



NEW HOLLAND

E385

NEW HOLLAND KOBELCO

**TROUBLESHOOTING
MANUAL
ISUZU ENGINE**

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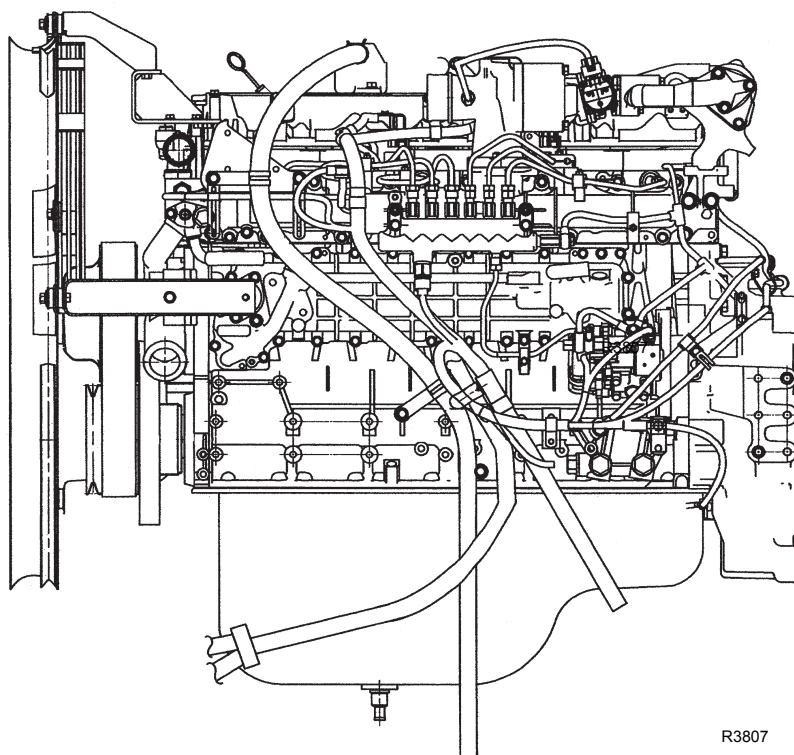
PROVEN PERFORMANCE

TROUBLESHOOTING MANUAL

4HK1-6HK1 ISUZU ENGINE

Workshop manual integration of the following models:

E385 (Tier 3)



R3807

All information, illustrations and specifications in this manual are based on the latest product information available at the time of publication.

The right is reserved to make changes at any time without notice.

Introduction

This Troubleshooting Manual describes the structure and the troubleshooting of electronic control fuel injection system (common rail type) in 4HK1 and 6HK1 industrial engines.

Use this manual sufficiently to perform service work properly and quickly.

For any question or comment, or should you notice any mistake concerning the content of this manual, please contact:

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Control System

Engine Control

(Electronic control fuel injection system (Common rail type))

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How to use this manual

This manual describes about engine-related trouble diagnosis, and is closely related to the machine trouble diagnosis. Always refer to both manuals for the trouble diagnosis.

This manual consists of the following contents. This section “How to use this manual” describes about abbreviations and instructions to use this manual. Therefore, if you are familiar with Isuzu manuals, start with Precautions on service work and Basic procedure of trouble diagnosis.

How to use this manual

- Table of abbreviation
- List of parts according to engine control specifications
- Wiring color code
- How to use wiring diagram

Precautions on service work

Procedure of trouble diagnosis

How to use trouble diagnosis-related tool

- How to use injector checker
- How to use flash tool
- How to use breaker box

Engine control system

List of function checks

List of diagnostic trouble codes

List of trouble symptom

1E-4 Electronic control fuel injection system (Common rail type)

Table of abbreviation

Abbreviation	Name	Meaning and remarks
A/D	Analog/Digital	Analog/Digital
AP	Accelerator Position	Accelerator opening angle
CAN	Controller Area Network	Communication system used to communicate between ECM and the machine control unit
CKP	Crankshaft Position	Crankshaft (the sensor is installed onto flywheel housing) position
C/U	Control/Unit	Abbreviation of control unit
CMP	Camshaft Position	Camshaft (the sensor is installed onto the rear of cylinder head) position
DLC	Data Link Connector	Connector for scan tool (also known as: Checker connector)
EMPS	Engine Module Programming System	Rewriting of control program in ECM
DMM	Digital Multi-Meter	Diagnostic tester for electrical equipment system
DTC	Diagnostic Trouble Code	Self-diagnosis code numbers which indicate trouble condition
ECT	Engine Coolant Temperature	Engine coolant temperature
ECM	Engine Control Module	Core of engine control in engine control computer
ECU	Electronic Control Unit	Computer for various control
EGR	Exhaust Gas Recirculation	Recirculation system which mixes exhaust gas from engine with intake air again to lower the combustion temperature resulting in reduction of NOx.
EMI	Electro Magnetic Interference	Electro Magnetic Interference
Exh	Exhaust	Exhaust
F/B	Feed/Back	Abbreviation of feedback
FT	Fuel Temperature	Fuel temperature (the sensor is installed onto supply pump.)
GND	Ground	Ground/Earth
IAT	Intake Air Temperature	Intake air temperature
J/C	Joint/Connection	Connector which connects each harness
MIL	Malfunction Indicator Lamp	Warning lamp MIL (diagnosis lamp)
PC	Pressure Control	Pressure control/Common rail pressure
SCV	Suction Control Valve	Valve which controls fuel flow to common rail and is installed onto supply pump
PCV	Pressure Control Valve	Valve which controls fuel flow to common rail and is installed onto supply pump
PWM	Pulse Width Modulation	Pulse width modulated wave
QOS	Quick On Start	Warming-up device
RP	Rail Pressure	Pressure in common rail
SBF	Slow Blow Fuse	Slow-blow type fuse which protects circuits of battery, motor, etc.
SIG	Signal	Signal

