DM

DIAGNOSIS MANUAL
COMMON RAIL SYSTEM

V3800-CR-TE4,V3800-CR-TIE4,
V3800-CR-TE4C,V3800-CR-TIE4C

Kubota

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INFORMATION

CONTENTS

1. SAFETY FIRST I-1

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1. SAFETY FIRST

⚠ SAFETY FIRST

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

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

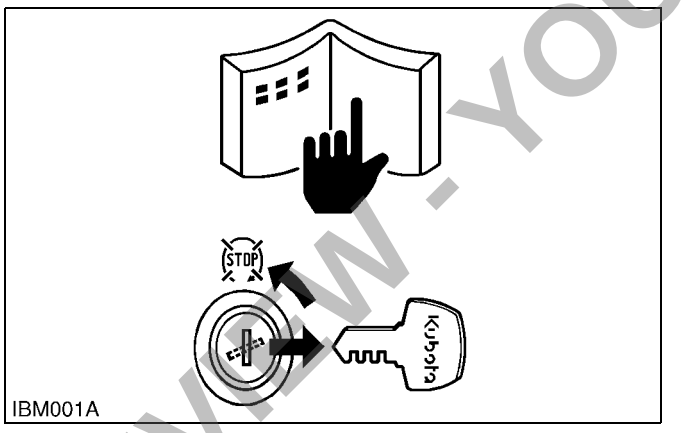
⚠ WARNING
- **Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

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

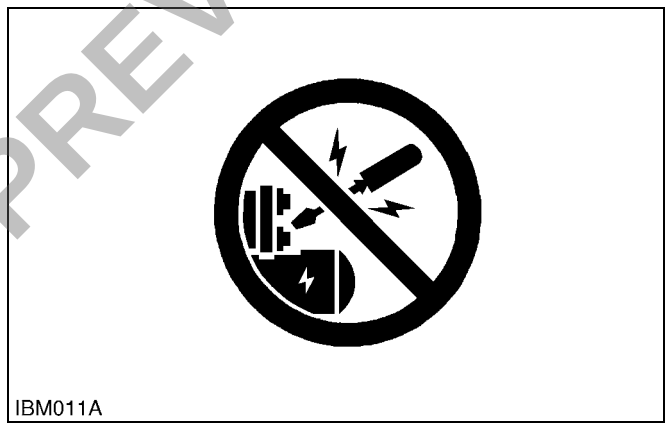
■ IMPORTANT
- **Indicates that equipment or property damage could result if instructions are not followed.**

■ NOTE
- **Gives helpful information.**

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BEFORE SERVICING AND REPAIRING

