

DM

DIAGNOSIS MANUAL COMMON RAIL SYSTEM

**V3800-CR-TE4,
V3800-CR-TIE4
(FOR TRACTOR)**

Kubota

KiSC issued 09, 2020 A

MECHANISM

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1. SAFETY FIRST

SAFETY FIRST

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

DANGER

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

WARNING

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

CAUTION

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

IMPORTANT

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

NOTE

- Gives helpful information.

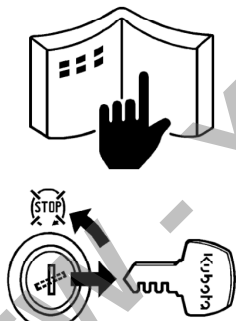
9Y1200192INI0001US0

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.

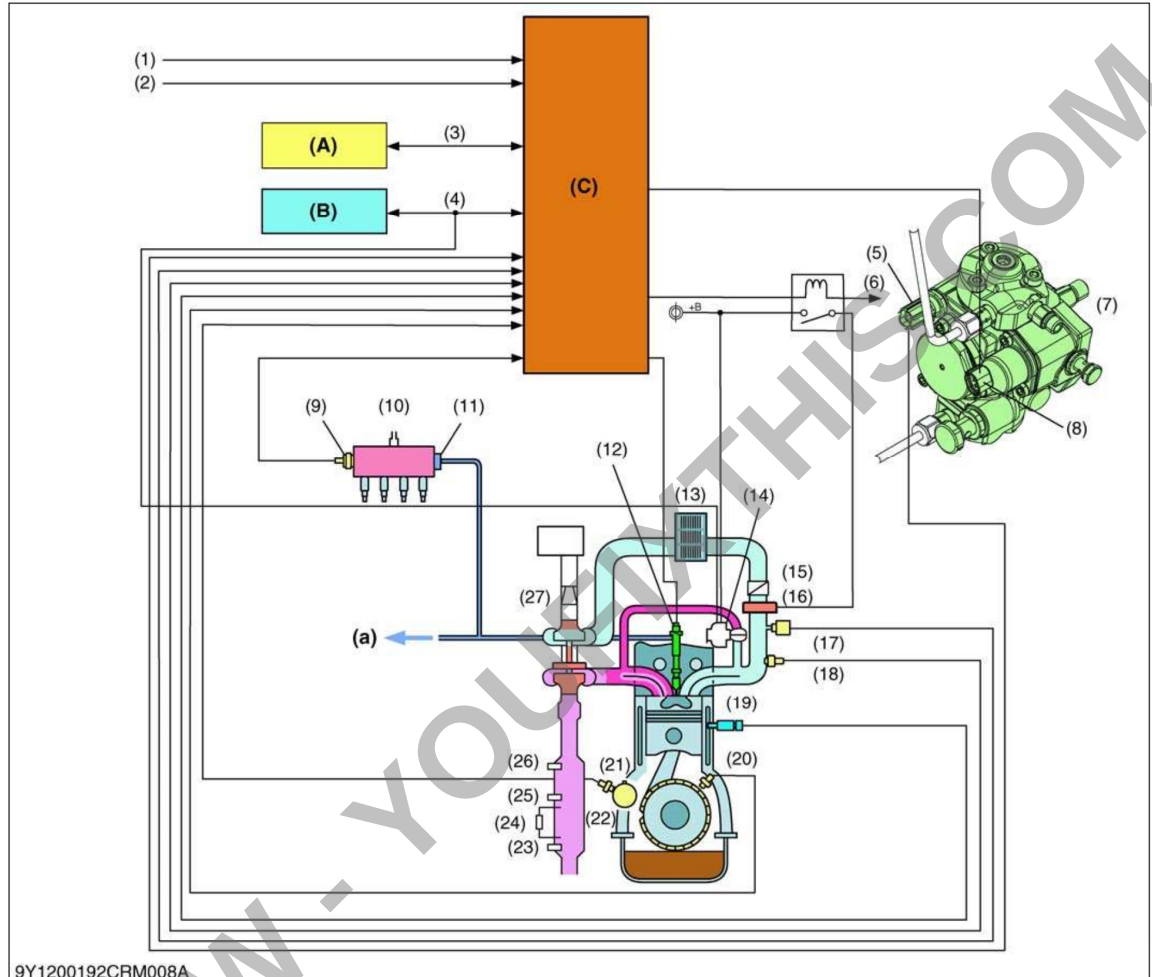
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1. BASIC SYSTEM INFORMATION