Electronic control fuel injection system (Common rail type) 1E-5

Abbreviation	Name	Meaning and remarks
VSS	Vehicle Speed Sensor	Sensor used to detect vehicle speed to control meters or engine
W/S	Weld/Splice	Joint of each harness without connector

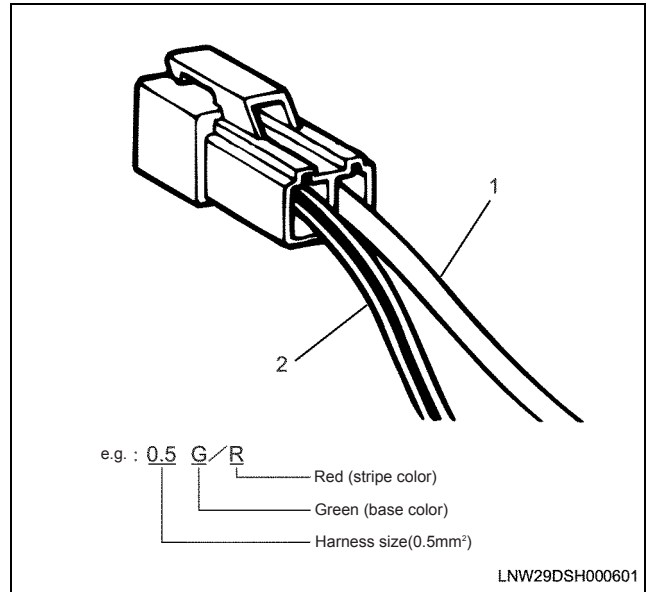
List of parts according to engine control specifications

	Engine					Function
	6W	6U	6H	4H	4J	
PCV	m	m				Controls the fuel pressure feed of supply pump.
SCV			m	m	m	Controls the fuel pressure feed of supply pump.
CMP sensor			m	m	m	Detects camshaft position of engine (used for identifying cylinder.)
G sensor	m	m				Detects cam position of supply pump (used for identifying cylinder.)
CKP sensor	m	m	m	m	m	Detects crankshaft position (used for engine control in general.)

1E-6 Electronic control fuel injection system (Common rail type)

About colors of wirings

All harnesses are identified by using different colors of claddings. The harness for the main circuit in a certain electrical system is identified by using a single color, while the harness for the sub circuit uses a color in stripes. Sizes and colors coding in a wiring diagram are as follows.

