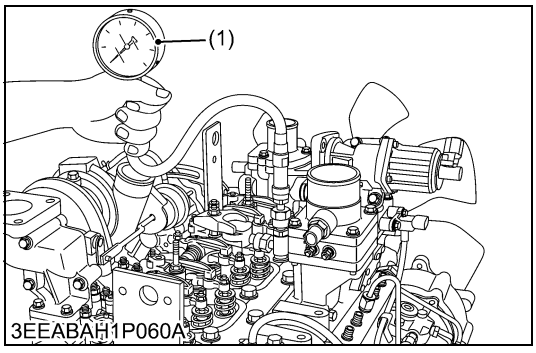
1. Measure the "Target rail pressure" and "Actual rail pressure" when accelerator is operated as indicated below using the diagnosis tool data monitor function.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure".

OK	Go to "10. Check the Engine"
NG	**(Check the trouble related to pressure** Refer to the pressure system items (P0087, P0088, P0089 and P0093 (Refer to page 1-S119)) and SCV abnormality items (P0628 and P0629 (Refer to 1-S191)) in "5.[2] DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts. ■ **NOTE** • **Some diagnosis items above may be mentioned twice.**

(a) CAN1 Connector

9Y1200209CRS0468US0



3EEABAH1P060A

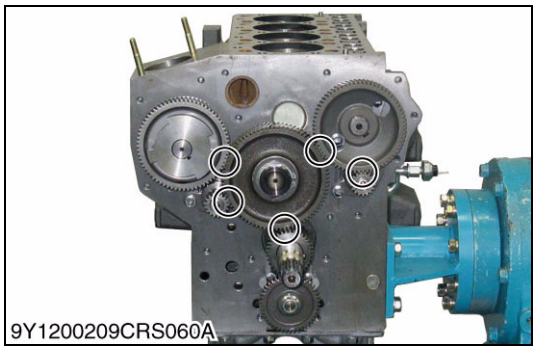
10. Check the Engine

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

OK	Normal.
NG	Repair the malfunction.

(1) Compression Tester

9Y1200209CRS0458US0


9Y1200209CRS060A

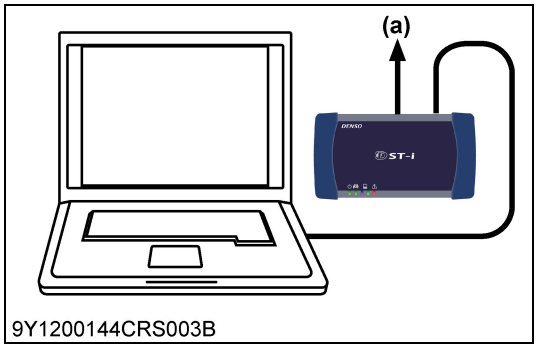
(5) Engine Noise

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 operation fault
3. Intake system
   - Leak from the intake system parts
4. Fuel system
   - 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)

9Y1200209CRS0470US0



9Y1200144CRS003B

1. Check the DTC

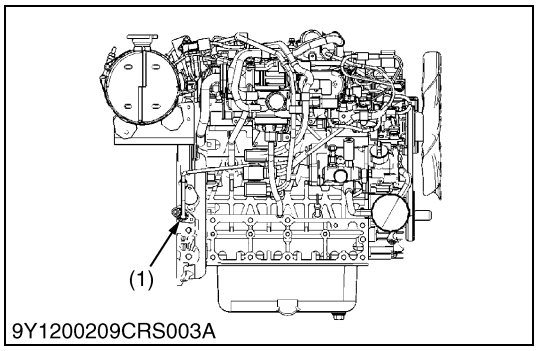
1. Turn the key switch ON and check the DTC.

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

9Y1200209CRS0471US0



9Y1200209CRS003A

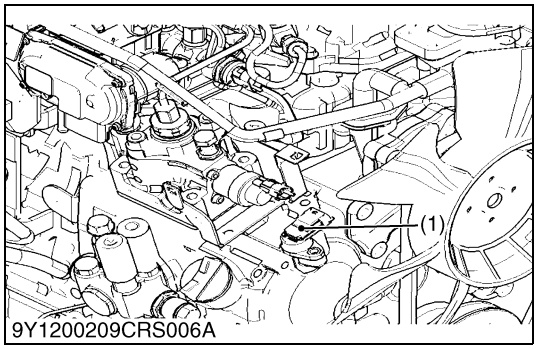
2. Check the Crankshaft Position Sensor

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)

9Y1200209CRS0472US0



9Y1200209CRS006A

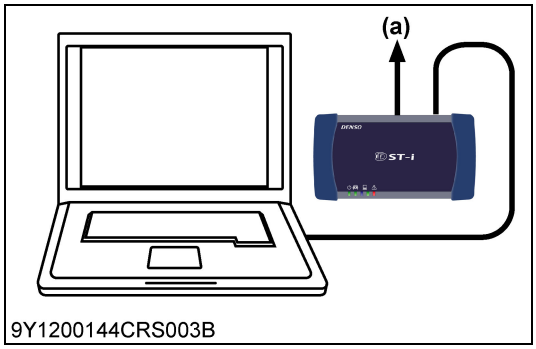
3. Check the Camshaft Position Sensor

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)

9Y1200209CRS0473US0



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

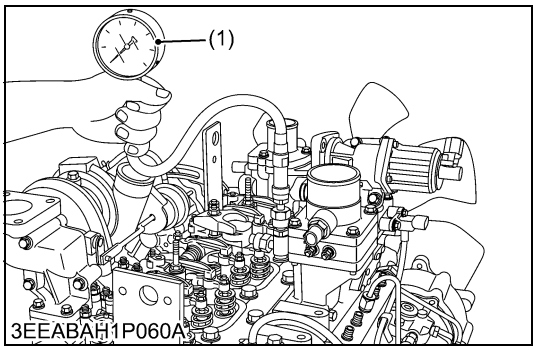
1. Perform the diagnosis tool active test (stopping the injector injection by cylinder) and check the injector performance.

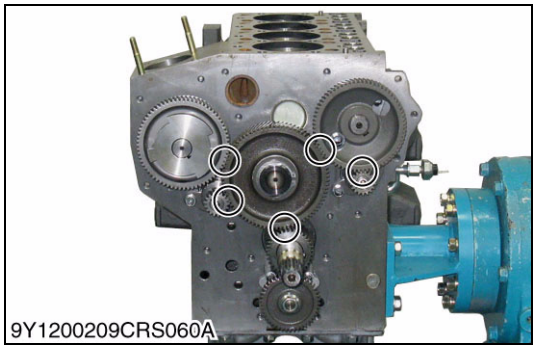
Factory specification	1. Engine vibration and noise are increased and the rotation speed is reduced when the injection for the corresponding cylinder is stopped. 2. The same results must be attained from all the cylinders.

OK	Go to "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

9Y1200209CRS0474US0





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

9Y1200209CRS0475US0

(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

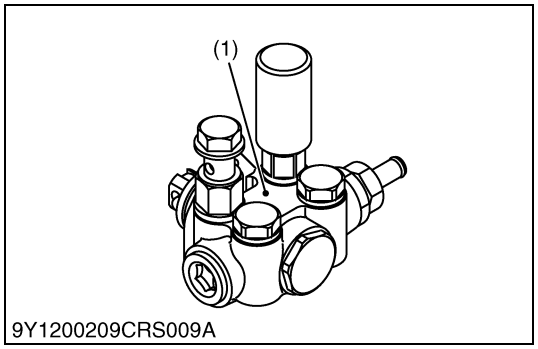
Reduced engine performance is not detected but the fuel consumption is higher.

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 operation fault
6. Intake system
   - Air cleaner clogging
   - Leak from the intake system parts
   - Turbocharger operation fault
7. Fuel system
   - 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

9Y1200209CRS0476US0



9Y1200209CRS009A

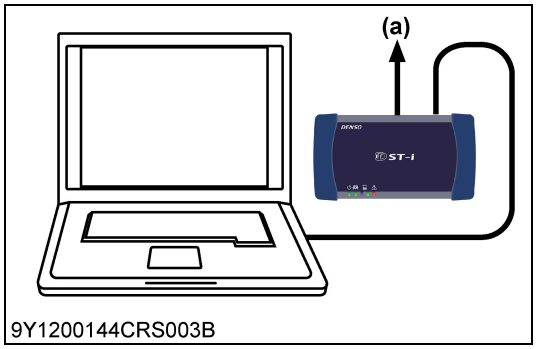
1. Check the Fuel Feed Pump Operation

1. Check the fuel feed pump is operating.

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-S274)

(1) Fuel Feed Pump

9Y1200209CRS0439US0



9Y1200144CRS003B

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

9Y1200209CRS0478US0

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".

9Y1200209CRS0479US0

4. Check the Engine and Machine Condition

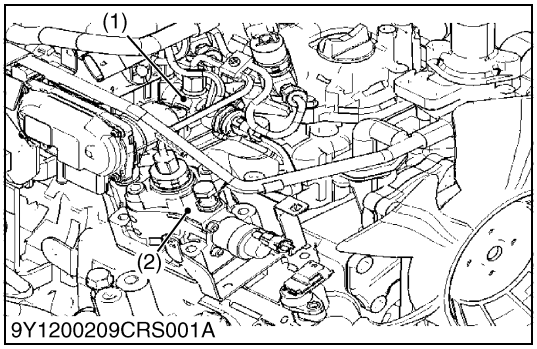
1. Check for the usage habits of the user or use of non-standard parts.
   - Use of non-standard parts such as tires, wheels and intake / exhaust system parts
   - Used under poor fuel consumption conditions
     – Engine used for a long time under a high load
     – Long idling time
   - Faulty maintenance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

9Y1200209CRS0480US0



9Y1200209CRS001A

5. Check the Fuel System

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271)

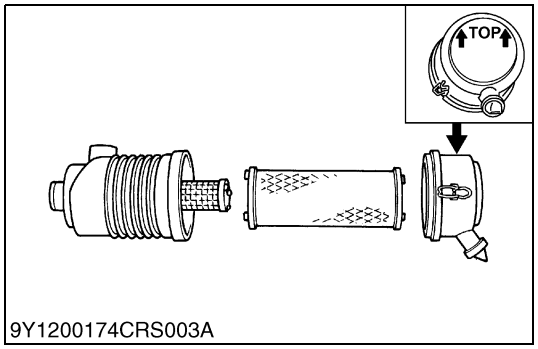
(Reference)

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

9Y1200209CRS0481US0



9Y1200174CRS003A

6. Check the Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270)

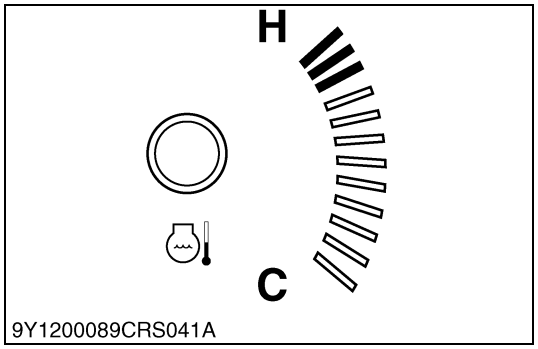
(Reference)

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.

9Y1200209CRS0482US0



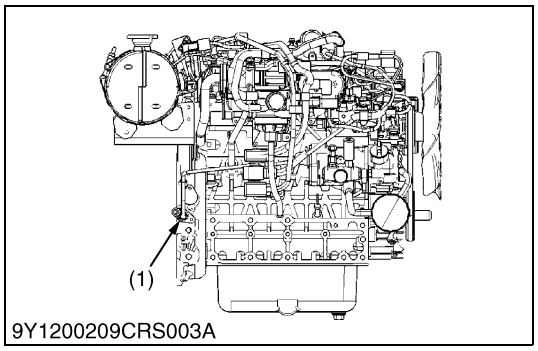
9Y1200089CRS041A

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.

9Y1200209CRS0483US0



9Y1200209CRS003A

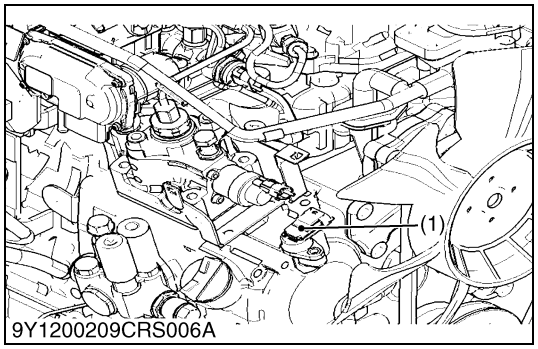
8. Check the Crankshaft Position Sensor

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)

9Y1200209CRS0484US0



9Y1200209CRS006A

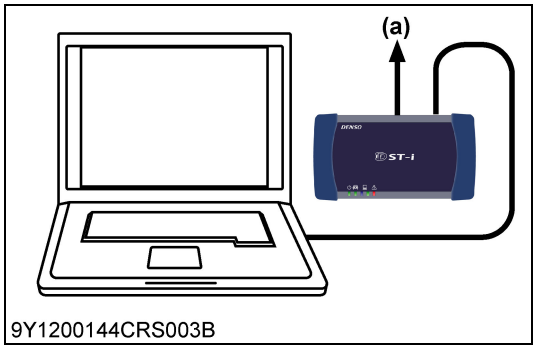
9. Check the Camshaft Position Sensor

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

OK	Go to "10. Check the Data Related to Pressure Control".
NG	Repair and replacement of camshaft position sensor-related parts.

(1) Camshaft Position Sensor (G Sensor)

9Y1200209CRS0485US0



9Y1200144CRS003B

10. Check the Data Related to Pressure Control

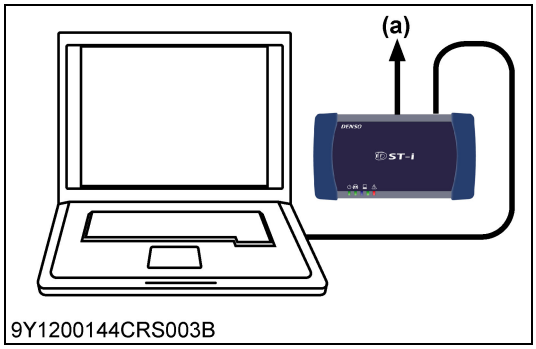
1. Measure the "Target rail pressure" and "Actual rail pressure" when accelerator is operated as indicated below using the diagnosis tool data monitor function.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure".

OK	Go to "11. Check the Injector (Including the Pipes, etc.)"
NG	**(Check the trouble related to pressure** Refer to the pressure system items (P0087, P0088, P0089 and P0093 (Refer to page 1-S119)) and SCV abnormality items (P0628 and P0629 (Refer to 1-S191)) in "5.[2] DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts. ■ **NOTE** • **Some diagnosis items above may be mentioned twice.**

(a) CAN1 Connector

9Y1200209CRS0486US0



9Y1200144CRS003B

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

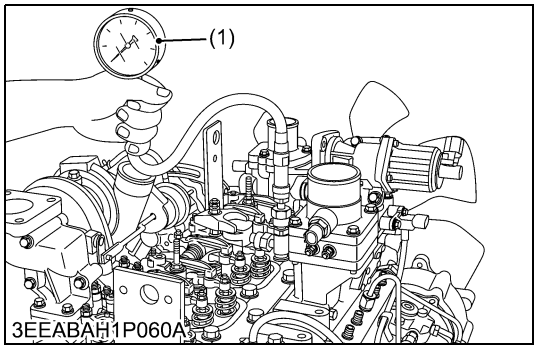
1. Perform the diagnosis tool active test (stopping the injector injection by cylinder) and check the injector performance.

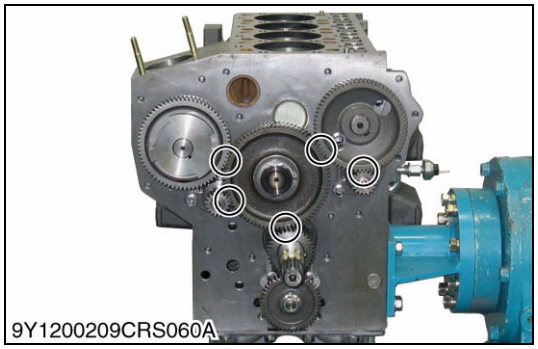
Factory specification	Engine vibration and noise are increased and the rotation speed is reduced when the injection for the corresponding cylinder is stopped. The same results must be attained from all the cylinders.

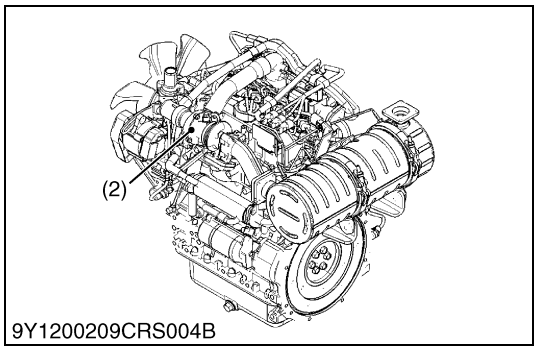
OK	Go to "12. Check the Engine".
NG	Check and repair faulty parts including the high pressure line of the defective cylinder.

(a) CAN1 Connector

9Y1200209CRS0487US0







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

9Y1200209CRS0488US0

(7) Poor Acceleration (Insufficient Output)

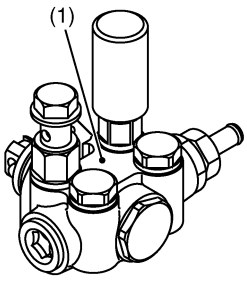
Possible causes:

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 operation fault
5. Intake system
   - Air cleaner clogging
   - Leak from the intake system parts
   - Turbocharger operation fault
6. Fuel system
   - 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

9Y1200209CRS0489US0



9Y1200209CRS009A

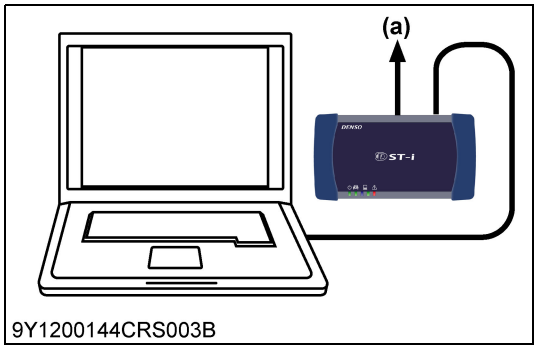
1. Check the Fuel Feed Pump Operation

1. Check the fuel feed pump is operating.

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-S274)

(1) Fuel Feed Pump

9Y1200209CRS0439US0



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 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

9Y1200209CRS0491US0

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.

9Y1200209CRS0492US0

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-S28)

9Y1200209CRS0493US0

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)** • 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".

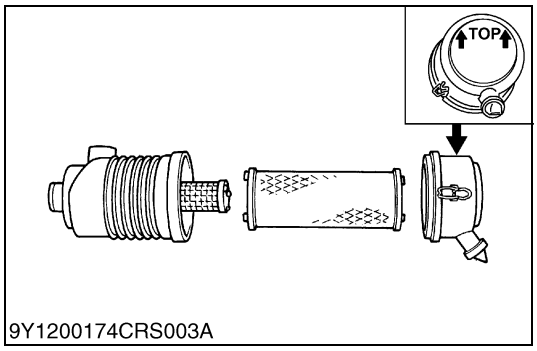
9Y1200209CRS0494US0

6. Malfunction Verification - 2

1. 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.

9Y1200209CRS0495US0



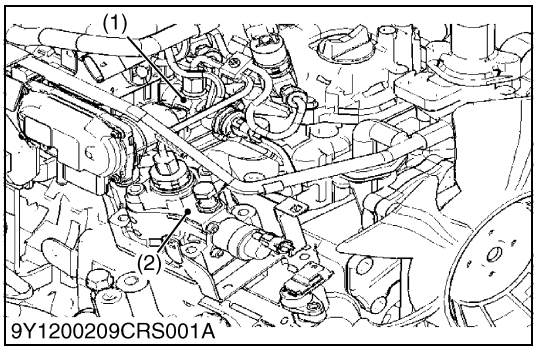
9Y1200174CRS003A

7. Check the Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270)

OK	Go to "8. Check the Fuel System".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270)

9Y1200209CRS0496US0



9Y1200209CRS001A

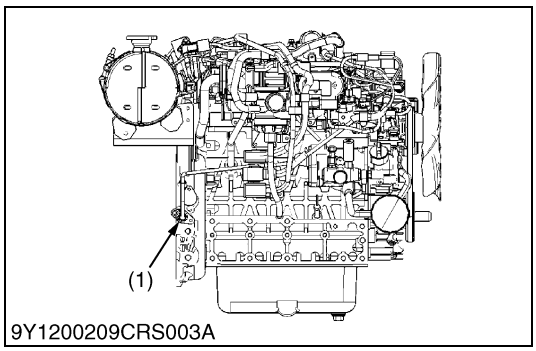
8. Check the Fuel System

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271)

OK	Go to "9. Check the Crankshaft Position Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271)

(1) Rail (2) Supply Pump

9Y1200209CRS0497US0



9Y1200209CRS003A

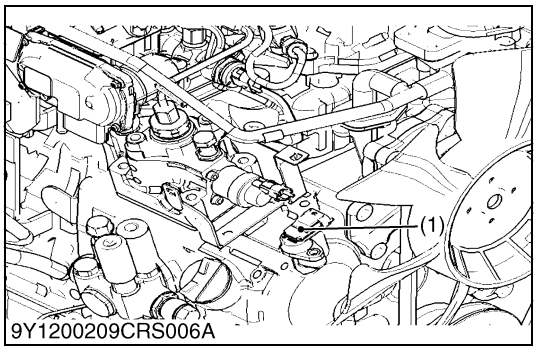
9. Check the Crankshaft Position Sensor

1. 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)

9Y1200209CRS0498US0



9Y1200209CRS006A

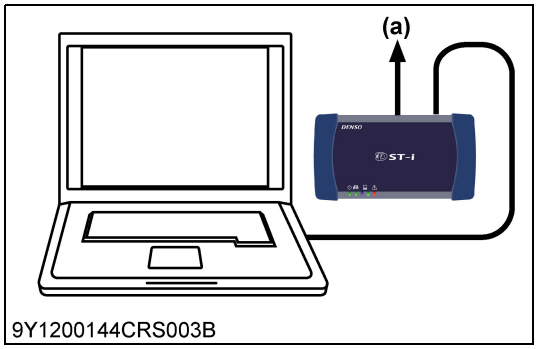
10. Check the Camshaft Position Sensor

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

OK	Go to "11. Check the Data Related to Pressure Control".
NG	Repair and replacement of camshaft position sensor-related parts.

(1) Camshaft Position Sensor (G Sensor)

9Y1200209CRS0499US0



11. Check the Data Related to Pressure Control

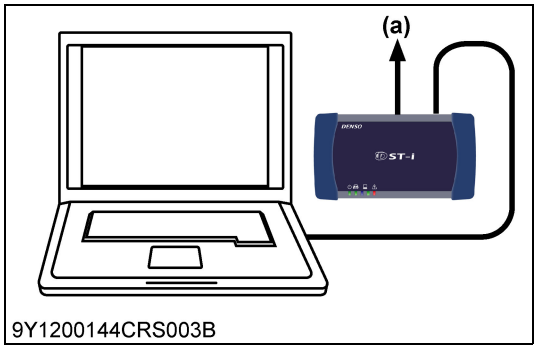
1. Measure the "Target rail pressure" and "Actual rail pressure" when accelerator is operated as indicated below using the diagnosis tool data monitor function.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure".

OK	Go to "12. Check the Injector (Including the Pipes, etc.)"
NG	**(Check the trouble related to pressure** Refer to the pressure system items (P0087, P0088, P0089 and P0093 (Refer to page 1-S119)) and SCV abnormality items (P0628 and P0629 (Refer to 1-S191)) in "5.[2] DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts. ■ **NOTE** • **Some diagnosis items above may be mentioned twice.**

(a) CAN1 Connector

9Y1200209CRS0500US0



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

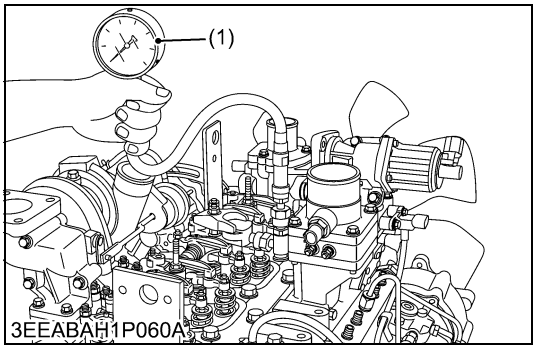
1. Perform the diagnosis tool active test (stopping the injector injection by cylinder) and check the injector performance.

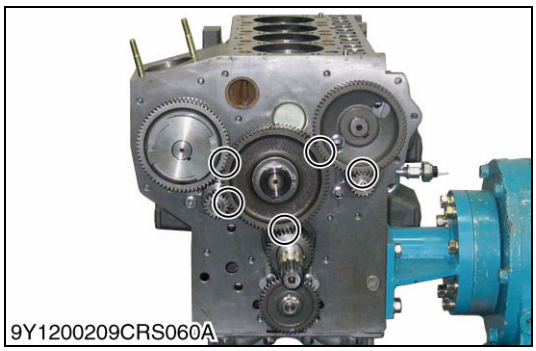
Factory specification	1. Engine vibration and noise are increased and the rotation speed is reduced when the injection for the corresponding cylinder is stopped. 2. The same results must be attained from all the cylinders.

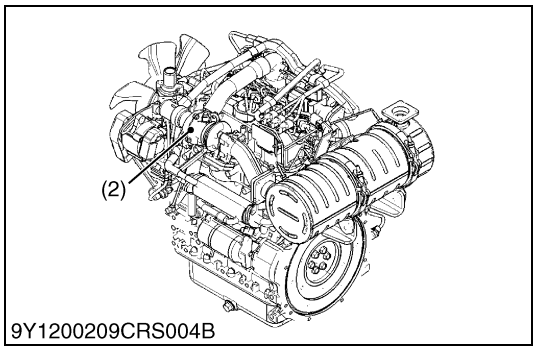
OK	Go to "13. Check the Engine"
NG	Check and repair faulty parts including the high pressure line of the defective cylinder.

(a) CAN1 Connector

9Y1200209CRS0501US0







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

9Y1200209CRS0502US0

(8) Abnormal Black Smoke Emitted

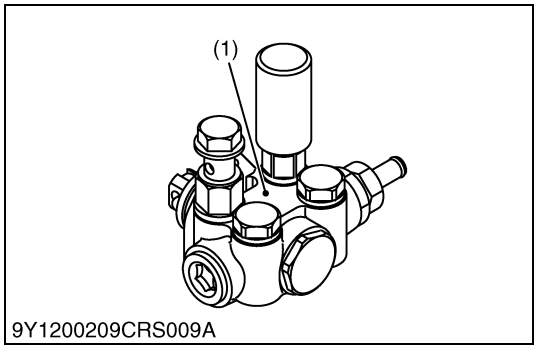
Possible causes:

1. Fuel feed pump operation fault.

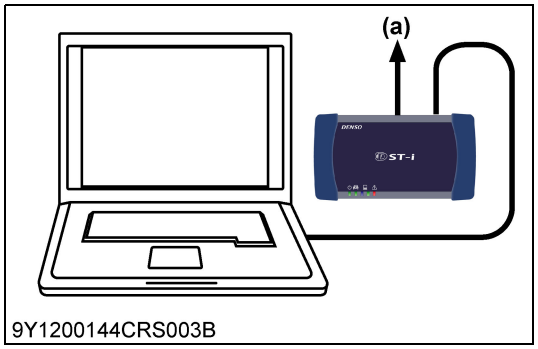
***Refer to the previous "List of malfunction causes by symptom" for the subsequent details.**

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 operation fault
   - EGR valve fault
4. Intake system
   - Air cleaner clogging
   - Leak from the intake system parts
   - Turbocharger operation fault
5. Fuel system
   - 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

9Y1200209CRS0503US0



9Y1200209CRS009A



9Y1200144CRS003B

1. Check the Fuel Feed Pump Operation

1. Check the fuel feed pump is operating.

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-S274)

(1) Fuel Feed Pump

9Y1200209CRS0439US0

2. Check the DTC

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

Factory specification	No DTC is output.

DTC presently existing

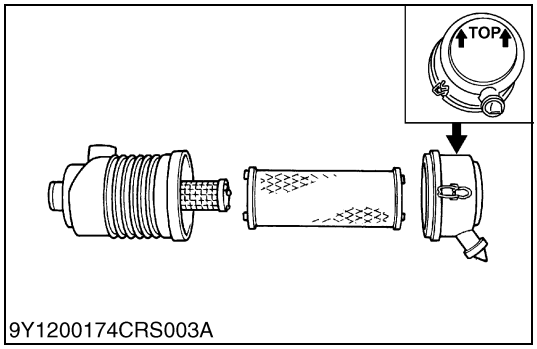
OK	Go to "3. Check the Intake System".
NG	Check in accordance with the troubleshooting procedures for each DTC.

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

9Y1200209CRS0505US0



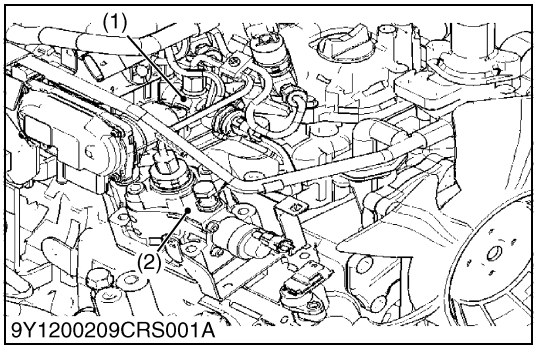
9Y1200174CRS003A

3. Check the Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270)

OK	Go to "4. Check the Fuel System".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270)

9Y1200209CRS0506US0



9Y1200209CRS001A

4. Check the Fuel System

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271)

OK	Go to "5. Check the Accelerator Position Sensor.
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271)

(1) Rail (2) Supply Pump

9Y1200209CRS0507US0

5. Check the Accelerator Position Sensor

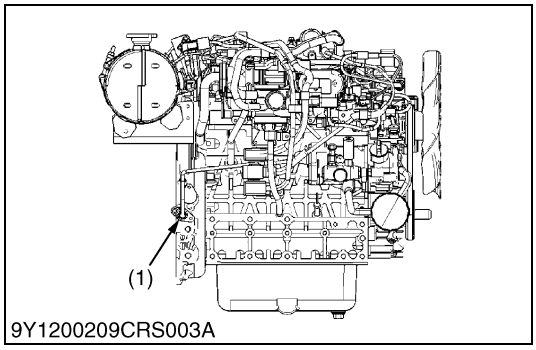
CAUTION

- **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.

9Y1200209CRS0508US0



9Y1200209CRS003A

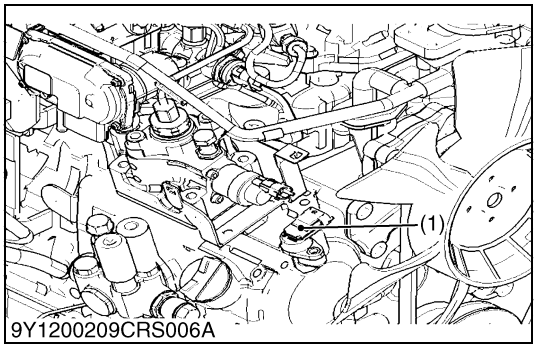
6. Check the Crankshaft Position Sensor

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)

9Y1200209CRS0454US0



9Y1200209CRS006A

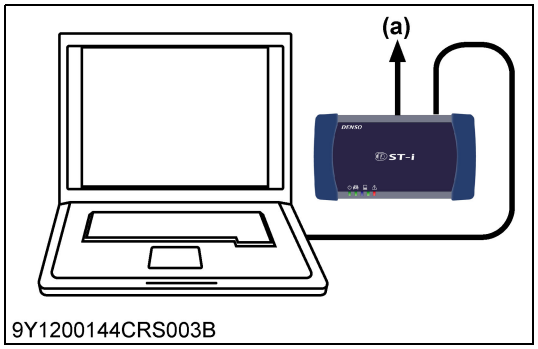
7. Check the Camshaft Position Sensor

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)

9Y1200209CRS0510US0



9Y1200144CRS003B

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-S112)

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.[4].(2) Normal Value". (Refer to page 1-M7) In addition, for the check procedures refer to "5.[2] DIAGNOSTIC PROCEDURE BY DTC". (Refer to page 1-S112)

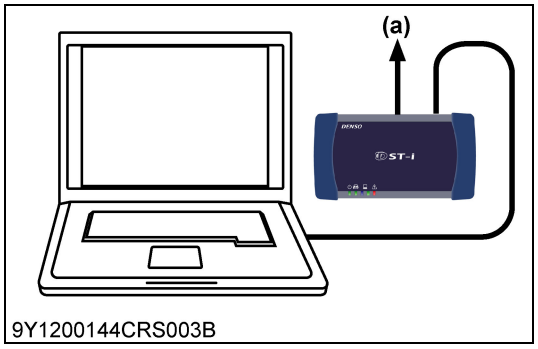
2. Perform an active test (EGR actuation test).

Factory specification	There is no difference between the target opening and actual opening.

OK	Go to "9. Check the Data Related to Pressure Control".
NG	Replace the EGR valve.

(a) CAN1 Connector

9Y1200209CRS0511US0



9Y1200144CRS003B

9. Check the Data Related to Pressure Control

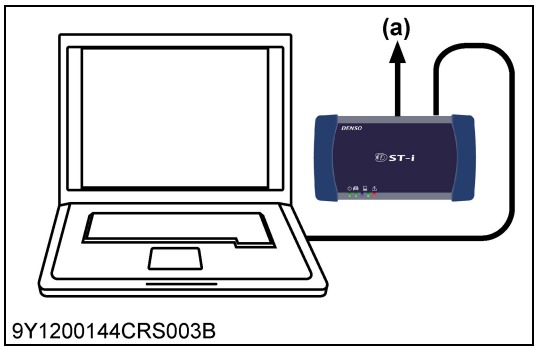
1. Measure the "Target rail pressure" and "Actual rail pressure" when accelerator is operated as indicated below using the diagnosis tool data monitor function.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure".

OK	Go to "10. Check the Injector (Including the Pipes, etc.)".
NG	**(Check the trouble related to pressure** Refer to the pressure system items (P0087, P0088, P0089 and P0093 (Refer to page 1-S119)) and SCV abnormality items (P0628 and P0629 (Refer to 1-S191)) in "5.[2] DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts. ■ **NOTE** • **Some diagnosis items above may be mentioned twice.**

(a) CAN1 Connector

9Y1200209CRS0512US0



9Y1200144CRS003B

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

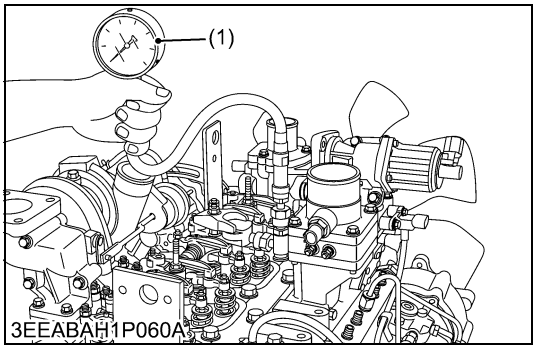
1. Perform the diagnosis tool active test (stopping the injector injection by cylinder) and check the injector performance.

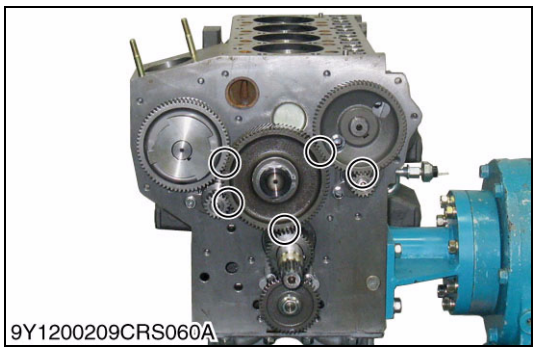
Factory specification	1. Engine vibration and noise are increased and the rotation speed is reduced when the injection for the corresponding cylinder is stopped. 2. The same results must be attained from all the cylinders.

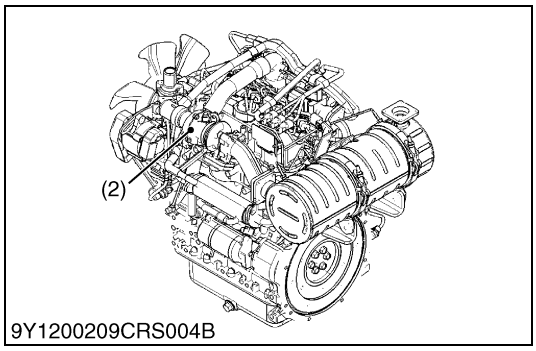
OK	Go to "11. Check the Engine".
NG	Check and repair faulty parts including the high pressure line of the defective cylinder.

(a) CAN1 Connector

9Y1200209CRS0513US0







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

9Y1200209CRS0514US0

(9) Abnormal White Smoke Emitted

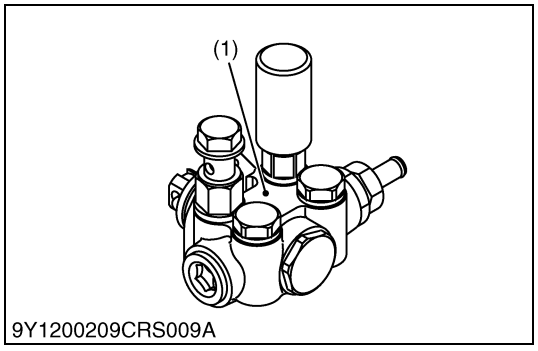
Possible causes:

1. Fuel feed pump operation fault.
2. Starting assist device fault (air heater and glow (air heater) relay do not operate)

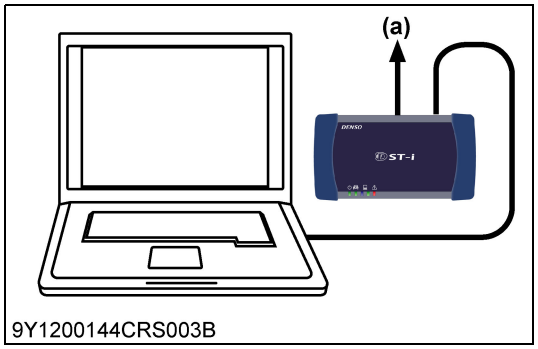
***Refer to the previous "List of malfunction causes by symptom" for the subsequent details.**

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 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
   - 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

9Y1200209CRS0515US0



9Y1200209CRS009A



9Y1200144CRS003B

1. Check the Fuel Feed Pump Operation

1. Check the fuel feed pump is operating.

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-S274)

(1) Fuel Feed Pump

9Y1200209CRS0439US0

2. Check the DTC

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

Factory specification	No DTC is output.

DTC presently existing

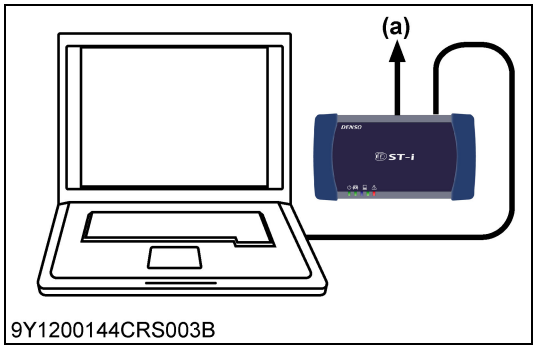
OK	Go to "3. Check the Starting Assist Device".
NG	Check in accordance with the troubleshooting procedures for each DTC.

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

9Y1200209CRS0450US0



9Y1200144CRS003B

3. Check the Starting Assist Device

1. Refer to the workshop manual for the machine and check the the glow plug, 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 (glow plug).

(a) CAN1 Connector

9Y1200209CRS0518US0

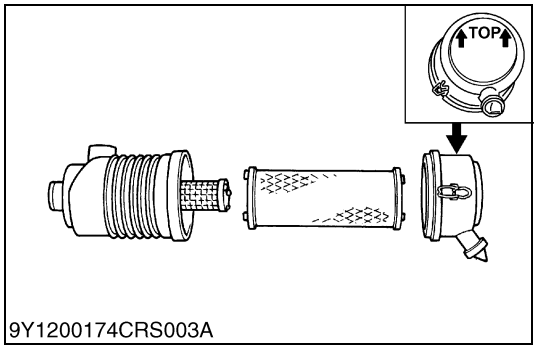
4. Check the Idle Condition

1. Check if idling is normal.

Factory specification	Stable at specified speed.

OK	Go to "5. Check the Intake System".
NG	Refer to "(4) Idle Failure", and implement checking and repair.(Refer to page 1-S28)

9Y1200209CRS0519US0



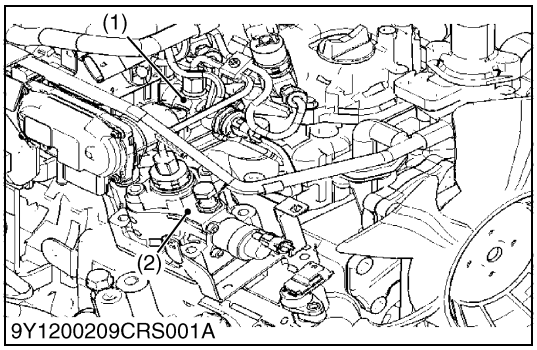
9Y1200174CRS003A

5. Check the Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270)

OK	Go to "6. Check the Fuel System".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270)

9Y1200209CRS0520US0



9Y1200209CRS001A

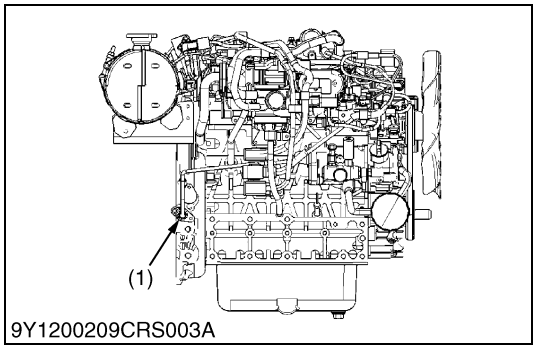
6. Check the Fuel System

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271)

OK	Go to "7. Check the Crankshaft Position Sensor".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271)

(1) Rail (2) Supply Pump

9Y1200209CRS0521US0



9Y1200209CRS003A

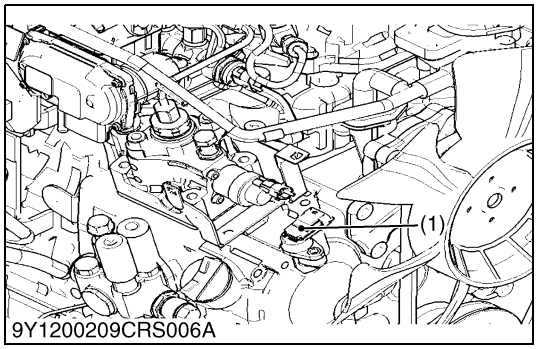
7. Check the Crankshaft Position Sensor

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)

9Y1200209CRS0466US0



9Y1200209CRS006A

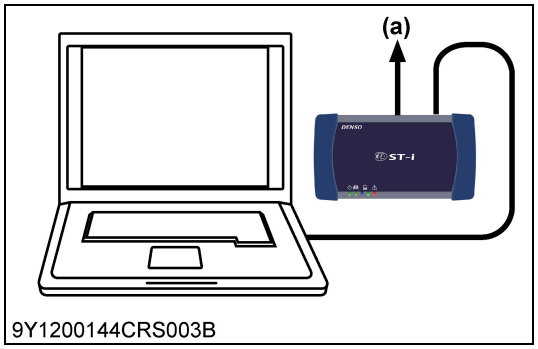
8. Check the Camshaft Position Sensor

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)

9Y1200209CRS0523US0



9Y1200144CRS003B

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-S112)

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.[4].(2) Normal Value". (Refer to page 1-M7) In addition, for the check procedures refer to "5.[2] DIAGNOSTIC PROCEDURE BY DTC". (Refer to page 1-S112)

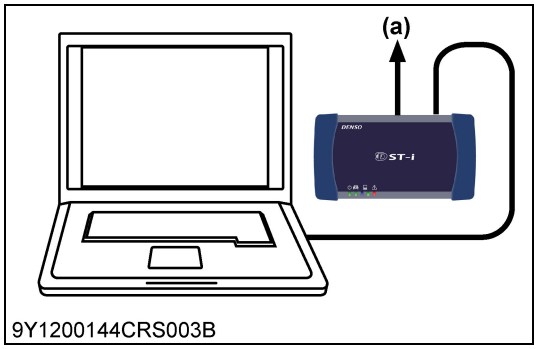
2. Perform an active test (EGR actuation test).

Factory specification	There is no difference between the target opening and actual opening.

OK	Go to "10. Check the Data Related to Pressure Control".
NG	Replace the EGR valve.

(a) CAN1 Connector

9Y1200209CRS0524US0



9Y1200144CRS003B

10. Check the Data Related to Pressure Control

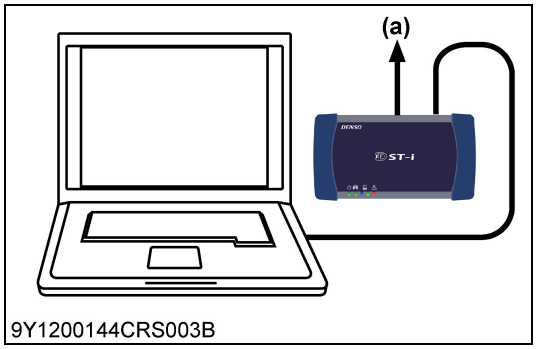
1. Measure the "Target rail pressure" and "Actual rail pressure" when accelerator is operated as indicated below using the diagnosis tool data monitor function.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure".

OK	Go to "11. Check the Injector (Including the Pipes, etc.)"
NG	**(Check the trouble related to pressure** Refer to the pressure system items (P0087, P0088, P0089 and P0093 (Refer to page 1-S119)) and SCV abnormality items (P0628 and P0629 (Refer to 1-S191)) in "5.[2] DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts. ■ **NOTE** • **Some diagnosis items above may be mentioned twice.**

(a) CAN1 Connector

9Y1200209CRS0486US0



9Y1200144CRS003B

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

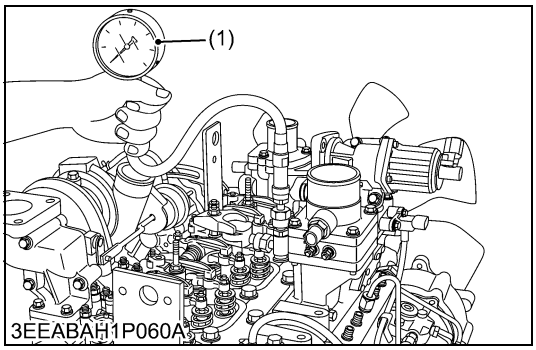
1. Perform the diagnosis tool active test (stopping the injector injection by cylinder) and check the injector performance.

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

9Y1200209CRS0487US0

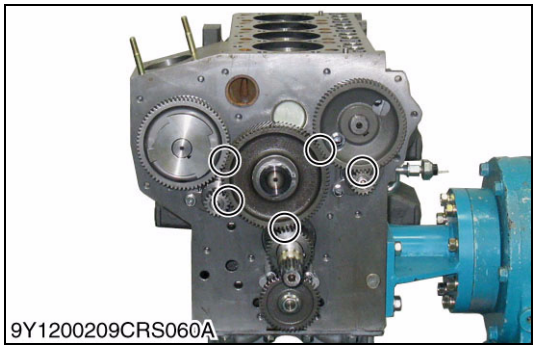


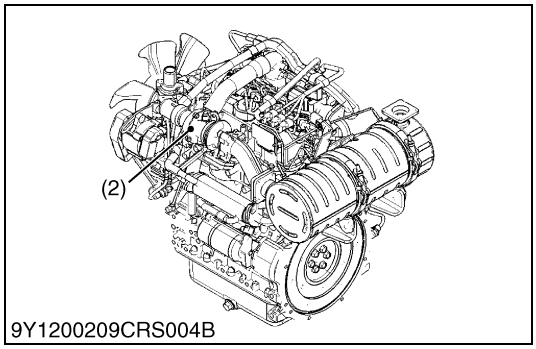
3EEABAH1P060A

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.


9Y1200209CRS060A



9Y1200209CRS004B

(1) Compression Tester (2) Turbocharger

9Y1200209CRS0527US0

(10) Engine Stalls On Deceleration

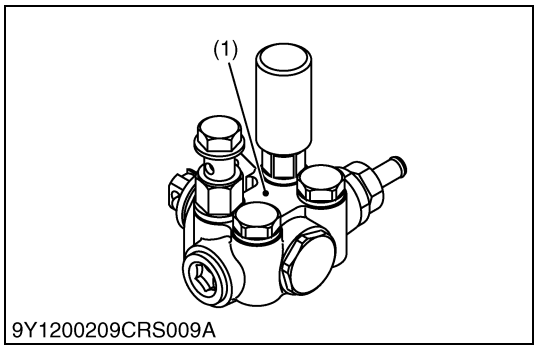
Possible causes:

1. Fuel feed pump operation fault.

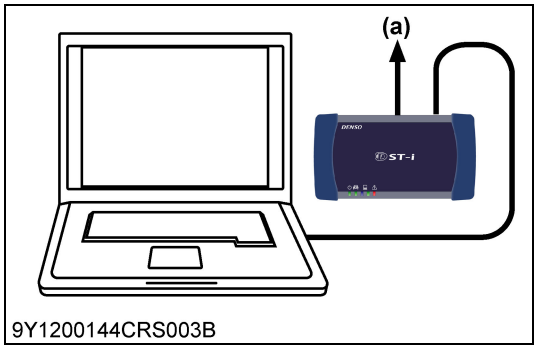
***Refer to the previous "List of malfunction causes by symptom" for the subsequent details.**

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 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

9Y1200209CRS0528US0



9Y1200209CRS009A



9Y1200144CRS003B

1. Check the Fuel Feed Pump Operation

1. Check the fuel feed pump is operating.

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-S274)

(1) Fuel Feed Pump

9Y1200209CRS0439US0

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

9Y1200209CRS0530US0

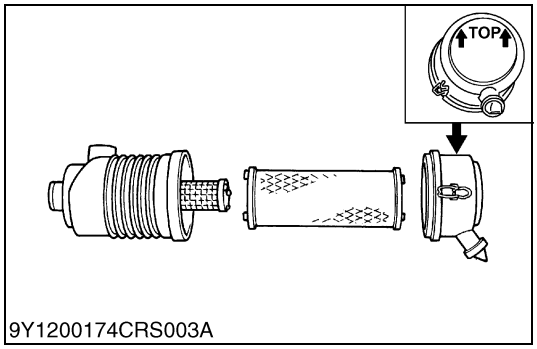
3. Check the Idle Condition

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-S28)

9Y1200209CRS0531US0



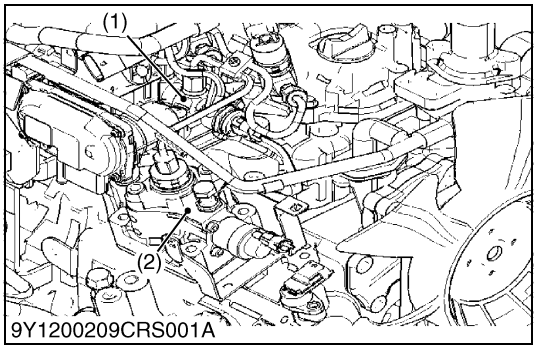
9Y1200174CRS003A

4. Check the Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270)

OK	Go to "5. Check the Fuel System".
NG	Repair in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270)

9Y1200209CRS0442US0



9Y1200209CRS001A

5. Check the Fuel System

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271)

OK	Go to "6. Check the Accelerator Position Sensor.
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271)

(1) Rail (2) Supply Pump

9Y1200209CRS0464US0

6. Check the Accelerator Position Sensor

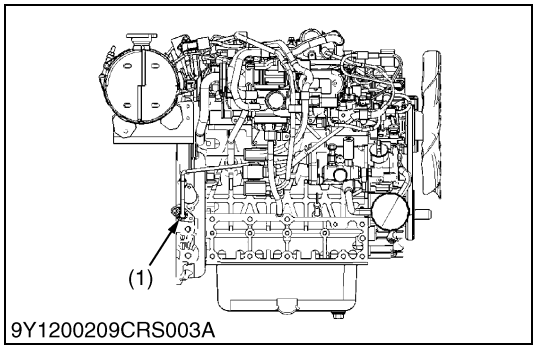
CAUTION

- **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.

9Y1200209CRS0465US0



9Y1200209CRS003A

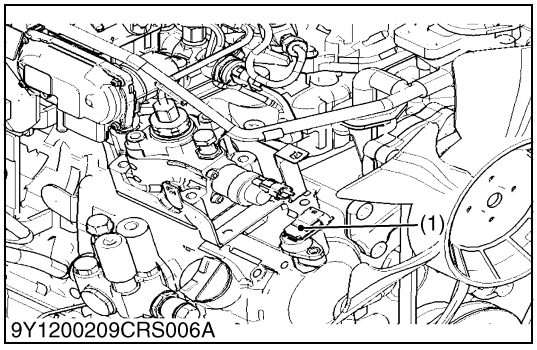
7. Check the Crankshaft Position Sensor

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)

9Y1200209CRS0466US0



9Y1200209CRS006A

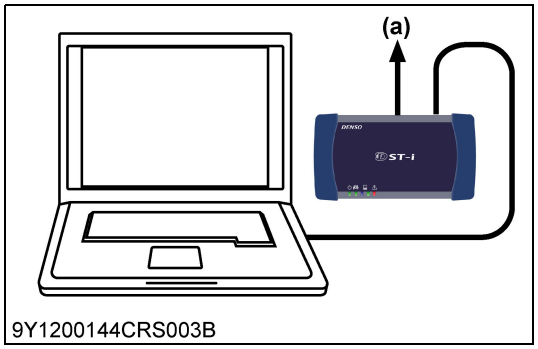
8. Check the Camshaft Position Sensor

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

OK	Go to "9. Check the Data Related to Pressure Control".
NG	Repair and replacement of camshaft position sensor-related parts.

(1) Camshaft Position Sensor (G Sensor)

9Y1200209CRS0467US0



9. Check the Data Related to Pressure Control

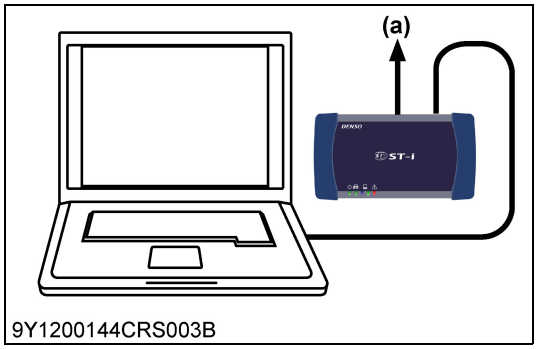
1. Measure the "Target rail pressure" and "Actual rail pressure" when accelerator is operated as indicated below using the diagnosis tool data monitor function.

Factory specification	The "Actual rail pressure" always follow to the "Target rail pressure".

OK	Go to "10. Check the Injector (Including the Pipes, etc.)".
NG	**(Check the trouble related to pressure** Refer to the pressure system items (P0087, P0088, P0089 and P0093 (Refer to page 1-S119)) and SCV abnormality items (P0628 and P0629 (Refer to 1-S191)) in "5.[2] DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts. ■ **NOTE** • **Some diagnosis items above may be mentioned twice.**

(a) CAN1 Connector

9Y1200209CRS0512US0



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

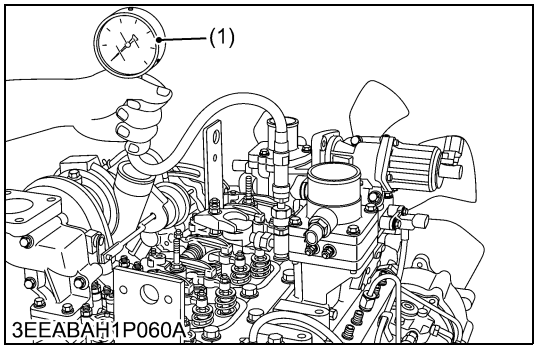
1. Perform the diagnosis tool active test (stopping the injector injection by cylinder) and check the injector performance.

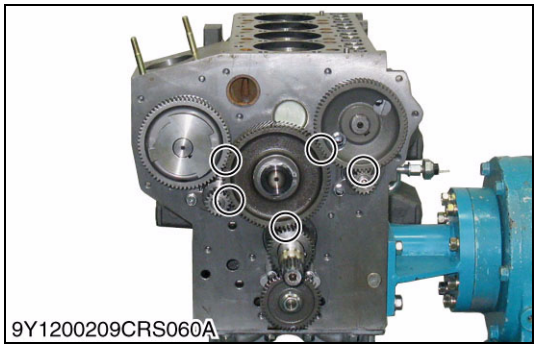
Factory specification	1. Engine vibration and noise are increased and the rotation speed is reduced when the injection for the corresponding cylinder is stopped. 2. The same results must be attained from all the cylinders.