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

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SAFETY STARTING

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

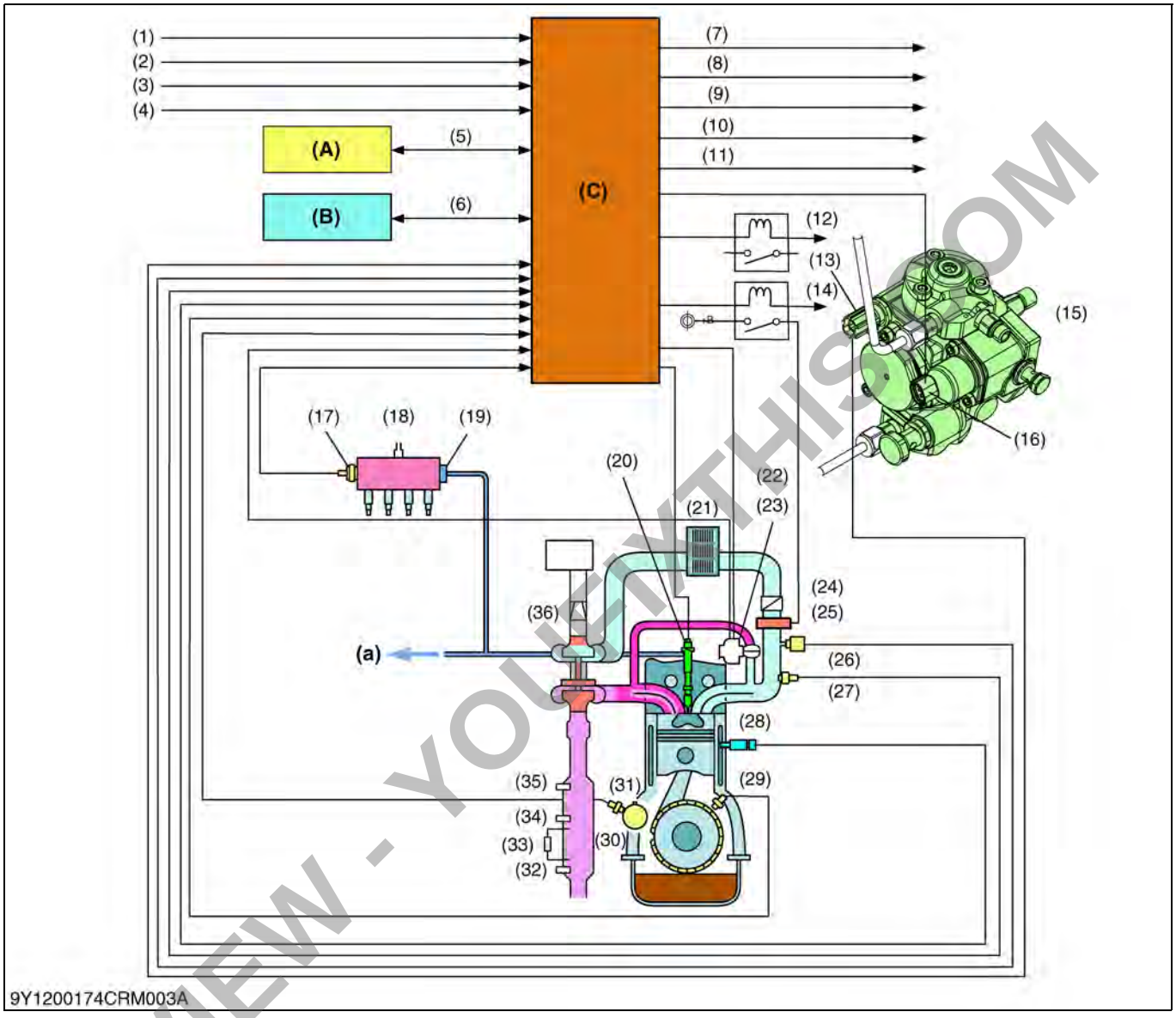
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1. BASIC SYSTEM INFORMATION

[1] SYSTEM CONFIGURATION



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

(A) CAN2 Connector (For OEM Machine)
(B) CAN1 Connector (For Service)
(C) Engine ECU
(a) To Fuel Tank