[1] SYSTEM CONFIGURATION



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- | | | | |
|---|------------------------------------|--|---|
| (1) Key Switch ON Signal | (9) Rail Pressure Sensor | (21) Camshaft Position Sensor | (26) Exhaust Gas Temperature Sensor0 (T0) (DOC Inlet Exhaust Gas Temperature) |
| (2) Starter Switch Signal | (10) Rail | (22) Diesel Particulate Filter (Hereinafter Referred To As The "DPF") Muffler | (27) Mass Air Flow Sensor |
| (3) CAN Communication for tractor (Accelerator Position Signal*, Neutral Switch*, Machine Travel Speed Signal*) | (11) Pressure Limiter | (23) Exhaust Gas Temperature Sensor2 (T2) (DPF Outlet Exhaust Gas Temperature) | |
| (4) CAN Communication for Service | (12) Injector | (24) Differential Pressure Sensor (DPF Differential Pressure) (ΔP) | |
| (5) Fuel Temperature Sensor | (13) Inter Cooler | (25) Exhaust Gas Temperature Sensor1 (T1) (DPF Inlet Exhaust Gas Temperature) | |
| (6) Air Heater Relay | (14) EGR DC Motor | | |
| (7) Supply Pump | (15) Intake Throttle Valve | | |
| (8) SCV (Suction Control Valve) | (16) Intake Air Heater | | |
| | (17) Boost Pressure Sensor | | |
| | (18) Intake Air Temperature Sensor | | |
| | (19) Coolant Temperature Sensor | | |
| | (20) Crankshaft Position Sensor | | |