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

9Y1200209CRS0513US0





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

9Y1200209CRS0539US0

5. DIAGNOSTIC PROCEDURE BY DTC

[1] DTC LIST

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
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 +30 and -20 degree
Time to action or number of error detection		• 2 times or more
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		(Invalid G signal) • Engine hesitates at start-up
Engine Warning Light		• ON
Recovery from error		• Diagnostic counter =zero
Delay time for recovery		• 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		• NE: Crankshaft position sensor • G: Camshaft position sensor

9Y1200209CRS0001US0

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
Detection item		• Ground short circuit of sensor / harness	• Open circuit or +B short circuit of sensor / harness.
DTC Set Preconditions		• Battery voltage is normal	• Battery voltage is normal
DTC set parameter		• Intake air temperature built-in MAF sensor voltage: 0.2 V or less	• Intake air temperature built-in MAF sensor voltage: 4.85 V or more
Time to action or number of error detection		• 3.0 sec. or more	• 3 sec. or more
Limp Home Action by engine ECU (system action)		• 25 °C (77 °F) [default value]	• 25 °C (77 °F) [default value]
Behaviour During Malfunction		• None	• None
Engine Warning Light		• ON	• ON
Recovery from error		• Diagnostic counter = zero	• Diagnostic counter = zero
Delay time for recovery		• Immediately	• Immediately
Remark			

9Y1200209CRS0002US0

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
Detection item		• Pressure limiter emergency open
DTC Set Preconditions		• Rail pressure sensor is normal • Sensor supply voltage VCC# is normal
DTC set parameter		• Pressure limiter emergency open • Engine speed is more than 700 min^{-1} (rpm)
Time to action or number of error detection		• 1 time or more
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
Behaviour During Malfunction		• Insufficient output • Worsening exhaust gas performance
Engine Warning Light		• ON
Recovery from error		• Key switch turn OFF
Delay time for recovery		–
Remark		• 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

9Y1200209CRS0003US0

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
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 ≥ 179 MPa (1830 kgf/cm^2, 26000 psi)
Time to action or number of error detection		• 3 sec. or more
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
Behaviour During Malfunction		• Insufficient output • Worsening exhaust gas performance
Engine Warning Light		• ON
Recovery from error		• Key switch turn OFF
Delay time for recovery		−
Remark		• To minimize PM emission to DPF

9Y1200209CRS0004US0

Name		SCV (MPROP) 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 (MPROP) stuck
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 mm^3/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 −730 mm^3/st and the actual rail pressure is 20 MPa (100 kgf/cm^2, 1400 psi) higher than command pressure.
Time to action or number of error detection		• 5 sec. or more
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
Behaviour During Malfunction		• Insufficient output • Worsening exhaust gas performance • Engine stops in some case
Engine Warning Light		• ON
Recovery from error		• Key switch turn OFF
Delay time for recovery		–
Remark		• To minimize PM emission to DPF

9Y1200209CRS0005US0

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)
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		• Pump supplies fuel fully • The deviation between actual rail pressure and desired one is more than 20 MPa
Time to action or number of error detection		• 60 sec. or more
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
Behaviour During Malfunction		• Insufficient output • Worsening exhaust gas performance • Engine stops in some case
Engine Warning Light		• ON
Recovery from error		• Key switch turn OFF
Delay time for recovery		–
Remark		• To minimize PM emission to DPF

9Y1200209CRS0006US0

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
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
Time to action or number of error detection		• 10.0 sec. or more
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		• Insufficient output
Engine Warning Light		• ON
Recovery from error		• Key switch turn OFF
Delay time for recovery		–
Remark		

9Y1200209CRS0007US0

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
Detection item		• Open circuit or ground short circuit of sensor / harness.	• +B short circuit of sensor / harness
DTC Set Preconditions		• Battery voltage is normal • Starter Switch signal is not activated • Sensor supply voltage is normal	• Battery voltage is normal • 700 min^{-1} (rpm) ≤ engine speed ≤ 2800 min^{-1} (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: 0.1 V or less	• Mass air flow sensor voltage: 4.9 V or more at normal operation condition
Time to action or number of error detection		• 3 sec. or more	• 3 sec. or more
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	• 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		• Insufficient output • Worsening exhaust gas performance	• Insufficient output • Worsening exhaust gas performance
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		–	–
Remark		• Engine is not stopped forcibly by ECU. However KUBOTA strongly recommends operator to stop engine as soon as possible.	• Engine is not stopped forcibly by ECU. However KUBOTA strongly recommends operator to stop engine as soon as possible.

9Y1200209CRS0008US0

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
Detection item		• Ground short circuit of sensor / harness	• Open circuit or +B short circuit of sensor / harness
DTC Set Preconditions		• Battery voltage is normal	• Battery voltage is normal
DTC set parameter		• Voltage of intake air temperature sensor is 0.2 V or less	• Voltage of intake air temperature sensor is 4.95 V or above
Time to action or number of error detection		• 3 sec. or more	• 3 sec. or more
Limp Home Action by engine ECU (system action)		• 40 °C (104 °F) [default value]	• 40 °C (104 °F) [default value]
Behaviour During Malfunction		• Amount of white smoke increases at low temperatures	• Amount of white smoke increases at low temperatures
Engine Warning Light		• ON	• ON
Recovery from error		• Diagnostic counter = zero	• Diagnostic counter = zero
Delay time for recovery		• 30 sec.	• 30 sec.
Remark			

9Y1200209CRS0009US0

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
Detection item		• Ground short circuit of sensor / harness	• Open circuit or +B short circuit of sensor / harness
DTC Set Preconditions		• Battery voltage is normal	• Battery voltage is normal
DTC set parameter		• Voltage of coolant temperature sensor is 0.176 V or less	• Voltage of coolant temperature sensor is 4.870 V or above
Time to action or number of error detection		• 3 sec. or more	• 3 sec. or more
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	• 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		• Amount of white smoke increases at low temperatures • Insufficient output • Worsening exhaust gas performance	• Amount of white smoke increases at low temperatures • Insufficient output • Worsening exhaust gas performance
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		–	–
Remark			

9Y1200209CRS0010US0

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
Detection item		• Ground short circuit of sensor / harness • Failure of sensor	• 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	• Battery voltage is normal • Sensor supply voltage VCC# is normal
DTC set parameter		• Voltage of rail pressure sensor is 0.065 V or less	• Voltage of rail pressure sensor is 3.235 V or above
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 • Speed limitation (Accelerator limitation: 50 %) • EGR stop • Intake throttle 100 % open • Engine forcibly stopped 60 sec. later	• 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		• Insufficient output • Worsening exhaust gas performance • Worsening running noise • Increase in white smoke • Engine stops	• Insufficient output • Worsening exhaust gas performance • Worsening running noise • Increase in white smoke • Engine stops
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		–	–
Remark		• To minimize PM emission to DPF	• To minimize PM emission to DPF

9Y1200209CRS0011US0

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
Detection item		• Injector charge voltage: High
DTC Set Preconditions		• Battery voltage is normal • CPU is normal
DTC set parameter		• Injector charge voltage: High
Time to action or number of error detection		• Transient
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
Behaviour During Malfunction		• Insufficient output • Worsening exhaust gas performance • Engine stops
Engine Warning Light		• ON
Recovery from error		• Key switch turn OFF
Delay time for recovery		–
Remark		

9Y1200209CRS0012US0

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
Detection item		• Open circuit of harness • Open circuit of injector coil	• Open circuit of harness • Open circuit of injector coil
DTC Set Preconditions		• Engine is operating • Battery voltage is normal • During injection • CPU is normal	• 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	• Open circuit of harness or open circuit of injector coil
Time to action or number of error detection		• 3 times or more	• 3 times or more
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open	• Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		• Insufficient output • Large vibration • Worsening exhaust gas performance	• Insufficient output • Large vibration • Worsening exhaust gas performance
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		–	–
Remark		• Injectors which have no DTC are operated • To minimize PM emission to DPF	• Injectors which have no DTC are operated • To minimize PM emission to DPF

9Y1200209CRS0013US0

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
Detection item		• Open circuit of harness • Open circuit of injector coil	• Open circuit of harness • Open circuit of injector coil
DTC Set Preconditions		• Engine is operating • Battery voltage is normal • During injection • CPU is normal	• 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	• Open circuit of harness or open circuit of injector coil
Time to action or number of error detection		• 3 times or more	• 3 times or more
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open	• Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		• Insufficient output • Large vibration • Worsening exhaust gas performance	• Insufficient output • Large vibration • Worsening exhaust gas performance
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		–	–
Remark		• Injectors which have no DTC are operated • To minimize PM emission to DPF	• Injectors which have no DTC are operated • To minimize PM emission to DPF

9Y1200209CRS0014US0

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
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 ≥ 120 °C (248 °F)	• Engine speed ≥ 3500 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 mm^3/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			

9Y1200209CRS0015US0

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
Detection item		• Ground short circuit of sensor / harness • Failure of sensor	• 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	• Battery voltage is normal • Sensor supply voltage VCC# is normal
DTC set parameter		• Voltage of boost pressure sensor is 0.2 V or below	• Voltage of boost pressure sensor is 4.9 V or above
Time to action or number of error detection		• 3 sec. or more	• 3 sec. or more
Limp Home Action by engine ECU (system action)		• 65kPa (0.66 kgf/cm^2, 9.4 psi) [default value]	• 65 kPa (0.66 kgf/cm^2, 9.4 psi) [default value]
Behaviour During Malfunction		• Insufficient output	• Insufficient output
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		–	–
Remark		• Default value is changed in consideration with high altitude usage	• Default value is changed in consideration with high altitude usage

9Y1200209CRS0016US0

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
Detection item		• Open circuit or short circuit of sensor / harness • Failure of sensor	• 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	• Battery voltage is normal • Sensor supply voltage VCC# is normal • 350 min^{-1} (rpm) or higher
DTC set parameter		• No recognition of Ne sensor pulse	• Pulse count per rotation is not 58 teeth
Time to action or number of error detection		• 10 times or more	• 10 times or more
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition	• Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		(Running only with G signal) • Faulty starting • Vibration is slightly large • Insufficient output	(Running only with G signal) • Faulty starting • Vibration is slightly large • Insufficient output
Engine Warning Light		• ON	• ON
Recovery from error		• Diagnostic counter = zero	• Diagnostic counter = zero
Delay time for recovery		• 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	• 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			

9Y1200209CRS0017US0

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
Detection item		• Open circuit or short circuit of sensor / harness • Failure of sensor	• 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	• Battery voltage is normal • Sensor supply voltage VCC# is normal • Engine speed is 350 min^{-1} (rpm) or higher
DTC set parameter		• No recognition of G sensor pulse	• Pulse count per rotation is not 3 teeth
Time to action or number of error detection		• 4.4 rotations of CRANK sensor pulse	• 4.4 rotations of CRANK sensor pulse
Limp Home Action by engine ECU (system action)		• None	• None
Behaviour During Malfunction		(Invalid G signal) • Engine hesitates at start-up	(Invalid G signal) • Engine hesitates at start-up
Engine Warning Light		• ON	• ON
Recovery from error		• Diagnostic counter = zero	• Diagnostic counter = zero
Delay time for recovery		• 1.1 rotations of CRANK sensor pulse	• 1.1 rotations of CRANK sensor pulse
Remark			

9Y1200209CRS0018US0

Name		Glow relay abnormality			
ISO 14229 P-Code		P0380	P0380	P0380	P0381
J1939-73	SPN	676	523544	523544	676
	FMI	5	3	4	0
SPN Name SAE J1939 Table C1		Engine Glow Plug Relay	proprietary	proprietary	Engine Glow Plug Relay
DTC Name		Open circuit of glow relay driving circuit	+B short of glow relay driving circuit	Ground short of glow relay driving circuit	Glow heater relay driving circuit overheat
Detection item		• Open circuit of air glow relay	• +B short of glow relay driving circuit	• Ground short of air glow relay driving circuit	• Overheat of glow plug driving circuit
DTC Set Preconditions		• Battery voltage is normal • Glow relay is being energized	• Battery voltage is normal • Glow relay is being energized	• Battery voltage is normal • Glow relay is being energized	• Battery voltage is normal • Glow relay is being energized
DTC set parameter		• Open circuit of harness or • Open circuit of relay coil	• +B short circuit of harness	• Ground short circuit of harness	• Glow relay coil resistance or load is too high that the specified value of ECU
Time to action or number of error detection		• 3 sec. or more	• 3 sec. or more	• 3 sec. or more	• 3 sec. or more
Limp Home Action by engine ECU (system action)		• None	• None	• None	• None
Behaviour During Malfunction		(At low temperature) • Faulty starting • Increase in white smoke	(At low temperature) • Faulty starting • Increase in white smoke	(At low temperature) • Faulty starting • Increase in white smoke	(At low temperature) • Faulty starting • Increase in white smoke
Engine Warning Light		• ON	• ON	• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF	• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		–	–	–	–
Remark					

9Y1200209CRS0019US0

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
Detection item		• EGR actuator open circuit	• EGR actuator coil short	• EGR position sensor failure
DTC Set Preconditions		• Battery voltage is normal • No DTC of U0077 "CAN1 Bus off" • EGR control line is normal	• Battery voltage is normal • No DTC of U0077 "CAN1 Bus off" • EGR control line is normal	• 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		• 3 sec. or more	• 3 sec. or more	• 3 sec. or more
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition • EGR stop	• Output limitation: Approximately 75 % of normal condition • EGR stop	• Output limitation: Approximately 75 % of normal condition • EGR stop
Behaviour During Malfunction		• Insufficient output • Worsening exhaust gas performance	• Insufficient output • Worsening exhaust gas performance	• 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				

9Y1200209CRS0020US0

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
Detection item		• Oil pressure switch
DTC Set Preconditions		• Battery voltage is normal • Key switch turn ON • Starter Switch signal 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
Time to action or number of error detection		• Transient
Limp Home Action by engine ECU (system action)		• None
Behaviour During Malfunction		• Engine stops
Engine Warning Light		• ON
Recovery from error		• Key switch turn OFF
Delay time for recovery		–
Remark		

9Y1200209CRS0021US0

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
Detection item		• Ground short circuit of sensor / harness	• Open circuit or +B short circuit of sensor / harness.
DTC Set Preconditions		• Battery voltage is normal	• 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		• Diesel Particulate Filter (hereinafter referred to as the "DPF") inlet temperature sensor (T1) voltage: 0.08 V or less	• DPF inlet temperature sensor (T1) voltage: 4.92 V or more
Time to action or number of error detection		• 5 sec. or more	• 120 sec. or more
Limp Home Action by engine ECU (system action)		• 0 °C (32 °F) [default value] • Output limitation: Approximately 75 % of normal condition	• 0 °C (32 °F) [default value] • Output limitation: Approximately 75 % of normal condition
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			

9Y1200209CRS0022US0

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
Detection item		• Ground short circuit of sensor / harness	• Open circuit or +B short circuit of sensor / harness.
DTC Set Preconditions		• Battery voltage is normal	• 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: 0.08 V or less	• DOC inlet temperature sensor (T0) voltage: 4.92 V or more
Time to action or number of error detection		• 5 sec. or more	• 120 sec. or more
Limp Home Action by engine ECU (system action)		• 0 °C (32 °F) [default value] • Output limitation: Approximately 75 % of normal condition	• 0 °C (32 °F) [default value] • Output limitation: Approximately 75 % of normal condition
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			

9Y1200209CRS0023US0

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
Detection item		• Open circuit, short circuit or damage of harness • Failure of battery	• Open circuit, short circuit or damage of harness • Failure of battery
DTC Set Preconditions		• Key switch is ON • Starter Switch signal is not activated	• Key switch is ON • Starter Switch signal is not activated
DTC set parameter		• ECU recognition of battery voltage is below 8 V in 12 V system • Not monitored during cranking	• ECU recognition of battery voltage is above 16 V in 12 V system
Time to action or number of error detection		• 1 sec. or more	• 1 sec. or more
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open	• Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		• Faulty starting • Insufficient output • Worsening exhaust gas performance • Engine stops in some case	• Faulty starting • Insufficient output • Worsening exhaust gas performance
Engine Warning Light		• ON	• ON
Recovery from error		• Diagnostic counter = zero	• Key switch turn OFF
Delay time for recovery		• 30 sec.	–
Remark			

9Y1200209CRS0024US0

Name		QR (IQA) 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 (IQA) data error	No QR (IQA) data
Detection item		• QR data read error	• QR data is unwritten
DTC Set Preconditions		• Key switch is ON	• Key switch is ON
DTC set parameter		• QR data read error from EEPROM	• Area of QR data on EEPROM is vacant
Time to action or number of error detection		• Transient	• Transient
Limp Home Action by engine ECU (system action)		• Nozzle calibration is not executed • Output limitation: Approximately 75 % of normal condition	• Nozzle correction factor = 0 [default value] • Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		• Insufficient output	• Insufficient output
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		–	–
Remark		• To cover each injector dispersion	

9Y1200209CRS0025US0

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
Detection item		• FLASH ROM error	• Failure of CPF and/or IC	• 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 is not activated	• Key switch is ON • Battery voltage is 10 V or more • Starter Switch signal is not activated
DTC set parameter		• Check-sum error • Erase error • Write error • Read error	• CPU and/or IC fatal error	• Failure of monitoring IC of CPU
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 Stop	• 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				

9Y1200209CRS0026US0

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
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
Time to action or number of error detection		• Transient
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		• Insufficient output • Worsening exhaust gas performance • Engine stops
Engine Warning Light		• ON
Recovery from error		• Key switch turn OFF
Delay time for recovery		–
Remark		• To minimize PM emission to DPF

9Y1200209CRS0027US0

Name		SCV (MPROP) drive system abnormality		
ISO 14229 P-Code		P0627	P0628	P0629
J1939-73	SPN	1347	1347	1347
	FMI	5	4	3
SPN Name SAE J1939 Table C1		Engine Fuel Pump Pressurizing Assembly #1	Engine Fuel Feed Pump Pressurizing Assembly #1	Engine Fuel Feed Pump Pressurizing Assembly #1
DTC Name		Open circuit of SCV (MPROP)	SCV (MPROP) drive system error	+B short circuit of SCV (MPROP)
Detection item		• Open circuit of SCV	• Open circuit or ground short circuit of SCV	• +B short circuit of SCV
DTC Set Preconditions		• Battery voltage is normal • Key switch is ON • Starter Switch signal is not activated	• Battery voltage is normal • Key switch is ON • Starter Switch signal is not activated	• Battery voltage is normal • Key switch is ON • Starter Switch signal is not activated
DTC set parameter		• Open circuit of SCV	• Open circuit or ground short of SCV	• +B short circuit of SCV
Time to action or number of error detection		• Transient	• Transient	• Transient
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	• Output limitation: Approximately 50 % of normal condition • Speed limitation (Accelerator limitation: 50 %) • EGR stop • Intake throttle 100 % open • Engine forcibly stopped 60 sec. later	• 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		• Insufficient output • Worsening exhaust gas performance	• Insufficient output • Worsening exhaust gas performance	• 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				

9Y1200209CRS0028US0

Name		Internal injector drive circuit abnormality	
ISO 14229 P-Code		P062B	P062D
J1939-73	SPN	1077	523605
	FMI	12	6
SPN Name SAE J1939 Table C1		Engine Fuel Injection Pump Controller	Injector driver
DTC Name		Injector drive IC error or Open circuit	Short circuit in injector driver IC
Detection item		• Injector drive IC error or Open circuit of No.1 and 4 cylinder injector or Open circuit of No.2 and 3 cylinder injector	• Open circuit of air glow relay
DTC Set Preconditions		• Key switch is ON • Battery voltage is 10 V or more • Starter Switch signal is not activated	• Battery voltage is normal • Key switch is ON
DTC set parameter		• Injector drive IC error or Open circuit of No.1 and 4 cylinder injector or Open circuit of No.2 and 3 cylinder injector	• Injector IC report the error
Time to action or number of error detection		• One time or more	• 3 times or more
Limp Home Action by engine ECU (system action)		• Engine Stop	• Injectors which have error stop injection • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		• Engine Stop	• Insufficient output • Large vibration • Worsening exhaust gas performance • Engine stops in some case
Engine Warning Light		• One time or more	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		–	–
Remark			

9Y1200209CRS0029US0

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
Detection item		• Sensor supply voltage 1 error or recognition error	• Sensor supply voltage 1 error or recognition error
DTC Set Preconditions		• Battery voltage is normal • Key switch turn ON • Starter Switch signal is not activated	• Battery voltage is normal • Key switch turn ON • Starter Switch signal is not activated
DTC set parameter		• Voltage to sensor is below 4.75 V	• Voltage to sensor is above 5.25 V
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 • Speed limitation (Accelerator limitation: 50 %) • EGR stop • Intake throttle 100 % open	• Output limitation: Approximately 50 % of normal condition • Speed limitation (Accelerator limitation: 50 %) • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		• Faulty starting • Insufficient output • Worsening exhaust gas performance • Engine stops in some case	• Faulty starting • Insufficient output • Worsening exhaust gas performance • Engine stops in some case
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		–	–
Remark		• Emission related	• Emission related

9Y1200209CRS0030US0

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
Detection item		• Sensor supply voltage 2 error or recognition error	• Sensor supply voltage 2 error or recognition error
DTC Set Preconditions		• Battery voltage is normal • Key switch turn ON • Starter Switch signal is not activated	• Battery voltage is normal • Key switch turn ON • Starter Switch signal is not activated
DTC set parameter		• Voltage to sensor is below 4.75 V	• Voltage to sensor is above 5.25 V
Time to action or number of error detection		• Transient	• Transient
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition	• Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		• Faulty starting • Insufficient output • Worsening exhaust gas performance	• Faulty starting • Insufficient output • Worsening exhaust gas performance
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		–	–
Remark			

9Y1200209CRS0031US0

Name		Sensor supply voltage 3 abnormality	
ISO 14229 P-Code		P0662	P0663
J1939-73	SPN	3511	3511
	FMI	4	3
SPN Name SAE J1939 Table C1		Sensor supply voltage 3	Sensor supply voltage 3
DTC Name		Sensor supply voltage 3: Low	Sensor supply voltage 3: High
Detection item		• Sensor supply voltage 3 error or recognition error	• Sensor supply voltage 3 error or recognition error
DTC Set Preconditions		• Battery voltage is normal • Key switch turn ON • Starter Switch signal is not activated	• Battery voltage is normal • Key switch turn ON
DTC set parameter		• Voltage to sensor is below 4.75 V	• Voltage to sensor is above 5.25 V
Time to action or number of error detection		• Transient	• Transient
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition	• Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		• Faulty starting	• Faulty starting
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		–	–
Remark			

9Y1200209CRS0032US0

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
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
Time to action or number of error detection		• 1 times or more
Limp Home Action by engine ECU (system action)		• None
Behaviour During Malfunction		• Dead battery
Engine Warning Light		• OFF
Recovery from error		• Key switch turn OFF
Delay time for recovery		–
Remark		

9Y1200209CRS0033US0

Name		EEPROM check sum error		
ISO 14229 P-Code		P1990	P1991	P1992
J1939-73	SPN	523700	523701	523702
	FMI	13	13	13
SPN Name SAE J1939 Table C1		proprietary	proprietary	proprietary
DTC Name		EEPROM check sum error	EEPROM check sum error (DST1)	EEPROM check sum error (DST2)
Detection item		• KBT-EEPROM check sum error	DST1-EEPROM check sum error	DST2-EEPROM check sum error
DTC Set Preconditions		• Battery voltage is normal	• Battery voltage is normal	• Battery voltage is normal
DTC set parameter		• EEPROM check sum error	• EEPROM check sum error (DST1)	• EEPROM check sum error (DST2)
Time to action or number of error detection		• Transient	• Transient	• Transient
Limp Home Action by engine ECU (system action)		• None	• None	• None
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				

9Y1200209CRS0034US0

Name		Intake throttle feedback error	Accelerator position sensor 1 abnormality	
ISO 14229 P-Code		P2108	P2122	P2123
J1939-73	SPN	523580	91	91
	FMI	2	4	3
SPN Name SAE J1939 Table C1		proprietary	Accelerator Pedal Position 1	Accelerator Pedal Position 1
DTC Name		Intake throttle feedback error	Accelerator position sensor 1: Low	Accelerator position sensor 1: High
Detection item		• Intake throttle feedback error	• Ground short circuit or open circuit of sensor / harness	• Battery short circuit out of sensor / harness
DTC Set Preconditions		• Battery voltage is normal	• Battery voltage is normal • Sensor supply voltage VCC1 is normal	• Battery voltage is normal • Sensor supply voltage VCC1 is normal
DTC set parameter		(Approximate parameter) • Deviation of throttle position is not corrected in 20 times of duty error recovery action.	• Voltage of accelerator position sensor 1 is 0.3 V or less	• Voltage of accelerator position sensor 1 is 4.8 V or less
Time to action or number of error detection		• 5 sec. or more	• Transient	• Transient
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition • Intake throttle 100 % open	• Forced Idle (Accelerator = 0 %)	• Forced Idle (Accelerator = 0 %)
Behaviour During Malfunction		• None	• Insufficient output	• Insufficient output
Engine Warning Light		• ON	• ON	• ON
Recovery from error		• Key switch turn OFF	• Diagnostic counter = zero	• Diagnostic counter = zero
Delay time for recovery		–	• 3 sec.	• 3 sec.
Remark				

9Y1200209CRS0035US0

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
Detection item		• Ground short circuit or open circuit of sensor / harness	• Battery short circuit out of sensor / harness
DTC Set Preconditions		• Battery voltage is normal • Sensor supply voltage VCC1 is normal	• 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	• Voltage of accelerator position sensor 2 is 4.8 V or less
Time to action or number of error detection		• Transient	• Transient
Limp Home Action by engine ECU (system action)		• Forced Idle (Accelerator = 0 %)	• Forced Idle (Accelerator = 0 %)
Behaviour During Malfunction		• Insufficient output	• Insufficient output
Engine Warning Light		• ON	• ON
Recovery from error		• Diagnostic counter = zero	• Diagnostic counter = zero
Delay time for recovery		• 3 sec.	• 3 sec.
Remark			

9Y1200209CRS0036US0

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
Detection item		• Accelerator position sensor signal error (sensor / harness open circuit, ground short circuit etc)	• Deviation from designed correlation in two sensors
DTC Set Preconditions		• Battery voltage is normal • Key switch turn ON • Starter Switch signal is not activated	• Battery voltage is normal • Accelerator position sensor1 is normal • Accelerator position sensor2 is normal
DTC set parameter		• Accelerator position sensor error signal received by CAN	• Deviation from designed correlation in two sensors
Time to action or number of error detection		• Transient	• Transient
Limp Home Action by engine ECU (system action)		• Not applicable	• Forced Idle (Accelerator = 0 %)
Behaviour During Malfunction		• Insufficient output	• Insufficient output
Engine Warning Light		• ON	• ON
Recovery from error		• Diagnostic counter = zero (CAN signal recovers)	• Diagnostic counter = zero
Delay time for recovery		• Immediately	• 3 sec.
Remark			

9Y1200209CRS0037US0

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, or all cylinder injector short to ground	1 & 4 cylinder injector short to +B or all cylinder injector short to +B
Detection item		• Wiring harness short to ground	• Wiring harness short to +B
DTC Set Preconditions		• Engine is operating • Battery voltage is normal	• Engine is operating • Battery voltage is normal
DTC set parameter		• Wiring harness short to ground	• Wiring harness short to +B
Time to action or number of error detection		• 3 times or more	• 3 times or more
Limp Home Action by engine ECU (system action)		• Injectors which have error stop injection • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open	• Injectors which have error stop injection • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		• Insufficient output • Large vibration • Worsening exhaust gas performance • Engine stops in some case	• Insufficient output • Large vibration • Worsening exhaust gas performance • Engine stops in some case
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		–	–
Remark		• Injectors which have no DTC are operated • To minimize PM emission to DPF	• Injectors which have no DTC are operated • To minimize PM emission to DPF

9Y1200209CRS0038US0

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, or all cylinder injector short to ground	2 & 3 cylinder injector short to +B or all cylinder injector short to +B
Detection item		• Wiring harness short to ground	• Wiring harness short to +B
DTC Set Preconditions		• Engine is operating • Battery voltage is normal	• Engine is operating • Battery voltage is normal
DTC set parameter		• Wiring harness short to ground	• Wiring harness short to +B
Time to action or number of error detection		• 3 times or more	• 3 times or more
Limp Home Action by engine ECU (system action)		• Injectors which have error stop injection • Output limitation: Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open	• Injectors which have error stop injection • Output limitation Approximately 75 % of normal condition • EGR stop • Intake throttle 100 % open
Behaviour During Malfunction		• Insufficient output • Large vibration • Worsening exhaust gas performance • Engine stops in some case	• Insufficient output • Large vibration • Worsening exhaust gas performance • Engine stops in some case
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		–	–
Remark		• Injectors which have no DTC are operated • To minimize PM emission to DPF	• Injectors which have no DTC are operated • To minimize PM emission to DPF

9Y1200209CRS0039US0

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)
Detection item		• Sensor / ECU internal circuit short to ground	• Sensor / ECU internal circuit short to +B
DTC Set Preconditions		• Battery voltage is normal	• Battery voltage is normal
DTC set parameter		• Barometric pressure sensor voltage: 0.2 V or less	• Barometric pressure sensor voltage: 4.850 V or more
Time to action or number of error detection		• 3 sec. or more	• 3 sec. or more
Limp Home Action by engine ECU (system action)		• 65 kPa (0.66 kgf/cm^2, 9.4 psi) [default value]	• 65 kPa (0.66 kgf/cm^2, 9.4 psi) [default value]
Behaviour During Malfunction		• Insufficient output	• Insufficient output
Engine Warning Light		• ON	• ON
Recovery from error		• Diagnostic counter = zero	• Diagnostic counter = zero
Delay time for recovery		• Immediately	• Immediately
Remark		• Default value is changed in consideration with high altitude usage	• Default value is changed in consideration with high altitude usage

9Y1200209CRS0040US0

Name		Pressure limiter abnormality	
ISO 14229 P-Code		P2293	P2293
J1939-73	SPN	679	679
	FMI	7	16
SPN Name SAE J1939 Table C1		Pressure relief valve	Pressure relief valve
DTC Name		Pressure limiter not open	Rail pressure failure after pressure limiter open
Detection item		• Raio pressure value is sticking or too low engine power not to open PL valve forcibility	• Rail pressure value is too high or low despite the existence of response that the pressure limiter opened
DTC Set Preconditions		• Battery voltage is normal • Key switch is ON • After DTC P0088, P0089	• Battery voltage is normal • Key switch is ON
DTC set parameter		• After fault opening PLV, rail pressure is above 160 MPa	• Pressure limiter open (the opening response is detected) • Rail pressure valve is within 50 MPa and 120 MPa
Time to action or number of error detection		• 3 sec. or more	• Transient
Limp Home Action by engine ECU (system action)		• Engine stop	• Engine stop
Behaviour During Malfunction		• Engine stop	• Engine stop
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		–	–
Remark			

9Y1200209CRS0041US0

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
Detection item		• EGR actuator valve stuck	• EGR (DC motor) overheat	• 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	• Battery voltage is normal • No DTC of U0077 "CAN1 Bus off" • EGR control line is normal	• 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	• EGR (DC motor) temperature error signal (thermistor: 125 °C (257 °F) or more) received via CAN	• EGR (DC motor) temperature sensor error signal received via CAN
Time to action or number of error detection		• 3 sec. or more	• 3 sec. or more	• 3 sec. or more
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition • EGR stop	• Output limitation: Approximately 75 % of normal condition • EGR stop	• Output limitation: Approximately 75 % of normal condition • EGR stop
Behaviour During Malfunction		• Insufficient output • Worsening exhaust gas performance	• Insufficient output • Worsening exhaust gas performance	• 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				

9Y1200209CRS0042US0

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
Detection item		• Ground short circuit of sensor / harness	• Open circuit or +B short circuit of sensor / harness.
DTC Set Preconditions		• Battery voltage is normal	• 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		• DPF outlet temperature sensor (T2) voltage: 0.08 V or less	• DPF outlet temperature sensor (T2) voltage: 4.92 V or more
Time to action or number of error detection		• 5 sec. or more	• 120 sec. or more
Limp Home Action by engine ECU (system action)		• 0 °C (32 °F) [default value] • Output limitation: Approximately 75 % of normal condition	• 0 °C (32 °F) [default value] • Output limitation: Approximately 75 % of normal condition
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			

9Y1200209CRS0043US0

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
Detection item		• Ground short circuit of sensor / harness	• Open circuit or +B short circuit of sensor / harness.
DTC Set Preconditions		• Battery voltage is normal • Sensor supply voltage VCC# is normal • Starter Switch signal is not activated	• Battery voltage is normal • Sensor supply voltage VCC# is normal • Starter Switch signal is not activated
DTC set parameter		• DPF differential pressure sensor voltage: 0.2 V or less	• DPF differential pressure sensor voltage: 4.8 V or more
Time to action or number of error detection		• 3 sec. or more	• 3 sec. or more
Limp Home Action by engine ECU (system action)		• 0 kPa (0.0 kgf/cm^2, 0.0 psi) [default value] • Output limitation: Approximately 75 % of normal condition	• 0 kPa (0.0 kgf/cm^2, 0.0 psi) [default value] • Output limitation: Approximately 75 % of normal condition
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			

9Y1200209CRS0044US0

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
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: 0.151 V or less	• Intake throttle lift sensor voltage: 4.848 V or more
Time to action or number of error detection		• 3 sec. or more	• 3 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			

9Y1200209CRS0045US0

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
Detection item		• DOC is heated up due to unburned fuel
DTC Set Preconditions		• 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		• T1 − T0 ≥ 250 °C (482 °F)
Time to action or number of error detection		• 60 sec. or more
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
Behaviour During Malfunction		• Insufficient output
Engine Warning Light		• ON
Recovery from error		• Key switch turn OFF
Delay time for recovery		–
Remark		• To minimize PM emission to DPF

9Y1200209CRS0046US0

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
Detection item		• DOC inlet temperature (T0) high	• DPF inlet temperature (T1) high
DTC Set Preconditions		• Exhaust gas temperature sensor T0,T1 and T2 are normal • Battery voltage is normal	• 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)		• Stop injection (Q = 0 mm^3/st) • Engine stop • Inhibit starter relay activation until exhaust gas temperature reduces down to 300 °C (572 °F)	• Stop injection (Q = 0 mm^3/st) • Engine stop • Inhibit starter relay activation until exhaust gas temperature reduces down to 300 °C (572 °F)
Behaviour During Malfunction		• Engine stops • Inhibit cranking until down to 300 °C (572 °F)	• Engine stops • Inhibit 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)

9Y1200209CRS0047US0

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
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
Time to action or number of error detection		• 2.0 sec. or more
Limp Home Action by engine ECU (system action)		• Stop injection (Q = 0 mm^3/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		• Engine stops • Inhibit cranking until down to 300 °C (572 °F)
Engine Warning Light		• ON
Recovery from error		• 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)

9Y1200209CRS0048US0

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
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

9Y1200209CRS0049US0

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
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 (Reset by Service tool)
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.

9Y1200209CRS0050US0

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
Detection item		• Disconnect the hose between the turbo blower out and intake flange • Boost pressure sensor error
DTC Set Preconditions		• 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		• Boost pressure sensor output is below target level in high air flow operating condition
Time to action or number of error detection		• 10 sec. or more
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
Behaviour During Malfunction		• Insufficient output
Engine Warning Light		• ON
Recovery from error		• Key switch turn OFF
Delay time for recovery		–
Remark		• Engine power is restricted by boost pressure signal accordingly • To minimize PM emission to DPF

9Y1200209CRS0051US0

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
Detection item		• During regeneration mode, engine warm-up condition is not satisfied (coolant temperature is low)	• Time out error: regeneration incomplete due to low temperature of DPF
DTC Set Preconditions		• During parked active regeneration mode	• During parked active regeneration mode • Coolant temperature is 65 °C (149 °F) or more
DTC set parameter		• Engine coolant temperature stays below 65 °C (149 °F) for 1500 seconds or more under parked regeneration process.	• Regeneration process is not completed within 2700 sec.
Time to action or number of error detection		• Transient	• Transient
Limp Home Action by engine ECU (system action)		• None	• None
Behaviour During Malfunction		• None	• None
Engine Warning Light		• ON	• ON
Recovery from error		• Diagnostic counter = zero (Leaving from parked active regeneration status)	• Diagnostic counter = zero (Leaving from parked active regeneration status)
Delay time for recovery		• Immediately	• Immediately
Remark			

9Y1200209CRS0052US0

Name		All exhaust gas temperature sensor failure
ISO 14229 P-Code		P3018
J1939-73	SPN	523599
	FMI	0
SPN Name SAE J1939 Table C1		proprietary
DTC Name		All exhaust gas temperature sensor failure
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 mm^3/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 100 sec. after cranking
DTC set parameter		• All exhaust gas temperature sensor failure (sensor low) simultaneously
Time to action or number of error detection		• 100 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		• Diagnostic counter = zero
Delay time for recovery		• Immediately
Remark		

9Y1200209CRS0053US0

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
Detection item		• Exhaust gas temperature sensor 0, 1, 2 output	• Time interval from the end time to the start time of the regeneration
DTC Set Preconditions		• Battery voltage is normal	• Battery voltage is normal • Key switch is ON
DTC set parameter		• All exhaust gas temperature (T0, T1 and T2) reduces down to 300 °C (572°F)	• Regeneration time interval within 30 min. occurs three times continuously
Time to action or number of error detection		• Transient	• Transient
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)	• Output limitation: Approximately 50 % of normal condition • EGR stop
Behaviour During Malfunction		• None	• Worsening exhaust gas performance (NOx)
Engine Warning Light		• ON	• ON
Recovery from error		• Diagnostic counter = zero	• Key switch turn OFF (Reset by Service tool)
Delay time for recovery		• Immediately	–
Remark			

9Y1200209CRS0054US0

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
Detection item		• Coolant temperature	• CAN2 +B / GND short circuit or high traffic error
DTC Set Preconditions		• Coolant temperature sensor is normal	• Battery voltage is normal • Key switch is ON
DTC set parameter		• Engine coolant temperature ≥ 110 °C (230 °F)	• CAN2 Bus off
Time to action or number of error detection		• Transient	• 2 sec. or more
Limp Home Action by engine ECU (system action)		• None	• Forced Idle (Accelerator = 0 %)
Behaviour During Malfunction		• Worsening exhaust gas performance (NOx)	• Insufficient output • Transmitted data is invalid
Engine Warning Light		• ON	• ON
Recovery from error		• Diagnostic counter = zero	• Key switch turn OFF
Delay time for recovery		• Immediately	–
Remark			

9Y1200209CRS0055US0

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
Detection item		• No communication with EGR	• CAN1 +B / GND short circuit or high traffic error
DTC Set Preconditions		• Battery voltage is normal • Starter Switch signal is not activated	• Battery voltage is normal • Key switch is ON
DTC set parameter		• Interruption of CAN	• CAN1 Bus off
Time to action or number of error detection		• 1.3 sec. or more	• 2 sec. or more
Limp Home Action by engine ECU (system action)		• Output limitation: Approximately 75 % of normal condition • EGR stop	• Output limitation: Approximately 75 % of normal condition • EGR stop
Behaviour During Malfunction		• Insufficient output • Worsening exhaust gas performance	• Insufficient output • Transmitted data is invalid
Engine Warning Light		• ON	• ON
Recovery from error		• Key switch turn OFF	• Key switch turn OFF
Delay time for recovery		–	–
Remark			

9Y1200209CRS0056US0

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
Detection item		• CAN-KBT original frame open circuit error	• CAN_CCVS communication stopping	• CAN_CM1 communication stopping
DTC Set Preconditions		• Battery voltage is normal • Key switch turn OFF to ON • Starter Switch signal is not activated • No error of "CAN2 Bus off"	• Battery voltage is normal • Starter Switch signal is not activated	• Battery voltage is normal • Starter Switch signal 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 [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				

9Y1200209CRS0057US0

Name		CAN2 frame error		
ISO 14229 P-Code		U0086	U0087	U0089
J1939-73	SPN	523595	523596	523598
	FMI	2	2	2
SPN Name SAE J1939 Table C1		proprietary	proprietary	proprietary
DTC Name		CAN ETC5 (Neutral SW) frame error	CAN TSC1 frame error	CAN EBC1 frame error
Detection item		• CAN_ETC5 communication stopping	• CAN_TSC1 communication stopping	• CAN_EBC1 communication stopping
DTC Set Preconditions		• Battery voltage is normal • Starter Switch signal is not activated	• Battery voltage is normal • Starter Switch signal is not activated	• Battery voltage is normal • Starter Switch signal is not activated
DTC set parameter		• CAN ETC5 frame time out error	• No request to "TSC1 buffer" continues 3 times after over-ride control request (other than 0x00)	• CAN EBC1 frame time out error
Time to action or number of error detection		• 0.5 sec. or more	• 60 sec. or more	• 0.5 sec. or more
Limp Home Action by engine ECU (system action)		• Neutral SW = OFF [default value]	• Override control mode = Normal mode [default value]	• Non shutdown [default value] • Output limitation: Approximately 75 % of normal condition
Behaviour During Malfunction		• None	• None	• None
Engine Warning Light		• ON	• ON	• ON
Recovery from error		• Key switch turn OFF	• Diagnostic counter = zero	• Diagnostic counter = zero
Delay time for recovery		–	• Immediately	• Immediately
Remark				

9Y1200209CRS0058US0

■ **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.**

9Y1200209CRS0059US0

[2] DIAGNOSTIC PROCEDURE BY DTC

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-S115
P0072	171	4	Intake air temperature built-in MAF sensor abnormality	1-S116
P0073	171	3		
P0087	633	7	Pressure limiter emergency open	1-S119
P0088	157	0	High rail pressure	1-S123
P0089	1347	7	SCV (MPROP) stuck	1-S127
P0093	1239	1	Fuel leak (in high pressured fuel system)	1-S131
P0101	132	1	Intake air volume: Low	1-S135
P0102	132	4	MAF sensor abnormality	1-S136
P0103	132	3		
P0112	172	4	Intake air temperature error	1-S138
P0113	172	3		
P0117	110	4	Coolant temperature sensor abnormality	1-S141
P0118	110	3		
P0192	157	4	Rail pressure sensor abnormality	1-S144
P0193	157	3		
P0200	523535	0	Injector charge voltage: High	1-S148
P0201	651	3	Open circuit of harness/coil	1-S150
P0202	653	3		
P0203	654	3		
P0204	652	3		
P0217	110	0	Engine overheat	1-S153
P0219	190	0	Engine overrun	1-S155
P0237	102	4	Boost pressure sensor abnormality	1-S156
P0238	102	3		
P0335	636	8	Crankshaft position sensor (NE sensor) abnormality	1-S160
P0336	636	2		
P0340	723	8	Camshaft position sensor (G sensor) abnormality	1-S164
P0341	723	2		
P0380	676	5	Glow relay abnormality	1-S168
P0380	523544	3		
P0380	523544	4		
P0381	676	0		
P0403	523574	3	EGR actuator abnormality	1-S172
P0404	523574	4		
P0409	523572	4		

ISO 14229 P-Code	J1939-73		Name	Reference Page
	SPN	FMI		
P0524	100	1	Oil pressure error	1-S175
P0543	3242	4	Exhaust gas temperature sensor 1 (T1) abnormality	1-S177
P0544	3242	3		
P0546	4765	4	Exhaust gas temperature sensor 0 (T0) abnormality	1-S180
P0547	4765	3		
P0562	168	4	Battery voltage abnormality	1-S183
P0563	168	3		
P0602	523538	2	QR (IQA) data abnormality	1-S186
P0602	523538	7		
P0605	628	2	ECU FLASH ROM and CPU abnormality	1-S187
P0606	1077	2		
P0606	523527	2		
P0611	523525	1	Injector charge voltage abnormality	1-S189
P0627	1347	5	SCV (MPROP) drive system abnormality	1-S191
P0628	1347	4		
P0629	1347	3		
P062B	1077	12	Internal injector drive circuit abnormality	1-S194
P062D	523605	6		
P0642	3509	4	Sensor supply voltage 1 abnormality	1-S197
P0643	3509	3		
P0652	3510	4	Sensor supply voltage 2 abnormality	1-S199
P0653	3510	3		
P0662	3511	4	Sensor supply voltage 3 abnormality	1-S201
P0663	3511	3		
P0687	1485	2	Main relay is locked in closed position	1-S203
P1990	523700	13	EEPROM check sum error	1-S206
P1991	523701	13		
P1992	523702	13		
P2108	523580	2	Intake throttle feedback error	1-S208
P2122	91	4	Accelerator position sensor 1 abnormality	1-S210
P2123	91	3		
P2127	29	4	Accelerator position sensor 2 abnormality	1-S213
P2128	29	3		
P2131	523543	2	Accelerator position sensor error (CAN)	1-S216
P2135	91	2	Accelerator position sensor correlation error	1-S218
P2147	523523	4	Injector short	1-S219
P2148	523523	3		
P2150	523524	4		
P2151	523524	3		
P2228	108	4	Barometric pressure sensor error	1-S224
P2229	108	3		

ISO 14229 P-Code	J1939-73		Name	Reference Page
	SPN	FMI		
P2293	679	7	Pressure limiter abnormality	1-S226
P2293	679	16		
P2413	523575	7	EGR (DC motor) abnormality	1-S230
P2414	523576	2		
P2415	523577	2		
P242C	3246	4	Exhaust gas temperature sensor 2 (T2) abnormality	1-S233
P242D	3246	3		
P2454	3251	4	Differential pressure sensor 1 abnormality	1-S236
P2455	3251	3		
P2621	523582	4	Intake throttle lift sensor abnormality	1-S240
P2622	523582	3		
P3001	3252	0	Emission deterioration	1-S242
P3002	4765	0	Exhaust gas temperature sensor 0: Emergency high	1-S244
P3003	3242	0	Exhaust gas temperature sensor 1: Emergency high	1-S246
P3004	3246	0	Exhaust gas temperature sensor 2: Emergency high	1-S248
P3006	3701	15	Excessive PM3	1-S250
P3007	3701	16	Excessive PM4	1-S251
P3008	3701	0	Excessive PM5	1-S252
P3011	132	15	Boost pressure low	1-S253
P3012	523589	17	Low coolant temperature in parked regeneration	1-S255
P3013	523590	16	Parked regeneration time out	1-S256
P3018	523599	0	All exhaust gas temperature sensor failure	1-S258
P3023	523601	0	High exhaust gas temperature after emergency high temperature DTC	1-S259
P3024	523602	0	High frequency of regeneration	1-S260
P3025	523603	15	Over heat pre-caution	1-S261
U0075	523547	2	CAN2 Bus off	1-S262
U0076	523578	2	No communication with EGR	1-S264
U0077	523604	2	CAN1 Bus off	1-S266
U0081	523548	2	CAN2 frame error	1-S267
U0082	523591	2		
U0083	523592	2		
U0086	523595	2		
U0087	523596	2		
U0089	523598	2		

9Y1200209CRS0062US0

(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

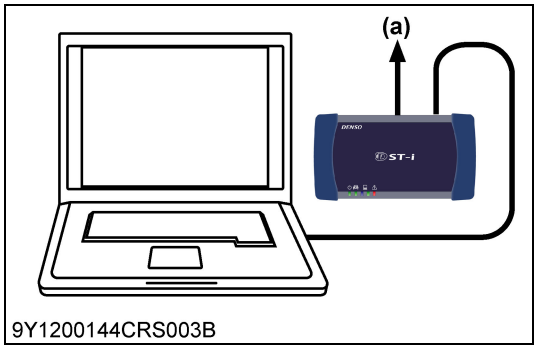
DTC set parameter: (Approximate)
- Phase difference between NE pulse and G pulse within +30 and −20 degree

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

9Y1200209CRS0063US0



9Y1200144CRS003B

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-S160) and "Camshaft Position Sensor (G sensor) Abnormality" (page 1-S164).	

■ **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

9Y1200209CRS0064US0

(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: 0.2 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

9Y1200209CRS0065US0

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

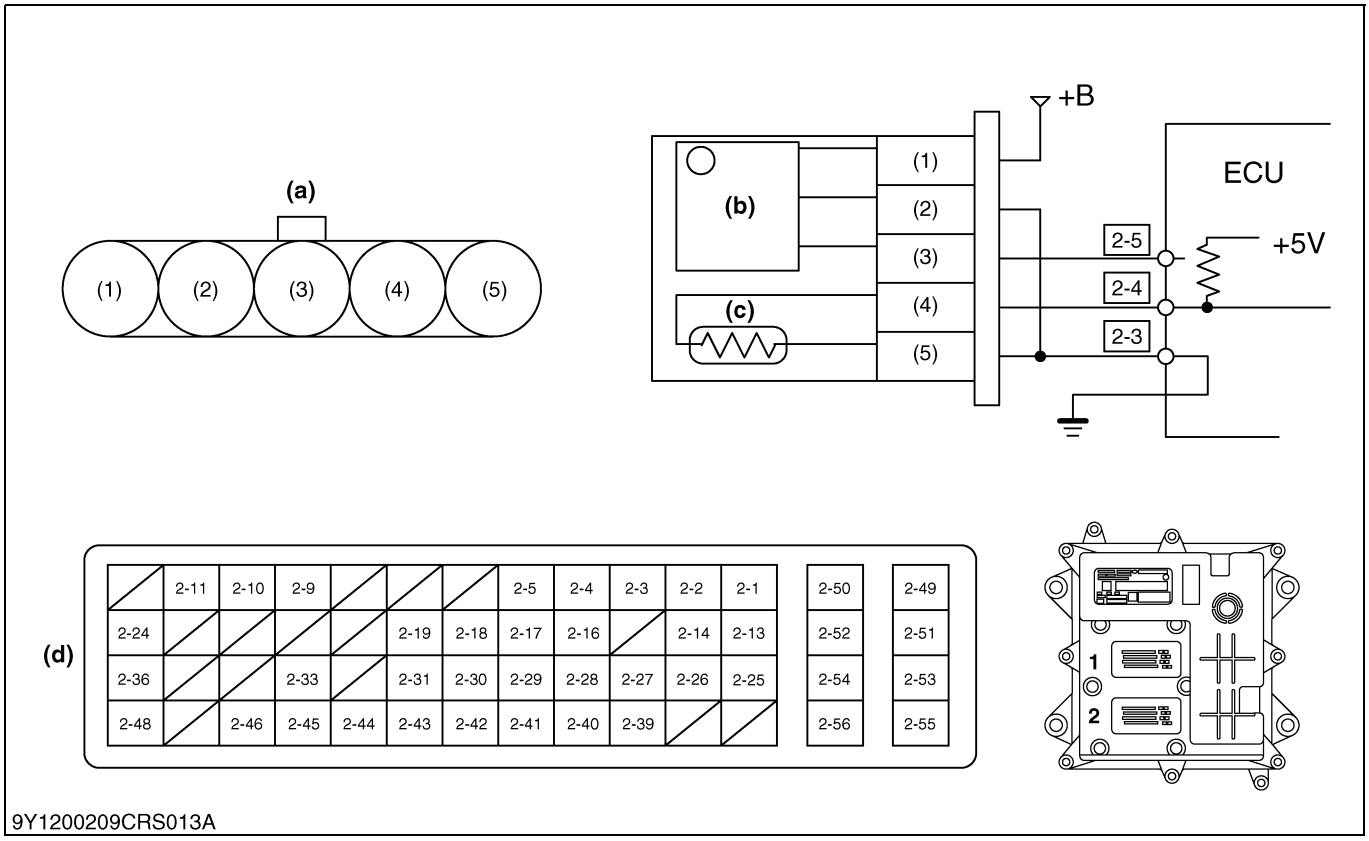
DTC set parameter:
- Intake air temperature built-in MAF sensor voltage: 4.85 V or more

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- 25 °C (77 °F) [default value]

Recovery from error:
- Diagnostic counter = zero

9Y1200209CRS0066US0

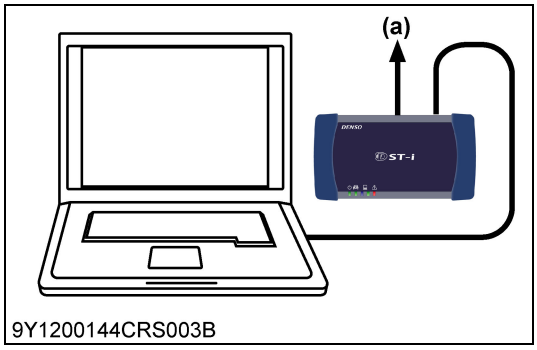


9Y1200209CRS013A

(1) Terminal +B (12 V)
(2) Terminal Ground (Air Flow)
(3) Terminal Signal (Air Flow)
(4) Terminal Signal (Intake Air Temperature)
(5) Terminal Ground (Intake Air Temperature)

(a) Terminal Layout
(b) Mass Air Flow (MAF) Sensor
(c) Intake Air Temperature (Built-in MAF)
(d) ECU Connector 2

9Y1200209CRS0067US0



9Y1200144CRS003B

1. Check the Intake Air Temperature Sensor Signals

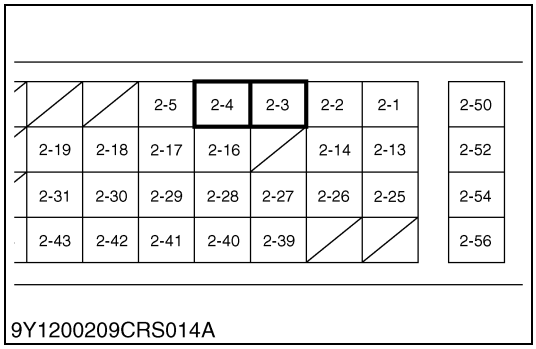
1. Place the key switch in the ON position, and check the "Intake air temperature" and "Intake air temperature sensor output voltage" on the diagnosis tool data monitor.

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

9Y1200209CRS0068US0



9Y1200209CRS014A

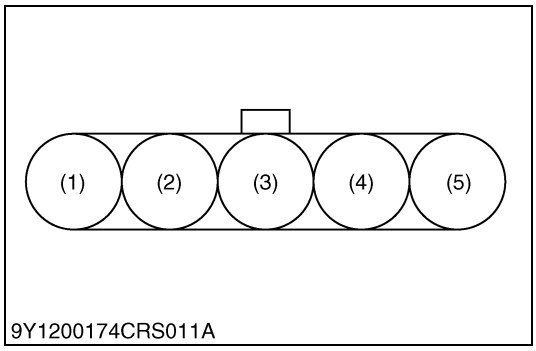
2. Measure the Resistance Between Terminals

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals 2-3 and 2-4 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".

9Y1200209CRS0069US0



9Y1200174CRS011A

3. Check the Sensor

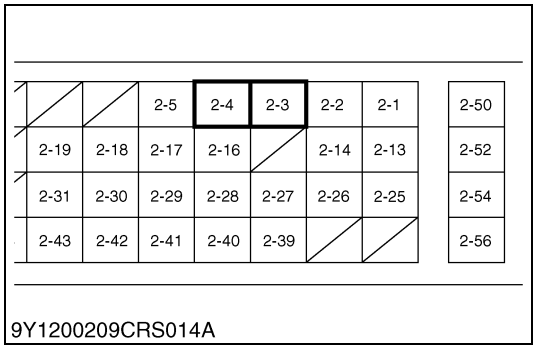
1. Turn the key switch OFF, remove the connector from the sensor side and measure the resistance between the terminals on the sensor side.

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 +B (12 V)
(2) Terminal Ground (Air Flow)
(3) Terminal Signal (Air Flow)
(4) Terminal Signal (Intake Air Temperature)
(5) Terminal Ground (Intake Air Temperature)

9Y1200209CRS0070US0



9Y1200209CRS014A

4. Measure the ECU Terminal Voltage

1. Plug the ECU wiring harness connector into socket again, unplug the sensor connector, and measure the voltage between ECU terminals 2-3 and 2-4 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.

9Y1200209CRS0071US0

(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:
- Pressure limiter emergency open
- Engine speed is more than 700 min^{-1} (rpm)

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

9Y1200209CRS0072US0

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 (MPROP) stuck
2. P2293: Pressure limiter abnormality

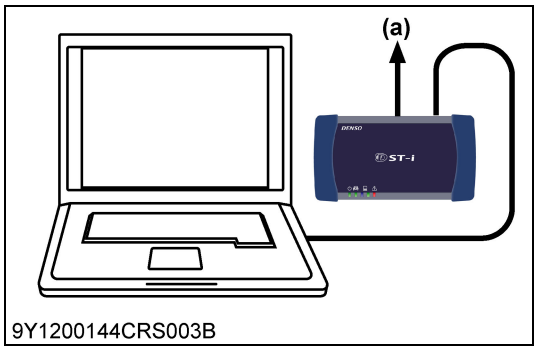
■ **IMPORTANT**
- **Multiple pressure system DTCs may be output simultaneously. Also, both abnormal high pressure and abnormal low pressure may be reported simultaneously under certain malfunction conditions.**

9Y1200209CRS0073US0

■ **NOTE**

- **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.**

9Y1200209CRS0074US0



9Y1200144CRS003B

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"

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

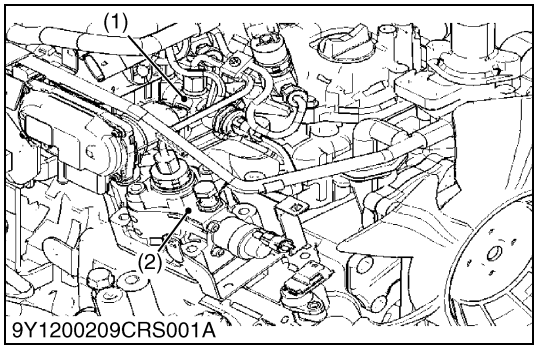
9Y1200209CRS0075US0

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.

9Y1200209CRS0076US0



9Y1200209CRS001A

3. Check the Fuel System

CAUTION

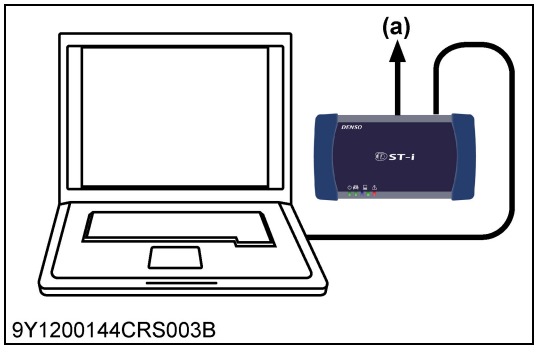
- **Visually check there is no leak in the high pressure fuel pipe system.**
- **A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.**

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271.)

OK	Go to "4. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271.)