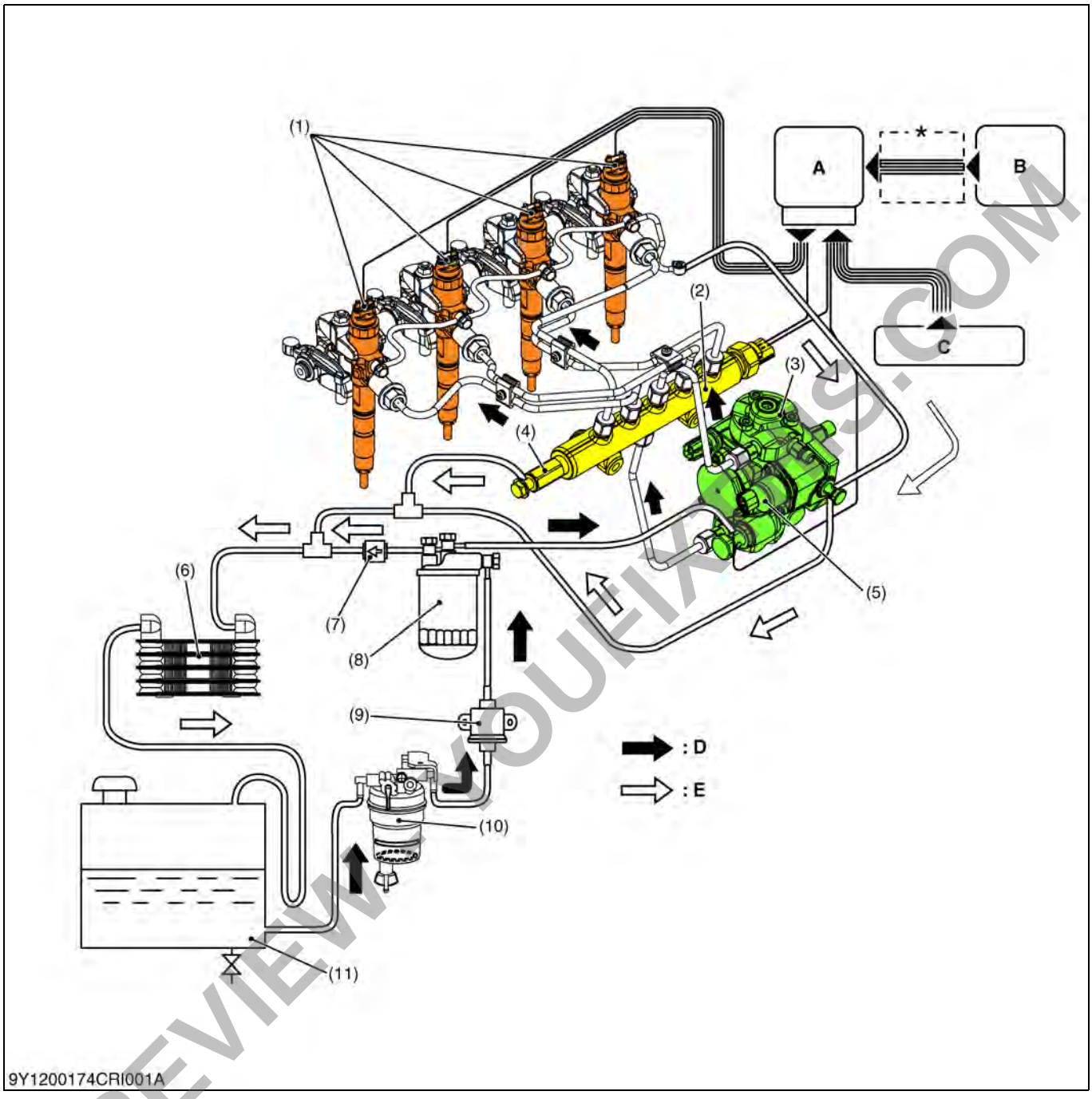
■ **NOTE**
- **The signals marked with * are CAN communication.**

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[2] FUEL SYSTEM



(1) Injector
(2) Rail
(3) Supply Pump
(4) Pressure Limiter
(5) SCV (Suction Control Valve)
(6) Fuel Cooler
(7) Check Valve
(8) Fuel Filter
(9) Fuel Feed Pump
(10) Water Separator
(11) Fuel Tank