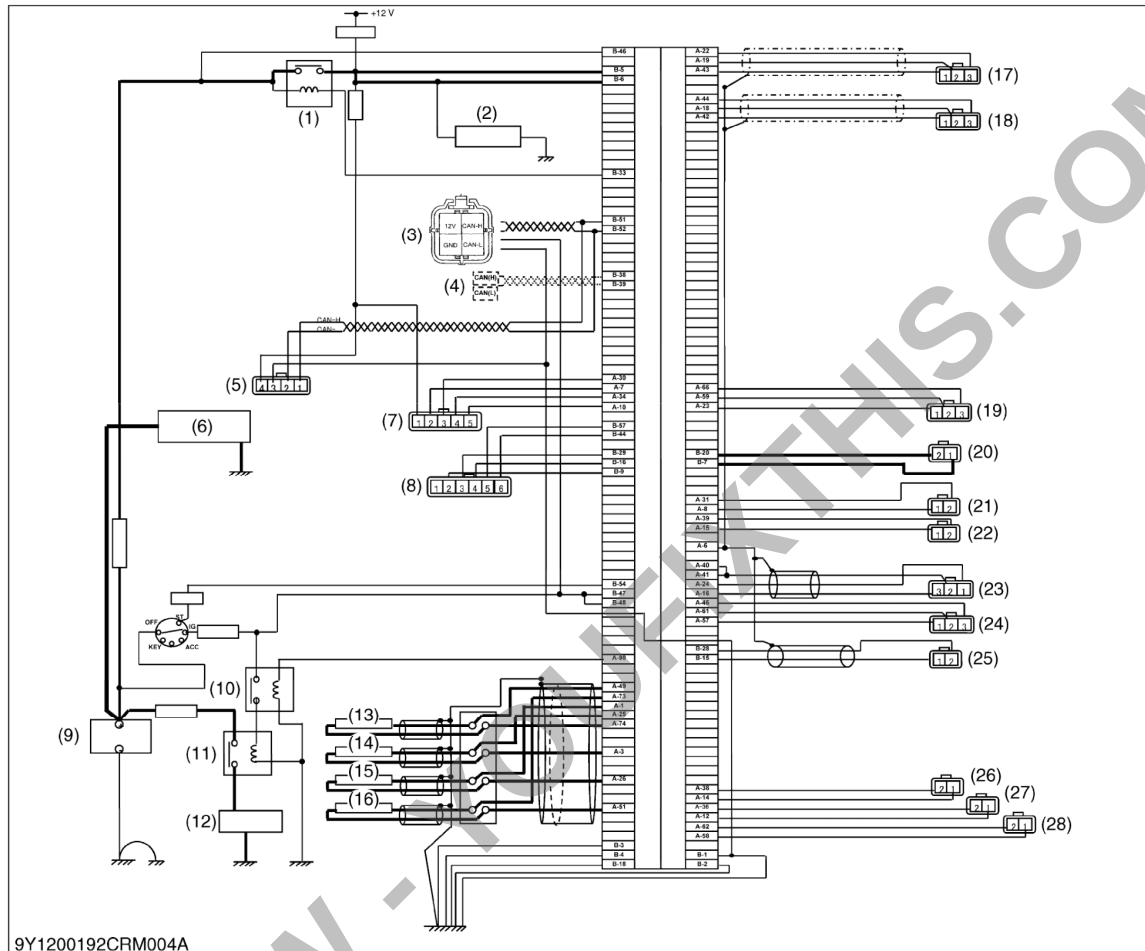
■ NOTE

- The signals marked with * are CAN communication.

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[4] WIRING DIAGRAM

(1) System Wiring Diagram



- | | |
|-------------------------------------|---------------------------------|
| (1) Main Relay | (9) Battery |
| (2) Fuel Feed Pump | (10) Air Heater Relay |
| (3) CAN1 Connector
(For Service) | (11) Air Heater Pre Relay |
| (4) CAN2 Connector
(For Tractor) | (12) Intake Air Heater |
| (5) EGR Valve | (13) Injector 1 |
| (6) Starter | (14) Injector 2 |
| (7) Mass Air Flow Sensor | (15) Injector 3 |
| (8) Intake Throttle Valve | (16) Injector 4 |
| | (17) Crankshaft Position Sensor |
| | (18) Camshaft Position Sensor |

- | |
|---|
| (19) DPF Differential Pressure
Sensor (ΔP) |
| (20) SCV (Suction Control Valve) |
| (21) Fuel Temperature Sensor |
| (22) Coolant Temperature Sensor |
| (23) Rail Pressure Sensor |
| (24) Boost Pressure Sensor |
| (25) Intake Air Temperature
Sensor |

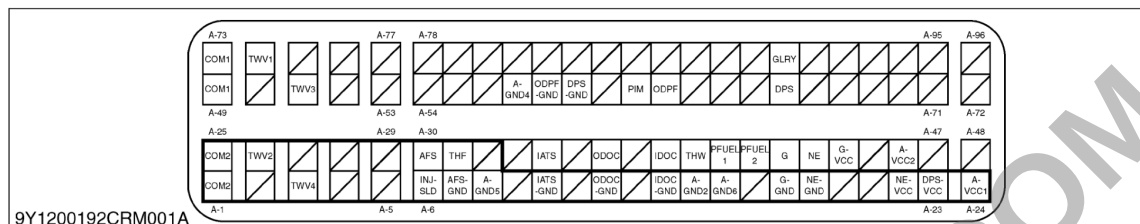
- | |
|---|
| (26) DPF Exhaust Gas
Temperature Sensor (T0) |
| (27) DPF Exhaust Gas
Temperature Sensor (T1) |
| (28) DPF Exhaust Gas
Temperature Sensor (T2) |

DPF: Diesel Particulate Filter

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[6] ECU TERMINAL LAYOUT

(1) ECU Terminal Layout 1 (A: 96 Pins)



No.	Terminal Name	Signal Name
A-1	COM2	INJ COMMON2
A-2	—	—
A-3	TWV4	INJ4 DRV TWV4
A-4	—	—
A-5	—	—
A-6	INJ-SLD	SHILD-GND
A-7	AFS-GND	AIR FLOW SENSOR GND
A-8	A-GND5	FUEL TEMPERATURE SENSOR GND
A-9	—	—
A-10	IATS-GND	INTAKE AIR TEMPERATURE SENSOR (AFS) GND
A-11	—	—
A-12	ODOC-GND	OUTLET DOC TEMP GND (EXHAUST GAS TEMPERATURE T1 GND)
A-13	—	—
A-14	IDOC-GND	INLET DOC TEMP GND (EXHAUST GAS TEMPERATURE T0 GND)
A-15	A-GND2	COOLANT TEMPERATURE SENSOR GND
A-16	A-GND6	RAIL PRESSURE SENSOR GND
A-17	—	—
A-18	G-GND	CAMSHAFT POSITION SENSOR GND
A-19	NE-GND	CRANKSHAFT POSITION SENSOR GND
A-20	—	—
A-21	—	—
A-22	NE-VCC	CRANKSHAFT POSITION SENSOR VCC
A-23	DPS-VCC	DIFFERENTIAL PRESSURE SENSOR VCC
A-24	A-VCC1	RAIL PRESSURE SENSOR VCC
A-25	COM2	INJ COMMON2
A-26	TWV2	INJ2 DRV TWV2
A-27	—	—
A-28	—	—
A-29	—	—
A-30	AFS	AIR FLOW SENSOR
A-31	THF	FUEL TEMPERATURE SENSOR
A-32	—	—