(1) Rail (2) Supply Pump

9Y1200209CRS0077US0



9Y1200144CRS003B

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

1. Check the rail pressure sensor.

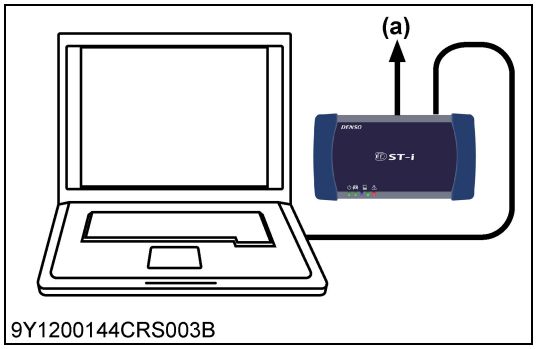
■ **NOTE**

- **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-S144)

(a) CAN1 Connector

9Y1200209CRS0078US0



9Y1200144CRS003B

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.)

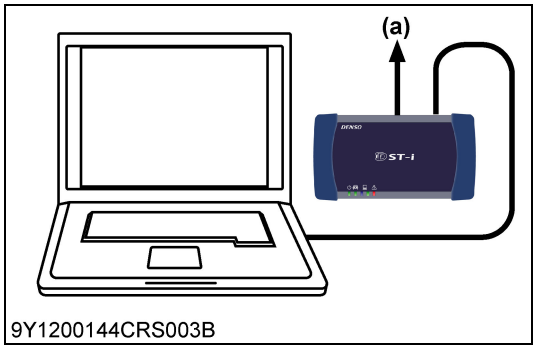
■ **NOTE**

- **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

9Y1200209CRS0079US0



9Y1200144CRS003B

6. Check the SCV-related Data

1. Check the "Target rail pressure", "Actual rail pressure", "Target SCV current", "Actual SCV current" 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 SCV current value" always follow to the "Target SCV current value".

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 supply pump.

(a) CAN1 Connector

9Y1200209CRS0080US0

(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 ≥ 179 MPa (1830 kgf/cm^2, 26000 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

9Y1200209CRS0081US0

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.

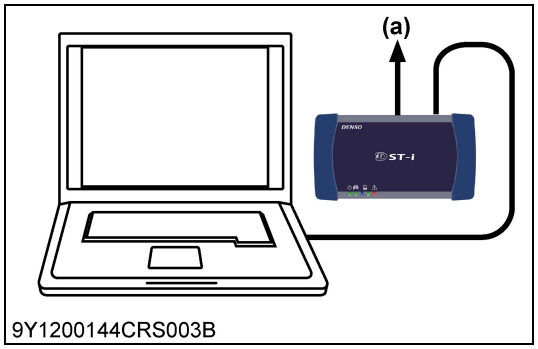
***Pressure system DTCs**
[High pressure abnormality]
1. P0088: High rail pressure

[Low pressure abnormality]
1. P0087: Pressure limiter emergency open
2. P0093: Fuel leak

[Abnormal pressure]
1. P0089: SCV (MPROP) stuck
2. P2293: Pressure limiter abnormality

■ **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.**

9Y1200209CRS0073US0



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"

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

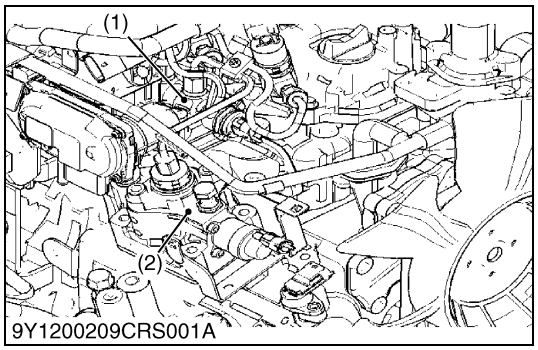
9Y1200209CRS0075US0

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.

9Y1200209CRS0076US0



3. Check the Fuel System

CAUTION

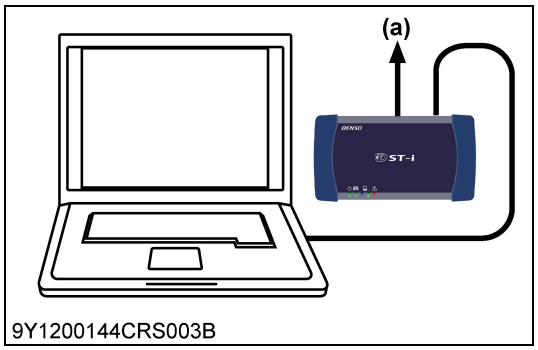
- **Visually check there is no leak in the high pressure fuel pipe system.**
- **A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.**

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271.)

OK	Go to "4. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271.)

(1) Rail (2) Supply Pump

9Y1200209CRS0077US0



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

1. Check the rail pressure sensor.

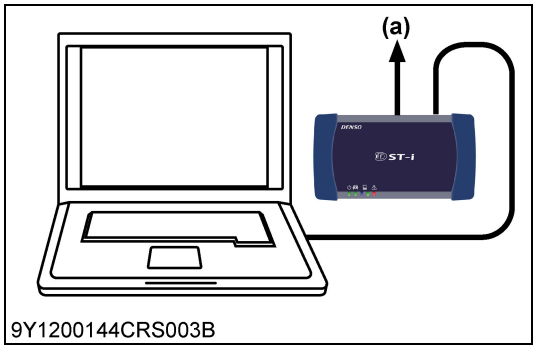
NOTE

- **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-S144)

(a) CAN1 Connector

9Y1200209CRS0078US0



9Y1200144CRS003B

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.)

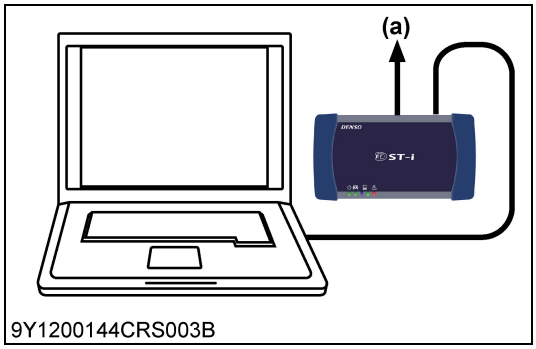
■ **NOTE**

- **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

9Y1200209CRS0079US0



9Y1200144CRS003B

6. Check the SCV-related Data

1. Check the "Target rail pressure", "Actual rail pressure", "Target SCV current", "Actual SCV current" 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 SCV current value" always follow to the "Target SCV current value".

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 supply pump.

(a) CAN1 Connector

9Y1200209CRS0080US0

(5) SCV (MPROP) 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 mm^3/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 −730 mm^3/st and the actual rail pressure is 20 MPa (100 kgf/cm^2, 1400 psi) higher than command pressure.

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

9Y1200209CRS0083US0

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.

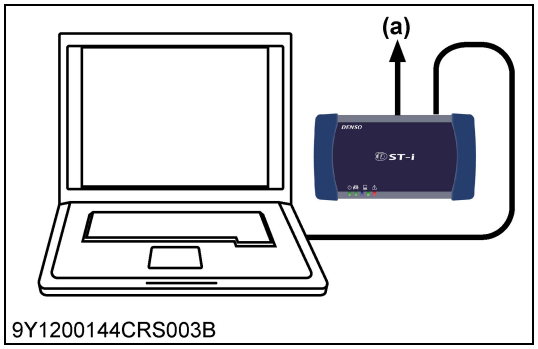
***Pressure system DTCs**
[High pressure abnormality]
1. P0088: High rail pressure

[Low pressure abnormality]
1. P0087: Pressure limiter emergency open
2. P0093: Fuel leak

[Abnormal pressure]
1. P0089: SCV (MPROP) stuck
2. P2293: Pressure limiter abnormality

■ **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.**

9Y1200209CRS0073US0



9Y1200144CRS003B

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"

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

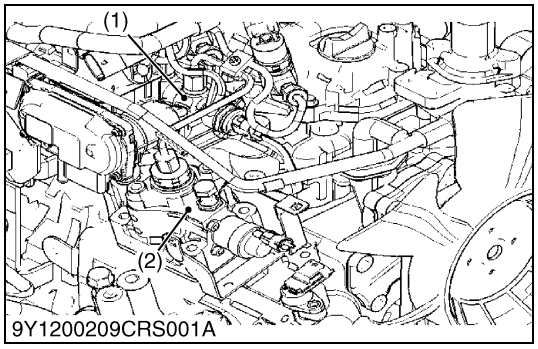
9Y1200209CRS0075US0

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.

9Y1200209CRS0084US0



9Y1200209CRS001A

3. Check the Fuel System

CAUTION

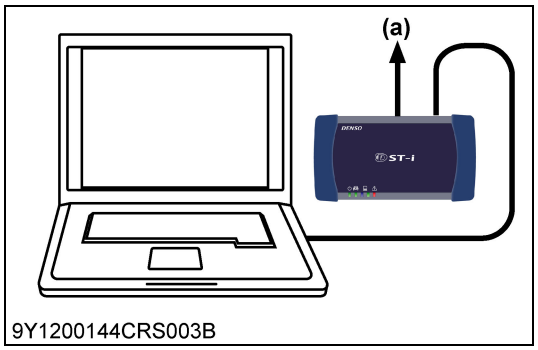
- **Visually check there is no leak in the high pressure fuel pipe system.**
- **A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.**

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271.)

OK	Go to "4. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271.)

(1) Rail (2) Supply Pump

9Y1200209CRS0077US0



9Y1200144CRS003B

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

1. Check the rail pressure sensor.

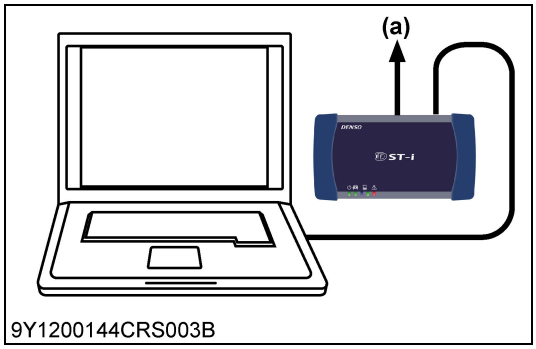
NOTE

- **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-S144)

(a) CAN1 Connector

9Y1200209CRS0078US0



9Y1200144CRS003B

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.)

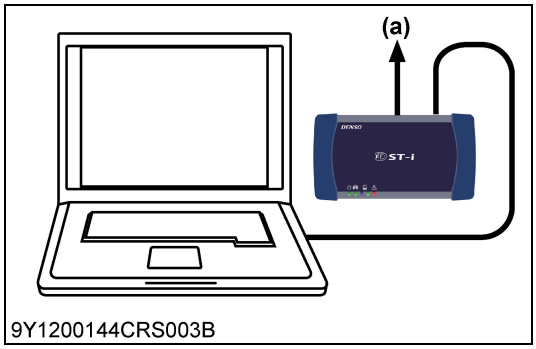
■ **NOTE**

- **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

9Y1200209CRS0079US0



9Y1200144CRS003B

6. Check the SCV-related Data

1. Check the "Target rail pressure", "Actual rail pressure", "Target SCV current", "Actual SCV current" 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 SCV current value" always follow to the "Target SCV current value".

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 supply pump.

(a) CAN1 Connector

9Y1200209CRS0080US0

(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:
- Pump supplies fuel fully.
- The deviation between actual rail pressure and desired one is more than 20 MPa

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

9Y1200209CRS0086US0

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.

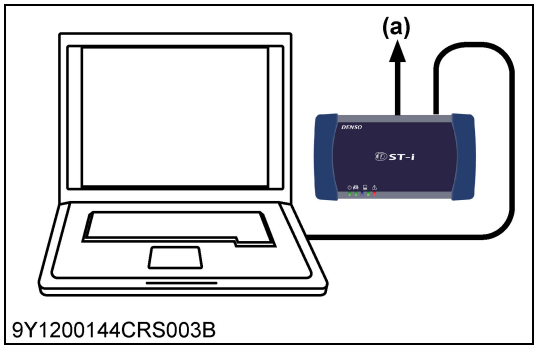
***Pressure system DTCs**
[High pressure abnormality]
1. P0088: High rail pressure

[Low pressure abnormality]
1. P0087: Pressure limiter emergency open
2. P0093: Fuel leak

[Abnormal pressure]
1. P0089: SCV (MPROP) stuck
2. P2293: Pressure limiter abnormality

■ **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.**

9Y1200209CRS0073US0



9Y1200144CRS003B

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"

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

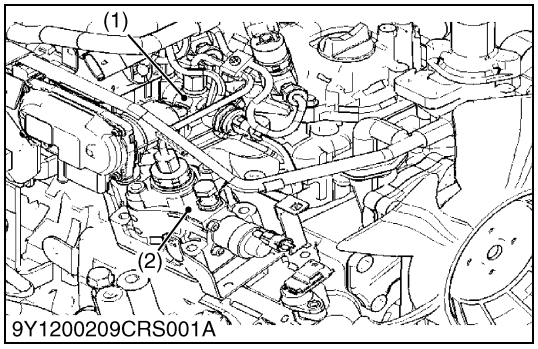
9Y1200209CRS0075US0

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.

9Y1200209CRS0084US0



9Y1200209CRS001A

3. Check the Fuel System

CAUTION

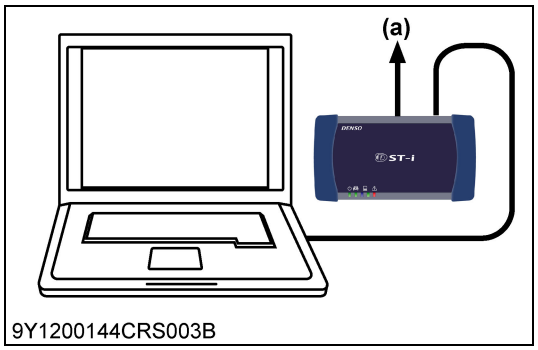
- **Visually check there is no leak in the high pressure fuel pipe system.**
- **A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.**

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271.)

OK	Go to "4. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271.)

(1) Rail (2) Supply Pump

9Y1200209CRS0077US0



9Y1200144CRS003B

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

1. Check the rail pressure sensor.

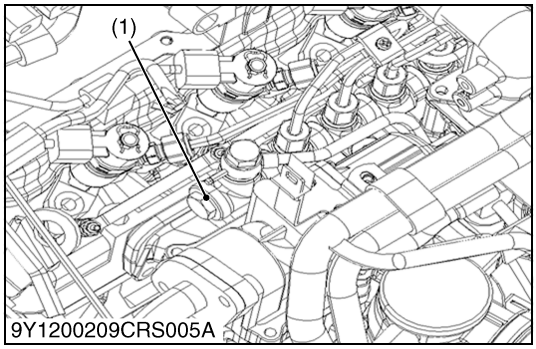
NOTE

- **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-S144)

(a) CAN1 Connector

9Y1200209CRS0087US0



9Y1200209CRS005A

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.

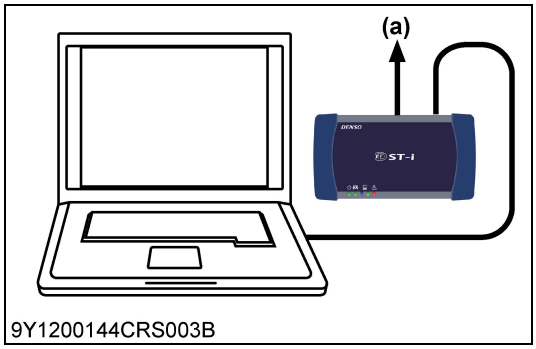
(Reference)

- 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 common rail (pressure limiter).

(1) Pressure Limiter

9Y1200209CRS0088US0



9Y1200144CRS003B

6. Check for a Fuel Leakage

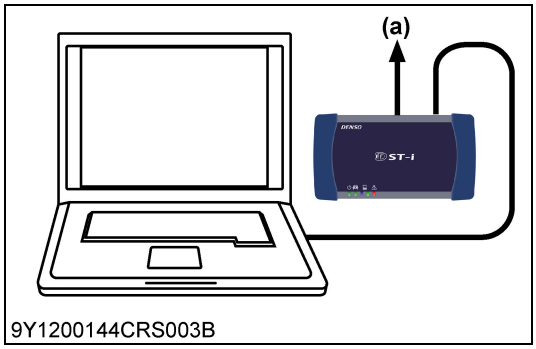
1. Increase the rail pressure by operating the accelerator pedal or accelerator lever, and check for a fuel leakage.

Factory specification	No fuel leaks.

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

(a) CAN1 Connector

9Y1200209CRS0089US0



9Y1200144CRS003B

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.)

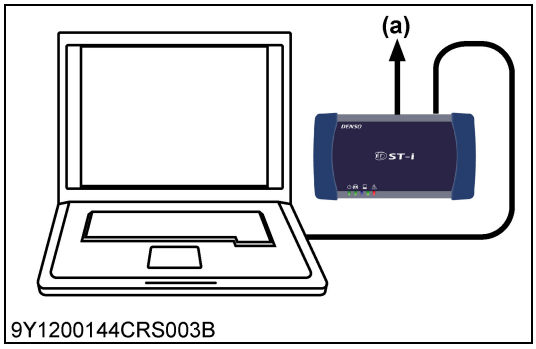
■ **NOTE**

- **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

9Y1200209CRS0090US0



9Y1200144CRS003B

8. Check the SCV-related Data

1. Check the "Target rail pressure", "Actual rail pressure", "Target SCV current", "Actual SCV current" 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 SCV current value" always follow to the "Target SCV current value".

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 supply pump.

(a) CAN1 Connector

9Y1200209CRS0091US0

(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

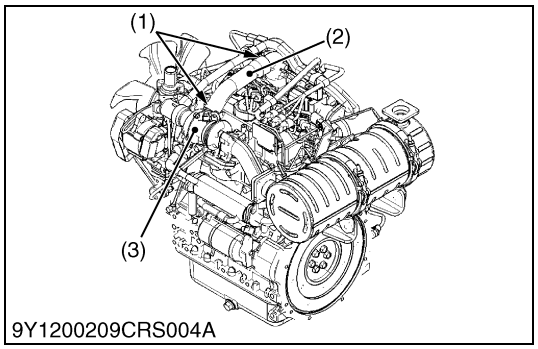
DTC set parameter:
- Engine Inlet Air Mass Flow Rate: less than half of target value

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

9Y1200209CRS0092US0



9Y1200209CRS004A

1. Check the Air Intake System

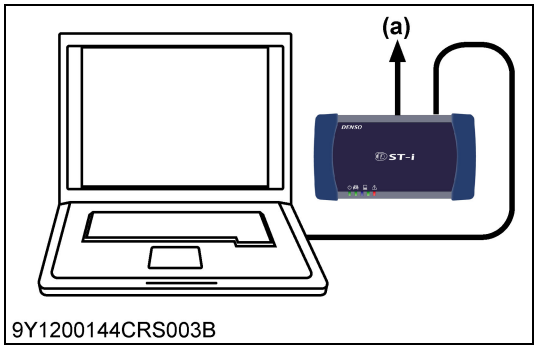
1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270.)

■ **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-S270.)

(1) Hose Clamp
(2) Hose
(3) Turbocharger

9Y1200209CRS0093US0



9Y1200144CRS003B

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

9Y1200209CRS0094US0

(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 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

9Y1200209CRS0095US0

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

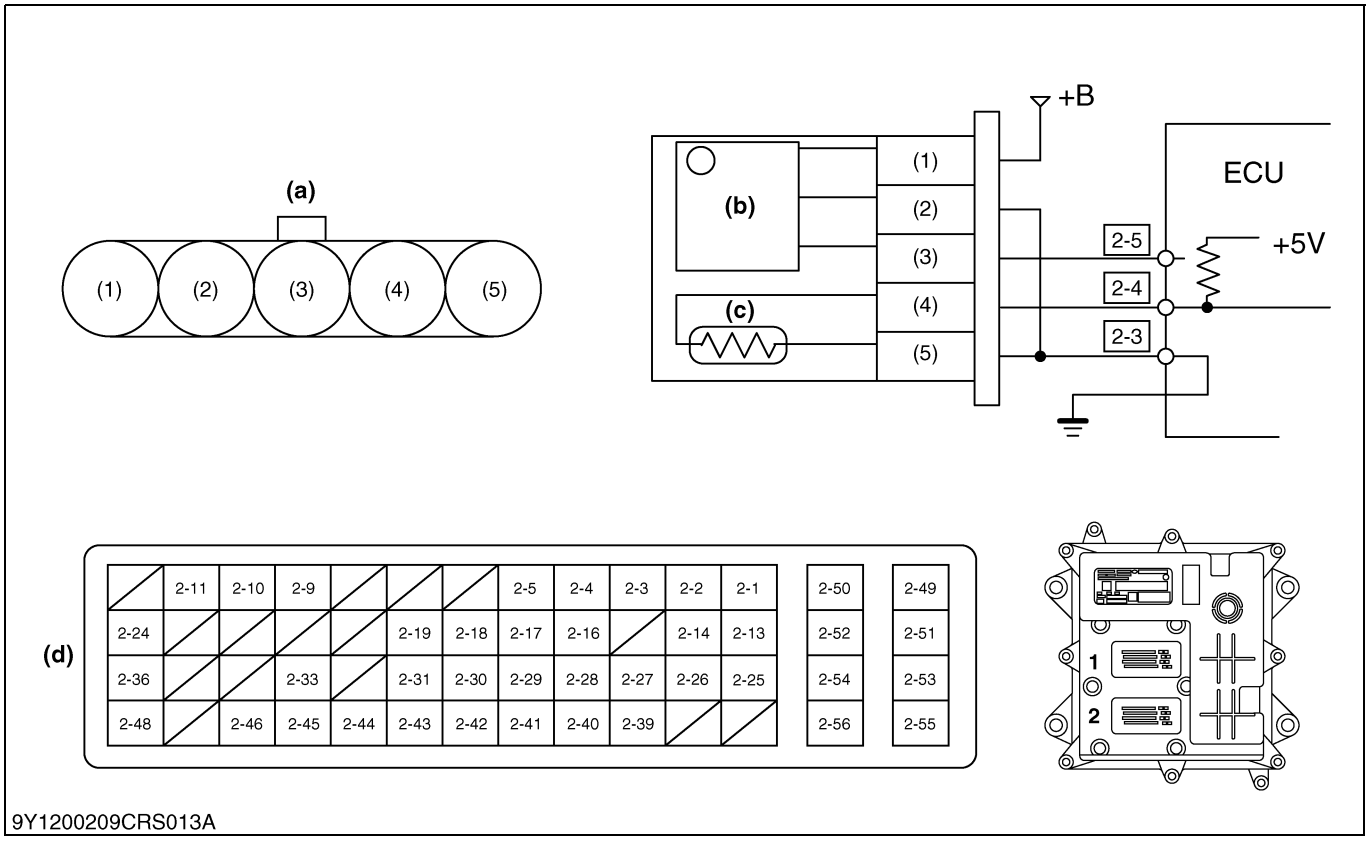
DTC set parameter:
- Mass air flow sensor voltage: 4.9 V or more at normal operation condition

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

9Y1200209CRS0096US0

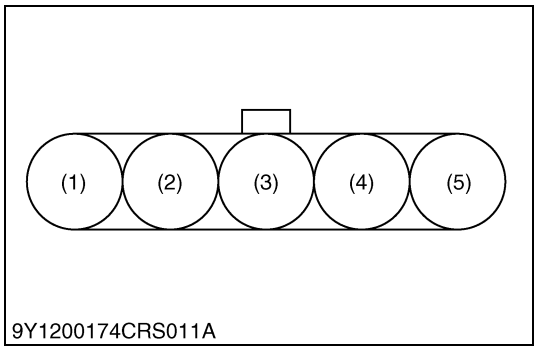


9Y1200209CRS013A

(1) Terminal +B (12 V)
(2) Terminal Ground (Air Flow)
(3) Terminal Signal (Air Flow)
(4) Terminal Signal (Intake Air Temperature)
(5) Terminal Ground (Intake Air Temperature)

(a) Terminal Layout
(b) Mass Air Flow (MAF) Sensor
(c) Intake Air Temperature Sensor (Built-in MAF)
(d) ECU Connector 2

9Y1200209CRS0097US0



9Y1200174CRS011A

1. Measure the Sensor Terminal Voltage

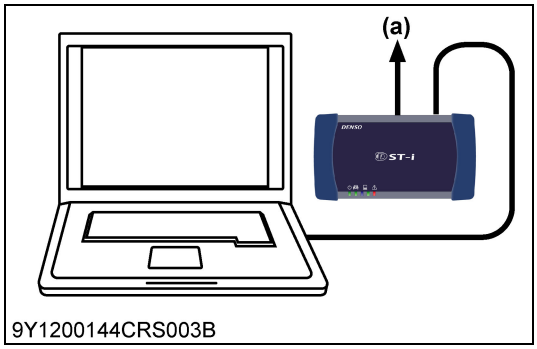
1. Move the key switch from the OFF to the ON position, and measure the voltage between sensor terminals 1 and 2.

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 +B (12 V)
(2) Terminal Ground (Air Flow)
(3) Terminal Signal (Air Flow)
(4) Terminal Signal (Intake Air Temperature)
(5) Terminal Ground (Intake Air Temperature)

9Y1200209CRS0098US0



9Y1200144CRS003B

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

9Y1200209CRS0094US0

(9) 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 0.2 V or less

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- 40 °C (104 °F) [default value]

Recovery from error:
- Diagnostic counter = zero

9Y1200209CRS0099US0

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

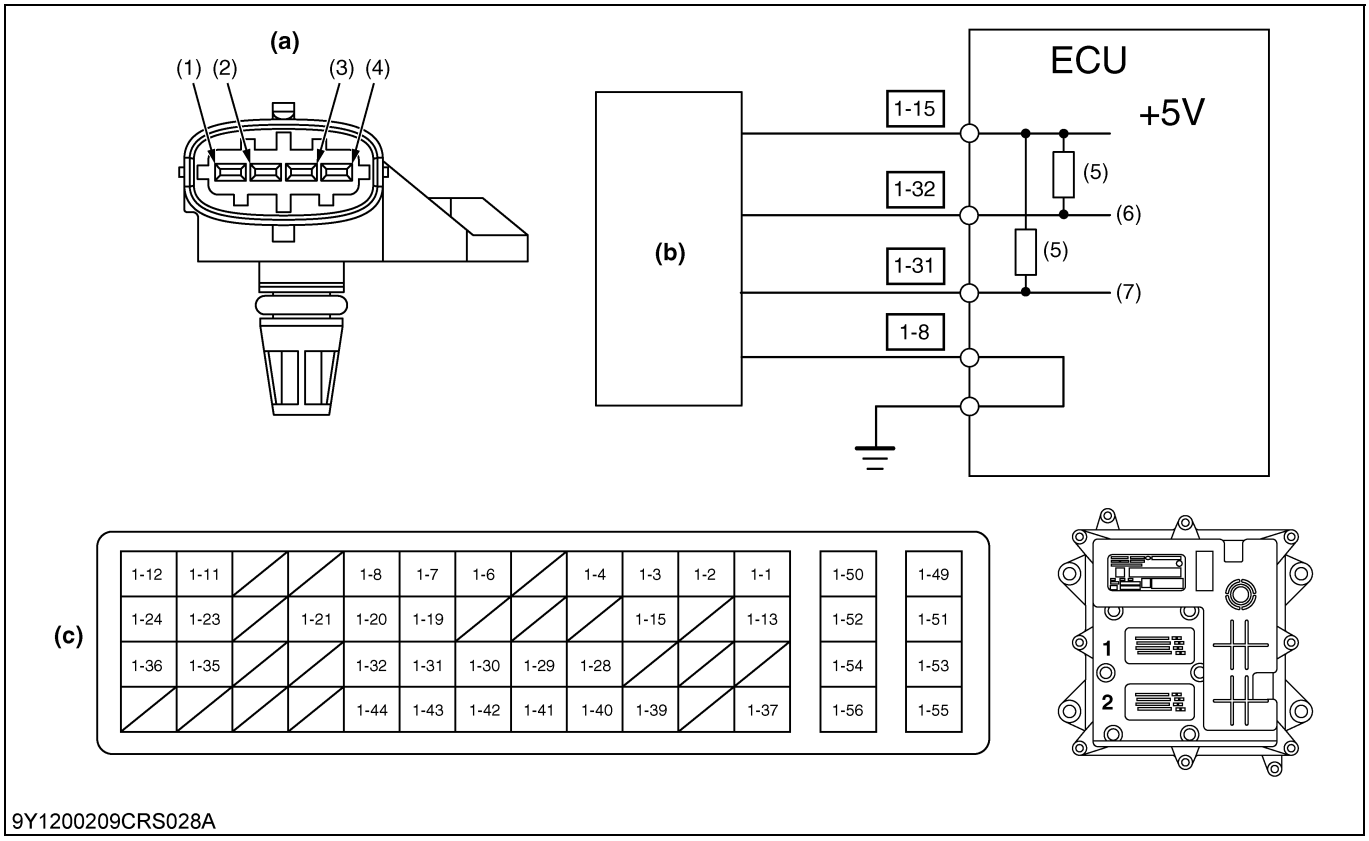
DTC set parameter:
- Voltage of intake air temperature sensor is 4.95 V or above

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- 40 °C (104 °F) [default value]

Recovery from error:
- Diagnostic counter = zero

9Y1200209CRS0100US0

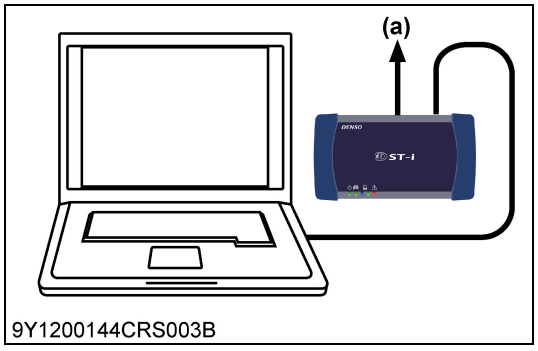


9Y1200209CRS028A

(1) Terminal Signal (Pressure)
(2) Terminal 5 V
(3) Terminal Signal (Temperature)
(4) Terminal Ground
(5) Fuse
(6) Pressure
(7) Temperature

(a) Terminal Layout
(b) Boost Pressure Sensor
(c) ECU Connector 1

9Y1200209CRS0139US0



9Y1200144CRS003B

1. Check the Intake Air Temperature Sensor Signals

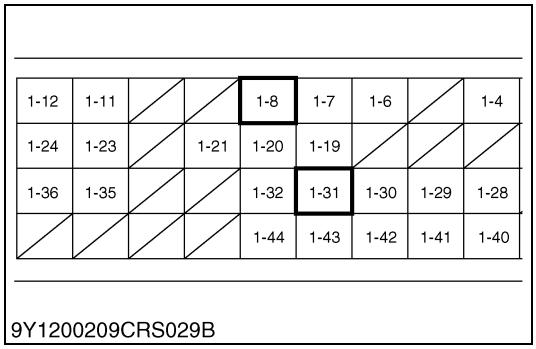
1. Place the key switch in the ON position, and check the "Intake air temperature" and "Intake air temperature sensor output voltage" on the diagnosis tool data monitor.

Factory specification	0.2 V to 4.95 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

9Y1200209CRS0102US0



9Y1200209CRS029B

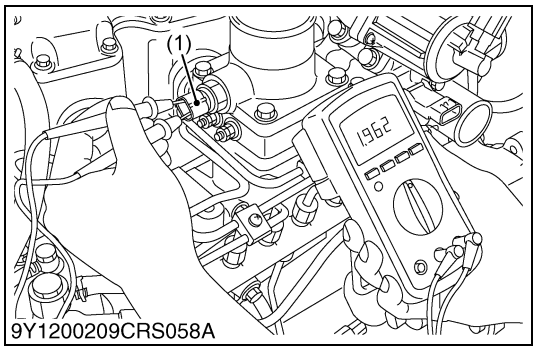
2. Measure the Resistance Between Terminals

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals 1-8 and 1-31 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".

9Y1200209CRS0103US0



9Y1200209CRS058A

3. Check the Sensor

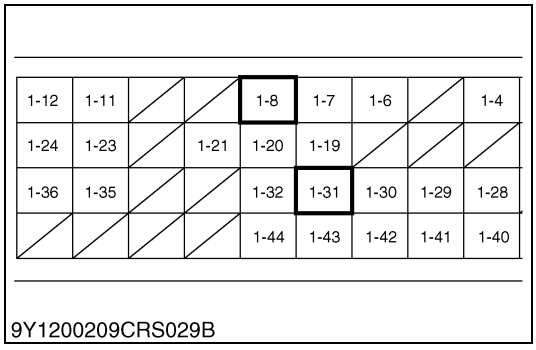
1. Turn the key switch OFF, remove the connector from the sensor side and measure the resistance between the terminals on the sensor side.

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

9Y1200209CRS0104US0



9Y1200209CRS029B

4. Measure the ECU Terminal Voltage

1. Plug the ECU wiring harness connector into socket again, unplug the sensor connector, and measure the voltage between ECU terminals 1-8 and 1-31 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.

9Y1200209CRS0105US0

(10) 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 0.176 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

9Y1200209CRS0106US0

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

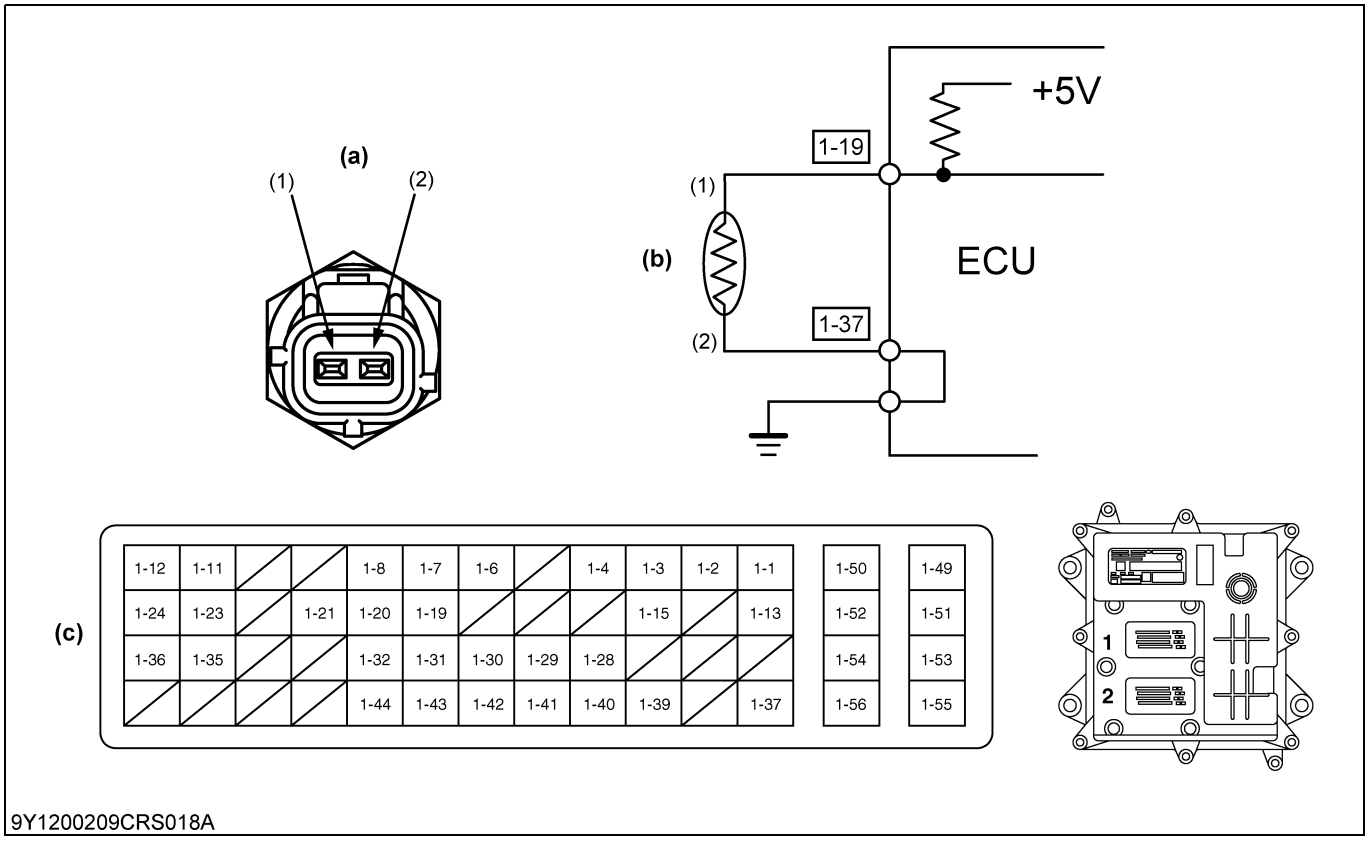
DTC set parameter:
- Voltage of coolant temperature sensor is 4.870 V or above

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

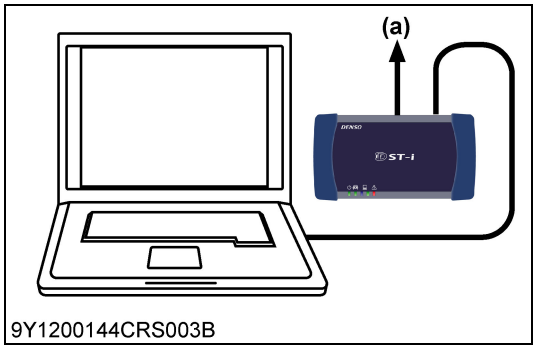
9Y1200209CRS0107US0



9Y1200209CRS018A

(1) Terminal Signal
(2) Terminal GND
(a) Terminal Layout
(b) Coolant Temperature Sensor
(c) ECU Connector 1

9Y1200209CRS0108US0



9Y1200144CRS003B

1. Check the Coolant Temperature Sensor Signals

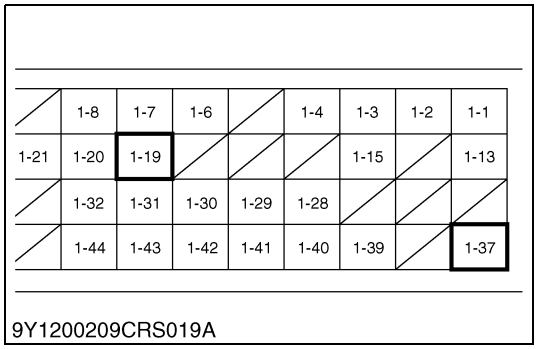
1. Place the key switch in the ON position, and check the "Coolant temperature" and "Coolant temperature sensor output voltage" on the diagnosis tool data monitor.

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

9Y1200209CRS0109US0



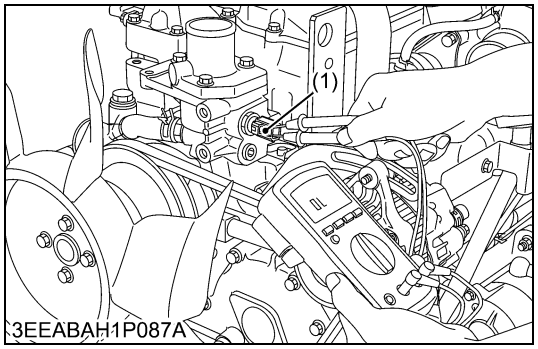
2. Measure the Resistance Between Terminals

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals 1-19 and 1-37 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".

9Y1200209CRS0110US0



3. Check the Sensor

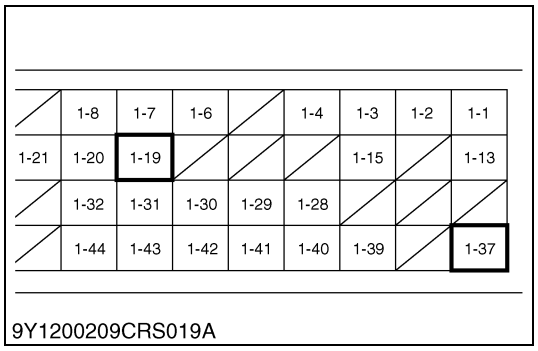
1. Turn the key switch OFF, remove the connector from the sensor side and measure the resistance between the terminals on the sensor side.

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

9Y1200209CRS0111US0



4. Measure the ECU Terminal Voltage

1. Plug the ECU wiring harness connector into socket again, unplug the sensor connector, and measure the voltage between ECU terminals 1-19 and 1-37 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.

9Y1200209CRS0112US0

(11) 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 0.065 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

9Y1200209CRS0113US0

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

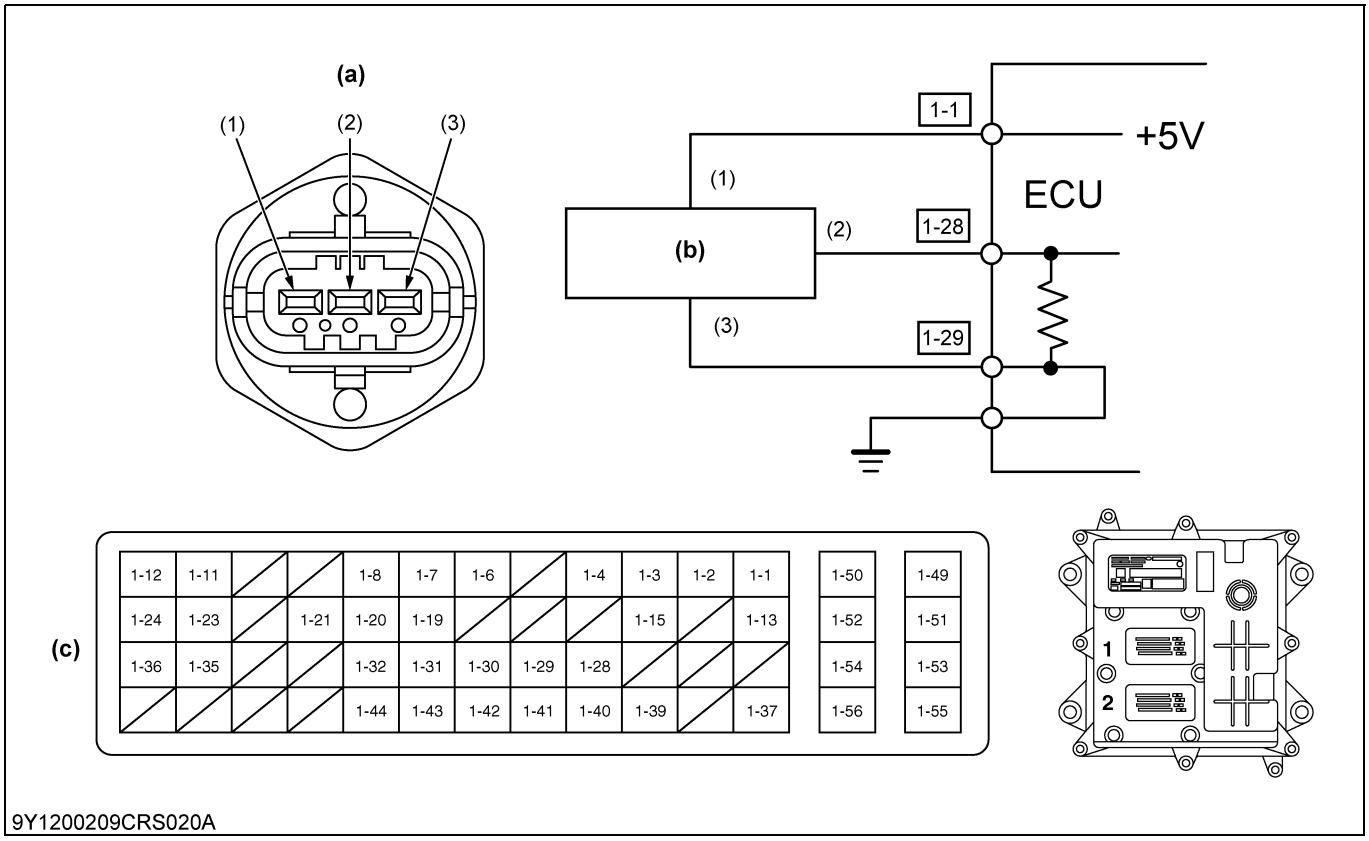
DTC set parameter:
- Voltage of rail pressure sensor is 3.235 V or above

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

9Y1200209CRS0114US0

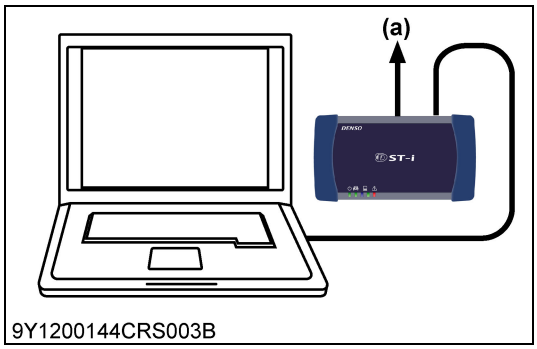


9Y1200209CRS020A

(1) Terminal 5 V
(2) Terminal Signal
(3) Terminal Ground

(a) Terminal Layout
(b) Rail pressure sensor
(c) ECU Connector 1

9Y1200209CRS0115US0



9Y1200144CRS003B

1. Check the Rail Pressure Sensor Signals

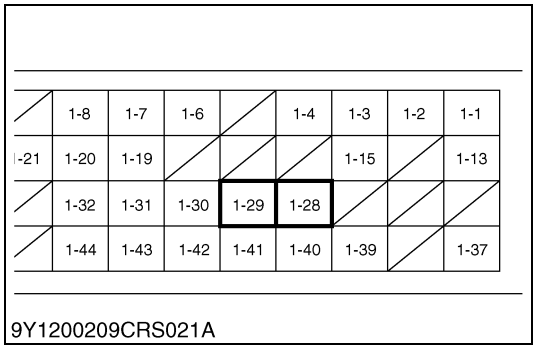
1. Place the key switch in the ON position, and check the "Actual rail pressure" and "Rail pressure sensor output voltage" on the diagnosis tool data monitor.
2. Next, start the engine, change the depressed amount of the accelerator pedal, and check the same items again.

Factory specification	0.7 to 2.5 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 ECU terminal voltage".	

(a) CAN1 Connector

9Y1200209CRS0116US0



9Y1200209CRS021A

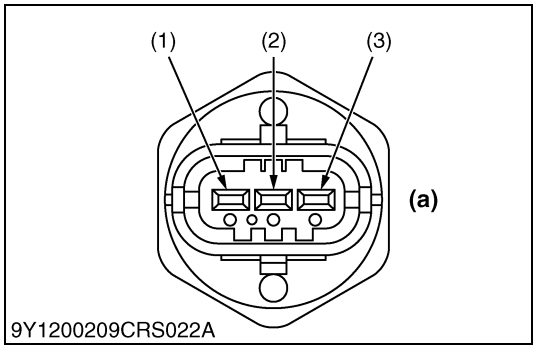
2. Measure the ECU Terminal Voltage

1. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals 1-28 and 1-29.
2. Next, start the engine, change the depressed amount of the accelerator pedal, and check the same items again.

Factory specification	0.7 to 2.5 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	Go to "3. Measure the Voltage Between Rail Pressure Sensor Terminals - 1".	

9Y1200209CRS0117US0



9Y1200209CRS022A

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.

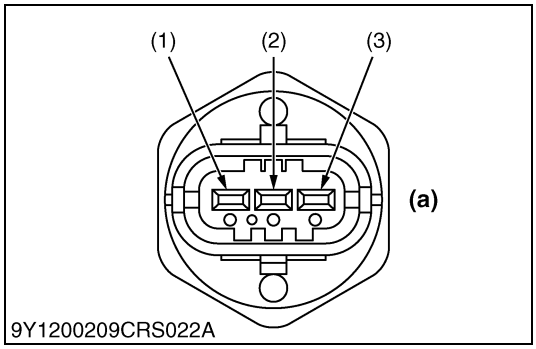
Factory specification	0.7 to 2.5 V

OK	Check the wiring harness (between ECU terminals 1-28 and sensor terminal (2)). → Repair the faulty area.
NG	Go to "4. Measure the Voltage Between Rail Pressure Sensor Terminals - 2".

(1) Terminal 5 V
(2) Terminal Signal
(3) Terminal Ground

(a) Terminal Layout

9Y1200209CRS0118US0



9Y1200209CRS022A

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).

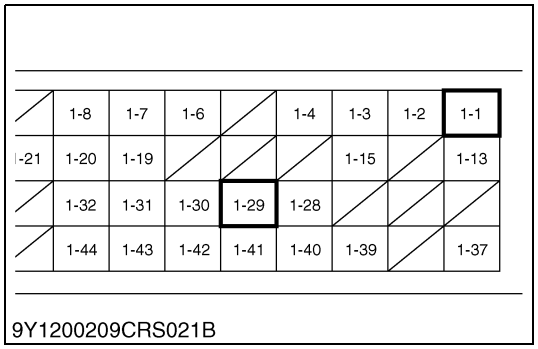
Factory specification	Approx. 5 V

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 5 V
(2) Terminal Signal
(3) Terminal Ground

(a) Terminal Layout

9Y1200209CRS0119US0



9Y1200209CRS021B

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 1-1 and 1-29.

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 1-1 and sensor terminal (1) and between ECU terminal 1-29 and sensor terminal (3)). → Repair the faulty area.	

9Y1200209CRS0120US0

(12) 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

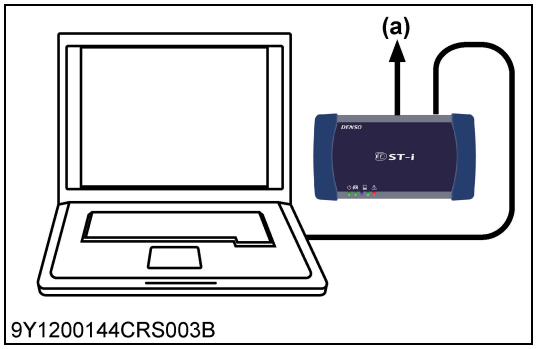
Limp home action by engine ECU (system action):

- 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

9Y1200209CRS0121US0



9Y1200144CRS003B

1. Checking Whether the DTC is Detected Again

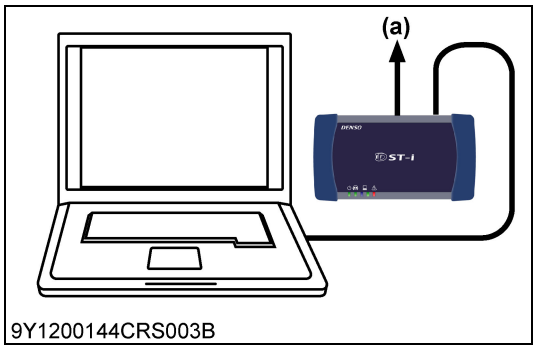
1. Turn the key switch OFF and then ON again.
2. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
3. Check whether or not the same DTC (P0200) is detected.

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

9Y1200209CRS0122US0



9Y1200144CRS003B

2. Replacing the Injector and Checking Whether the DTC Is Detected Again

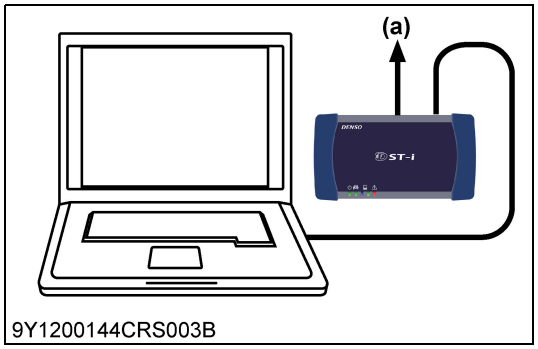
1. Replace the injector.
2. Turn the key switch OFF and then ON again.
3. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
4. Check whether or not the same DTC (P0200) is detected.

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

9Y1200209CRS0123US0



9Y1200144CRS003B

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

9Y1200209CRS0124US0

(13) 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 wiring harness open circuit, coil open circuit
P0202 / 653-3: Engine No. 3 cylinder injector wiring harness open circuit, coil open circuit
P0203 / 654-3: Engine No. 4 cylinder injector wiring harness open circuit, coil open circuit
P0204 / 652-3: Engine No. 2 cylinder injector 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

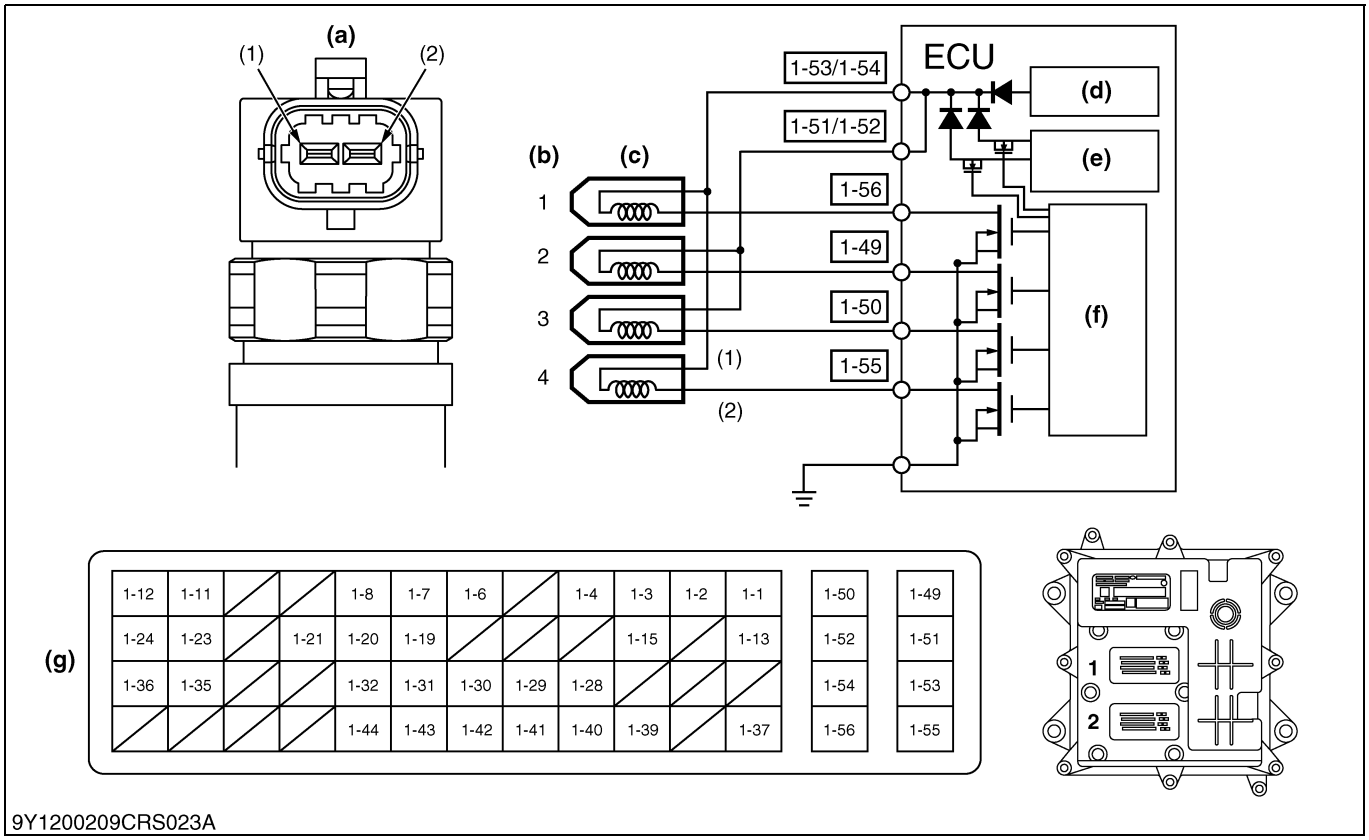
DTC set parameter:
- Open circuit of harness or open circuit of injector coil

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

9Y1200209CRS0125US0

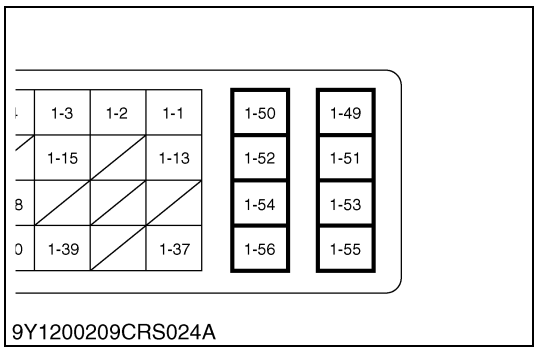


9Y1200209CRS023A

(1) Terminal High
(2) Terminal Low

(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

9Y1200209CRS0126US0



9Y1200209CRS024A

1. Measure the Resistance Between ECU Terminals

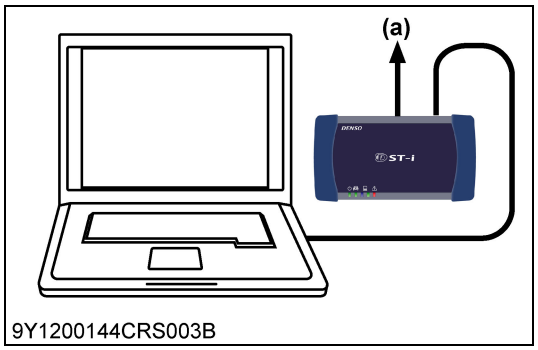
1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance each terminal of the connector.

Engine cylinder	Measurement terminal
No. 1 cylinder	1-53←→1-56
No. 3 cylinder	1-52←→1-49
No. 4 cylinder	1-51←→1-50
No. 2 cylinder	1-54←→1-55

Factory specification	1.5 Ω or lower

OK	Go to "2. Check the DTC".
NG	Go to "4. Measure the Resistance Between Injector Terminals".

9Y1200209CRS0127US0



9Y1200144CRS003B

2. Check the DTC

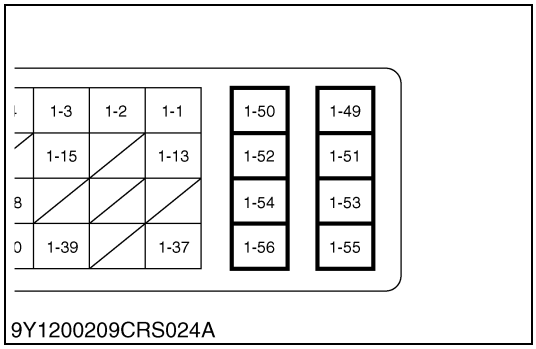
1. Plug the ECU connector into socket, and start the engine.
2. Clear the DTCs that occurred previously, and check the currently existing trouble.