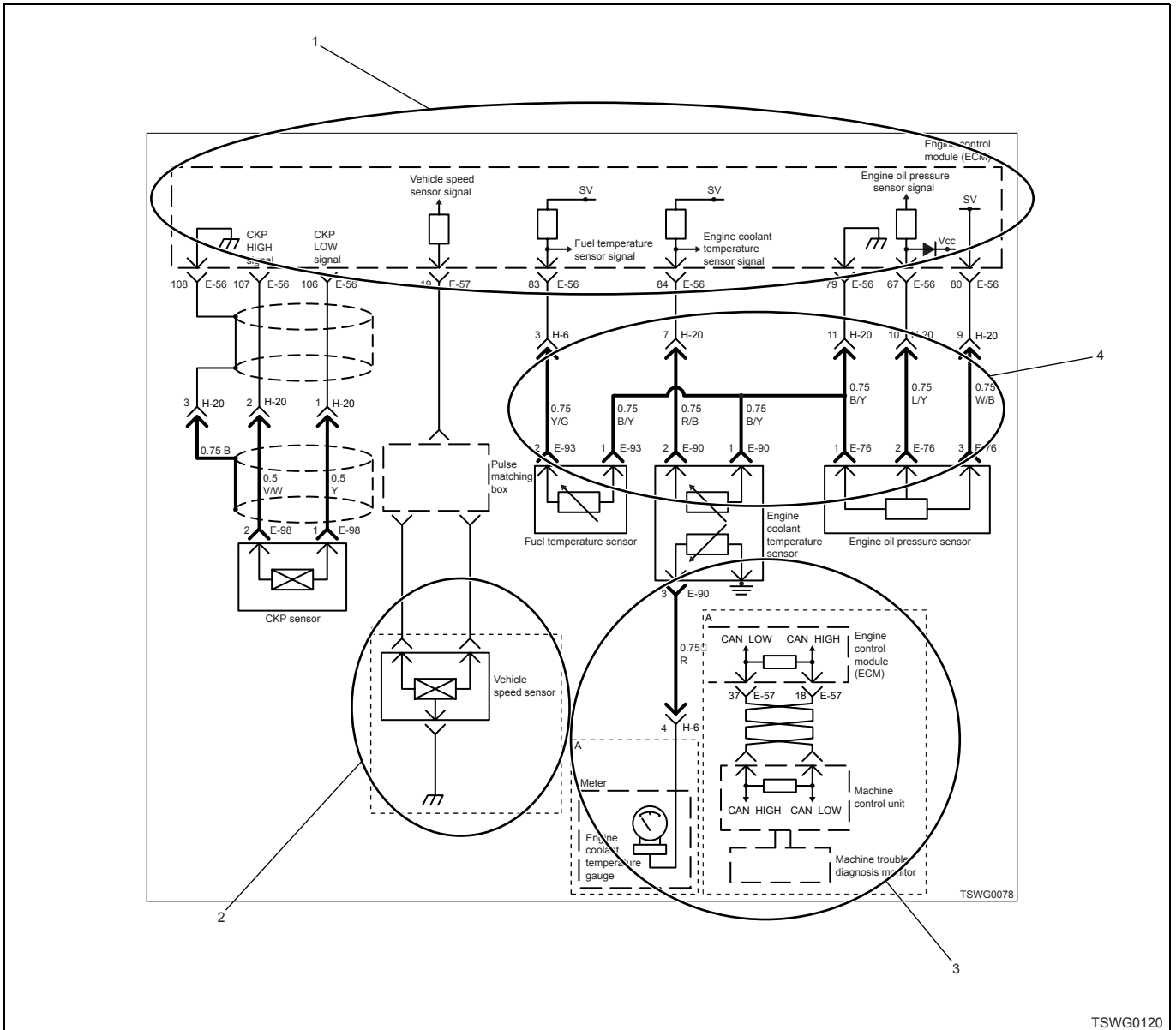


Name

1. Single color
2. Color stripe

Symbol	Color	Symbol	Color
B	Black	BR	Brown
W	White	LG	Light green
R	Red	GR	Grey
G	Green	P	Pink
Y	Yellow	SB	Sky blue
L	Blue	V	Violet
O	Orange		

About wiring diagrams



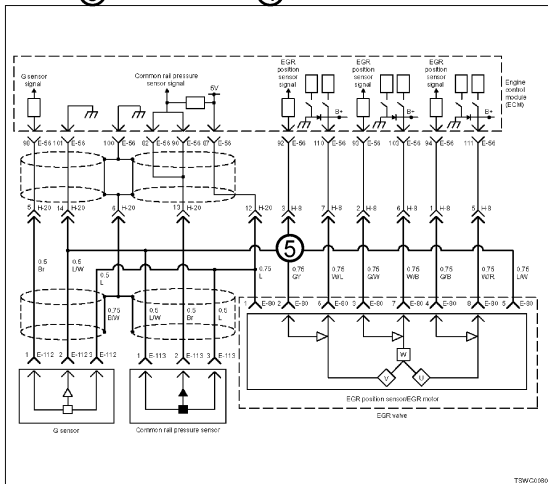
1. Sections surrounded by long broken lines are used to indicate the units, such as ECM.
2. Sections surrounded by dotted lines are used to classify or differentiate the specifications of machines. Confirmation of specifications is needed.
3. Sections surrounded by dotted lines and marked with a symbol ("A" in example) on the upper left are used to classify different wiring in the specifications of machines. Confirmation of specifications is needed.
4. Sections surrounded by heavy lines are used to differentiate engine harnesses from other harnesses. Heavy lines indicate engine harnesses, other lines indicate machine harnesses.

1E-8 Electronic control fuel injection system (Common rail type)

How to read trouble diagnosis section

The following illustration is an example for trouble diagnosis section. See this illustration and description.

DTC: ① P2 (Flush code ② 5)
Common rail ③ ssure sensor fault (low v ④ e fault)



Description of circuit

The common rail pressure sensor detects the common rail internal pressure. The common rail pressure sensor is installed to the common rail. As the common rail internal pressure changes depending on engine condition, output voltage of the common rail pressure sensor will change (⑥). If common rail internal fuel pressure is low, output voltage becomes low, if the pressure is high, the output voltage becomes high as well. The engine control module (ECM) reads this output voltage change, converting it into common rail internal pressure, to utilize for control. Dedicated communication circuits are used for the sensor power supply (5V), SIG, and ground in the common rail pressure sensor, which are connected to the ECM. Also, the sensor circuit is shielded to avoid electrical noise etc.

Main trouble symptom

- Engine blowby ⑦

Preconditions when DTC is set

- Key switch input voltage is 18 V or more.
- DTC P1630 ⑧ or P1635 is not detected.

DTC set condition

- Common rail ⑨ ssure sensor voltage is 0.7 V or less.

Action taken when DTC is set

- Turns the dial ⑩ lamp ON.

Back-up mode

- Specified back ⑪ alue (depending on the machine manufacturer)

Return to normal condition

⑫

The conditions to clear the MIL/DTC

- The current trouble turns to past trouble (history) when the condition is out of the range from DTC set condition (recovery from trouble).
- The diagnosis lamp will go off after the code turns to history code and the key switch is turned "OFF" then "ON" again.
- Using the scan tool, or memory clear switch and diagnostic switch operation enables to clear DTCs.

Diagnostic aid

If the intermittent trouble is suspected, followings may be the cause.

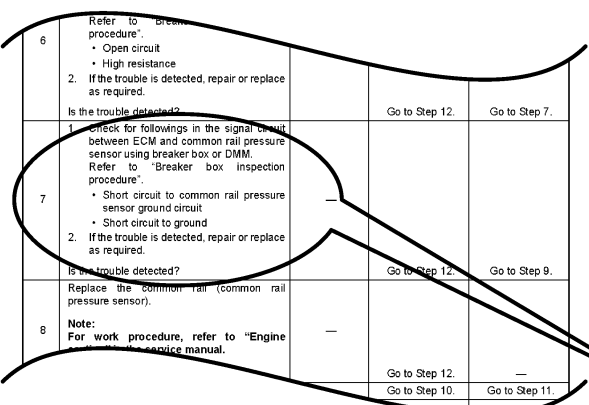
- Improper connection of harness connector
 - Defective harness cladding ⑬
 - Worn harness cladding ⑬
 - Wire disconnection inside harness cladding
- Following inspections are necessary to detect these causes.
- Improper connection of harness connector and ECM connector

- Poor connection of terminal from connector
- Unmatched terminals are fitted.
- Damage of connector lock
- Poor contact between terminal and wire
- Damaged harness
- Visually check the harness for damage.
- Check the relevant items on the scan tool data display while moving the connector and the harness which are related to the sensor. The variation of the display indicates the faulty part.