(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)
		Engine speed active flag	—	OFF	ON	ON	ON	ON
		Cam speed active flag	—	OFF	ON	ON	ON	ON
		Machine speed	km/h	Sensor unused by CAN input				
	Analog signal	Final accelerator pedal position opening	%	0	0	0	0 → 100	100
		Accelerator pedal position sensor 1 output voltage	V	Sensor unused by CAN input				
		Accelerator pedal position sensor 2 output voltage	V					
		Boost pressure	kPa	Approx. 100	Approx. 100	Approx. 100	—	—
		Boost pressure sensor output voltage	V	Approx. 1.0	Approx. 1.0	Approx. 1.0	—	—
		Fuel temperature	°C	Representative value: Approx. 20 °C (68 °F) → Approx. 2.4 V				
		Fuel temperature sensor output voltage	V					
		Coolant temperature	°C	Representative value: Approx. 20 °C (68 °F) → Approx. 2.4 V				
		Coolant temperature sensor voltage output	V					
		Intake air temperature	°C	Representative value: Approx. 20 °C (68 °F) → Approx. 2.4 V				
		Intake air temperature sensor output voltage	V					
		Atmospheric pressure	kPa	Representative value: Approx. 100 kPa → 3.7 V (Depending on the atmospheric pressure)				
		Atmospheric pressure sensor output voltage	V					
		Battery voltage	V	When stopped: Approx. 12.5 V When operating: Approx. 14 V (Depends on the battery charging condition, whether or not there is a load voltage, rotation speed)				
	Digital signal	Key Switch	—	ON	ON	ON	ON	ON
		Start switch	—	OFF	ON	OFF	OFF	OFF
		Neutral switch	—	Sensor unused by CAN input				

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5. DIAGNOSTIC PROCEDURE BY DTC