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

9Y1200209CRS0128US0



9Y1200209CRS024A

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.

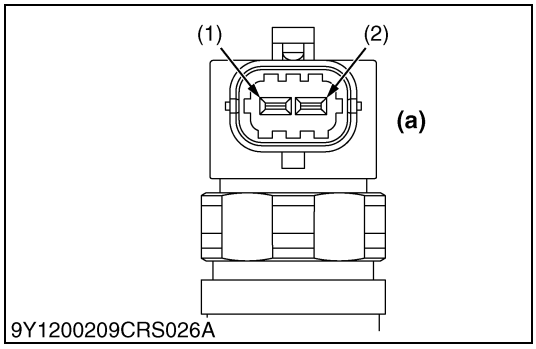
Factory specification	Must be free from faulty connection, deformation, poor contact or other defects.

■ **NOTE**

- **Intermediate connector and wiring harness in head cover should be checked, they are possible cause.**

OK	Check the wiring harness and connector. → Repair.
NG	Check the injector wiring harnesses and connectors. → Repair.

9Y1200209CRS0129US0



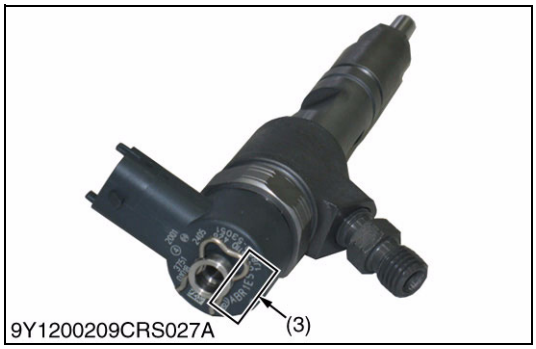
9Y1200209CRS026A

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	0.35 to 0.55 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.)



9Y1200209CRS027A

(1) Terminal High
(2) Terminal Low
(3) ID Code

(a) Injector

9Y1200209CRS0130US0

(14) Engine Overheat (DTC P0217 / 110-0)

Behaviour during malfunction:
- Insufficient output
- Overheat

Detection item:
- Overheat of engine coolant temperature

DTC set preconditions:
- Coolant temperature sensor is normal

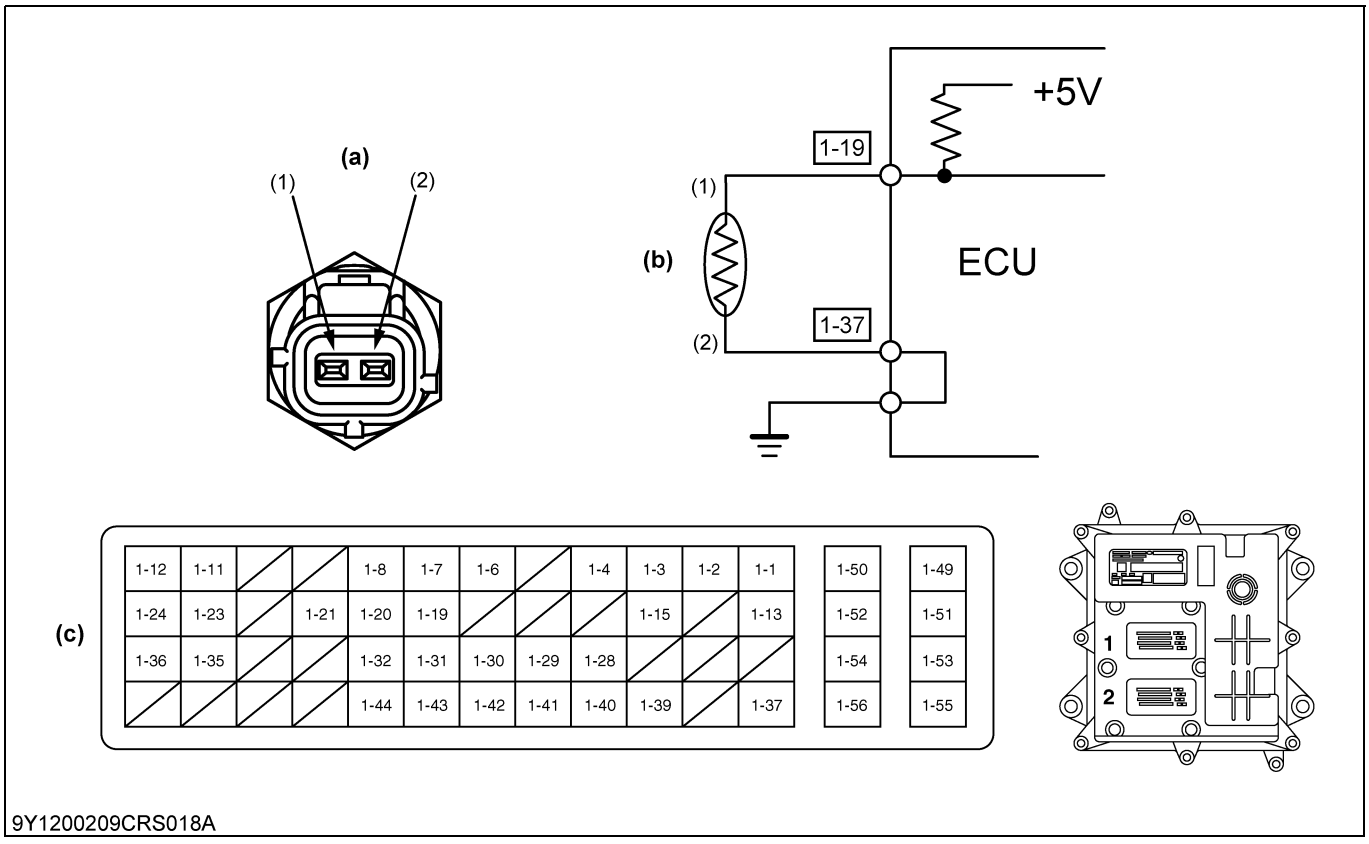
DTC set parameter:
- Engine coolant temperature ≥ 120 °C (248 °F)

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

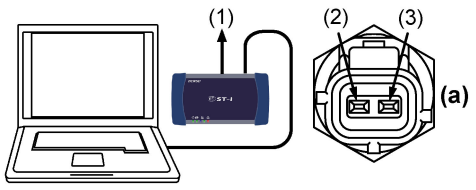
9Y1200209CRS0131US0



9Y1200209CRS018A

(1) Terminal Signal
(2) Terminal Ground
(a) Terminal Layout
(b) Coolant Temperature Sensor
(c) ECU Connector 1

9Y1200209CRS0132US0



9Y1200144CRS006A

	1-8	1-7	1-6		1-4	1-3	1-2	1-1
1-21	1-20	1-19				1-15		1-13
	1-32	1-31	1-30	1-29	1-28			
	1-44	1-43	1-42	1-41	1-40	1-39		1-37

9Y1200209CRS019A

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 Signal
(3) Terminal Ground

(a) Terminal Layout

9Y1200209CRS0133US0

(15) Engine Overrun (DTC P0219 / 190-0)

Behaviour during malfunction:
- Overrun

Detection item:
- Engine speed exceeds threshold speed

DTC set preconditions:
- Key switch is ON

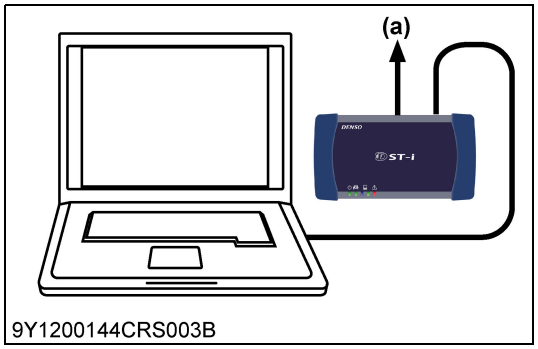
DTC set parameter:
- Engine speed ≥ 3500 min^{-1} (rpm)

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Stop injection (Q = 0 mm^3/st)

Recovery from error:
- Diagnostic counter = zero

9Y1200209CRS0134US0



9Y1200144CRS003B

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

9Y1200209CRS0135US0

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.

9Y1200209CRS0136US0

(16) Boost Pressure Sensor Abnormality (DTC P0237 / 102-4, P0238 / 102-3)

P0237 / 102-4: Boost pressure 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/cm^2, 9.4 psi) [default value]

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0137US0

P0238 / 102-3: Boost pressure 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

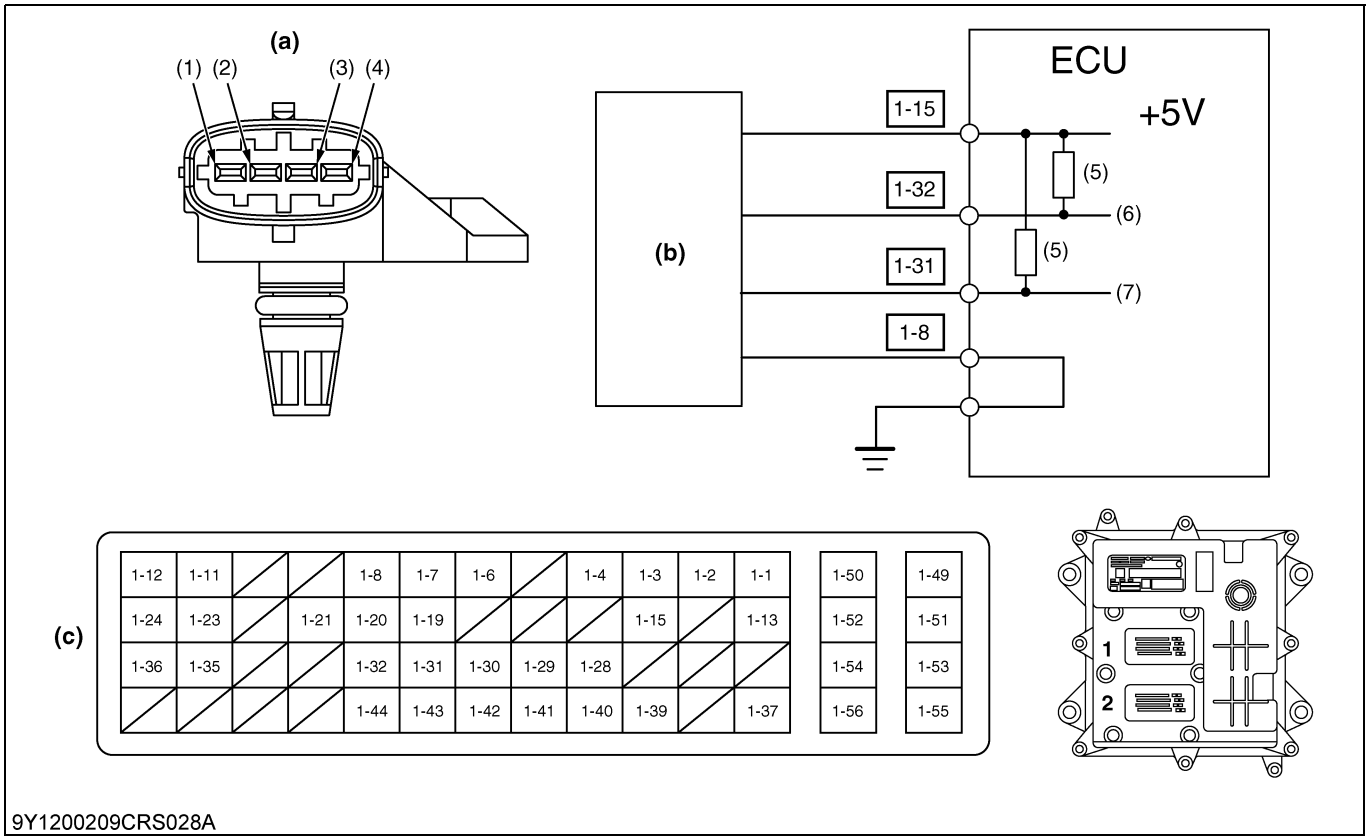
DTC set parameter:
- Voltage of boost pressure sensor is 4.9 V or above

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- 65 kPa (0.66 kgf/cm^2, 9.4 psi) [default value]

Recovery from error:
- Key switch turn OFF

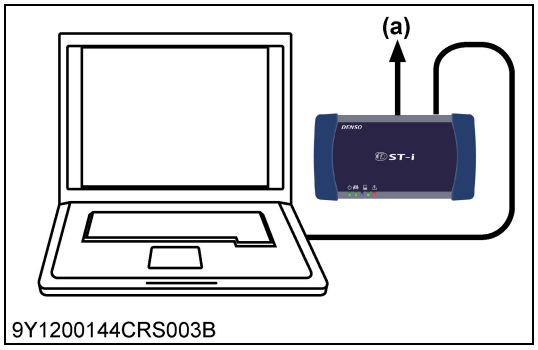
9Y1200209CRS0138US0



(1) Terminal Signal (Pressure)
(2) Terminal 5 V
(3) Terminal Signal (Temperature)
(4) Terminal Ground
(5) Fuse
(6) Pressure
(7) Temperature

(a) Terminal Layout
(b) Boost Pressure Sensor
(c) ECU Connector 1

9Y1200209CRS0139US0



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.

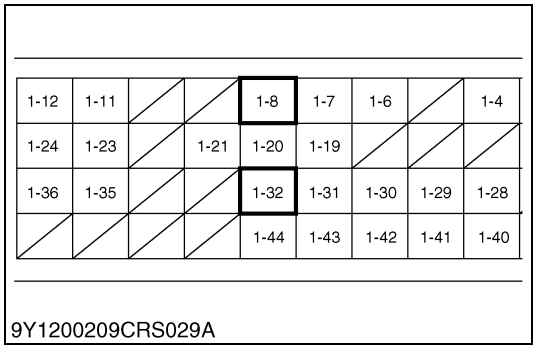
Factory specification		
Engine state	Actual boost pressure	Output voltage
Key switch is ON	Approx. 100 kPa (1.02 kgf/cm^2, 14.5 psi)	Approx. 1.0 V
After engine start-up	100 to 180 kPa (1.02 to 1.83 kgf/cm^2, 14.5 to 26.1 psi)	1.0 to 2.2 V

■ **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

9Y1200209CRS0140US0



9Y1200209CRS029A

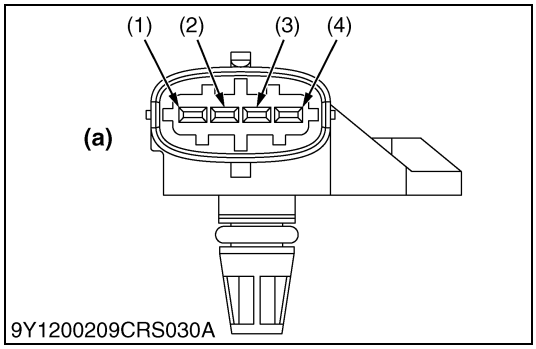
2. Measure the ECU Terminal Voltage

1. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals 1-32 and 1-8.
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".	

9Y1200209CRS0141US0



9Y1200209CRS030A

3. Measure the Voltage Between Boost Pressure Sensor Terminals

1. Place the key switch in the ON position, and measure the voltage between terminals (1) and (4) 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.

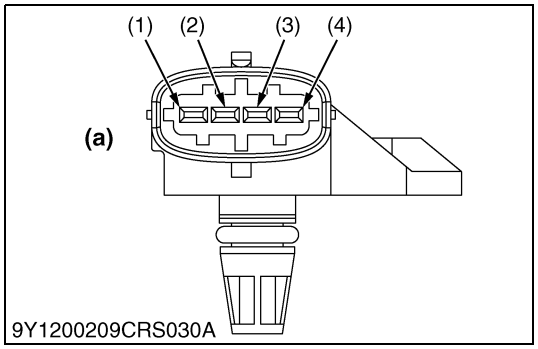
Factory specification	
Engine state	Output voltage
Key switch ON	Approx. 1.0 V
After engine start-up	1.0 to 2.2 V

OK	Check the wiring harness (between ECU terminal 1-32 and sensor terminal (1)). → Repair the faulty area.
NG	Go to "4. Measure the Voltage Between Boost Pressure Sensor Terminals".

(1) Terminal Signal (Pressure)
(2) Terminal 5 V
(3) Terminal Signal (Temperature)
(4) Terminal Ground

(a) Terminal Layout

9Y1200209CRS0142US0



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 (2) and (4) of the boost pressure sensor connector (at the wiring harness side).

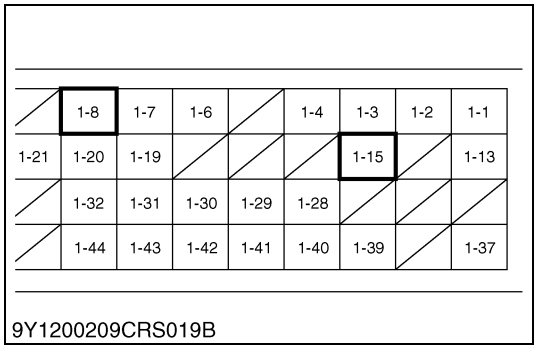
Factory specification	Approx. 5 V

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 Signal (Pressure)
(2) Terminal 5 V
(3) Terminal Signal (Temperature)
(4) Terminal Ground

(a) Terminal Layout

9Y1200209CRS0143US0



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 1-8 and 1-15.

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 1-8 and sensor terminal (4) and between ECU terminal 1-15 and sensor terminal (2)). → 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.**

9Y1200209CRS0144US0

(17) 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

9Y1200209CRS0145US0

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 58 teeth

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition

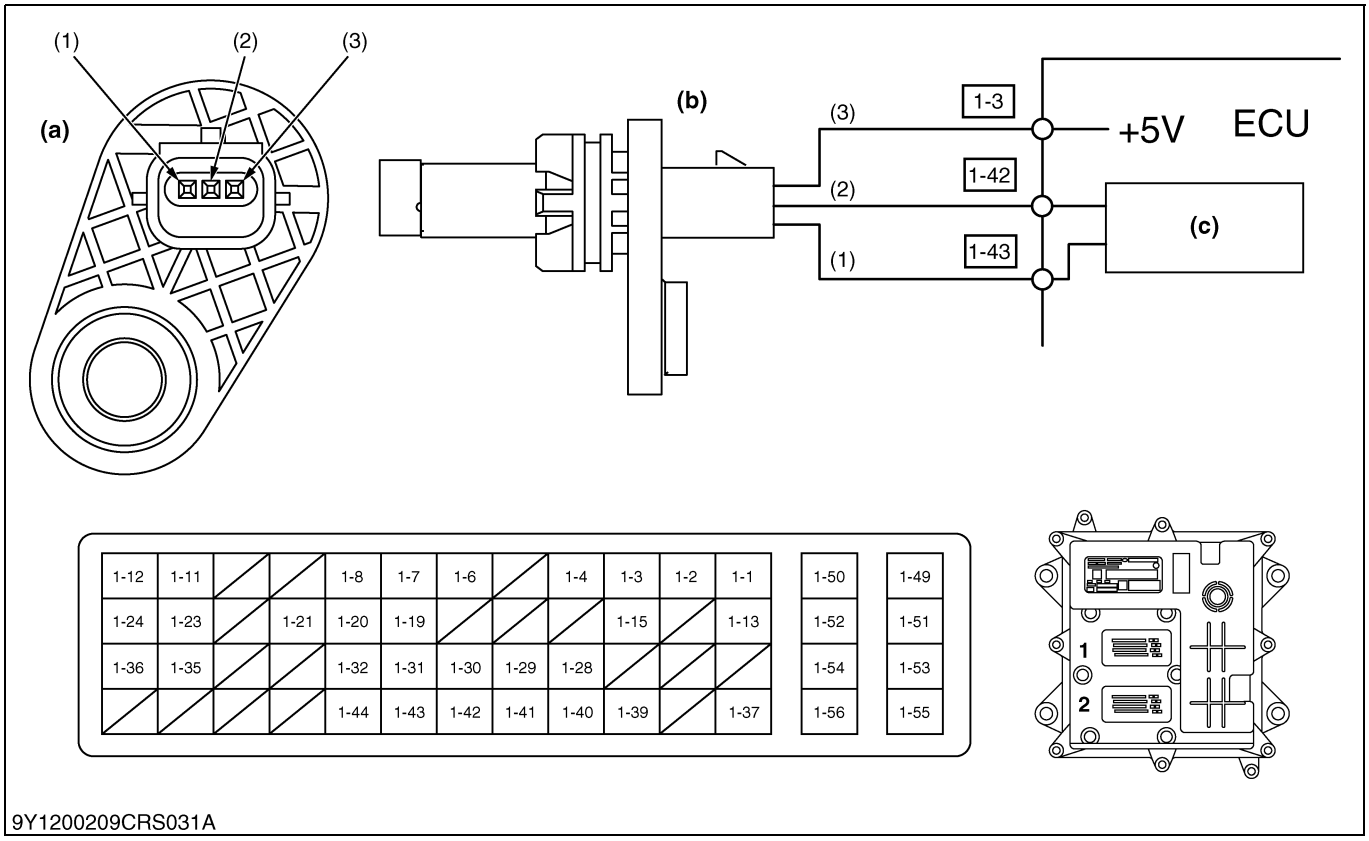
■ **NOTE**

- **Engine will stop if both NE and G fail**

Recovery from error:

- Diagnostic counter = zero

9Y1200209CRS0146US0

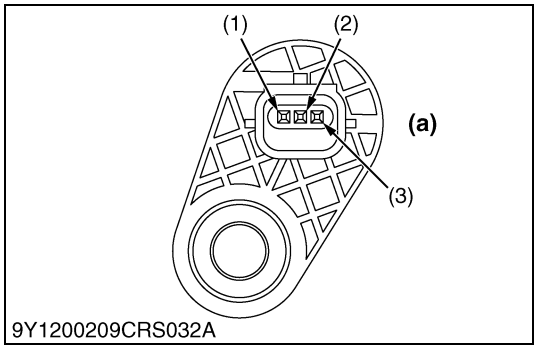


9Y1200209CRS031A

(1) Terminal Ground
(2) Terminal Signal
(3) Terminal 5 V

(a) Terminal Layout
(b) Crankshaft Position Sensor (NE Sensor)
(c) NE Sensor Input Circuit
(d) ECU Connector 1

9Y1200209CRS0147US0



9Y1200209CRS032A

1. 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 terminal (1) and (3) terminal at the wiring harness side.

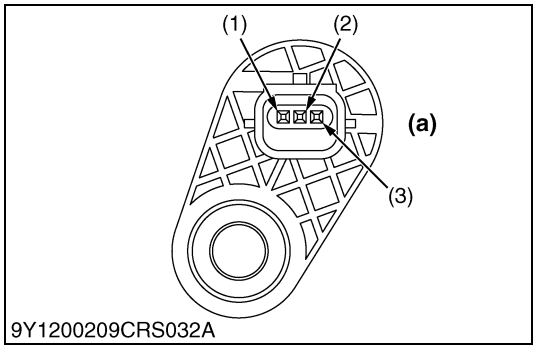
Factory specification	Approx. 5 V

OK	Go to "2. Check the Connectors".
NG	Go to "4. Measure the ECU Terminal Voltage".

(1) Terminal Ground
(2) Terminal Signal
(3) Terminal 5 V

(a) Terminal Layout

9Y1200209CRS0149US0



9Y1200209CRS032A

2. Check the Connectors

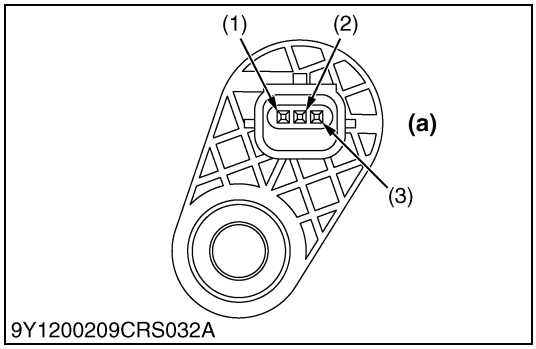
1. Check the sensor and wiring harness connectors for incorrect connection, inappropriate fitting, poor contact or other faulty areas.

Factory specification	Must be free from incorrect connection, inappropriate fitting, poor contact.

OK	Go to "3. Check the Wiring Harness".
NG	Repair or replace.

(1) Terminal Ground
(2) Terminal Signal
(3) Terminal 5 V
(a) Terminal Layout

9Y1200209CRS0150US0



9Y1200209CRS032A

3. Check the Wiring Harness

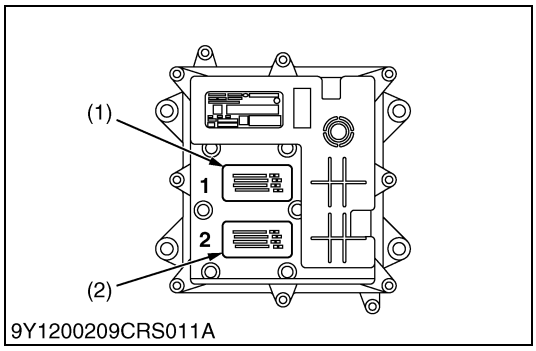
1. Check the wiring harness between terminal (2) of sensor and ECU for a short or an open circuit.

Factory specification	Must be free from shorts and open circuit.

OK	The sensor has abnormality. → Replace.
NG	Repair.

(1) Terminal Ground
(2) Terminal Signal
(3) Terminal 5 V
(a) Terminal Layout

9Y1200209CRS0151US0



9Y1200209CRS011A

4. Measure the ECU Terminal Voltage

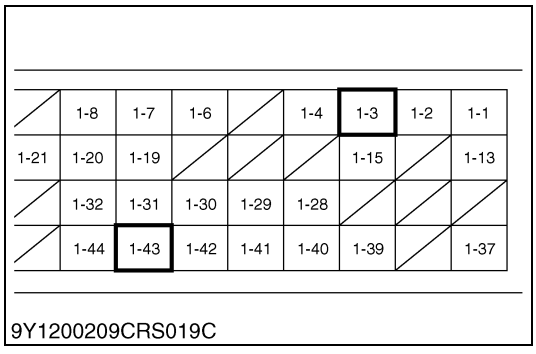
1. Place the key switch in the OFF position, and unplug the ECU wiring harness connector 1 (1) from the socket.
2. Place the key switch in the ON position, and measure the voltage between ECU terminals 1-3 and 1-43.

Factory specification	Approx. 5 V

OK	Go to "5. Check the Connectors".
NG	Replace the ECU.

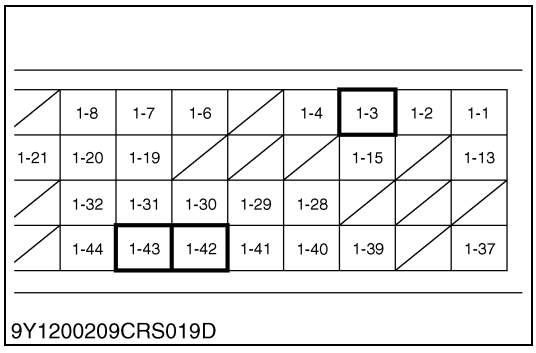
(1) ECU Wiring Harness Connector 1 (Engine Side)
(2) ECU Wiring Harness Connector 2 (Machine Side)

9Y1200209CRS0152US0



	1-8	1-7	1-6		1-4	1-3	1-2	1-1
1-21	1-20	1-19				1-15		1-13
	1-32	1-31	1-30	1-29	1-28			
	1-44	1-43	1-42	1-41	1-40	1-39		1-37

9Y1200209CRS019C



	1-8	1-7	1-6		1-4	1-3	1-2	1-1
1-21	1-20	1-19				1-15		1-13
	1-32	1-31	1-30	1-29	1-28			
	1-44	1-43	1-42	1-41	1-40	1-39		1-37

9Y1200209CRS019D

5. Check the Connectors

1. Check ECU terminals 1-3, 1-42, 1-43 (at the ECU side) and the connectors (at the wiring harness side) for incorrect connection, inappropriate fitting, poor contact.

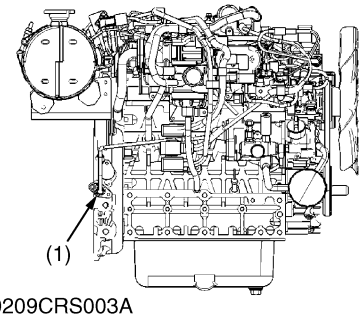
Factory specification	Must be free from incorrect connection, inappropriate fitting, poor contact.

OK	Go to "6. Check the Wiring Harness".
NG	Repair or replace.

9Y1200209CRS0153US0

	1-8	1-7	1-6		1-4	1-3	1-2	1-1
1-21	1-20	1-19				1-15		1-13
	1-32	1-31	1-30	1-29	1-28			
	1-44	1-43	1-42	1-41	1-40	1-39		1-37

9Y1200209CRS019D



9Y1200209CRS003A

6. Check the Wiring Harness

1. Check the wiring harness being connected to ECU terminals 1-3, 1-42, 1-43 for a short or an open circuit.

Factory specification	Must be free from shorts and open circuit.

OK	Go to "7. Check the Sensor".
NG	Repair.

9Y1200209CRS0154US0

7. 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)

9Y1200209CRS0155US0

(18) 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

9Y1200209CRS0157US0

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 3 teeth

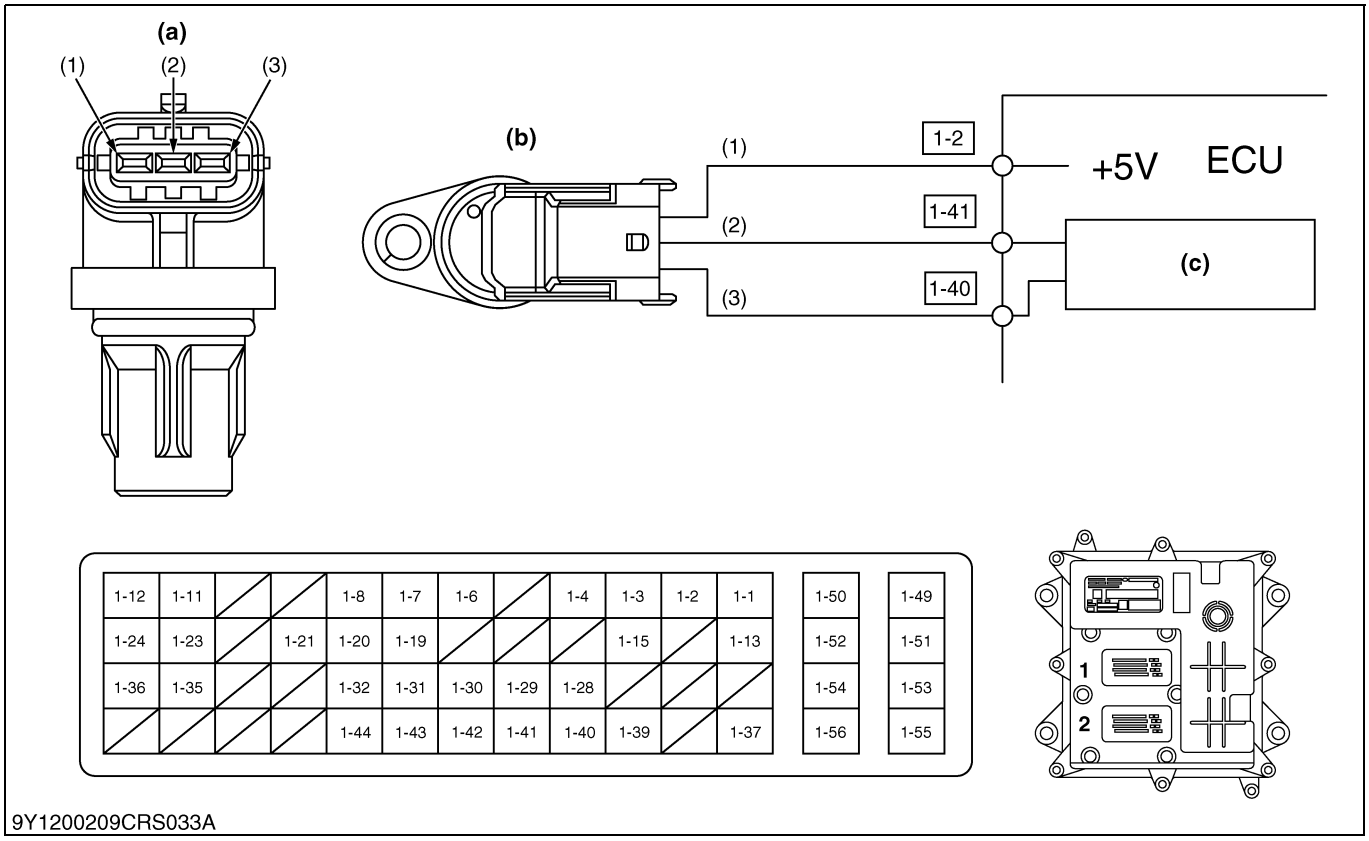
Engine warning light:
- ON

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

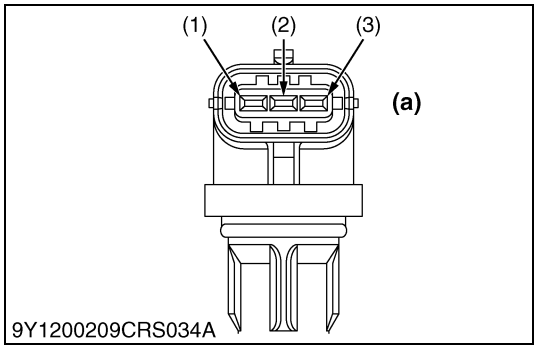
9Y1200209CRS0158US0



(1) Terminal 5 V
(2) Terminal Signal
(3) Terminal Ground

(a) Terminal Layout
(b) Camshaft Position Sensor (G Sensor)
(c) G Sensor Input Circuit
(d) ECU Connector 1

9Y1200209CRS0159US0



1. 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 (1) and (3) terminals at the wiring harness side.

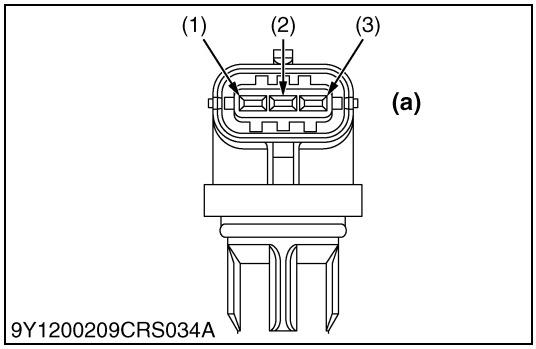
Factory specification	Approx. 5 V

OK	Go to "2. Check the Connectors".
NG	Go to "4. Measure the ECU Terminal Voltage".

(1) Terminal 5 V
(2) Terminal Signal
(3) Terminal Ground

(a) Terminal Layout

9Y1200209CRS0161US0



9Y1200209CRS034A

2. Check the Connectors

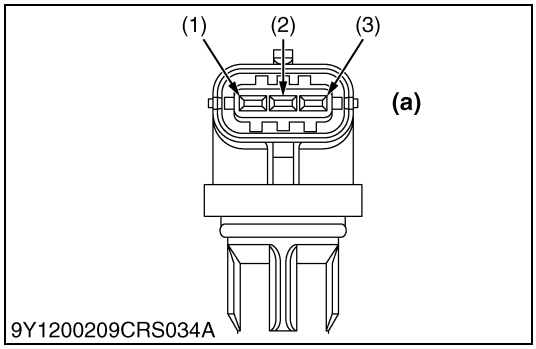
1. Check the sensor and wiring harness connectors for incorrect connection, inappropriate fitting, poor contact or other faulty areas.

Factory specification	Must be free from incorrect connection, inappropriate fitting, poor contact.

OK	Go to "3. Check the Wiring Harness".
NG	Repair or replace.

(1) Terminal 5 V
(2) Terminal Signal
(3) Terminal Ground
(a) Terminal Layout

9Y1200209CRS0162US0



9Y1200209CRS034A

3. Check the Wiring Harness

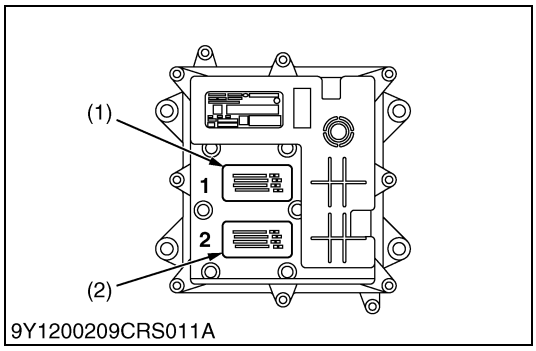
1. Check the wiring harness between G+ terminal of sensor and ECU for a short or an open circuit.

Factory specification	Must be free from shorts and open circuit.

OK	The sensor has abnormality. → Replace.
NG	Repair.

(1) Terminal 5 V
(2) Terminal Signal
(3) Terminal Ground
(a) Terminal Layout

9Y1200209CRS0163US0



9Y1200209CRS011A

4. Measure the ECU Terminal Voltage

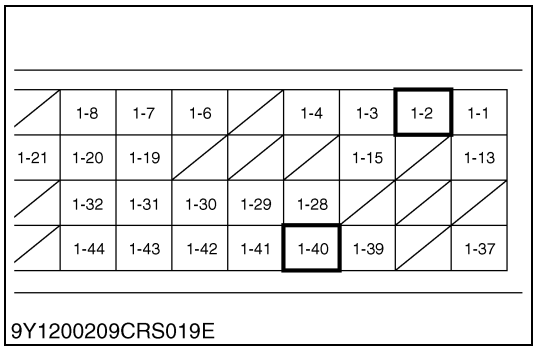
1. Place the key switch in the OFF position, and unplug the ECU wiring harness connector 1 (1) from the socket.
2. Place the key switch in the ON position, and measure the voltage between ECU terminals 1-2 and 1-40.

Factory specification	Approx. 5 V

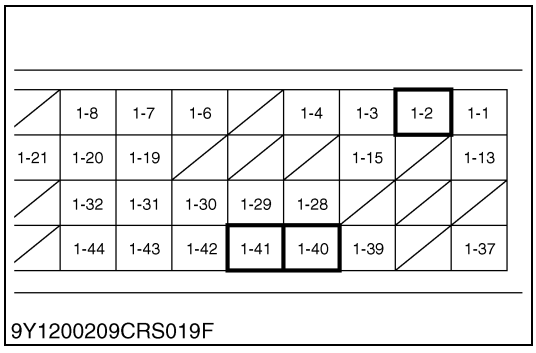
OK	Go to "5. Check the Connectors".
NG	Replace the ECU.

(1) ECU Wiring Harness Connector 1 (Engine Side)
(2) ECU Wiring Harness Connector 2 (Machine Side)

9Y1200209CRS0164US0



9Y1200209CRS019E



9Y1200209CRS019F

5. Check the Connectors

1. Check ECU terminals 1-2, 1-40, 1-41 (at the ECU side) and the connectors (at the wiring harness side) for incorrect connection, inappropriate fitting, poor contact.

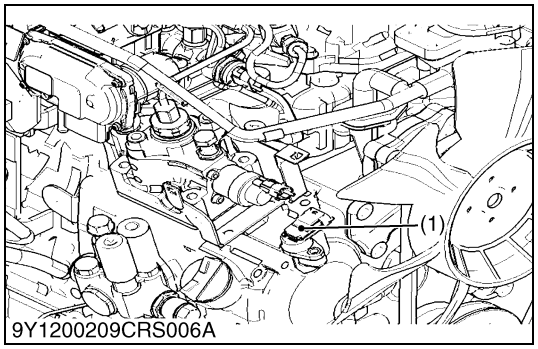
Factory specification	Must be free from incorrect connection, inappropriate fitting, poor contact.

OK	Go to "6. Check the Wiring Harness".
NG	Repair or replace.

9Y1200209CRS0165US0

	1-8	1-7	1-6		1-4	1-3	1-2	1-1
1-21	1-20	1-19				1-15		1-13
	1-32	1-31	1-30	1-29	1-28			
	1-44	1-43	1-42	1-41	1-40	1-39		1-37

9Y1200209CRS019F



9Y1200209CRS006A

6. Check the Wiring Harness

1. Check the wiring harness being connected to ECU terminals 1-2, 1-40, 1-41 for a short or an open circuit.

Factory specification	Must be free from shorts and open circuit.

OK	Go to "7. Check the Sensor".
NG	Repair.

9Y1200209CRS0166US0

7. 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) Camshaft Position Sensor (G Sensor)

9Y1200209CRS0167US0

(19) Glow Relay Driving Circuit Abnormality (DTC P0380 / 676-5 / 523544-3 / 523544-4, P0381 / 676-0)

■ **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 / 676-5: Open circuit of glow relay driving circuit
Behaviour during malfunction (At low temperature):

- Faulty starting
- Increase in white smoke

Detection item:

- Open circuit of glow relay

DTC set preconditions:

- Battery voltage is normal
- Glow relay is being energized

DTC set parameter:

- Open circuit of harness or relay coil

Engine warning light:

- ON

Limp home action by engine ECU (system action):

- None

Recovery from error:

- Key switch turn OFF

9Y1200209CRS0542US0

P0380 / 523544-3: +B short of glow 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
- Glow relay is being energized

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

9Y1200209CRS0168US0

P0380 / 523544-4: Ground short of glow relay driving circuit
Behaviour during malfunction (At low temperature):
- Faulty starting
- Increase in white smoke

Detection item:
- Ground short or open circuit of glow relay driving circuit

DTC set preconditions:
- Battery voltage is normal
- Glow relay is being energized

DTC set parameter:
- Ground short circuit of harness

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- None

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0169US0

P0381 / 676-0: Glow heater relay driving circuit overheat
Behaviour during malfunction (At low temperature):
- Faulty starting
- Increase in white smoke

Detection item:
- Overheat of glow plug driving circuit

DTC set preconditions:
- Battery voltage is normal
- Glow relay is being energized

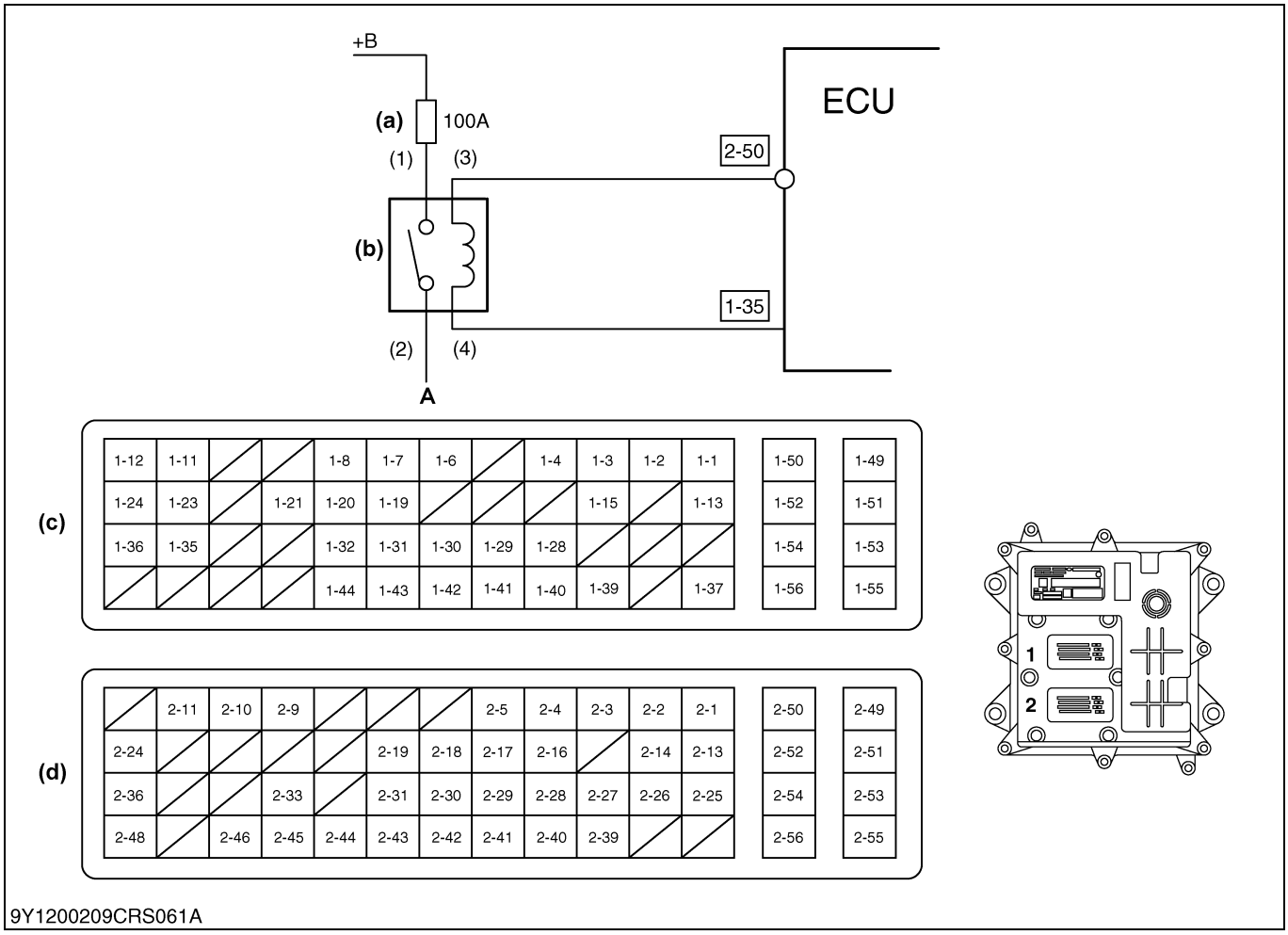
DTC set parameter:
- Glow relay coil resistance or load is too high that the specified value of ECU

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- None

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0543US0



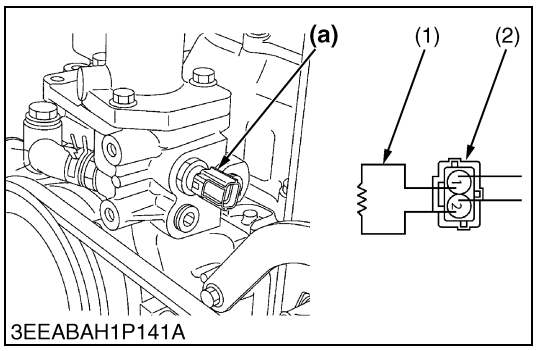
9Y1200209CRS061A

(1) Terminal +B
(2) Terminal Glow Plug
(3) Terminal Glow Relay (+)
(4) Terminal Ground

(a) Fuse
(b) Glow Relay
(c) ECU Connector 1
(d) ECU Connector 2

A: To Glow Plug

9Y1200209CRS0170US0



3EEABAH1P141A

1. Check the Glow Relay Signal

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.

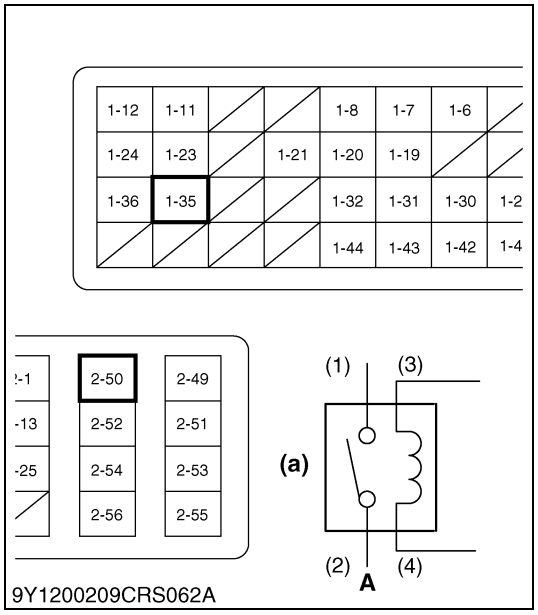
Factory specification	ON

OK	Normal.
NG	Go to "2. Check the Wiring Harness / Connector".

(1) Dummy Resistor
(2) Connector

(a) Coolant Temperature Sensor

9Y1200209CRS0171US0



2. Check the Wiring Harness / Connector

1. Remove the connector from the ECU side and check the state of the continuity between terminal 2-50 and (3).
2. Next, check the state of the continuity between terminal 1-35 and (4).

Factory specification	Both have continuity

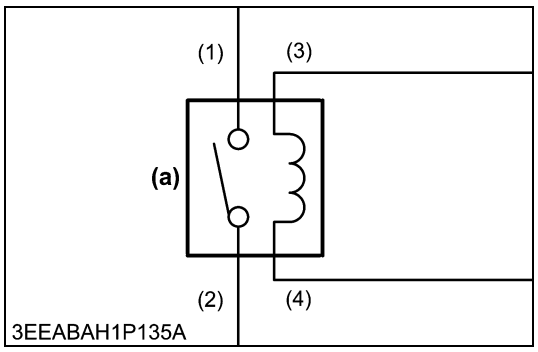
3. Check the connector for poor connection, engagement and contact.

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 Glow Plug
(3) Terminal Glow Relay (+)
(4) Terminal Ground
(a) Glow Relay
A: To Glow Plug

9Y1200209CRS0172US0



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

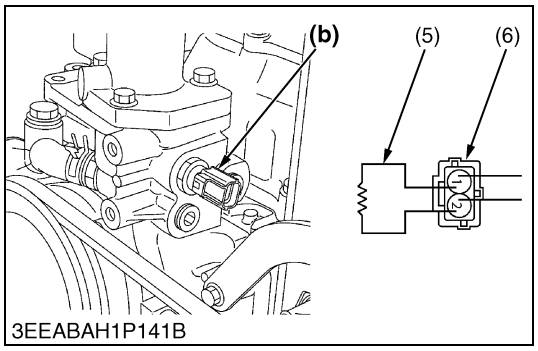
3. Check the state of the continuity between (1) and (2).

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)).

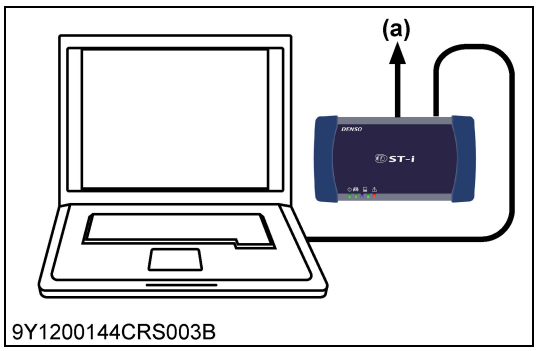
Factory specification	Coil resistance value of relay to use

OK	Go to "4. ECU Replacement Check".
NG	Relay fault → Replace.



(1) Terminal +B
(2) Terminal Glow Plug
(3) Terminal Glow Relay (+)
(4) Terminal Ground
(5) Dummy Resistor
(6) Connector
(a) Glow Relay
(b) Coolant Temperature Sensor

9Y1200209CRS0173US0



4. ECU Replacement Check

1. Replace the ECU and perform the previous "Check the Glow Relay signal".

OK	ECU fault → Replace the ECU.

(a) CAN1 Connector

9Y1200209CRS0174US0

(20) 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

9Y1200209CRS0175US0

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

9Y1200209CRS0176US0

P0409 / 523572-4: EGR position sensor failure

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas performance

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

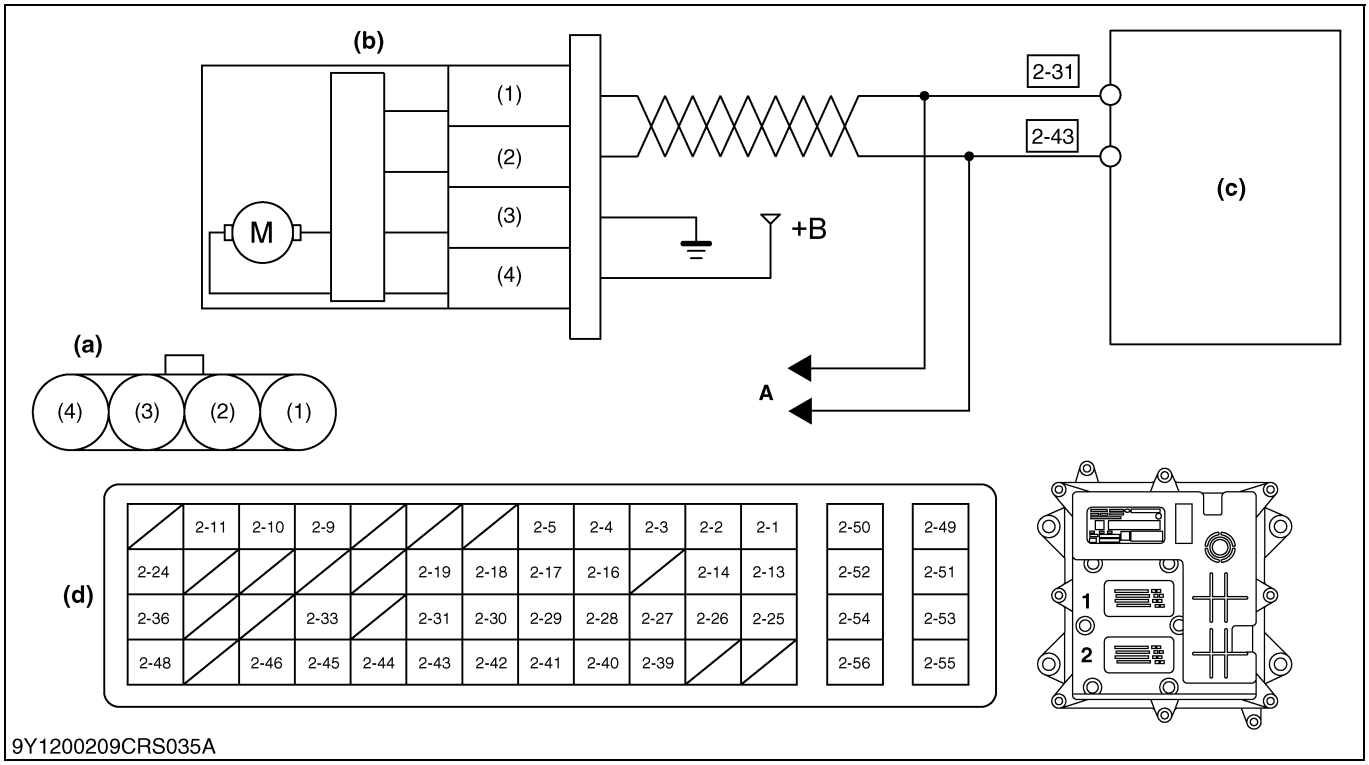
Limp home action by engine ECU (system action):

- Output limitation: Approximately 75 % of normal condition
- EGR stop

Recovery from error:

- Key switch turn OFF

9Y1200209CRS0177US0



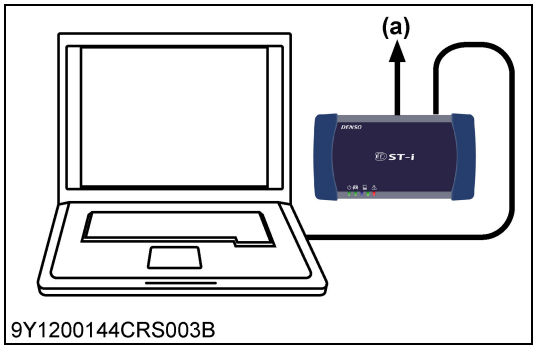
9Y1200209CRS035A

(1) Terminal CAN-H
(2) Terminal CAN-L
(3) Terminal Ground
(4) Terminal +B (12 V)

(a) Terminal Layout
(b) EGR Valve Assembly
(c) Engine ECU
(d) ECU Connector 2

A: To Diagnosis Tool

9Y1200209CRS0178US0



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 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

9Y1200209CRS0179US0

(21) Oil Pressure Error (P0524 / 100-1)

Behaviour during malfunction:
- Engine stops

Detection item:
- Oil pressure switch

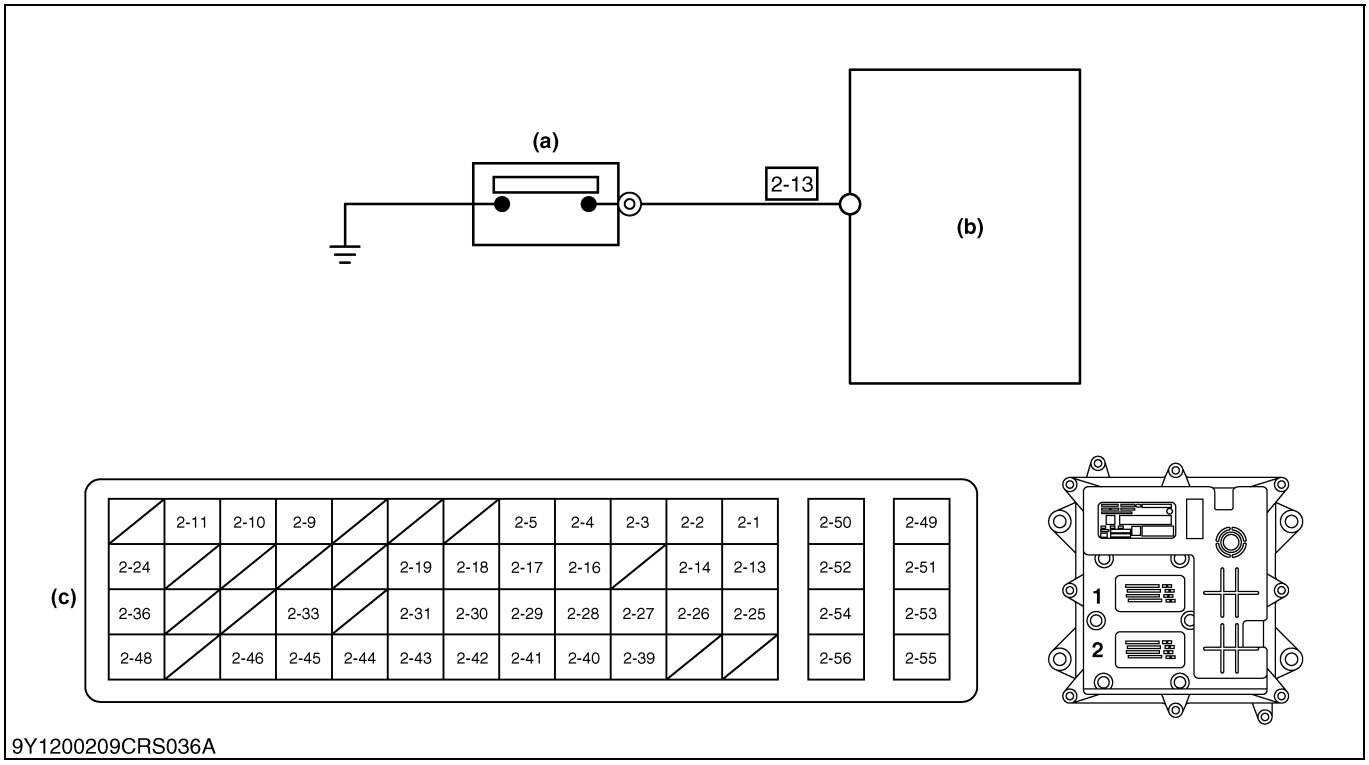
DTC set preconditions:
- Battery voltage is normal
- Key switch turn ON
- Starter Switch signal is not activated
- 10 sec or more after engine start [700 min^{-1} (rpm) or higher]

DTC set parameter:
- Oil pressure switch ON: continues one sec or more

Engine warning light:
- ON

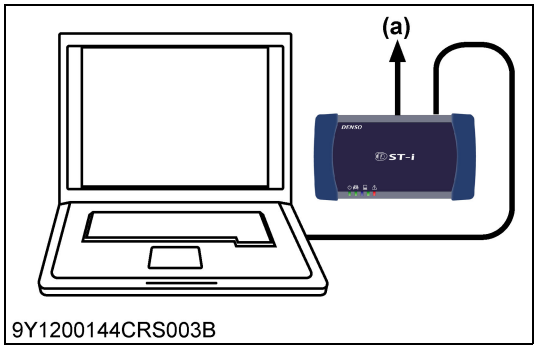
Limp home action by engine ECU (system action):
- None

Recovery from error:
- Key switch turn OFF



(a) Oil Pressure Switch **(b) Engine ECU** **(c) ECU Connector 2**

9Y1200209CRS0180US0



1. DTC Judgment

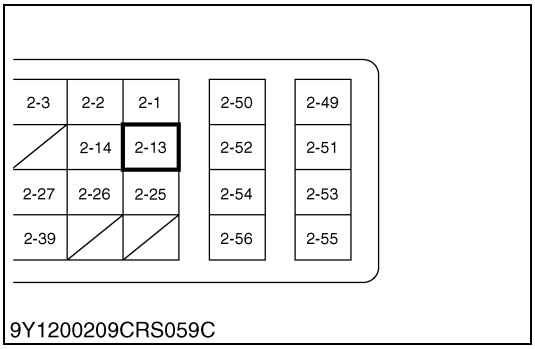
1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Place the key switch in the ON position, check whether the DTC (P0524) is output or not.