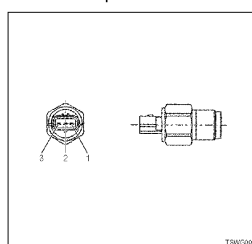
Test description

Numbers below indicate step numbers in the chart.
3. In case of current trouble, the "Common rail pressure sensor" displays more than the specified value. In this case, identify the cause by referring to "Diagnostic aid".
5. If the "Common rail pressure sensor" displays more than the specified value when the common rail pressure sensor connector is removed, the circuit beyond the sensor is normal including ECM.

Step	Action	Value	YES	NO
1	Perform the OBD system check. Is the procedure completed?	—	Go to Step 2.	Perform "OBD system check", and Go to Step 2.
2	Is the scan tool available?	—	Go to Step 3.	Go to Step 14.
3	Check the value for common rail pressure sensor using scan tool. 1. Connect the scan tool. 2. Start the engine.	Common rail 0.7V (at idle)	Go to Step 4.	Go to "Diagnostic aid".



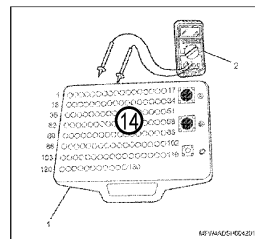
About common rail pressure sensor



- Name
1. GND
 2. Signal
 3. Power supply

Breaker box inspection procedure

Perform the inspection in the following procedure if there is such an instruction to use breaker box in the step. After inspection, return to the diagnostic step.



- Name
1. Breaker box
 2. DMM

Step	Item to be checked	Inspection method	Measuring condition	Terminal No.	Normal value	Abnormal value
6	Open circuit/high resistance	Resistance measurement	• Disconnect the sensor connector. • Key switch "OFF"	87 - Sensor connector power supply terminal	100Ω or less	10MΩ or more
7	Short circuit to ground circuit/ground	Resistance measurement	• Disconnect the sensor connector. • Key switch "OFF"	82 - 101 90 - 101 82 - Ground 90 - Ground	10MΩ or more	100Ω or less
	Open circuit/high resistance	Resistance measurement	• Disconnect the sensor connector. • Key switch "OFF"	82 - Sensor connector signal terminal 90 - Sensor connector signal terminal	100Ω or less	10MΩ or more

Description of DTC diagnosis section

The following numbers correspond to those shown in the illustration. They describe each item.

1. DTC:
This indicates trouble code.
2. Flash code
Trouble code indicated by lamp flashing
3. Description of trouble symptom
4. Conditions on system that establish the codes
5. Circuit diagram
Circuit diagram related to trouble code
6. Description of circuit
System circuit principle related to trouble
7. Main trouble symptom
Expected state of engine caused by system trouble
8. Preconditions when DTC is set
Judgment is not performed unless this condition is established.
9. DTC set condition
Condition for fault judgment when preconditions are met
10. Action taken when DTC is set
Behavior of diagnosis lamp, monitor display on the machine and engine control when trouble code is set.
11. Back-up mode
A system operation mode that uses back-up data stored in the ECM memory in disregard of abnormal signal from sensor, when making fault judgment.
12. Recovery from failure
Description of recovery from failure to normal state
13. Diagnostic aid
Expected trouble causes are listed. They are important information to perform diagnosis.
Be sure to read before trouble diagnosis.
14. Breaker box inspection procedure
There is an appropriate table in diagnostic chart. It describes detailed diagnostic procedure.

Precautions on Service Work

Use of tools for circuit test

If there are no special instructions according to the diagnostic procedure, test lights must not be used in the diagnosis of electric system of powertrain. Use a connector test adaptor kit 5-8840-0385-0 when a probe connector is required during the diagnostic procedure.

Commercial electrical equipment

Commercial electrical equipment means that commercial electrical components installed to a machine after shipment from factory. Be careful that no special consideration for this equipment is taken in the design process of the machine.

Caution:

Connect commercial electrical equipment to the circuit whose power supply and ground wires are not related to the electronic control system.

Commercial electrical equipment may cause malfunction of the electronic control system even if they are installed properly. They include devices which are not connected to the electrical systems on the machine, such as mobile phones or radios. Therefore, in trouble diagnosis of powertrain, first check if this commercial electrical equipment is installed, and if so, remove it from the machine. If the trouble has not been solved after the removal, diagnose it in usual procedures.

Welding work on the machine

If performing welding on the machine, remove the battery in advance. Otherwise, the current during welding may cause system trouble or damage.

Damage caused by electrostatic discharge

The electronic components used in the electronic control systems are easy to get damaged, caused by electrostatic discharge because they are designed to operate in a very low voltage. Some kinds of electronic components may get damaged by electrostatic in even less than 100 V which human cannot feel. For reference sake, the voltage of 4,000 V is needed for human to feel the flow of electrostatic discharge.

There are several ways for human body to have electrostatic charged. The common way to be charged is caused by friction or induction.