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

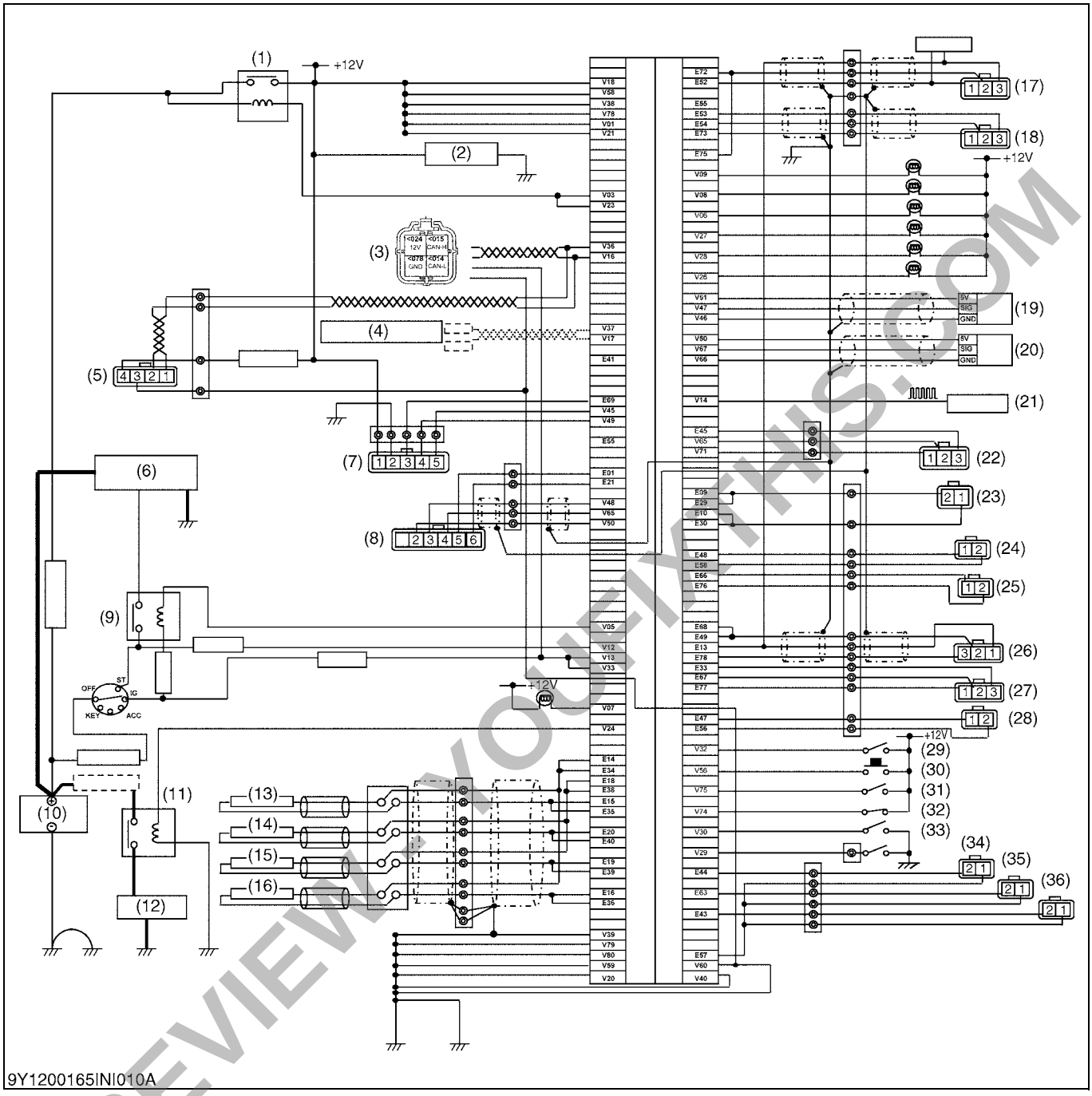
■ **NOTE**
- **The signals marked with * are CAN communication.**

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(4) System Wiring Diagram



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

DPF: Diesel Particulate Filter

■ **NOTE**

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

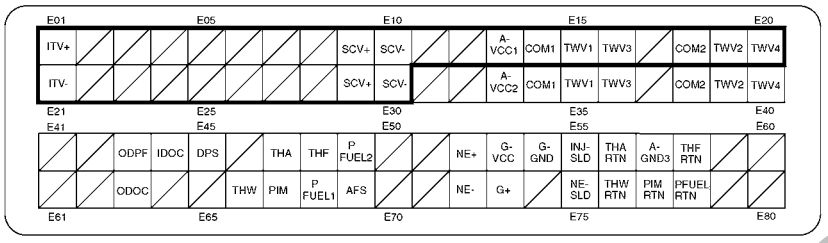
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[6] ECU TERMINAL LAYOUT

(1) ECU Terminal Layout 1 (Engine Side)