Factory specification	DTC (P0524) must not be output.

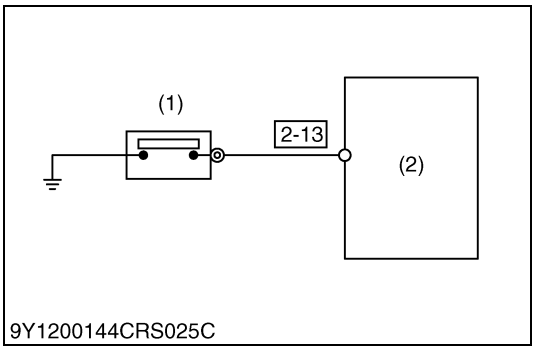
OK	Normal.
NG	Go to "2. Check the Wiring Related to the Oil Pressure Switch".

(a) CAN1 Connector

9Y1200209CRS0181US0



9Y1200209CRS059C



9Y1200144CRS025C

2. Check the Wiring Related to the Oil Pressure Switch

1. Check the connector and the wiring harness being connected to ECU terminal 2-13 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-S275.)**

OK	Go to "3. Check the Oil Pressure Switch".
NG	Repair or replace the faulty areas.

9Y1200209CRS0182US0

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

9Y1200209CRS0183US0

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"

9Y1200209CRS0184US0

5. Check the Engine

1. Check the inside of the engine (oil passage).

OK	Normal.
NG	Repair the malfunction.

9Y1200209CRS0185US0

(22) 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

9Y1200209CRS0186US0

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.

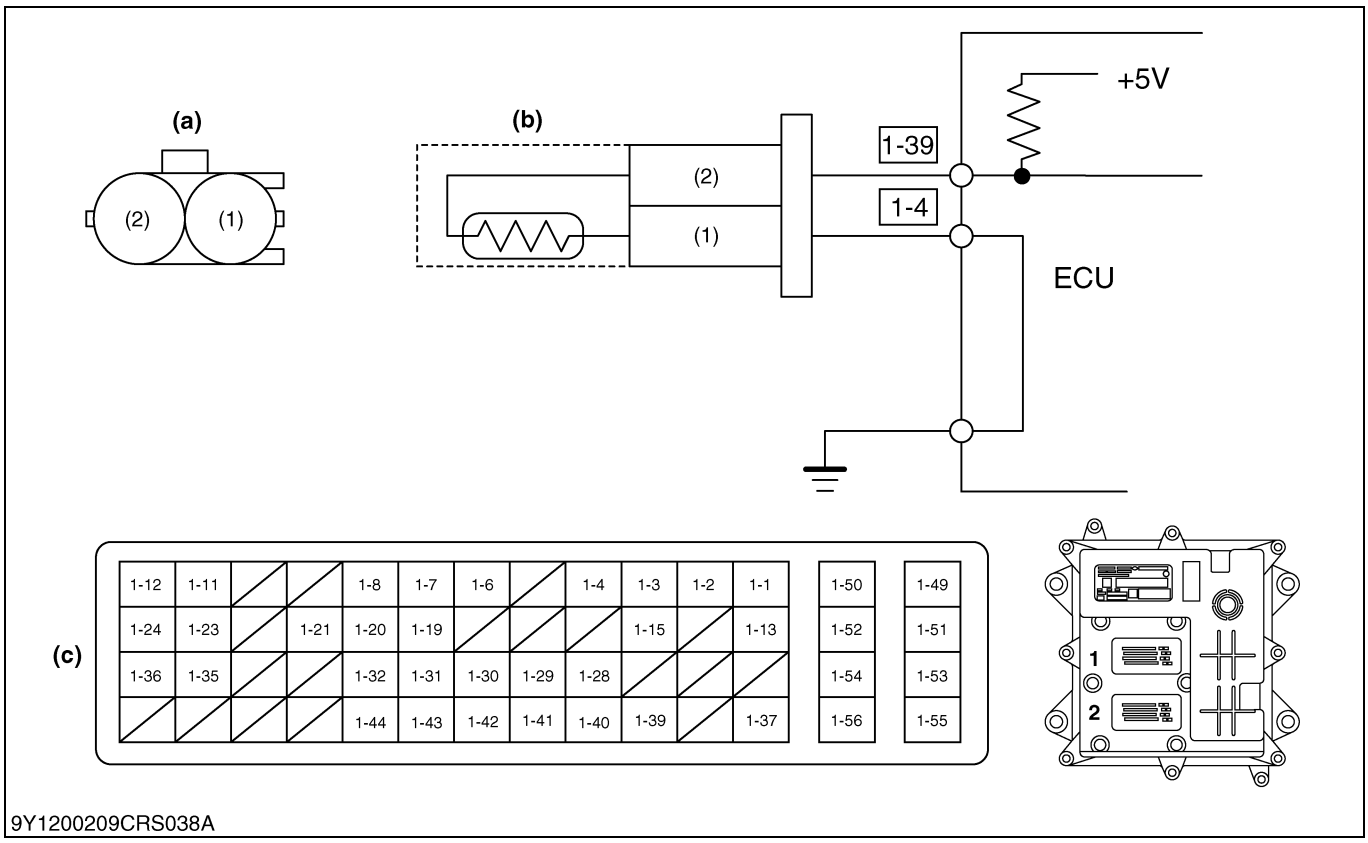
DTC set parameter:
- DPF inlet temperature sensor (T1) voltage: 4.92 V or more

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

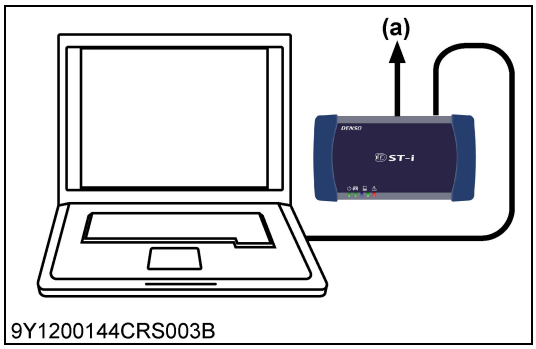
9Y1200209CRS0187US0



9Y1200209CRS038A

(1) Terminal Ground
(2) Terminal Signal
(a) Terminal Layout
(b) Exhaust Gas Temperature Sensor 1 (T1)
(c) ECU Connector 1

9Y1200209CRS0188US0



9Y1200144CRS003B

1. Check the Exhaust Gas Temperature Sensor Signals

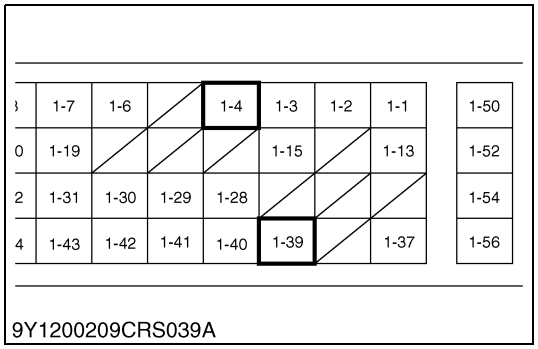
1. Place the key switch in the ON position, and check the "Exhaust gas temperature" and "Exhaust gas temperature sensor output voltage" on the diagnosis tool data monitor.

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

9Y1200209CRS0189US0



9Y1200209CRS039A

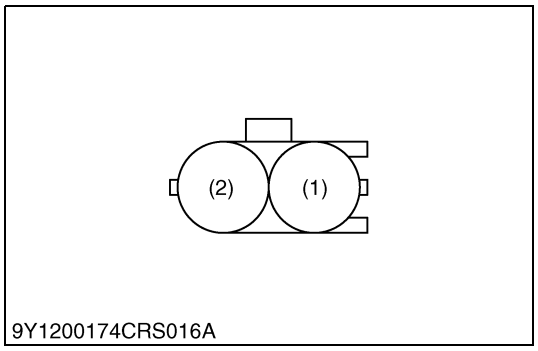
2. Measure the Resistance Between Terminals

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals 1-4 and 1-39 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".

9Y1200209CRS0190US0



9Y1200174CRS016A

3. Check the Sensor

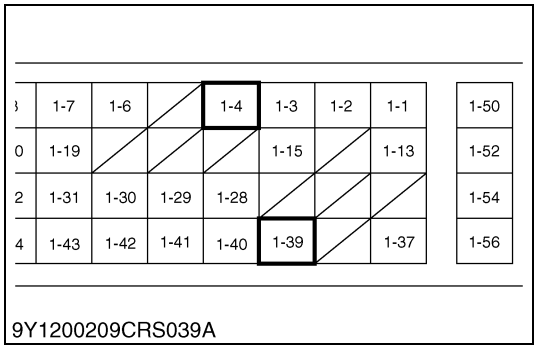
1. Turn the key switch OFF, remove the connector from the sensor side and measure the resistance between the terminals on the sensor side.

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 Ground (2) Terminal Signal

9Y1200209CRS0191US0



9Y1200209CRS039A

4. Measure the ECU Terminal Voltage

1. Plug the ECU wiring harness connector into socket again, unplug the sensor connector, and measure the voltage between ECU terminals 1-4 and 1-39 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.

9Y1200209CRS0192US0

(23) 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:
- Diesel Particulate Filter (hereinafter referred to as the "DPF") 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

9Y1200209CRS0193US0

P0547 / 4765-3: Exhaust gas temperature sensor 0 (T0) 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.

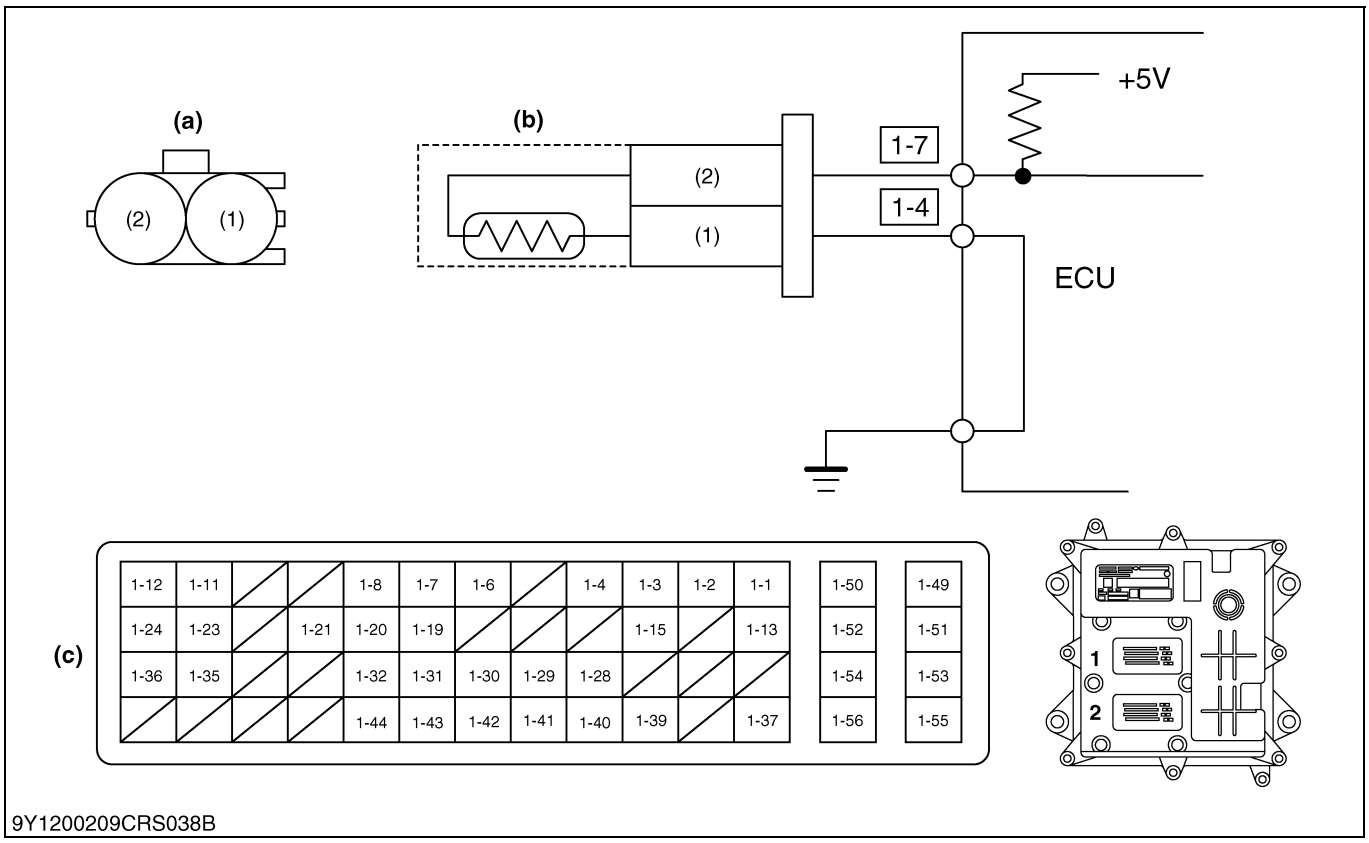
DTC set parameter:
- DPF inlet temperature sensor (T0) voltage: 4.92 V or more

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

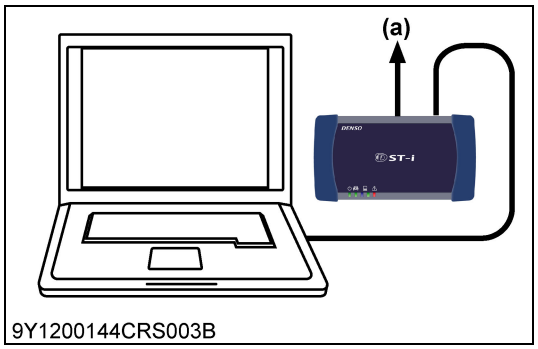
Recovery from error:
- Key switch turn OFF

9Y1200209CRS0194US0



(1) Terminal Ground
(2) Terminal Signal
(a) Terminal Layout
(b) Exhaust Gas Temperature Sensor 0 (T0)
(c) ECU Connector 1

9Y1200209CRS0195US0



1. Check the Exhaust Gas Temperature Sensor Signals

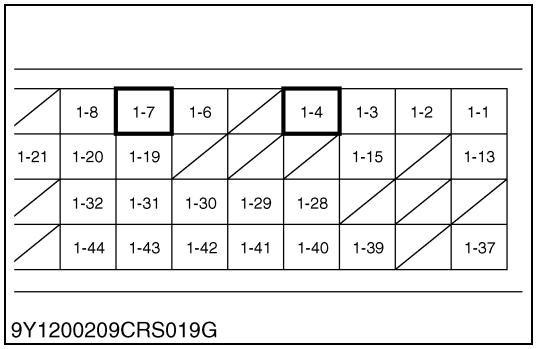
1. Place the key switch in the ON position, and check the "Exhaust gas temperature" and "Exhaust gas temperature sensor output voltage" on the diagnosis tool data monitor.

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

9Y1200209CRS0189US0



9Y1200209CRS019G

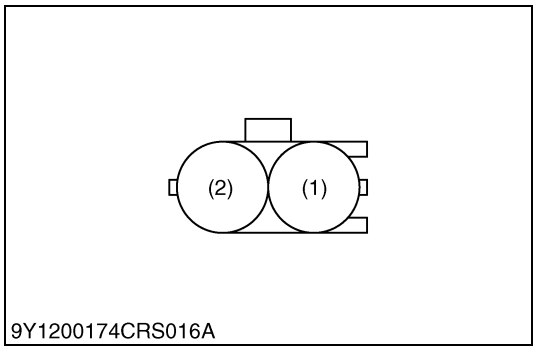
2. Measure the Resistance Between Terminals

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals 1-4 and 1-7 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".

9Y1200209CRS0196US0



9Y1200174CRS016A

3. Check the Sensor

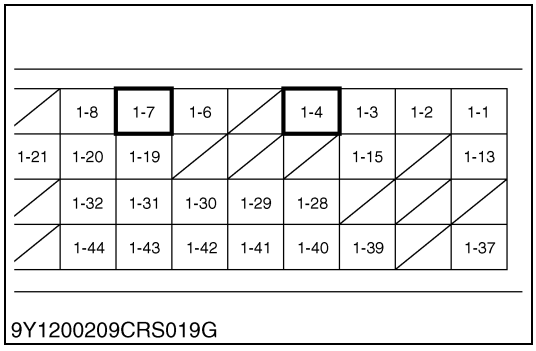
1. Turn the key switch OFF, remove the connector from the sensor side and measure the resistance between the terminals on the sensor side.

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 Ground (2) Terminal Signal

9Y1200209CRS0197US0



9Y1200209CRS019G

4. Measure the ECU Terminal Voltage

1. Plug the ECU wiring harness connector into socket again, unplug the sensor connector, and measure the voltage between ECU terminals 1-4 and 1-7 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.

9Y1200209CRS0198US0

(24) 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 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

9Y1200209CRS0199US0

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 is not activated

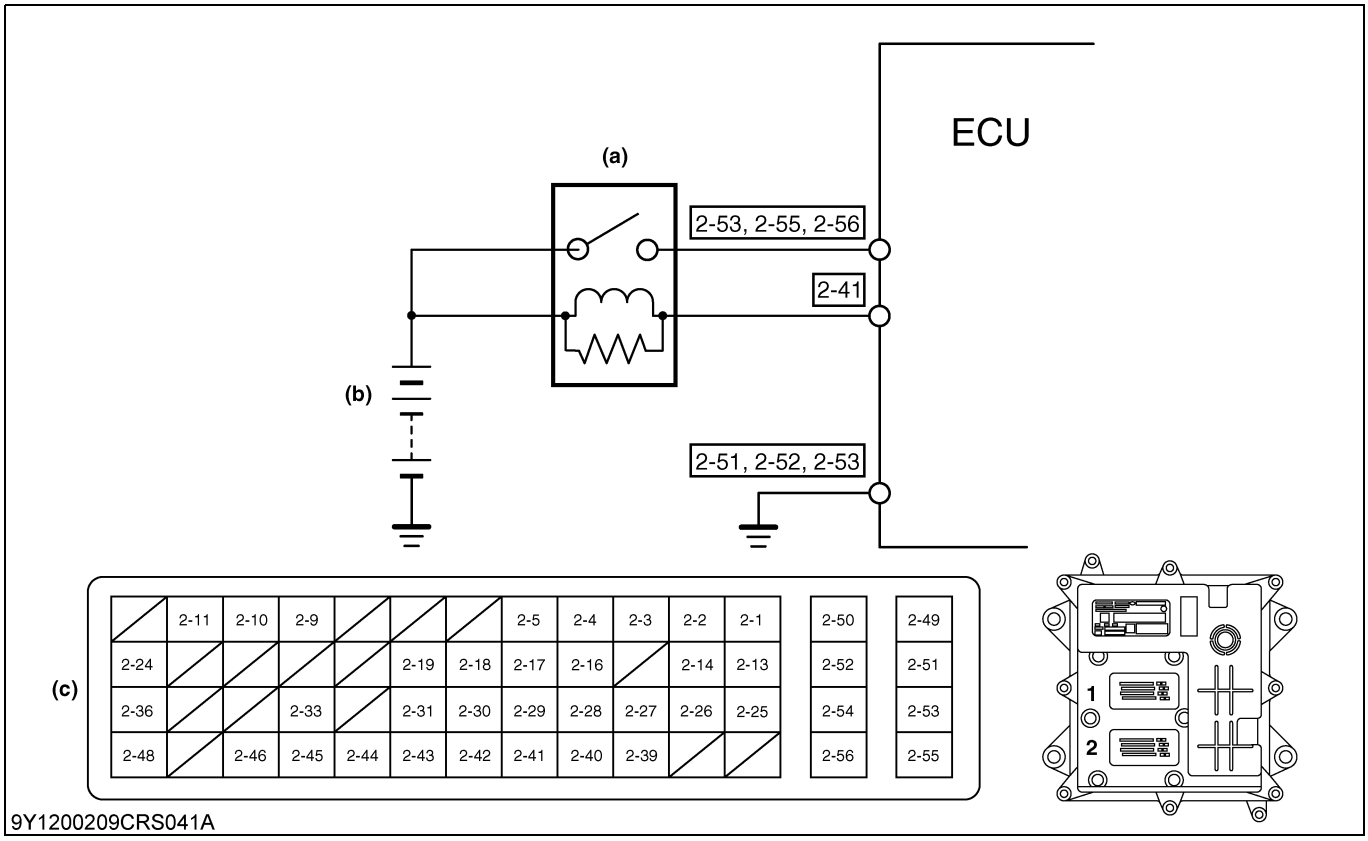
DTC set parameter:
- ECU recognition of battery voltage is above 16 V in 12 V system

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

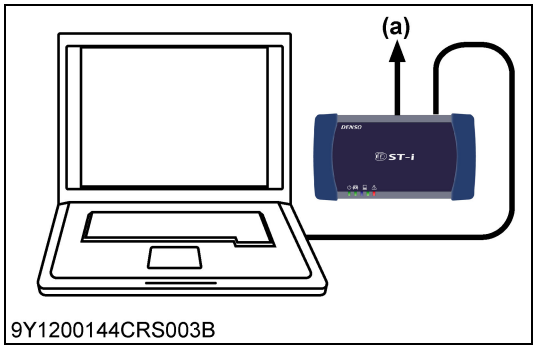
Recovery from error:
- Key switch turn OFF

9Y1200209CRS0200US0



(a) Main Relay **(b) Battery** **(c) ECU Connector 2**

9Y1200209CRS0201US0



1. Check the ECU Data

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".

Factory specification	8 V or lower, 16 V or higher (except intense cold temperature)

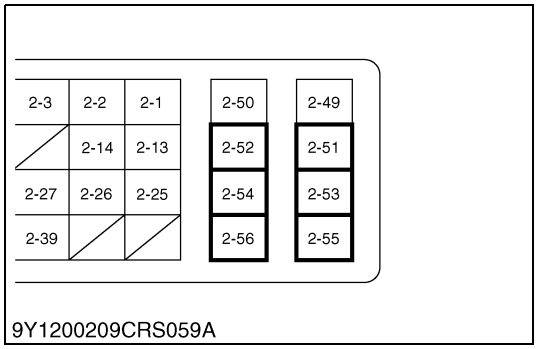
■ **NOTE**

- **Try to change the engine speed as the generated voltage changes accordingly.**

OK	Clear the DTC and check whether it is output again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Check the ECU Terminal Voltage (Part 1)".	

(a) CAN1 Connector

9Y1200209CRS0202US0



9Y1200209CRS059A

2. Check the ECU Terminal Voltage (Part 1)

1. Change the engine operation status, and measure the voltage between ECU terminals 2-53 / 2-55 / 2-56 and 2-51 / 2-52 / 2-54.

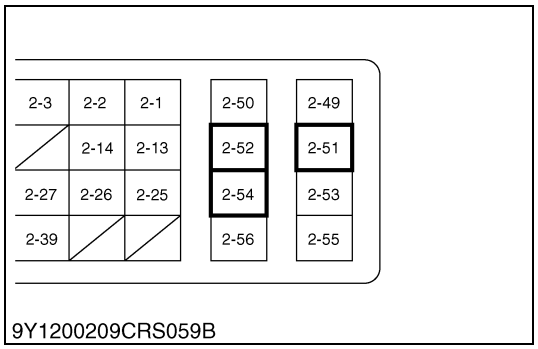
Factory specification	8 V or lower, 16 V or higher (except intense cold temperature)

■ **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)".	

9Y1200209CRS0203US0



9Y1200209CRS059B

3. Check the ECU Terminal Voltage (Part 2)

1. Change the engine operation status, and measure the voltage between ECU terminal 2-51 / 2-52 / 2-54 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.

9Y1200209CRS0204US0

(25) QR (IQA) Data Abnormality (DTC P0602/523538-2, P0602/523538-7)

P0602 / 523538-2: QR (IQA) 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 calibration is not executed
- Output limitation: Approximately 75 % of normal condition

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0205US0

P0602 / 523538-7: No QR (IQA) data

Behaviour during malfunction:
- Insufficient output

Detection item:
- QR data is unwritten

DTC set preconditions:
- Key switch is ON

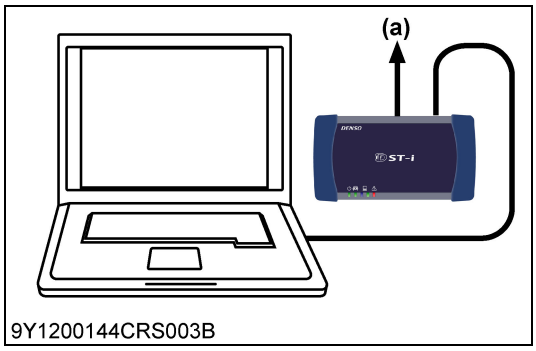
DTC set parameter:
- Area of QR data on EEPROM is vacant.

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

9Y1200209CRS0206US0



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

9Y1200209CRS0207US0

(26) 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
- Erase error
- Write error
- Read error

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Engine Stop

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0208US0

P0606 / 1077-2: ECU CPU (Main IC) error
Behaviour during malfunction:
- Engine stops

Detection item:
- Failure of CPF and/or IC

DTC set preconditions:
- Key switch is ON
- Battery voltage is 10 V or more
- Starter Switch signal is not activated

DTC set parameter:
- CPU and/or IC fatal error

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Engine Stop

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0209US0

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 is not activated

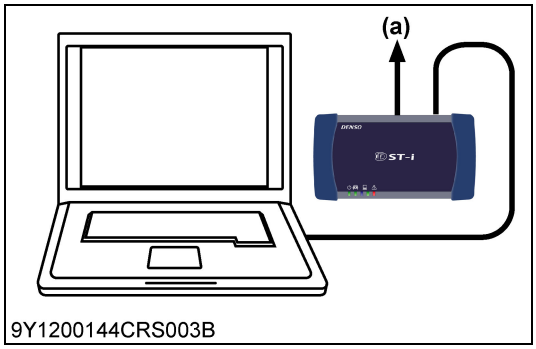
DTC set parameter:
- Failure of monitoring IC of CPU

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Engine Stop

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0210US0



9Y1200144CRS003B

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

9Y1200209CRS0211US0

(27) Injector Charge Voltage Abnormality (DTC P0611 / 523525-1)

■ **NOTE**
- **This DTC is detected when the charge voltage in the injector actuation circuit is too low.**

Behaviour during malfunction:
- Insufficient output
- Worsening exhaust gas performance
- Engine stops

Detection item:
- Injector charge voltage: Low
- Failure of charge circuit of ECU

DTC set preconditions:
- Battery voltage is normal
- CPU is normal

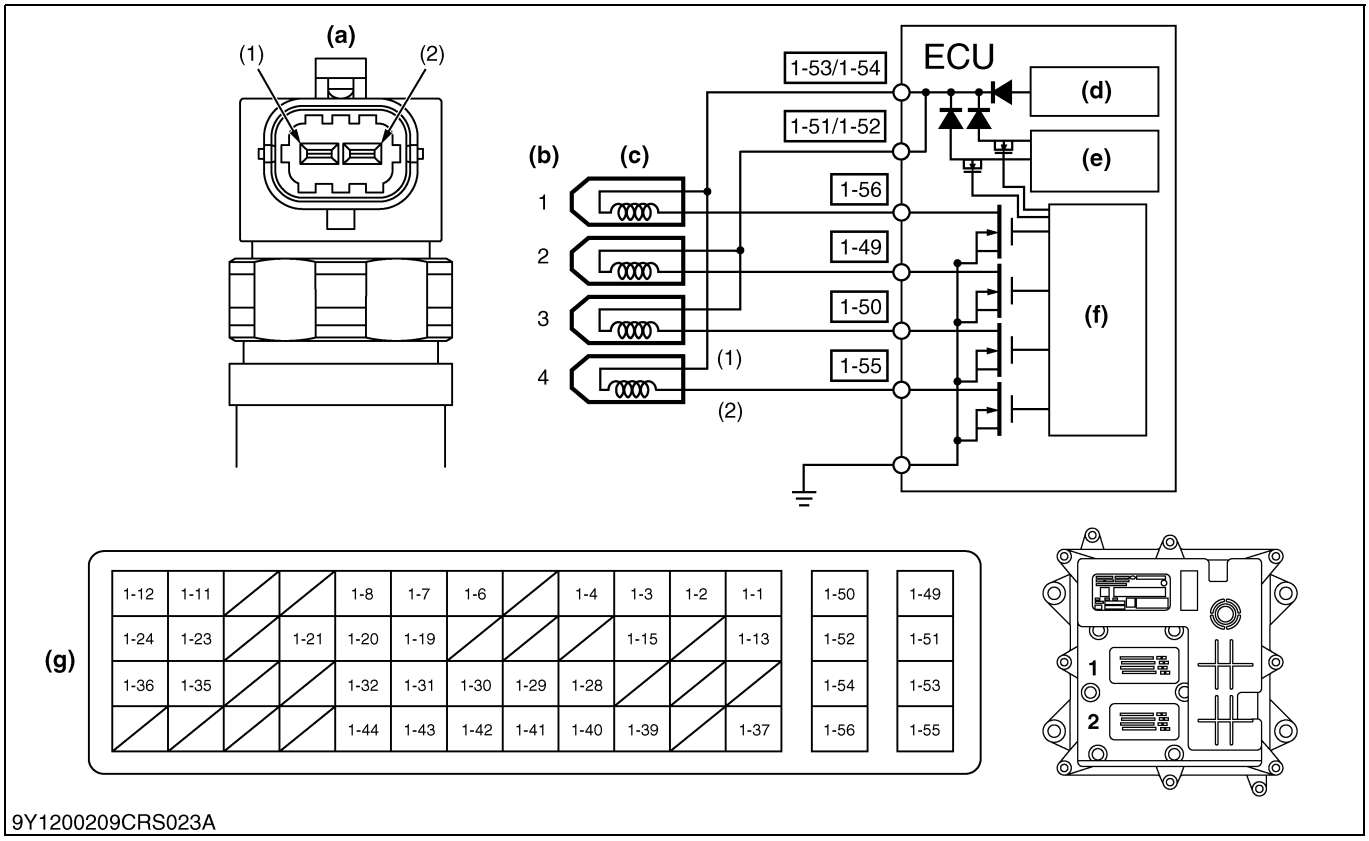
DTC set parameter:
- Injector charge voltage: Low
- Failure of charge circuit of ECU

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Output limitation: Approximately 75 % of normal condition
- EGR stop
- Intake throttle 100 % open

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0212US0

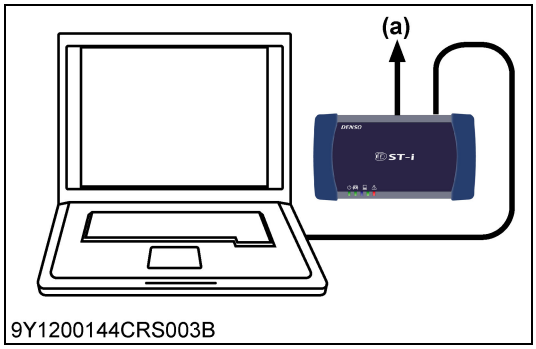


9Y1200209CRS023A

(1) Terminal High
(2) Terminal Low

(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

9Y1200209CRS0213US0



1. Checking Whether the DTC Is Detected Again

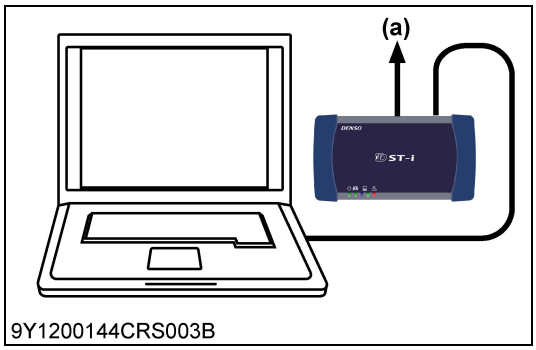
1. Turn the key switch OFF and then ON again.
2. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
3. Check whether or not the same DTC (P0611) is detected.

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

9Y1200209CRS0214US0



2. Replacing the Injector and Checking Whether the DTC Is Detected Again

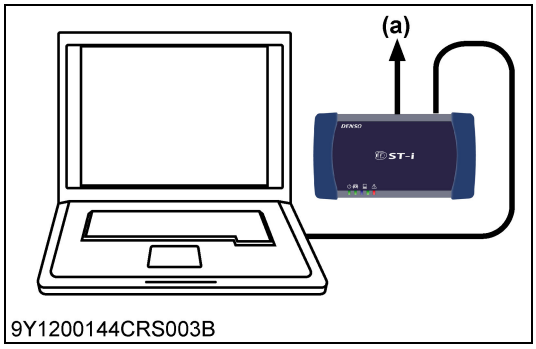
1. Replace the injector.
2. Turn the key switch OFF and then ON again.
3. After clearing the DTC, turn the key switch OFF and then ON again, and start the engine.
4. Check whether or not the same DTC (P0611) is detected.

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

9Y1200209CRS0215US0



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

9Y1200209CRS0216US0

(28) SCV (MPROP) Drive System Abnormality (DTC P0627 / 1347-5, P0628 / 1347-4, P0629 / 1347-3)

P0627 / 1347-5: Open circuit of SCV (MPROP)

Behaviour during malfunction:
- Insufficient output
- Worsening exhaust gas performance

Detection item:
- Open circuit of SCV

DTC set preconditions:
- Battery voltage is normal
- Key switch is ON
- Starter Switch signal is not activated

DTC set parameter:
- Open 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
- Engine forcibly stopped 60 sec later

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0545US0

P0628 / 1347-4: SCV (MPROP) 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 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

9Y1200209CRS0217US0

P0629 / 1347-3: +B short circuit of SCV (MPROP)

Behaviour during malfunction:

- Insufficient output
- Worsening exhaust gas performance

Detection item:

- +B+B short circuit of SCV

DTC set preconditions:

- Battery voltage is normal
- Key switch is ON
- Starter Switch signal is not activated

DTC set parameter:

- +B short circuit of SCV

Engine warning light:

- ON

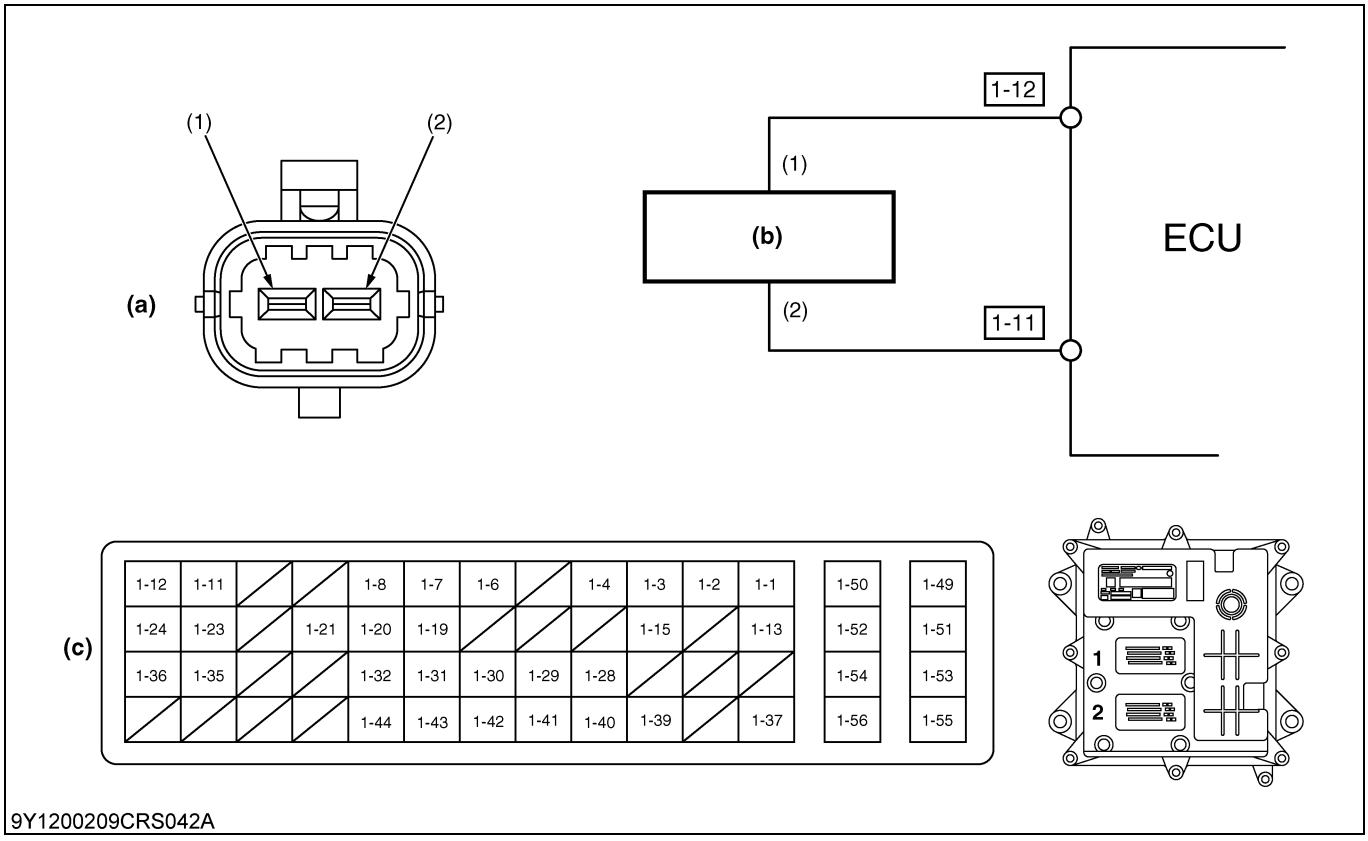
Limp home action by engine ECU (system action):

- 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

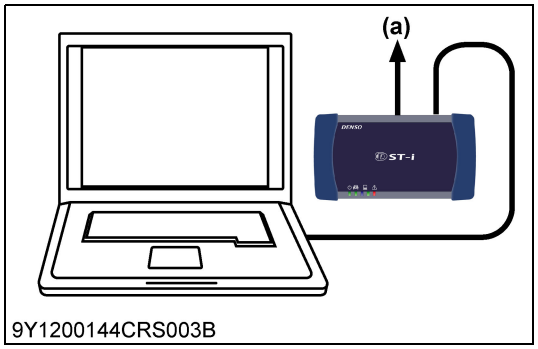
9Y1200209CRS0218US0



9Y1200209CRS042A

(1) Terminal SCV (+)
(2) Terminal SCV (−)
(a) Terminal Layout
(b) SCV (Suction Control Valve)
(c) ECU Connector 1

9Y1200209CRS0219US0



9Y1200144CRS003B

1. Check the SCV Current

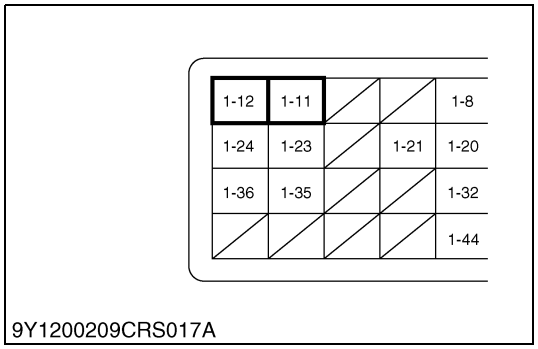
1. Place the key switch in the ON position, and check the "Target SCV current" and "Actual SCV current" on the diagnosis tool data monitor.

Factory specification	1. The "Actual SCV current value" always follow to the "Target SCV current value".

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

9Y1200209CRS0220US0



9Y1200209CRS017A

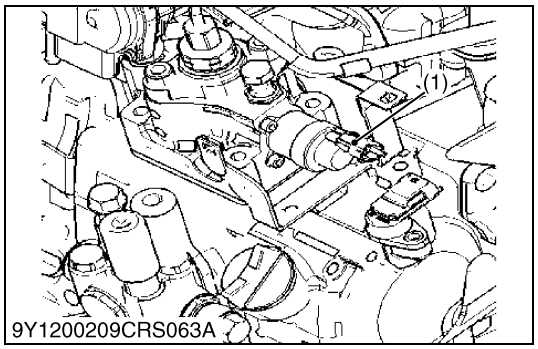
2. Measure the Resistance Between Terminals

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals 1-11 and 1-12 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 MΩ or higher

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

9Y1200209CRS0221US0



9Y1200209CRS063A

3. Check the SCV

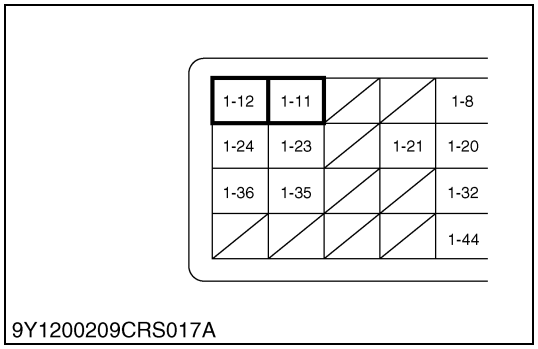
1. Turn the key switch OFF, remove the connector from the SCV side and measure the resistance between the terminals on the SCV side.

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.

(1) SCV (Suction Control Valve)

9Y1200209CRS0222US0



9Y1200209CRS017A

4. Measure the ECU Terminal Voltage

1. Unplug the ECU wiring harness connector 1 from socket, and measure the voltage between ECU terminals 1-11 and 1-12 and the ground (at the wiring harness side).

Factory specification	Both must be approx. 0 V.

OK	Normal.
NG	Repair the wiring harness.

9Y1200209CRS0223US0

(29) Internal Injector Drive Circuit Abnormality (DTC P062B / 1077-12, P062D / 523605-6)

P062B / 1077-12: Injector drive IC error or Open circuit

Behaviour during malfunction:
- Engine stop

Detection item:
- Injector drive IC error or Open circuit of No.1 and 4 cylinder injector or Open circuit of No.2 and 3 cylinder injector

DTC set preconditions:
- Battery voltage is normal
- Key switch is ON
- Starter Switch signal is not activated

DTC set parameter:
- Injector drive IC error or Open circuit of No.1 and 4 cylinder injector or Open circuit of No.2 and 3 cylinder injector

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- EGR stop

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0546US0

P062D / 523605-6: Short circuit in injector driver IC

Behaviour during malfunction:
- Insufficient output
- Large vibration
- Worsening exhaust gas performance
- Engine stops in some case

Detection item:
- Short circuit in injector driver IC

DTC set preconditions:
- Battery voltage is normal
- Key switch is ON

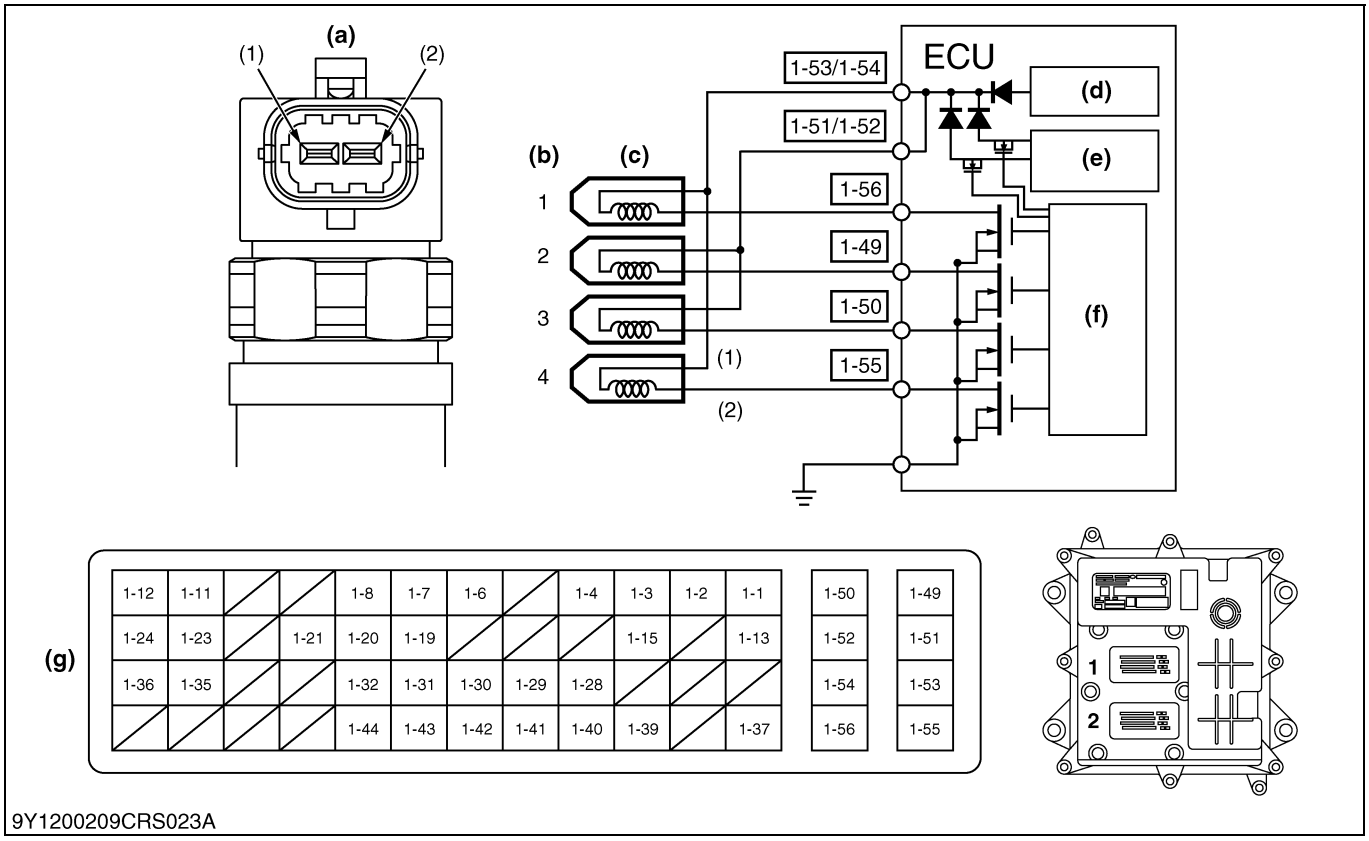
DTC set parameter:
- Injector IC report the error

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
- Intake throttle 100 % open

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0224US0

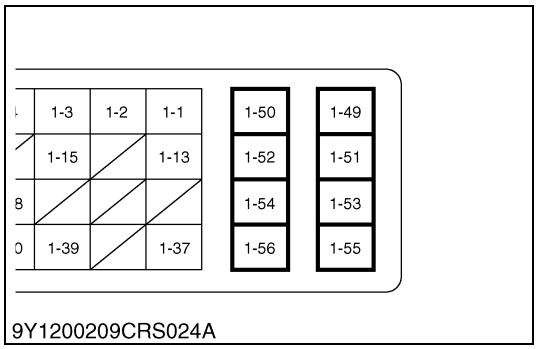


9Y1200209CRS023A

(1) Terminal High
(2) Terminal Low

(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

9Y1200209CRS0428US0



9Y1200209CRS024A

1. Measure the Resistance Between ECU Terminals

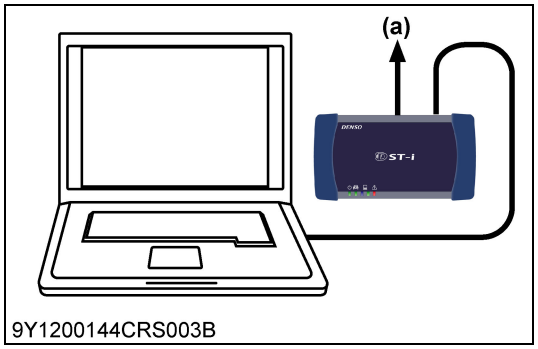
1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance each terminal of the connector.

Engine cylinder	Measurement terminal
No. 1 cylinder	1-53←→1-56
No. 3 cylinder	1-52←→1-49
No. 4 cylinder	1-51←→1-50
No. 2 cylinder	1-54←→1-55

Factory specification	1.5 Ω or lower

OK	Go to "2. Check the DTC".
NG	Go to "4. Measure the Resistance Between Injector Terminals".

9Y1200209CRS0429US0



9Y1200144CRS003B

2. Check the DTC

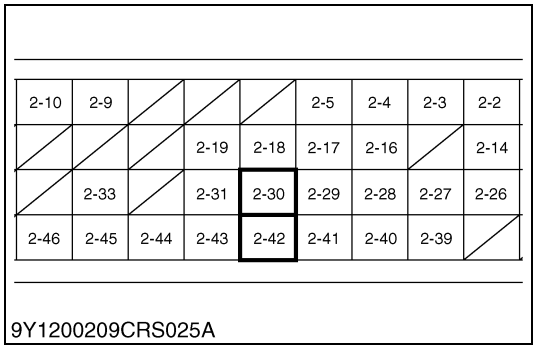
1. Plug the ECU connector into socket, and start the engine.
2. Clear the DTCs that occurred previously, and check the currently existing trouble.

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

9Y1200209CRS0430US0



9Y1200209CRS025A

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. → Repair.
NG	Check the injector wiring harnesses and connectors. → Repair.

9Y1200209CRS0431US0

(30) 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 is not activated

DTC set parameter:
- Voltage to sensor is below 4.75 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

9Y1200209CRS0225US0

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 is not activated

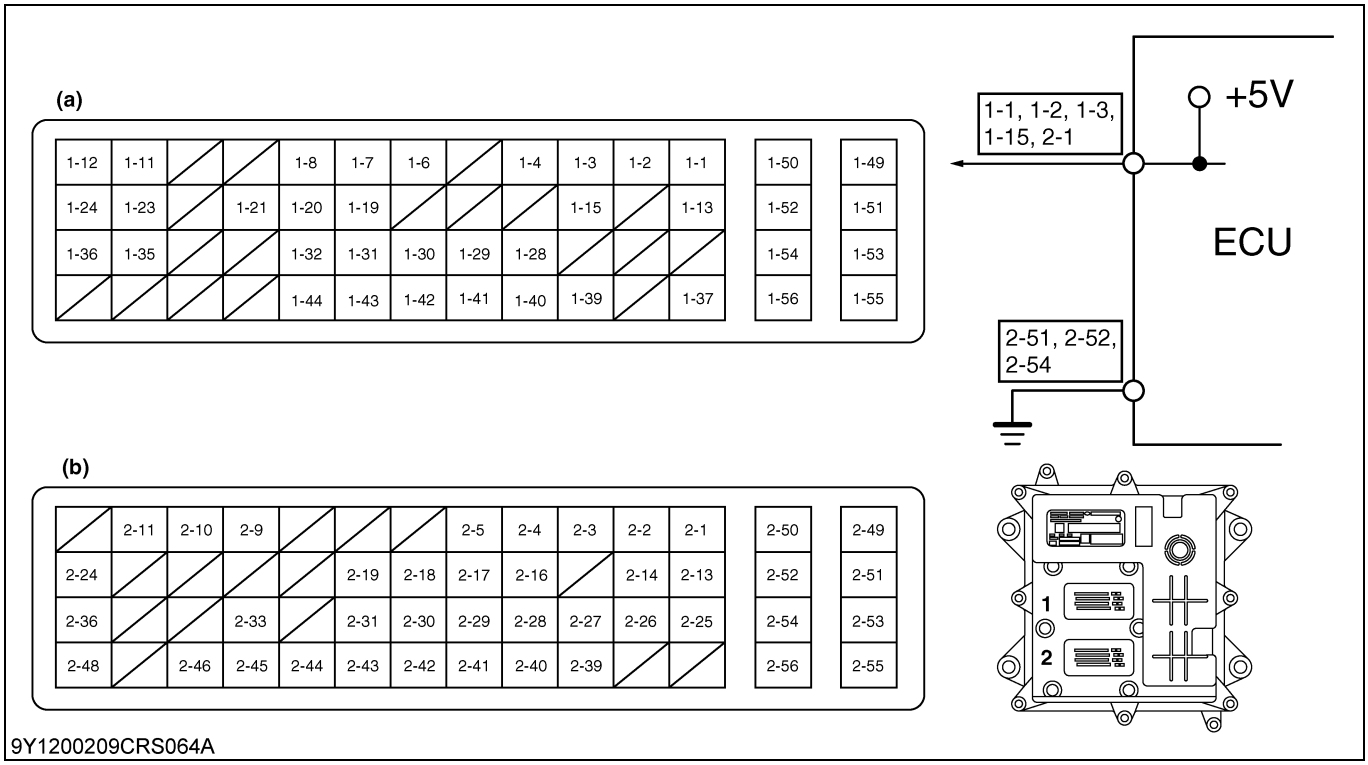
DTC set parameter:
- Voltage to sensor is above 5.25 V

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

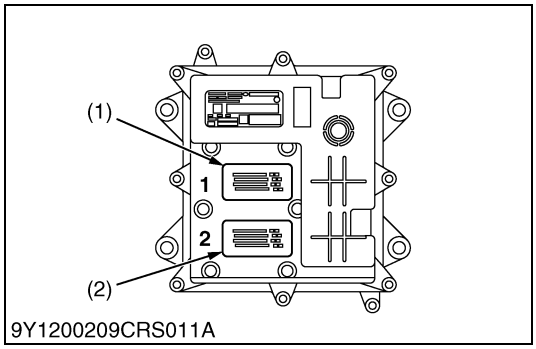
9Y1200209CRS0226US0



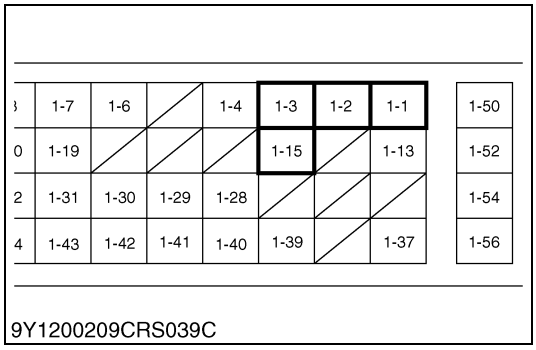
9Y1200209CRS064A

(a) ECU Connector 1 **(b) ECU Connector 2**

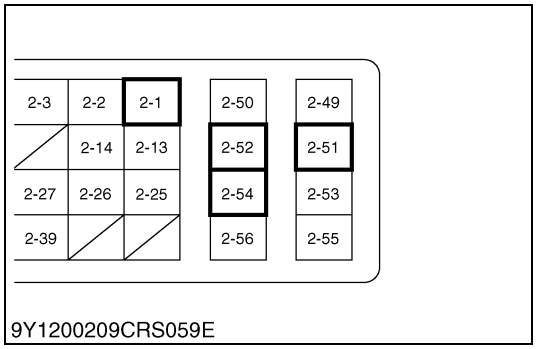
9Y1200209CRS0227US0



9Y1200209CRS011A



9Y1200209CRS039C



9Y1200209CRS059E

1. Measure the ECU Terminal Voltage

1. Place the key switch in the OFF position, and unplug the ECU wiring harness connector from the socket.
2. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals 1-1 / 1-2 / 1-3 / 1-15 / 2-1 and 2-51 / 2-52 / 2-54.