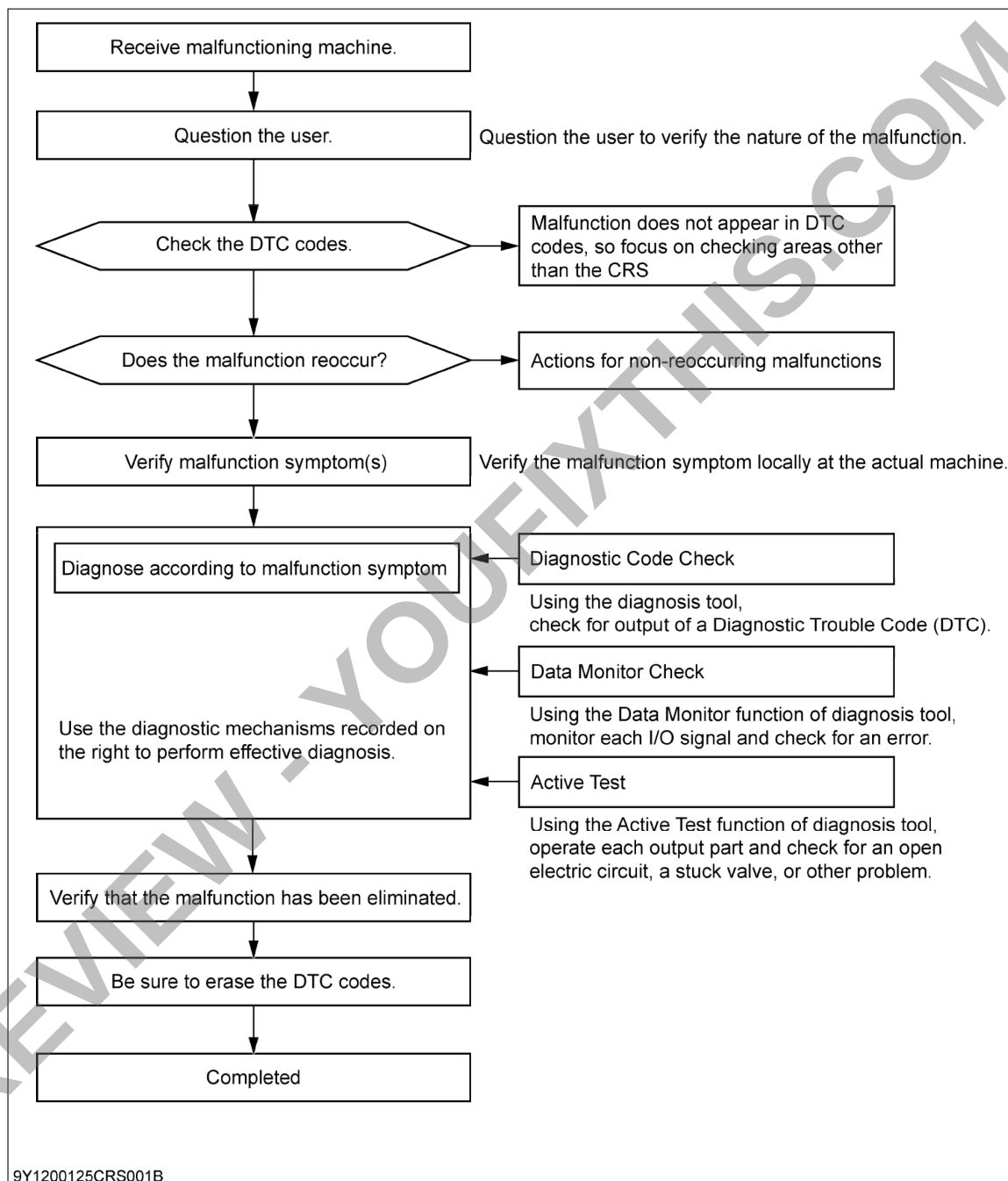
[1] DTC LIST

Name		NE-G phase shift
ISO 14229 P-Code		P0016
J1939-73	SPN	636
	FMI	7
DTC Name		NE-G phase shift
Management Unit for Detected Part		NEGUM
Detection item		<ul style="list-style-type: none"> Large phase shift between NE (crankshaft position sensor) pulse and G (camshaft position sensor) pulse
DTC Set Preconditions		<ul style="list-style-type: none"> Engine is operating above low idle speed Battery voltage is normal Sensor supply voltage VCC# is normal NE signal is normal G signal is normal Coolant temperature is 10 °C (50 °F) or higher
DTC set parameter		(Approximate) <ul style="list-style-type: none"> Phase difference between NE pulse and G pulse is within ± 0.26 rad ($\pm 15^\circ$)
Time to action or number of error detection		<ul style="list-style-type: none"> 10 times or more
System Action		<ul style="list-style-type: none"> None
Behaviour During Malfunction		(Invalid G signal) <ul style="list-style-type: none"> Engine hesitates at start-up
Engine Warning Light		<ul style="list-style-type: none"> ON
Recovery from error		<ul style="list-style-type: none"> Diagnostic counter =zero

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1. GENERAL

[1] OVERALL DIAGNOSTIC PROCEDURE



3. ACTIVE TEST AND SUPPLY PUMP DIFFERENCE LEARNING

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

1	Injector non-injection instruction	From the active test screen
2	EGR actuation test	
3	Air heater relay actuation test	
4	Supply pump difference learning (clear the learning value)	From the utility screen

9Y1200192CRS0018US0

(Operating conditions → specified tool conditions)

- The conditions below are required for 1. Injector non-injection instruction and 4. Supply pump difference learning:
 - Machine is stopped (KWSPD = 0)
 - Neutral switch is ON (XNEU = 1 or ON)

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[Operation details]

- 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.
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■ NOTE