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

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(2) Normal Value

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

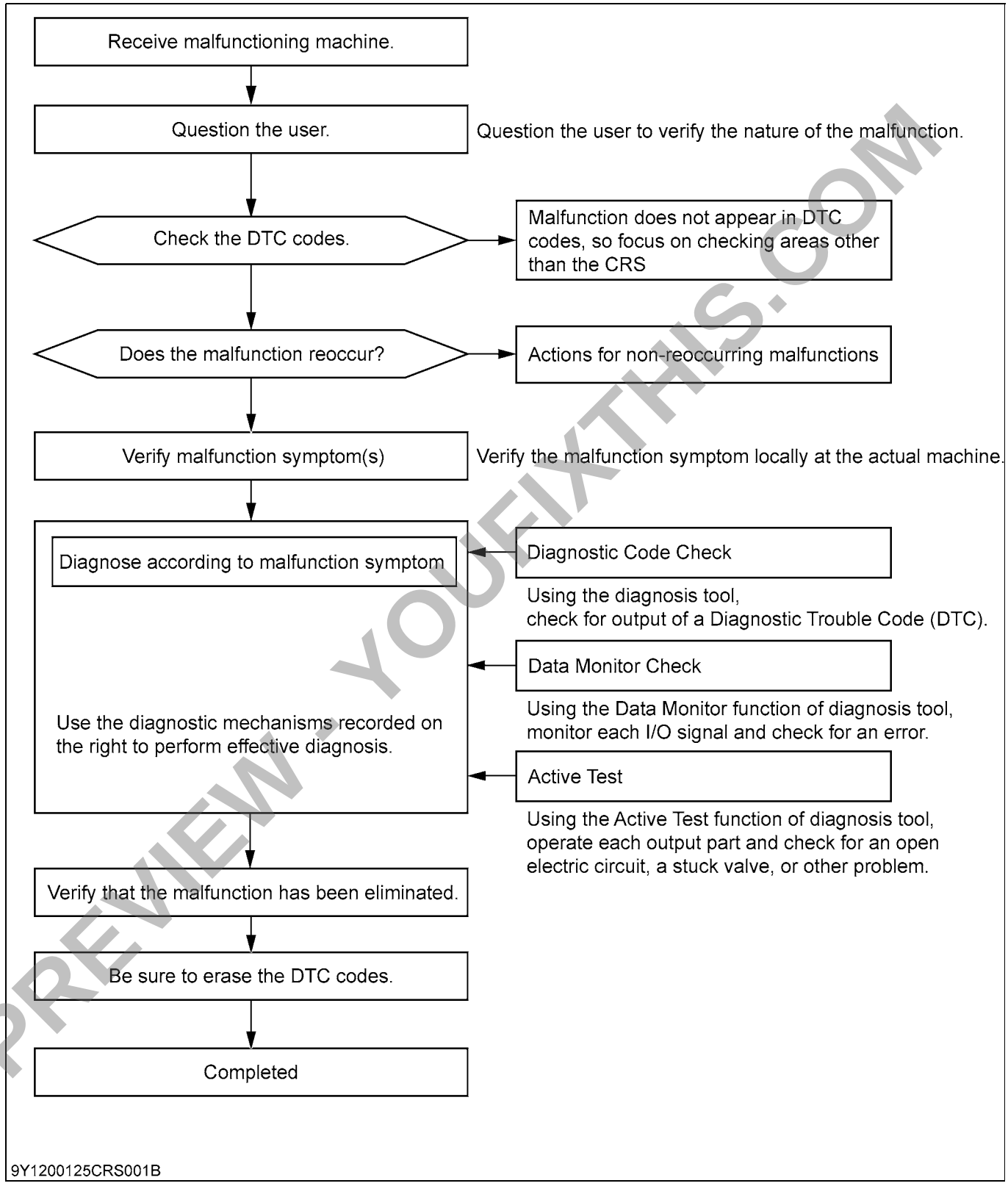
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1. GENERAL

[1] OVERALL DIAGNOSTIC PROCEDURE



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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.