Factory specification	Approx. 5 V

OK	Check the wiring harness 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)

9Y1200209CRS0228US0

(31) 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 is not activated

DTC set parameter:
- Voltage to sensor is below 4.75 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

9Y1200209CRS0229US0

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 is not activated

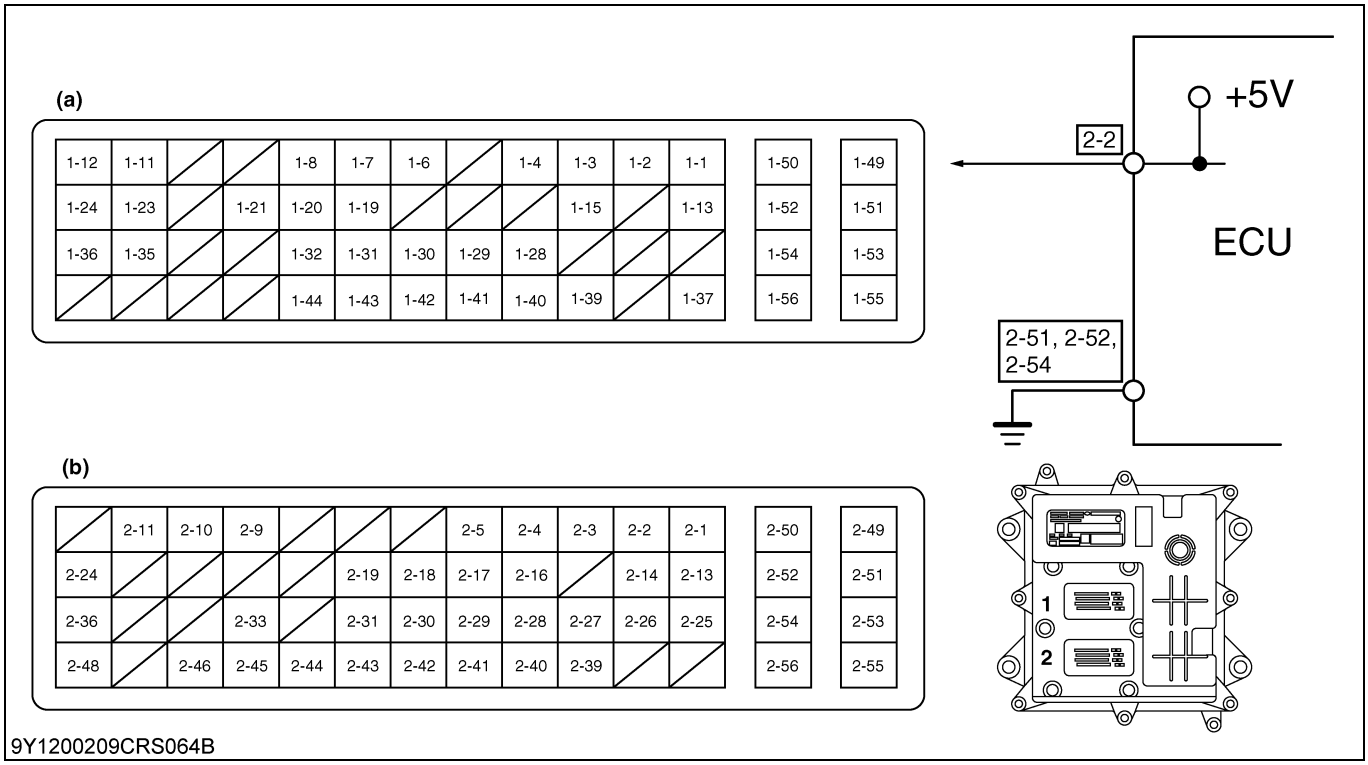
DTC set parameter:
- Voltage to sensor is above 5.25 V

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Output limitation: Approximately 75 % of normal condition

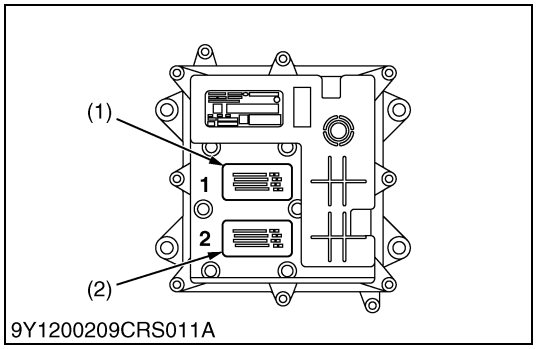
Recovery from error:
- Key switch turn OFF

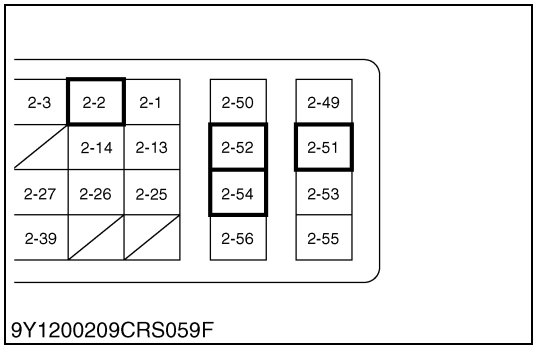
9Y1200209CRS0230US0



(a) ECU Connector 1 **(b) ECU Connector 2**

9Y1200209CRS0231US0





1. Measure the ECU Terminal Voltage

1. Place the key switch in the OFF position, and unplug the ECU wiring harness connector from the socket.
2. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals 2-2 and 2-51 / 2-52 / 2-54.

Factory specification	Approx. 5 V

OK	Check the wiring harness 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)

9Y1200209CRS0232US0

(32) Sensor Supply Voltage 3 Abnormality (DTC P0662 / 3511-4, P0663 / 3511-3)

P0662 / 3511-4: Sensor supply voltage 3 abnormality (Low side)
Behaviour during malfunction:
- Faulty starting

Detection item:
- Sensor supply voltage 3 error or recognition error

DTC set preconditions:
- Battery voltage is normal
- Key switch turn ON
- Starter Switch signal is not activated

DTC set parameter:
- Voltage to sensor is below 4.75 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

9Y1200209CRS0233US0

P0663 / 3511-3: Sensor supply voltage 3 abnormality (High side)
Behaviour during malfunction:
- Faulty starting

Detection item:
- Sensor supply voltage 3 error or recognition error

DTC set preconditions:
- Battery voltage is normal
- Key switch turn ON

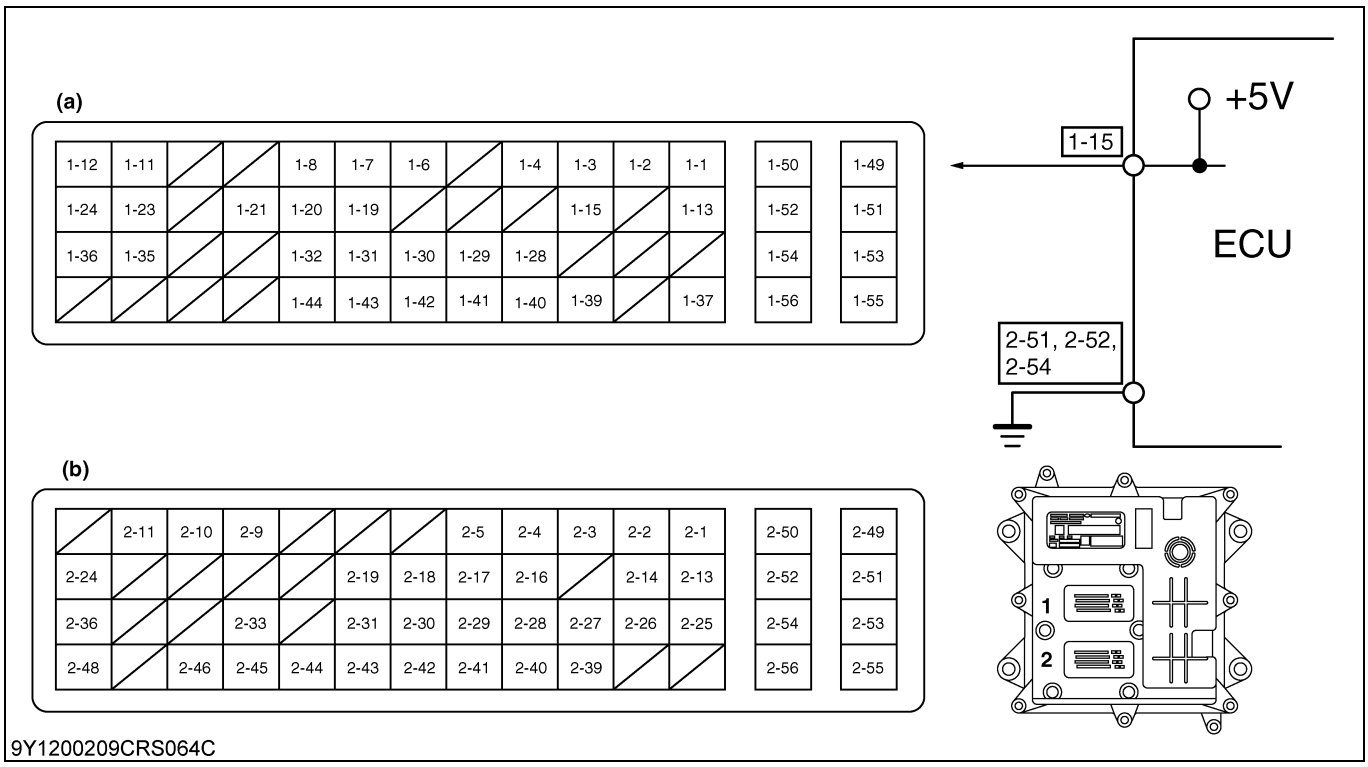
DTC set parameter:
- Voltage to sensor is above 5.25 V

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Output limitation: Approximately 75 % of normal condition

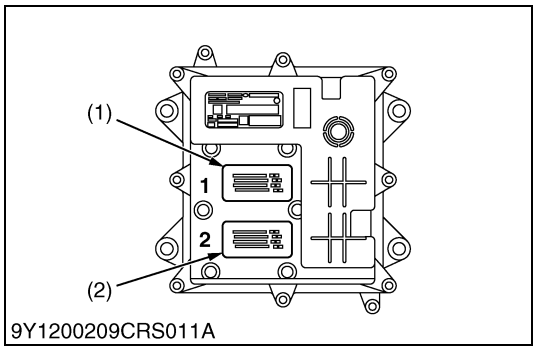
Recovery from error:
- Key switch turn OFF

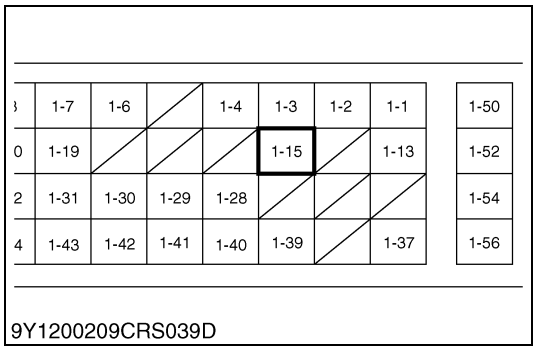
9Y1200209CRS0234US0

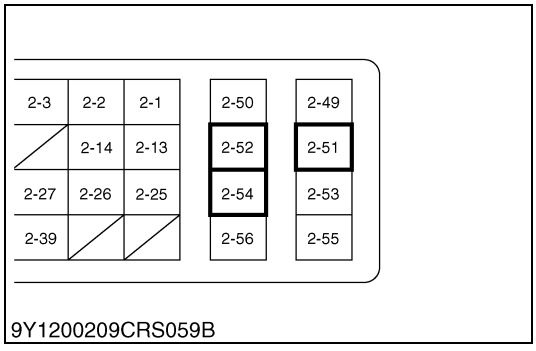


(a) ECU Connector 1 **(b) ECU Connector 2**

9Y1200209CRS0235US0







1. Measure the ECU Terminal Voltage

1. Place the key switch in the OFF position, and unplug the ECU wiring harness connector from the socket.
2. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals 1-15 and 2-51 / 2-52 / 2-54.

Factory specification	Approx. 5 V

OK	Check the wiring harness 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)

9Y1200209CRS0236US0

(33) 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

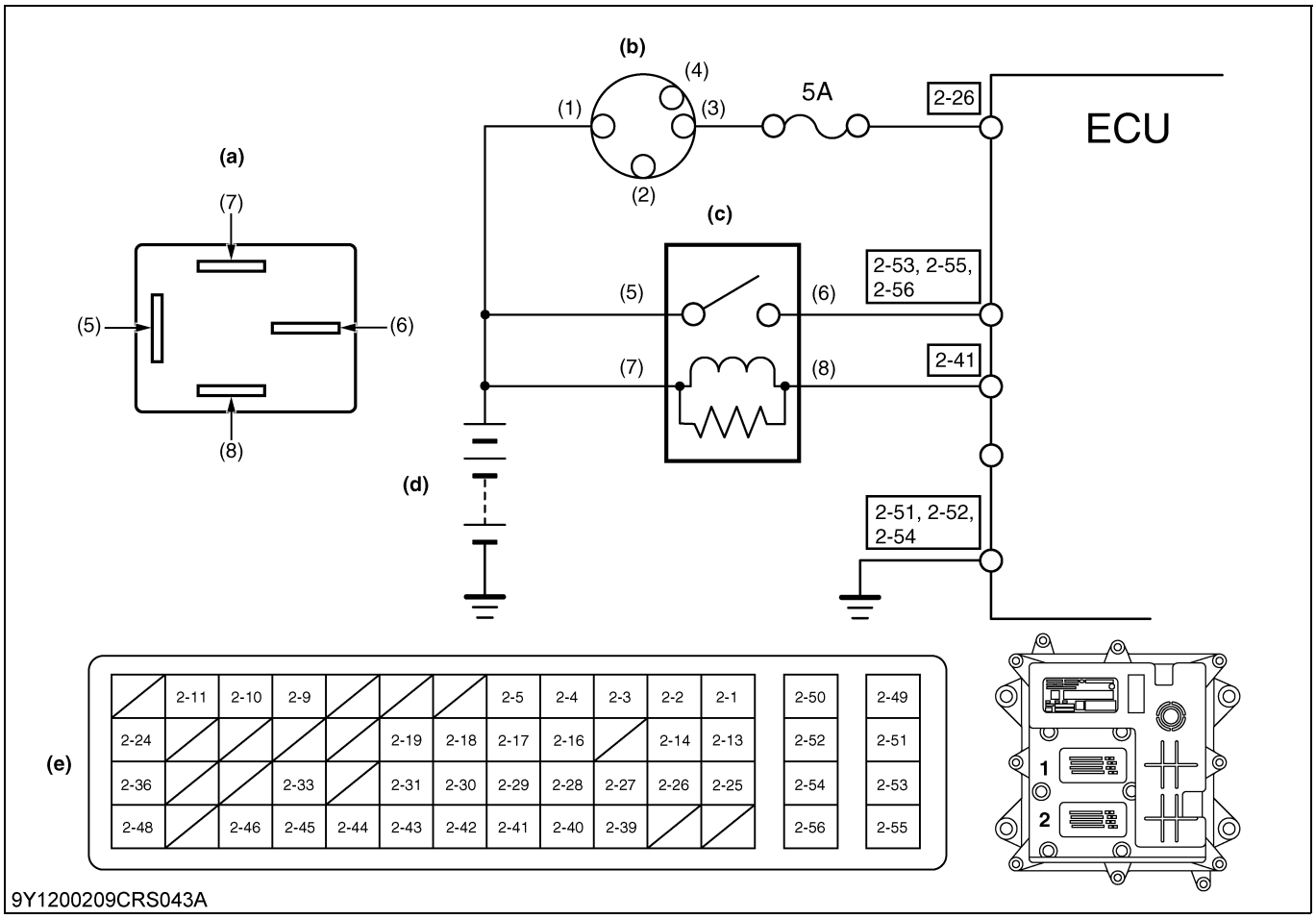
DTC set parameter:
- Main relay stays active longer than 1 sec. without command

Engine warning light:
- OFF

Limp home action by engine ECU (system action):
- None

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0237US0

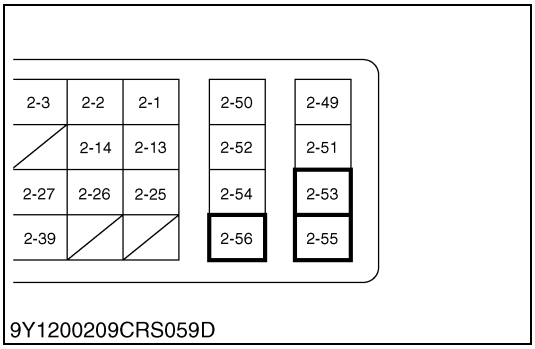


9Y1200209CRS043A

(1) OFF
(2) ACC
(3) ON
(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

9Y1200209CRS0238US0



9Y1200209CRS059D

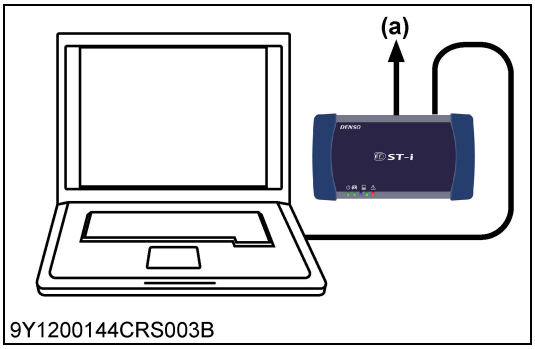
1. Measure the ECU Terminal Voltage

1. Place the key switch in the OFF position, and measure the voltage between ECU terminals 2-53 / 2-55 / 2-56 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".	

9Y1200209CRS0239US0



9Y1200144CRS003B

2. Check the Key Switch Signal

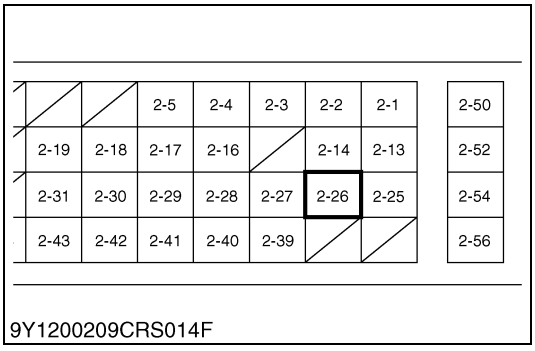
1. Place the key switch in the OFF position, attach the diagnosis tool to the CAN1 connector, and return the key switch to the ON position again.
2. Using the data monitor function of diagnosis tool, check the "Key switch" data when the key switch is placed in the OFF position.

Factory specification	OFF

OK	Go to "4. Check the ECU Terminal Voltage".
NG	Go to "3. Check the KEY SW Signal".

(a) CAN1 Connector

9Y1200209CRS0240US0



9Y1200209CRS014F

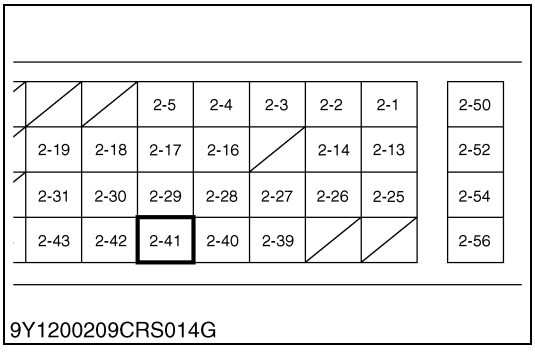
3. Check the KEY SW Signal

1. Place the key switch in the OFF position, and measure the voltage at ECU terminal 2-26.

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.

9Y1200209CRS0241US0



9Y1200209CRS014G

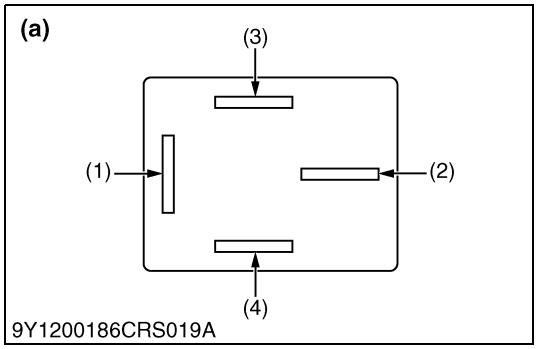
4. Check the ECU Terminal Voltage

1. Keep the key switch in the OFF position, and measure the voltage at ECU main relay terminal 2-41.

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.

9Y1200209CRS0242US0



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

9Y1200209CRS0243US0

(34) EEPROM Check Sum Error (DTC P1990 / 523700-13, P1991 / 523701-13, P1992 / 523702-13)

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 parameter:
- EEPROM check sum error

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- None

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0244US0

P1991 / 523701-13: EEPROM check sum error (DST1)
Behaviour during malfunction:
- None

Detection item:
- DST1-EEPROM check sum error

DTC set preconditions:
- Battery voltage is normal

DTC set parameter:
- EEPROM check sum error (DST1)

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- None

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0247US0

P1992 / 523702-13: EEPROM check sum error (DST2)
Behaviour during malfunction:
- None

Detection item:
- DST2-EEPROM check sum error

DTC set preconditions:
- Battery voltage is normal

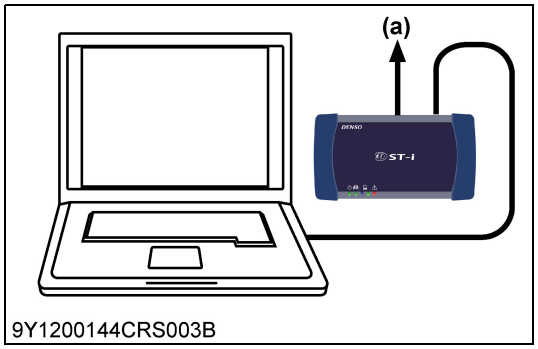
DTC set parameter:
- EEPROM check sum error (DST2)

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- None

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0248US0



1. Check the DTC

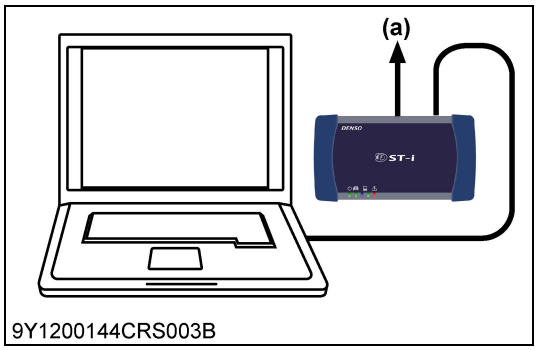
1. Place the key switch in the OFF position, attach the diagnosis tool to the CAN1 connector, and return the key switch to the ON position again.
2. Clear the DTC, and check whether the same DTC is output again or not.

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

9Y1200209CRS0245US0



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

9Y1200209CRS0246US0

(35) 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

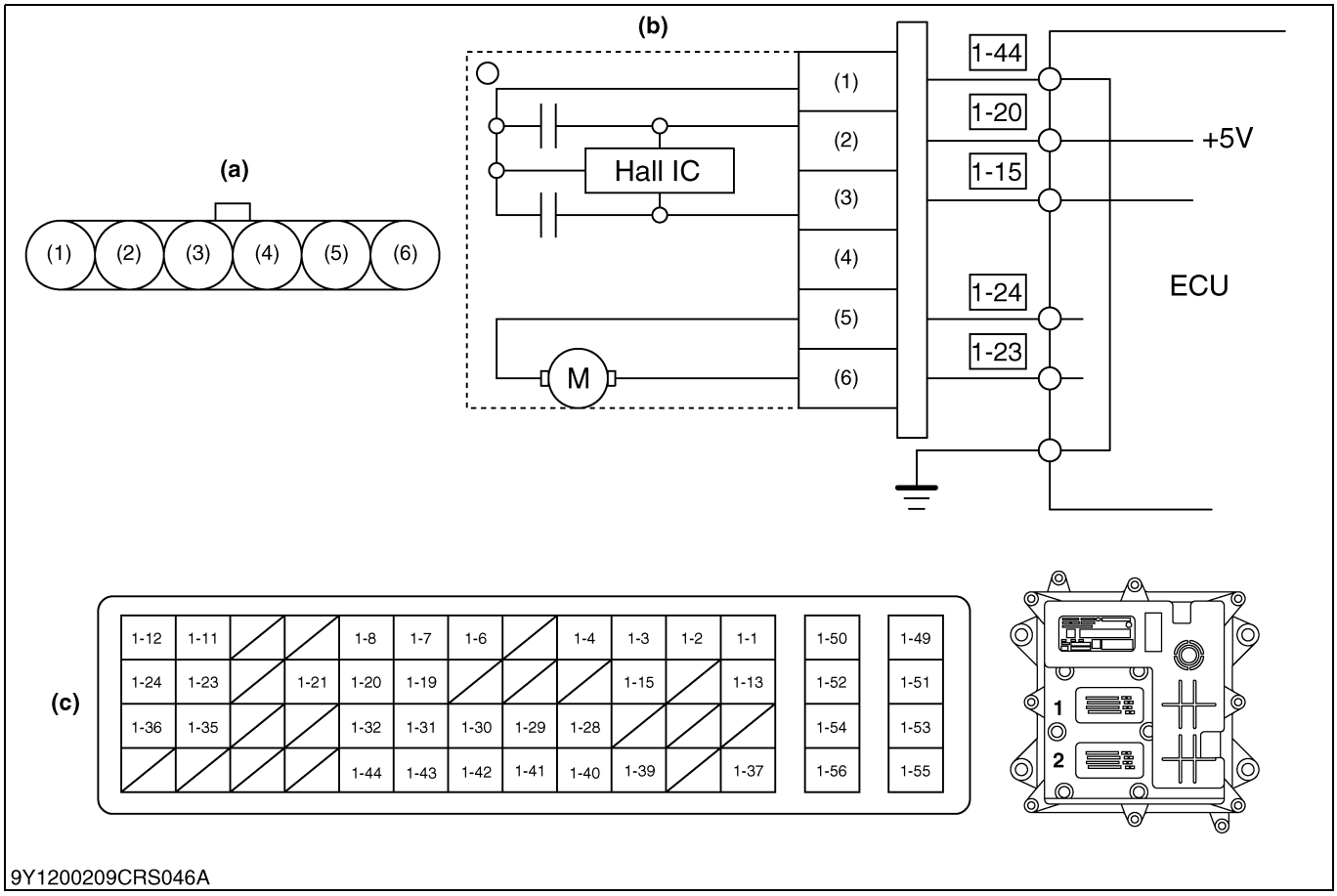
DTC set parameter (Approximate parameter):
- Deviation of throttle position is not corrected in 20 times of duty error recovery action.

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

9Y1200209CRS0249US0

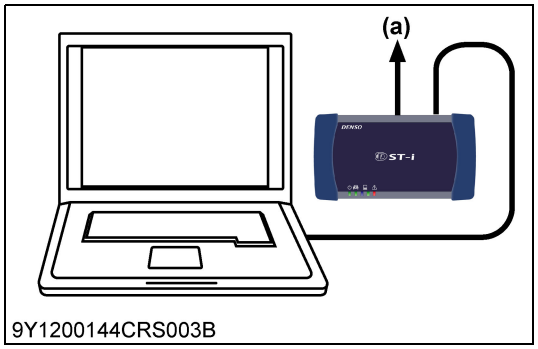


9Y1200209CRS046A

(1) Terminal Ground
(2) Terminal Signal
(3) Terminal 5 V
(4) No Connection
(5) Terminal Motor (−)
(6) Terminal Motor (+)

(a) Terminal Layout
(b) Intake Throttle Valve
(c) ECU Connector 1

9Y1200209CRS0250US0



9Y1200144CRS003B

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

9Y1200209CRS0251US0

(36) 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 VCC1 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 ≤ 25 %

Recovery from error:
- Diagnostic counter = zero

9Y1200209CRS0252US0

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 VCC1 is normal

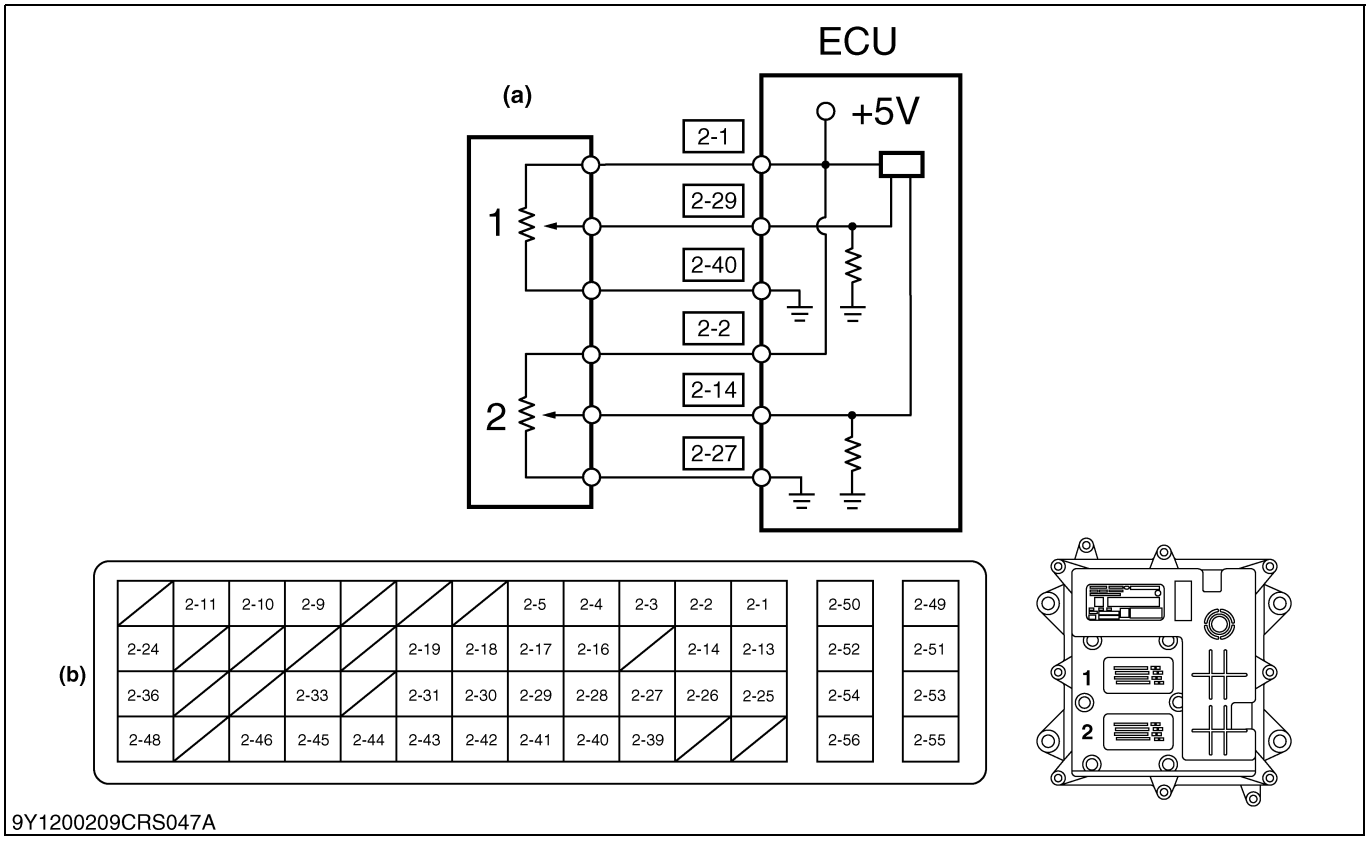
DTC set parameter:
- Accelerator position sensor voltage 1 is 4.8 V or higher

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Accelerator opening limit: ACCPF ≤ 25 %

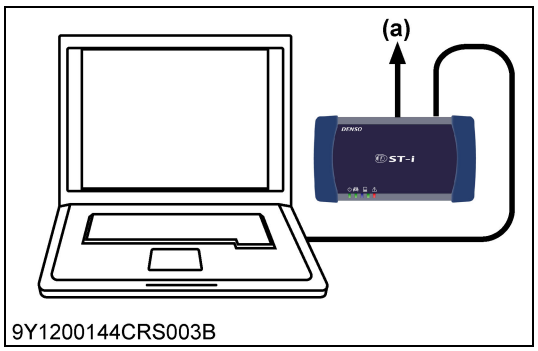
Recovery from error:
- Diagnostic counter = zero

9Y1200209CRS0253US0



(a) Accelerator Position Sensor (b) ECU Connector 2

9Y1200209CRS0254US0



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

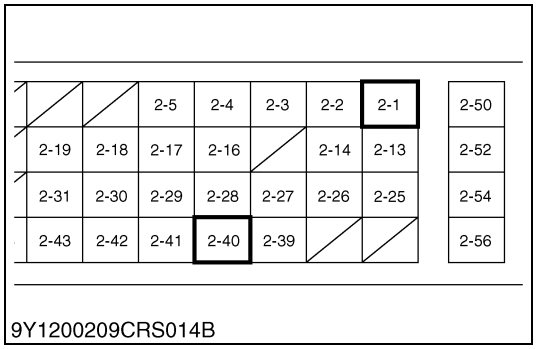
■ **NOTE**

- **"Full close" and "Full open" are with the accelerator position sensor, not with the accelerator pedal or hand accelerator.**

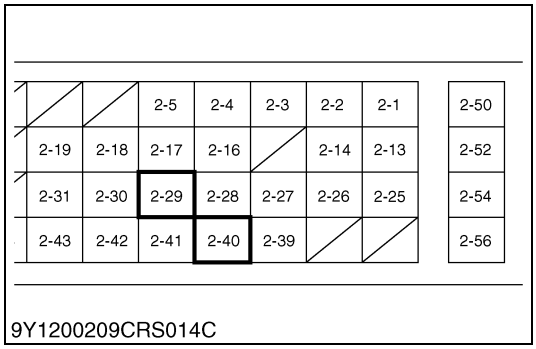
OK	Clear the DTC and check whether it is detected again or not.	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Terminal Voltage".	

(a) CAN1 Connector

9Y1200209CRS0255US0



9Y1200209CRS014B



9Y1200209CRS014C

2. Measure the Terminal Voltage

1. Measure the voltage between ECU terminals 2-1 and 2-40.

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.

9Y1200209CRS0257US0

3. 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 2-29 and 2-40.

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	Faulty ECU → Replace.
NG	Repair the ECU connectors.

9Y1200209CRS0258US0

(37) 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

9Y1200209CRS0260US0

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

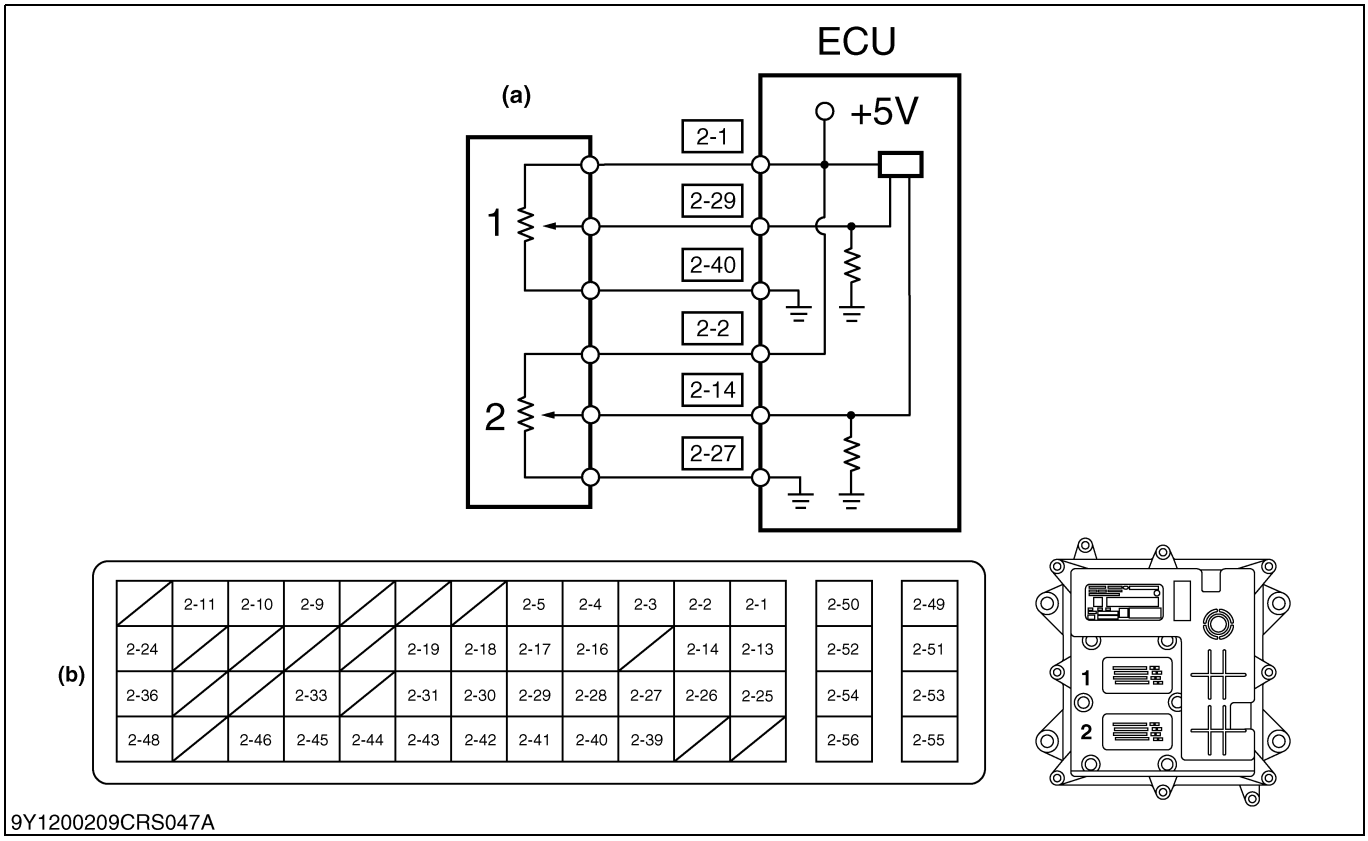
DTC set parameter:
- Voltage of accelerator position sensor 2 is 4.8 V or less

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Forced Idle (Accelerator = 0 %)

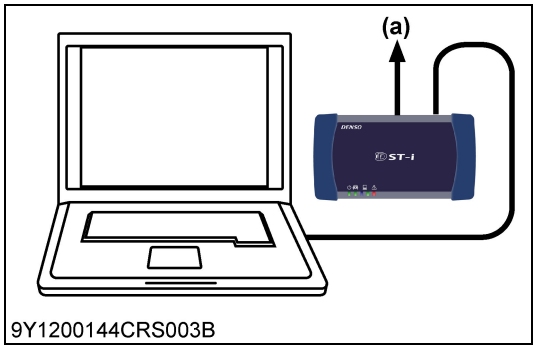
Recovery from error:
- Diagnostic counter = zero

9Y1200209CRS0261US0



(a) Accelerator Position Sensor (b) ECU Connector 2

9Y1200209CRS0262US0



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

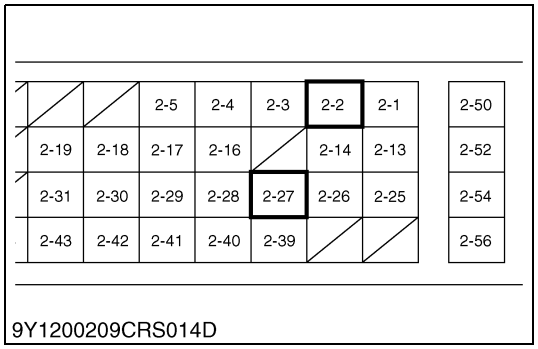
■ **NOTE**

- **"Full close" and "Full open" are with the accelerator position sensor, not with the accelerator pedal or hand accelerator.**

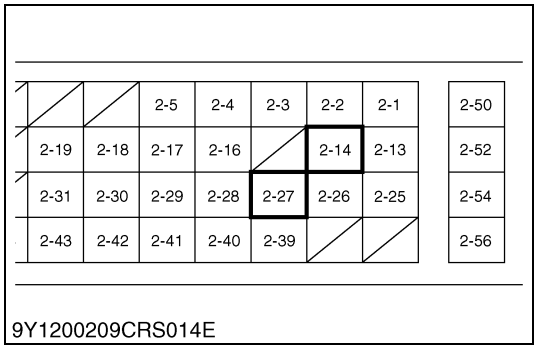
OK	Clear the DTC and check whether it is detected again or not. ▼	
	OK	Normal.
	NG	Replace the ECU.
NG	Go to "2. Measure the Terminal Voltage".	

(a) CAN1 Connector

9Y1200209CRS0263US0



9Y1200209CRS014D



9Y1200209CRS014E

2. Measure the Terminal Voltage

1. Measure the voltage between ECU terminals 2-2 and 2-27.

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.

9Y1200209CRS0265US0

3. 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 2-14 and 2-27.

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	Faulty ECU → Replace.
NG	Repair the ECU connectors.

9Y1200209CRS0266US0

(38) Accelerator Position Sensor Error (CAN) (DTC P2131 / 523543-2)

Behaviour during malfunction:
- Insufficient output

Detection item:
- Accelerator position sensor signal error (sensor / harness open circuit, short to ground etc)

DTC set preconditions:
- Battery voltage is normal
- Key switch turn OFF to ON
- Starter switch signal is not activated

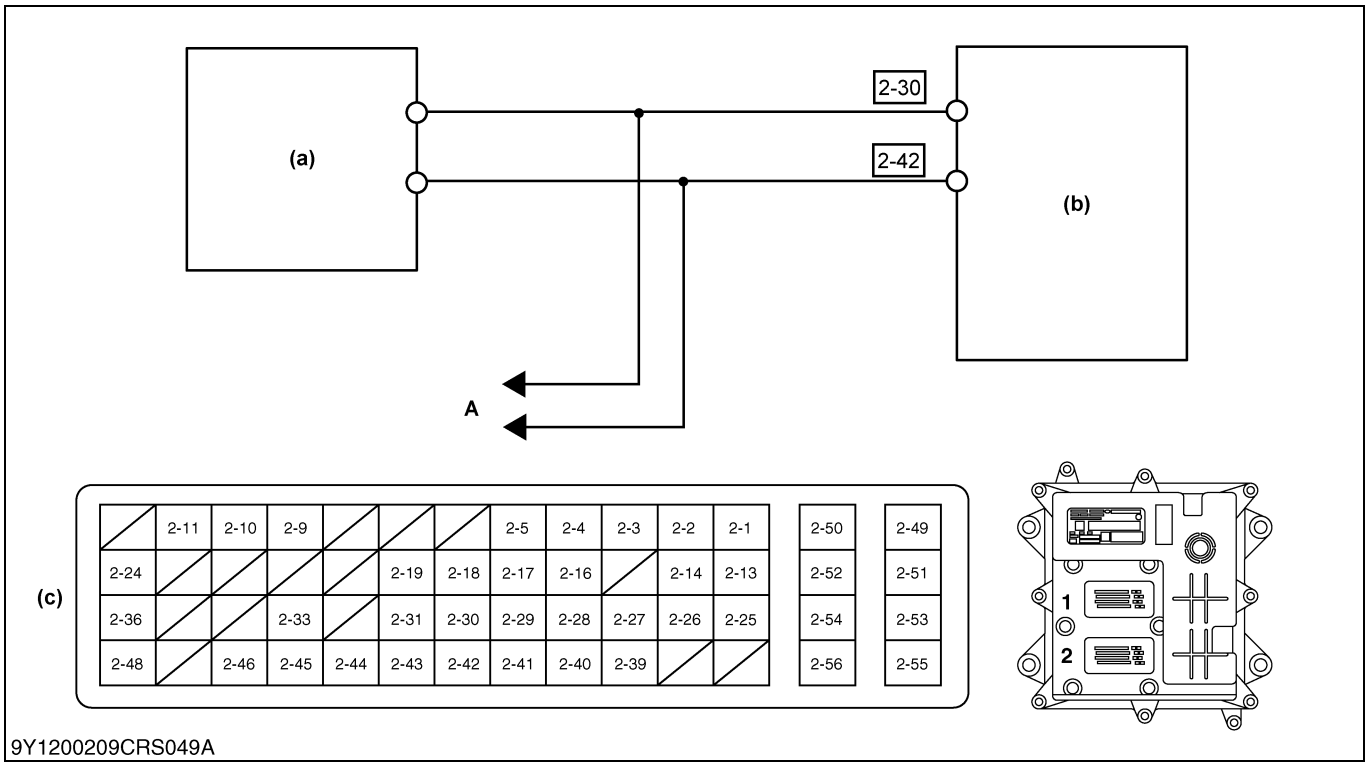
DTC set parameter:
- When accelerator position sensor error signal received by CAN

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Not applicable

Recovery from error:
- Diagnostic counter = zero (CAN signal recovers)

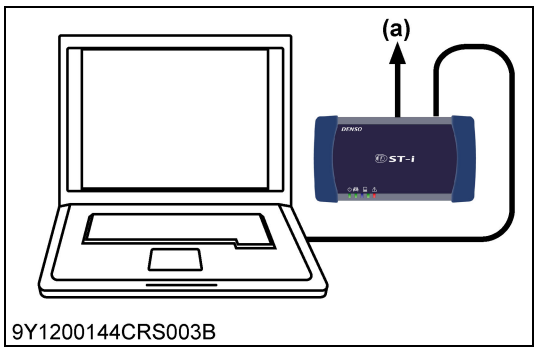
9Y1200209CRS0268US0



9Y1200209CRS049A

(a) ECU for Machine **(b) Engine ECU** **(c) ECU Connector 2** **A: To Other ECU**

9Y1200209CRS0269US0



9Y1200144CRS003B

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

9Y1200209CRS0270US0

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.

9Y1200209CRS0271US0

(39) 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

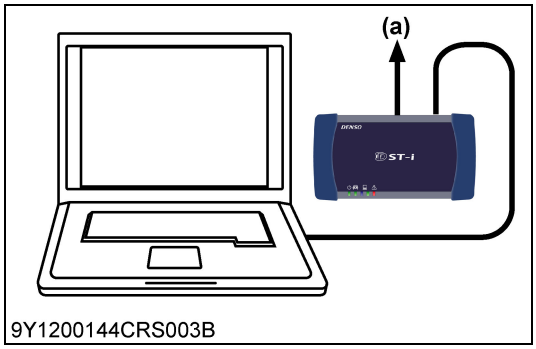
DTC set parameter:
- Deviation from designed correlation in two sensors

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Forced Idle (Accelerator = 0%)

Recovery from error:
- Diagnostic counter = zero

9Y1200209CRS0272US0



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-S210)

■ **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

9Y1200209CRS0273US0

(40) Injector Short (DTC P2147 / 523523-4, P2148 / 523523-3, P2150 / 523524-4, P2151 / 523524-3)

P2147 / 523523-4: No.1 & 4 Cylinder Injector Short To Ground At Power Supply Side, Or All Cylinder Injector Short To Ground

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:
- 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
- Intake throttle 100 % open

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0274US0

P2148 / 523523-3: No.1 & 4 Cylinder Injector Short To +B, Or All Cylinder Injector Short To +B

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:
- Wiring harness short to +B

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

9Y1200209CRS0275US0

P2150 / 523524-4: No.2 & 3 Cylinder Injector Short To Ground At Power Supply Side, Or All Cylinder Injector Short To Ground

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:
- Wiring harness short to ground

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

9Y1200209CRS0283US0

P2151 / 523524-3: No.2 & 3 Cylinder Injector Short To +B, Or All Cylinder Injector Short To +B

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

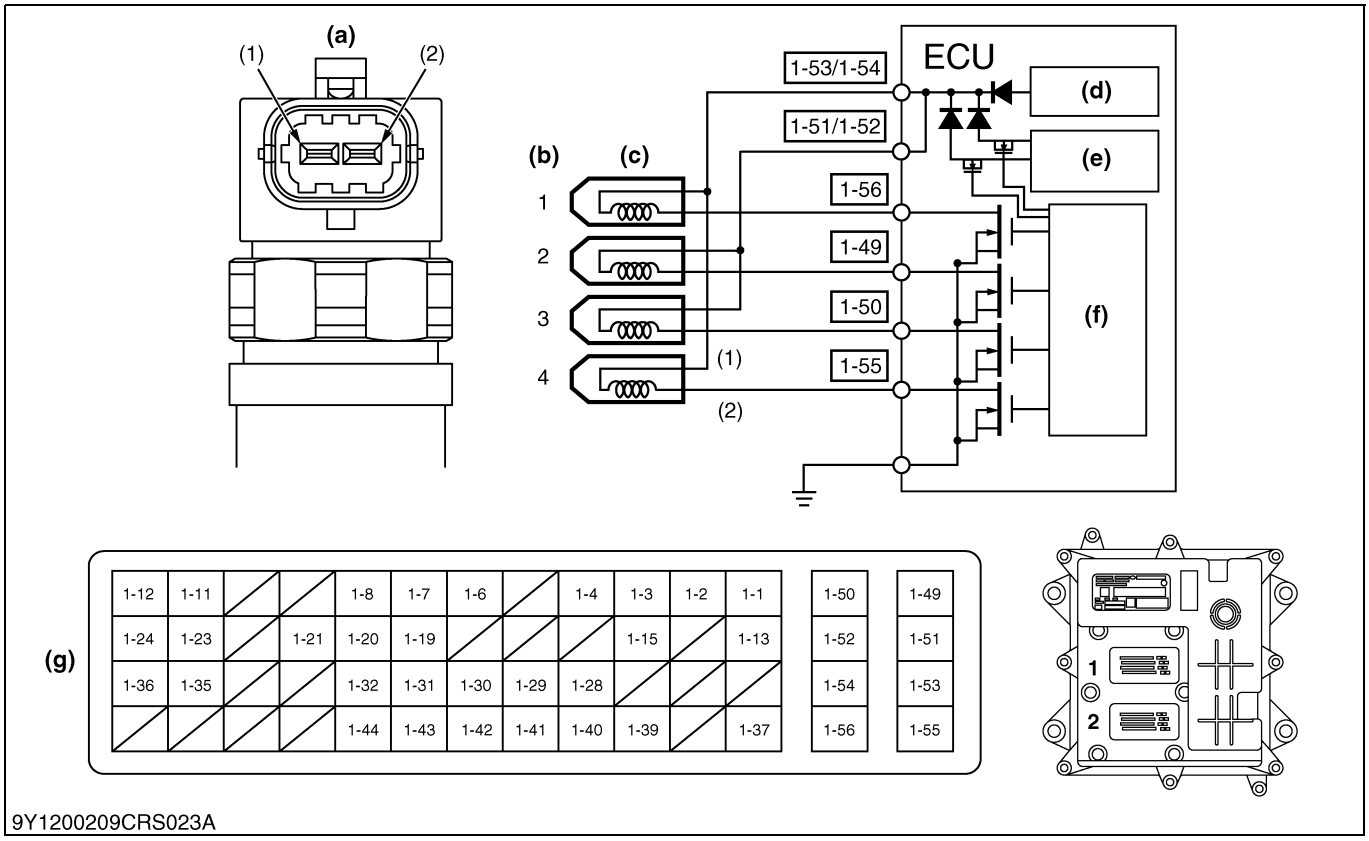
DTC set parameter:
- Wiring harness short to +B

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

9Y1200209CRS0284US0

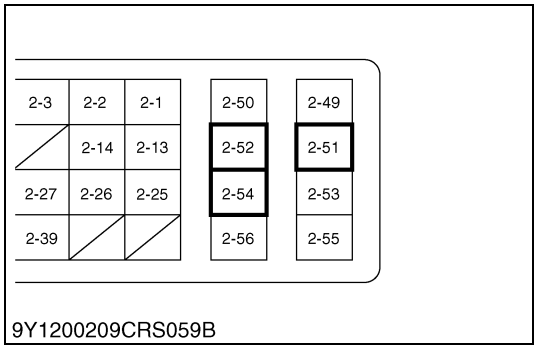


9Y1200209CRS023A

(1) Terminal High
(2) Terminal Low

(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

9Y1200209CRS0276US0



9Y1200209CRS059B

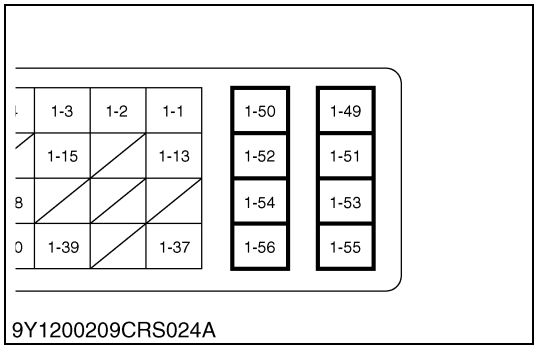
1, Check the Wiring Harness

1. 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 2-51, 2-52, 2-54 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.

9Y1200209CRS0277US0



9Y1200209CRS024A

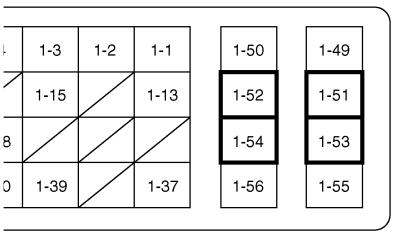
2. Check the Wiring Harness Connectors and ECU Pins

1. 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.

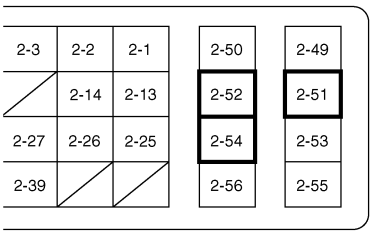
Factory specification	Must be free from faulty connection, deformation, poor contact or other defects.

OK	Go to "3. Measure the ECU Terminal Voltage (Part 1)".
NG	Repair wiring harness connectors and ECU pins, or replace them if defective.

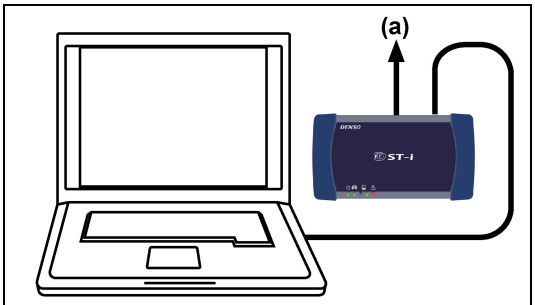
9Y1200209CRS0278US0



9Y1200209CRS024B



9Y1200209CRS059B



9Y1200144CRS003B

3. Measure the ECU Terminal Voltage (Part 1)

1. Place the key switch in the ON position, and measure the voltage between ECU terminal 1-51 / 1-52 or 1-53 / 1-54 and terminal 2-51 / 2-52 / 2-54.

Factory specification	Approx. 6 V

OK	Go to "4. Check the DTC".
NG	Go to "5. Measure the ECU Terminal Voltage (Part 2)".

9Y1200209CRS0279US0

4. Check the DTC

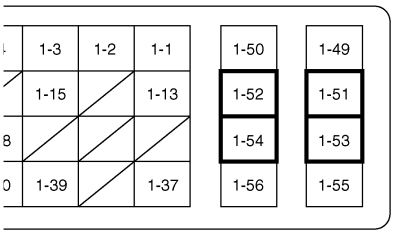
1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Start the engine, and clear the past DTCs.
3. Read the DTC again.

Factory specification	Normal (No DTC is output.)

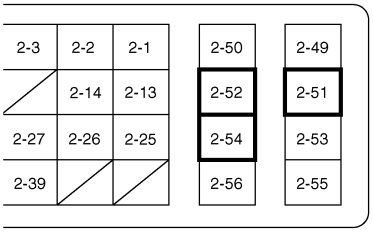
OK	Normal.
NG	Faulty ECU → Replace.

(a) CAN1 Connector

9Y1200209CRS0280US0



9Y1200209CRS024B



9Y1200209CRS059B

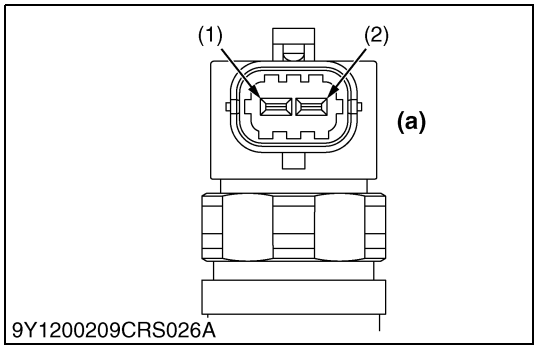
5. Measure the ECU Terminal Voltage (Part 2)

1. 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 1-51 / 1-52 and 1-53 / 1-54 and 2-51 / 2-52 / 2-54. (at the wiring harness side).

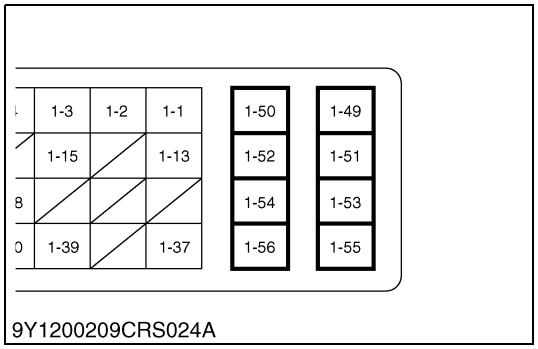
Factory specification	Approx. 6 V

OK	Go to "6. Check the Wiring Harness".
NG	Faulty ECU → Replace.

9Y1200209CRS0281US0



9Y1200209CRS026A



9Y1200209CRS024A

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, P2150	Terminal 1-51 / 1-52 or 1-53 / 1-54 (1-49, 1-50, 1-55, 1-56 occurring simultaneously)	Ground
P2148, P2151		Power supply

■ **NOTE**

- **If DTC P2147 and P2150 (Shorted injector actuation circuit to the ground) has occurred, be sure to check the insulation of injector itself in the following procedure.**

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.