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

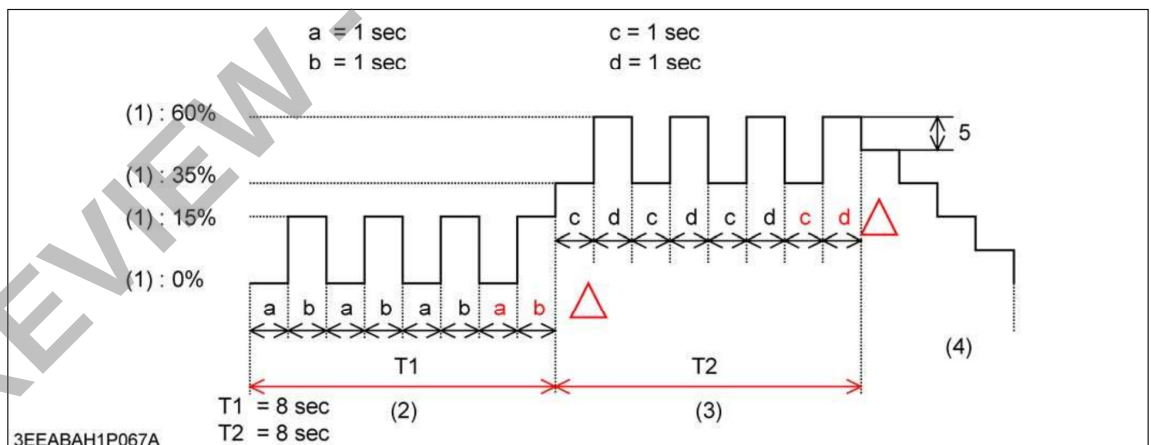
2. EGR actuation test

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

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

■ NOTE

- In some cases the actual opening may be different from the target opening.**
The reason for this is because the learning value is always reflected for 0 lift, after being used for a long time 0 points are shifted.
As such, the factory spec. is a relative evaluation and not an absolute evaluation.



(1) Opening

(2) Operation Check on the Fully Closed Valve Side

(3) Operation Check on the Fully Open Valve Side

(4) Fully Open → Impact Dampening When Fully Closed

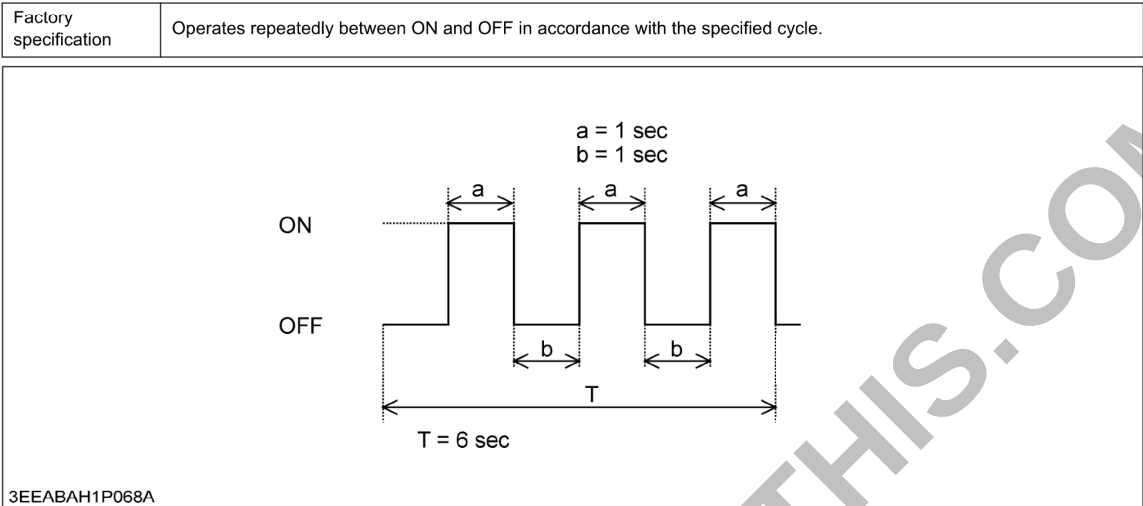
INFORMATION

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3. Air heater relay actuation test

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



4. Supply pump difference learning (clear the learning value)

■ IMPORTANT

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

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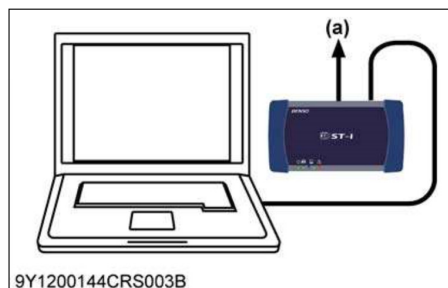
■ NOTE

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

(The conditions of pump difference learning)

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

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9. Check the Data Related to Pressure Control

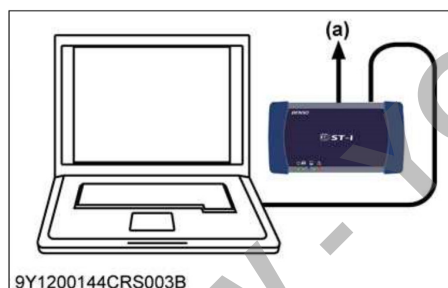
1. Measure the "Target rail pressure" and "Actual rail pressure" when accelerator is operated as indicated below using the diagnosis tool data monitor function.