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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
SPN Name SAE J1939 Table C1		Engine Position Sensor
DTC Name		NE-G phase shift
Management Unit for Detected Part		NEGUM
Detection item		• Large phase shift between NE (crankshaft position sensor) pulse and G (camshaft position sensor) pulse
DTC Set Preconditions		• Engine is operating above low idle speed • Battery voltage is normal • Sensor supply voltage VCC# is normal • NE signal is normal • G signal is normal • Coolant temperature is 10 °C (50 °F) or higher
DTC set parameter		(Approximate) • Phase difference between NE pulse and G pulse is within ± 0.26 rad (± 15 °)
Time to action or number of error detection		• 10 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

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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

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(Operating conditions → specified tool conditions)

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

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[Operation details]

1. Injector non-injection instruction
   - Stop the injection for each cylinder injector in accordance with the requests from the tool.

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

■ **NOTE**

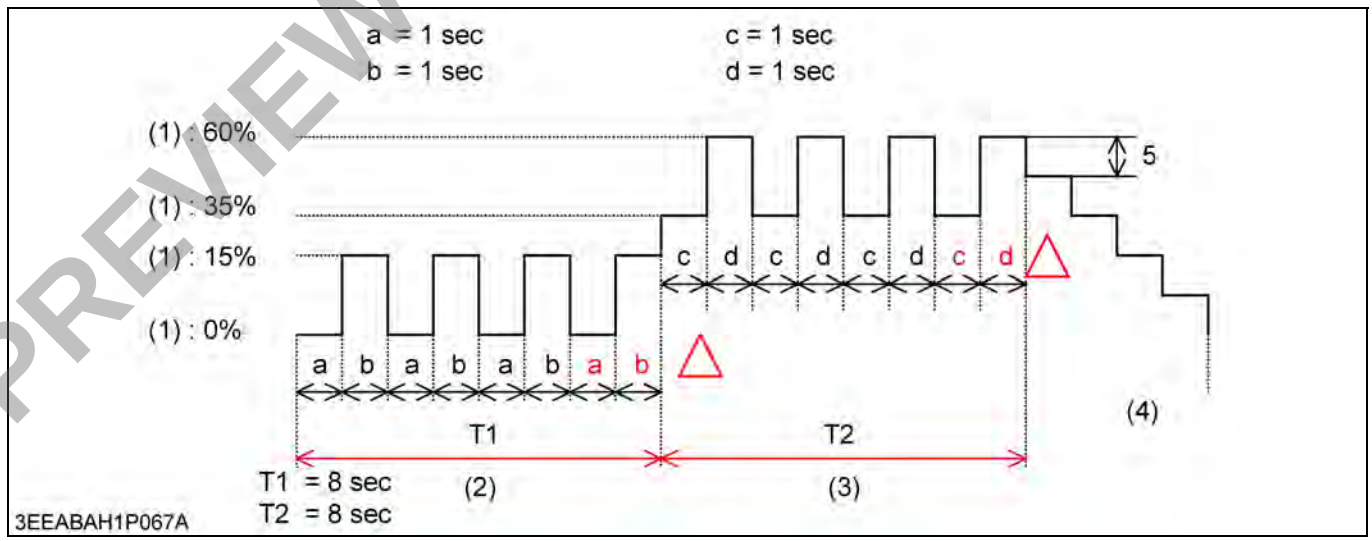
- **Do not judge with the corresponding cylinder only: also compare with the symptoms in the other cylinders.**

2. EGR actuation test
   - Operate as shown in the diagram below and in accordance with the requests from the tool.

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

■ **NOTE**

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



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

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Name		Intake air volume: Low
ISO 14229 P-Code		P0101
J1939-73	SPN	132
	FMI	1
SPN Name SAE J1939 Table C1		Engine Inlet Air Mass Flow Rate
DTC Name		Intake air volume: Low
Management Unit for Detected Part		GA
Detection item		• 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		