2. 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 High
(2) Terminal Low
(a) Injector

9Y1200209CRS0282US0

(41) 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: 0.2 V or less

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- 65 kPa (0.66 kgf/cm^2, 9.4 psi) [default value]

Recovery from error:
- Diagnostic counter = zero

9Y1200209CRS0286US0

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

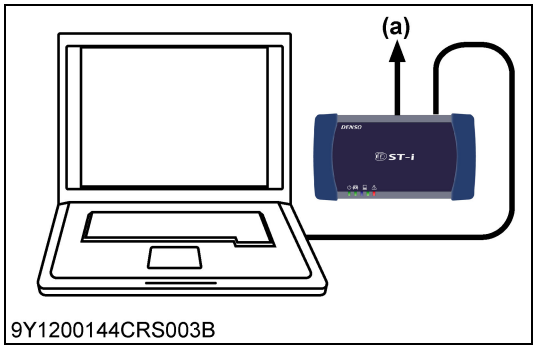
DTC set parameter:
- Barometric pressure sensor voltage: 4.850 V or more

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- 65 kPa (0.66 kgf/cm^2, 9.4 psi) [default value]

Recovery from error:
- Diagnostic counter = zero

9Y1200209CRS0287US0



9Y1200144CRS003B

1. Check the Atmospheric Pressure Signals

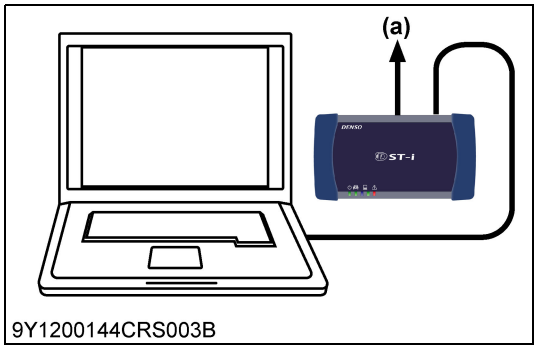
1. Place the key switch in the ON position, and check the "Atmospheric pressure" on the diagnosis tool data monitor.

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

9Y1200209CRS0288US0



9Y1200144CRS003B

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

9Y1200209CRS0289US0

(42) Pressure Limiter Abnormality (DTC P2293 / 679-7 / 679-16)

P2293 / 679-7: Pressure limiter not open

Behaviour during malfunction:
- Engine stop

Detection item:
- Raio pressure value is sticking or too low engine power not to open PL valve forcibility

DTC set preconditions:
- Battery voltage is normal
- Key switch is ON
- After DTC P0088, P0089

DTC set parameter:
- After fault opening PLV, rail pressure is above 160 MPa

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Engine stop

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0290US0

P2293 / 679-16: Rail pressure failure after pressure limiter open

Behaviour during malfunction:
- Engine stop

Detection item:
- Rail pressure value is too high or low despite the existence of response that the pressure limiter opened

DTC set preconditions:
- Battery voltage is normal
- Key switch is ON

DTC set parameter:
- Pressure limiter open (the opening response is detected).
- Rail pressure valve is within 50 MPa and 120 MPa

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Engine stop

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0291US0

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 (MPROP) stuck
2. P2293: Pressure limiter abnormality

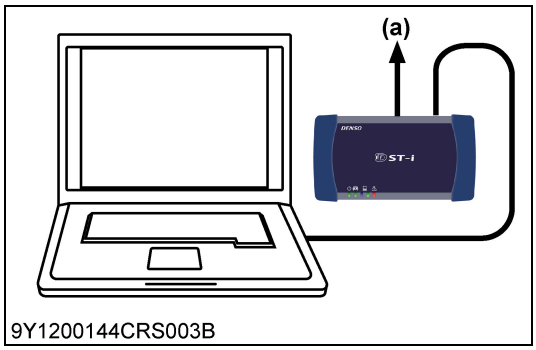
■ **IMPORTANT**
- **Multiple pressure system DTCs may be output simultaneously. Also, both abnormal high pressure and abnormal low pressure may be reported simultaneously under certain malfunction conditions.**

9Y1200209CRS0073US0

■ **NOTE**

- **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.**

9Y1200209CRS0074US0



9Y1200144CRS003B

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"

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

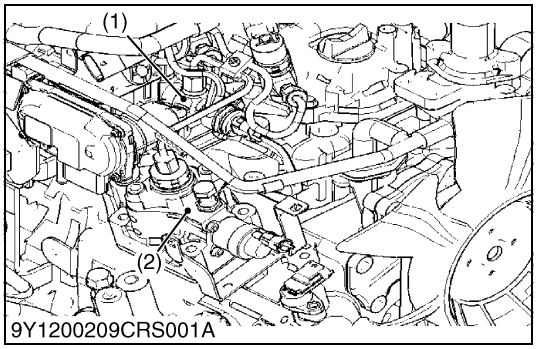
9Y1200209CRS0075US0

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.

9Y1200209CRS0076US0



9Y1200209CRS001A

3. Check the Fuel System

CAUTION

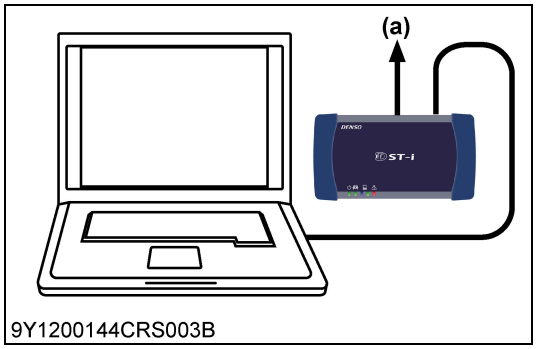
- **Visually check there is no leak in the high pressure fuel pipe system.**
- **A visual check is not possible if a leak (high pressure system) occurs inside the head cover, so check that the oil level has not increased.**

1. Check in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271.)

OK	Go to "4. Check the Rail Pressure Sensor (*Refer to Items P0192 and P0193)".
NG	Repair in accordance with "6.[2] FUEL SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S271.)

(1) Rail (2) Supply Pump

9Y1200209CRS0077US0



9Y1200144CRS003B

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

1. Check the rail pressure sensor.

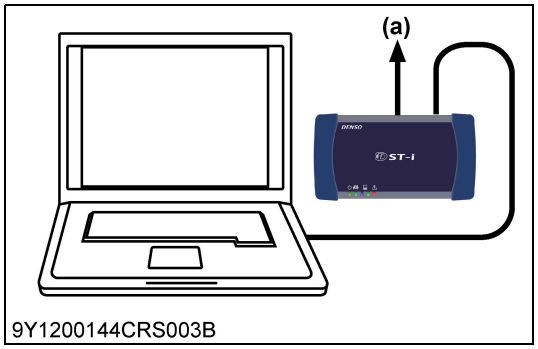
■ **NOTE**

- **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-S144)

(a) CAN1 Connector

9Y1200209CRS0078US0



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.)

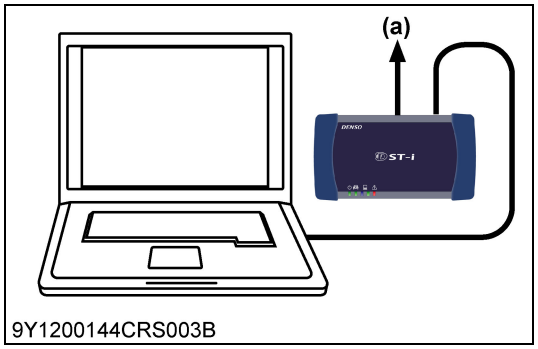
■ **NOTE**

- **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

9Y1200209CRS0079US0



6. Check the SCV-related Data

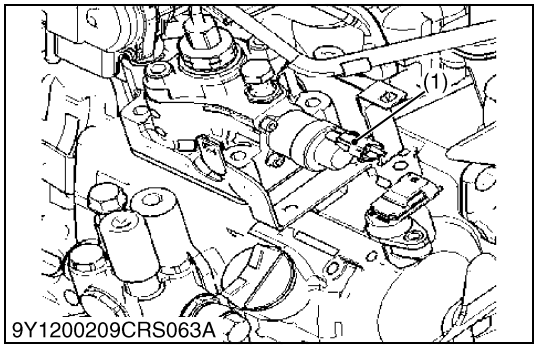
1. Check the "Target rail pressure", "Actual rail pressure", "Target SCV current", "Actual SCV current" on the data monitor.
2. Observe the data signals by operating the accelerator pedal and others and by performing the actual run test.

Factory specification	1. The "Actual SCV current value" always follow to the "Target SCV current value".

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 supply pump.

(a) CAN1 Connector

9Y1200209CRS0080US0



7. Check the "Actual rail pressure" with fully-opened SCV

1. Disconnect the SCV connector during the engine operating.
2. Check the "Actual rail pressure" on the data monitor.

Factory specification	Actual rail pressure: 50 MPa to 120 MPa

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 Rail.

(1) SCV (Suction Control Valve)

9Y1200209CRS0544US0

(43) 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

9Y1200209CRS0292US0

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

9Y1200209CRS0293US0

P2415 / 523577-2: EGR (DC motor) temperature sensor failure

Behaviour during malfunction:
- Insufficient output
- Worsening exhaust gas performance

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

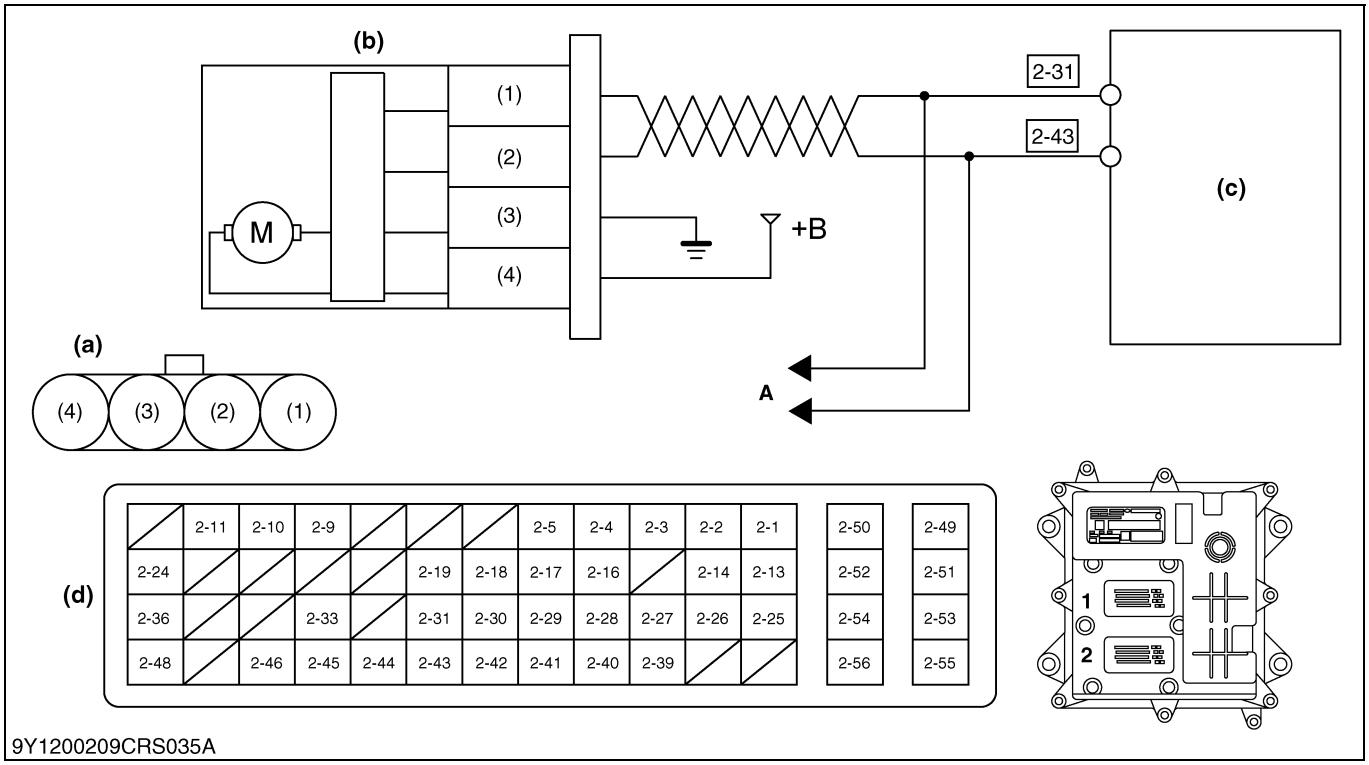
DTC set parameter:
- EGR (DC motor) temperature sensor error signal received via CAN

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

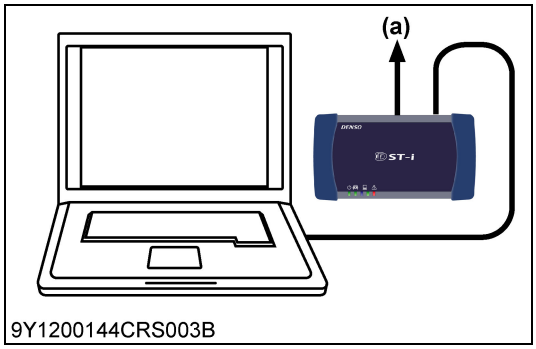
9Y1200209CRS0294US0



9Y1200209CRS035A

(1) Terminal CAN-H
(2) Terminal CAN-L
(3) Terminal Ground
(4) Terminal +B (12 V)
(a) Terminal Layout
(b) EGR Valve Assembly
(c) Engine ECU
(d) ECU Connector 2
A: To Diagnosis Tool

9Y1200209CRS0178US0



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 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

9Y1200209CRS0179US0

(44) 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

9Y1200209CRS0295US0

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.

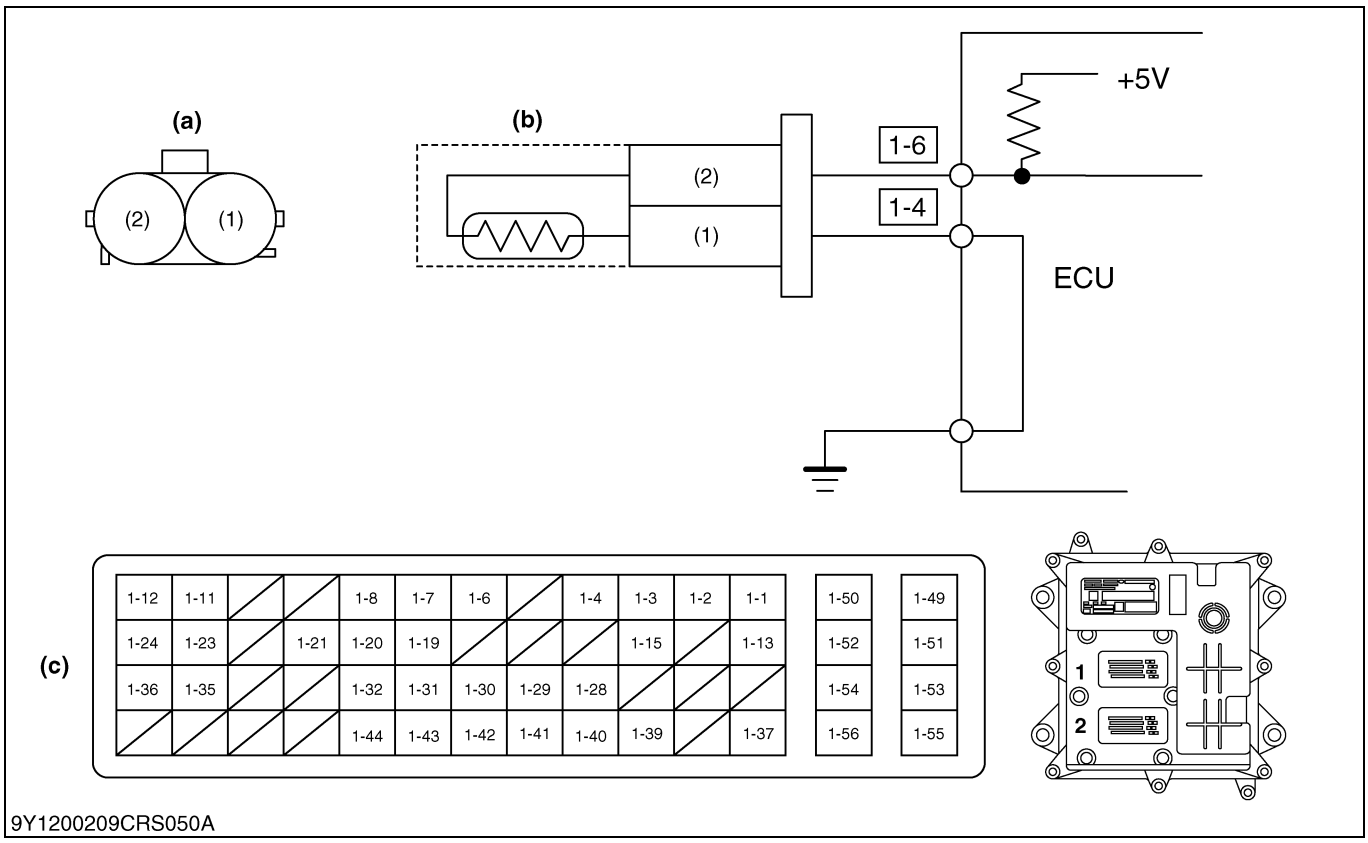
DTC set parameter:
- DPF outlet temperature sensor (T2) voltage: 4.92 V or more

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

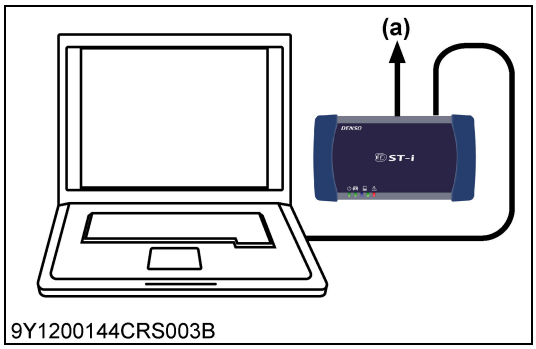
9Y1200209CRS0296US0



9Y1200209CRS050A

(1) Terminal Ground
(2) Terminal Signal
(a) Terminal Layout
(b) Exhaust Gas Temperature Sensor 2 (T2)
(c) ECU Connector 1

9Y1200209CRS0297US0



9Y1200144CRS003B

1. Check the Exhaust Gas Temperature Sensor Signals

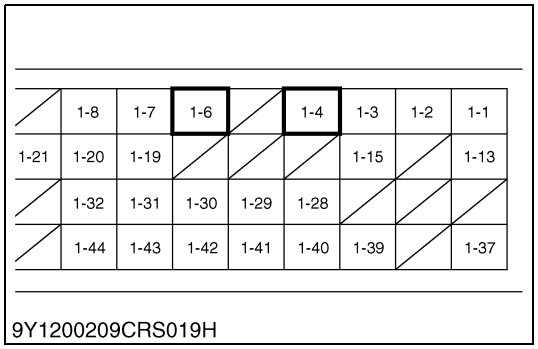
1. Place the key switch in the ON position, and check the "Exhaust gas temperature" and "Exhaust gas temperature sensor output voltage" on the diagnosis tool data monitor.

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

9Y1200209CRS0298US0



9Y1200209CRS019H

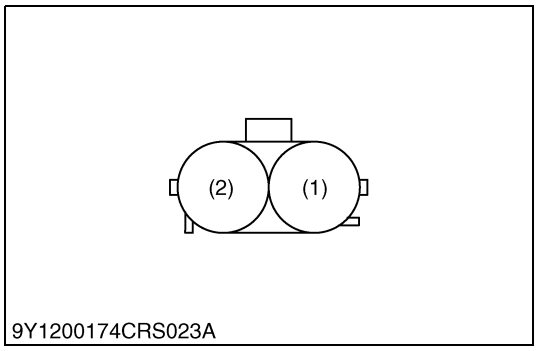
2. Measure the Resistance Between Terminals

1. Place the key switch in the OFF position, unplug the ECU wiring harness connector from the socket, and measure the resistance between terminals 1-4 and 1-6 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".

9Y1200209CRS0299US0



9Y1200174CRS023A

3. Check the Sensor

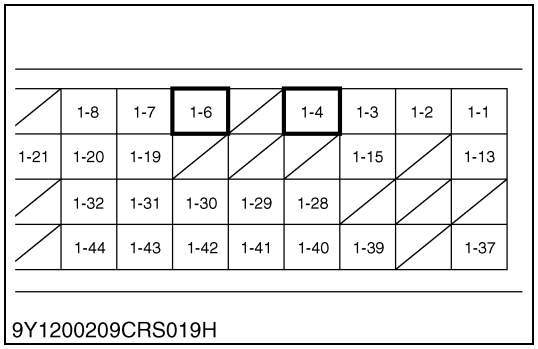
1. Turn the key switch OFF, remove the connector from the sensor side and measure the resistance between the terminals on the sensor side.

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 Ground (1) Terminal Signal

9Y1200209CRS0300US0



9Y1200209CRS019H

4. Measure the ECU Terminal Voltage

1. Plug the ECU wiring harness connector into socket again, unplug the sensor connector, and measure the voltage between ECU terminals 1-4 and 1-6 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.

9Y1200209CRS0301US0

(45) 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
- Starter switch signal is not activated

DTC set parameter:
- DPF differential pressure sensor voltage: 0.2 V or less

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- 0 kPa (0.0 kgf/cm^2, 0.0 psi) [default value]
- Output limitation: Approximately 75 % of normal condition

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0302US0

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
- Starter switch signal is not activated

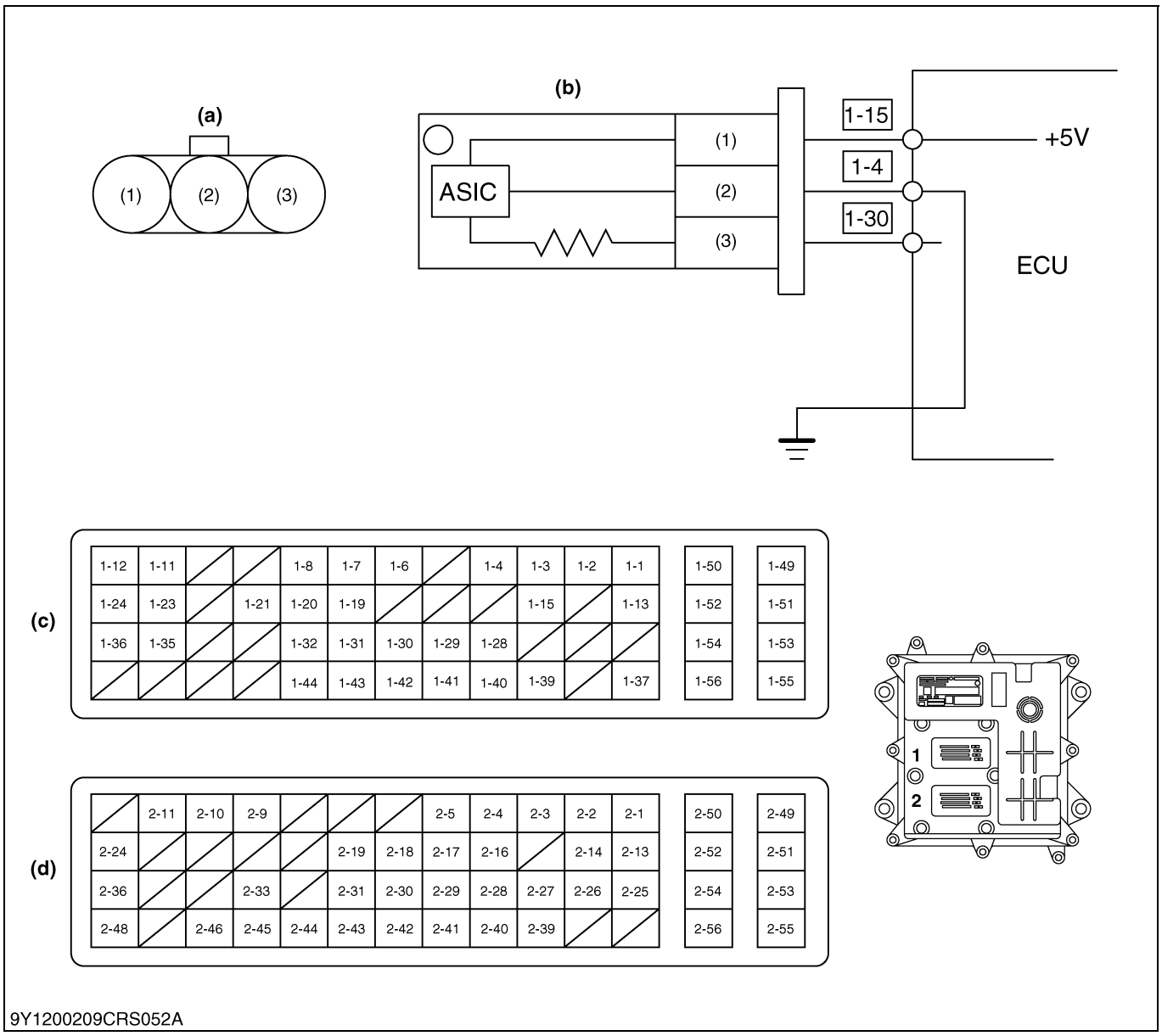
DTC set parameter:
- DPF differential pressure sensor voltage: 4.8 V or more

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- 0 kPa (0.0 kgf/cm^2, 0.0 psi) [default value]
- Output limitation: Approximately 75 % of normal condition

Recovery from error:
- Key switch turn OFF

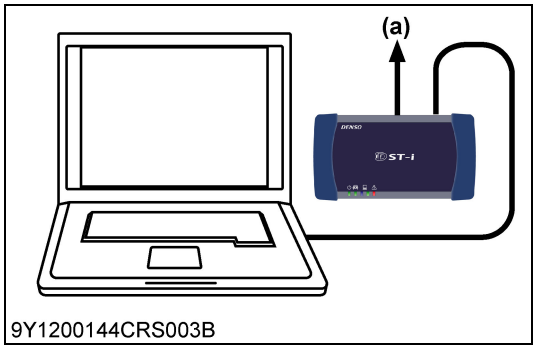
9Y1200209CRS0303US0



(1) Terminal 5 V
(2) Terminal Ground
(3) Terminal Signal

(a) Terminal Layout
(b) Differential Pressure Sensor
(c) ECU Connector 1
(d) ECU Connector 2

9Y1200209CRS0304US0



9Y1200144CRS003B

1. Check the Differential Pressure Signals

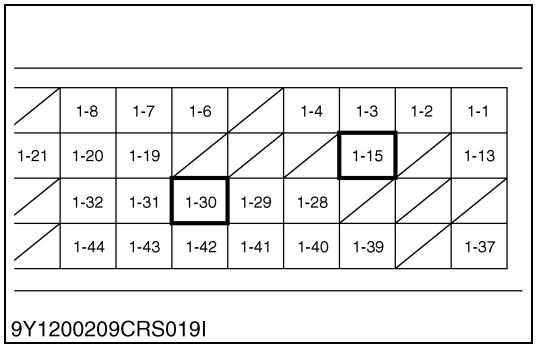
1. Place the key switch in the OFF position, attach the diagnosis tool to the CAN1 connector, and return the key switch to the ON position again. Then, check the "Differential pressure" and "Differential pressure sensor output voltage" on the diagnosis tool data monitor.

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

9Y1200209CRS0305US0



9Y1200209CRS019I

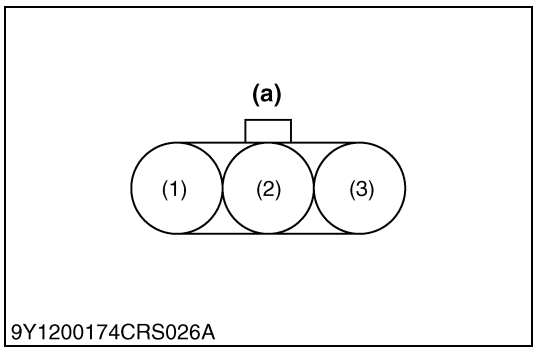
2. Measure the ECU Terminal Voltage

1. Move the key switch from the OFF to the ON position, and measure the voltage between ECU terminals 1-15 and 1-30.

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".	

9Y1200209CRS0306US0



9Y1200174CRS026A

3. Measure the Voltage Between Differential Pressure Sensor Terminals

1. 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.

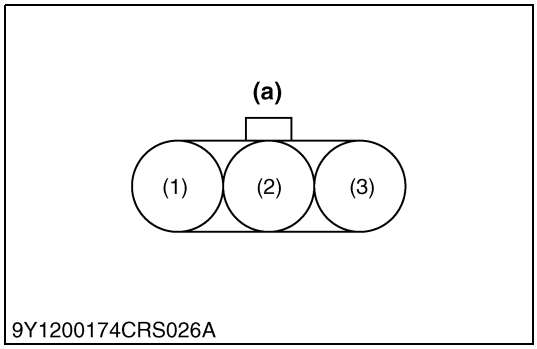
Factory specification	
Engine state	Output voltage
Key switch ON	Approx. 0.7 V

OK	Check the wiring harness (between ECU terminal 1-30 and sensor terminal (3)). → Repair the faulty area.
NG	Go to "4. Measure the Voltage Between Differential Pressure Sensor Terminals".

(1) Terminal 5 V
(2) Terminal Ground
(3) Terminal Signal

(a) Differential Pressure Sensor Connector

9Y1200209CRS0307US0



9Y1200174CRS026A

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).

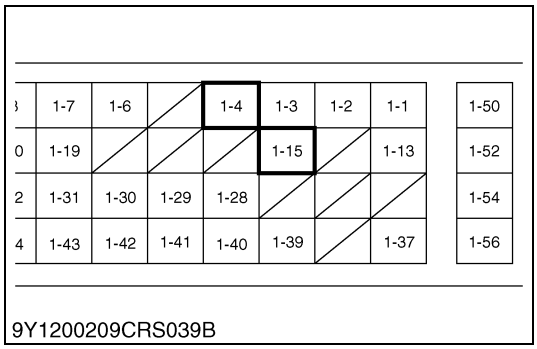
Factory specification	Approx. 5 V

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 5 V
(2) Terminal Ground
(3) Terminal Signal

(a) Differential Pressure Sensor Connector

9Y1200209CRS0308US0



9Y1200209CRS039B

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 1-4 and 1-15.

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 1-4 and sensor terminal (2) and between ECU terminal 1-15 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.**

9Y1200209CRS0309US0

(46) 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: 0.151 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

9Y1200209CRS0310US0

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

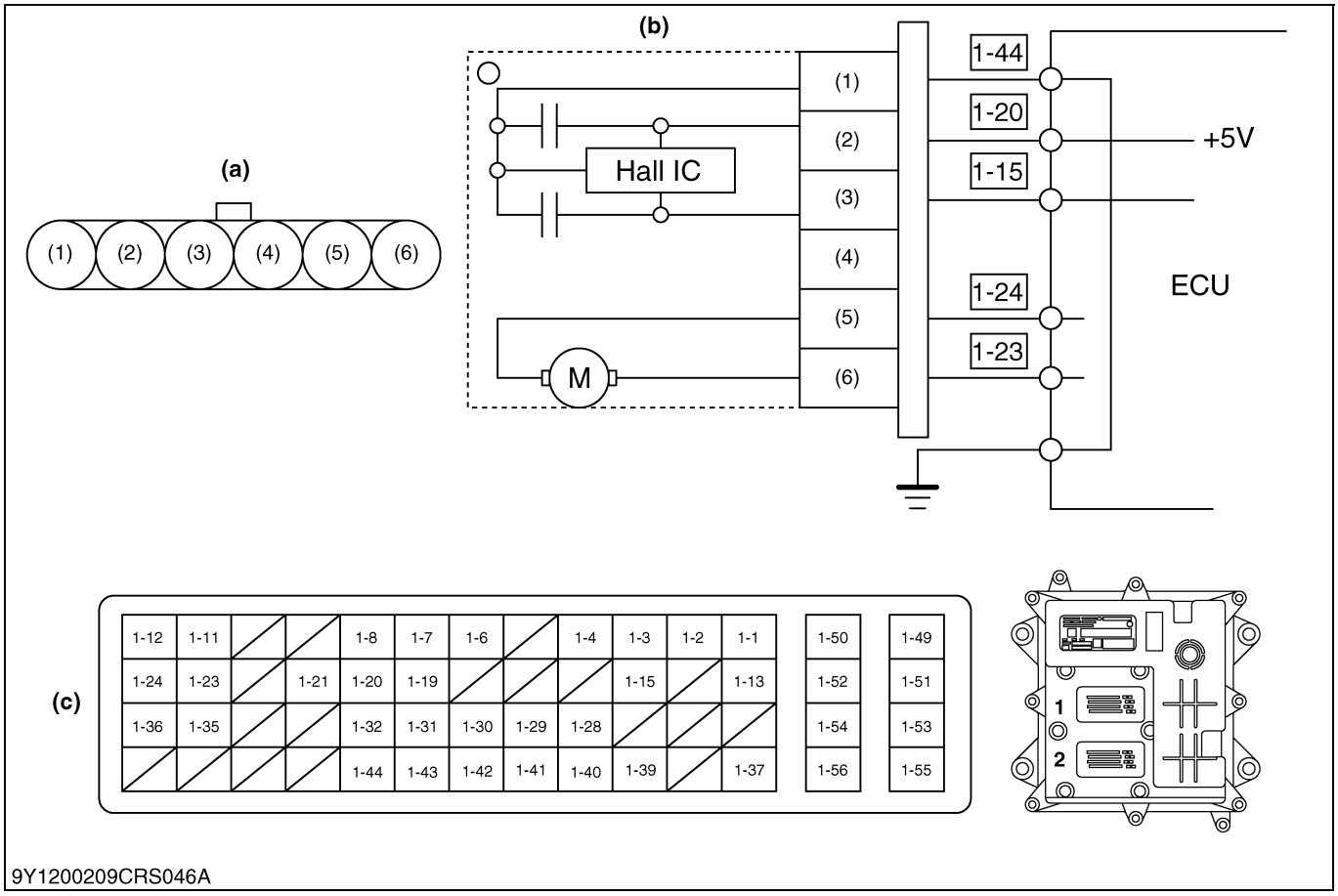
DTC set parameter:
- Intake throttle lift sensor voltage: 4.848 V or more

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

9Y1200209CRS0311US0

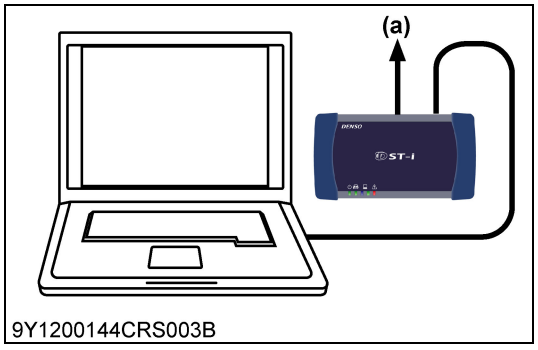


9Y1200209CRS046A

(1) Terminal Ground
(2) Terminal Signal
(3) Terminal 5 V
(4) No Connection
(5) Terminal Motor (−)
(6) Terminal Motor (+)

(a) Terminal Layout
(b) Intake Throttle Valve
(c) ECU Connector 1

9Y1200209CRS0250US0



9Y1200144CRS003B

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

9Y1200209CRS0251US0

(47) 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

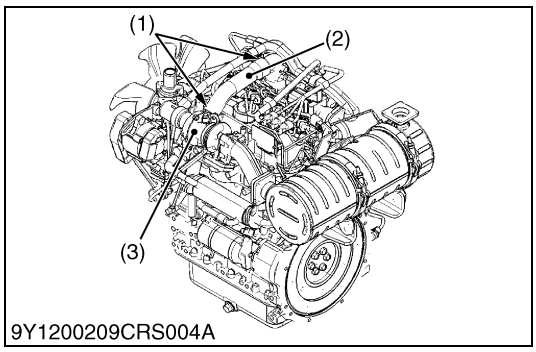
DTC set parameter:
- T1 − T0 ≥ 250 °C (482 °F)

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

9Y1200209CRS0312US0



9Y1200209CRS004A

1. Check the Air Intake System

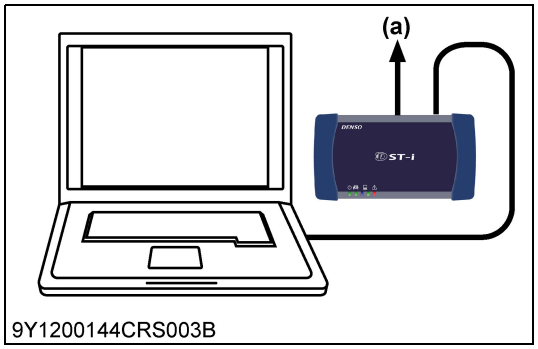
1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270.)

■ **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-S270.)

(1) Hose Clamp
(2) Hose
(3) Turbocharger

9Y1200209CRS0313US0



9Y1200144CRS003B

2. Check the DTC

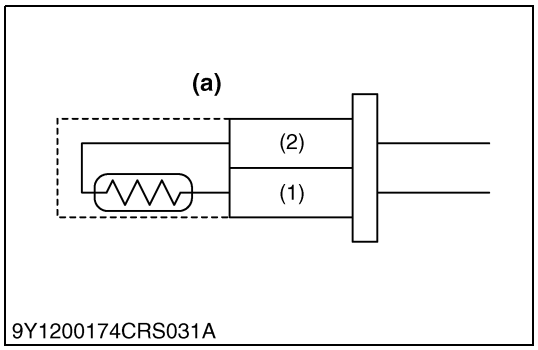
1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position and select the "Exhaust Gas Temperature sensor 0", "Exhaust gas temperature sensor 1" and "Exhaust gas temperature sensor 2" on the data monitor.function.
3. Check 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

9Y1200209CRS0314US0



9Y1200174CRS031A

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 Ground
(2) Terminal Signal

(a) Exhaust Gas Temperature Sensor (T0, T1 and T2)

9Y1200209CRS0315US0

(48) 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

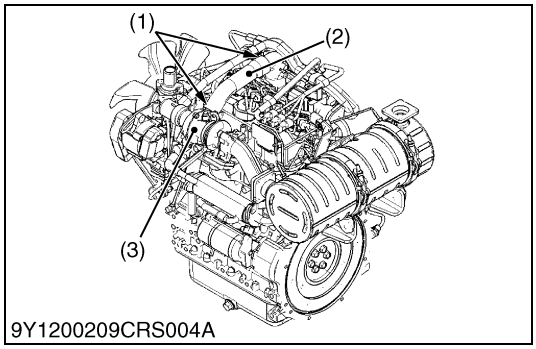
DTC set parameter:
- DOC inlet temperature (T0): 700 °C (1292 °F) or more

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Stop injection (Q = 0 mm^3/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

9Y1200209CRS0316US0



9Y1200209CRS004A

1. Check the Air Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270.)

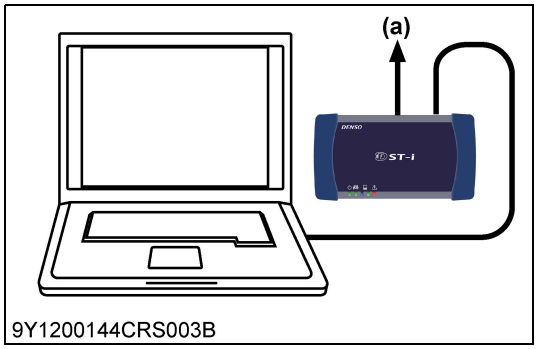
■ **IMPORTANT**
- **If the two errors occur from "Emergency exhaust gas temperature sensor T0 high", "Emergency exhaust gas temperature sensor T1 high", and "Emergency exhaust gas temperature T2 high" at the same time, check the exhaust gas temperature starting from a bigger number.**

■ **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-S270.)

(1) Hose Clamp
(2) Hose
(3) Turbocharger

9Y1200209CRS0317US0



9Y1200144CRS003B

2. Check the Exhaust Gas Temperature

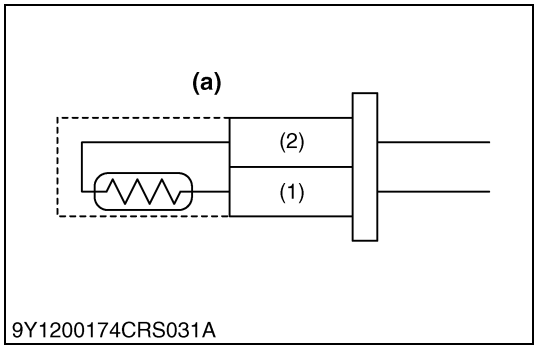
1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position and select the "Exhaust gas temperature Sensor 0", "Exhaust gas temperature Sensor 1" and "Exhaust gas temperature Sensor 2" on the data monitor.function.
3. If 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

9Y1200209CRS0318US0



9Y1200174CRS031A

3. Check the Exhaust Gas Temperature Sensors (Refer to items P0543, P0546 and P242C)

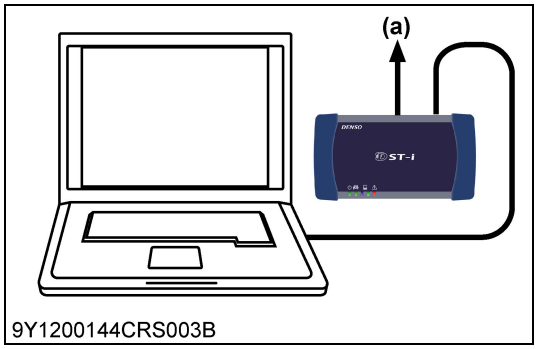
1. Check the exhaust gas temperature sensors (T0, T1 and T2).

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 Ground
(2) Terminal Signal

(a) Exhaust Gas Temperature Sensor (T0, T1 and T2)

9Y1200209CRS0319US0



9Y1200144CRS003B

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

9Y1200209CRS0320US0

(49) 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

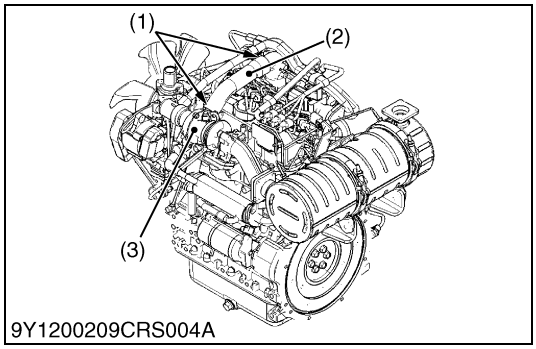
DTC set parameter:
- DPF inlet temperature (T1): 715 °C (1319 °F) or more

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Stop injection (Q = 0 mm^3/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

9Y1200209CRS0321US0



9Y1200209CRS004A

1. Check the Air Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270.)

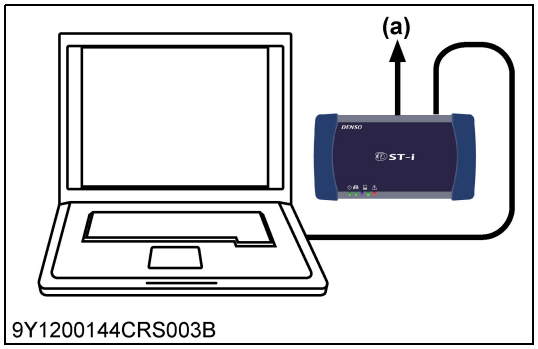
■ **IMPORTANT**
- **If the two errors occur from "Emergency exhaust gas temperature sensor T0 high", "Emergency exhaust gas temperature sensor T1 high", and "Emergency exhaust gas temperature T2 high" at the same time, check the exhaust gas temperature starting from a bigger number.**

■ **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-S270.)

(1) Hose Clamp
(2) Hose
(3) Turbocharger

9Y1200209CRS0317US0



9Y1200144CRS003B

2. Check the Exhaust Gas Temperature

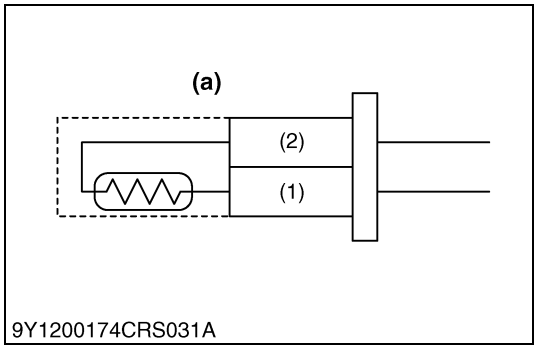
1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position and select the "Exhaust Gas Temperature Sensor 0", "Exhaust Gas Temperature Sensor 1" and "Exhaust Gas Temperature Sensor 2" on the data monitor function.
3. If 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

9Y1200209CRS0322US0



9Y1200174CRS031A

3. Check the Exhaust Gas Temperature Sensors (Refer to items P0543, P0546 and P242C)

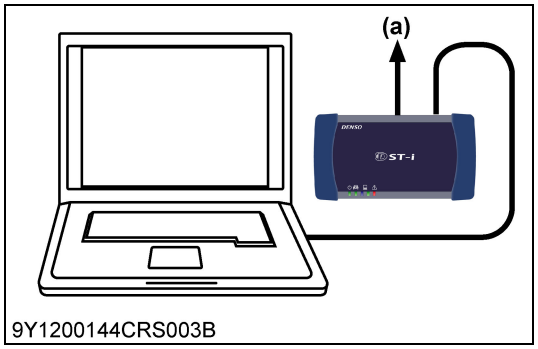
1. Check the exhaust gas temperature sensors (T0, T1 and T2).

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 Ground
(2) Terminal Signal

(a) Exhaust Gas Temperature Sensor (T0, T1 and T2)

9Y1200209CRS0323US0



9Y1200144CRS003B

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

9Y1200209CRS0324US0

(50) 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

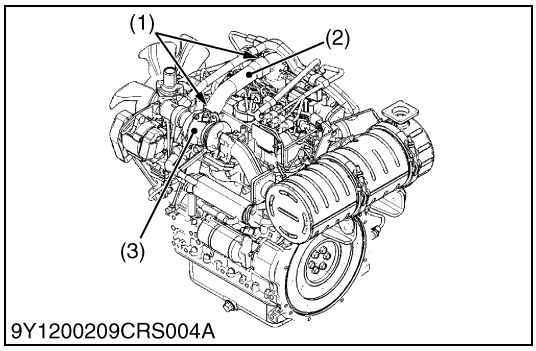
DTC set parameter:
- DPF outlet temperature (T2): 820 °C (1508 °F) or more

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Stop injection (Q = 0 mm^3/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

9Y1200209CRS0325US0



9Y1200209CRS004A

1. Check the Air Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270.)

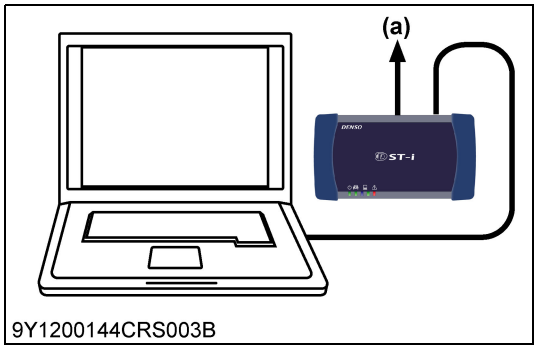
■ **IMPORTANT**
- **If the two errors occur from "Emergency exhaust gas temperature sensor T0 high", "Emergency exhaust gas temperature sensor T1 high", and "Emergency exhaust gas temperature T2 high" at the same time, check the exhaust gas temperature starting from a bigger number.**

■ **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-S270.)

(1) Hose Clamp
(2) Hose
(3) Turbocharger

9Y1200209CRS0317US0



9Y1200144CRS003B

2. Check the Exhaust Gas Temperature

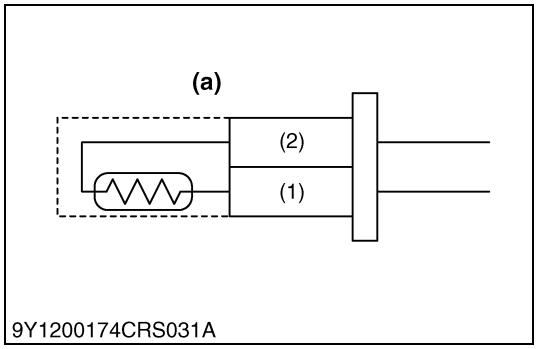
1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position and select the "Exhaust Gas Temperature Sensor 0", "Exhaust Gas Temperature Sensor 1" and "Exhaust Gas Temperature Sensor 2" on the data monitor.function.
3. If 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

9Y1200209CRS0326US0



9Y1200174CRS031A

3. Check the Exhaust Gas Temperature Sensors (Refer to items P0543, P0546 and P242C)

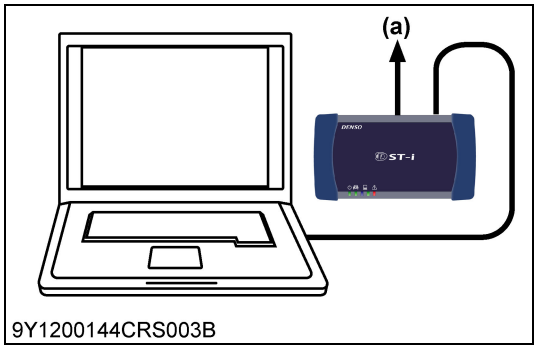
1. Check the exhaust gas temperature sensors (T0, T1 and T2).

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 Ground
(2) Terminal Signal

(a) Exhaust Gas Temperature Sensor (T0, T1 and T2)

9Y1200209CRS0327US0



9Y1200144CRS003B

4. Check the DTC

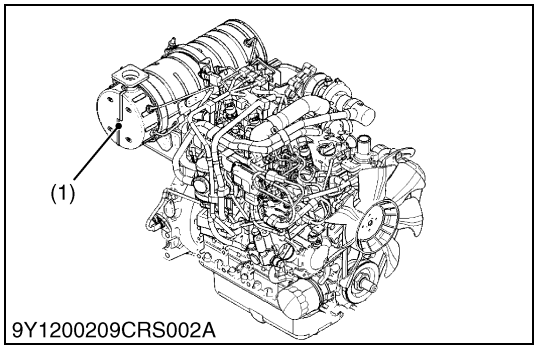
1. Check the engine noise and vibration after starting up the engine. Check whether turbo has abnormality. (sound and externals)
2. Check whether the other DTC is output or not by operating the engine in the normal condition.
3. If it is OK, restart and operate the engine for 10 minutes with the engine 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

9Y1200209CRS0328US0



9Y1200209CRS002A

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

9Y1200209CRS0329US0

(51) 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

9Y1200209CRS0330US0

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.**

9Y1200209CRS0331US0

(52) Excessive PM4 (DTC P3007 / 3701-16)

Behaviour during malfunction:
- Insufficient output

Detection item:
- PM accumulation level4

DTC set preconditions:
- Battery voltage is normal

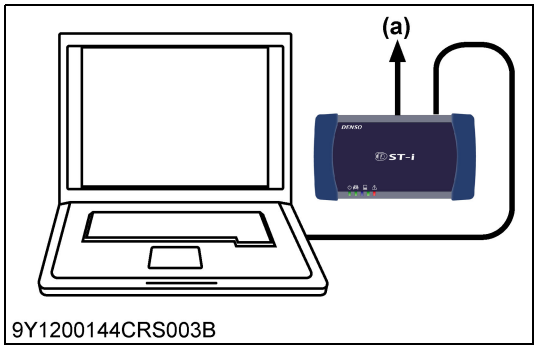
DTC set parameter:
- PM accumulation more than trigger level
  Regeneration level = 4

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

9Y1200209CRS0332US0



9Y1200144CRS003B

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

9Y1200209CRS0333US0

(53) Excessive PM5 (DTC P3008 / 3701-0)

Behaviour during malfunction:
- Insufficient output

Detection item:
- PM accumulation level5

DTC set preconditions:
- Battery voltage is normal

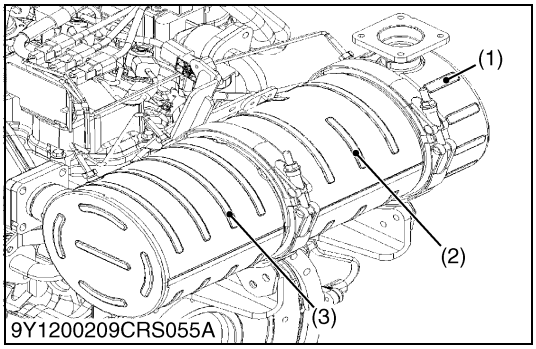
DTC set parameter:
- PM accumulation more than trigger level
  Regeneration level = 5

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

9Y1200209CRS0334US0



1. Replace of DPF

1. Replace the DPF Filter Comp.

■ **NOTE**
- **Followings are potential causes.**
  - **A manual regeneration has not been carried out.**

(1) DPF Outlet Body
(2) DPF Filter Comp
(3) DOC

9Y1200209CRS0335US0

(54) 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

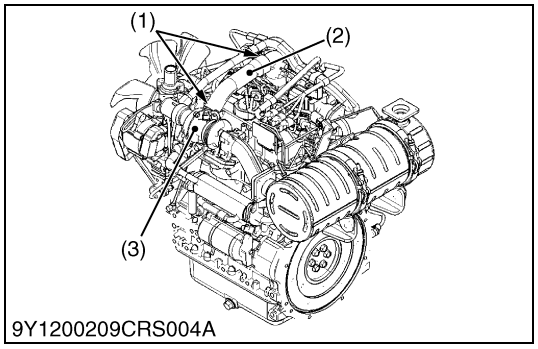
DTC set parameter:
- Disconnect the hose between the turbo blower out and intake flange
- Boost pressure sensor error

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
- Intake throttle 100 % open

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0336US0



9Y1200209CRS004A

1. Check the Air Intake System

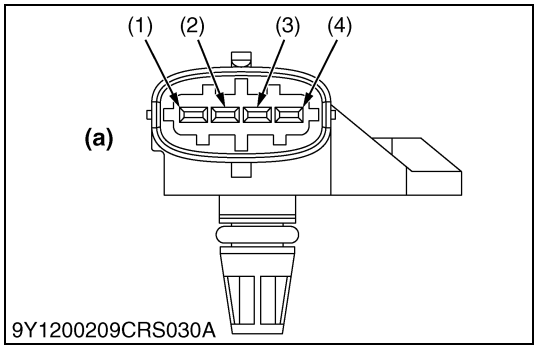
1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270.)

■ **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-S270.)

(1) Hose Clamp
(2) Hose
(3) Turbocharger

9Y1200209CRS0337US0



9Y1200209CRS030A

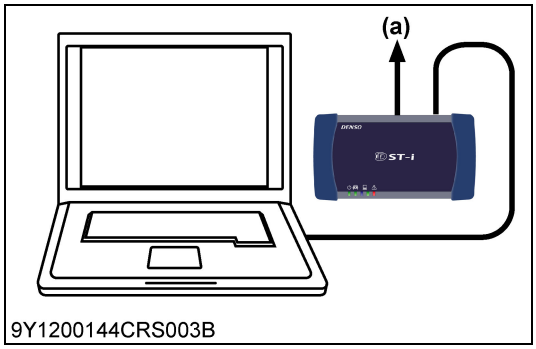
2. Check the Boost Pressure Sensor (Refer to items P0237 and P0238)

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 Signal (Pressure)
(2) Terminal 5 V
(3) Terminal Signal (Temperature)
(4) Terminal Ground
(a) Boost Pressure Sensor

9Y1200209CRS0338US0



9Y1200144CRS003B

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

9Y1200209CRS0339US0

(55) 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]

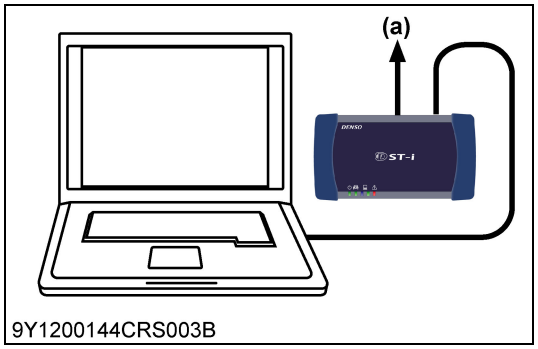
DTC set parameter:
- Engine coolant temperature stays below 65 °C (149 °F) under parked regeneration process. when the state above continues for 1500 seconds or more

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)

9Y1200209CRS0340US0



9Y1200144CRS003B

1. Check the Coolant Temperature

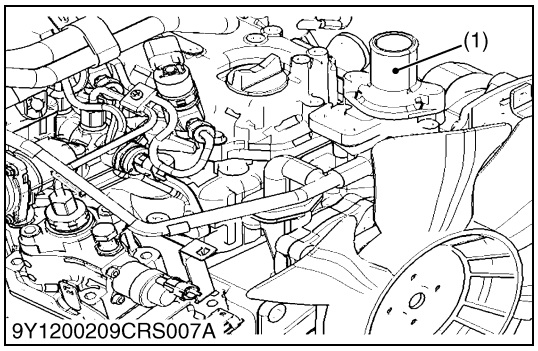
1. Perform the DPF Manual Regeneration again after warming up the engine.
2. Monitor the coolant temperature in the no-load maximum speed status with the diagnosis tool.

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

9Y1200209CRS0341US0



9Y1200209CRS007A

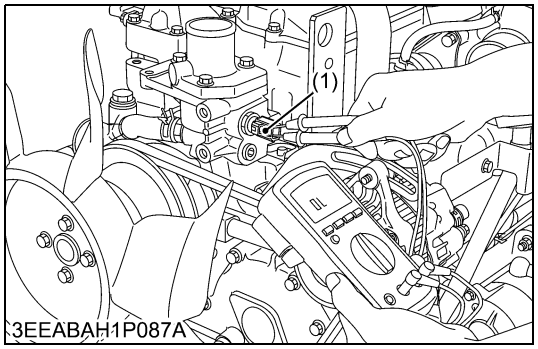
2. Check the Thermostat

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

9Y1200209CRS0342US0



3EEABAH1P087A

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

9Y1200209CRS0343US0

(56) 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]

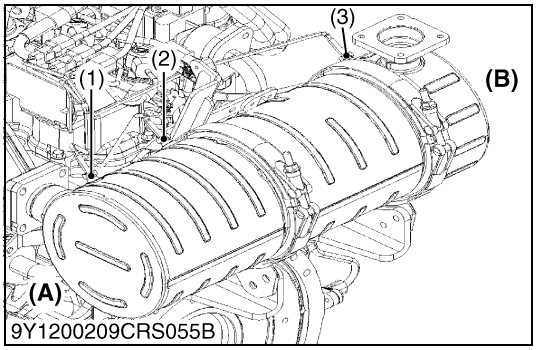
DTC set parameter:
- Coolant temperature is 65 °C (149 °F) or more and Regeneration was not completed within target time (approximately 30 min.) when the state above continues for 2700 seconds or more

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)

9Y1200209CRS0344US0



9Y1200209CRS055B

1. Check the Installation of Exhaust Gas Temperature sensor

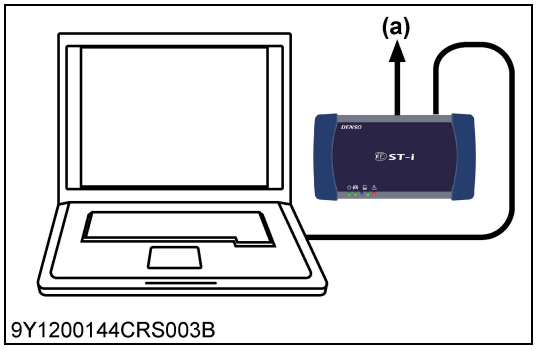
1. Check the installation of all exhaust gas temperature sensors (T0, T1 and T2).
2. Check the installation condition of the thermostat, and whether rust is not occurred.
3. Reinstall or replace the thermostat as necessary.