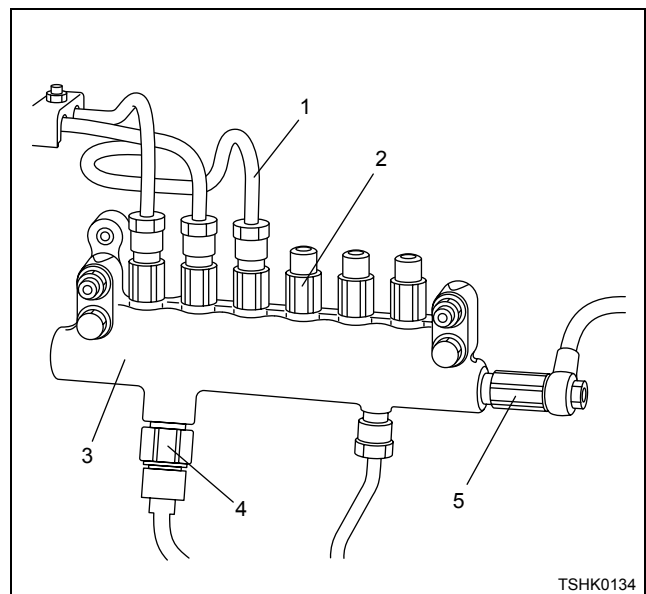
- For example, a charging by friction is caused when a person slides on the seat of the machine.
- A charging by induction occurs when a person who wears well-insulated shoes stands near the high-electrified object and then he grounds instantly. The same electric charge flows out and that person is charged in the high opposite electric charge. It is important to be careful in handling or testing the electronic components because electrostatic causes damage.

Caution:

The following guidelines should be followed to prevent the damage caused by electrostatic discharge:

- Do not touch the ECM connector pins or the electronic components soldered on to the circuit board of the ECM.
- Package of that part should not be opened until the preparation of the installation of the replacement part is completed.
- Connect that package to the normal grounding on the machine before taking out the parts from the package.
- If handling the parts with moving seats in sliding, or sitting down from the standing position, or walking for a certain distance, it is required to touch the normal grounding before the installation of the parts.

Fuel pipe



Name

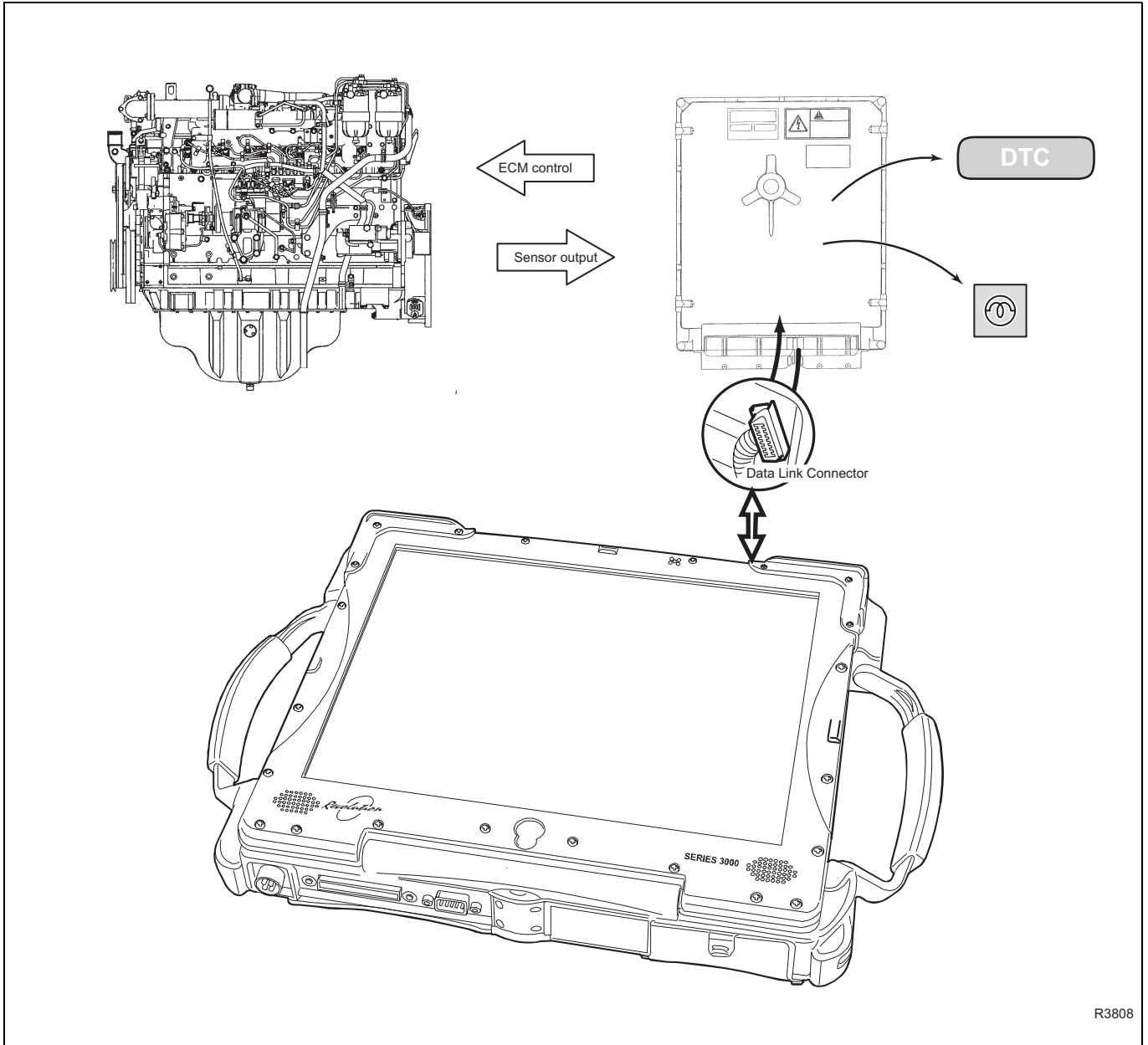
1. Injector pipe
2. Flow damper
3. Common rail
4. Common rail pressure sensor
5. Pressure limiter

- Do not reuse the high-pressure pipe and injector pipe of the fuel system. Replace with new one if it is removed.
- Never replace the pressure limiter, fuel temperature sensor, flow damper alone. If faulty, replace the common rail assembly and all the fuel pipes.