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[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-S112
P0072	171	4	Intake air temperature built-in MAF sensor abnormality	1-S113
P0073	171	3		
P0087	633	7	Pressure limiter emergency open	1-S116
P0088	157	0	High rail pressure	1-S121
P0089	1347	7	SCV stuck	1-S126
P0093	1239	1	Fuel leak (in high pressured fuel system)	1-S131
P0101	132	1	Intake air volume: Low	1-S136
P0102	132	4	MAF sensor abnormality	1-S137
P0103	132	3		
P0111	172	0	Intake air temperature: high (Inter cooler model only)	1-S139
P0112	172	4	Intake air temperature error	1-S140
P0113	172	3		
P0117	110	4	Coolant temperature sensor abnormality	1-S143
P0118	110	3		
P0181	174	0	Fuel high temperature	1-S146
P0182	174	4	Fuel temperature sensor abnormality	1-S147
P0183	174	3		
P0192	157	4	Rail pressure sensor abnormality	1-S150
P0193	157	3		
P0200	523535	0	Injector charge voltage: High	1-S154
P0201	651	3	Open circuit of harness/coil	1-S156
P0202	653	3		
P0203	654	3		
P0204	652	3		
P0217	110	0	Engine overheat	1-S159
P0219	190	0	Engine overrun	1-S161
P0237	102	4	Boost pressure sensor abnormality	1-S162
P0238	102	3		
P0335	636	8	Crankshaft position sensor (NE sensor) abnormality	1-S166
P0336	636	2		
P0340	723	8	Camshaft position sensor (G sensor) abnormality	1-S171
P0341	723	2		
P0380	523544	3	Air heater relay driving circuit abnormality	1-S175
P0380	523544	4		

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(16) Open Circuit of Harness/Coil (DTC P0201 / 651-3, P0202 / 653-3, P0203 / 654-3, P0204 / 652-3)

P0201 / 651-3: Engine No. 1 cylinder injector (TWV1) wiring harness open circuit, coil open circuit
P0202 / 653-3: Engine No. 3 cylinder injector (TWV2) wiring harness open circuit, coil open circuit
P0203 / 654-3: Engine No. 4 cylinder injector (TWV3) wiring harness open circuit, coil open circuit
P0204 / 652-3: Engine No. 2 cylinder injector (TWV4) wiring harness open circuit, coil open circuit

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

Detection item:
- Open circuit of harness
- Open circuit of injector coil

DTC set preconditions:
- Engine is operating
- Battery voltage is normal
- During injection
- CPU is normal

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

Engine warning light:
- ON

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

Recovery from error:
- Key switch turn OFF

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(33) Sensor Supply Voltage 2 Abnormality (DTC P0652 / 3510-4, P0653 / 3510-3)

P0652 / 3510-4: Sensor supply voltage 2 abnormality (Low side)
Behaviour during malfunction:
- Faulty starting
- Insufficient output
- Worsening exhaust gas performance

Detection item:
- Sensor supply voltage 2 error or recognition error

DTC set preconditions:
- Battery voltage is normal
- Key switch turn ON
- Starter Switch signal (ECU: V12 terminal) is not activated

DTC set parameter:
- Voltage to sensor is below 4.375 V

Engine warning light:
- ON

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

Recovery from error:
- Key switch turn OFF

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P0653 / 3510-3: Sensor supply voltage 2 abnormality (High side)
Behaviour during malfunction:
- Faulty starting
- Insufficient output
- Worsening exhaust gas performance

Detection item:
- Sensor supply voltage 2 error or recognition error

DTC set preconditions:
- Battery voltage is normal
- Key switch turn ON
- Starter Switch signal (ECU: V12 terminal) is not activated

DTC set parameter:
- Voltage to sensor is above 5.625 V

Engine warning light:
- ON

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

Recovery from error:
- Key switch turn OFF

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(49) Differential Pressure Sensor 1 Abnormality (DTC P2454 / 3251-4, P2455 / 3251-3)

P2454 / 3251-4: Differential pressure sensor 1 abnormality (Low side)

Behaviour during malfunction:
- None

Detection item:
- Sensor / Harness short to ground

DTC set preconditions:
- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- NO ST signal

DTC set parameter:
- DPF differential pressure sensor voltage: 0.1 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

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P2455 / 3251-3: Differential pressure sensor 1 abnormality (High side)

Behaviour during malfunction:
- None

Detection item:
- Sensor / Harness open circuit and short to + B

DTC set preconditions:
- Battery voltage is normal
- Sensor supply voltage VCC# is normal
- NO ST signal

DTC set parameter:
- DPF differential pressure sensor voltage: 4.9 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

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