OK	Go to "2. 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

9Y1200209CRS0345US0



9Y1200144CRS003B

2. DPF Manual Regeneration

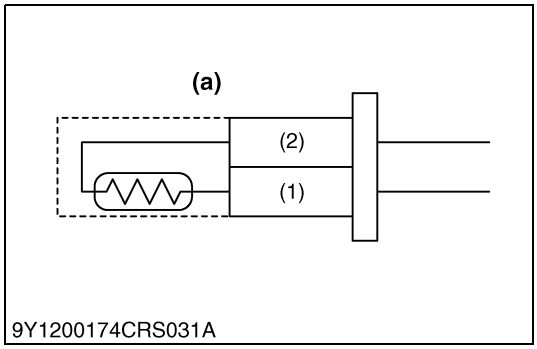
1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Turn the key switch to the ON position and select the "Exhaust Gas Temperature Sensor 0", "Exhaust Gas Temperature Sensor 1" and "Exhaust Gas Temperature Sensor 2" on the data monitor.function.
3. Perform 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

9Y1200209CRS0346US0



9Y1200174CRS031A

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 Ground
(2) Terminal Signal
(a) Exhaust Gas Temperature Sensor (T0, T1 and T2)

9Y1200209CRS0347US0

(57) 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 mm^3/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

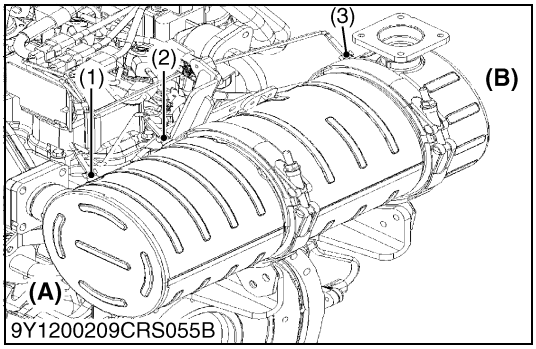
DTC set parameter:
- All exhaust gas temperature sensor failure (sensor low) simultaneously

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

9Y1200209CRS0348US0



9Y1200209CRS055B

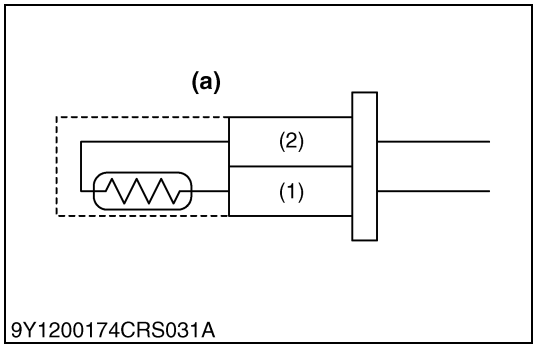
1. Check the Installation of Exhaust Gas Temperature sensor

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
(2) Exhaust Gas Temperature Sensor T1
(3) Exhaust Gas Temperature Sensor T2
(A) Exhaust Inlet Side
(B) Exhaust Outlet Side

9Y1200209CRS0349US0



9Y1200174CRS031A

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 Ground
(2) Terminal Signal
(a) Exhaust Gas Temperature Sensor (T0, T1 and T2)

9Y1200209CRS0350US0

(58) 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

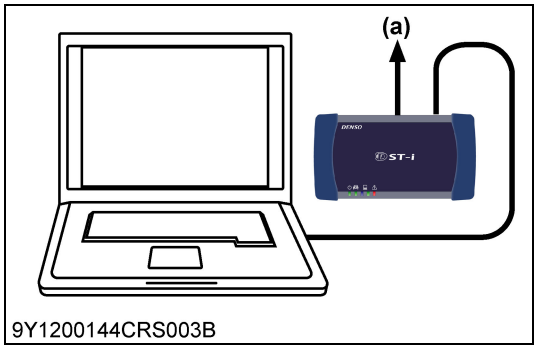
DTC set parameter:
- All exhaust gas temperature (T0, T1 and T2) reduces down to 300 °C (572 °F)

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

9Y1200209CRS0351US0



9Y1200144CRS003B

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

9Y1200209CRS0352US0

(59) 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

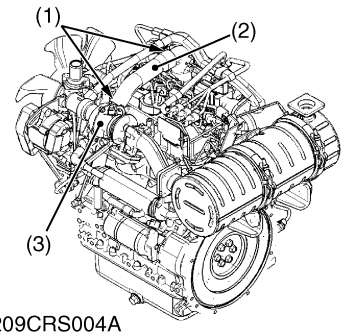
DTC set parameter:
- Regeneration time interval within 30 min. occurs three times continuously

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 (Reset by Service tool)

9Y1200209CRS0353US0



9Y1200209CRS004A

1. Check the Air Intake System

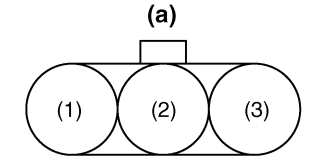
1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S270.)

■ **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-S270.)

(1) Hose Clamp
(2) Hose
(3) Turbocharger

9Y1200209CRS0354US0



9Y1200174CRS026A

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 5 V
(2) Terminal Ground
(3) Terminal Signal
(a) Differential Pressure Sensor Connector

9Y1200209CRS0355US0

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.

9Y1200209CRS0356US0

(60) 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

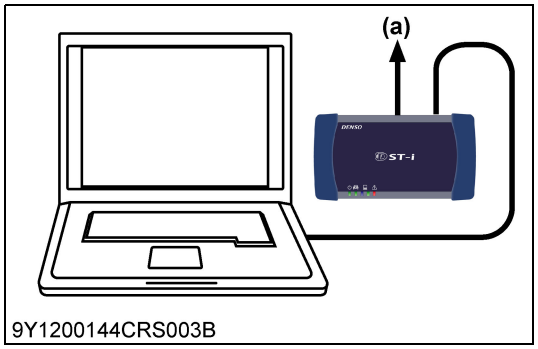
DTC set parameter:
- Engine coolant temperature ≥ 110 °C (230 °F)

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- None

Recovery from error:
- Diagnostic counter = zero

9Y1200209CRS0357US0



9Y1200144CRS003B

1. Check the DTC

1. This DTC does not mean error.
   The EGR operation is restricted when the coolant temperature rises above 110 °C (230 °F).
   So, this warning indicates that emission could worsen due to the limitation.

(a) CAN1 Connector

9Y1200209CRS0358US0

(61) 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

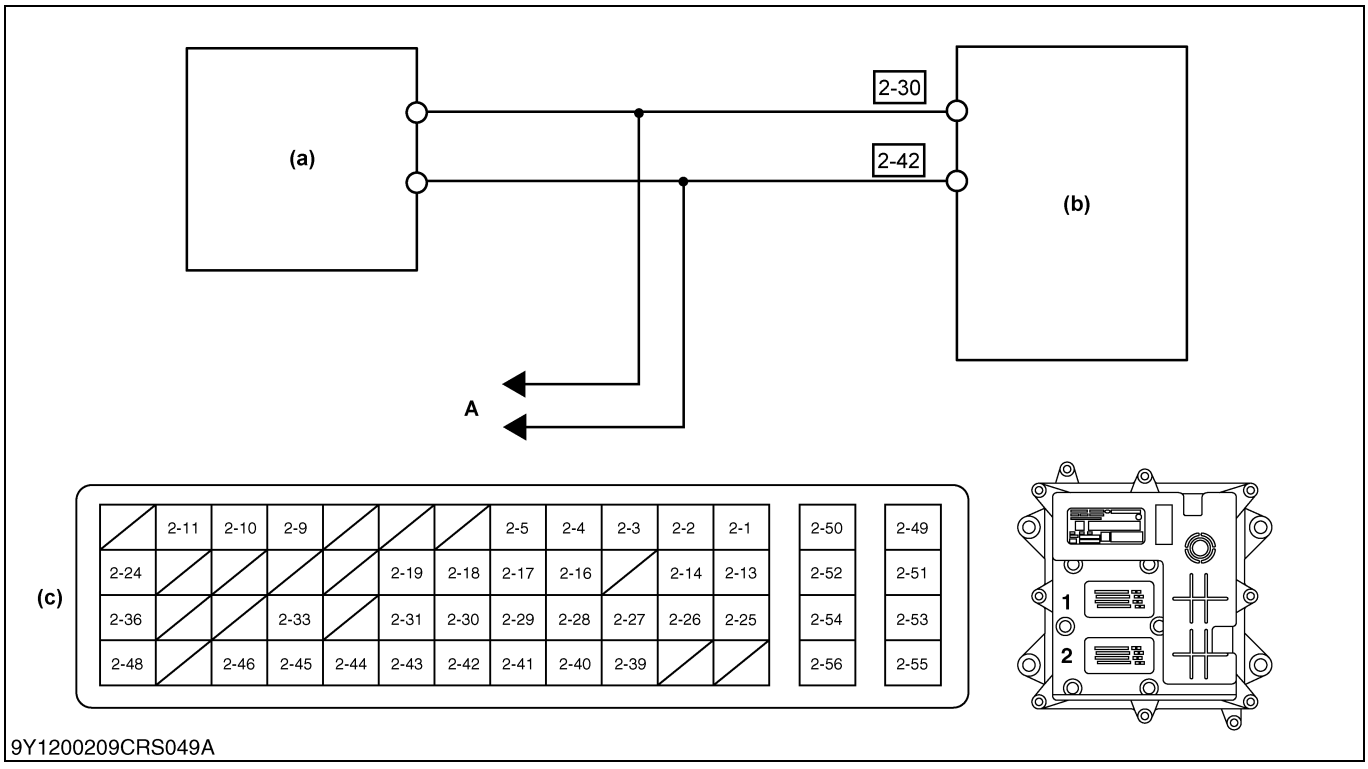
DTC set preconditions:
- Battery voltage is normal
- Key switch is ON

DTC set parameter:
- CAN2 Bus off

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Forced Idle (Accelerator = 0 %)

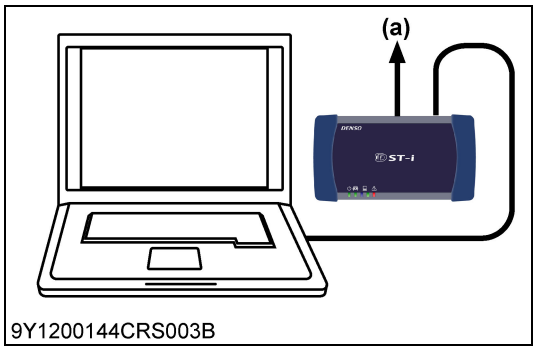
Recovery from error:
- Key switch turn OFF



9Y1200209CRS049A

(a) ECU for Machine **(b) Engine ECU** **(c) ECU Connector 2** **A: To Other ECU**

9Y1200209CRS0359US0



9Y1200144CRS003B

1. DTC Judgment

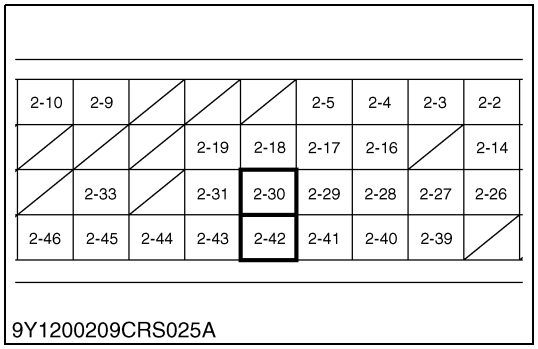
1. Place the key switch in the OFF position, and attach the diagnosis tool to the CAN1 connector.
2. Place the key switch in the ON position, check whether the DTC (U0075) is output or not.

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

9Y1200209CRS0360US0



9Y1200209CRS025A

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 2-30 and 2-42 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-S275)**

OK	Replace the ECU.
NG	Repair or replace the faulty areas.

9Y1200209CRS0361US0

(62) No Communication with EGR (DTC U0076 / 523578-2)

Behaviour during malfunction:
- Insufficient output
- Worsening exhaust gas performance

Detection item:
- No communication with EGR

DTC set preconditions:
- Battery voltage is normal
- Starter switch signal is not activated

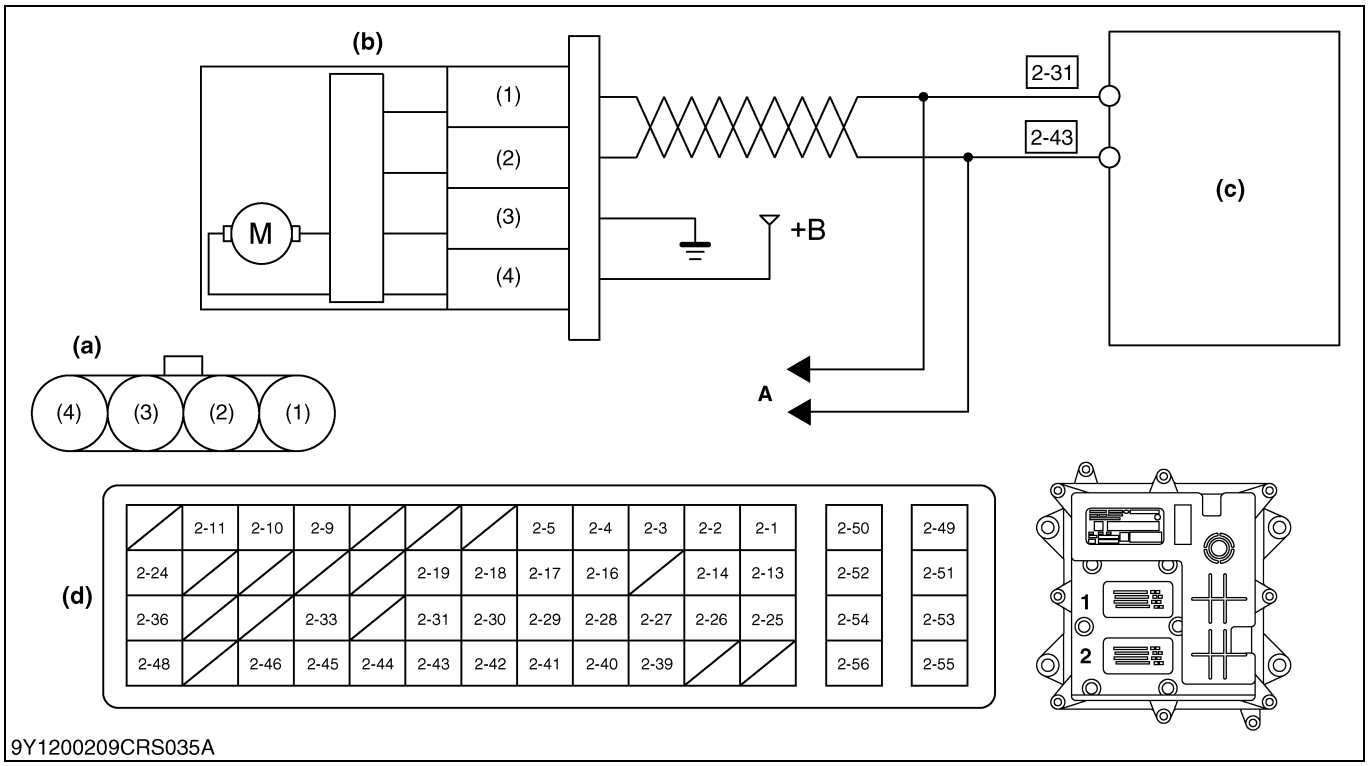
DTC set parameter:
- Interruption of CAN

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

9Y1200209CRS0365US0



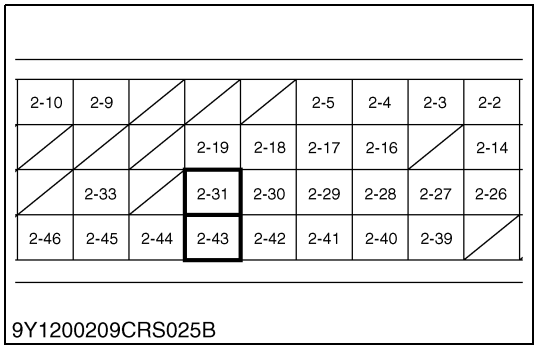
9Y1200209CRS035A

(1) Terminal CAN-H
(2) Terminal CAN-L
(3) Terminal Ground
(4) Terminal +B (12 V)

(a) Terminal Layout
(b) EGR Valve Assembly
(c) Engine ECU
(d) ECU Connector 2

A: To Diagnosis Tool

9Y1200209CRS0178US0



9Y1200209CRS025B

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 2-31 and 2-43 for a short or an open circuit.

■ **IMPORTANT**

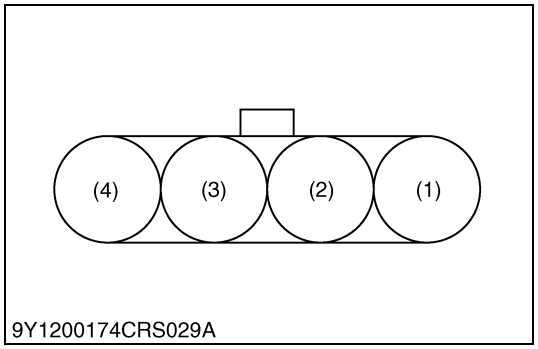
- **Refer to "6.[3] ELECTRIC SYSTEM INSPECTION PROCEDURE - (1) Basics of Checking Electrical / Electronic Circuit Systems". (Refer to page 1-S275)**

■ **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.

9Y1200209CRS0366US0



9Y1200174CRS029A

2. Measure the EGR Terminal Voltage

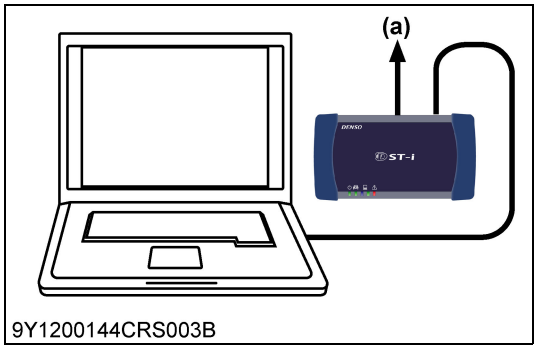
1. Place the key switch in the ON position, and measure the voltage between EGR terminals (3) and (4).

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 +B (12 V)

9Y1200209CRS0367US0



9Y1200144CRS003B

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 engine with the coolant temperature over 65 °C (149 °F).**

OK	Normal.
NG	Replace the EGR assembly.

(a) CAN1 Connector

9Y1200209CRS0368US0

(63) 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

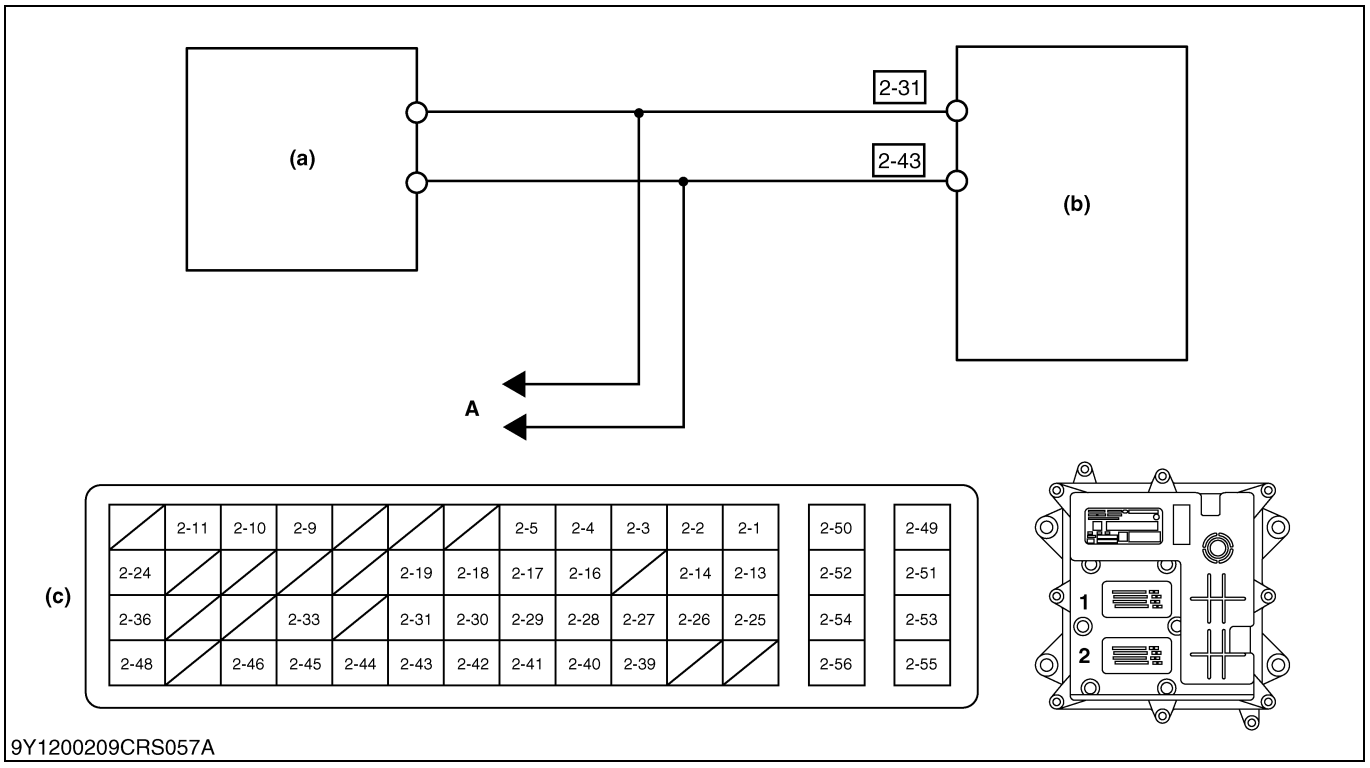
DTC set parameter:
- CAN1 Bus off

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

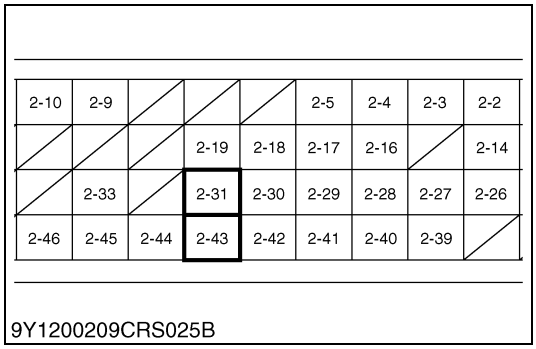
9Y1200209CRS0362US0



9Y1200209CRS057A

(a) ECU for Machine **(b) Engine ECU** **(c) ECU Connector 2** **A: To Diagnosis Tool**

9Y1200209CRS0363US0



9Y1200209CRS025B

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 2-43 and 2-31 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-S275)**

OK	Replace the ECU.
NG	Repair or replace the faulty areas.

9Y1200209CRS0364US0

(64) CAN2 Frame Error (DTC U0081 / 523548-2, U0082 / 523591-2, U0083 / 523592-2, 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
- Starter switch signal is not activated
- 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

9Y1200209CRS0369US0

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
- Starter switch signal is not activated

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

9Y1200209CRS0370US0

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
- Starter switch signal is not activated

DTC set parameter:
- CAN CM1 frame time out error

Engine warning light:
- ON

Limp home action by engine ECU (system action):
- Regeneration inhibit = ON [default value]

Recovery from error:
- Key switch turn OFF

9Y1200209CRS0371US0

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 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

9Y1200209CRS0372US0

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 is not activated

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

9Y1200209CRS0373US0

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 is not activated

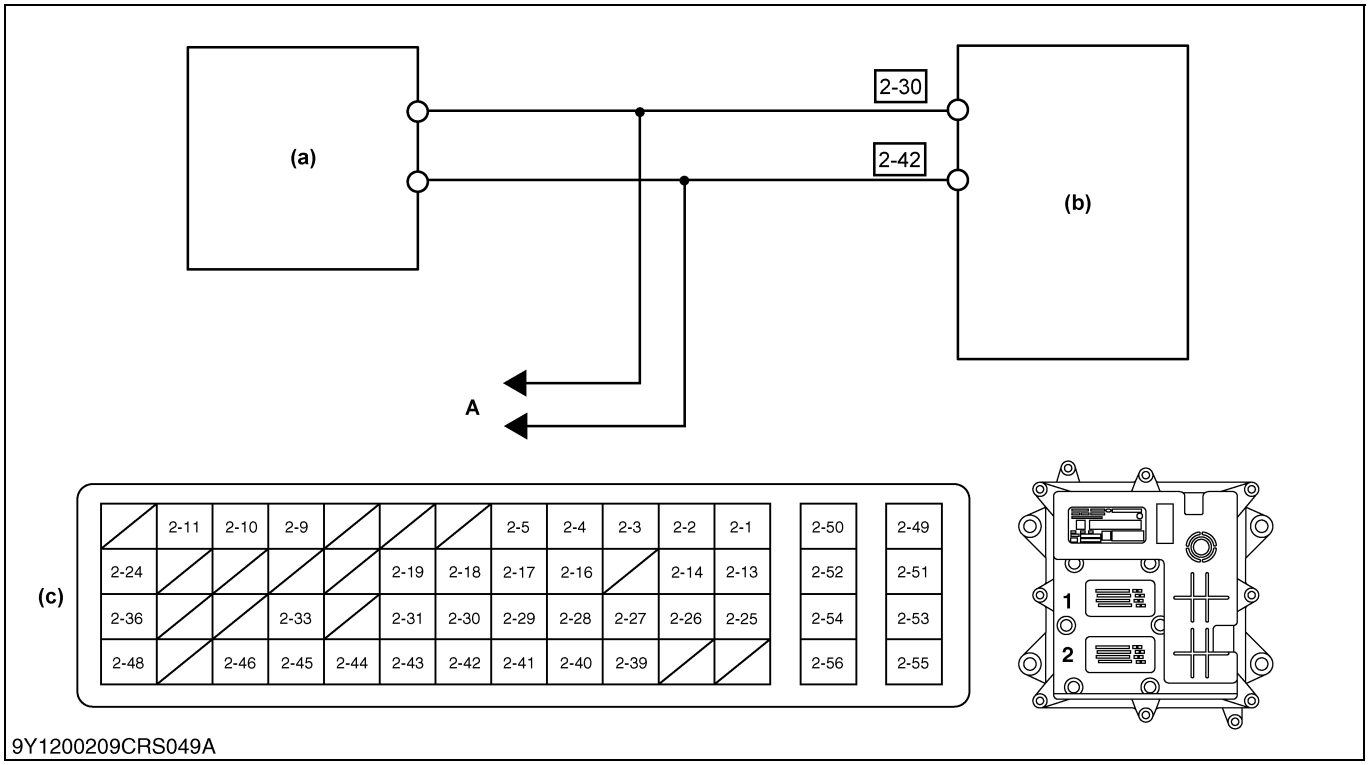
DTC set parameter:
- CAN EBC1 frame time out error

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

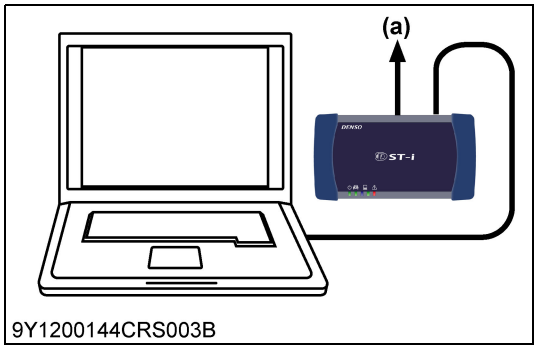
9Y1200209CRS0374US0



9Y1200209CRS049A

(a) ECU for Machine **(b) Engine ECU** **(c) ECU Connector 2** **A: To Other ECU**

9Y1200209CRS0375US0



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 is output or not.

■ **NOTE**

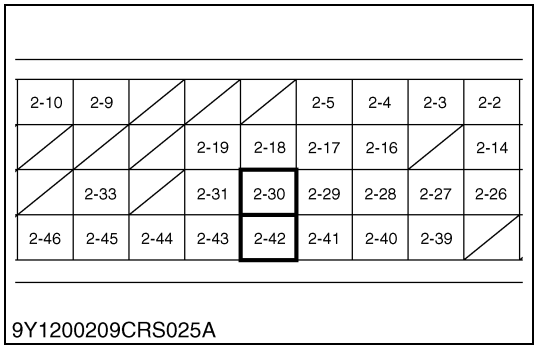
- **If the "CAN 2 Bus off error" is output at the same time, carry out this inspection first.**
- **Make sure that the ECU on the machine side operates properly.**

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

9Y1200209CRS0376US0



9Y1200209CRS025A

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 2-30 and 2-42 for a short or an open circuit.

■ **IMPORTANT**

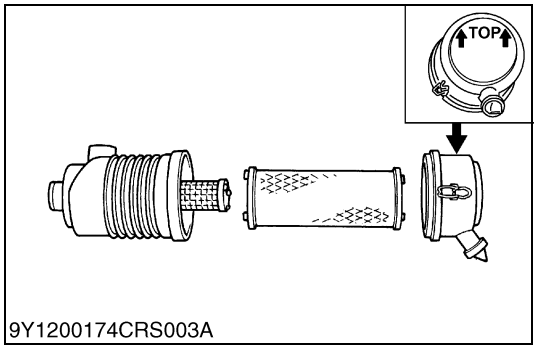
- **Refer to "6.[3] ELECTRIC SYSTEM INSPECTION PROCEDURE - (1) Basics of Checking Electrical / Electronic Circuit Systems". (Refer to page 1-S275)**

OK	Replace the ECU.
NG	Repair or replace the faulty areas.

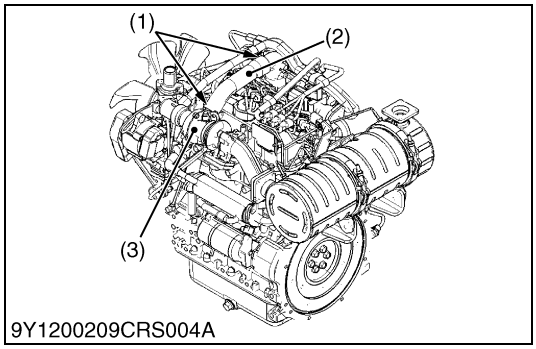
9Y1200209CRS0377US0

6. INSPECTION PROCEDURE FOR EACH SYSTEM

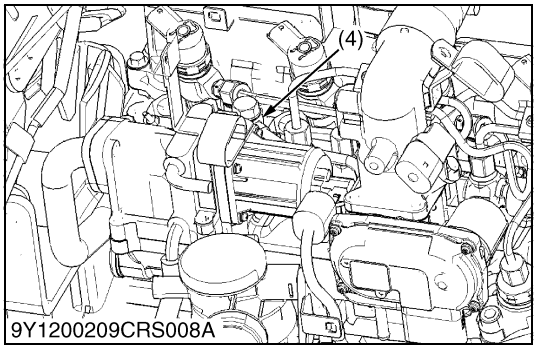
[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE



9Y1200174CRS003A



9Y1200209CRS004A



9Y1200209CRS008A

1. Check the Air Cleaner

1. 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.

9Y1200209CRS0378US0

2. Check the Suction Path

1. Check the suction path for leaks. (including 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.**

OK	Normal.
NG	Repair or replace the malfunctioning component.

(1) Hose Clamp
(2) Hose
(3) Turbocharger
(4) EGR Valve

9Y1200209CRS0379US0

[2] FUEL SYSTEM INSPECTION PROCEDURE

Fuel:

Fuel is flammable and can be dangerous.
You should handle fuel with care.

- 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.%

- When biodiesel fuel is used, change the fuel filter cartridge, fuel rubber piping and clamp bands with new ones at intervals half of the usual ones.

■ **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, fuel rubber piping and clamp bands with new ones 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.

9Y1200209CRS0380US0

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 turbidit).
   - 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).

9Y1200209CRS0381US0

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.

9Y1200209CRS0382US0

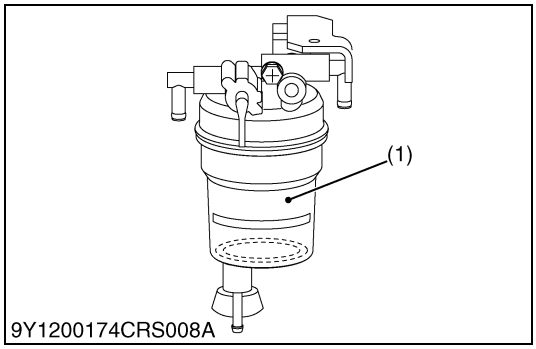
3. Tank External Fuel Path Conditions (Crushed Hose, Clogging, Air Introduction at Hose Connection)

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).

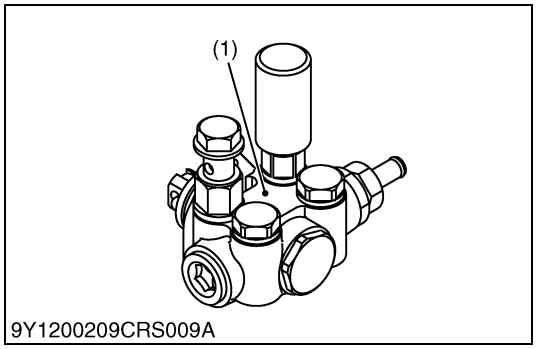
■ **NOTE**
- **Be cautious when vacuum pressure is present, as air will be drawn into the hose.**

OK	Go to "4. Check the Water Separator".
NG	Replace the hose.

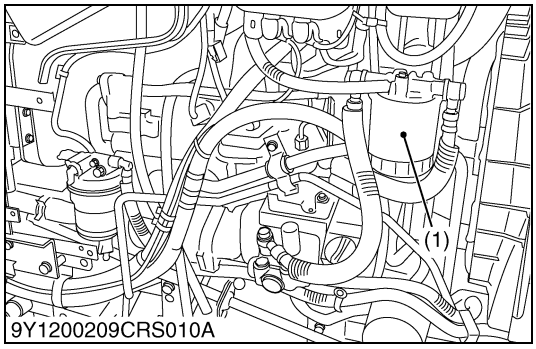
9Y1200209CRS0383US0



9Y1200174CRS008A



9Y1200209CRS009A



9Y1200209CRS010A

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

9Y1200209CRS0384US0

5. Check the Fuel Feed Pump

1. Check the operation of the fuel feed pump.

■ **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 actuation system abnormality**
- **Others**

OK	Go to "6. Fuel Filter Clogged".
NG	Replace the fuel feed pump.

(1) Fuel Feed Pump

9Y1200209CRS0385US0

6. Fuel Filter Clogged

1. Check the fuel filter for clogging and dirt.

■ **NOTE**
- **Replace the fuel filter every 400 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

9Y1200209CRS0386US0

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.

9Y1200209CRS0387US0

8. Check the High Pressure Piping and CRS Components (Such as the Fuel Injector and the Supply Pump) for Fuel Leakage (Engine External Leak)

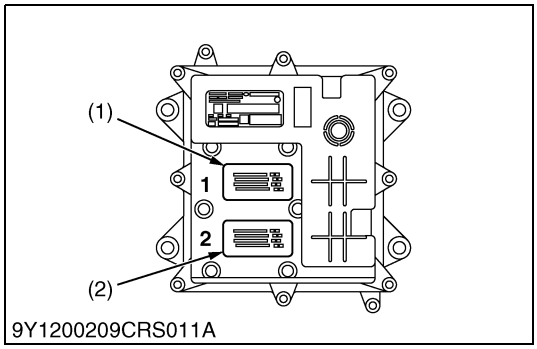
1. Visually check and specify areas leaking fuel.
2. Be cautious because there may be oil leaks in the high pressure pipe and injector areas.

OK	Normal.
NG	Repair leaking high pressure pipe, etc. or replace leaking parts.

9Y1200209CRS0388US0

[3] ELECTRIC SYSTEM INSPECTION PROCEDURE

(1) Basics Of Checking Electrical / Electronic Circuit Systems



9Y1200209CRS011A

Measure the ECU Terminal Voltage and Resistance

1. 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.

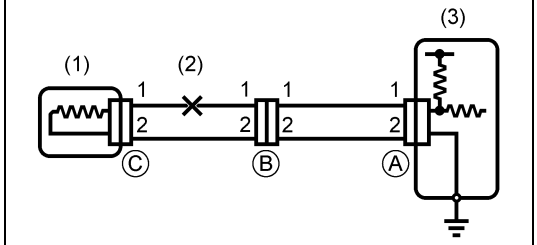
■ **IMPORTANT**

- **When inserting a fine metal wire for measurement purposes, ensure that the connector waterproof rubber is not damaged.**

(1) ECU Connector 1 (Engine Side) (2) ECU Connector 2 (Machine Side)

9Y1200209CRS0389US0

(A-1)



3EEABAH1P024A

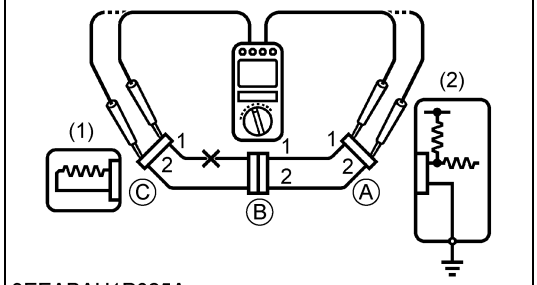
Open Circuit Check

1. 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

9Y1200209CRS0390US0

(A-2)



3EEABAH1P025A

Check for Continuity

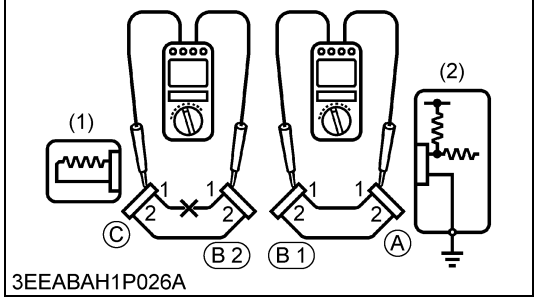
1. Remove connectors **"A"** and **"C"** and measure resistance between the two.

(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"**.

(A-3)

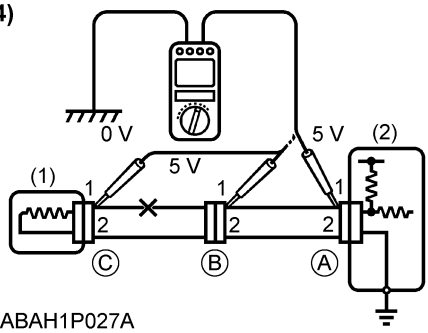


3EEABAH1P026A

(1) Sensor (2) ECU

9Y1200209CRS0391US0

(A-4)



3EEABAH1P027A

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.

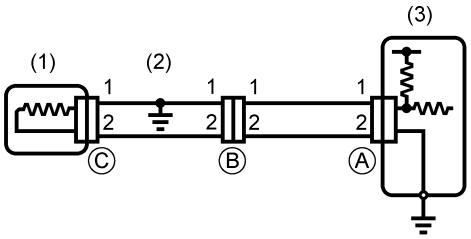
(Faulty Circuit)

- There is an open circuit between terminal 1 of connector **"B"** and terminal 1 of connector **"C"**.

(1) Sensor (2) ECU

9Y1200209CRS0392US0

(A-5)



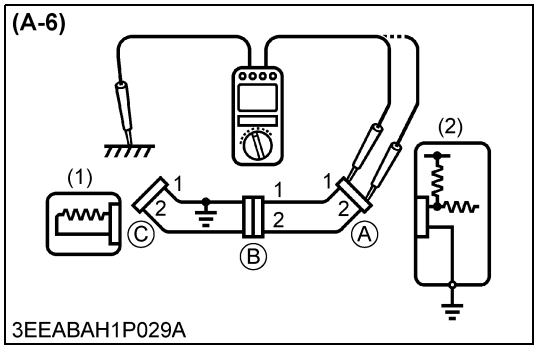
3EEABAH1P028A

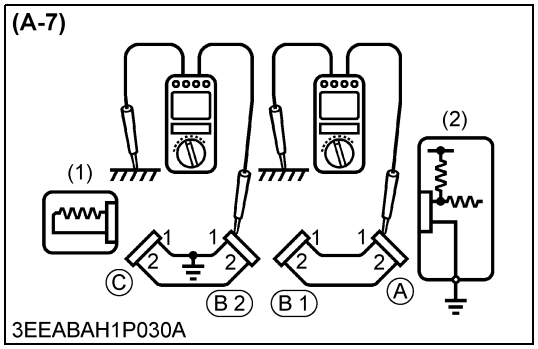
Short Circuit Check

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

9Y1200209CRS0393US0





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

(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.

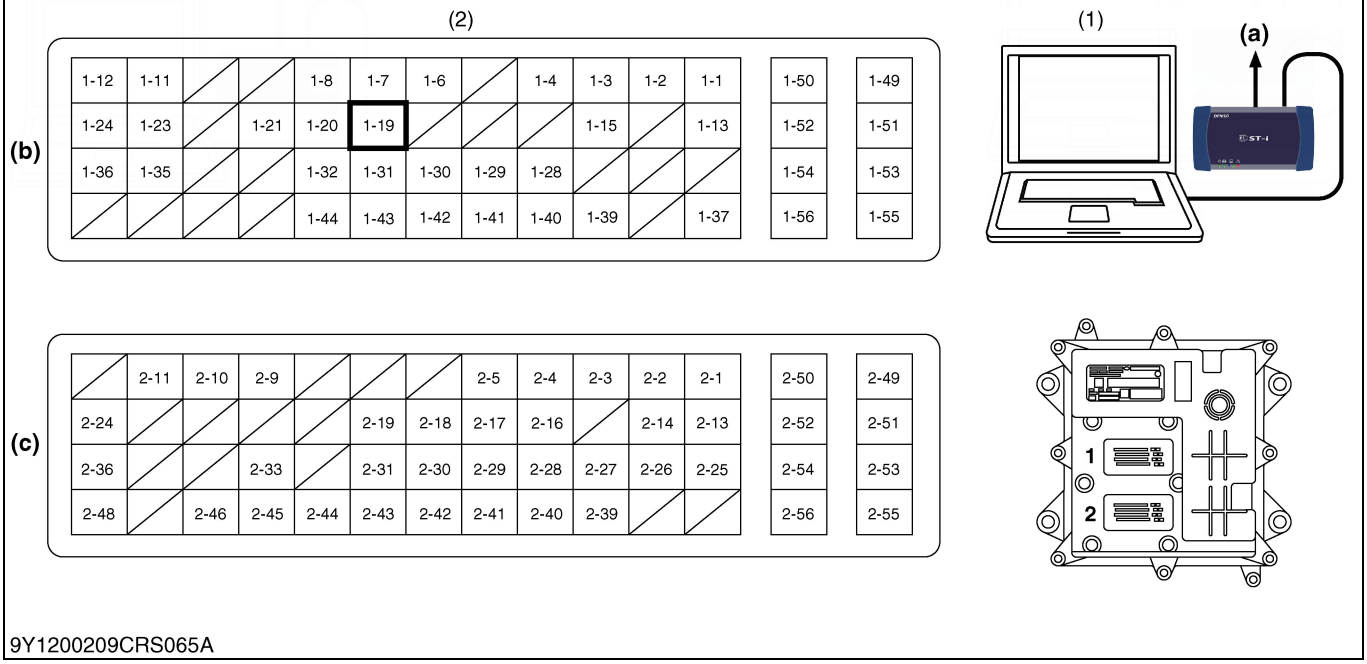
(Faulty Circuit)

- There is a short circuit between terminal 1 of connector **"B2"** and terminal 1 of connector **"C"**.

(1) Sensor (2) ECU

9Y1200209CRS0394US0

(2) Connector Connection Fault Verification Method



9Y1200209CRS065A

(1) Diagnosis Tool Data Monitor (Sensor Output Voltage)
(2) Voltage Measurement
(A) Sensor Example
(a) CAN1 Connector
(b) ECU Connector 1
(c) ECU Connector 2

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.

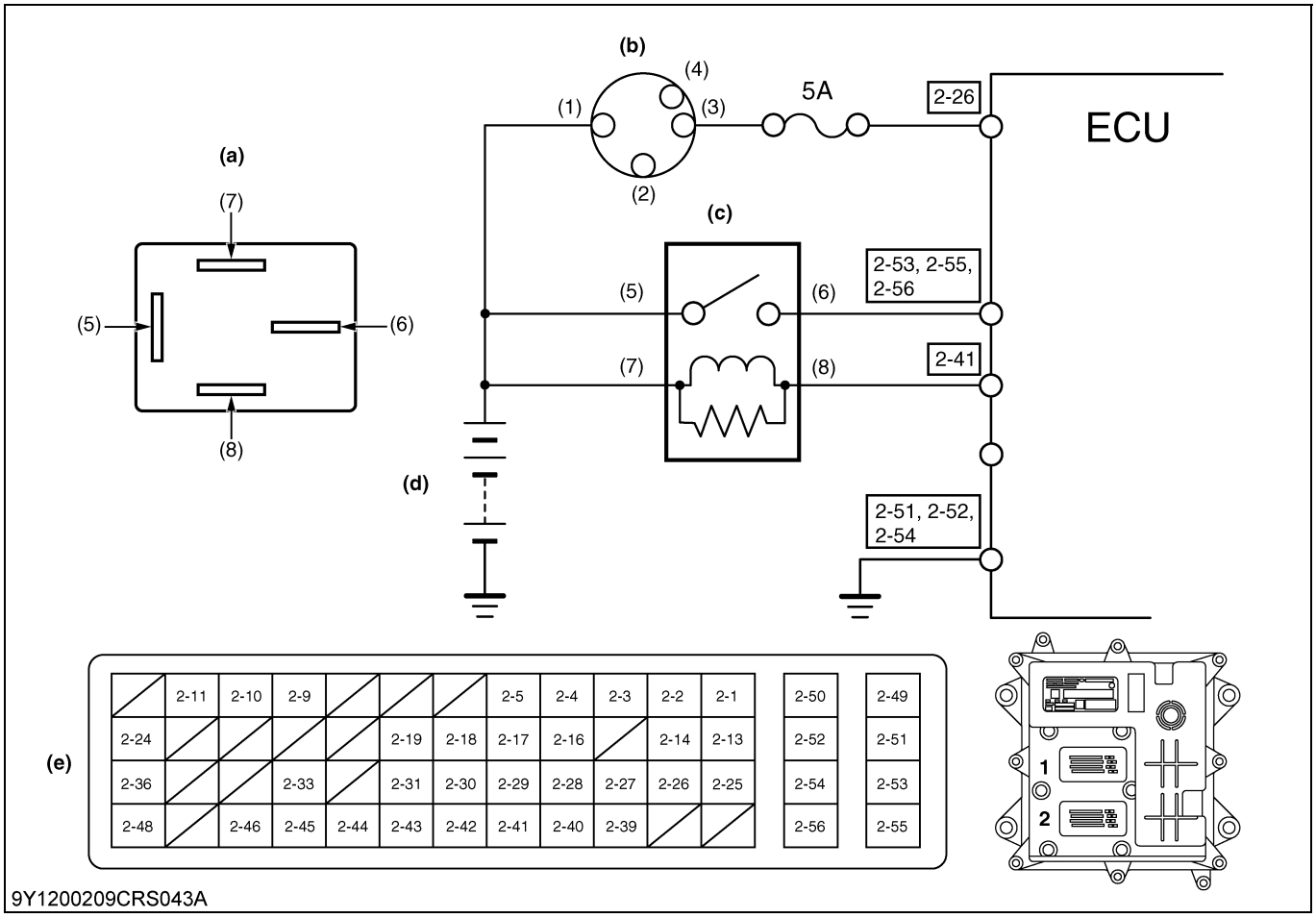
9Y1200209CRS0395US0

(3) Checking The Power And Ground System (Main Relay, ECU Circuit)

If the ECU is not operating, check the following.

Malfunction symptoms:

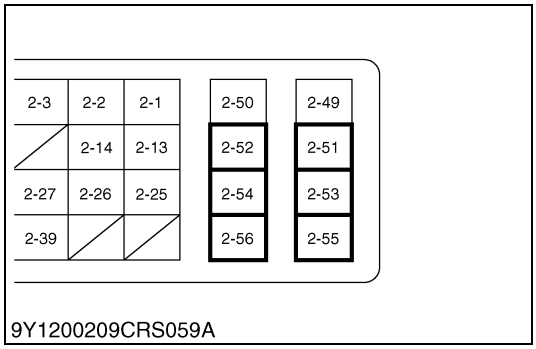
- Engine does not start.
- Engine warning light is not lit.
- A diagnosis tool communication error occur.



(1) OFF
(2) ACC
(3) ON
(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

9Y1200209CRS0396US0



9Y1200209CRS059A

1. Measure the ECU +BP and Ground Voltage

1. Turn the key switch ON and measure the voltage between the ECU +BP terminals (2-53, 2-55, 2-56) and ground (body / battery terminal). Then measure voltage between the ECU ground terminals (2-51, 2-52, 2-54) 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

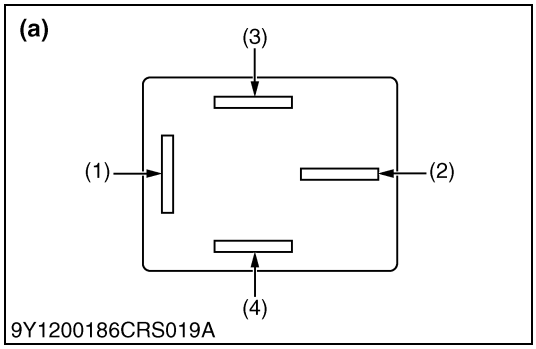
+BP terminal unsatisfactory

OK	Normal.	
NG	Check battery, wiring harness, ground wire.	
	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.

9Y1200209CRS0397US0



9Y1200186CRS019A

2. Check the Relay Terminal Voltage -1

1. Turn the key switch ON and measure voltage at relay terminal 2 (2).

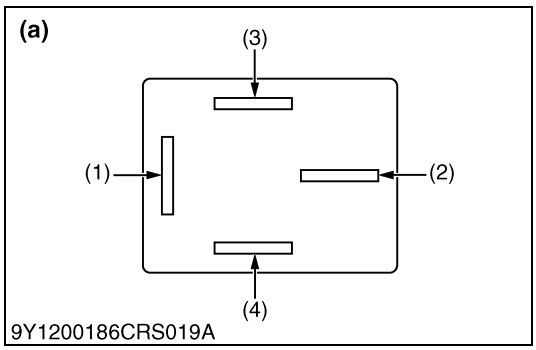
Factory specification	10 V or higher

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

9Y1200209CRS0398US0



9Y1200186CRS019A

3. Check the Relay Terminal Voltage - 2

1. Measure voltage at relay terminal 1 (1).

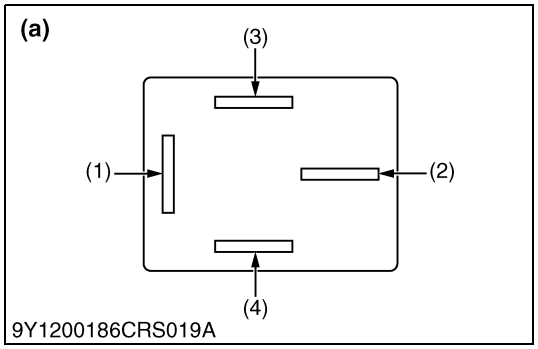
Factory specification	10 V or higher

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

9Y1200209CRS0399US0



4. Check the Relay Terminal Voltage - 3

1. Measure voltage at relay terminal 3 (3).

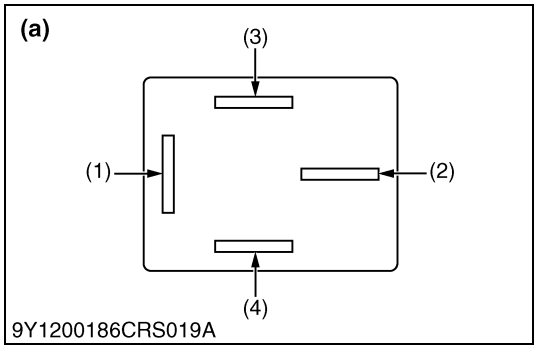
Factory specification	10 V or higher

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

9Y1200209CRS0400US0



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.**

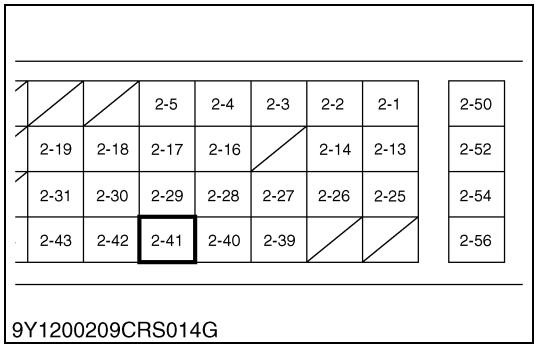
Factory specification	10 V or higher

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

9Y1200209CRS0401US0



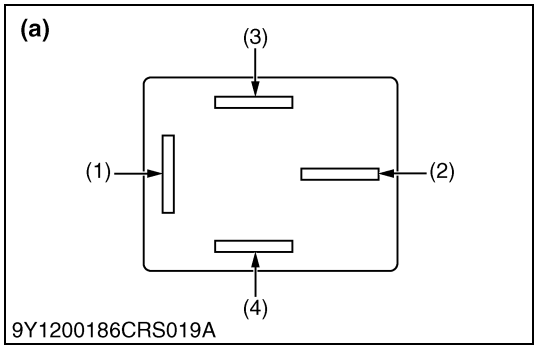
6. Check the Relay Terminal Voltage - 5

1. With the key switch OFF, measure voltage at the ECU main relay terminals (2-41).

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.

9Y1200209CRS0402US0



7. Check the Relay Terminal Voltage - 6

1. Turn the key switch ON and measure voltage at relay terminal 4 (4).

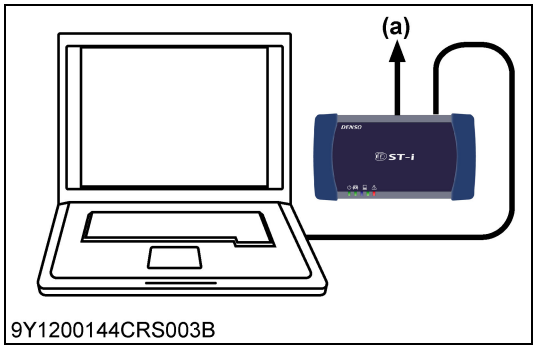
Factory specification	Approx. 0 V

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

9Y1200209CRS0403US0



9Y1200144CRS003B

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.

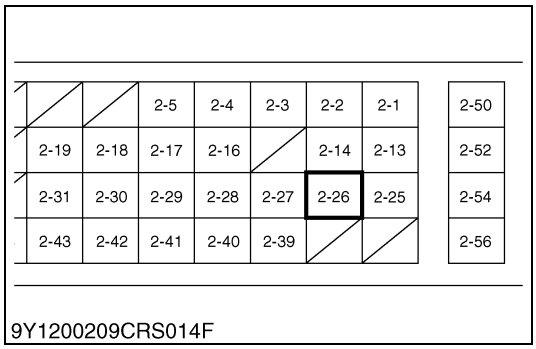
■ **IMPORTANT**

- **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

9Y1200209CRS0404US0



9Y1200209CRS014F

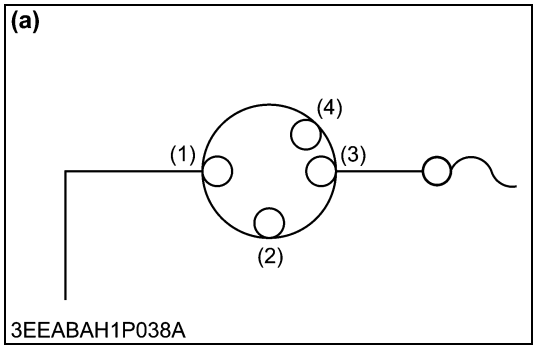
9. Check the Key Switch Signal -2

1. Place the key switch in the ON position, and measure the voltage at ECU terminal 2-26.

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".	

9Y1200209CRS0405US0



3EEABAH1P038A

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).

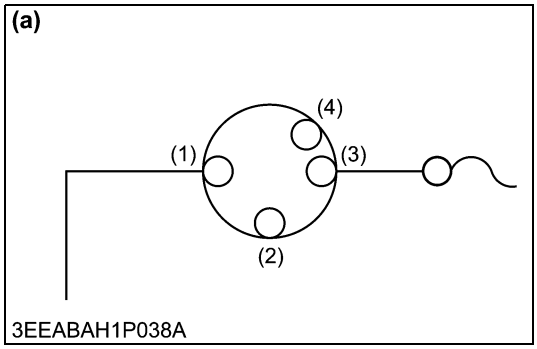
Factory specification	10 V or higher

OK	Check the wiring harness between the key switch output terminal and ECU terminal (2-26), 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

9Y1200209CRS0406US0



3EEABAH1P038A

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

9Y1200209CRS0407US0

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