Procedure of trouble diagnosis

The following diagnostic procedure is extremely important to solve the problems of all electric/electronic (E/E) systems. Failure to perform this procedure may require unnecessary repair. Read carefully this procedure to understand, and then perform trouble diagnosis.

In addition, use the effective function or a scan tool to perform trouble diagnosis and system check.



1E-12 Electronic control fuel injection system (Common rail type)

Step 1 Confirm the user's complaint

- Organize the trouble conditions using a check list.

Step 2 Perform pre-inspection

- Perform an overall visual check.
- Confirm the service history in the past.
- Detect faulty such as noise, abnormal smell, etc.
- Collect the diagnostic trouble code (DTC) information for effective repair.
- Check for faults by comparing with the specified value.

Step 3 Check service information

- Check service bulletins for the market.

Step 4 Check according to each DTC

- Check the items indicated by the diagnostic trouble code (DTC)

Step 5 Perform fault inspection for each symptom

- Check the items not indicated by the diagnostic trouble code (DTC)

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Engine Control (Electronic control fuel injection system (Common rail type))	
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P0612 (Flush code 34)	10D-276
P0615 (Flush code 19)	10D-281
P0680 (Flush code 77)	10D-286
P1093 (Flush code 227)	10D-291
P1094 (Flush code 228)	10D-296
P1095 (Flush code 229)	10D-306
P1112 (Flush code 542)	10D-314
P1113 (Flush code 156)	10D-322
DTC: P1249 (Flush code 97)	10D-313
DTC: P1345 (Flush code 16)	10D-363
DTC: P1625 (Flush code 4)	10D-397
DTC: P1630 (Flush code 4)	10D-373
DTC: P1631 (Flush code 4)	10D-374
DTC: P1632 (Flush code 4)	10D-377
DTC: P1633 (Flush code 4)	10D-380
DTC: P1634 (Flush code 55)	10D-383
DTC: P1635 (Flush code 55)	10D-386
DTC: U2104 (Flush code 84)	10D-389
DTC: U2105 (Flush code 85)	10D-393
List of trouble symptom	10D-397
Engine stall	10D-401
Engine hunting, rough idling	10D-404
Engine output shortage	10D-408
Exhaust gas contains a lot of white smoke	10D-411
Exhaust gas contains a lot of black smoke	10D-414
Programming	10D-416
Rewriting of ECM (On-board)	10D-416

Name

- Diagnosis for each DTC
- List of trouble symptom

Information:

About types of system trouble diagnosis

System diagnostic method is a standardized method to repair all the electric/electronic (E/E) systems. The faults in E/E system often occur in the following stages, different from general machine fault.

- Early stage of fault;
 - As the fault occurs for a short period and singly, a customer often does not notice and miss it. In this stage, customer's complaint is indefinite and it is impossible to reproduce the trouble. However, the engine control module (ECM) may store the fault.
= Past fault (history trouble)
- Middle stage of fault;
 - The fault occurs for a short period and singly, but repeats intermittently and definitely occurs under a specific condition. A customer's complaint (contents of the fault) is clear but description of condition of the fault is not clear. Therefore, it is possible to reproduce the trouble if a mechanic could figure out the conditions.
= Intermittent trouble (intermittent)
- Stage that fault is real;
 - The fault occurs on a steady basis and a customer's complaint is realistic and clear. Therefore, it is possible for a mechanic to reproduce the fault. However, sometimes there are multiple causes.
= Current fault (present trouble)

Interview

Interview

1. Comprehend the contents of a customer’s complaint using “Check list (engine control system)”.
<Reference>
Do not interview blindly. Interview about the trouble presumed by symptoms (cases).
2. Evaluate the trouble information correctly.
Figure out specifically based on 5W1H.
Example: The temperature is low, at the time of starting, constantly, in the vicinity of the engine portion, metallic noise, etc.

2. All of complaints from customers do not always mean troubles.
3. Extra repair steps are caused if the trouble condition is not correctly reported to a mechanic in charge.
 - The check list helps to diagnose, repair, and recheck after repair work in the maintenance shop.

Points for interview

- What Trouble symptom
- When Date, time, frequency of occurrence
- Where Road condition
- In what condition Running condition, operating condition, weather
- How Feeling about symptom

Check list for engine control system

It is necessary to confirm “Trouble symptom” and “Data of occurrence of a trouble” based on check list (engine control system) on receiving the machine from a customer at a service shop.