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

OK	Go to "10. Check the Injector (Including the Pipes, etc.)".
NG	<p>(Check the trouble related to pressure Refer to the pressure system items (P0087, P0088, P0089 and P0093 (Refer to page 1-S139)) and SCV abnormality items (P0628 and P0629 (Refer to 1-S224)) in "5 [2] DIAGNOSTIC PROCEDURE BY DTC", perform diagnosis for the ECU, wiring harness and sensor, and repair or replace the required parts.</p> <p>■ NOTE • Some diagnosis items above may be mentioned twice.</p>

(a) CAN1 Connector

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

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

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

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

9Y1200192CRS0101US0

Name		Injector charge voltage abnormality
ISO 14229 P-Code		P0611
J1939-73	SPN	523525
	FMI	1
DTC Name		Injector charge voltage: Low
Management Unit for Detected Part		LCHG
Detection item		<ul style="list-style-type: none"> • Injector charge voltage: Low • Failure of charge circuit of ECU
DTC Set Preconditions		<ul style="list-style-type: none"> • Battery voltage is normal • CPU is normal
DTC set parameter		<ul style="list-style-type: none"> • Injector charge voltage: Low • Failure of charge circuit of ECU
Time to action or number of error detection		<ul style="list-style-type: none"> • Transient
System Action		<ul style="list-style-type: none"> • Output limitation: Approximately 50 % of normal condition • Speed limitation (Accelerator limitation: 50 %) • Rail pressure limitation: Command pressure ≤ 80 MPa (820 kgf/cm², 12000 psi) • EGR stop • Only main injection permitted
Behaviour During Malfunction		<ul style="list-style-type: none"> • Insufficient output • Worsening exhaust gas performance • Engine stops in some case
Engine Warning Light		<ul style="list-style-type: none"> • ON
Recovery from error		<ul style="list-style-type: none"> • Key switch turn OFF

9Y1200192CRS0634US0

Diagnostic Procedure for Pressure System DTCs

Checking of fault conditions and actions taken

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

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

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

Diagnose the affected pressure system indicated by DTCs.

If a DTC currently exists

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

If only a past DTC exists

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

Pressure system DTCs*[High pressure abnormality]**

1. P0088: High rail pressure

[Low pressure abnormality]

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

[Abnormal pressure]

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

■ IMPORTANT

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

9Y1200192CRS0203US0

(17) Boost Pressure Sensor Abnormality (DTC P0237 / 102-4, P0238 / 102-3)**P0237 / 102-4: Boost temperature sensor abnormality (Low side)****Behaviour during malfunction:**

- Insufficient output

Detection item:

- Ground short circuit of sensor / harness
- Failure of sensor

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Voltage of boost pressure sensor is 0.2 V or below

Engine warning light:

- ON

System action:

- 65 kPa (0.6628 kgf/cm², 9.426 psi) [default value]

Recovery from error:

- Key switch turn OFF

9Y1200192CRS0710US0

P0238 / 102-3: Boost temperature sensor abnormality (High side)**Behaviour during malfunction:**

- Insufficient output

Detection item:

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

DTC set preconditions:

- Battery voltage is normal
- Sensor supply voltage VCC# is normal

DTC set parameter:

- Voltage of boost pressure sensor is 4.9 V or above

Engine warning light:

- ON

System action:

- 65 kPa (0.6628 kgf/cm², 9.426 psi) [default value]

Recovery from error:

- Key switch turn OFF

9Y1200192CRS0711US0

(32) 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 and battery voltage is 8 V or more

Engine warning light:

- ON
 - * Follow the machine instruction

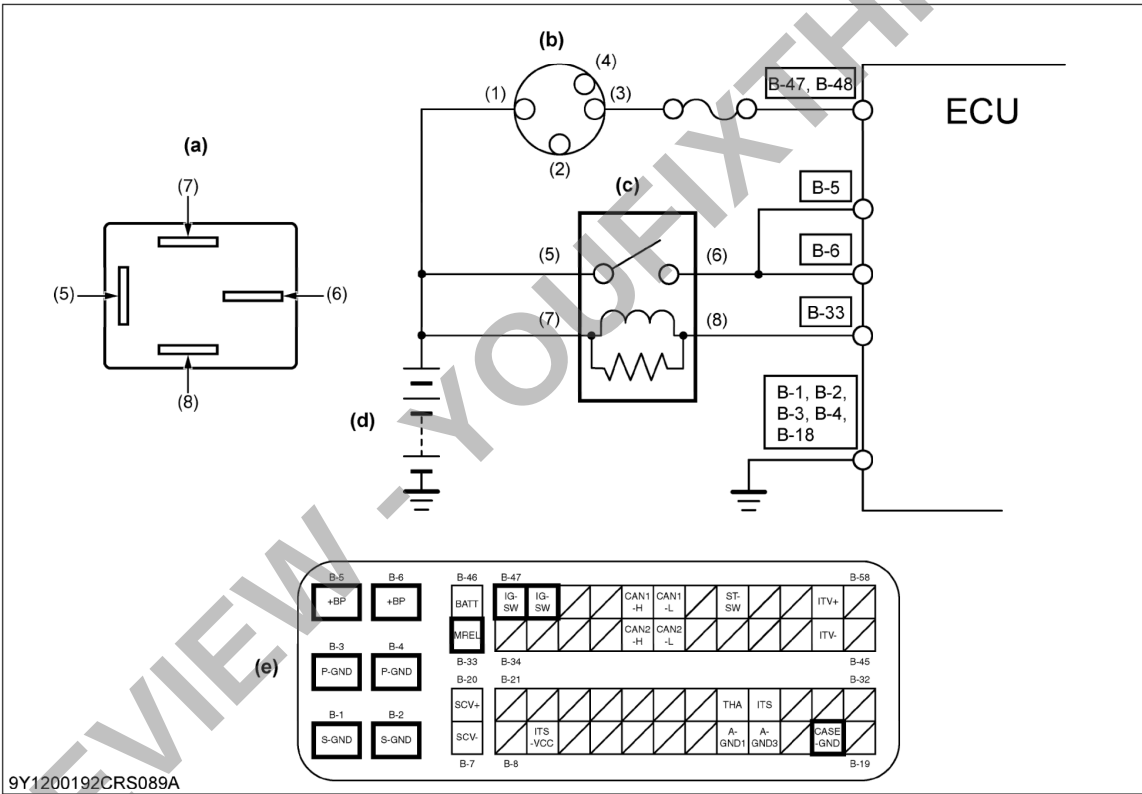
System action:

- None

Recovery from error:

- Diagnostic counter = zero

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9Y1200192CRS089A

- (1) Input Terminal
(2) ACC
(3) Output Terminal
(4) START

- (5) Terminal 1
(6) Terminal 2
(7) Terminal 3
(8) Terminal 4

- (a) Main Relay Terminal Layout (d) Battery
(b) Key Switch (e) ECU Connector 2
(c) Main Relay (B: 58 Pin)

9Y1200186CRS0112US0

(46) 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

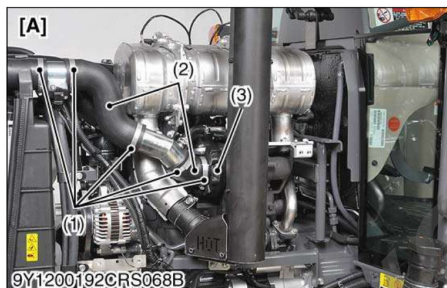
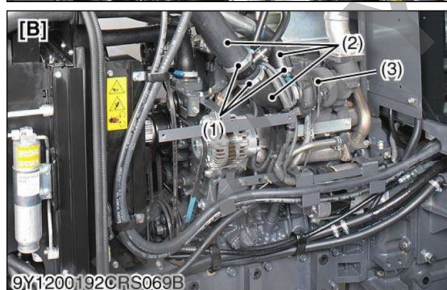
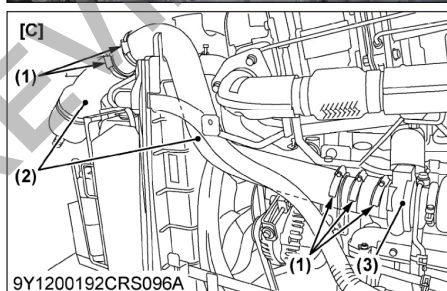
System action:

- Stop injection (Q = 0 mm³/st)
- Engine stop
- Inhibit starter relay activation until Exhaust Gas Temperature reduces down to 300 °C (572 °F)

Recovery from error:

- Under 300 °C (572 °F) & key switch turn OFF

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1. Check the Air Intake System

1. Check in accordance with "6.[1] AIR INTAKE SYSTEM INSPECTION PROCEDURE". (Refer to page 1-S300)

■ 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 sensor 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-S300)

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

- [A] M60 Series
[B] M-GX Series
[C] M5 Utility Narrow Series and M5-AUS Series.

9Y1200192CRS0931US0

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