Engine control system questionnaire		Date of interview	
		Site of inspection	
1	Year of issue	Make	Model
	Year of purchase	Year of purchase	Year of first purchase
2	Year of issue	Year of issue	Year of issue
	Year of purchase	Year of purchase	Year of purchase
1	Year of issue	Year of issue	Year of issue
	Year of purchase	Year of purchase	Year of purchase
	Year of issue	Year of issue	Year of issue
	Year of purchase	Year of purchase	Year of purchase
	Year of issue	Year of issue	Year of issue
	Year of purchase	Year of purchase	Year of purchase
	Year of issue	Year of issue	Year of issue
	Year of purchase	Year of purchase	Year of purchase
	Year of issue	Year of issue	Year of issue
	Year of purchase	Year of purchase	Year of purchase
	Year of issue	Year of issue	Year of issue
	Year of purchase	Year of purchase	Year of purchase
2	Year of issue	Year of issue	Year of issue
	Year of purchase	Year of purchase	Year of purchase
	Year of issue	Year of issue	Year of issue
	Year of purchase	Year of purchase	Year of purchase
	Year of issue	Year of issue	Year of issue
	Year of purchase	Year of purchase	Year of purchase
	Year of issue	Year of issue	Year of issue
	Year of purchase	Year of purchase	Year of purchase
	Year of issue	Year of issue	Year of issue
	Year of purchase	Year of purchase	Year of purchase
	Year of issue	Year of issue	Year of issue
	Year of purchase	Year of purchase	Year of purchase

Name

1. Trouble symptom
2. Frequency of trouble occurrence / trouble conditions

Because:

1. It may be impossible to reproduce the trouble symptom at a service shop.

1E-14 Electronic control fuel injection system (Common rail type)

Engine control system questionnaire

Company of inspector _____

Name of inspector _____

User	User's name	Machine application
	Address	
Machine	Date of diagnosis Year Month Date	Date of delivery Year Month Date
	Operating period Present Time (When trouble occurs Time)	Date of trouble occurrence Year Month Date
	Machine model	Machine serial No.
Engine model	Engine model	Engine serial No.

Trouble symptom	<input type="checkbox"/> Engine does not start	<input type="checkbox"/> Engine does not crank	<input type="checkbox"/> No first combustion	<input type="checkbox"/> Combustion but incomplete
	<input type="checkbox"/> Difficult starting of engine	<input type="checkbox"/> Engine cranks slowly takes more than sec.	<input type="checkbox"/> Others	
	<input type="checkbox"/> Unstable idling	<input type="checkbox"/> Abnormal idling <input type="checkbox"/> High (r p m)	<input type="checkbox"/> Low (r p m)	
		<input type="checkbox"/> Rough idle (out of specified speed for full warm-up) <input type="checkbox"/> Others		
	<input type="checkbox"/> Low operability of machine	<input type="checkbox"/> Surging	<input type="checkbox"/> Knocking	<input type="checkbox"/> Low output <input type="checkbox"/> Others
	<input type="checkbox"/> Abnormal smoke	<input type="checkbox"/> Much black smoke	<input type="checkbox"/> Much white smoke	<input type="checkbox"/> Much bluish smoke <input type="checkbox"/> Others
	<input type="checkbox"/> Noise	<input type="checkbox"/> Engine vibration sound (Circumference) <input type="checkbox"/> Noise in engine (Circumference)		
<input type="checkbox"/> Engine stalls	<input type="checkbox"/> Immediately after starting		<input type="checkbox"/> When accelerator pedal (lever) is released	<input type="checkbox"/> When A/C is operated
	<input type="checkbox"/> When operating at full load <input type="checkbox"/> At certain operation mode <input type="checkbox"/> Others ()			
<input type="checkbox"/> Vibration at idling	<input type="checkbox"/> Vertical vibration <input type="checkbox"/> Horizontal vibration <input type="checkbox"/> Others ()			

Trouble condition	Frequency of trouble	<input type="checkbox"/> Always <input type="checkbox"/> Sometimes (How many times: Date/Month) <input type="checkbox"/> Once		
		<input type="checkbox"/> Others ()		
	Weather	<input type="checkbox"/> Fine	<input type="checkbox"/> Cloudiness	<input type="checkbox"/> Rain <input type="checkbox"/> Snow
		<input type="checkbox"/> After lightening <input type="checkbox"/> Others ()		
	Ambient temperature	<input type="checkbox"/> 30°C or more	<input type="checkbox"/> Around 20°C ~ 30°C	<input type="checkbox"/> Around 10°C ~ 15°C <input type="checkbox"/> 0°C or less (°C)
	Season	<input type="checkbox"/> Spring	<input type="checkbox"/> Summer	<input type="checkbox"/> Autumn <input type="checkbox"/> Winter
	Location	<input type="checkbox"/> Outdoor	<input type="checkbox"/> Indoor	<input type="checkbox"/> General road <input type="checkbox"/> Rough road
		<input type="checkbox"/> Expressway	<input type="checkbox"/> Slope (grade °)	<input type="checkbox"/> Height (m above sea level) <input type="checkbox"/> In mountain
		<input type="checkbox"/> On the sea	<input type="checkbox"/> Harbor	<input type="checkbox"/> Construction field (Type)
		<input type="checkbox"/> Roadworks field (Type)	<input type="checkbox"/> Others ()	
	Engine temperature	<input type="checkbox"/> Cold	<input type="checkbox"/> During warm-up	<input type="checkbox"/> After warm-up <input type="checkbox"/> Others ()
	Engine coolant temperature/oil temperature	<input type="checkbox"/> Engine coolant temperature (°C) <input type="checkbox"/> Oil temperature (°C)		
	Operating condition	<input type="checkbox"/> When starting	<input type="checkbox"/> Immediately after starting(min)	<input type="checkbox"/> Idling <input type="checkbox"/> Racing
<input type="checkbox"/> During operation		<input type="checkbox"/> Constant speed	<input type="checkbox"/> When engine speed rises <input type="checkbox"/> When engine speed lowers	
	<input type="checkbox"/> A/C SW ON <input type="checkbox"/> A/C SW OFF <input type="checkbox"/> Others ()			
Condition when trouble occurs	<input type="checkbox"/> After engine oil is replaced <input type="checkbox"/> After oil filter is replaced <input type="checkbox"/> After replenishment of fuel <input type="checkbox"/> After sedimenter is drained			
	<input type="checkbox"/> After operating on slope <input type="checkbox"/> After out of gas <input type="checkbox"/> After washing with high pressure <input type="checkbox"/> Others ()			
Oil to be used	A P I	<input type="checkbox"/> CD <input type="checkbox"/> CE <input type="checkbox"/> CF <input type="checkbox"/> CH	<input type="checkbox"/> CF-4 <input type="checkbox"/> CH-4 <input type="checkbox"/> CI-4	
	A C E A	<input type="checkbox"/> B2 <input type="checkbox"/> B3 <input type="checkbox"/> E2 <input type="checkbox"/> E3	<input type="checkbox"/> E5	
	J A S O	<input type="checkbox"/> DH-1		
	Others	Maker () Manufacturer () Grade () Viscosity ()		
Fuel type	<input type="checkbox"/> Diesel fuel <input type="checkbox"/> Diesel fuel No. 1 <input type="checkbox"/> Diesel fuel special No.1 <input type="checkbox"/> Diesel fuel No. 2			
	<input type="checkbox"/> Diesel fuel special No.3 <input type="checkbox"/> Krosene <input type="checkbox"/> A heavy oil <input type="checkbox"/> Others ()			

Trouble code(s)	State of diag lamp	<input type="checkbox"/> ON <input type="checkbox"/> Sometimes comes on <input type="checkbox"/> Not come on			
	Diagnostic trouble code(s)	Current trouble	<input type="checkbox"/> _____ <input type="checkbox"/> _____ <input type="checkbox"/> _____ <input type="checkbox"/> _____		
		Past trouble	<input type="checkbox"/> _____ <input type="checkbox"/> _____ <input type="checkbox"/> _____ <input type="checkbox"/> _____		
	Past trouble history	Date of trouble occurrence: Year Month Date /description: /Action to be taken:			
	Date of trouble occurrence: Year Month Date /description: /Action to be taken:				

Others

Pre-inspection

Visual inspection of engine compartment

Visual inspection of engine compartment should be carefully when performing the diagnostic procedure. This inspection can often solve the trouble with no extra steps. If performing visual inspection, follow the guideline below.

- Check all the air hoses etc. for punch hole, cut, disconnection or improper routing.
- Inspect the hoses hidden behind other components.
- Check if all the harnesses of the engine compartment are properly connected, if there are any burnout parts or worn parts, if harnesses are pinched, if there are any contacts with sharp edges, or an exhaust manifold or pipes in high temperature, etc.

Machine maintenance result check

If the maintenance of the machine is not properly performed, the diagnosis lamp comes on. Clogging in oil filter or fuel filter caused by insufficient oil change or improper oil viscosity and deposit in crankcase may cause troubles on the machine, which were not found before on-board diagnosis (OBD) system check.

Though improper maintenance of the machine is not classified as "The trouble caused by other than a machine", a maintenance schedule should be more strictly followed because of high sensitivity of the on-board diagnosis (OBD) system check.

Non-OEM parts

All the on-board diagnosis system checks are adjusted to be operated by genuine parts. Therefore, if a commercial general sensor or switch is installed, the diagnosis lamp comes on due to faulty diagnosis.

If commercial electronic devices, such as mobile phone, stereo, antitheft device, etc. are installed and their installation is not proper, EMI (electromagnetic interference) may be discharged to the control system. That leads to the generation of fault sensor information and the diagnosis lamp comes on. When performing trouble diagnosis, turn the power of all commercial parts to "OFF" or remove those parts, and check for faults again.

Information:

Fault in related system

Many on-board diagnosis (OBD) system checks enter the back-up operating mode by instruction from engine control module (ECM) when the ECM detects the fault in related systems or components. In the back-up operating mode, they lower output to protect the machine.

Trouble Diagnosis

About diagnostic trouble code (DTC)

Every time turning the key switch to ON, the ECM performs self-test of most wiring and components and stores the detected faults in memory. For some DTCs, it also performs the back-up control. If the fault which affects operation occurs, the diagnosis lamp comes on to notify an operator.

Basic knowledge for required tools

Important:

If performing the diagnostic procedure, no basic knowledge on this powertrain may lead to faulty diagnosis or damage to powertrain components. If you do not have basic knowledge, do not perform the diagnosis of the trouble relating to powertrain. Basic understanding on hand tools, such as scan tools, is required to utilize service manual effectively.

About on-board diagnosis test

Types of trouble diagnosis results are the following.

1. History trouble
 - Trouble codes which occurred under the following conditions are called "History trouble".
 - Diagnostic test was completed at previous ignition cycle.
 - Diagnosis test has accepted at current ignition cycle.
 - Faults found by the diagnostic test do not currently exist.
2. Present trouble
 - Trouble codes which occurred under the following conditions are called "Present trouble".
 - Diagnostic test was completed at previous ignition cycle.
 - The faults detected by the diagnostic test currently exist.
 - The faults exist at current ignition cycle.

Description of terms

Ignition cycle

Ignition cycle is defined as Key ON, Run and Key OFF so that the machine can be operated under the specified diagnostic standard.

Diagnosis lamp

Basically, the diagnosis lamp comes on when a fault is detected in electronic control, such as engine control module (ECM).